172-65710M-04 (SC-F71 Parameters/Functions) 5 January 2022

ISO 9001
ISO 14001
CERTIFIED
ISO 9001・ISO 14001
Manufacturer
TLV CO., LTD.
Kakogawa, Japan
is approved by LRQA Ltd. to ISO 9001/14001

Instruction Manual

Multi-purpose Controller
SC-F71

(Parameters/Functions)

Contents

Introduction

Thank you for purchasing the TLV multi-purpose controller.

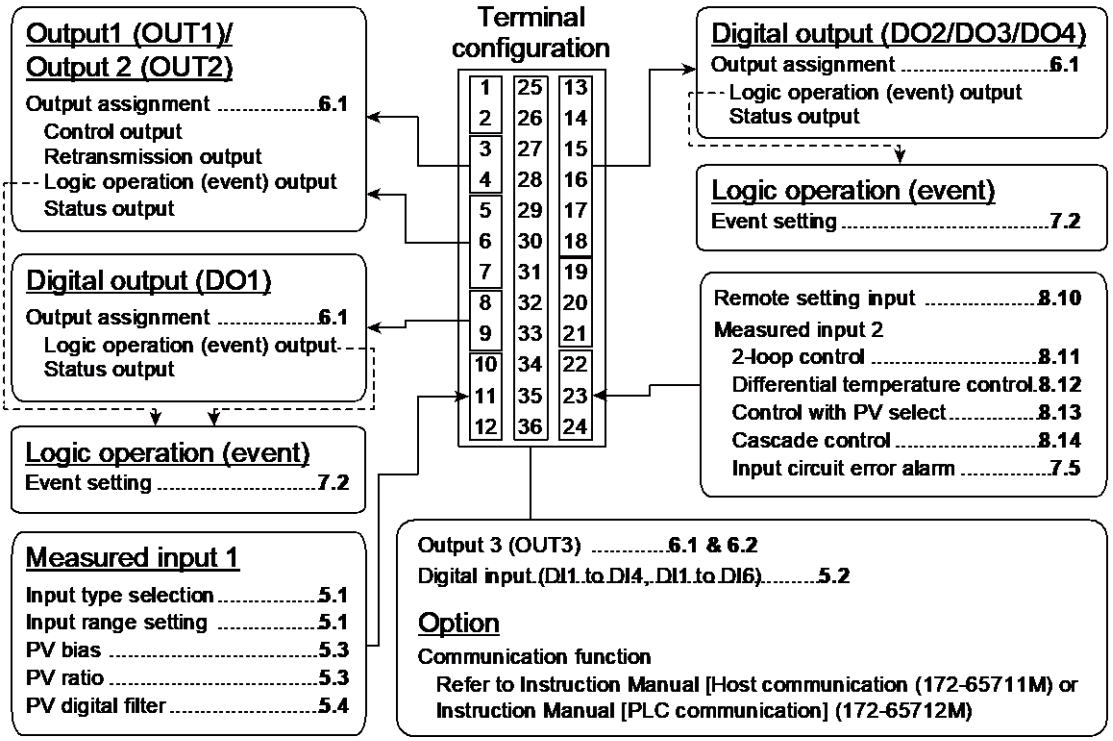
This product has been thoroughly inspected before being shipped from the factory. When the product is delivered, before doing anything else, check the specifications and external appearance to make sure nothing is out of the ordinary. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the product properly.

If detailed instructions for special order specifications or options not contained in this manual are required, please contact TLV for full details.

This instruction manual is intended for use with the model(s) listed on the front cover. It is necessary not only for installation but for subsequent maintenance, disassembly/ reassembly and troubleshooting. Please keep it in a safe place for future reference.

Pictorial table of contents

Sections describing hardware shown below.



Safety Considerations

- Read this section carefully before use and be sure to follow the instructions.
- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- The precautions listed in this manual are designed to ensure safety and prevent equipment damage and personal injury. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential damage and danger: DANGER, WARNING and CAUTION.
- The three types of cautionary items above are very important for safety: be sure to observe all of them as they relate to installation, use, maintenance, and repair. Furthermore, TLV accepts no responsibility for any accidents or damage occurring as a result of failure to observe these precautions.

Symbols

Indicates a DANGER, WARNING or CAUTION item.	
DANGER	Indicates an urgent situation which poses a threat of death or serious injury
WARNING	Indicates that there is a potential threat of death or serious injury such as electrical shock, fire (burns), etc.
CAUTION	Indicates that there is a possibility of injury or equipment/product damage

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. • TLV is not responsible if this instrument is repaired, modified or disassembled by non-factory-approved personnel. Malfunction may occur and warranty is void under these conditions.

Continued on the next page

⚠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 of 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.

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.
- TLV is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- TLV 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. TLV 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 TLV.
- Various symbols are used on the equipment, and they have the following meaning.

   : Alternating current

   : Direct 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.

Notice Regarding the Export Trade Control Order (Japan)

The intended application and end user should be checked to make sure this product will not be used in weapons of mass destruction, military applications or military equipment etc.
Take precautions not to allow this product to be illegally exported, even in the case of reselling or distribution.

Disposal

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

Symbols

Pictorial Symbols (safety symbols)

 **NOTE**	This icon indicates important information on installation, handling and operating procedures.
	This icon indicates supplemental information on installation, handling and operating procedures.
	This icon indicates where additional information may be located.

Character Symbols

11-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
											

A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
											

L	M	N	n	O (o)	P	Q	R	S	T	t	U
											

u	V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)	→
										

7-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
											

A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
											

L	M	N (n)	O (o)	P	Q	R	S	T	t	U	u
											

V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)
								

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		
AT	Autotuning	V (input)	Voltage (input)
ST	Startup tuning	I (input)	Current (input)
OUT (1 to 3)	Output (1 to 3)	HBA (1, 2)	Heater break alarm (1, 2)
DI (1 to 6)	Digital input (1 to 6)	CT (1, 2)	Current transformer (1, 2)
DO (1 to 4)	Digital output (1 to 4)	LBA	Control loop break alarm
FBR	Feedback resistance	LBD	LBA deadband
		V/I	Voltage (V)/Current (I)

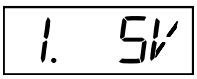
Screens used in this manual

The SC-F71 has two inputs. Following input type is available by setting parameters: Dual PV (PV + PV) type or PV + Remove setting type. The input type is set to PV + Remote setting type when shipped from the factory.

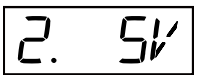
For a dual input model, the same parameter may exist in both Input 1 and Input 2. " 1. " or "2. " is added to the top of the parameters for identification. " 1. " is not added to the top of the parameters list for the single input type.

Display example of the dual input type:

Input 1_Set value (SV)

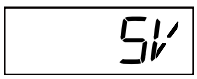


Input 2_Set value (SV)



Display example of a single input type:

Set value (SV)



This manual uses the dual inputs for explanation. For other types such as a single input type, ignore the first character " 1. " at the top of the parameter.

The parameters used only for the dual input type are displayed in the colored background ( ).

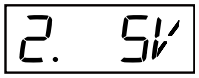
Notation in this manual:

This part is not displayed on the single input type.

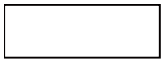
Input 1_Set value (SV)

Parameter shown only on the dual input type

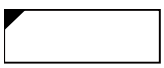
Input 2_Set value (SV)



- In 2. Selecting Parameters, two types of frames are used to distinguish different parameter conditions as follows.



Parameters to be always displayed



Parameter to be displayed when display condition is satisfied

Document Configuration

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

Contact TLV for the following manuals.

Manual	Document Number	Remarks
Multi-purpose Controller SC-F71 Quick Start Guide	172-65706M	This manual is enclosed with instrument. This manual explains the basic key operation, mode menu, and data setting.
Multi-purpose Controller SC-F71 Installation Manual	172-65707M	This manual is enclosed with instrument. This manual explains the mounting and wiring.
Multi-purpose Controller SC-F71 Parameter List	172-65708M	This manual is enclosed with instrument. This list is a compilation of the parameter data of each mode.
Multi-purpose Controller SC-F71 Instruction Manual [Hardware]	172-65709M	This manual describes installation, wiring, troubleshooting and product specification.
Multi-purpose Controller SC-F71 Instruction Manual [Parameters/Functions]	**172-65710M**	**The manual you are reading now. Parameters: This manual describes how to switch the operation modes and parameters, the range of parameters, and initialization/automatic conversion associated with the change of settings. Functions: This manual describes how to set up and each function.**
Multi-purpose Controller SC-F71 Instruction Manual [Host Communication]	172-65711M	This manual explains original communication protocol and Modbus relating to communication parameters setting.
Multi-purpose Controller SC-F71 Instruction Manual [PLC Communication]	172-65712M	This manual describes how to set up the instrument for communication with a programmable controller (PLC).

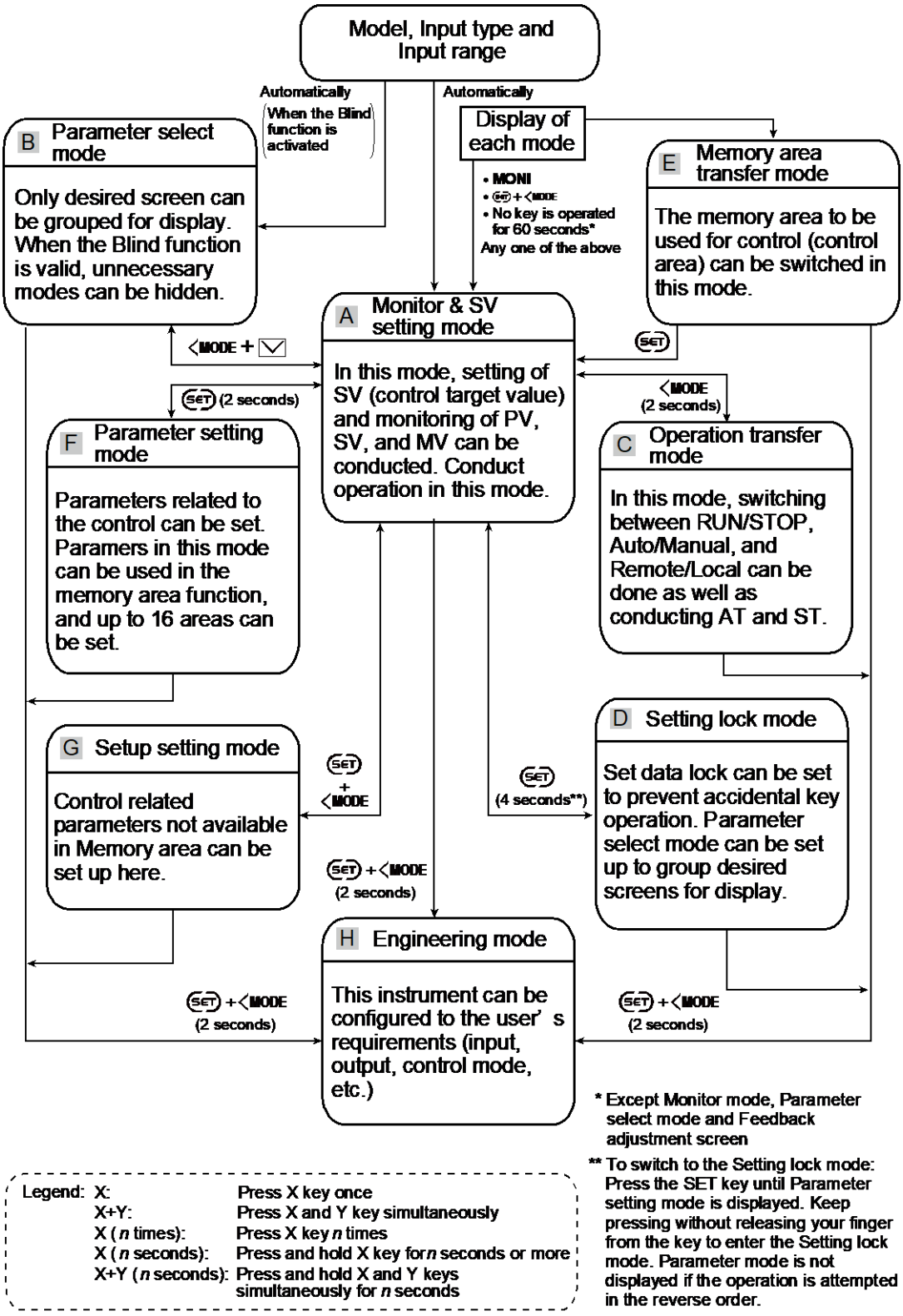
📖 Read this manual carefully before operating the instrument. Please place the manual in a convenient location for easy reference.

1. Mode Switching

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

Mode switching

The instrument has eight different modes for operation and setting. Modes can be switched through the key operation of SET and MODE keys.



Model, Input type, Unit and Input range

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

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

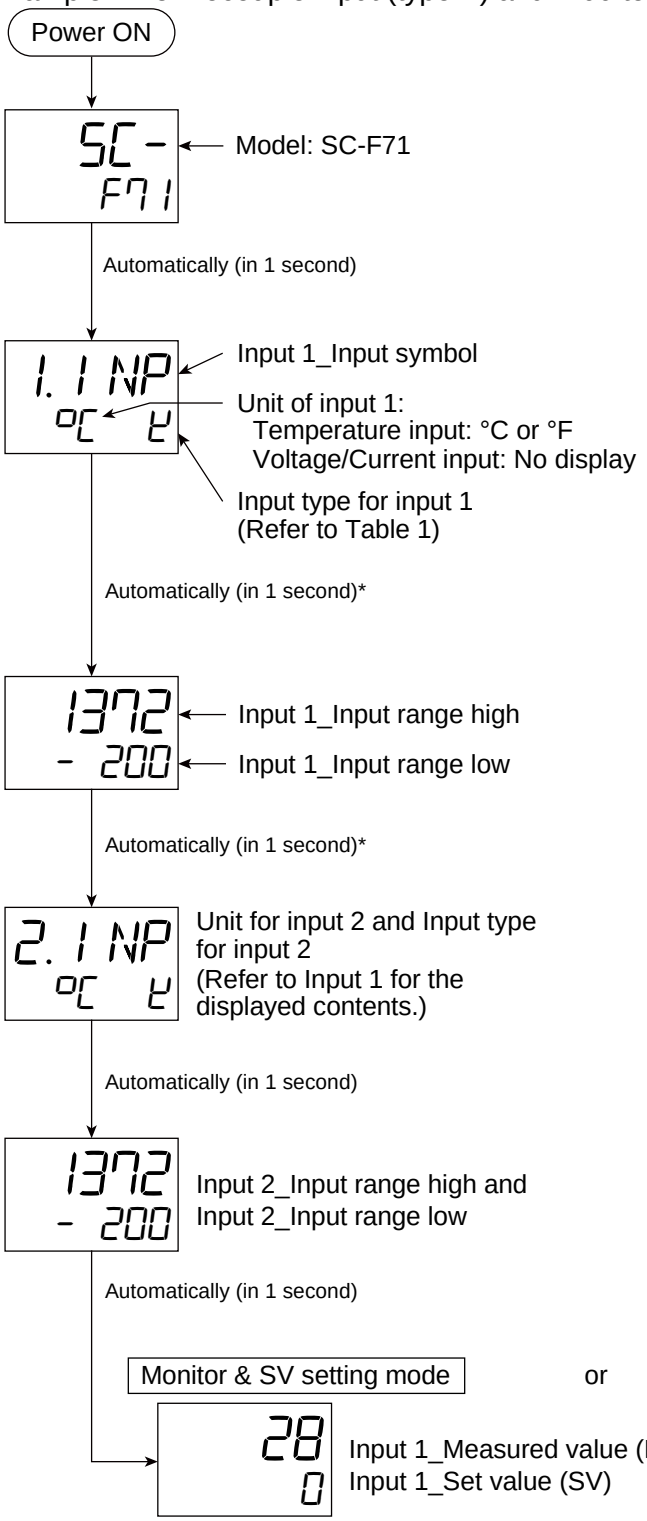


Table 1: Input type symbol

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

* Displayed for 2 seconds (Single input type)

2. Selecting Parameters

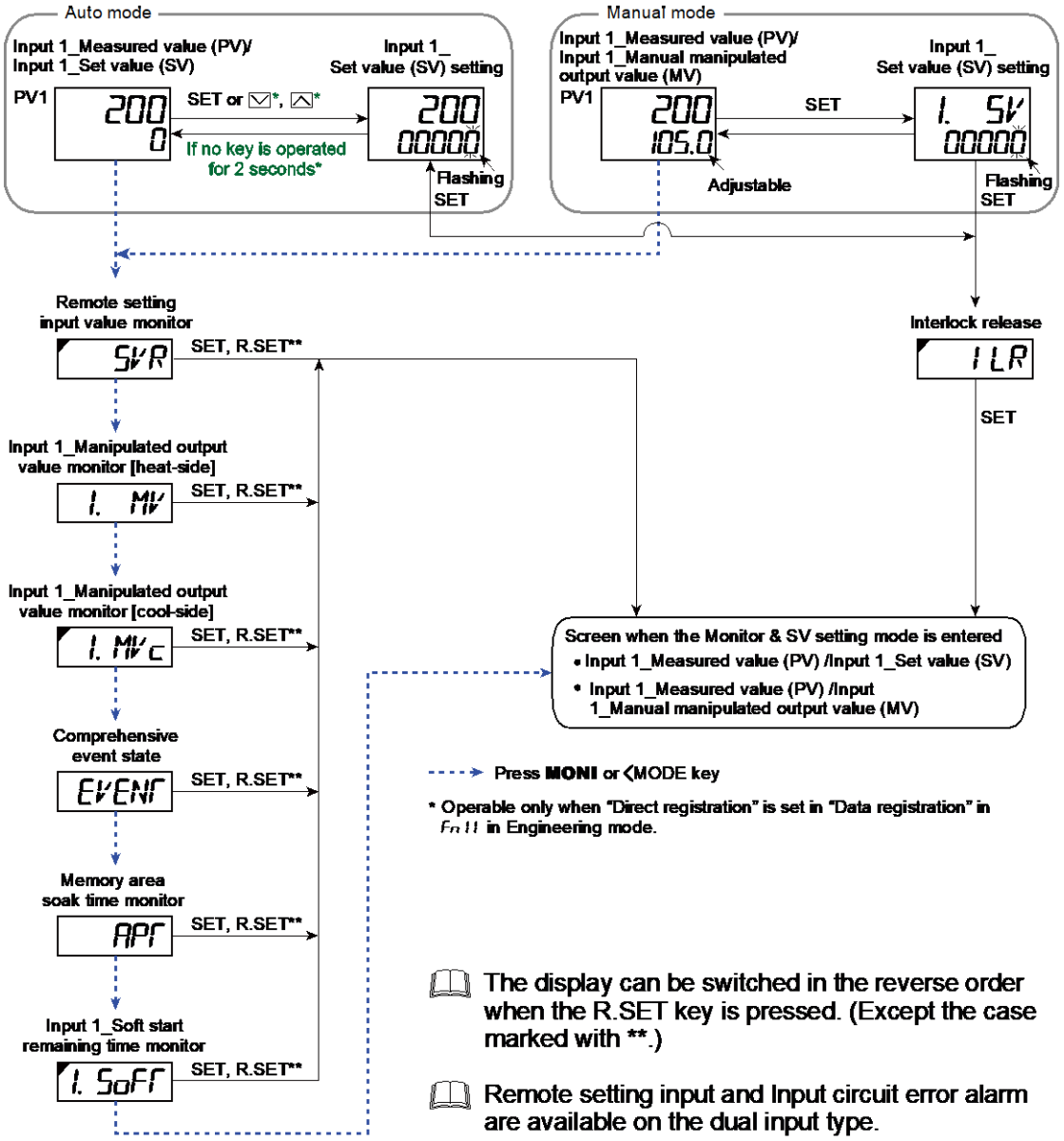
This chapter describes various parameter types and how to switch between them.

2.1 Monitor & SV Setting Mode [A]

When the Monitor and SV setting mode is entered, there are 4 (four) display contents depending on the control. Each display also differs between the Auto mode and the Manual mode.

- 1-loop control (including Remote setting input/Input circuit error alarm)
- 2-loop control/Cascade control
- Control with PV select
- Differential temperature control

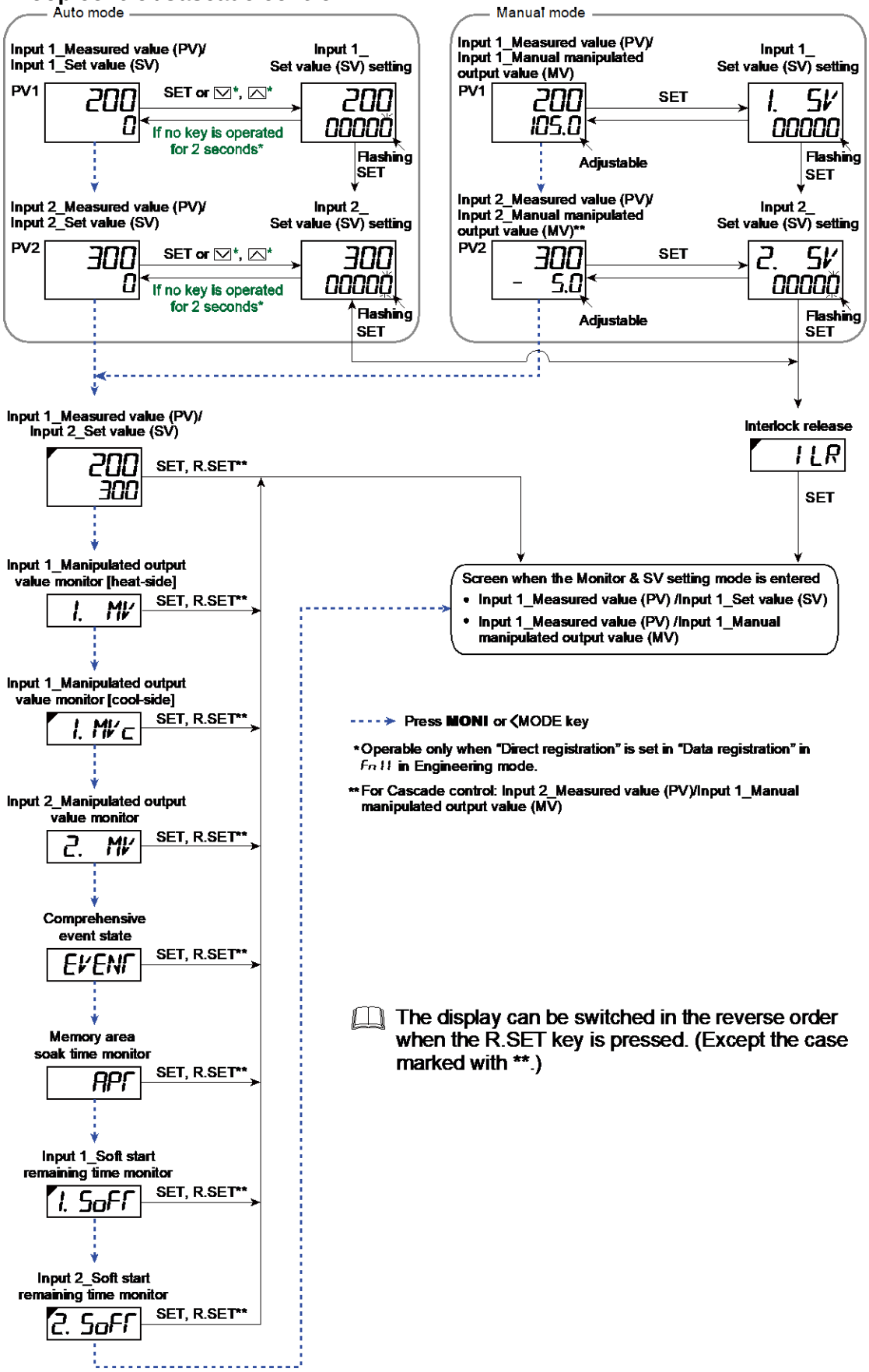
1-loop control (including Remote setting input/Input circuit error alarm)



The display can be switched in the reverse order when the R.SET key is pressed. (Except the case marked with **.)

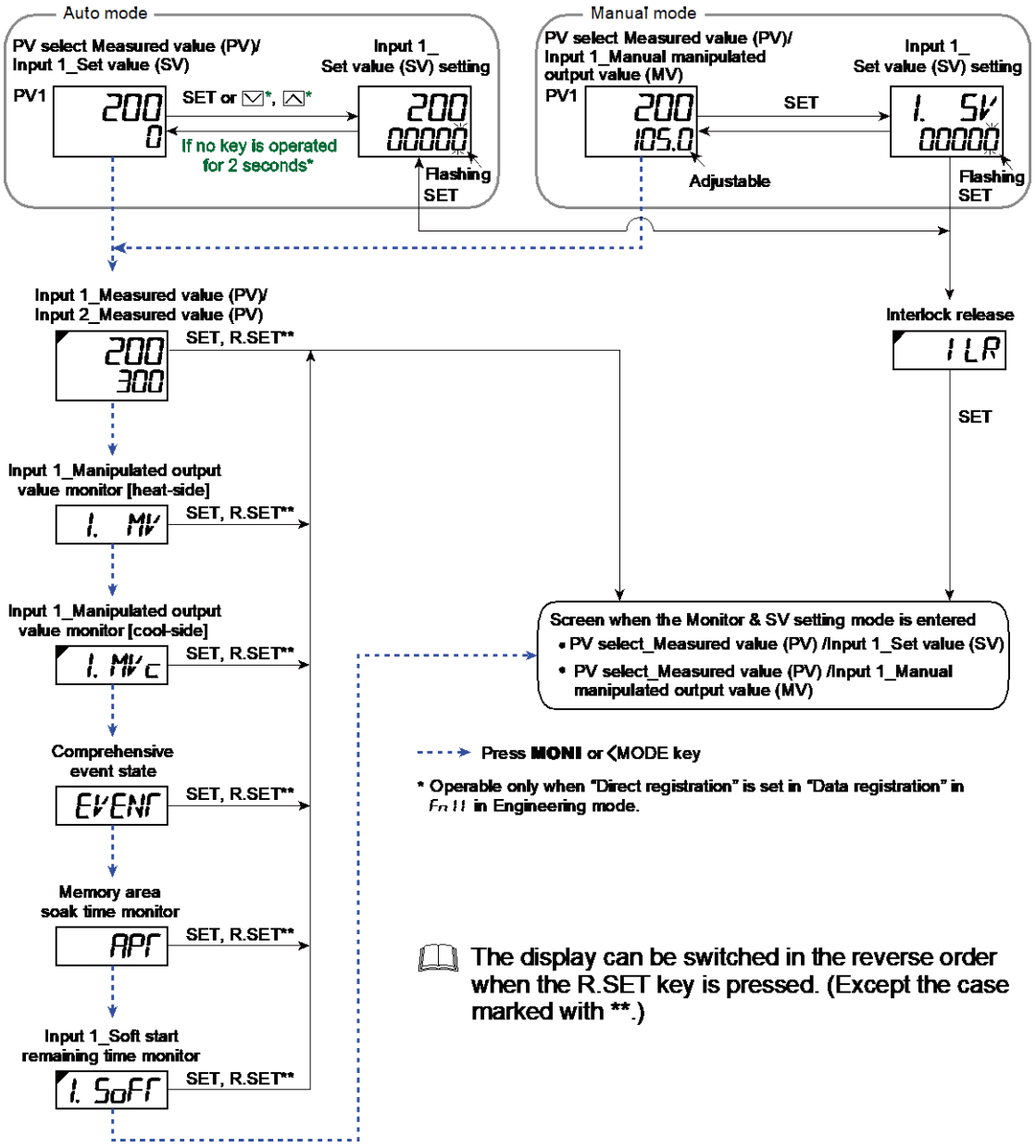
Remote setting input and Input circuit error alarm are available on the dual input type.

2-loop control/Cascade control

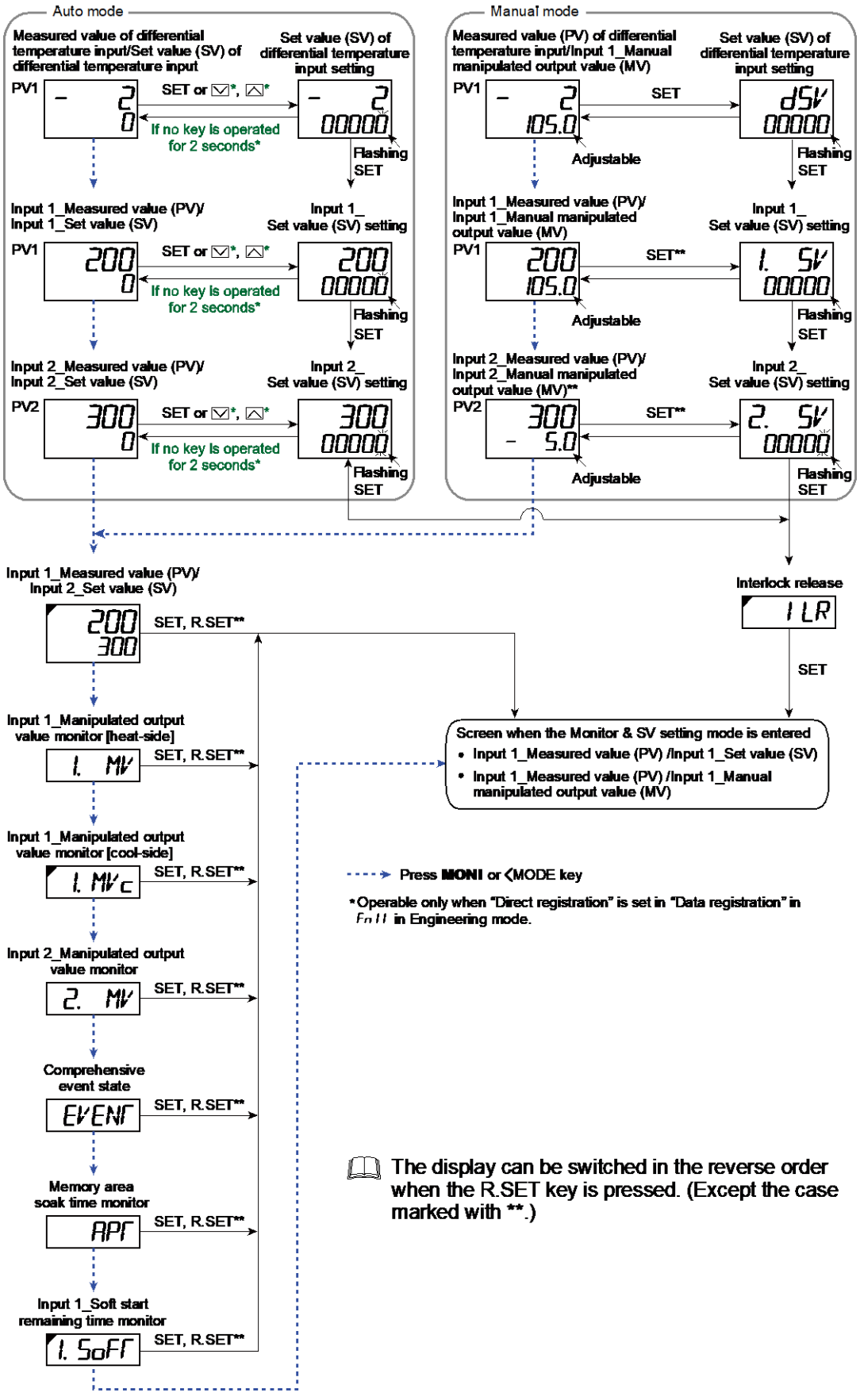


The display can be switched in the reverse order when the R.SET key is pressed. (Except the case marked with **.)

Control with PV select

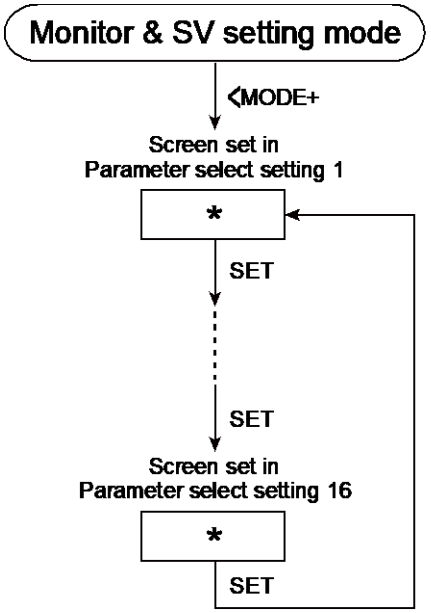

Auto mode
PV select Measured value (PV)/
Input 1_Set value (SV)
Input 1_
Set value (SV) setting
PV1
200
0
SET or *, *
If no key is operated
for 2 seconds*
200
00000
Flashing
SET
Manual mode
PV select Measured value (PV)/
Input 1_Manual manipulated
output value (MV)
Input 1_
Set value (SV) setting
PV1
200
105.0
SET
Adjustable
1. SV
00000
Flashing
SET
Input 1_Measured value (PV)/
Input 2_Measured value (PV)
200
300
SET, R.SET**
Interlock release
1LR
SET
Input 1_Manipulated output
value monitor [heat-side]
1. MV
SET, R.SET**
Input 1_Manipulated output
value monitor [cool-side]
1. MVC
SET, R.SET**
Comprehensive
event state
EVENT
SET, R.SET**
Memory area
soak time monitor
APT
SET, R.SET**
Input 1_Soft start
remaining time monitor
1. SoFT
SET, R.SET**
Screen when the Monitor & SV setting mode is entered
• PV select_Measured value (PV) /Input 1_Set value (SV)
• PV select_Measured value (PV) /Input 1_Manual
manipulated output value (MV)
Press MONI or <MODE key
* Operable only when "Direct registration" is set in "Data registration" in
Fn11 in Engineering mode.
The display can be switched in the reverse order
when the R.SET key is pressed. (Except the case
marked with **.)

Differential temperature control



2.2 Parameter Select Mode [B]

Displays the screens registered in Parameter select setting.

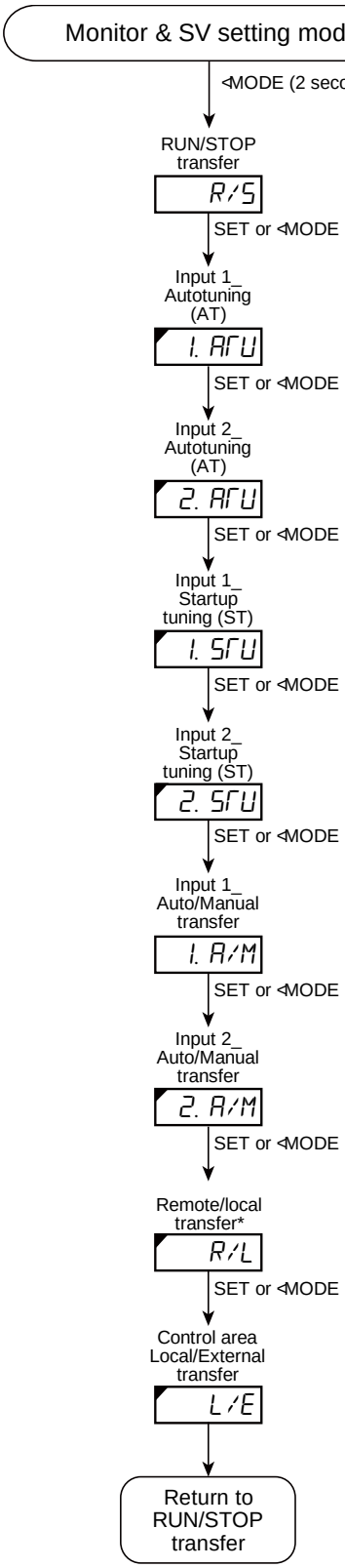


* Parameter symbol is displayed inside this box.

- The display can be switched in the reverse order when the R.SET key is pressed.
- While the Blind function is activated, only Parameter select setting screen, Set data lock mode, and PV/SV monitor* screens are displayed. The instrument starts from the Parameter select mode after being turned on.

* The PV/SV monitor includes SV setting mode and Manual manipulated output value setting.

2.3 Operation Transfer Mode [C]

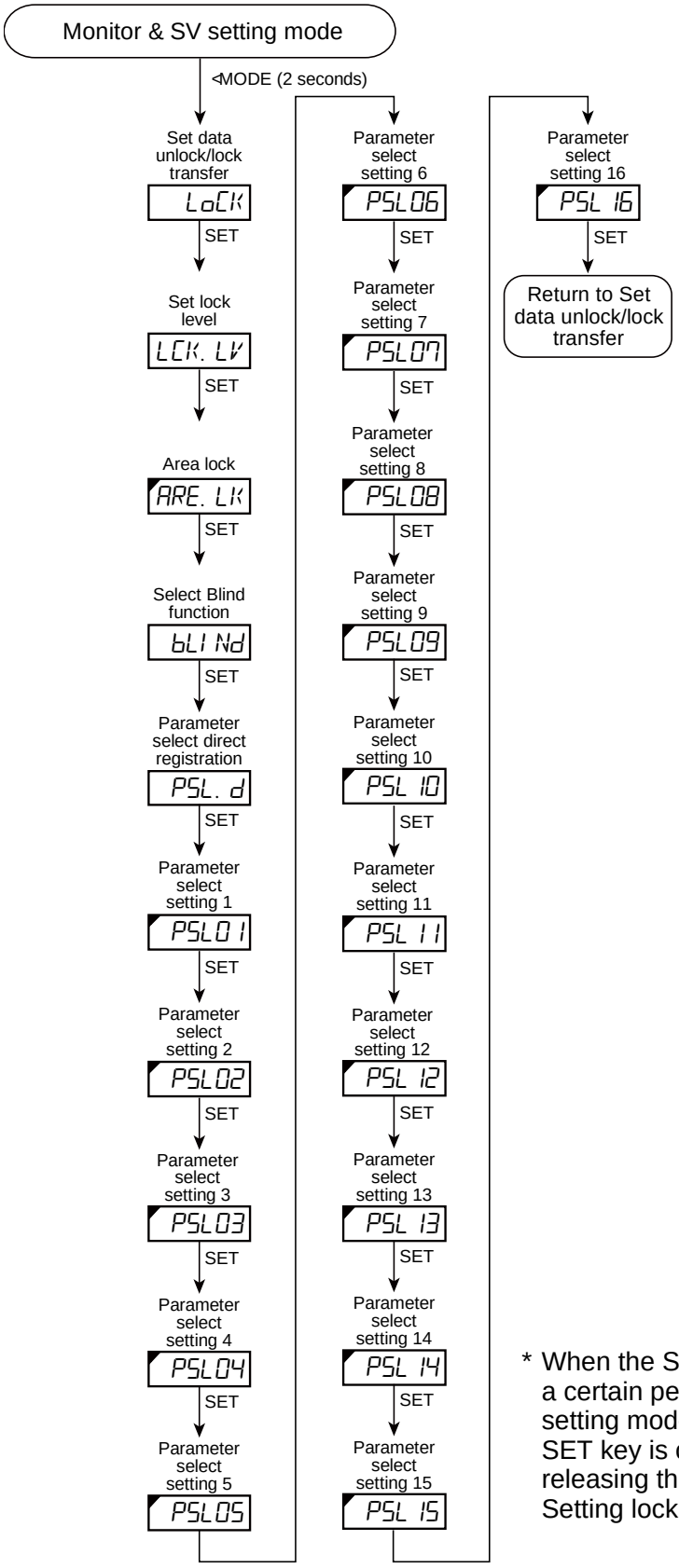


* This parameter is displayed when any of the following is selected in Select function for input 2: "Remote setting input", "Cascade control", "Control with PV select", or "2-loop control/Differential temperature control".

The display can be switched in the reverse order when the R.SET key is pressed.

Use the ∧ or ∨ key to switch modes (no SET key operation required), and a status indicator lights up or blinks if there is a status indicator corresponding to the mode.

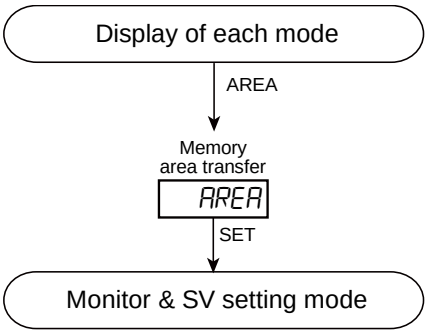
2.4 Setting Lock Mode [D]



* When the SET key is pressed and held for a certain period of time, the Parameter setting mode will be displayed once. If the SET key is continuously pressed without releasing the finger from the key, the Setting lock mode is entered.

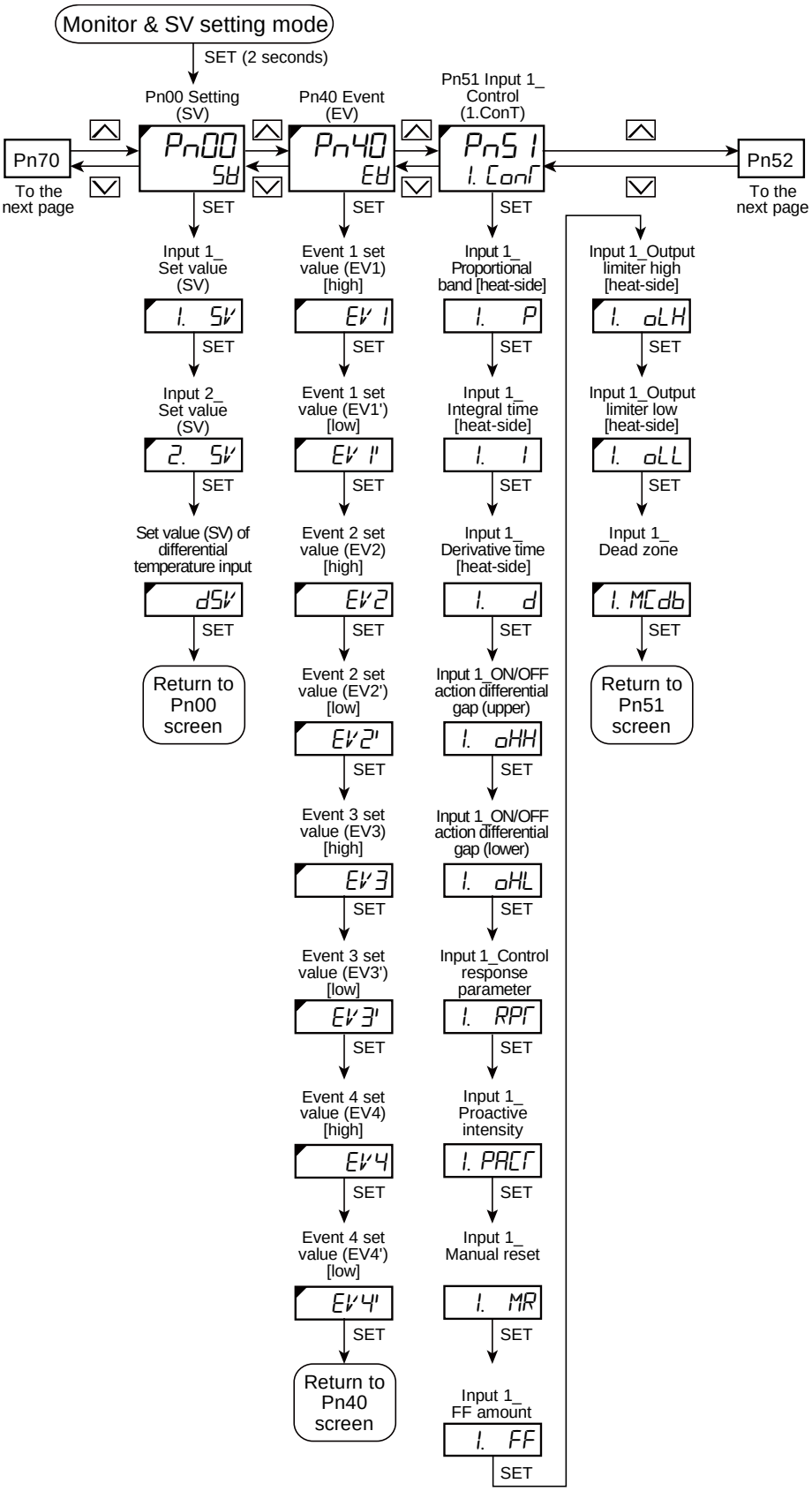
📖 The display can be switched in the reverse order when the R.SET key is pressed.

2.5 Memory Area Transfer Mode [E]

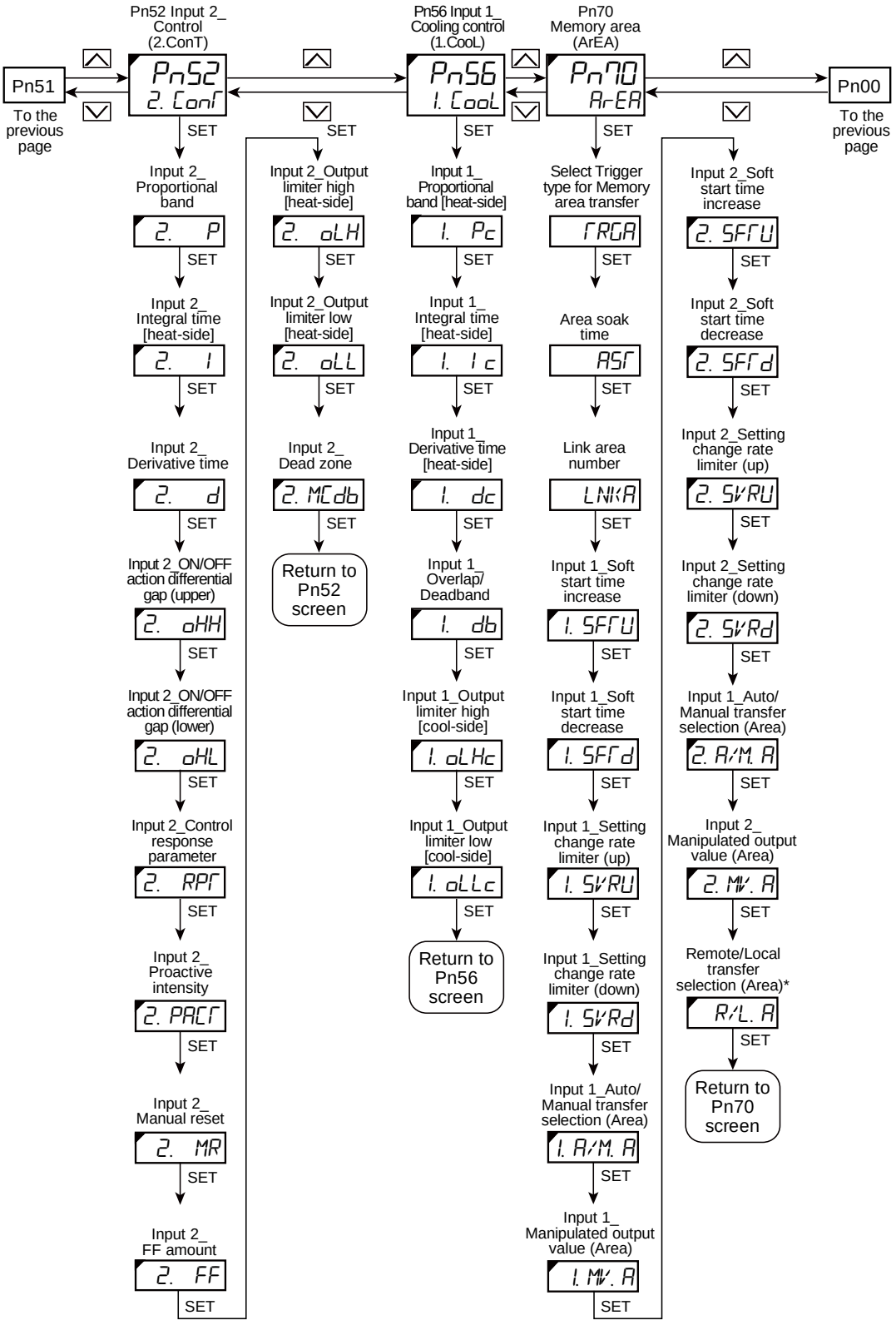


The display can be switched in the reverse order when the R.SET key is pressed.

2.6 Parameter Setting Mode [F]



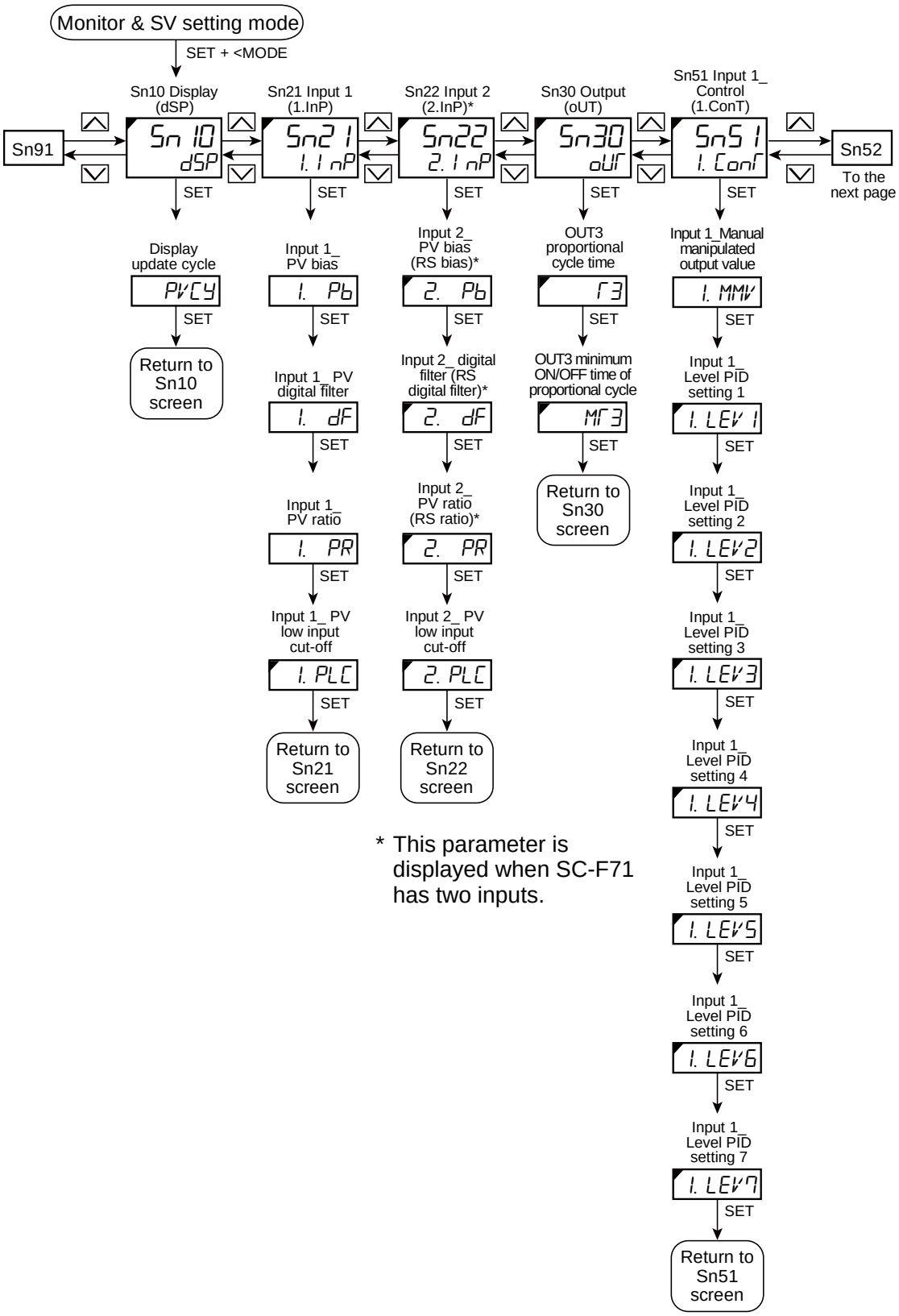
The display can be switched in the reverse order when the R.SET key is pressed.



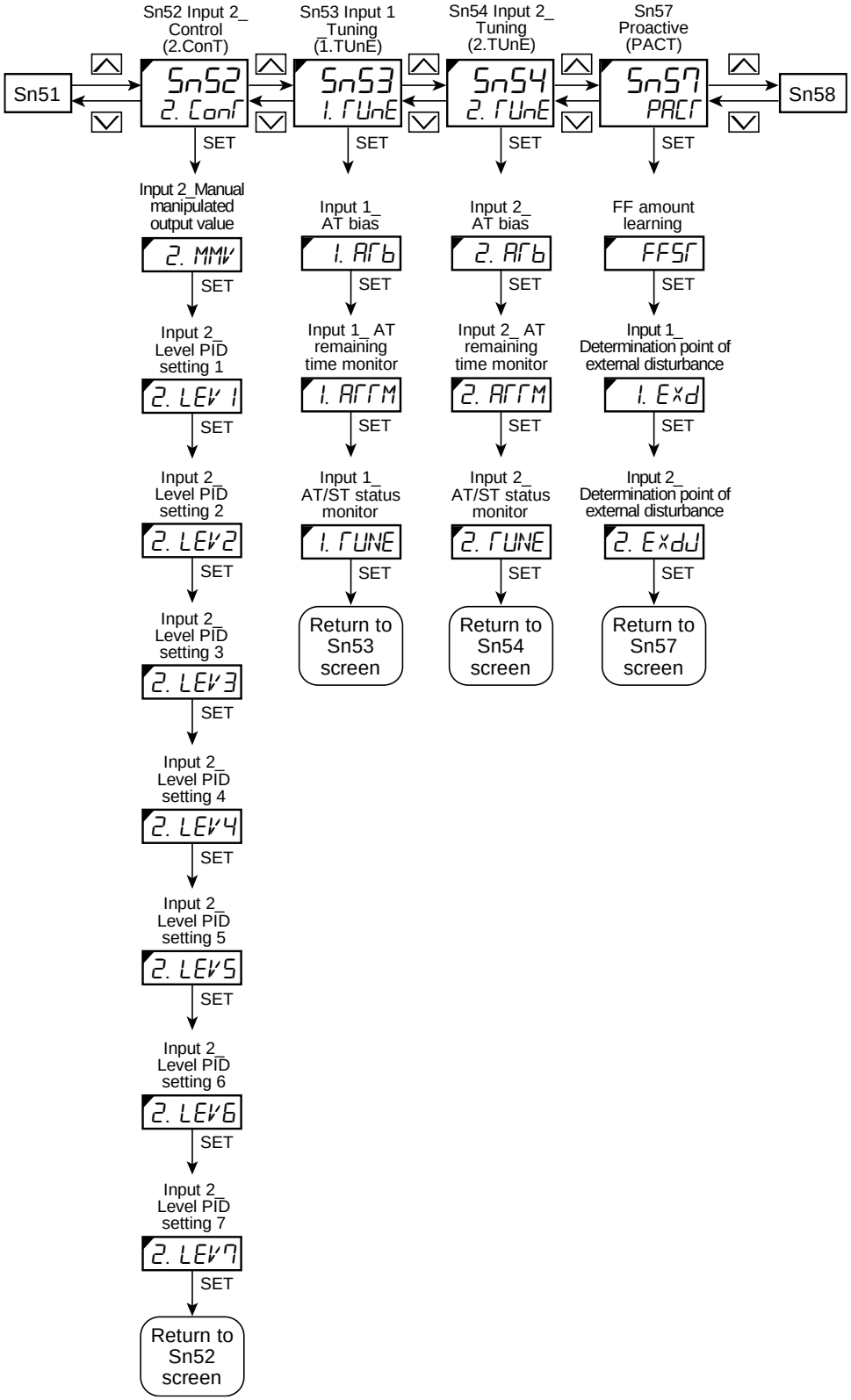
* This parameter is displayed when any of the following are selected in Select function for input 2: "Remote setting input", "Cascade control", "Control with PV select", or "2-loop control/Differential temperature control".

The display can be switched in the reverse order when the R.SET key is pressed.

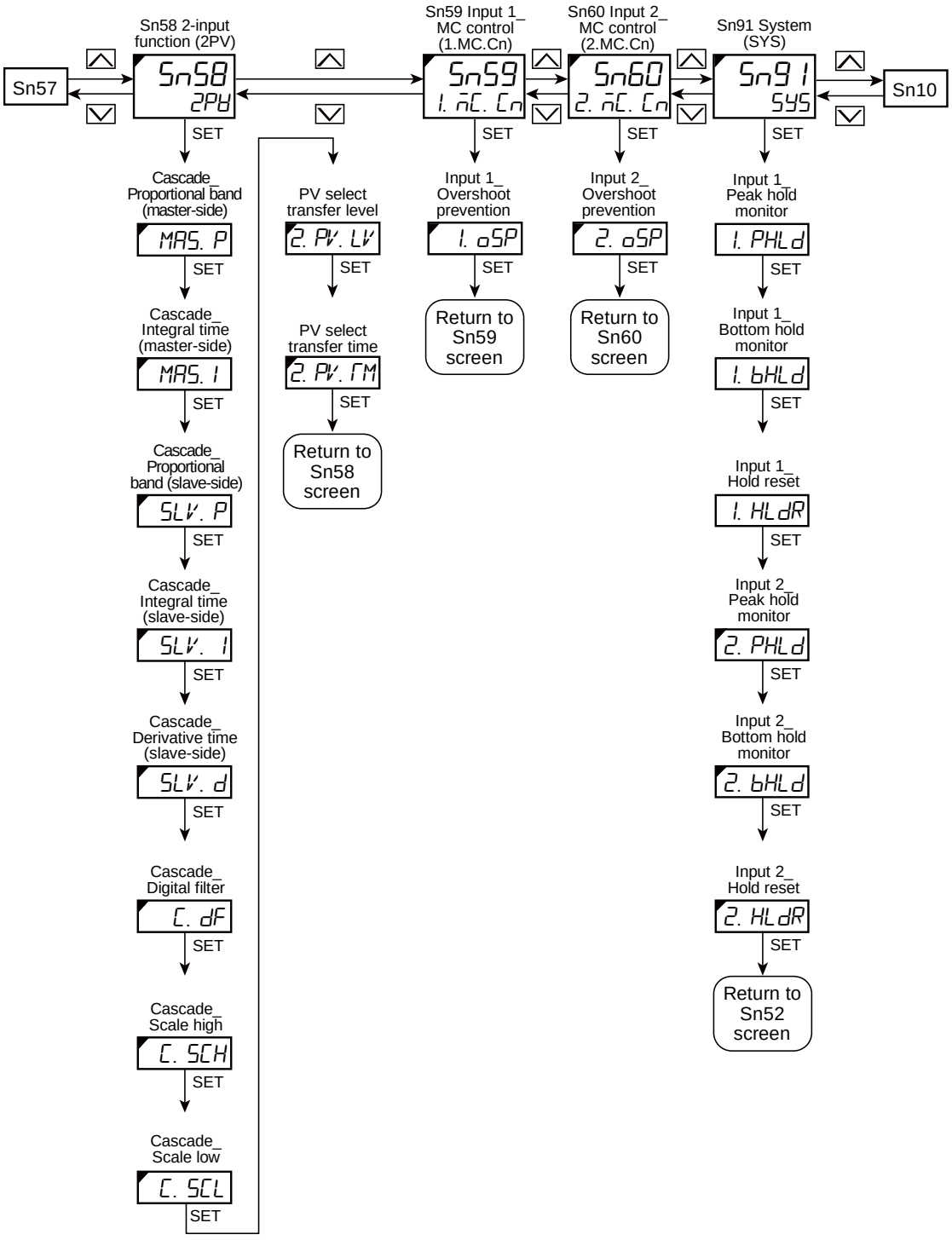
2.7 Setup Setting Mode [G]



The display can be switched in the reverse order when the R.SET key is pressed.

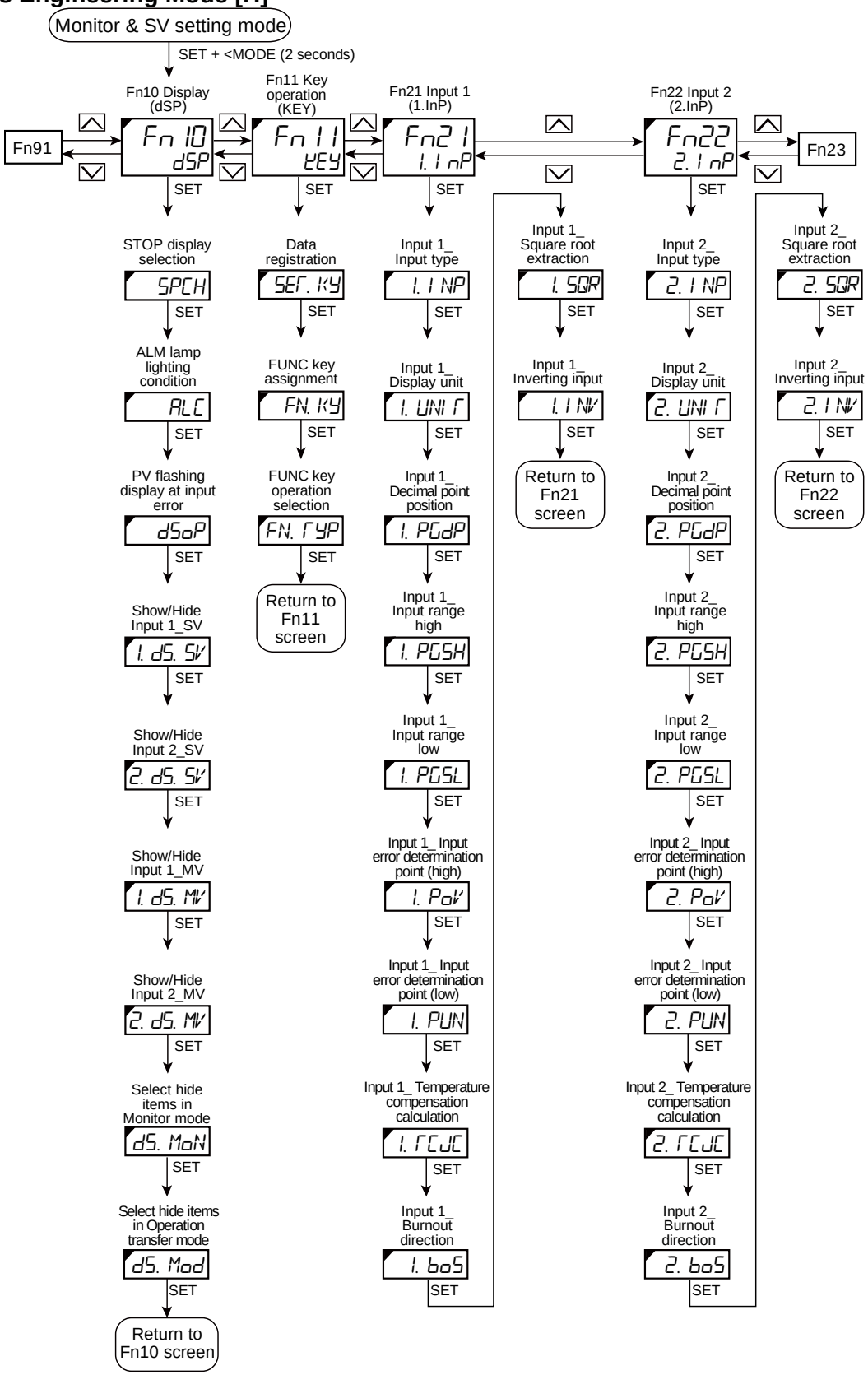


The display can be switched in the reverse order when the R.SET key is pressed.



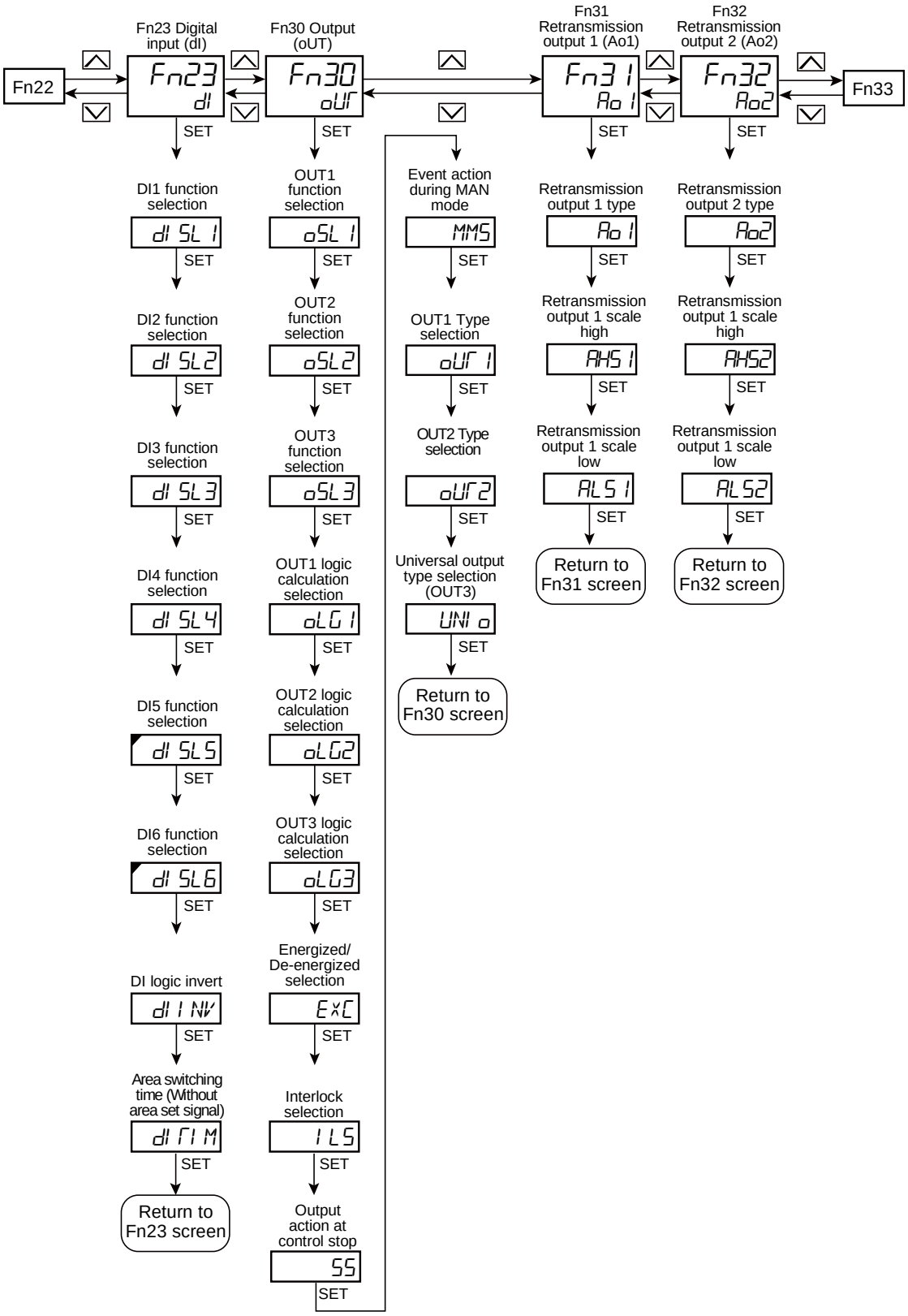
The display can be switched in the reverse order when the R.SET key is pressed.

2.8 Engineering Mode [H]

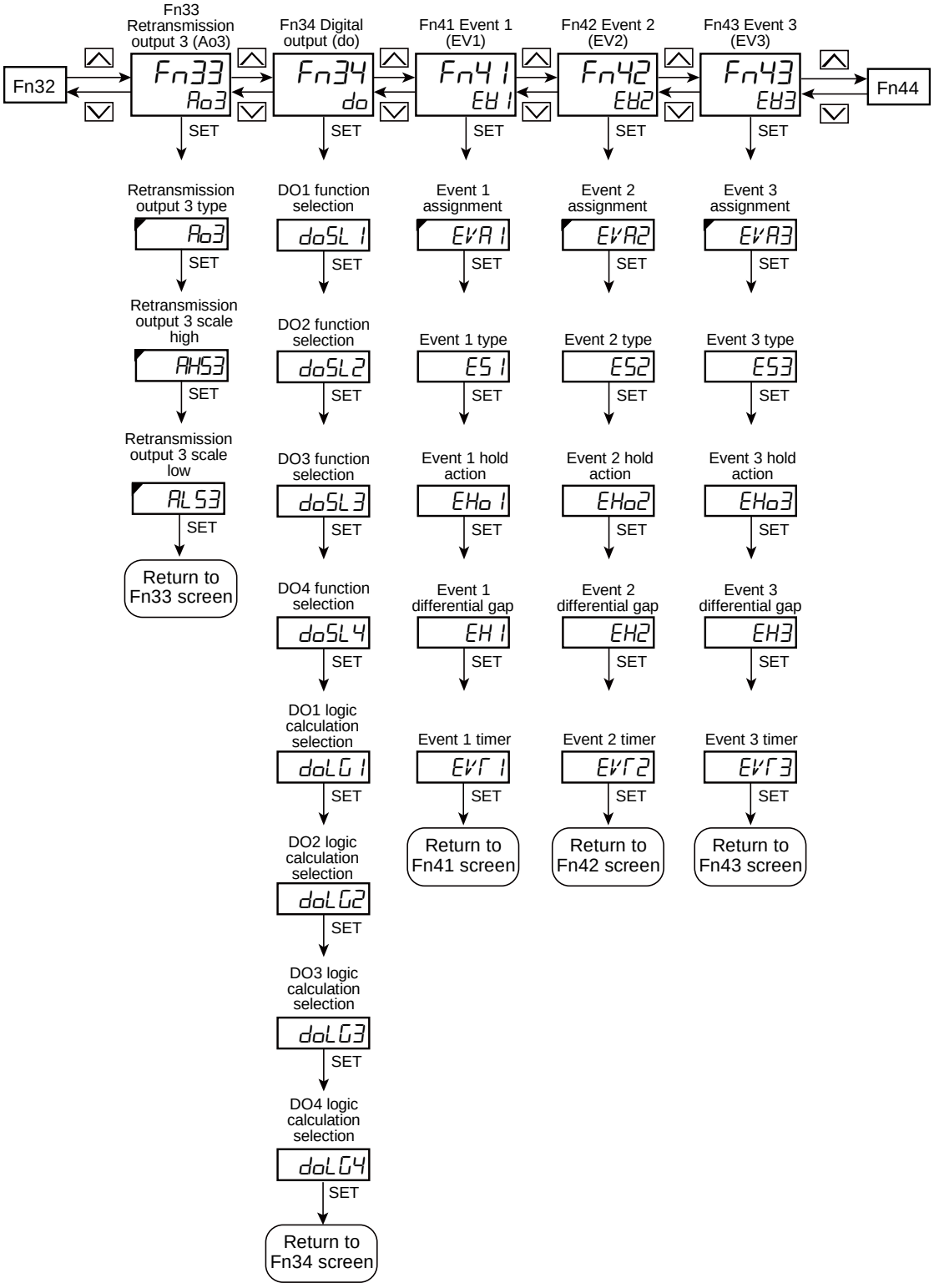


NOTE To set up parameters in Engineering mode, control must be stopped (STOP). Parameters can be checked while in RUN mode.

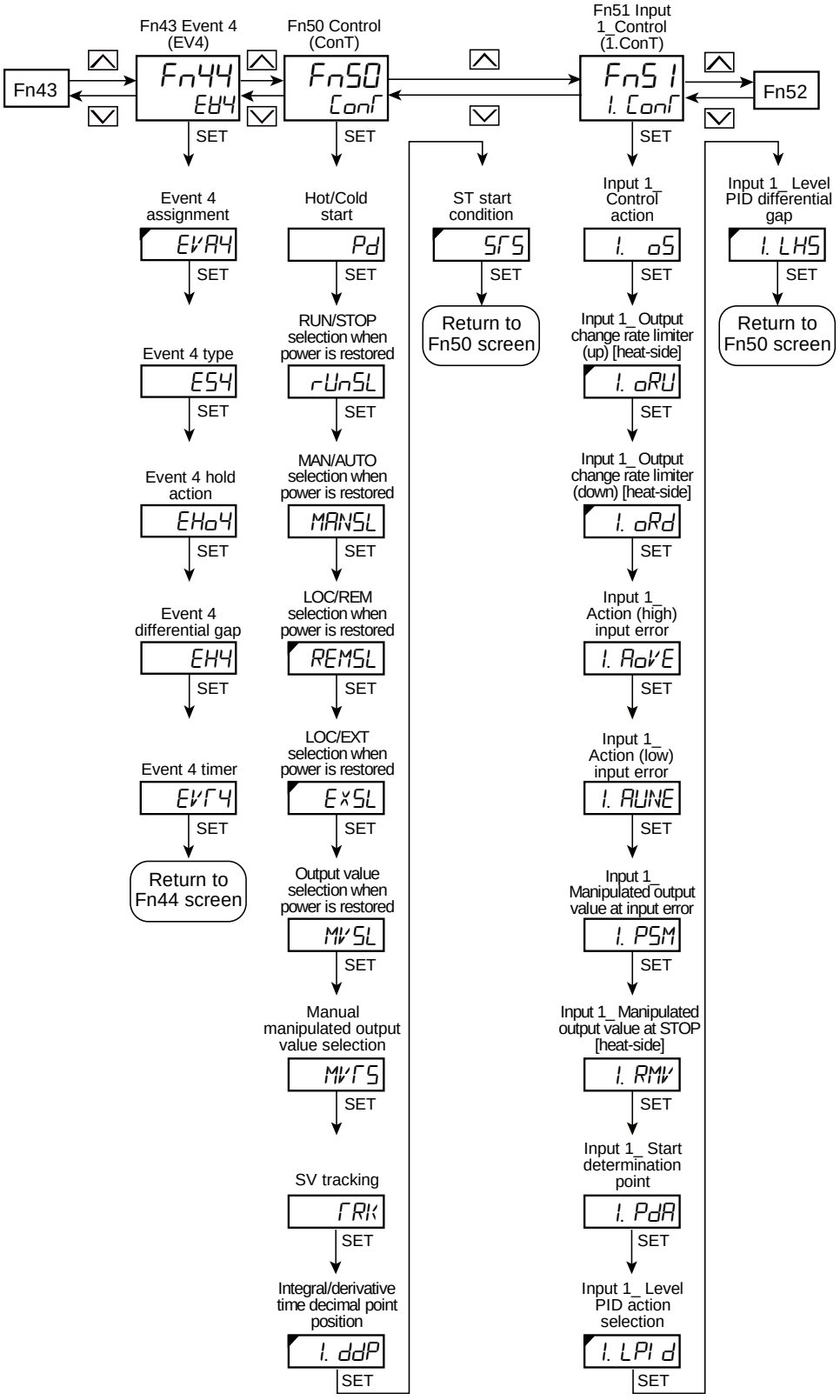
The display can be switched in the reverse order when the R.SET key is pressed.



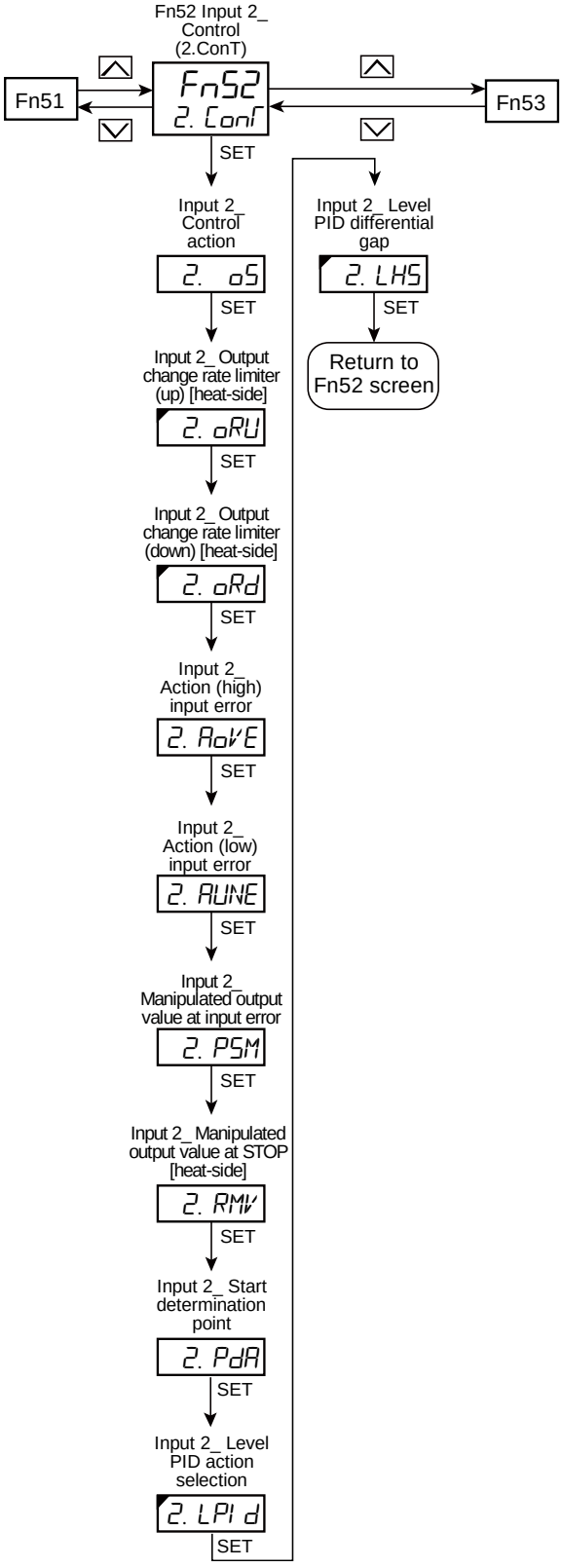
The display can be switched in the reverse order when the R.SET key is pressed.



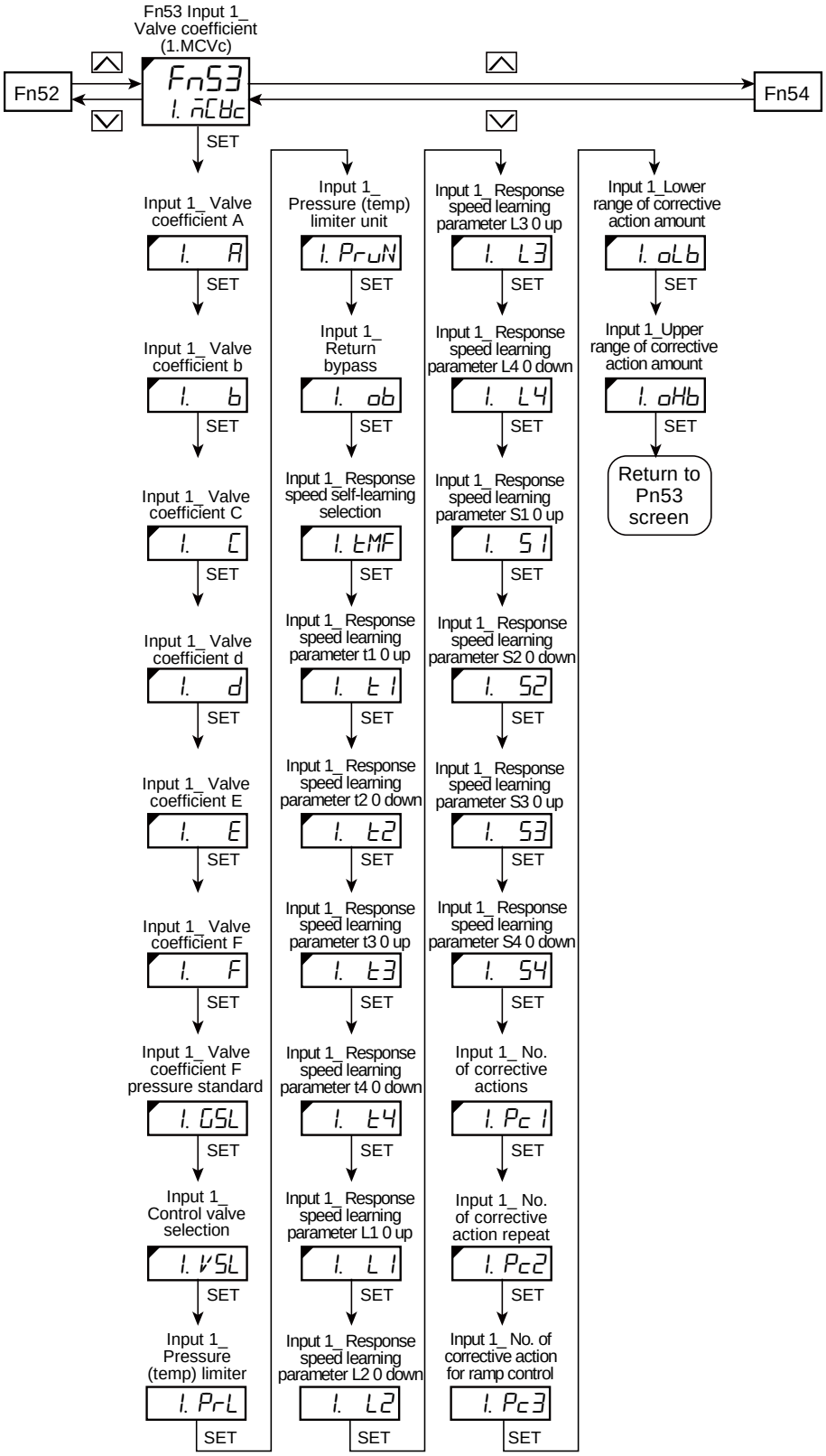
The display can be switched in the reverse order when the R.SET key is pressed.



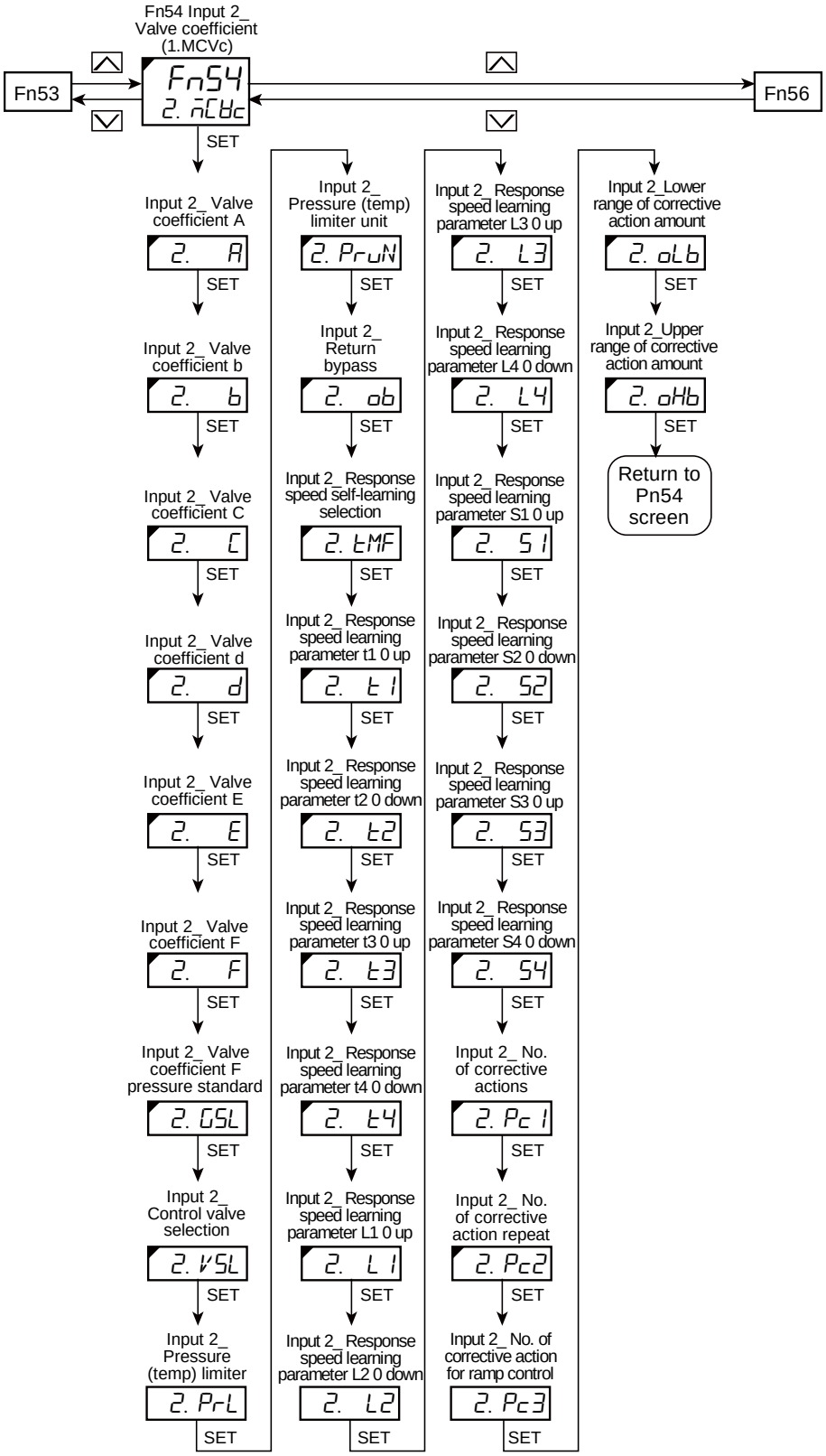
The display can be switched in the reverse order when the R.SET key is pressed.



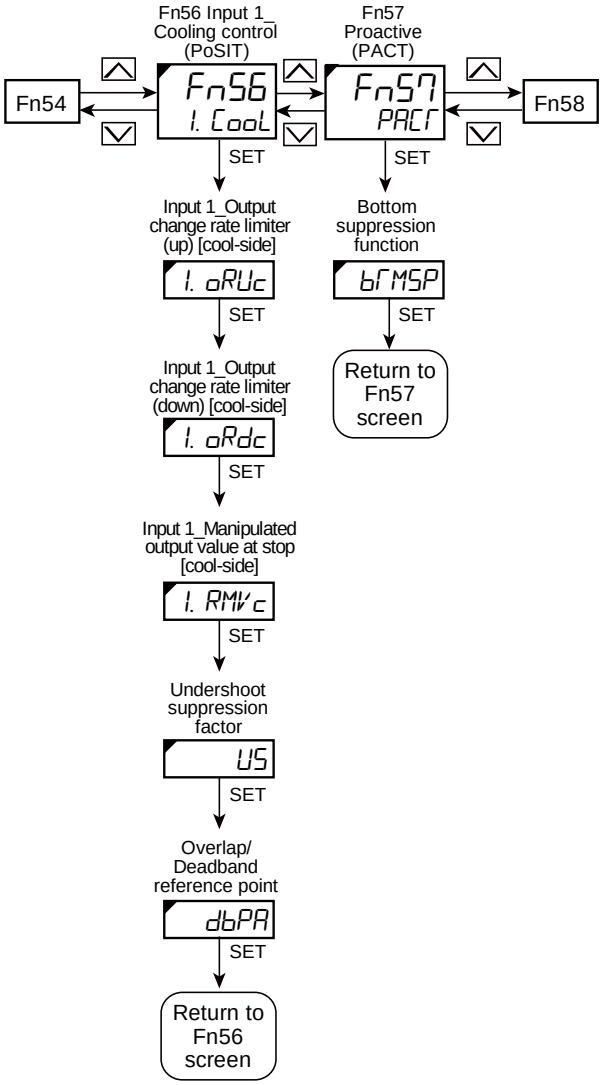
The display can be switched in the reverse order when the R.SET key is pressed.



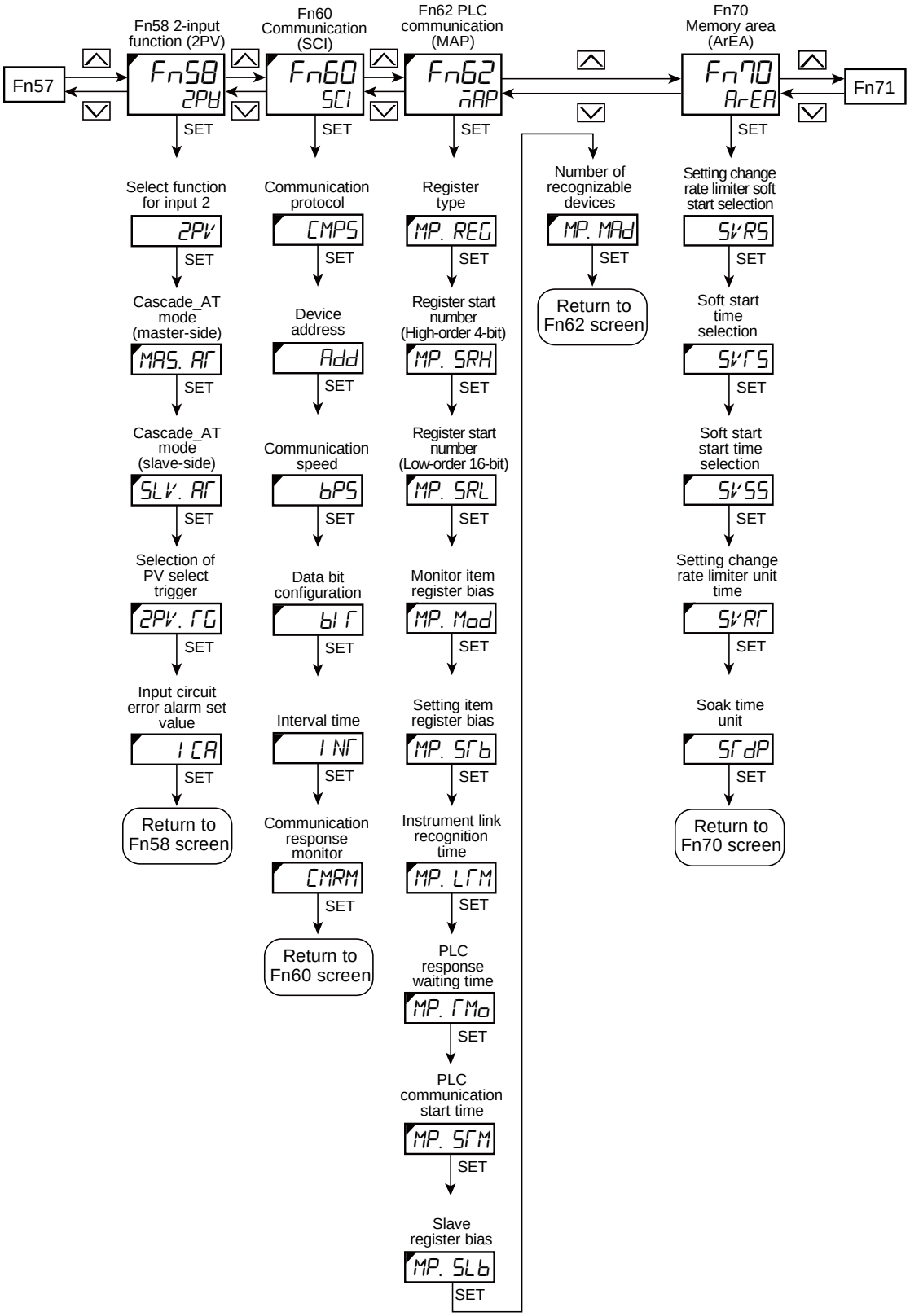
The display can be switched in the reverse order when the R.SET key is pressed.



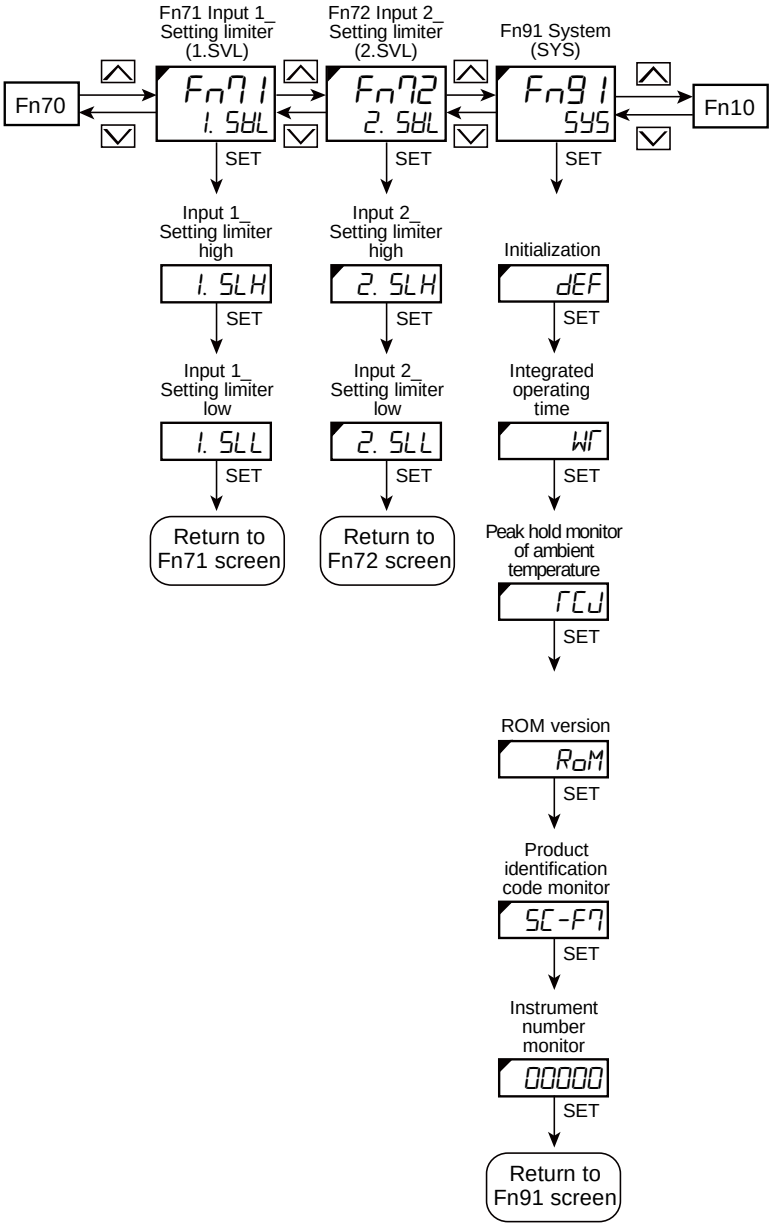
The display can be switched in the reverse order when the R.SET key is pressed.



The display can be switched in the reverse order when the R.SET key is pressed.



The display can be switched in the reverse order when the R.SET key is pressed.



The display can be switched in the reverse order when the R.SET key is pressed.

3. Parameter

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

3.1 How to Read the Table

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

(1) No.: This is a screen number used to register screens displayed in Parameter select mode. The screen number can be registered in the Parameter select setting screen. Parameters without numbers cannot be registered in the 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

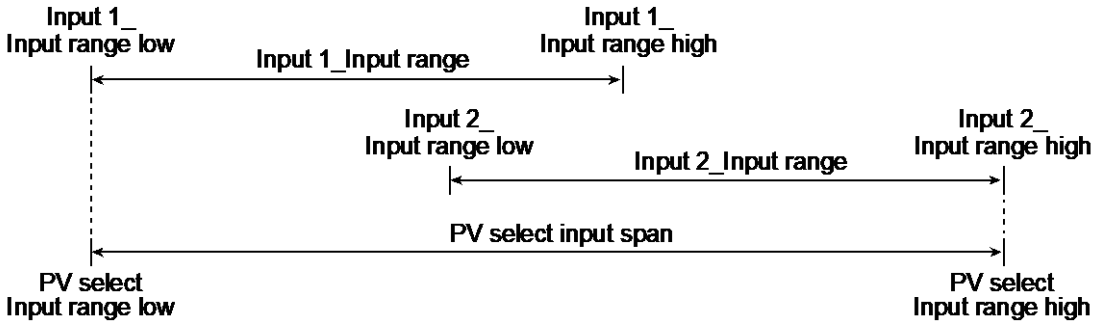
(5) Factory set value: Factory set value of parameters

(6) User set value: Stores parameter values set by the user. This may be useful when the data is initialized.

In the data range and the factory set value some unfamiliar expressions are used. These are used for Control with PV select and can be rephrased as follows:
PV select input span as Input span
PV select input range high as Input range high
PV select input range low as Input range low
The setting range is as follows.

- PV select input range high: Input range high of Input 1 and Input 2, whichever is larger
- PV select input range low: Input range low of Input 1 and Input 2, whichever is smaller
- PV select input span: PV select input range low up to PV select input range high

[Example] When there is a relation as follows between the Input range of Input 1 and Input 2.



3.2 Monitor & SV Setting Mode [A]

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	Input 1_Measured value (PV)/ Input 1_Set value (SV) [1]	PV display unit: Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
			SV display unit [2]: • Input 1_Set value (SV) (Auto mode: at RUN) • STOP display [STOP, dSTP, KSTP] • Remote setting input value (at Remote mode) • Input 1_Manual manipulated output value (at Manual mode)		
1	—	PV select Measured value (PV)/ Input 1_Set value (SV) [3]	PV display unit: When controlling with Input 1: Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) When controlling with Input 2: Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
			SV display unit [2]: • Input 1_Set value (SV) (Auto mode: at RUN) • STOP display [STOP, dSTP, KSTP] • Input 1_Manual manipulated output value (at Manual mode)		
2	—	Input 2_Measured value (PV)/ Input 2_Set value (SV) [4]	PV display unit: Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
			SV display unit [1] [2]: • Input 2_Set value (SV) (Auto mode: at RUN) • STOP display [STOP, dSTP, KSTP] • Input 2_Manual manipulated output value (at Manual mode)		
3	—	Measured value (PV) of differential temperature input/ Set value (SV) of differential temperature input [5]	PV display unit: -19999 to +99999 [Varies with the setting of the Decimal point position.]	—	—
			SV display unit: -(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]		
4	—	Input 1_Measured value (PV)/ Input 2_ Measured value (PV) [6]	PV display unit: Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
			SV display unit: Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]		
24	1. SV	Input 1_Set value (SV) [7] ★	Input 1_Setting limiter low to Input 1_ Setting limiter high [Varies with the setting of the Decimal point position.]	0	
25	2. SV	Input 2_Set value (SV) [7] [8] ★	Input 2_Setting limiter low to Input 2_ Setting limiter high [Varies with the setting of the Decimal point position.]	0	
26	dSV	Set value (SV) of differential temperature	-(Input 1_Input span) to +(Input 1_Input span)	0	

		input [5) 7)] ★	[Varies with the setting of the Decimal point position.]		
5	SVR	Remote setting input value monitor [9)]	Input 1_Setting limiter low to Input 1_ Setting limiter high [Varies with the setting of the Decimal point position.]	—	—
6	1. MV	Input 1_Manipulated output value monitor [heat-side]	-5.0 to +105.0%	—	—
7	1. MVc	Input 1_Manipulated output value monitor [cool-side] [10)]	-5.0 to +105.0%	—	—
8	2. MV	Input 2_Manipulated output value monitor [11)]	-5.0 to +105.0%	—	—
9	EVENT	Comprehensive event state	When an event occurs, the character of the occurring event is displayed on the Set value (SV) display unit. If two or more events occur at the same time, the relevant characters are displayed alternately every 0.5 seconds. EVT 1: Event 1 EVT2: Event 2 EVT3: Event 3 EVT4: Event 4 In1UP: Input 1_Input error high In1dn: Input 1_Input error low In2UP: Input 2_Input error high In2dn: Input 2_Input error low	—	—
10	APT	Memory area soak time monitor	0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds 0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Data range of Memory area soak time monitor can be selected on the Soak time unit.]	—	—
11	1. SoFT	Input 1_Soft start remaining time [12)]	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes to 59 seconds [Time unit depends on the Soft start time unit setting.]	—	—
12	2. SoFT	Input 2_Soft start remaining time [11) 12)]	0 hours00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes to 59 seconds [Time unit depends on the Soft start time unit setting.]	—	—
13	ILR	Interlock release [13)]	oFF: Interlock release on: Interlock state	oFF	

★ Data included in Memory area

1) Not displayed when “Control with PV select” is selected in “Select function for input 2.”

2) Refer to the following table for the display range and the setting range of each data.

Display data	Data type	Data range
Input 1_Set value (SV)	Monitor/Setting	Input 1_Setting limiter low to Input 1_Setting limiter high
Input 2_Set value (SV)	Monitor/Setting	Input 2_Setting limiter low to Input 2_Setting limiter high
Remote setting input value	Monitor	Input 1_Setting limiter low to Input 1_Setting limiter high
Input 1_Manual manipulated output value	Setting	• In case of PID control: Input 1_Output limiter low [heat-side] to Input 1_Output limiter high [heat-side] • In case of Heating/Cooling PID control: −Input 1_Output limiter low [cool-side] to +Input 1_Output limiter high [heat-side] • In case of pressure or temperature control with MC-(V)COS(R): Input 1_Output limiter low [heat-side] to whichever the smaller value of either "calculated value from Input 1_Pressure (temperature) limiter" or "Input 1_Output limiter high [heat_side]
Input 2_Manual manipulated output value	Setting	Input 2_Output limiter low to Input 2_Output limiter high

3) Displayed when “Control with PV select” is selected in “Select function for input 2.”

4) Displayed when “2-loop control/Differential temperature control” or “Cascade control” is selected in “Select function for input 2.”

5) Displayed when “2-loop control/Differential temperature control” is selected in “Select function for input 2” AND “Differential temperature control” is selected in “2-loop control/Differential temperature control.”

6) Displayed when “2-loop control/Differential temperature control,” “Cascade control,” “Control with PV select” or “Input circuit error alarm” is selected in “Select function for input 2.”

7) Displayed in Manual mode.

8) Displayed when “2-loop control/Differential temperature control” or “Cascade control” is selected in “Select function for input 2.”

9) Displayed when “Remote setting input” is selected in “Select function for input 2.”

10) Displayed when Input 1 is Heating/Cooling PID control.

11) Displayed when " 2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "2-loop" is selected in "Remote/Local transfer (two-loop/differential temperature control transfer)".

12 Displayed when "Soft start" is selected in "Soft start/setting change rate limiter selection" in Function block No. 70: Memory area function (ArEA).

13 Displayed when Interlock function is available.

3.3 Parameter Select Mode [B]

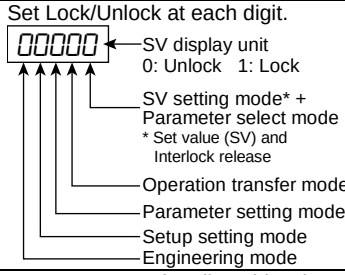
Up to 16 screens registered on the Parameter select setting screen (Set data lock mode) by the user can be displayed.

3.4 Operation Transfer Mode [C]

No.	Symbol	Name	Data range	Factory set value	User set value
15	R/S	RUN/STOP transfer	rUn: RUN (Control start) StoP: STOP (Control stop)	StoP	
16	1. AtU	Input 1_Autotuning (AT) [1]	oFF: PID control on: Start Autotuning When the Autotuning (AT) is finished, the control will automatically return to "oFF."	oFF	
17	2. AtU	Input 2_Autotuning (AT) [2]	oFF: PID control on: Start Autotuning When the Autotuning (AT) is finished, the control will automatically return to "oFF."	oFF	
18	1. StU	Input 1_Startup tuning (ST) [1]	oFF: ST unused on 1: Execute once * on2: Execute always * When the ST is finished, the control will automatically return to "oFF."	oFF	
19	2. StU	Input 2_Startup tuning (ST) [2]	oFF: ST unused on 1: Execute once * on2: Execute always * When the ST is finished, the control will automatically return to "oFF."	oFF	
20	1. A/M	Input 1_Auto/Manual transfer	Auto: Auto mode nAn: Manual mode	nAn	
21	2. A/M	Input 2_Auto/Manual transfer [3]	Auto: Auto mode nAn: Manual mode	nAn	
22	R/L	Remote/Local transfer [4]	When "Remote setting input" is selected at Select function for Input 2 [5] LoC: Local mode rEn: Remote mode	LoC	
			When "Cascade control" is selected at Select function for input 2 [6] SnGL: Single control CAS: Cascade control	SnGL	
			When "Control with PV select" is selected at Select function for input 2 [7] inP 1: Input 1 inP2: Input 2	inP 1	
			When "2-loop control/Differential temperature control" is selected at Select function for input 2 [8] 2LooP: 2-loop control dIFF: Differential temperature control	2LooP	
23	L/E	Control area Local/ External transfer [9]	LoC: Local mode EXT: External mode	LoC	

[1] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".
[2] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "Pressure control operation [MC-(V)COS(R)]" is not selected in "Input 2_Control action".
[3] Displayed when one of "Remote setting input", "Cascade control", "Control with PV select", or "2-loop control/Differential temperature control" is selected, AND in the case of "2-loop control", "PID control" or "Heating/Cooling PID control" is selected in both Input 1_Control action and Input 2_Control action.
[4] Displayed when "Remote setting input" is selected in "Select function for Input 2."
[5] Displayed when "Cascade control" is selected in "Select function for Input 2."
[6] Displayed when "Control with PV select" is selected in "Select function for Input 2." When "Switching by level" is selected at "Selection of PV select trigger," the parameter becomes display only.
[7] Displayed when "Control with PV select" is selected in "Select function for Input 2." When "Switching by level" is selected at "Selection of PV select trigger," the parameter becomes display only.
[8] Displayed when "2-loop/differential temperature control" is selected in "Select function for Input 2" AND "PID control" or "Heating/Cooling PID control" is selected both in Input 1 and Input 2.
[9] Displayed when "Memory area transfer (without area set signal)" is selected in DI function selection.

3.5 Setting Lock Mode [D]

No.	Symbol	Name	Data range	Factory set value	User set value
—	LoCK	Set data unlock/lock transfer	oFF: Unlock state on: Lock state	oFF	
—	LCK. LV	Set lock level	Set Lock/Unlock at each digit.  	00000	
—	ARE. LK	Area lock	0: Memory area is adjustable when the setting data is locked. 1: Memory area is not adjustable when the setting data is locked. (Memory area transfer mode is not displayed)	0	
—	bLInd	Select Blind function	oFF: Blind function: OFF on: Blind function: ON	oFF	
—	PSL. d	Parameter select direct registration	oFF: Direct registration: OFF on: Direct registration: ON	oFF	
—	PSL01	Parameter select setting 1	1 to 351 (Screen No.) 0: No registration	0	
—	PSL02	Parameter select setting 2	1 to 351 (Screen No.) 0: No registration	0	
—	PSL03	Parameter select setting 3	1 to 351 (Screen No.) 0: No registration	0	
—	PSL04	Parameter select setting 4	1 to 351 (Screen No.) 0: No registration	0	
—	PSL05	Parameter select setting 5	1 to 351 (Screen No.) 0: No registration	0	
—	PSL06	Parameter select setting 6	1 to 3513 (Screen No.) 0: No registration	0	
—	PSL07	Parameter select setting 7	1 to 351 (Screen No.) 0: No registration	0	
—	PSL08	Parameter select setting 8	1 to 351 (Screen No.) 0: No registration	0	
—	PSL09	Parameter select setting 9	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 10	Parameter select setting 10	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 11	Parameter select setting 11	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 12	Parameter select setting 12	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 13	Parameter select setting 13	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 14	Parameter select setting 14	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 15	Parameter select setting 15	1 to 351 (Screen No.) 0: No registration	0	
—	PSL 16	Parameter select setting 16	1 to 351 (Screen No.) 0: No registration	0	

3.6 Memory Area Transfer Mode [E]

No.	Symbol	Name	Data range	Factory set value	User set value
14	AREA	Memory area transfer [1)]	1 to 16	1	

[1)] Displayed in the Monitor & SV setting mode.
Displayed only (not settable) when "Memory area transfer (without area set signal)" is selected in "DI function selection" AND "External mode" is selected in "Control area Local/External transfer."
Not displayed when "Memory area is not adjustable when the setting data is locked" is selected in Area lock.

3.7 Parameter Setting Mode [F]

3.7.1 Parameter group No. 00: Setting (SU)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn00	Parameter group No. 00	This is the first parameter symbol of Parameter group No. 00.	—	—
24	1. SV	Input 1_Set value (SV) ★	Input 1_Setting limiter low to Input 1_ Setting limiter high [Varies with the setting of the Decimal point position.]	0	
25	2. SV	Input 2_Set value (SV) [1] ★	Input 2_Setting limiter low to Input 2_ Setting limiter high [Varies with the setting of the Decimal point position.]	0	
26	dSV	Set value (SV) of differential temperature input [2] ★	-(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	0	

★ Data included in Memory area
[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."
[2] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "Differential temperature control" is selected in "two-loop control/Differential temperature control."

3.7.2 Parameter group No. 40: Event (EU)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn40	Parameter group No. 40 [1]	This is the first parameter symbol of Parameter group No. 40.	—	—
27	EV 1	Event 1 set value (EV1) [2] Event 1 set value (EV1) [high] [2] [3] ★	Deviation: • When assigned to Input_1 or Differential temperature input −(Input 1_Input span) to +(Input 1_ Input span) • When assigned to Input 2 −(Input 2_Input span) to +(Input 2_ Input span) • When Control with PV select is selected at Select function for input 2. -(PV select input span) to +(PV select input span) [Varies with the setting of the Decimal point position.] Input value or Set value: • When assigned to Input 1 Input 1_Input range low to Input 1_ Input range high • When assigned to Input 2 Input 2_Input range low to Input 2_ Input range high • When assigned to Differential temperature input −(Input 1_Input span) to +(Input 1_ Input span) • When Control with PV select is selected at Select function for input 2. PV select input range low to PV select input range high [Varies with the setting of the Decimal point position.] Manipulated output value: -5.0 to +105.0%	High action, high/low action: max. Low action, process action: min.	

28	EV 1	Event 1 set value (EV1') [low] [2) 3)] ★	Deviation: • When assigned to Input_1 or Differential temperature input -(Input 1_Input span) to +(Input 1_ Input span) • When assigned to Input 2 -(Input 2_Input span) to +(Input 2_ Input span) • When Control with PV select is selected at Select function for input 2. -(PV select input span) to +(PV select input span) Input value or Set value: • When assigned to Input 1 Input 1_Input range low to Input 1_ Input range high • When assigned to Input 2 Input 2_Input range low to Input 2_ Input range high • When assigned to Differential temperature input −(Input 1_Input span) to +(Input 1_ Input span) • When Control with PV select is selected at Select function for input 2. PV select input range low to PV select input range high [Varies with the setting of the Decimal point position.]	High/low action: min. Process action: max.	
29	EV2	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]		
30	EV2'	Event 2 set value (EV2') [low] [4) 5)] ★	Same as Event 1 set value (EV1') [low]		
31	EV3	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]		
32	EV3'	Event 3 set value (EV3') [low] [6) 7)] ★	Same as Event 1 set value (EV1') [low]		
33	EV4	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]		
34	EV4'	Event 4 set value (EV4') [low] [8) 9)] ★	Same as Event 1 set value (EV1') [low]		

★ Data included in Memory area
1) Displayed when the Event function is available.
2) Displayed when Event 1 is available.
3) Displayed when type selected in Event 1 has high/low individual setting.
4) Displayed when Event 2 is available.
5) Displayed when type selected in Event 2 has high/low individual setting.
6) Displayed when Event 3 is available.
7) Displayed when type selected in Event 3 has high/low individual setting.
8) Displayed when Event 4 is available.
9) Displayed when type selected in Event 4 has high/low individual setting.

3.7.3 Parameter group No. 51: Input 1_Control (1. Cont)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn51	Parameter group No. 51	This is the first parameter symbol of Parameter group No. 51	—	—
35	1. P	Input 1_Proportional band [heat-side]	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when temperature control operation [MC-(V)COS(R)] is selected for Input 1_ Control action. ★	TC/RTD inputs: 30 V/I inputs: 3.0	
36	1. I	Input 1_Integral 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): PD action [Varies with the setting of the Integral/Derivative time decimal point position.]	240	
37	1. d	Input 1_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	
38	1. oHH	Input 1_ON/OFF action differential gap (upper) [3) 5)]	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 1_Input span (When Control with PV select: 0.0 to 100.0% of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1	
39	1. oHL	Input 1_ON/OFF action differential gap (lower) [1) 3)]	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 1_Input span (When Control with PV select: 0.0 to 100.0% of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1	
40	1. rPr	Input 1_Control response parameter[1)] ★	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	PID control: 0 Heating/Cooling PID control: 2	
41	1. PACt	Input 1_Proactive intensity [1) 2) 4)] ★	0 to 4 0: No function	2	
42	1. MR	Input 1_Manual reset [1) 5)] ★	-100.0 to +100.0%	0.0	
43	1. FF	Input 1_FF amount [1) 2) 4) 6)] ★	-100.0 to +100.0%	0.0	
44	1. oLH	Input 1_Output limiter high [heat-side] ★	Input 1_Output limiter low [heat-side] to 105.0%	105.0	
45	1. oLL	Input 1_Output limiter low [heat-side] ★	-5.0% to Input 1_Output limiter high [heat-side]	–5.0	
46	1. MCdb	Input 1_Dead zone [7)] ★	0 to 10% of Input 1_Input span [Decimal point position depends on the setting for Input 1_Valve coefficient F.]	See Table 1	

★ Data included in Memory area

[1)] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

[2] Displayed when the “Input 1_Proportional band [heat-side]” in the same memory area is other than 0 (0.0).
[3] Displayed when the “Input 1_Proportional band [heat-side]” in any memory area is 0 (0.0). (Common setting in memory area)
[4] Displayed when the “Input 1_Proportional band [heat-side]” in the same memory area is other than 0 (0.0).
[5] Displayed when the “Input 1_Integral time [heat-side]” in the same memory area is other than 0 (0.0, 0.00).
[6] Displayed when Bottom suppression function is avaialble.
[7] Displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

Table 1: Factory set value of the Dead zone

Control action*	Valve coefficient F (pressure unit)								
	0	1	2	3	4	10	11	12	13
3	0.03	0.03	0.4	3	0.003	—	—	—	—
4	0.04	0.04	0.4	4	0.004	—	—	—	—
5	0.10	0.10	1.5	10	0.010	—	—	—	—
6	0.10	0.10	1.5	10	0.010	—	—	—	—
7	—	—	—	—	—	7	10	0.3	0.14

* Set value for the control operation set in Function block No. 51: Input 1_Control action (1. Conf)
For Input 2, the set value is for Function block No. 52: Input 2_Control action (2. Conf)

3.7.4 Parameter group No. 52: Input 2_Control (2. Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn52	Parameter group No. 52 [1]	This is the first parameter symbol of Parameter group No. 52	—	—
47	2. P	Input 2_Proportional band [1] [2] ★	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when temperature control operation [MC-(V)COS(R)] is selected for Input 2_ Control action.	TC/RTD inputs: 30 V/I inputs: 3.0	
48	2. I	Input 2_Integral time [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	
49	2. d	Input 2_Derivative time [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	
50	2. oHH	Input 2_ON/OFF action differential gap (upper) [1] [2] [4]	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span	TC/RTD inputs: 1 V/I inputs: 0.1	
51	2. oHL	Input 2_ON/OFF action differential gap (lower) [1] [2] [4]	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span	TC/RTD inputs: 1 V/I inputs: 0.1	
52	2. rPr	Input 2_Control response parameter [1] [2] ★	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	0	
53	2. PACt	Input 2_Proactive intensity [1] [2] [3] [5] ★	0 to 4 0: No function	2	
54	2. MR	Input 2_Manual reset [1] [2] [6] ★	−100.0 to +100.0%	0.0	
55	2. FF	Input 2_FF amount [1] [2] [3] [5] [7] ★	−100.0 to +100.0%	0.0	
56	2. oLH	Input 2_Output limiter high [1] ★	Input 2_Output limiter low to 105.0%	105.0	
57	2. oLL	Input 2_Output limiter low [1] ★	−5.0% to Input 2_Output limiter high	−5.0	

58	2. MCdb	Input 2_Deadband [1) 8)] ★	0 to 10% of input_2 span [Decimal point position depends on the setting for Input 2_Valve coefficient F.]	See Table 1 in 3.7.3	

★ Data included in Memory area
1) Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."
2) Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".
3) Displayed when "Input 2_Proportional band [heat-side]" in the same memory area is other than 0 (0.0).
4) Displayed when "Input 2_Proportional band [heat-side]" in any memory area is 0 (0.0). (Common setting in memory area)
5) Displayed when "Input 2_Integral time [heat-side]" in the same memory area is other than 0 (0.0, 0.00).
6) Displayed when "Input 2_Integral time [heat-side]" in the same memory area is 0 (0.0, 0.00).
7) Displayed when Bottom suppression function is available.
8) Displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

3.7.5 Parameter group No. 56: Input 1_Cooling control (1. CooL)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn56	Parameter group No. 56 [1)]	This is the first parameter symbol of Parameter group No. 56	—	—
59	1. Pc	Input 1_Proportional band [cool-side] [1) 2)]	TC/RTD inputs: 1 (0.1, 0.01) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 1 to PV select input span) [Varies with the setting of the Decimal point position.] ★ Voltage (V)/Current (I) inputs: 0.1 to 1000.0% of Input 1_Input span (When Control with PV select: 0.1 to 1000.0 % of PV select input span)	TC/RTD inputs: 30 V/I inputs: 3.0	
60	1. Ic	Input 1_Integral time [cool-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): PD action [Varies with the setting of the Integral/ Derivative time decimal point position.] ★	240	
61	1. dc	Input 1_Derivative time [cool-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	
62	1. db	Input 1_Overlap/Deadband [1)]	TC/RTD inputs: -(Input 1_Input span) to +(Input 1_ Input span) (When Control with PV select: -(PV select input span) to +(PV select 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 1_Input span ★ (When Control with PV select: -100.0 to +100.0% of PV select 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	
63	1. oLHc	Input 1_Output limiter high [cool-side] [1)] ★	Input 1_Output limiter low [cool-side] to 105.0%	105.0	
64	1. oLLc	Input 1_Output limiter low [cool-side] [1)] ★	-5.0% to Input 1_Output limiter high [cool-side]	-5.0	

★ Data included in Memory area
1) Displayed when the “Input 1_Control action” is Heating/Cooling PID control.
2) Displayed when the “Input 1_Proportional band [heat-side]” in the same memory area is other than 0 (0.0)

3.7.6 Parameter group No. 70: Memory area (Ar-EA)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Pn70	Parameter group No. 70	This is the first parameter symbol of Parameter group No. 70	—	—
65	TRGA	Select Trigger type for Memory area transfer	0 to 63 0: No assignment +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Digital input 1 (DI1) Close edge +32: Digital input 1 (DI1) Open edge To select two or more functions, sum each value. ★	0	
66	AST	Area soak time	0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds 0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Data range of Area soak time can be selected on the Soak time unit.] ★	0:00 (0 minutes 00 seconds)	
67	LNKA	Link area number ★	0 to 16 0: No link	0	
68	1. SFTU	Input 1_Soft start time (up) [1]	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Data range of Soft start time can be selected on the Soft start unit.] ★	0:00 (0 minutes 00 seconds)	
69	1. SFTd	Input 1_Soft start time (down) [1] ★	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Data range of Soft start time can be selected on the Soft start unit.]	0:00 (0 minutes 00 seconds)	
70	1. SVRU	Input 1_Setting change rate limiter (up) [2]	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: No function [Varies with the setting of the Decimal point position.] ★	0	
71	1. SVRd	Input 1_Setting change rate limiter (down) [2]	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: No function [Varies with the setting of the Decimal point position.] ★	0	
72	1. A/M. A	Input 1_Auto/Manual transfer selection (Area) [3]	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump) ★	0	
73	1. MV. A	Input 1_Manipulated output value (Area) [3]	PID control, Position proportioning PID control: -5.0 to +105.0% Heating/Cooling PID control: -105.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 1_Auto/Manual transfer selection (Area)] ★	Heating/Cooling PID control: 0.0 Other control: -5.0	
74	2.SFTU	Input 2_Soft start time increase [4]	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the Soft start time unit setting.]	0:00 (0 minutes 00 seconds)	
75	2.SFTd	Input 2_Soft start time decrease [4]	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the Soft start time unit setting.]	0:00 (0 minutes 00 seconds)	
76	2. SVRU	Input 2_Setting change rate limiter (up) [5]	0 to Input 2_Input span 0: No function [Varies with the setting of the Decimal point position.] ★	0	

77	2. SVRd	Input 2_Setting change rate limiter (down) [5] ★	0 to Input 2_Input span 0: No function [Varies with the setting of the Decimal point position.]	0	
78	2. A/M. A	Input 2_Auto/Manual transfer selection (Area) [6] ★	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump)	0	
79	2. MV. A	Input 2_Manipulated output value (Area) [6] ★	-5.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 2_Auto/Manual transfer selection (Area)]	-5.0	
80	R/L.A	Remote/Local transfer selection (Area) [7] ★	• When “Remote setting input” is selected at Select function for Input 2 [8] 0: No transfer 1: Local mode 2: Remote mode	0	
			• When “Cascade control” is selected at Select function for input 2 [9] 0: No transfer 1: Single control 2: Cascade control		
			• When “Control with PV select” is selected at Select function for input 2 [10] 0: No transfer 1: Input 1 2: Input 2		
			• When “2-loop control/Differential temperature control” is selected at Select function for input 2 [11] 0: No transfer 1: 2-loop control 2: Differential temperature control		

★ Data included in Memory area

[1] Displayed when "Soft start" is selected in "Soft start/setting change rate limiter selection" in Function block No. 70: Memory area function (Ar-ER).

[2] Displayed when "Setting change rate limiter" is selected in "Soft start/setting change rate limiter selection" in Function block No. 70: Memory area function (Ar-ER).

[3] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

[4] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2", AND "Soft start" is selected in "Soft start/setting change rate limiter selection" in Function block No. 70: Memory area function (Ar-ER).

[5] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2" AND "Setting change rate limiter" is selected in "Soft start/setting change rate limiter selection" in Function block No. 70: Memory area function (Ar-ER).

[6] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "Pressure control operation [MC-(V)COS(R)]" is not selected in "Input 2_Control action".

[7] Displayed when one of "Remote setting input", "Cascade control", "Control with PV select", or "2-loop control/Differential temperature control" is selected AND in the case of "2-loop control", "PID control" or "Heating/Cooling PID control" is selected in both Input 1_ Control action and Input 2_Control action.

[8] Displayed when “Remote setting input” is selected in “Select function for Input 2”.

[9] Displayed when “Cascade control” is selected in “Select function for Input 2”.

[10] Displayed when “Control with PV select” is selected in “Select function for Input 2”.

[11] Displayed when "2-loop control/Differential temperature control" is selected, AND in the case of "2-loop control", "PID control" or "Heating/Cooling PID control" is selected in both Input 1_Control action and Input 2_Control action.

3.8 Setup Setting Mode [G]

3.8.1 Setting group No. 10: Display (dSP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn 10	Setting group No. 10	This is the first parameter symbol of Setting group No. 10	—	—
81	PVCY	Display update cycle	1: 50 ms* 5: 250 ms 9: 450 ms 2: 100 ms 6: 300 ms 10: 500 ms 3: 150 ms 7: 350 ms 4: 200 ms 8: 400 ms * When “Cascade control” or “2-loop control/ Differential temperature control” is selected, Display update cycle is 100 ms even when “1” is selected.	1	

3.8.2 Setting group No. 21: Input 1 (I.InP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn21	Setting group No. 21	This is the first parameter symbol of Setting group No. 21	—	—
82	I. Pb	Input 1_PV bias	-(Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: -(PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	0	
83	I. dF	Input 1_PV digital filter	0.0 to 100.0 seconds 0.0: Filter OFF	0.0	
84	I. PR	Input 1_PV ratio	0.500 to 1.500	1.000	
85	I. PLC	Input 1_PV low input cut-off [1)]	0.00 to 25.00% of Input 1_Input span (When Control with PV select: 0.00 to 25.00% of PV select input span)	0.00	

[1)] Displayed when Input 1 is Voltage/Current and Square root extraction is available.

3.8.3 Setting group No. 22: Input 2 (2.InP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn22	Setting group No. 22 [1)]	This is the first parameter symbol of Setting group No. 22	—	—
86	2. Pb	Input 2_PV bias [1)] (RS bias) [2)]	Input 2_PV bias -(Input 2_Input span) to +(Input 2_ Input span) RS bias -(Input 1_Input span) to +(Input 1_ Input span) [Varies with the setting of the Decimal point position.]	0	—
87	2. dF	Input 2_PV digital filter [1)] (RS digital filter) [3)]	0.0 to 100.0 seconds 0.0: Filter OFF	0.0	
88	2. PR	Input 2_PV ratio [1)] (RS ratio) [4)]	Input 2_PV ratio: 0.500 to 1.500 RS ratio: 0.001 to 9.999	1.000	
89	2. PLC	Input 2_PV low input cut-off [5)]	0.00 to 25.00% of Input 2_Input span (When Control with PV select: 0.00 to 25.00% of PV select input span)	0.00	

[1)] Not displayed when “No function” is selected in “Select function for Input 2.”

[2)] Displayed as "RS bias" when "Remote setting input" is selected in Select function for Input 2.

[3)] Displayed as "RS digital filter" when "Remote setting input" is selected in Select function for Input 2.

[4)] Displayed as "RS ratio" when "Remote setting input" is selected in Select function for Input 2.

[5)] Displayed when Input 2 is Voltage/Current and when Square root extraction is available. Not displayed when "No function" or "Remote setting input" is slected in "Select function for Input 2."

3.8.4 Setting group No. 30: Output (oUT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn30	Setting group No. 30	This is the first parameter symbol of Setting group No. 30	—	—
90	r3	OUT3 proportional cycle time [1]	0.1 to 100.0 seconds	2.0	
91	Mr3	OUT3 minimum ON/OFF time of proportional cycle [1]	0 to 1000 ms	0	

[1] Displayed when OUT3 is supplied and "Universal output type selection" is "Voltage pulse output."

3.8.5 Setting group No. 51: Input 1_Control (I.Conr)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn51	Setting group No. 51	This is the first parameter symbol of Setting group No. 51	—	—
92	I. MMV	Input 1_Manual manipulated output value	PID control, Position proportioning PID control: Input 1_Output limiter low [heat-side] to Input 1_Output limiter high [heat-side] Heating/Cooling PID control [1]: -(Input 1_Output limiter high [cool-side]) to +(Input 1_Output limiter high [heat-side]) MC-(V)COS(R) pressure/temperature control: Input 1_Output limiter low [heat-side] to whichever the smaller value of either "calculated value from Input 1_Pressure (temperature) limiter" or "Input 1_Output limiter high [heat-side]. When STOP is set, Input 1_Output limiter low [heat-side] to Input 1_Output limiter high [heat-side]	PID control, Position proportioning PID control: -5.0 Heating/Cooling PID control: 0.0	
93	I.LEV 1	Input 1_Level PID setting 1 [2] [3]	Input 1_Input range low to Input 1_Input range high (When Control with PV select: PV select input range low to PV select input range high) [Varies with the setting of the Decimal point position.]	Input 1_ Input range high (Control with PV select: PV select input range high)	
94	I.LEV2	Input 1_Level PID setting 2 [2] [3]	Same as Input 1_Level PID setting 1	Same as Input 1_ Level PID setting 1	
95	I.LEV3	Input 1_Level PID setting 3 [2] [3]	Same as Input 1_Level PID setting 1		
96	I.LEV4	Input 1_Level PID setting 4 [2] [3]	Same as Input 1_Level PID setting 1		
97	I.LEV5	Input 1_Level PID setting 5 [2] [3]	Same as Input 1_Level PID setting 1		
98	I.LEV6	Input 1_Level PID setting 6 [2] [3]	Same as Input 1_Level PID setting 1		
99	I.LEV7	Input 1_Level PID setting 7 [2] [3]	Same as Input 1_Level PID setting 1		

[1] In case of Heating/Cooling PID control, the data range has exceptional conditions, such as shown below.
(1) Input 1_Output limiter high [cool-side] is less than or equal to 0.0 %
- Input 1_Output limiter low [heat-side] is less than or equal to 0.0 %: 0.0 % to +(Input 1_Output limiter high [heat-side])
- Input 1_Output limiter low [heat-side] is greater than 0.0 %: Input 1_Output limiter low [heat-side] to Input 1_Output limiter high [heat-side]

(2) Input 1_Output limiter high [heat-side] is less than or equal to 0.0 %
- Input 1_Output limiter low [cool-side] is less than or equal to 0.0 %: -(Input 1_Output limiter high [cool-side]) to 0.0%
- Input 1_Output limiter low [cool-side] is greater than 0.0 %: -(Input 1_Output limiter high [cool-side]) to -(Input 1_Output limiter low [cool-side])

(3) Fixed at 0.0% in the following cases: Input 1_Output limiter high [cool-side] less than or equal to 0.0 %, AND Input 1_Output limiter high [heat-side] less than or equal to 0.0 %

[2] Displayed when Input 1 is with Level-PID AND any code other than "Cascade control" is selected in Select function for Input 2, AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected for "Input 1_Control action".

[3] Input 1_Level PID settings 1 to 7 always maintain the following relation.
(Input 1_Level PID setting 1) less than or equal to (Input 1_Level PID setting 2) less than or equal to (Input 1_Level PID setting 3) less than or equal to (Input 1_Level PID setting 4) less than or equal to (Input 1_Level PID setting 5) less than or equal to (Input 1_ Level PID setting 6) less than or equal to (Input 1_Level PID setting 7)

3.8.6 Setting group No. 52: Input 2_Control (2.Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn52	Setting group No. 52	This is the first parameter symbol of Setting group No. 52	—	—
100	2. M.MV	Input 2_Manual manipulated output value [1]	Input 2_Output limiter low to Input 2_ Output limiter high Pressure/temperature control operation [MC-(V)COS(R)]: Input 2_Output limiter low to whichever the smaller value of either "calculated value from Input 2_Pressure (temperature) limiter" or "Input 2_Output limiter high [heat-side]. When STOP is set, Input 2_Output limiter low [heat-side] to Input 2_Output limiter high [heat-side]	-5.0	
101	2.LEV 1	Input 2_Level PID setting 1 [2] [3]	Input 2_Input range low to Input 2_Input range high [Varies with the setting of the Decimal point position.]	Input 2_ Input range high	
102	2.LEV2	Input 2_Level PID setting 2 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	
103	2.LEV3	Input 2_Level PID setting 3 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	
104	2.LEV4	Input 2_Level PID setting 4 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	
105	2.LEV5	Input 2_Level PID setting 5 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	
106	2.LEV6	Input 2_Level PID setting 6 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	
107	2.LEV7	Input 2_Level PID setting 7 [2] [3]	Same as Input 2_Level PID setting 1	Same as Input 2_ Level PID setting 1	

[1] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2."
[2] Displayed when Input 2 is with Level-PID AND "2-loop control/Differential temperature control" is selected in Select function for Input 2, AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected for "Input 2_Control action".
[3] Input 2_Level PID settings 1 to 7 always maintain the following relation.
(Input 2_Level PID setting 1) less than or equal to (Input 2_Level PID setting 2) less than or equal to (Input 2_Level PID setting 3) less than or equal to (Input 2_Level PID setting 4) less than or equal to (Input 2_Level PID setting 5) less than or equal to (Input 2_Level PID setting 6) less than or equal to (Input 2_Level PID setting 7)

3.8.7 Setting group No. 53: Input 1_Tuning (1.TUnE)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn53	Setting group No. 53 [1]	This is the first parameter symbol of Setting group No. 53	—	—
108	1. AT6	Input 1_AT bias [1]	-(Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: -(PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	0	
109	1. ATTM	Input 1_AT remaining time monitor [1]	0 hours 00 minutes to 48 hours 00 minutes	—	—
110	1. TUNE	Input 1_AT/ST status monitor [1]	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	—	—

[1] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

3.8.8 Setting group No. 54: Input 2_Tuning (2TUNE)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn54	Setting group No. 54	This is the first parameter symbol of Setting group No. 54	—	—
111	2. AT b	Input 2_AT bias [1]	-(Input 2_Input span) to +(Input 2_Input span) [Varies with the setting of the Decimal point position.]	0	
112	2. ATTM	Input 2_AT remaining time monitor [1]	0 hours 00 minutes to 48 hours 00 minutes	—	—
113	2. TUNE	Input 2_AT/ST status monitor [1]	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.	—	—

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

[2] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "Pressure control operation [MC-(V)COS(R)]" is not selected in "Input 2_Control action".

3.8.9 Setting group No. 57: Proactive (PRCT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn57	Setting group No. 57 [1]	This is the first parameter symbol of Setting group No. 57	—	—
114	FFST	FF amount learning [2]	0 to 3 0: No learning +1: Learn Input 1 +2: Learn Input 2 To select two or more functions, sum each value.	0	
115	1.Ex dJ	Input 1_Determination point of external disturbance [3]	−(Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: −(PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	−1	
116	2.Ex dJ	Input 2_Determination point of external disturbance [4]	-(Input 2_Input span) to +(Input 2_Input span) [Varies with the setting of the Decimal point position.]	−1	

[1] Displayed when a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action" or "Input 2_Control action".

[2] Displayed when "Bottom suppression function" is available AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action", OR "2-loop control/Differential temperature control" is selected AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

[3] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

[4] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

3.8.10 Setting group No. 58: 2-input function (2PU)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn58	Setting group No. 58 [1] [2] [3]	This is the first parameter symbol of Setting group No. 58	—	—
117	MAS. P	Cascade_Proportional band (master-side) [1] [3]	TC/RTD inputs: 1 (0.1, 0.01) to Input 1_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 1_Input span	TC/RTD inputs: 30 V/I inputs: 3.0	
118	MAS. I	Cascade_Integral time (master-side) [1] [3]	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	

119	MAS. d	Cascade_Derivative time (master-side) [1) 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	
120	SLV. P	Cascade_Proportional band (slave-side) [1) 3)]	TC/RTD inputs: 1 (0.1, 0.01) to Input 2_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 2_Input span	TC/RTD inputs: 30 V/I inputs: 3.0	
121	SLV. I	Cascade_Integral time (slave-side) [1) 3)]	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	
122	SLV. d	Cascade_Derivative time (slave-side) [1) 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	
123	C. dF	Cascade_Digital filter [1) 3)]	0.0 to 100.0 seconds 0.0: Filter OFF	10.0	
124	C. SCH	Cascade_Scale high [1) 3)]	Cascade_Scale low to Input 2_Setting limiter high [Varies with the setting of the Decimal point position.]	Input 2_ Setting limiter high	
125	C. SCL	Cascade_Scale low [1) 3)]	Input 2_Setting limiter low to Cascade_ Scale high [Varies with the setting of the Decimal point position.]	Input 2_ Setting limiter low	
126	2PV. LV	PV select transfer level [2) 3)]	Input 1_Input range low to Input 1_Input range high [Varies with the setting of the Decimal point position.]	Input 1_ Input range high	
127	2PV. TM	PV select transfer time [2) 3)]	0.0 to 100.0 seconds	0.0	

[1)] Displayed when “Cascade control” is selected in “Select function for Input 2.”
[2)] Displayed when “Control with PV select” is selected in “Select function for Input 2.”
[3)] Not displayed when "Pressure control operation [MC-(V)COS(R)]" or "Temperature control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action" and "Input 2_Control action".

3.8.11 Setting group No. 59: Input 1_MC-COS(R)/MC-VCOS(R) pressure control (1nCCn)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn59	Setting group No. 59	This is the first parameter symbol of Setting group No. 59	—	—
128	1. oSP	Input 1_Overshoot prevention feature [1)]	0: No 1: Yes	0	

[1)] Displayed when "3-7: Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

3.8.12 Setting group No. 60: Input 2_MC-COS(R)/MC-VCOS(R) pressure control (2nCCn)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn60	Setting group No. 59	This is the first parameter symbol of Setting group No. 60	—	—
129	2. oSP	Input 2_Overshoot prevention feature [1)]	0: No 1: Yes	0	

[1)] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND "3 – 7 (Pressure control operation [MC-(V)COS(R)])" is selected in "Input 2_Control action".

3.8.13 Setting group No. 91: System (SYS)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Sn91	Setting group No. 91	This is the first parameter symbol of Setting group No. 91	—	—
130	1.PHLd	Input 1_Peak hold monitor	Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
131	1.bHLd	Input 1_Bottom hold monitor	Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
132	1.HLdR	Input 1_Hold reset	HoLd: Hold rESEt: Reset Returns to Hold state automatically after reset.	HoLd	—
133	2.PHLd	Input 2_Peak hold monitor [1)]	Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
134	2.bHLd	Input 2_Bottom hold monitor [1)]	Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—	—
135	2.HLdR	Input 2_Hold reset [1)]	HoLd: Hold rESEt: Reset Returns to Hold state automatically after reset.	HoLd	—

[1)] Displayed when "Cascade control", "Control with PV select", "2-loop control/Differential temperature control" or "Input circuit error alarm" is selected in "Select function for Input 2".

3.9 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. TLV 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 STOP mode. However, only checking can be made even in the RUN state.

3.9.1 Function block No. 10: Display (dSP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn 10	Function block No. 10	This is the first parameter symbol of Function block No. 10	—	—
136	SPCH	STOP display selection	0: Stop on PV display 1: Stop on SV display 2: Stop on MV display.	1	

137	ALC	ALM lamp lighting condition	0 to 255 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	15	
138	dSoP	PV flashing display at input error	0: Flashing display 1: Non-flashing display	0	
139	1.dS.SV	Show/Hide Input 1_SV	0: Hide Input 1_SV 1: Show Input 1_SV	1	
140	2.dS.SV	Show/Hide Input 2_SV [1]	0: Hide Input 2_SV 1: Show Input 2_SV	1	
141	1.dS.MV	Show/Hide Input 1_MV [2]	0: Hide 1: Show Input 1_Manipulated output value (MV) 2: Show Memory area soak time 3: Show soft start time	1	
142	2.dS.MV	Show/Hide Input 2_MV [3]	0: Hide 1: Show Input 2_Manipulated output value (MV) 2: Show Memory area soak time 3: Show soft start time	1	
143	dS.MoN	Select hide items in Monitor mode	0 to 31 0: Show all +1: Remote setting input value monitor +2: Manipulated output value (MV) monitor +4: Current transformer (CT) monitor +8: Comprehensive event state +16: Memory area soak time To select two or more functions, sum each value.	0	
144	dS.Mod	Select hide items in Operation transfer mode	0 to 63 0: Show all +1: RUN/STOP transfer +2: Autotuning (AT) +4: Startup tuning (ST) +8: Auto/Manual transfer +16: Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) +32: Control area Local/External transfer To select two or more functions, sum each value.	0	

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."
[2] When "cascade control" is selected in "Select function for Input 2", it also applies to the setting in Input 2.
[3] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2."

3.9.2 Function block No. 11: Key operation (KEY)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn11	Function block No. 11	This is the first parameter symbol of Function block No. 11	—	—
145	SEt.Ky	Data registration	0: SET key method Used to register the Set value (SV) using the SET key. 1: Direct registration Used to register the Set value (SV) without pressing the SET key.	0	

146	FN.KY	FUNC key assignment	0: Unused 1: RUN/STOP transfer 2: Autotuning (AT) (Common to Input 1 and 2) 3: Input 1_Autotuning (AT) 4: Input 2_Autotuning (AT) 5: Auto/Manual transfer (Common to Input 1 and 2) 6: Input 1_Auto/Manual transfer 7: Input 2_Auto/Manual transfer 8: Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) 9: Control area Local/External transfer 10: Interlock release 11: Hold reset (Common to Input 1 and 2) 12: Input 1_Hold reset 13: Input 2_Hold reset 14: Set data unlock/lock transfer 15: Area jump 16: Parameter setting mode display switching	1	
147	FN.TYP	FUNC key operation selection	0: Press once The function set at “FUNC key assignment” is activated upon a press of the FUNC key. 1: Press and hold The function set at "FUNC key assignment" is activated by holding the FUNC key pressed.	0	

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

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn21	Function block No. 21	This is the first parameter symbol of Function block No. 21	—	—
148	I. 1 NP	Input 1_Input type	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 PLII 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 ・When MC-(V)COS(R) pressure control is selected for Input 1_Control action: 15 to 24	Product identification code specified at the time of order.	
149	I.UNI T	Input 1_Display unit [1)]	0: °C 1: °F	Product identification code specified at the time of order.	

150	I.PGdP	Input 1_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 (When Control with PV select: Decimal point position setting of Input 1 and Input 2 is compared and the smaller will be used.)	Product identification code specified at the time of order. For V/I inputs: 1	
151	I.PGSH	Input 1_Input range high	(Input 1_Input range low + 1 digit) to Input 1_Maximum value of input range [Varies with the setting of the Decimal point position.] When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 1_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.	Product identification code specified at the time of order. For V/I inputs: 100.0	
152	I.PGSL	Input 1_Input range low	Input 1_Minimum value of input range to (Input 1_Input range high - 1 digit) [Varies with the setting of the Decimal point position.] When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 1_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.	Product identification code specified at the time of order. For V/I inputs: 0.0	
153	I. PoV	Input 1_Input error determination point (high)	Input 1_Input error determination point (low) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	Input 1_ Input range high + (Input 1_ 5% of input span)	
154	I. PUN	Input 1_Input error determination point (low)	Input 1_Input range low - (Input 1_5% of input span) * to Input 1_Input error determination point (high) [Varies with the setting of the Decimal point position.] * When Input type of Input 1 is RTD, low limit value is about 2 Ohms. (Pt100: -245.5 °C [-409.8 °F], JPt100: -237.6 °C [-395.7 °F])	Input 1_ Input range low - (Input 1_5% of input span)	
155	I.rCJC	Input 1_Temperature compensation calculation [2]	0: No temperature compensation calculation 1: With temperature compensation calculation	1	
156	I. boS	Input 1_Burnout direction [3]	0: Upscale 1: Downscale	0	
157	I. SQR	Input 1_Square root extraction 1 [4]	0: Unused 1: Used	0	
158	I. INV	Input 1_Inverting input [4]	0: Unused 1: Used	0	

[1] Displayed when Thermocouple (TC)/RTD is selected in "Input 1_Input type".
[2] Displayed when Thermocouple (TC) is selected in "Input 1_Input type".
[3] Displayed when "Thermocouple (TC) input" and "Low voltage input (0 to 100 mV DC, 0 to 10 mV DC) is selected in "Input 1_Input type", AND a setting other than "Pressure control operation [MC-(V)COS(R)])" is selected in "Input 1_Control action".
[4] Displayed when "Voltage (V)/Current (I)" is selected in Input 1 AND "PID control" or "Heating/Cooling PID control" is selected in "Input 1_Control action".

3.9.4 Function block No. 22: Input 2 (2. InP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn22	Function block No. 22 [1]	This is the first parameter symbol of Function block No. 22	—	—
159	2. INP	Input 2_Input type [1]	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 PLII 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 ・ When Remote setting input is selected and MC-(V)COS(R) pressure control is selected for Input 1_Control action: 15 to 24 ・ When Measured input 2 is selected and MC-(V)COS(R) pressure control is selected for Input 2_Control action: 15 to 24	Same as Input 1_ Input type When Remote setting input is specified at the time of order, but the input type is not specified: 17	
160	2.UNIT	Input 2_Display unit [1] [2] [3]	0: °C 1: °F	Same as Input 1_ Display unit	
161	2.PGdP	Input 2_Decimal point position [1] [3]	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: 0 to 4	Same as Input 1_ Decimal point position	
162	2.PGSH	Input 2_Input range high [1]	TC/RTD inputs and Voltage (V)/Current (I) Inputs (For other than Remote setting input): (Input 2_Input range low + 1 digit) to Input 2_Maximum value of input range Voltage (V)/Current (I) Inputs (For Remote setting input): (Input 2_Input range low + 1 digit) to Input 1_Maximum value of input range [Varies with the setting of the Decimal point position.] When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 2_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.	Same as Input 1_ Input range high	
163	2.PGSL	Input 2_Input range low [1]	TC/RTD inputs and Voltage (V)/Current (I) Inputs (For other than Remote setting input): Input 2_Minimum value of input range to (Input 2_Input range high - 1 digit) Voltage (V)/Current (I) Inputs (For Remote setting input): Input 1_Minimum value of input range to (Input 2_Input range high - 1 digit)	Same as Input 1_ Input range low	

			[Varies with the setting of the Decimal point position.] When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 2_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.		

164	2. PoV	Input 2_Input error determination point (high) [4]	Input 2_Input error determination point (low) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	Input 2_ Input range high + (Input 2_ 5% of input span)	
165	2. PUN	Input 2_Input error determination point (low) [4]	Input 2_Input range low - (Input 2_5% of input span)* to Input 2_Input error determination point (high) [Varies with the setting of the Decimal point position.] * When Input type of Input 2 is RTD, low limit value is about 2 Ohms. (Pt100: -245.5 °C (-409.8 °F), JPt100: -237.6 °C (-395.7 °F))	Input 2_ Input range low - (Input 2_5% of input span)	
166	2.rCJC	Input 2_Temperature compensation calculation [1] [5]	0: No temperature compensation calculation 1: With temperature compensation calculation	1	
167	2. boS	Input 2_Burnout direction [1] [6] [8] [9]	0: Upscale 1: Downscale	0	
168	2. SQR	Input 2_Square root extraction [1] [7] [10]	0: Unused 1: Used	0	
169	2. INV	Input 2_Inverting input [4] [7] [10]	0: Unused 1: Used	0	

[1] Not displayed when "No function" is selected in "Select function for Input 2".
[2] Displayed when Input 2 is either Thermocouple (TC) or RTD.
[3] Not settable when "Remote setting input" or "Control with PV select" is selected.
[4] Not displayed when "No function" or "Remote setting input" is selected in "Select function in Input 2".
[5] Displayed when Input 2 is Thermocouple (TC) input.
[6] Displayed when Input 2_Input type is "Thermocouple (TC) input" and "Low voltage input (0 to 100 mV DC, 0 to 10 mV DC).
[7] Displayed when "PID control (0 to 1) is selected in "Input 2_Control action" AND "Voltage (V)/Current (I) input" is selected for Input 2.
[8] Displayed when "2-loop control" is selected in "Select function for Input 2" AND a setting other than "0, 1 and 8 (Pressure control operation [MC-(V)COS(R)])" is selected in "Input 2_Control action".
[9] Displayed when "Remote control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".
[10] Displayed when PID control or Heating/Cooling PID control is selected in "Input 2_Control action".

3.9.5 Function block No. 23: Digital input (dI)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn23	Function block No. 23	This is the first parameter symbol of Function block No. 23	—	—
170	dI SL 1	DI1 function selection	0: No function 1: RUN/STOP transfer 2: Auto/Manual transfer (Common to Input 1 and 2) 3: Input 1_Auto/Manual transfer 4: Input 2_Auto/Manual transfer [1] 5: Remote/Local transfer [2] (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) 6: Interlock release 7: Hold reset (Common to Input 1 and 2) 8: Input 1_Hold reset 9: Input 2_Hold reset [1] 10: Autotuning (AT) (Common to Input 1 and 2) 11: Input 1_Autotuning (AT) 12: Input 2_Autotuning (AT) [1] 13: Set data unlock/lock transfer 14: Direct/Reverse action transfer 15: Memory area transfer (2 points, without area set signal)	0	

			16: Memory area transfer (8 points, without area set signal) 17: Memory area transfer (8 points, with area set signal) 18: Memory area transfer (16 points, without area set signal) 19: Memory area transfer [3)] (16 points, with area set signal) 20: Area jump		
171	dI SL2	DI2 function selection	0 to 14 Same as DI1 function selection (0 to 14)	0	
172	dI SL3	DI3 function selection	0 to 14 Same as DI1 function selection (0 to 14)	0	
173	dI SL4	DI4 function selection	0 to 14 Same as DI1 function selection (0 to 14)	0	
174	dI SL5	DI5 function selection[3)]	0 to 14 Same as DI1 function selection (0 to 14)	0	
175	dI SL6	DI6 function selection [3)]	0 to 14 Same as DI1 function selection (0 to 14)	0	
176	dI I NV	DI logic invert	0 to 31 0: No logic invert +1: RUN/STOP transfer +2: Auto/Manual transfer +4: Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) +8:Set data unlock/lock transfer +16: Direct/Reverse action transfer To select two or more functions, sum each value.	0	
177	dI TI M	Area switching time (without area set signal)	1 to 5 seconds	2	

[1)] Only when two inputs are available.
[2)] The function selected at “Select function for Input 2” can be switched.
[3)] Displayed when six or more Digital inputs (DI) are available (when the communication option is not selected.)

3.9.6 Function block No. 30: Output (oUT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn30	Function block No. 30	This is the first parameter symbol of Function block No. 30	—	—
178	oSL 1	OUT1 function selection	0: No assignment 1: Input 1_Control output [heat-side] or [open-side] 2: Input 1_Control output [cool-side] or [close-side] 3: Input 2_Control output 4: Retransmission output 5: Logic calculation output (Event, Input error) 6: RUN state output 7: Input 1_Manual mode state output 8: Input 2_Manual mode state output 9: Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select) 10: Input 1_Autotuning (AT) state output 11: Input 2_Autotuning (AT) state output 12: Output while Set value of Input 1 is changing 13: Output while Set value of Input 2 is changing 14: Output of the communication monitoring result 15: FAIL output	1	
179	oSL2	OUT2 function selection	Same as OUT1 function selection	4	
180	oSL3	OUT3 function selection	Same as OUT1 function selection	4	
181	oLG1	OUT1 logic calculation selection	0 to 255 0: OFF +1: Event 1 +2: Event 2	0	

			+4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.		
182	oLG2	OUT2 logic calculation selection	Same as OUT1 logic calculation selection	0	
183	oLG3	OUT3 logic calculation selection	Same as OUT1 logic calculation selection	0	
184	ExC	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	
185	ILS	Interlock selection	0 to 255 0: Unused +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	0	
186	SS	Output action at control stop	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	
187	MMS	Event action during MAN mode	0: Yes 1: No	0	
188	oUT1	OUT1 Type selection	0: Continuous current output (4 to 20 mA) 1: Continuous current output (0 to 20 mA)	0	
189	oUT2	OUT2 Type selection	0: Continuous current output (4 to 20 mA) 1: Continuous current output (0 to 20 mA)	0	
190	UNIo	Universal output type selection (OUT3)	0: Voltage pulse output 1: Current output (4 to 20 mA) 2: Current output (0 to 20 mA)	1	

3.9.7 Function block No. 31: Retransmission output 1 (Ao1)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn31	Function block No. 31	This is the first parameter symbol of Function block No. 31	—	—
191	Ao1	Retransmission output 1 type	0: No retransmission output 1: Input 1_Measured value (PV) 2: Input 1_Local SV 3: Input 1_SV monitor value 4: Input 1_Deviation 5: Input 1_Manipulated output value [heat-side] 6: Input 1_Manipulated output value [cool-side] 7: Input 2_Measured value (PV) 8: Input 2_Local SV 9: Input 2_SV monitor value 10: Input 2_Deviation	0	

			11: Input 2_Manipulated output value 12: Remote setting input value 13: Current transformer 1 (CT1) input value 14: Current transformer 2 (CT2) input value 15: Measured value (PV) of differential temperature input		

192	AH5 1	Retransmission output 1 scale high	No retransmission output, Input 1_ Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low to Input 1_Input range high (When Control with PV select: PV select input range low to PV select input range high) [Varies with the setting of the Decimal point position.] Input 1_Deviation: -(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.] Input 2_Measured value (PV), Input 2_ Local SV, and Input 2_SV monitor value: Input 2_Input range low to Input 2_Input range high [Varies with the setting of the Decimal point position.] Input 2_Deviation: -(Input 2_Input span) to +(Input 2_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% Measured value (PV) of differential temperature input: -(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	No retransmission output, Input 1_ Measured value (PV), Input 1_ Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_ Input range high (Control with PV select: PV select input range high) Input 1_Deviation: +(Input 1_Input span) Input 2 _Measured value (PV), Input 2_ Local SV, and Input 2 _SV monitor value: Input 2_ Input range high Input 2_ Deviation: +(Input 2_Input span) Manipulated output value, and Current transformer (CT) input value: 100.0 Measured value (PV) of differential temperature input: 100	

193	AL51	Retransmission output 1 scale low	No retransmission output, Input 1_ Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low to Input 1_Input range high (When Control with PV select: PV select input range low to PV select input range high) [Varies with the setting of the Decimal point position.] Input 1_Deviation: -(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.] Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range low to Input 2_Input range high [Varies with the setting of the Decimal point position.] Input 2_Deviation: -(Input 2_Input span) to +(Input 2_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% Measured value (PV) of differential temperature input: -(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	No retransmission output, Input 1_ Measured value (PV), Input 1_ Local SV, Input 1_ SV monitor value, and Remote setting input value: Input 1_ Input range low (Control with PV select: PV select input range low) Input 1_Deviation: −(Input 1_Input span) Input 2_Measured value (PV), Input 2_ Local SV, and Input 2_SV monitor value: Input 2_ Input range low Input 2_ Deviation: −(Input 2_ Input span) Manipulated output value, and Current transformer (CT) input value: 0.0 Measured value (PV) of differential temperature input: −100	

3.9.8 Function block No. 32: Retransmission output 2 (Ao2)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn32	Function block No. 32	This is the first parameter symbol of Function block No. 32	—	—
194	Ao2	Retransmission output 2 type	Same as Retransmission output 1 type	1	
195	AH52	Retransmission output 2 scale high	Same as Retransmission output 1 scale high		
196	AL52	Retransmission output 2 scale low	Same as Retransmission output 1 scale low		

3.9.9 Function block No. 33: Retransmission output 3 (Ao3)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn33	Function block No. 33 [1)]	This is the first parameter symbol of Function block No. 33	—	—
197	Ao3	Retransmission output 3 type [1)]	Same as Retransmission output 1 type	3	
198	AHS3	Retransmission output 3 scale high [1)]	Same as Retransmission output 1 scale high		
199	ALS3	Retransmission output 3 scale low [1)]	Same as Retransmission output 1 scale low		

[1)] Displayed when "Current output" is selected in "Universal output (OUT3)_type selection".

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

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn34	Function block No. 34	This is the first parameter symbol of Function block No. 34	—	—
200	doSL1	DO1 function selection	0: No assignment 1: Logic calculation output (Event, Input error) 2: RUN state output 3: Input 1_Manual mode state output 4: Input 2_Manual mode state output 5: Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select) 6: Input 1_Autotuning (AT) state output 7: Input 2_Autotuning (AT) state output 8: Output while Set value of Input 1 is changing 9: Output while Set value of Input 2 is changing 10: Output of the communication monitoring result 11: FAIL output 12:Input 1_Control error state output* 13:Input 2_Control error state output * * 12 and 13 are displayed only when pressure is controlled by MC-COS(R)/MC-VCOS(R).	0	
201	doSL2	DO2 function selection	Same as DO1 function selection	0	
202	doSL3	DO3 function selection	Same as DO1 function selection	0	
203	doSL4	DO4 function selection	Same as DO1 function selection	0	
204	doLG1	DO1 logic calculation selection	0 to 255 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	0	
205	doLG2	DO2 logic calculation selection	Same as DO1 logic calculation selection	0	
206	doLG3	DO3 logic calculation selection	Same as DO1 logic calculation selection	0	
207	doLG4	DO4 logic calculation selection	Same as DO1 logic calculation selection	0	

3.9.11 Function block No. 41: Event 1 (EV1)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn41	Function block No. 41	This is the first parameter symbol of Function block No. 41	—	—
208	EVA1	Event 1 assignment [1]	1: Input 1 2: Input 2 3: Differential temperature input	1	
209	ES1	Event 1 type	0: None 1: Deviation high (Using SV monitor value) [1] 2: Deviation low (Using SV monitor value) [1] 3: Deviation high/low (Using SV monitor value) [1] 4: Band (Using SV monitor value) [1] 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) 8: SV low (Using SV monitor value) 9: Process high [b] 10: Process low [b] 11: Deviation high (Using local SV) [1] 12: Deviation low (Using local SV) [1] 13: Deviation high/low (Using local SV) [1] 14: Band (Using local SV) [1] 15: Deviation high/low (Using local SV) [High/Low individual setting] [1] 16: Band (Using local SV) [High/Low individual setting] [1] 17: SV high (Using local SV) 18: SV low (Using local SV) 19: MV high [heat-side] [2) c)] 20: MV low [heat-side] [2) c)] 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.	0	
210	EHo1	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.	0	
211	EH1	Event 1 differential gap	Deviation, Process and SV: • If event assignment is set to either Input 1 or Differential temperature. 0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) • If event assignment is set to Input 2 0 to Input 2_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	
212	EVT1	Event 1 timer	0.0 to 600.0 seconds	0.0	

[1)] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."

3.9.12 Function block No. 42: Event 2 (EV2)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn42	Function block No. 42	This is the first parameter symbol of Function block No. 42	—	—
213	EVA2	Event 2 assignment [1)]	Same as Event 1 assignment		
214	ES2	Event 2 type	Same as Event 1 type		
215	EHo2	Event 2 hold action	Same as Event 1 hold action		

216	EH2	Event 2 differential gap	Same as Event 1 differential gap	
217	EVT2	Event 2 timer	Same as Event 1 timer	

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."

3.9.13 Function block No. 43: Event 3 (EB3)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn43	Function block No. 43	This is the first parameter symbol of Function block No. 43	—	—
218	EVA3	Event 3 assignment [1]	Same as Event 1 assignment		
219	ES3	Event 3 type	Same as Event 1 type		
210	EHo3	Event 3 hold action	Same as Event 1 hold action		
221	EH3	Event 3 differential gap	Same as Event 1 differential gap		
222	EVT3	Event 3 timer	Same as Event 1 timer		

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."

3.9.14 Function block No. 44: Event 4 (EB4)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn44	Function block No. 44	This is the first parameter symbol of Function block No. 44	—	—
223	EVA4	Event 4 assignment [1]	Same as Event 1 assignment		
224	ES4	Event 4 type	Same as Event 1 type		
225	EHo4	Event 4 hold action	Same as Event 1 hold action		
226	EH4	Event 4 differential gap	Same as Event 1 differential gap		
227	EVT4	Event 4 timer	Same as Event 1 timer		

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."

3.9.15 Function block No. 50: Control (Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn50	Function block No. 50	This is the first parameter symbol of Function block No. 50	—	—
228	Pd	Hot/Cold start	0: Hot start 1 1: Hot start 2 2: Cold start 3: STOP start 4: Follow the selected action when power is restored	4	
229	rUnSL	RUN/STOP selection when power is restored	0: STOP 1: RUN 2: Operation immediately before power cut	0	
230	MANSL	MAN/AUTO selection when power is restored	0: MAN 1: AUTO 2: Operation immediately before power cut	0	
231	REMSL	LOC/REM selection when power is restored [1]	0: LOCAL 1: REMOTE 2: Operation immediately before power cut	0	
232	ExSL	LOC/EXT selection when power is restored [2]	0: LOC 1: EXT 2: Operation immediately before power cut	0	
233	MVSL	Output value selection when power is restored	0: 0% 1: Output limiter low 2: Status immediately before power cut	0	
234	MVTS	Manual manipulated output value selection	0: The last manipulated output value (Balanceless-bumpless function) 1: Manual manipulated output value	0	

235	rAK	SV tracking	0 to 3 0: No SV tracking function +1: SV tracking at transferring Remote/Local * * Including Cascade mode transfer, 2-loop control/Differential temperature control transfer +2: SV tracking at transferring Auto/Manual To select two or more functions, sum each value.	1	
236	IddP	Integral/Derivative time decimal point position [3) 4)]	0: No decimal place 1: One decimal place 2: Two decimal places	0	
237	SrS	ST start condition [3) 4)]	0: Activate the Startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; 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 STOP to RUN. 2: Activate the Startup tuning (ST) function when the Set value (SV) is changed.	0	

[1)] Displayed when "Remote setting input", "Cascade control", "Control with PV select" or "2-loop control" are selected in "Select function for Input 2" AND in the case of "2-loop control", both "Input 1_Control action" and "Input 2_Control action" are set to "PID control" (0 or 1) or "Heat/cool PID control" (2).

[2)] Displayed when "DI function selection" is set to "Area switching (without area set signal)".

[3)] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

[4)] Displayed when "2-loop control" is selected in "Select function for Input 2" AND "Pressure control operation [MC-(V)COS(R)]" is not selected in "Input 2_Control action".

3.9.16 Function block No. 51: Input 1_Control (I. Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn51	Function block No. 51	This is the first parameter symbol of Function block No. 51	—	—
238	I. oS	Input 1_Control action	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 2: Heating/Cooling PID control with Autotuning [Cooling linear type] 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] For cascade control, only 0 or 1 are selectable. In the case of Control with PV select, only “0 to 2” are selectable.	Product identification code specified at the time of order.	
239	I. oRU	Input 1_Output change rate limiter (up) [heat-side] [1)]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	
240	I. oRd	Input 1_ Output change rate limiter (down) [heat-side] [1)]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	

241	I.AoVE	Input 1_Action (high) input error	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_ Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2	
242	I.AUNE	Input 1_Action (low) input error	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_ Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2	
243	I. PSM	Input 1_Manipulated output value at input error	Heating/Cooling PID control: -105.0 to +105.0% Other control: -5.0 to +105.0%	Heating/Cooling PID control: 0.0 Other control: -5.0	
244	I. RMV	Input 1_ Manipulated output value at STOP [heat-side]	-5.0 to +105.0%	-5.0	
245	I. PdA	Input 1_Start determination point	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	0	
246	I.LPI d	Input 1_Level PID action selection [2)]	0: Switching by Memory area number 1: Switching by Set value (SV) (Level PID action) 2: Switching by Measured value (PV) (Level PID action)	0	
247	I. LHS	Input 1_Level PID differential gap [2)]	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2	

[1)] Not displayed when "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

[2)] Displayed when "Cascade control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

3.9.17 Function block No. 52: Input 2_Control (2. Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn52	Function block No. 52 [1]	This is the first parameter symbol of Function block No. 52	—	—
248	2. oS	Input 2_Control action [1]	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] 2: n/a In the case of Cascade control, only “0” or “1” is selectable.	1	
249	2. oRU	Input 2_Output change rate limiter (up) [3]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	
250	2. oRd	Input 2_Output change rate limiter (down) [3]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	
251	2.AoVE	Input 2_Action (high) input error [2]	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 2_ Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 2_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2	
252	2.AUNE	Input 2_Action (low) input error [2]	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 2_ Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 2_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2	
253	2. PSM	Input 2_Manipulated output value at input error [2]	-5.0 to +105.0%	-5.0	
254	2. RMV	Input 2_Manipulated output value at STOP [2]	-5.0 to +105.0%	-5.0	
255	2. PdA	Input 2_Start determination point [1]	0 to Input 2_Input span 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	0	
256	2.LPI d	Input 2_Level PID action selection [3]	0: Switching by Memory area number 1: Switching by Set value (SV) (Level PID action) 2: Switching by Measured value (PV) (Level PID action)	0	

257	2. LHS	Input 2_Level PID differential gap [3]	0 to Input 2_Input span [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2	

[1] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."
[2] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2."
[3] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

3.9.18 Function block No. 53: Input 1_Valve coefficient (1. MCVC)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn53	Function block No. 53 [1]	This is the first parameter symbol of Function block No. 53	—	—
258	1. A	Input 1_Valve coefficient A [1]	-1999 to 9999	0	
259	1. b	Input 1_Valve coefficient b [1]	-1999 to 9999	0	
260	1. C	Input 1_Valve coefficient C [1]	-1999 to 9999	0	
261	1. d	Input 1_Valve coefficient d [1]	-1999 to 9999	0	
262	1. E	Input 1_Valve coefficient E [1]	-1999 to 9999	0	
263	1. F	Input 1_Valve coefficient F [1]	When Input 1_Control action is set to 3 to 7 or 8: 0: kg/cm^{2}G 1: barg 2: psig 3: kPaG 4: MPaG When Input 1_Control action is 7 or 9: 10:mmHg/Torr 11:mbar 12:inHg 13:psi 14:kPa NOTE: The pressure unit to be entered for the pressure value is defined by the valve coefficient F. Parameters to be entered in pressure units, such as measurement input range, target set value, and alarm set value, must be entered in the same pressure units defined by the valve coefficient F. If the pressure unit and the parameter do not match, the product will not operate properly. To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate) is used, refer to the "Converting valve coefficient" section in "8.8 Using with MC-COS/MC-VCOS" in the instruction manual (parameters/functions) to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	Product identification code specified at the time of order	
264	1. GSL	Input 1_Valve coefficient F pressure standard [2]	0: Atmospheric pressure standard 1: Absolute pressure standard	Product identification code specified at the time of order	
265	1. VSL	Input 1_Control valve selection [2]	0: MC-VCOS(R) 1: PC-VCOS(R)	0	
266	1. PrL	Input 1_Pressure (Temp) limiter [1]	When Input 1_Control action is set to 3 to 7: Input 1_Input range low to Input 1_Input range high When Input 1_Control action is set to 8: Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99 Coefficient F = 1 (barg): 0.00 to 99.99 Coefficient F = 2 (psig): 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999	When a setting other than "7" is selected in Input 1_ Control action: 0 When “7” is	

			Coefficient F = 4 (MPaG): 0.000 to 9.999 When Input 1_Control action is 9: 0.0 to whichever the smaller value of either Input 1_range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 1_Display unit When Input type is set to V/I input: Input 1_Temperature limiter unit Pressure (temperature) limiter function is OFF when 0 (0.0, 0.00, 0.000) is set [Varies with the setting of the Decimal point position, when a setting is other than 8 for Input 1_Control action.]	selected in Input 1_ Control action: Input 1_Input range high	

267	1. PrUN	Input 1_Temperature limiter unit [3]	Displayed when “Current/Voltage input” is set to Input type in Temperature control operation [MC-VCOS] 0: °C 1: °F	Follows the unit specified at the time of order	
268	1. ob	Input 1_Regression equation bias [1]	-50.0 to +50.0%	0.0	
269	1. tMF	Input 1_Response speed self-learning selection [4]	0: Yes 1: No	0	
270	1. t1	Input 1_Response speed learning parameter [4] [5] t1 0 up	0 to 9999 seconds	6	
271	1. t2	Input 1_Response speed learning parameter [4] [5] t2 0 down	0 to 9999 seconds	6	
272	1. t3	Input 1_Response speed learning parameter [4] [5] t3 set up	0 to 9999 seconds	6	
273	1. t4	Input 1_Response speed learning parameter [4] [5] t4 set down	0 to 9999 seconds	6	
274	1. L1	Input 1_Response speed learning parameter [4] [5] L1 0 up	0 to 9999 seconds	2	
275	1. L2	Input 1_Response speed learning parameter [4] [5] L2 0 down	0 to 9999 seconds	2	
276	1. L3	Input 1_Response speed learning parameter [4] [5] L3 set up	0 to 9999 seconds	2	
277	1. L4	Input 1_Response speed learning parameter [4] [5] L4 set down	0 to 9999 seconds	2	
278	1. S1	Input 1_Response speed learning parameter [4] [5] S1 0 up	0 to 9999 seconds	2	
279	1. S2	Input 1_Response speed learning parameter [4] [5] S2 0 down	0 to 9999 seconds	2	
280	1. S3	Input 1_Response speed learning parameter [4] [5] S3 set up	0 to 9999 seconds	2	
281	1. S4	Input 1_Response speed learning parameter [4] [5] S4 set down	0 to 9999 seconds	2	
282	1. Pc1	Input 1_No. of corrective actions [4]	0 to 99 times (99: unlimited times)	99	
283	1. Pc2	Input 1_Corrective action repeat [4]	0: Yes 1: No	1	
284	1. Pc3	Input 1_Corrective actions for ramp control [4]	0: Yes 1: No	0	

285	1. oLb	Input 1_Lower range of corrective action amount [4]	0.0 to 105.0%	20.0	
286	1. oHb	Input 1_Upper range of corrective action amount [4]	0.0 to 105.0%	20.0	

[1] Displayed when 3 to 9 is selected in "Input 1_Control action".
[2] Displayed when "7 (Pressure control operation [MC-VCOS(R)])" is selected.
[3] Displayed when "9 (Temperature control operation [MC-VCOS(R)])" is selected, AND "Current" or "Voltage input" is selected in Input 1_type.
[4] Displayed when "3-7 (Pressure control operation [MC-(V)COS(R)])" is selected in "Input 1_Control action".
[5] Displayed when "1" is selected in "Input 1_Response speed self-learning selection".

3.9.19 Function block No. 54: Input 2_Valve factor (2. McVc)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn54	Function block No. 54 [1]	This is the first parameter symbol of Function block No. 54	—	—
287	2. A	Input 2_Valve coefficient A [1]	-1999 to 9999	0	
288	2. b	Input 2_Valve coefficient b [1]	-1999 to 9999	0	
289	2. C	Input 2_Valve coefficient C [1]	-1999 to 9999	0	
290	2. d	Input 2_Valve coefficient d [1]	-1999 to 9999	0	
291	2. E	Input 2_Valve coefficient E [1]	-1999 to 9999	0	
292	2. F	Input 2_Valve coefficient F [1]	When Input 2_Control action is set to 3 to 6 or 8: 0: kg/cm^{2}G 1: barg 2: psig 3: kPaG 4: MPaG When Input 2_Control action is 7 or 9: 10: mmHg/Torr 11: mbar 12: inHg 13: psi 14: kPa NOTE: The pressure unit to be entered for the pressure value is defined by the valve coefficient F. Parameters to be entered in pressure units, such as measurement input range, target set value, and alarm set value, must be entered in the same pressure units defined by the valve coefficient F. If the pressure unit and the parameter do not match, the product will not operate properly.. To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate), refer to the "Converting valve coefficient" section in "8.8 Using with MC-COS/MC-VCOS" in the instruction manual (parameters/functions) to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	Same as Input 1_ Valve coefficient F (pressure unit)	
293	2. GSt	Input 2_Pressure standard for valve coefficient F [2]	0: Atmospheric pressure standard 1: Absolute pressure standard	Same as pressure standard for Input 1_ Valve coefficient F	
294	2. VSt	Input 2_Control valve selection [2]	0: MC-VCOS(R) 1: PC-VCOS(R)	0	
295	2. PrL	Input 2_Pressure (Temp) limiter [1]	When Input 2_Control action is set to 3 to 7: Input 2_Input range low to Input 2_Input range high When Input 2_Control action is set to 8:	When a setting other than “7” is selected in Input 2_	

			Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99 Coefficient F = 1 (barg): 0.00 to 99.99 Coefficient F = 2 (psig): 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999 Coefficient F = 4 (MPaG): 0.000 to 9.999 When Input 2_Control action is 9: 0.0 to Whichever the smaller value of either Input 2_range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 2_Display unit When Input type is set to V/I input: Input 2_Temperature limiter unit Pressure (temperature) limiter function is OFF when 0 (0.0, 0.00, 0.000) is set [Varies with the setting of the Decimal point position, when a setting is other than 8 for Input 1_Control action.]	Control action: 0 When “7” is selected in Input 2_Control action: Input 2_Input range high	
296	2. PruN	Input 2_Temperature limiter unit [3]	Displayed when “Voltage/Current input” is selected in Temperature control operation [MC-VCOS] 0: °C 1: °F	Same as Input 1_Pressure (Temp) limiter unit	
297	2. ob	Input 2_Regression equation bias[1]	-50.0 to +50.0%	0.0	
298	2. tMF	Input 2_Response speed self-learning selection [4]	0: Yes 1: No	0	
299	2. t1	Input 2_Response speed learning parameter [4] [5] t1 0 up	0 to 9999 seconds	6	
300	2. t2	Input 2_Response speed learning parameter [4] [5] t2 0 down	0 to 9999 seconds	6	
301	2. t3	Input 2_Response speed learning parameter [4] [5] t3 set up	0 to 9999 seconds	6	
302	2. t4	Input 2_Response speed learning parameter [4] [5] t4 set down	0 to 9999 seconds	6	
303	2. L1	Input 2_Response speed learning parameter [4] [5] L1 0 up	0 to 9999 seconds	2	
304	2. L2	Input 2_Response speed learning parameter [4] [5] L2 0 down	0 to 9999 seconds	2	
305	2. L3	Input 2_Response speed learning parameter [4] [5] L3 set up	0 to 9999 seconds	2	
306	2. L4	Input 2_Response speed learning parameter [4] [5] L4 set down	0 to 9999 seconds	2	
307	2. S1	Input 2_Response speed learning parameter [4] [5] S1 0 up	0 to 9999 seconds	2	
308	2. S2	Input 2_Response speed learning parameter [4] [5] S2 0 down	0 to 9999 seconds	2	
309	2. S3	Input 2_Response speed learning parameter [4] [5] S3 set up	0 to 9999 seconds	2	
310	2. S4	Input 2_Response speed learning parameter [4] [5] S4 set down	0 to 9999 seconds	2	
311	2. Pc1	Input 2_No. of corrective actions [4]	0 to 99 times (99: unlimited times)	99	
312	2. Pc2	Input 2_Corrective action repeat [4]	0: Yes 1: No	1	
313	2. Pc3	Input 2_Corrective actions for ramp control [4]	0: Yes 1: No	0	
314	2. oLb	Input 2_Lower range of corrective action amount [4]	0.0 to 105.0%	20.0	

315	2. oHb	Input 2_Upper range of corrective action amount [4]	0.0 to 105.0%	20.0	

[1] Displayed when "2-loop control" is selected in "Select function for Input 2" AND "3-9: Pressure control operation [MC-VCOS(R)]" or "8-9: Temperature control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".
[2] Displayed when "2-loop control" is selected in "Select function for Input 2" AND "7: Pressure control operation [MC-VCOS(R)]" is selected in "Input 2_Control action".
[3] Displayed when "2-loop control" is selected in "Select function for Input 2" AND "9: Temperature control operation [MC-VCOS(R)]" is selected in "Input 2_Control action", AND "Current" or "Voltage output" is selected in "Input 2_type".
[4] Displayed when "2-loop control" is selected in "Select function for Input 2" AND "3-7: Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".
[5] Displayed when "1" is selected in "Input 2_Response speed self-learning selection".

3.9.20 Function block No. 56: Input 1_Cooling control (1. CooL)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn56	Function block No. 56 [1]	This is the first parameter symbol of Function block No. 56	—	—
316	1.oRUc	Input 1_Output change rate limiter (up) [cool-side] [1]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	
317	1.oRdc	Input 1_Output change rate limiter (down) [cool-side] [1]	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0	
318	1.RMVc	Input 1_Manipulated output value at STOP [cool-side] [1]	-5.0 to +105.0%	-5.0	
319	US	Undershoot suppression factor [1]	0.000 to 1.000	1.000	
320	dbPA	Overlap/Deadband reference point [1]	0.0 to 1.0	0.0	

[1] Displayed when "2: Heating/Cooling PID control" is selected in "Input 1_Control action".

3.9.21 Function block No. 57: Proactive (PACT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn57	Function block No. 57 [1]	This is the first parameter symbol of Function block No. 57	—	—
321	bTMSP	Bottom suppression function [1]	0: No function 1: FF amount is added by level 2: FF amount is forcibly added	0	

[1] Displayed when a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action", OR "2-loop control" is selected in "Select function for Input 2" AND a setting other than "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

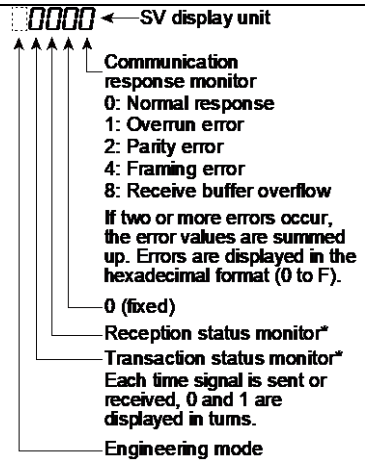
3.9.22 Function block No. 58: 2-input function (2PU)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn58	Function block No. 58	This is the first parameter symbol of Function block No. 58	—	—
322	2PV	Select function for input 2	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) 5: Cascade control (Master single ↔ Cascade) 6: Input circuit error alarm Selectable range is limited depending on Input 1_ Control action. PID control: 0 to 6 When pressure control operation [MC-(V)COS(R)] is selected: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1	
323	MAS.AT	Cascade_AT mode (master-side) [1]	0: Easy adjustment (AT: one cycle) 1: Load factor adjustment (AT: 2 cycles)	TC/RTD inputs: 0 V/I inputs: 1	
324	SLV.AT	Cascade_AT mode (slave-side) [1]	0: Easy adjustment (AT: one cycle) 1: Load factor adjustment (AT: 2 cycles)	TC/RTD inputs: 0	

				V/I inputs: 1	
325	2PV.TG	Selection of PV select trigger [2]	0: Switching by level 1: Switching by signal (Key, DI and Communication)	0	
326	I CA	Input circuit error alarm set value [3]	0 to Input 1_Input span 0: No function [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 10 V/I inputs: 5% of Input 1_Input span	

[1] Displayed when "Cascade control" is selected in "Select function for Input 2."
[2] Displayed when "Control with PV select" is selected in "Select function for Input 2."
[3] Displayed when "Input circuit error alarm" is selected in "Select function for Input 2."

3.9.23 Function block No. 60: Communication (SCI)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn60	Function block No. 60 [1]	This is the first parameter symbol of Function block No. 60	—	—
327	CMPS	Communication protocol [1]	0: Original 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])	0	
328	Add	Device address [1]	Original communication: 0 to 99 Modbus: 1 to 99 PLC communication: 0 to 30	Original communication: 0 Modbus: 1 PLC communication: 0	
329	bPS	Communication speed [1]	0: 2400 bps 3: 19200 bps 1: 4800 bps 4: 38400 bps 2: 9600 bps 5: 57600 bps	3	
330	bIT	Data bit configuration [1]	0 to 11 Refer to Data bit configuration table	0	
331	INT	Interval time [1]	0 to 250 ms	10	
332	CMRM	Communication response monitor [1]		—	—

[1] Displayed when Communication function is supplied.

Data bit configuration table

Set value	Data bit	Parity bit	Stop bit
0	8	Without	1
1	8	Without	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	Without	1
7	7	Without	2
8	7	Even	1
9	7	Even	2
10	7	Odd	1
11	7	Odd	2

: Not settable for Modbus

3.9.24 Function block No. 62: PLC communication (Fn62)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn62	Function block No. 62 [1]	This is the first parameter symbol of Function block No. 62	—	—
333	MP.REG	Register type [1]	Mitsubishi PLC (MELSEC) 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	
334	MP.SRH	Register start number (High-order 4-bit) [1]	0 to 15	0	
335	MP.SRL	Register start number (Low-order 16-bit) [1]	0 to 65535	1000	
336	MP.Mod	Monitor item register bias [1]	12 to 65535	12	
337	MP.SRb	Setting item register bias [1]	0 to 65535	0	
338	MP.LRM	Instrument link recognition time [1]	0 to 255 seconds	5	
339	MP.RMo	PLC response waiting time [1]	0 to 3000 ms	255	
340	MP.SRM	PLC communication start time [1]	1 to 255 seconds	5	
341	MP.SLb	Slave register bias [1]	0 to 65535	80	
342	MP.MAd	Number of recognizable devices [1]	0 to 30	8	

[1] Displayed when both Communication function and PLC communication protocol are supplied.

3.9.25 Function block No. 70: Memory area (AreA)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn70	Function block No. 70	This is the first parameter symbol of Function block No. 70	—	—
343	SvRS	Soft start/setting change rate limiter selection	0: Soft start 1: Setting change rate limiter	0	
344	SvTS	Soft start time selection [1]	0: m.s 1: h.m	0	
345	SvSS	Soft start point selection [1]	0: Measured value (PV) start 1: Zero point start	0	
346	SvRT	Setting change rate limiter unit time [2]	1 to 3600 seconds	60	
347	SrdP	Soak time unit	0: 0 hours 00 minutes to 99 hours 59 minutes 1: 0 minutes 00 seconds to 199 minutes 59 seconds 2: 0 hours 0 minutes 0 seconds to 9 hours 59 minutes 59 seconds	1	

[1] Displayed when "0: Soft start" is selected in "Soft start/Setting change rate limiter selection".
[2] Displayed when "1: Setting change rate limiter" is selected in "Soft start/Setting change rate limiter selection".

3.9.26 Function block No. 71: Input 1_Setting limiter (I. SHL)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn71	Function block No. 71	This is the first parameter symbol of Function block No. 71	—	—
.348	I. SLH	Input 1_Setting limiter high	Input 1_Setting limiter low to Input 1_Input range high (When Control with PV select Input 1_Setting limiter low to PV select input range high) [Varies with the setting of the Decimal point position.]	Input 1_ Input range high (Control with PV select: PV select input range high)	
349	I. SLL	Input 1_Setting limiter low	Input 1_Input range low to Input 1_Setting limiter high	Input 1_ Input range	

			(When Control with PV select PV select input range low to Input 1_Setting limiter high) [Varies with the setting of the Decimal point position.]	low (Control with PV select: PV select input range low)	

3.9.27 Function block No. 72: Input 2_Setting limiter (2. SHL)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn72	Function block No. 72 [1)]	This is the first parameter symbol of Function block No. 72	—	—
350	2. SLH	Input 2_Setting limiter high [1)]	Input 2_Setting limiter low to Input 2_Input range high [Varies with the setting of the Decimal point position.]	Input 2_ Input range high	
351	2. SLL	Input 2_Setting limiter low [1)]	Input 2_Input range low to Input 2_Setting limiter high [Varies with the setting of the Decimal point position.]	Input 2_ Input range low	

[1)] Displayed when "2-loop control/Differential temperature control" or "Cascade control" is selected in "Select function for Input 2."

3.9.28 Function block No. 91: System (SYS)

No.	Symbol	Name	Data range	Factory set value	User set value
—	Fn91	Function block No. 91	This is the first parameter symbol of Function block No. 91	—	—
—	dEF	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	—
—	WT	Integrated operating time	0 to 65535 hours	—	—
—	TCJ	Peak hold monitor of ambient temperature	-120 to +120 °C	—	—
—	RoM	ROM version	The installed ROM version is displayed	—	—
—	SC-F7	Product identification code monitor	Product identification code is displayed. Use the UP or DOWN key to scroll the display horizontally (left or right).	—	—
—	00000 The serial number of the instrument is displayed.	Instrument number monitor	Instrument number is displayed.	—	—

4. Parameters that are Initialized/Modified when Settings are Changed

This chapter describes the parameters that are initialized/modified when settings are changed.

4.1 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.

• Select function for Input 2	Engineering Mode	Function block No. 58
• Input 1_Input type	Engineering Mode	Function block No. 21
• Input 1_Display unit	Engineering Mode	Function block No. 21
• Input 1_Decimal point position	Engineering Mode	Function block No. 21
• Input 2_Input type	Engineering Mode	Function block No. 22
• Input 2_Display unit	Engineering Mode	Function block No. 22
• Input 1_Control action	Engineering Mode	Function block No. 51
• Input 2_Control action	Engineering Mode	Function block No. 52
• OUT3 function selection	Engineering Mode	Function block No. 30
• Universal output type selection	Engineering Mode	Function block No. 30
• Retransmission output 1 type	Engineering Mode	Function block No. 31
• Retransmission output 2 type	Engineering Mode	Function block No. 32
• Retransmission output 3 type	Engineering Mode	Function block No. 33
• Event 1 type	Engineering Mode	Function block No. 41
• Event 1 assignment	Engineering Mode	Function block No. 41
• Event 2 type	Engineering Mode	Function block No. 42
• Event 2 assignment	Engineering Mode	Function block No. 42
• Event 3 type	Engineering Mode	Function block No. 43
• Event 3 assignment	Engineering Mode	Function block No. 43
• Event 4 type	Engineering Mode	Function block No. 44
• Event 4 assignment	Engineering Mode	Function block No. 44
• Integral/Derivative time decimal point position	Engineering Mode	Function block No. 50
• Input 1_Valve coefficient (F)	Engineering Mode	Function block No. 53
• Input 2_Valve coefficient (F)	Engineering Mode	Function block No. 54
• Communication protocol	Engineering Mode	Function block No. 60
• Register type	Engineering Mode	Function block No. 62
• Soak time unit	Engineering Mode	Function block No. 70
• Initialization	Engineering Mode	Function block No. 91

4.1.1 When Select function for input 2 (2PV) is changed [Engineering Mode: Function block No. 58]

The following parameters will be initialized.
Some parameters may have prerequisites for initialization. (See below for conditions.)

Mode		Items	Symbol	Initial value	Condition
Operation Transfer Mode		Remote/Local transfer When “Remote setting input” is selected in Select function for Input 2	R/L	LoC	—
		Remote/Local transfer When “Cascade control” is selected in Select function for Input 2	R/L	SnGL	—
		Remote/Local transfer When “Control with PV select” is selected in Select function for Input 2	R/L	InP1	—
		Remote/Local transfer When “2-loop control/Differential temperature control” is selected in Select function for Input 2	R/L	2LooP	—
Monitor & SV Setting Mode		Input 1_Set value (SV)		0	1
Parameter Setting Mode	Parameter group No. 00	Input 1_Set value (SV)	1. SV	0	1
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	High action, high/low action: max. Low action, process action: min.	4
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2		4
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3		4
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4		4
		Event 1 set value (EV1’) [low]	EV 1'	High/low action: min. Process action: max.	4
		Event 2 set value (EV2’) [low]	EV2'		4
		Event 3 set value (EV3’) [low]	EV3'		4
		Event 4 set value (EV4’) [low]	EV4'		4
	Parameter group No. 51	Input 1_Proportional band [heat-side]	1. P	TC/RTD inputs: 30 V/I inputs: 3.0	1
		Input 1_Integral time [heat-side]	1. I	240	1
		Input 1_Derivative time [heat-side]	1. d	60	1
		Input 1_Control response parameter	1. RPr	PID control: 0 Heating/Cooling PID control: 2	1
		Input 1_Proactive intensity	1.PACr	2	1
		Input 1_Manual reset	1. MR	0.0	1
		Input 1_FF amount	1. FF	0.0	1
		Input 1_ON/OFF action differential gap (upper)	1. oHH	TC/RTD inputs: 1 V/I inputs: 0.1	1
		Input 1_ON/OFF action differential gap (lower)	1. oHL		1
	Parameter group No. 56	Input 1_Proportional band [cool-side]	1. Pc	TC/RTD inputs: 30 V/I inputs: 3.0	1
		Input 1_Integral time [cool-side]	1. Ic	240	1
		Input 1_Derivative time [cool-side]	1. dc	60	1
		Input 1_Overlap/Deadband	1. db	TC/RTD inputs: 0 V/I inputs: 0.0	1
	Parameter group No. 70	Input 1_Setting change rate limiter (up)	1.SVRU	0	1
		Input 1_Setting change rate limiter (down)	1.SVRd	0	1

Setup Setting Mode	Setting group No. 21	Input 2_PV bias	1. Pb	0	1
	Setting group No. 22	Input 2_PV bias (RS bias)	2. Pb	0	2
		Input 2_PV digital filter (RS digital filter)	2. dF	0.0	2
		Input 2_PV ratio (RS ratio)	2. PR	1.000	2
	Setting group No. 51	Input 1_Level PID setting 1	1.LEV 1	Input 1_Input range high (Control with PV select: PV select input range high)	1
		Input 1_Level PID setting 2	1.LEV2		1
		Input 1_Level PID setting 3	1.LEV3		1
		Input 1_Level PID setting 4	1.LEV4		1
		Input 1_Level PID setting 5	1.LEV5		1
		Input 1_Level PID setting 6	1.LEV6		1
		Input 1_Level PID setting 7	1.LEV7		1
	Setting group No. 53	Input 1_AT bias	1. ATb	0	1
	Setting group No. 57	Input 1_Determination point of external disturbance	1. ExdU	-1	1
Engineering Mode	Function block No. 21	Input 1_Decimal point position	1. PGdP	0	1
	Function block No. 22	Input 2_Input type	2. 1NP	Same as Input 1_Input type When Remote setting input is specified at the time of order: 17	3
		Input 2_Display unit	2. UNI T	Same as Input 1_Display unit Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Not initialized in other cases.	5
		Input 2_Decimal point position	2. PGdP	Same as Input 1_ Decimal point position Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Zero (0) for other cases.	5
		Input 2_Input range high	2. PGSH	・TC/RTD inputs Input 2_Maximum value of input range ・V/I inputs Remote setting input: Input 1_Maximum value of input range Others: 100	6
		Input 2_Input range low	2. PGSL	・TC/RTD inputs Input 2_Minimum value of input range ・V/I inputs Remote setting input: Input 1_Minimum value of input range Others: 0	6
	Function block No. 31	Retransmission output 1 scale high	AHS 1	Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range high (Control with PV select: PV select input range high) Input 1_Deviation: +(Input 1_Input span) Measured value (PV) of differential temperature input: 100	1 and 7

	Function block No. 31	Retransmission output 1 scale low	AL51	Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low (Control with PV select: PV select input range low) Input 1_Deviation: -(Input 1_Input span) Measured value (PV) of differential temperature input: -100	1 and 7
	Function block No. 32	Retransmission output 2 scale high	AH52	Same as Retransmission output 1 scale high	1 and 7
		Retransmission output 2 scale low	AL52	Same as Retransmission output 1 scale low	1 and 7
	Function block No. 33	Retransmission output 3 scale high	AH53	Same as Retransmission output 1 scale high	1 and 7
		Retransmission output 3 scale low	AL53	Same as Retransmission output 1 scale low	1 and 7
	Function block No. 41	Event 1 assignment	EVA1	1	—
		Event 1 differential gap	EH1	TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2	4
	Function block No. 42	Event 2 assignment	EVA2	1	—
		Event 2 differential gap	EH2	TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2	4
	Function block No. 43	Event 3 assignment	EVA3	1	—
		Event 3 differential gap	EH3	TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2	4
	Function block No. 44	Event 4 assignment	EVA4	1	—
		Event 4 differential gap	EH4	TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2	4
	Function block No. 51	Input 1_Start determination point	1.PdA	0	1
	Function block No. 51	Input 1_Level PID differential gap	1.LHS	TC/RTD inputs: 2 V/I inputs: 0.2	1
	Function block No. 58	Input circuit error alarm set value	ICA	TC/RTD inputs: 10 V/I inputs: 5 % of Input 1_Input span	3
	Function block No. 71	Input 1_Setting limiter high	1.SLH	Input 1_Input range high (Control with PV select: PV select input range high)	1
		Input 1_Setting limiter low	1.SLL	Input 1_Input range low (Control with PV select: PV select input range low)	1

Conditions:

1. "Select function for Input 2" is switched between "Control with PV select" and another setting*.
   * No function, Remote setting input, 2-loop control/Differential temperature control, Cascade control, or Input circuit error alarm.
2. "Select function for Input 2" is switched between "Remote setting input" and another setting*.
   * No function, Control with PV select, 2-loop control/Differential temperature control, Cascade control, or Input circuit error alarm.
3. "Select function for Input 2" is switched between "Input circuit error alarm" and another setting*.
   * No function, Remote setting input, Control with PV select, 2-loop control/Differential temperature control, or Cascade control.
4. Event type is a setting other than Manipulated output value AND "Select function for Input 2" is switched between "Control with PV select" and another setting*.
   * No function, Remote setting input, 2-loop control/Differential temperature control, Cascade control, or Input circuit error alarm.
5. "Select function for input t 2" is switched from any of "Remote setting input," "Control with PV select" or "Input circuit error alarm" to another setting*.
   * No function, 2-loop control/Differential temperature control, and Cascade control.
6. "Select function for Input 2" is switched from either "Remote setting input" or "Input circuit error alarm" to another setting *.
   * No function, Control with PV select, 2-loop control/Differential temperature control, or Cascade control.
7. Retransmission output is "No retransmission output," "Input 1_Measured value (PV)", "Input 1_Set value (SV)", "Input 1_Deviation," "Input 1_Remote setting input value," OR Measured value (PV) of differential temperature input.

4.1.2 When Input 1_Input type (I. INP) and Input 1_Display unit (I. UNIT) are changed [Engineering Mode: Function block No. 21]

The following parameters will be initialized. Some parameters may have prerequisites for initialization. (See below for conditions.)

Mode		Items	Symbol	Initial value	Condition
Monitor & SV Setting Mode		Input 1_Set value (SV)		Input 1_Set value (SV)	—
		Set value (SV) of differential temperature input		Set value (SV) of differential temperature input	—
Parameter Setting Mode	Parameter group No. 00	Input 1_Set value (SV)	I. SV	—	—
		Set value (SV) of differential temperature input	dSV	—	—
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	High action, high/low action: max. Low action, process action: min.	3
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2		3
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3		3
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4		3
		Event 1 set value (EV1') [low]	EV 1'	High/low action: min. Process action: max.	3
		Event 2 set value (EV2') [low]	EV2'		3
		Event 3 set value (EV3') [low]	EV3'		3
		Event 4 set value (EV4') [low]	EV4'		3
Parameter Setting Mode	Parameter group No. 51	Input 1_Proportional band [heat-side]	I. P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Input 1_Integral time [heat-side]	I. I	240	—
		Input 1_Derivative time [heat-side]	I. d	60	—
		Input 1_Control response parameter	I. RPT	PID control: 0 Heating/Cooling PID control: 2	—
		Input 1_Proactive intensity	I. PACT	2	—
		Input 1_Manual reset	I. MR	0.0	—
		Input 1_FF amount	I. FF	0.0	—
		Input 1_ON/OFF action differential gap (upper)	I. oHH	TC/RTD inputs: 1 V/I inputs: 0.1	—
		Input 1_ON/OFF action differential gap (lower)	I. oHL		—
	Parameter group No. 56	Input 1_Proportional band [cool-side]	I. Pc	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Input 1_Integral time [cool-side]	I. Ic	240	—
		Input 1_Derivative time [cool-side]	I. dc	60	—
		Input 1_Overlap/Deadband	I. db	TC/RTD inputs: 0 V/I inputs: 0.0	—
	Parameter group No. 70	Input 1_Setting change rate limiter (up)	I. SVRU	0	—
		Input 1_Setting change rate limiter (down)	I. SVRd	0	—
Setup Setting Mode	Setting group No. 21	Input 1_PV bias	I. Pb	0	—
		Input 1_PV digital filter	I. dF	0.0	—
		Input 1_PV ratio	I. PR	1.000	—
		Input 1_PV low input cut-off [1)]	I. PLC	0.00	—
	Setting group No. 22	Input 2_PV bias (RS bias)	2. Pb	0	1
		Input 2_PV digital filter (RS digital filter)	2. dF	0.0	1
		Input 2_PV ratio (RS ratio)	2. PR	1.000	1
	Setting group No. 51	Input 1_Level PID setting 1	I. LEV 1	Input 1_Input range high Control with PV select: PV select input range high	—
		Input 1_Level PID setting 2	I. LEV2		—
		Input 1_Level PID setting 3	I. LEV3		—
		Input 1_Level PID setting 4	I. LEV4		—
		Input 1_Level PID setting 5	I. LEV5		—
		Input 1_Level PID setting 6	I. LEV6		—
		Input 1_Level PID setting 7	I. LEV7		—
	Setting group No. 53	Input 1_AT bias	I. ATb	0	—
	Setting group No. 57	Input 1_Determination point of external disturbance	I. ExdJ	–1	—

Setup Setting Mode	Setting group No. 58	Cascade_Proportional band (master-side)	MAS. P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Cascade_Integral time (master-side)	MAS. I	240	—
		Cascade_Derivative time (master-side)	MAS. d	60	—
		Cascade_Proportional band (slave-side)	SLV. P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Cascade_Integral time (slave-side)	SLV. I	240	—
		Cascade_Derivative time (slave-side)	SLV. d	60	—
		Cascade_Digital filter	C. dF	10.0	—
		Cascade_Scale high	C. SCH	Input 2_Setting limiter high	—
		Cascade_Scale low	C. SCL	Input 2_Setting limiter low	—
		PV select transfer level	2PV. LV	Input 1_Input range high	—
	Setting group No. 91	Input 1_Peak hold monitor	1. PHLd		—
		Input 1_Bottom hold monitor	1. bHLd		—
Engineering Mode	Function block No. 21	Input 1_Decimal point position [1)]	1. PGdP	0	—
		Input 1_Input range high	1. PGSH	・TC/RTD inputs: Input 1_Maximum value of input range ・V/I inputs: 100	—
		Input 1_Input range low	1. PGSL	・TC/RTD inputs: Input 1_Minimum value of input range ・V/I inputs: 0	—
		Input 1_Input error determination point (high)	1. PoV	Input 1_Input range high + (Input 1_5% of input span)	—
		Input 1_Input error determination point (low)	1. PUN	Input 1_Input range low - (Input 1_5% of input span)	—
	Function block No. 22	Input 2_Display unit [2)]	2. UNIT	Same as Input 1_ Display unit Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Not initialized in other cases.	2
		Input 2_Decimal point position [1)]	2. PGdP	Same as Input 1_ Decimal point position Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Zero (0) for other cases.	2
		Input 2_Input range high	2. PGSH	・TC/RTD inputs Input 2_Maximum value of input range ・V/I inputs Remote setting input: Input 1_ Maximum value of input range Others: 100	1
		Input 2_Input range low	2. PGSL	・TC/RTD inputs Input 2_Minimum value of input range ・V/I inputs Remote setting input: Input 1_Minimum value of input range Others: 0	1

Engineering Mode	Function block No. 31	Retransmission output 1 scale high	AHS1	Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range high (Control with PV select: PV select input range high) Input 1_Deviation: +(Input 1_Input span) Measured value (PV) of differential temperature input: 100	4
		Retransmission output 1 scale low	ALS1	Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low (Control with PV select: PV select input range low) Input 1_Deviation: −(Input 1_Input span) Measured value (PV) of differential temperature input: -100	4
	Function block No. 32	Retransmission output 2 scale high	AHS2	Same as Retransmission output 1 scale high	4
		Retransmission output 2 scale low	ALS2	Same as Retransmission output 1 scale low	4
	Function block No. 33	Retransmission output 3 scale high	AHS3	Same as Retransmission output 1 scale high	4
		Retransmission output 3 scale low	ALS3	Same as Retransmission output 1 scale low	4
	Function block No. 41	Event 1 differential gap	EH1	TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2	3
	Function block No. 42	Event 2 differential gap	EH2		3
	Function block No. 43	Event 3 differential gap	EH3		3
	Function block No. 44	Event 4 differential gap	EH4		3
	Function block No. 51	Input 1_Start determination point	I.PdA	0	—
		Input 1_Level PID differential gap	I.LHS	TC/RTD inputs: 2 V/I inputs: 0.2	—
	Function block No. 58	Cascade_AT mode (master-side)	MASAT	TC/RTD inputs: 0 V/I inputs: 1	—
		Cascade_AT mode (slave-side)	SLVAT		—
		Input circuit error alarm set value	ICA	TC/RTD inputs: 10 V/I inputs: 5% of Input 1_Input span	—
	Function block No. 71	Input 1_Setting limiter high	I.SLH	Input 1_Input range high (Control with PV select: PV select input range high)	—
		Input 1_Setting limiter low	I.SLL	Input 1_Input range low (Control with PV select: PV select input range low)	—

[1] When Input 1_Input type is changed.

[2] When Input 1_Display unit is changed.

Condition

1. When "Remote setting input" is selected in "Select function for Input 2" AND either Voltage input or Current input are selected in "Input 2_Input type".
2. When "Remote setting input" is selected in "Select function for Input 2" AND either Voltage input or Current input are selected in "Input 2_Input type", OR "Control with PV select is selected in "Select function for Input 2".
3. The condition is either of the following.
   - "Manipulated output value" is not selected in "Event type" AND "Control with PV select" is selected in "Select function for Input 2".
   - Event type is a setting other than Manipulated output value AND Event assignment is either "Input 1" or "Differential temperature input."
4. Retransmission output is "No retransmission output," "Input 1_Measured value (PV)," "Input 1_Set value (SV)," "Input 1_Deviation," "Input 1_Remote setting input value," OR Measured value (PV) of differential temperature input.

4.1.3 When Input 1_Decimal point position (I.PGdP) is changed [Engineering

Mode: Function block No. 21]

The following parameters will be initialized.
When Select function for input 2 is “Remote setting input” AND Input 2_Input type is Voltage/Current input, OR Select function for input 2 is “Control with PV select.”

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 22	Input 2_Decimal point position	2.PGdP	Same as Input 1_Decimal point position Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Zero (0) for other cases.

4.1.4 When Input 2_Input type (2. INP) and Input 2_Display unit (2. UNIT) are changed [Engineering Mode: Function block No. 22]

The following parameters will be initialized. Some parameters may have prerequisites for initialization. (See below for conditions.)

Mode		Items	Symbol	Initial value	Condition
Monitor & SV Setting Mode		Input 2_Set value (SV)		0	—
Parameter Setting Mode	Parameter group No. 00	Input 2_Set value (SV)	2. SV	0	—
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	High action, high/low action: max. Low action, process action: min.	3
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2		3
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3		3
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4		3
		Event 1 set value (EV1’) [low]	EV 1'	High/low action: min. Process action: max.	3
		Event 2 set value (EV2’) [low]	EV2'		3
		Event 3 set value (EV3’) [low]	EV3'		3
		Event 4 set value (EV4’) [low]	EV4'		3
	Parameter group No. 52	Input 2_Proportional band	2. P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Input 2_Integral time	2. I	240	—
		Input 2_Derivative time	2. d	60	—
		Input 2_Control response parameter	2. RPT	0	—
		Input 2_Proactive intensity	2.PACT	2	—
		Input 2_Manual reset	2. MR	0.0	—
		Input 2_FF amount	2. FF	0.0	—
		Input 2_ON/OFF action differential gap (upper)	2. oHH	TC/RTD inputs: 1 V/I inputs: 0.1	—
		Input 2_ON/OFF action differential gap (lower)	2. oHL		—
	Parameter group No. 70	Input 2_Setting change rate limiter (up)	2.SVRU	0	—
		Input 2_Setting change rate limiter (down)	2.SVRd	0	—

Setup Setting Mode	Setting group No. 22	Input 2_PV bias (RS bias)	2. Pb	0	—
		Input 2_PV digital filter (RS digital filter)	2. dF	0.0	—
		Input 2_PV ratio (RS ratio)	2. PR	1.000	—
		Input 2_PV low input cut-off [1)]	2. PLC	0.00	—
	Setting group No. 52	Input 2_Level PID setting 1	2.LEV 1	Input 2_Input range high	—
		Input 2_Level PID setting 2	2.LEV2		—
		Input 2_Level PID setting 3	2.LEV3		—
		Input 2_Level PID setting 4	2.LEV4		—
		Input 2_Level PID setting 5	2.LEV5		—
		Input 2_Level PID setting 6	2.LEV6		—
		Input 2_Level PID setting 7	2.LEV7		—
	Setting group No. 54	Input 2_AT bias	2. ATb	0	—
	Setting group No. 57	Input 2_Determination point of external disturbance	2.ExdJ	-1	—
	Setting group No. 58	Cascade_Proportional band (master-side)	MAS.P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Cascade_Integral time (master-side)	MAS.I	240	—
		Cascade_Derivative time (master-side)	MAS.d	60	—
		Cascade_Proportional band (slave-side)	SLV.P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Cascade_Integral time (slave-side)	SLV.I	240	—
		Cascade_Derivative time (slave-side)	SLV.d	60	—
		Cascade_Digital filter	C.dF	10.0	—
		Cascade_Scale high	C.SCH	Input 2_Setting limiter high	—
		Cascade_Scale low	C.SCL	Input 2_Setting limiter low	—
	Setting group No. 91	Input 2_Peak hold monitor	2.PHLd		—
		Input 2_Bottom hold monitor	2.bHLd		—
Engineering Mode	Function block No. 21	Input 1_Decimal point position [1)]	1.PGdP	0	1
	Function block No. 22	Input 2_Decimal point position [1)]	2.PGdP	Same as Input 1_ Decimal point position Only when the input type is Control with PV select, Input circuit error alarm, and Remote setting input (V/I inputs). Zero (0) for other cases.	2
		Input 2_Input range high	2.PGSH	・TC/RTD inputs Input 2_Maximum value of input range ・V/I inputs Remote setting input: Input 1_Maximum value of input range Others: 100	—
		Input 2_Input range low	2.PGSL	・TC/RTD inputs Input 2_Minimum value of input range ・V/I inputs Remote setting input: Input 1_Minimum value of input range Others: 0	—
		Input 2_Input error determination point (high)	2. PoV	Input 2_Input range high + (Input 2_5 % of input span)	—
		Input 2_Input error determination point (low)	2. PUN	Input 2_Input range low − (Input 2_5 % of input span)	—

	Function block No. 31	Retransmission output 1 scale high	AHS1	Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range high Input 2_Deviation: +(Input 2_Input span)	4
		Retransmission output 1 scale low	ALS1	Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range low Input 2_Deviation: −(Input 2_Input span)	4
	Function block No. 32	Retransmission output 2 scale high	AHS2	Same as Retransmission output 1 scale high	4
		Retransmission output 2 scale low	ALS2	Same as Retransmission output 1 scale low	4
	Function block No. 33	Retransmission output 3 scale high	AHS3	Same as Retransmission output 1 scale high	4
		Retransmission output 3 scale low	ALS3	Same as Retransmission output 1 scale low	4
Engineering Mode	Function block No. 41	Event 1 differential gap	EH1	TC/RTD inputs: 2 V/I inputs: 0.2	3
	Function block No. 42	Event 2 differential gap	EH2		3
	Function block No. 43	Event 3 differential gap	EH3		3
	Function block No. 44	Event 4 differential gap	EH4		3
	Function block No. 52	Input 2_Start determination point	2.PdA	3% of Input 2_Input span	—
		Input 2_Level PID differential gap	2.LHS	TC/RTD inputs: 2 V/I inputs: 0.2	—
	Function block No. 58	Cascade_AT mode (master-side)	MAS.AT	TC/RTD inputs: 0 V/I inputs: 1	—
		Cascade_AT mode (slave-side)	SLV.AT		—
	Function block No. 72	Input 2_Setting limiter high	2.SLH	Input 2_Input range high	—
		Input 2_Setting limiter low	2.SLL	Input 2_Input range low	—

[1)] When Input 2_Input type is changed.
Conditions:
1. "Select function for Input 2" is "Control with PV select."
2. A setting other than Control with PV select is selected for "Select function for Input 2"
3. Event type is a setting other than Manipulated output value AND "Select function for Input 2" is a setting other than "Control with PV select," AND Event assignment is "Input 2."
4. Retransmission output is "Input 1_Measured value (PV)," "Input 1_Set value (SV)," or "Input 1_Deviation."

4.1.5 When Input 1_Control action (1.oS) is changed [Engineering Mode: Function block No. 51]

The following parameters will be initialized. Some parameters may have prerequisites for initialization. (See below for the conditions.)

Mode		Items	Symbol	Initial value	Condition
Parameter Setting Mode	Parameter group No. 51	Input 1_Proportional band [heat-side]	1.P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Input 1_Integral time [heat-side]	1.I	240	—
		Input 1_Derivative time [heat-side]	1.d	60	—
		Input 1_Control response parameter	1.RPT	PID control or Position proportioning PID control: 0 Heating/Cooling PID control: 2	—
		Input 1_Proactive intensity	1.PACT	2	—
		Input 1_Manual reset	1.MR	0.0	—
		Input 1_FF amount	1.FF	0.0	—
		Input 1_ON/OFF action differential gap (upper)	1.oHH	TC/RTD inputs: 1 V/I inputs: 0.1	—
		Input 1_ON/OFF action differential gap (lower)	1.oHL		—

		Input 1_Dead zone	1. MCdb	See Table 1 in 3.7.3	5
	Parameter group No. 56	Input 1_Proportional band [cool-side]	1. Pc	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Input 1_Integral time [cool-side]	1. Ic	240	—
		Input 1_Derivative time [cool-side]	1. dc	60	—
		Input 1_Overlap/Deadband	1. db	TC/RTD inputs: 0 V/I inputs: 0.0	—
	Parameter group No. 70	Input 1_Manipulated output value (For Area transfer)	1. MV.A	Heating/Cooling PID control: 0.0 Other control: -5.0	4
Setup Setting Mode	Setting group No. 30	OUT3 proportional cycle time	r3	Voltage pulse output: See NOTE below	3
	Setting group No. 51	Input 1_Manual manipulated output value	1. M.MV	Heating/Cooling PID control: 0.0 Other control: -5.0	4
Engineering Mode	Function block No. 51	Input 1_Manipulated output value at input error	1. PSM	PID control: –5.0 Heating/Cooling PID control: 0.0	4
	Function block No. 53	Input 1_Valve coefficient F	1. F	MC-COS(R) control: 3 MC-VCOS(R) control: 10	5
		Input 1_ Pressure (Temperature) limiter	1. PrL	0	5
	Function block No. 56	Undershoot suppression factor	US	Water cooling: 0.100 Air cooling: 0.250 Cooling linear: 1.000	—

Conditions:

1. OUT1 is configured to control output: (Switching between Dir/Rev action in Input 1 is excluded from the initialization).
2. OUT2 is configured to control output: (Switching between Dir/Rev action in Input 1 is excluded from the initialization).
3. OUT3 is configured to control output: (Switching between Dir/Rev action in Input 1 is excluded from the initialization)..
4. Input 1_Control action is other than switching between Dir/Rev action and Cooling action.
5. "Pressure/Temperature control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

4.1.6 When Input 2_Control action (2. oS) is changed [Engineering Mode: Function block No. 52]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 52	Input 2_Proportional band	2. P	TC/RTD inputs: 30 V/I inputs: 3.0
		Input 2_Integral time	2. I	240
		Input 2_Derivative time	2. d	60
		Input 2_Control response parameter	2. RPr	0
		Input 2_Proactive intensity	2.PACr	2
		Input 2_Manual reset	2. MR	0.0
		Input 2_FF amount	2. FF	0.0
		Input 2_ON/OFF action differential gap (upper)	2. oHH	TC/RTD inputs: 1 V/I inputs: 0.1
		Input 2_ON/OFF action differential gap (lower)	2. oHL	
		Input 2_Dead band	2.MCdb	See Table 1 in 3.7.3
Engineering mode	Function block No. 54	Input 2_Valve coefficient F	2. F	MC-COS(R) control: 3 MC-VCOS(R) control: 10
		Input 2_Pressure (Temperature) limiter	2. PrL	0

4.1.7 When OUT3 function selection (oSL3) and Universal output type selection (UNI o) 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	r3	2.0

4.1.8 When Retransmission output 1 type (Ao1) 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	AHS1	• Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range high (Control with PV select: PV select input range high) • Input 1_Deviation: +(Input 1_Input span) • Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range high • Input 2_Deviation: +(Input 2_Input span) • Manipulated output value, and Current transformer (CT) input value: 100.0 • Measured value (PV) of differential temperature input: 100
		Retransmission output 1 scale low	ALS1	• Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low (Control with PV select: PV select input range low) • Input 1_Deviation: −(Input 1_Input span) • Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range low • Input 2_Deviation: −(Input 2_Input span) • Manipulated output value, and Current transformer (CT) input value: 0.0 • Measured value (PV) of differential temperature input: −100

4.1.9 When Retransmission output 2 type (Ao2) 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	AHS2	Same as Retransmission output 1 scale high
		Retransmission output 2 scale low	ALS2	Same as Retransmission output 1 scale low

4.1.10 When Retransmission output 3 type (Ao3) 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	AHS3	Same as Retransmission output 1 scale high
		Retransmission output 3 scale low	ALS3	Same as Retransmission output 1 scale low

4.1.11 When Event 1 type (ES1) and Event 1 assignment (EVA1) are changed [Engineering Mode: Function block No. 41]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	High action, high/low action: max. Low action, process action: min.
		Event 1 set value (EV1') [low]	EV 1'	High/low action: min. Process action: max.
Engineering Mode	Function block No. 41	Event 1 hold action	EHo1	0
		Event 1 differential gap	EH1	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 MV: 0.2
		Event 1 timer	EVT1	0.0

4.1.12 When Event 2 type (ES2) and Event 2 assignment (EVA2) are changed [Engineering Mode: Function block No. 42]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 40	Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2	High action, high/low action: max. Low action, process action: min.
		Event 2 set value (EV2') [low]	EV2'	High/low action: min. Process action: max.
Engineering Mode	Function block No. 42	Event 2 hold action	EHo2	0
		Event 2 differential gap	EH2	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 MV: 0.2
		Event 2 timer	EVT2	0.0

4.1.13 When Event 3 type (ES3) and Event 3 assignment (EVA3) are changed [Engineering Mode: Function block No. 43]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 40	Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3	High action, high/low action: max. Low action, process action: min.
		Event 3 set value (EV3') [low]	EV3'	High/low action: min. Process action: max.
Engineering Mode	Function block No. 43	Event 3 hold action	EHo3	0
		Event 3 differential gap	EH3	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 MV: 0.2
		Event 3 timer	EVT3	0.0

4.1.14 When Event 4 type (E54) and Event 4 assignment (EvA4) are changed [Engineering Mode: Function block No. 44]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 40	Event 4 set value (EV4) Event 4 set value (EV4) [high]	Ev4	High action, high/low action: max. Low action, process action: min.
		Event 4 set value (EV4') [low]	Ev4'	High/low action: min. Process action: max.
Engineering Mode	Function block No. 44	Event 4 hold action	EHo4	0
		Event 4 differential gap	EH4	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 MV: 0.2
		Event 4 timer	EvT4	0.0

4.1.15 When Integral/Derivative time decimal point position (I ddP) is changed [Engineering Mode: Function block No. 50]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 51	Input 1_Integral time [heat-side]	1. I	240
		Input 1_Derivative time [heat-side]	1. d	60
	Parameter group No. 52	Input 2_Integral time	2. I	240
		Input 2_Derivative time	2. d	60
	Parameter group No. 56	Input 1_Integral time [cool-side]	1. Ic	240
		Input 1_Derivative time [cool-side]	1. dc	60
Setup Setting Mode	Setting group No. 58	Cascade _Integral time (master-side)	MAS. I	240
		Cascade _Derivative time (master-side)	MAS.d	60
		Cascade _Integral time (slave-side)	SLv.I	240
		Cascade _Derivative time (slave-side)	SLv.d	60

4.1.16 When Input 1_Valve coefficient (F) is changed [Engineering Mode: Function block No. 53]

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 51	Input 1_Dead zone	1. MCdb	See Table 1 in 3.7.3

4.1.17 When Input 2_Valve coefficient (F) is changed [Engineering Mode: Function block No. 54]

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 52	Input 2_Dead zone	2. MCdb	See Table 1 in 3.7.3

4.1.18 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	Add	Original communication: 0 Modbus: 1 PLC communication: 0
		Data bit configuration	bIT	0
	Function block No. 62	Register type	MP. REG	0

4.1.19 When Register type (MP. REG) 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)	MP.SRH	0
		Register start number (Low-order 16-bit)	MP.SRL	1000

4.1.20 When Soak time unit (SrdP) is changed [Engineering Mode: Function block No. 70]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 70	Area soak time	ASr	0:00 (0 minutes 00 seconds)

4.1.21 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.

4.2 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 the "Example of automatic conversion" in 4.2 Parameters to be Automatically Converted for automatic conversion.

• Input data type	Engineering Mode	Function block No. 21
• Input 1_Decimal point position	Engineering Mode	Function block No. 21
• Input 1_Input range high/low	Engineering Mode	Function block No. 21
• Input 1_Setting limiter high/low	Engineering Mode	Function block No. 71
• Input 1_Output limiter high/low [heat-side]	Parameter Setting Mode	Function block No. 51
• Input 1_Output limiter high/low [cool-side]	Parameter Setting Mode	Function block No. 56
• Input 2_Decimal point position	Engineering Mode	Function block No. 22
• Input 2_Input range high/low	Engineering Mode	Function block No. 22
• Input 2_Setting limiter high/low	Engineering Mode	Function block No. 72
• Input 2_Output limiter high/low	Parameter Setting Mode	Function block No. 52
• Memory area transfer	Monitor & SV Setting Mode Memory Area Transfer Mode	
• Input 1_Level PID setting 1	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 2	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 3	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 4	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 5	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 6	Setup Setting Mode	Setting group No. 51
• Input 1_Level PID setting 7	Setup Setting Mode	Setting group No. 51

• Input 2_Level PID setting 1	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 2	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 3	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 4	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 5	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 6	Setup Setting Mode	Setting group No. 52
• Input 2_Level PID setting 7	Setup Setting Mode	Setting group No. 52
• Input 1_Pressure (Temperature) Limiter	Engineering Mode	Function block No. 53
• Input 2_Pressure (Temperature) Limiter	Engineering Mode	Function block No. 54

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 1_Input range high is set to 400.0 °C, changing the decimal point position to 0 from 1 will change the Input 1_Input range high to 400 °C.

  Input 1_
  Input range high

  The value will be rounded off to a positive integer.
  (400.5 °C is rounded off to 401 °C)

  Example 2:
  When Input 1_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.

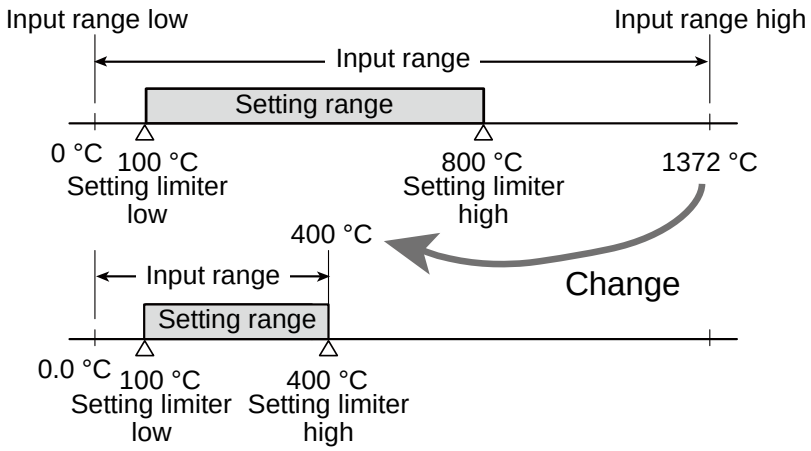
  Input 1_
  Input range high

  In case of RTD Pt100, as the maximum measuring range with decimal place of 2 is -100.0 to +100.0 °C, this value will not be exceeded.

  Input 1_
  Input range low

- When the input range is changed, the setting limiter will be also changed according to the setting.

  Example:
  Input 1_Input range is 0 to 1372 °C, Input 1_Setting limiter high is 800 °C.
  Changing the Input 1_Input range high to 400 °C will change the Setting limiter high to 400 °C accordingly.



4.2.1 When Input 1_Decimal point position (I. PGdP), Input 1_Input range high (I. PGSH) and Input 1_Input range low (I. PGSL) are changed [Engineering Mode: Function block No. 21]

The following parameters will be automatically converted.

Mode		Items	Symbol	Condition
Monitor & SV Setting Mode		Input 1_Set value (SV)		—
		Set value (SV) of differential temperature input		—
Parameter Setting Mode	Parameter group No. 00	Input 1_Set value (SV)	I. SV	—
		Set value (SV) of differential temperature input	dSV	—
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	3
		Event 1 set value (EV1') [low]	EV 1'	3
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2	3
		Event 2 set value (EV2') [low]	EV2'	3
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3	3
		Event 3 set value (EV3') [low]	EV3'	3
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4	3
		Event 4 set value (EV4') [low]	EV4'	3
	Parameter group No. 51	Input 1_Proportional band [heat-side]	I. P	2
		Input 1_ON/OFF action differential gap (upper)	I. oHH	2
		Input 1_ON/OFF action differential gap (lower)	I. oHL	2
		Input 1_Dead zone	I. MCdb	5
	Parameter group No. 56	Input 1_Proportional band [cool-side]	I. Pc	2
		Input 1_Overlap/Deadband	I. db	2
	Parameter group No. 70	Input 1_Setting change rate limiter (up)	I. SVRU	—
		Input 1_Setting change rate limiter (down)	I. SVRd	—
Setup Setting Mode	Setting group No. 21	Input 1_PV bias	I. Pb	—
	Setting group No. 22	Input 2_PV bias (RS bias) *	2. Pb	1
	Setting group No. 51	Input 1_Level PID setting 1	I. LEV 1	—
		Input 1_Level PID setting 2	I. LEV2	—
		Input 1_Level PID setting 3	I. LEV3	—
		Input 1_Level PID setting 4	I. LEV4	—
		Input 1_Level PID setting 5	I. LEV5	—
		Input 1_Level PID setting 6	I. LEV6	—
		Input 1_Level PID setting 7	I. LEV7	—
	Setting group No. 53	Input 1_AT bias	I. ATb	—
	Setting group No. 57	Input 1_Determination point of external disturbance	I. ExdJ	—
	Setting group No. 58	Cascade_Proportional band (master-side)	MAS. P	2
		PV select transfer level	2PV. LV	—
	Setting group No. 91	Input 1_Peak hold monitor	I. PHLd	—
		Input 1_Bottom hold monitor	I. bHLd	—
Engineering Mode	Function block No. 21	Input 1_Input range high [1)]	I. PGSH	—
		Input 1_Input range high [1)]	I. PGSL	—

Engineering Mode	Function block No. 21	Input 1_Input error determination point (high)	1. PoV	—
		Input 1_Input error determination point (low)	1. PUN	—
	Function block No. 22	Input 2_Input range high [1)]	2. PGSH	1
		Input 2_Input range high [1)]	2. PGSL	1
	Function block No. 31	Retransmission output 1 scale high	AHS1	4
		Retransmission output 1 scale low	ALS1	4
	Function block No. 32	Retransmission output 2 scale high	AHS2	4
		Retransmission output 2 scale low	ALS2	4
	Function block No. 33	Retransmission output 3 scale high	AHS3	4
		Retransmission output 3 scale low	ALS3	4
	Function block No. 41	Event 1 differential gap	EH1	3
	Function block No. 42	Event 2 differential gap	EH2	3
	Function block No. 43	Event 3 differential gap	EH3	3
	Function block No. 44	Event 4 differential gap	EH4	3
	Function block No. 51	Input 1_Start determination point	1. PdR	—
		Input 1_Level PID differential gap	1. LHS	—
	Function block No. 53	Input 1_AT bias	1. ATb	—
	Function block No. 58	Input circuit error alarm set value	ICA	—
	Function block No. 71	Input 1_Setting limiter high	1. SLH	—
		Input 1_Setting limiter low	1. SLL	—

[1)] Only when the Input 1_Decimal point position has been changed. (Not applicable to high and low limit of Input 1)
Conditions:
1. “Select function for input 2” is Remote setting input AND Input 2_Input type is either voltage output or current output.
2. When Input 1_Input type is Thermocouple/RTD input.
3. The condition is either of the following when:
   - Event type is a setting other than Manipulated output value AND "Select function for Input 2" is a setting other than "Control with PV select".
   - Event type is a setting other than Manipulated output value AND Event assignment is either "Input 1" or "Differential temperature input."
4. Retransmission output is "No retransmission output," "Input 1_Measured value (PV)," "Input 1_Set value (SV)," "Input 1_Deviation," "Input 1_Remote setting input value," OR Measured value (PV) of differential temperature input.
5: "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".
6: "Pressure control operation [MC-(V)COS(R)]" or "Temperature control operation [MC-(V)COS(R)]" is selected in "Input 1_Control action".

4.2.2 When Input 1_Setting limiter high/low (1. SLH, 1. SLL) is changed [Engineering Mode: Function block No. 71]

The following parameters will be automatically converted.

Mode		Items	Symbol
Monitor & SV Setting Mode		Input 1_Set value (SV)	—
Parameter Setting Mode	Parameter group No. 00	Input 1_Set value (SV)	1. SV

4.2.3 When Input 1_Output limiter high/low [heat-side] (1. oLH, 1. oLL) 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	Input 1_Manual manipulated output value	1. MMV

4.2.4 When Input 1_Output limiter high/low [cool-side] (1. oLHc, 1. oLLc) is changed [Parameter Setting Mode: Parameter group No. 56]

The following parameters will be automatically converted.
If the control action is set to “Heating/Cooling PID control,” the data of the following parameter will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Manual manipulated output value	1. MMV

4.2.5 When Input 2_Decimal point position (2. PGdP) is changed [Engineering Mode: Function block No. 22]

The following parameters will be automatically converted.

Mode		Items	Symbol	Condition
Monitor & SV Setting Mode		Input 2_Set value (SV)	—	—
Parameter Setting Mode	Parameter group No. 00	Input 2_Set value (SV)	2. SV	—
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV 1	3
		Event 1 set value (EV1') [low]	EV 1'	3
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2	3
		Event 2 set value (EV2') [low]	EV2'	3
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3	3
		Event 3 set value (EV3') [low]	EV3'	3
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4	3
		Event 4 set value (EV4') [low]	EV4'	3
	Parameter group No. 52	Input 2_Proportional band	2. P	2
		Input 2_ON/OFF action differential gap (upper)	2. oHH	2
		Input 2_ON/OFF action differential gap (lower)	2. oHL	2
	Parameter group No. 70	Input 2_Setting change rate limiter (up)	2. SVRU	—
		Input 2_Setting change rate limiter (down)	2. SVRd	—
Setup Setting Mode	Setting group No. 22	Input 2_PV bias (RS bias)	2. Pb	1
	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1	—
		Input 2_Level PID setting 2	2. LEV2	—
		Input 2_Level PID setting 3	2. LEV3	—
		Input 2_Level PID setting 4	2. LEV4	—
		Input 2_Level PID setting 5	2. LEV5	—
		Input 2_Level PID setting 6	2. LEV6	—
		Input 2_Level PID setting 7	2. LEV7	—
	Setting group No. 54	Input 2_AT bias	2. ATb	—
	Setting group No. 57	Input 2_Determination point of external disturbance	2. ExdU	—
	Setting group No. 58	Cascade_Proportional band (master-side)	SLV. P	2
		Cascade_Scale high	C. SCH	—
		Cascade_Scale low	C. SCL	—
	Setting group No. 91	Input 2_Peak hold monitor	2. PHLd	—
		Input 2_Bottom hold monitor	2. bHLd	—

Engineering Mode	Function block No. 22	Input 2_Input range high	2. PGSH	1
		Input 2_Input range low	2. PGSL	1
		Input 2_Input error determination point (high)	2. PoV	—
		Input 2_Input error determination point (low)	2. PUN	—
	Function block No. 31	Retransmission output 1 scale high	AHS1	4
		Retransmission output 1 scale low	ALS1	4
	Function block No. 32	Retransmission output 2 scale high	AHS2	4
		Retransmission output 2 scale low	ALS2	4
Engineering Mode	Function block No. 33	Retransmission output 3 scale high	AHS3	4
		Retransmission output 3 scale low	ALS3	4
	Function block No. 41	Event 1 differential gap	EH1	3
	Function block No. 42	Event 2 differential gap	EH2	3
	Function block No. 43	Event 3 differential gap	EH3	3
	Function block No. 44	Event 4 differential gap	EH4	3
	Function block No. 52	Input 2_Start determination point	2. PdA	—
		Input 2_Level PID differential gap	2. LHS	—
	Function block No. 72	Input 2_Setting limiter high	2. SLH	—
		Input 2_Setting limiter low	2. SLL	—

Conditions:
1. “Select function for input 2” is Remote setting input.
2. Input 1_Input type is Thermocouple/RTD input.
3. Event type is a setting other than Manipulated output value AND "Select function for Input 2" is a setting other than "Control with PV select," AND Event assignment is "Input 2."
4. Retransmission output is “Input 2_Measured value (PV)”, “Input 2_Set value (SV)”, or “Input 2_Deviation.”

4.2.6 When Input 2_Setting limiter high/low (2. PGSH, 2. PGSL) is changed [Engineering Mode: Function block No. 22]

The following parameters will be automatically converted. Some parameters may have prerequisite for automatic conversion. (See below for conditions.)

Mode		Items	Symbol	Condition
Monitor & SV Setting Mode		Input 2_Set value (SV)	—	—
Parameter Setting Mode	Parameter group No. 00	Input 1_Set value (SV)	1. SV	1
		Input 2_Set value (SV)	2. SV	—
	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	EV1	5
		Event 1 set value (EV1’) [low]	EV1'	5
		Event 2 set value (EV2) Event 2 set value (EV2) [high]	EV2	5
		Event 2 set value (EV2’) [low]	EV2'	5
		Event 3 set value (EV3) Event 3 set value (EV3) [high]	EV3	5
		Event 3 set value (EV3’) [low]	EV3'	5
		Event 4 set value (EV4) Event 4 set value (EV4) [high]	EV4	5
		Event 4 set value (EV4’) [low]	EV4'	5
	Parameter group No. 51	Input 1_Proportional band [heat-side]	1. P	3
		Input 1_ON/OFF action differential gap (upper)	1. oHH	3
		Input 1_ON/OFF action differential gap (lower)	1. oHL	3

	Parameter group No. 52	Input 2_Proportional band	2. P	2
		Input 2_ON/OFF action differential gap (upper)	2. oHH	2
		Input 2_ON/OFF action differential gap (lower)	2. oHL	2
		Input 2_Dead zone	2. MCdb	7
	Parameter group No. 56	Input 1_Proportional band [cool-side]	1. Pc	3
		Input 1_Overlap/Deadband	1. db	3
	Parameter group No. 70	Input 1_Setting change rate limiter (up)	1. SVRU	1
		Input 1_Setting change rate limiter (down)	1. SVRd	1
		Input 2_Setting change rate limiter (up)	2. SVRU	—
		Input 2_Setting change rate limiter (down)	2. SVRd	—
Setup Setting Mode	Setting group No. 22	Input 2_PV bias (RS bias)	2. Pb	4
	Setting group No. 51	Input 1_Level PID setting 1	1. LEV 1	1
		Input 1_Level PID setting 2	1. LEV2	1
		Input 1_Level PID setting 3	1. LEV3	1
		Input 1_Level PID setting 4	1. LEV4	1
		Input 1_Level PID setting 5	1. LEV5	1
		Input 1_Level PID setting 6	1. LEV6	1
		Input 1_Level PID setting 7	1. LEV7	1
	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1	—
		Input 2_Level PID setting 2	2. LEV2	—
		Input 2_Level PID setting 3	2. LEV3	—
		Input 2_Level PID setting 4	2. LEV4	—
		Input 2_Level PID setting 5	2. LEV5	—
		Input 2_Level PID setting 6	2. LEV6	—
		Input 2_Level PID setting 7	2. LEV7	—
Setup Setting Mode	Setting group No. 53	Input 1_AT bias	1. Atb	1
	Setting group No. 54	Input 2_AT bias	2. Atb	—
	Setting group No. 57	Input 1_Determination point of external disturbance	1. ExdU	1
		Input 2_Determination point of external disturbance	2. ExdU	—
	Setting group No. 58	Cascade_Proportional band (slave-side)	SLV. P	2
		Cascade_Scale high	C. SCH	—
		Cascade_Scale low	C. SCL	—
	Setting group No. 91	Input 2_Peak hold monitor	2. PHLd	—
		Input 2_Bottom hold monitor	2. bHLd	—
Engineering Mode	Function block No. 22	Input 2_Input error determination point (high)	2. PoV	—
		Input 2_Input error determination point (low)	2. PUN	—
	Function block No. 31	Retransmission output 1 scale high	AHS 1	6
		Retransmission output 1 scale low	AL S 1	6
	Function block No. 32	Retransmission output 2 scale high	AHS2	6
		Retransmission output 2 scale low	AL S2	6
	Function block No. 33	Retransmission output 3 scale high	AHS3	6
		Retransmission output 3 scale low	AL S3	6
	Function block No. 41	Event 1 differential gap	EH 1	5
	Function block No. 42	Event 2 differential gap	EH2	5
	Function block No. 43	Event 3 differential gap	EH3	5
	Function block No. 44	Event 4 differential gap	EH4	5
	Function block No. 51	Input 1_Start determination point	1. PdA	1
		Input 1_Level PID differential gap	1. LPI d	1
	Function block No. 52	Input 2_Start determination point	2. PdA	—
		Input 2_Level PID differential gap	2. LHS	—
	Function block No. 54	Input 2_ Pressure (Temp) limiter	2. PrL	8
	Function block No. 71	Input 1_Setting limiter high	1. SLH	1
		Input 1_Setting limiter low	1. SLL	1
	Function block No. 72	Input 2_Setting limiter high	2. SLH	—
		Input 2_Setting limiter low	2. SLL	—

Conditions:
1. “Select function for input 2” is “Control with PV select.”
2. Input type is Thermocouple/RTD input.
3. “Select function for input 2” is “Control with PV select” AND Input 2_Input type is Thermocouple/RTD input.
4. A setting other than Remote setting input is selected for "Select function for Input 2"
5. When Event type is a setting other than Manipulated output value AND "Select function for Input 2" is a setting other than "Control with PV select," AND Event assignment is "Input 2."
6. The condition is either of the following.
   - Retransmission output is “Input 2_Measured value (PV),” “Input 2_Set value (SV),” or “Input 2_Deviation.”
   - When “Control with PV select” is set to “Select function for Input 2”, the Retransmission output will be as follows. “No retransmission output,” “Input 1_Measured value (PV),” “Input 1_Set value (SV),” “Input 1_Deviation,” “Input 1_ Remote setting input value,” OR Measured value (PV) of differential temperature input.
7. "Pressure control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".
8. "Pressure control operation [MC-(V)COS(R)]" or "Temperature control operation [MC-(V)COS(R)]" is selected in "Input 2_Control action".

4.2.7 When Input 2_Setting limiter high/low (2. SLH, 2. SLL) is changed [Engineering Mode: Function block No. 72]

The following parameters will be automatically converted.

Mode		Items	Symbol
Monitor & SV Setting Mode		Input 2_Set value (SV)	
Parameter Setting Mode	Parameter group No. 00	Input 2_Set value (SV)	2. SV
Setup Setting Mode	Setting group No. 58	Cascade_Scale high	C. SCH
		Cascade_Scale low	C. SCL

4.2.8 When Input 2_Output limiter high/low (2. oLH, 2. oLL) is changed [Parameter Setting Mode: Parameter group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Manual manipulated output value	2. M.MV

4.2.9 When Memory area transfer (AREA) is changed [Memory Area Transfer Mode]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Manual manipulated output value	1. M. MV
	Setting group No. 52	Input 2_Manual manipulated output value	2. M. MV

4.1.10 When Input 1_Level PID setting 1 (1. LEV 1) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 2	1.LEV2
		Input 1_Level PID setting 3	1.LEV3
		Input 1_Level PID setting 4	1.LEV4
		Input 1_Level PID setting 5	1.LEV5
		Input 1_Level PID setting 6	1.LEV6
		Input 1_Level PID setting 7	1.LEV7

4.2.11 When Input 1_Level PID setting 2 (1. LEV2) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	1.LEV 1
		Input 1_Level PID setting 3	1.LEV3
		Input 1_Level PID setting 4	1.LEV4
		Input 1_Level PID setting 5	1.LEV5
		Input 1_Level PID setting 6	1.LEV6
		Input 1_Level PID setting 7	1.LEV7

4.2.12 When Input 1_Level PID setting 3 (1. LEV3) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	1. LEV 1
		Input 1_Level PID setting 2	1. LEV2
		Input 1_Level PID setting 4	1. LEV4
		Input 1_Level PID setting 5	1. LEV5
		Input 1_Level PID setting 6	1. LEV6
		Input 1_Level PID setting 7	1. LEV7

4.2.13 When Input 1_Level PID setting 4 (I. LEV4) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	I.LEV 1
		Input 1_Level PID setting 2	I.LEV2
		Input 1_Level PID setting 3	I.LEV3
		Input 1_Level PID setting 5	I.LEV5
		Input 1_Level PID setting 6	I.LEV6
		Input 1_Level PID setting 7	I.LEV7

4.2.14 When Input 1_Level PID setting 5 (I. LEV5) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	I.LEV 1
		Input 1_Level PID setting 2	I.LEV2
		Input 1_Level PID setting 3	I.LEV3
		Input 1_Level PID setting 4	I.LEV4
		Input 1_Level PID setting 6	I.LEV6
		Input 1_Level PID setting 7	I.LEV7

4.2.15 When Input 1_Level PID setting 6 (I. LEV6) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	I. LEV 1
		Input 1_Level PID setting 2	I. LEV2
		Input 1_Level PID setting 3	I. LEV3
		Input 1_Level PID setting 4	I. LEV4
		Input 1_Level PID setting 5	I. LEV5
		Input 1_Level PID setting 7	I. LEV7

4.2.16 When Input 1_Level PID setting 7 (I. LEV7) is changed [Setup Setting Mode: Setting group No. 51]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Level PID setting 1	I. LEV 1
		Input 1_Level PID setting 2	I. LEV2
		Input 1_Level PID setting 3	I. LEV3
		Input 1_Level PID setting 4	I. LEV4
		Input 1_Level PID setting 5	I. LEV5
		Input 1_Level PID setting 6	I. LEV6

4.2.17 When Input 2_Level PID setting 1 (2. LEV 1) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 2	2. LEV2
		Input 2_Level PID setting 3	2. LEV3
		Input 2_Level PID setting 4	2. LEV4
		Input 2_Level PID setting 5	2. LEV5
		Input 2_Level PID setting 6	2. LEV6
		Input 2_Level PID setting 7	2. LEV7

4.2.18 When Input 2_Level PID setting 2 (2. LEV2) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1
		Input 2_Level PID setting 3	2. LEV3
		Input 2_Level PID setting 4	2. LEV4
		Input 2_Level PID setting 5	2. LEV5
		Input 2_Level PID setting 6	2. LEV6
		Input 2_Level PID setting 7	2. LEV7

4.2.19 When Input 2_Level PID setting 3 (2. LEV3) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1
		Input 2_Level PID setting 2	2. LEV2
		Input 2_Level PID setting 4	2. LEV4
		Input 2_Level PID setting 5	2. LEV5
		Input 2_Level PID setting 6	2. LEV6
		Input 2_Level PID setting 7	2. LEV7

4.2.20 When Input 2_Level PID setting 4 (2. LEV4) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1
		Input 2_Level PID setting 2	2. LEV2
		Input 2_Level PID setting 3	2. LEV3
		Input 2_Level PID setting 5	2. LEV5
		Input 2_Level PID setting 6	2. LEV6
		Input 2_Level PID setting 7	2. LEV7

4.2.21 When Input 2_Level PID setting 5 (2. LEV5) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1
		Input 2_Level PID setting 2	2. LEV2
		Input 2_Level PID setting 3	2. LEV3
		Input 2_Level PID setting 4	2. LEV4
		Input 2_Level PID setting 6	2. LEV6
		Input 2_Level PID setting 7	2. LEV7

4.2.22 When Input 2_Level PID setting 6 (2. LEV6) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2. LEV 1
		Input 2_Level PID setting 2	2. LEV2
		Input 2_Level PID setting 3	2. LEV3
		Input 2_Level PID setting 4	2. LEV4
		Input 2_Level PID setting 5	2. LEV5
		Input 2_Level PID setting 7	2. LEV7

4.2.23 When Input 2_Level PID setting 7 (2. LEV7) is changed [Setup Setting Mode: Setting group No. 52]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_Level PID setting 1	2.LEV 1
		Input 2_Level PID setting 2	2.LEV2
		Input 2_Level PID setting 3	2.LEV3
		Input 2_Level PID setting 4	2.LEV4
		Input 2_Level PID setting 5	2.LEV5
		Input 2_Level PID setting 6	2.LEV6

4.2.24 When Input 1_Pressure (Temperature) limiter (1. Pr-L) is changed [Engineering mode: Function block No. 53]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 51	Input 1_Manual manipulated output value	1. MMV

4.2.25 When Input 2_Pressure (Temperature) limiter (2. Pr-L) is changed [Engineering mode: Function block No. 54]

The following parameters will be automatically converted.

Mode		Items	Symbol
Setup Setting Mode	Setting group No. 52	Input 2_ Manual manipulated output value	2. MMV

5. Input Function

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

5.1 Changing Measured Input Settings

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

– Input type
– Temperature unit
– Decimal point position
– Input range high/Input range low

Description of function

Input type

Input type can be easily configured to thermocouple (TC), RTD, current (I) or voltage (V) 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

Temperature unit

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

Decimal point position

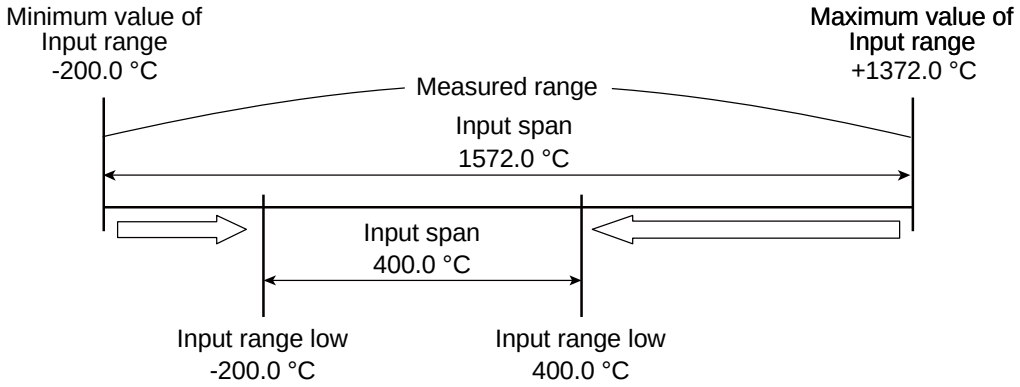
The decimal point position depends on the input type.

- 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: No decimal place, one decimal place, two decimal places, three decimal places or four decimal places

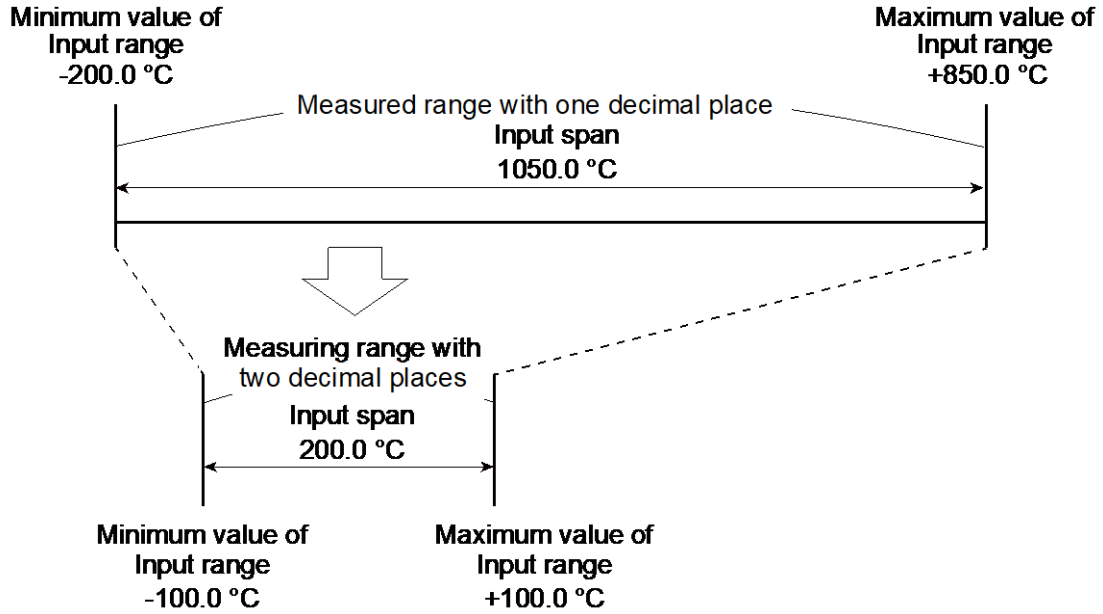
Input range high/low

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.)

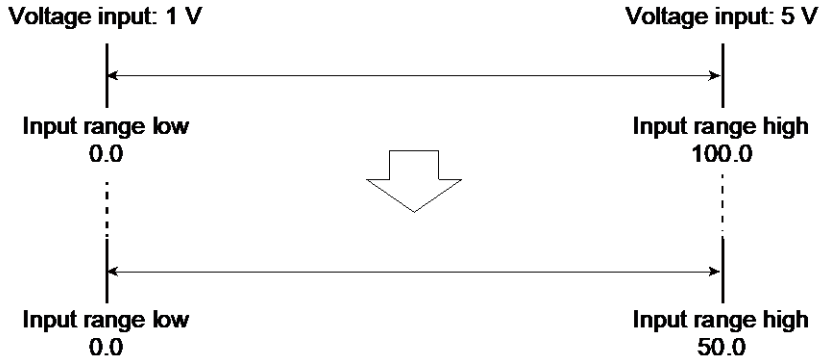
Example of input change 1: Changing thermocouple K “-200.0 to +1372.0 °C” to “0.0 to 400.0 °C”



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.”



NOTE When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 2_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 2_Valve coefficient F.

Parameter setting

☞ Refer to the Input range table for the input range of each input type.
☞ Refer to Input range code table for the input range code.

Input 1_Input type [Engineering Mode: Function block No. 21 (Fn21)]

Parameter symbol	Data range		Factory set value
1.1NP	0: TC input K	13: RTD input Pt100	Product identification code specified at the time of order.
	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 W5Re/W26Re	21: Voltage input -10 to +10 V DC	
	9: TC input PL II	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		

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 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or changed when the Input 1_input type is changed.

Input 2_Input type [Engineering Mode: Function block No. 22 (Fn22)]

Parameter symbol	Data range		Factory set value
2.1NP	0: TC input K	12: TC input PR40-20	Same as Input 1_ Input type
	1: TC input J	13: RTD input Pt100	
	2: TC input R	14: RTD input JPt100	
	3: TC input S	15: Current input 0 to 20 mA DC	
	4: TC input B	16: Current input 4 to 20 mA DC	
	5: TC input E	17: Voltage input 0 to 10 V DC	
	6: TC input N	18: Voltage input 0 to 5 V DC	
	7: TC input T	19: Voltage input 1 to 5 V DC	
	8: TC input W5Re/W26Re	20: Voltage input 0 to 1 V DC	
		21: Voltage input −10 to +10 V DC	
	9: TC input PL II	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	

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

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or changed when the Input 2_input type is changed.

Input 1_Display unit [Engineering Mode: Function block No. 21 (Fn21)]

Parameter symbol	Data range	Factory set value
1.UNIT	0: °C 1: °F	Product identification code specified at the time of order.

📖 To display “Input 1_Display unit”, choose “Thermocouple” or “RTD” in Function block No. 21: Input 1_Input type (Engineering mode).

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or changed when the Input 1_display unit is changed.

Input 2_ Display unit [Engineering Mode: Function block No. 22 (Fn22)]

Parameter symbol	Data range	Factory set value
2.UNIT	0: °C 1: °F	Same as Input 1_Display unit

📖 To display “Input 2_Display unit”, choose “Thermocouple” or “RTD” in Function block No. 22: Input 2_Input type (Engineering mode).

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode). The setting cannot be changed when Remote setting input and Control with PV select are set.

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or changed when the Input 2_display unit is changed.

Input 1_Decimal point position [Engineering Mode: Function block No. 21 (Fn21)]

Parameter symbol	Data range	Factory set value
1.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: 0 to 4 (When Control with PV select: Decimal point position setting of Input 1 and Input 2 is compared and the smaller will be used.)	Product identification code specified at the time of order. For unspecified V/I inputs: 1

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or automatically converted when the Input 1_decimal point position is changed.

Input 2_Decimal point position [Engineering Mode: Function block No. 22 (Fn22)]

Parameter symbol	Data range	Factory set value
2.PGdP	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places	Same as Input 1_Decimal point position

	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: 0 to 4	

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode). The setting cannot be changed when Remote setting input and Control with PV select are set.

📖 When Control with PV select is set in Function block No. 58: Select function for Input 2 (Engineering mode), a smaller value (of Decimal point position setting for Input 1 and Input 2) will be used.

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or automatically converted when the Input 2_decimal point position is changed.

Input 1_Input range high [Engineering Mode: Function block No. 21 (Fn21)]

Parameter symbol	Data range	Factory set value
1.PGSH	(Input 1_Input range low + 1 digit) to Input 1_Maximum value of input range [Varies with the setting of the Decimal point position.] Refer to the Input range table for the input range of each input type.	Product identification code specified at the time of order. For unspecified V/I inputs: 100.0

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Input range high is changed.

📖 **NOTE** When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 1_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.

Input 2_Input range high [Engineering Mode: Function block No. 22 (Fn22)]

Parameter symbol	Data range	Factory set value
2.PGSH	• TC/RTD inputs and Voltage (V)/Current (I) inputs (For other than Remote setting input): (Input 2_Input range low + 1 digit) to Input 2_Maximum value of input range [Varies with the setting of the Decimal point position.] • Voltage (V)/Current (I) inputs (For Remote setting input): (Input 2_Input range low + 1 digit) to Input 1_ Maximum value of input range [Varies with the setting of the Decimal point position.] Refer to the Input range table for the input range of each input type.	Same as Input 1_Input range high

☞ Not displayed when No function is selected in Function block No. 58: Select function for Input 2 (Engineering mode). Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Input range high is changed.

📖 **NOTE** When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 2_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 2_Valve coefficient F.

Input 1_Input range low [Engineering Mode: Function block No. 21 (Fn21)]

Parameter symbol	Data range	Factory set value
1.PGSL	Input 1_Minimum value of input range to (Input 1_ Input range high − 1 digit) [Varies with the setting of the Decimal point position.] Refer to the Input range table for the input range of each input type.	Product identification code specified at the time of order. For unspecified V/I inputs: 0.0

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Input range low is changed.

📖 **NOTE** When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 1_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 1_Valve coefficient F.

Input 2_Input range low [Engineering Mode: Function block No. 22 (Fn22)]

Parameter symbol	Data range	Factory set value
2.PGSL	• TC/RTD inputs and Voltage (V)/Current (I) inputs (For other than Remote setting input): Input 2_Minimum value of input range to (Input 2_Input range high − 1 digit) [Varies with the setting of the Decimal point position.] • Voltage (V)/Current (I) inputs (For Remote setting input): Input 1_Minimum value of input range to (Input 2_Input range high − 1 digit) [Varies with the setting of the Decimal point position.] Refer to the Input range table for the input range of each input type.	Same as Input 1_Input range low

☞ Not displayed when No function is selected in in Function block No. 58: Select function for Input 2 (Engineering mode). Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Input range low is changed.

📖 **NOTE** When 3 to 7 (pressure control operation [MC-(V)COS(R)]) is set to Input 2_Control action, the set value for the parameter should be entered with the same pressure unit selected for Input 2_Valve coefficient F.

Input range table

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

TC input

Input type	Decimal point position	°C	°F
K	No decimal place	-200 to +400 °C	-328 to +752 °F
		-200 to +1372 °C	-328 to +2502 °F
	One decimal place	-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	No decimal place	-200 to +400 °C	-328 to +752 °F
		-200 to +1200 °C	-328 to +2192 °F
	One decimal place	-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	No decimal place	-200 to +400 °C	-328 to +752 °F
	One decimal place	-200.0 to +400.0 °C	-328.0 to +752.0 °F
S	No decimal place	-50 to +1768 °C	-58 to +3214 °F
	One decimal place	-50.0 to +1768.0 °C	-58.0 to +3214.0 °F
R	No decimal place	-50 to +1768 °C	-58 to +3214 °F

	One decimal place	-50.0 to +1768.0 °C	-58.0 to +3214.0 °F
E	No decimal place	-200 to +1000 °C	-328 to +1832 °F
	One decimal place	-200.0 to +1000.0 °C	-328.0 to +1832.0 °F
B	No decimal place	0 to 1800 °C	0 to +3272 °F
	One decimal place	0.0 to 1800.0 °C	0.0 to +3272.0 °F
N	No decimal place	0 to 1300 °C	0 to +2372 °F
	One decimal place	0.0 to 1300.0 °C	0.0 to +2372.0 °F
W5Re/W26Re	No decimal place	0 to 2300 °C	0 to +4200 °F
PL II	No decimal place	0 to 1390 °C	0 to +2534 °F
	One decimal place	0.0 to 1390.0 °C	0.0 to +2534.0 °F
U	No decimal place	-200 to +600 °C	-328 to +1112 °F
	One decimal place	-200.0 to +600.0 °C	-328.0 to +1112.0 °F
L	No decimal place	0 to 900 °C	0 to 1652 °F
	One decimal place	0.0 to 900.0 °C	0.0 to 1652.0 °F
PR40-20	No decimal place	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).

K, J, T, S, R, E, B, N, PL II, U, and L are settable to one decimal place. Other thermocouple inputs are fixed with no decimal place.

RTD input

Input type	Decimal point position	°C	°F
Pt100	No decimal place	-200 to +850 °C	-328 to +1562 °F
		-100 to +100 °C	-148 to +212 °F
		0 to 50	32 to 122 °F
	One decimal place	-200.0 to +850.0 °C	-328.0 to +1562.0 °F
		-100.0 to +100.0 °C	-148.0 to +212.0 °F
		0.0 to 50.0	32.0 to 122.0 °F
	Two decimal place	-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	No decimal place	-200 to +649 °C	-328 to +1184 °F
		-200 to +100 °C	-148 to +212 °F
		0 to 50	32 to 122 °F
	One decimal place	-200.0 to +649.0 °C	-328.0 to +1184.0 °F
		-100.0 to +100.0 °C	-148.0 to +212.0 °F
		0.0 to 50.0	32.0 to 122.0 °F
	Two decimal place	-100.00 to +100.00 °C	-148.00 to +212.00 °F
		0.00 to 50.00 °C	-32.00 to +122.00 °F

Current/voltage input

Input type	Decimal point position	°C
Pt100	No decimal place	-19999 to +99999
	One decimal place	-1999.9 to +9999.9
	Two decimal place	-199.99 to +999.99
	Three decimal place	-19.999 to +99.999
	Four decimal place	-1.9999 to +9.9999

Input range code table

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.

Thermocouple (TC) input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits**
	K01	0 to 200 °C	4		T01	-199.9 to +400.0 °C	4

K	K02	0 to 400 °C	4	T	T02	-199.9 to +100.0 °C	4
	K03	0 to 600 °C	4		T03	-100.0 to +200.0 °C	4
	K04	0 to 800 °C	4		T19	-200.0 to +400.0 °C	5
	K06	0 to 1200 °C	4	R	R01	0 to 1600 °C	4
	K07	0 to 1372 °C	4		R07	-50 to +1768 °C	4
	K08	-199.9 to +300.0 °C	4	S	S06	-50 to +1768 °C	4
	K09	0.0 to 400.0 °C	4	B	B03	0 to 1800 °C	4
	K10	0.0 to 800.0 °C	4	E	E01	0 to 800 °C	4
	K14	0 to 300 °C	4	N	N02	0 to 1300 °C	4
	K41	-200 to +1372 °C	4	W5Re/ W26Re	W03	0 to 2300 °C	4
	K42	-200.0 to +1372.0 °C	5				
	KA1	0 to 800 °F	4	PL II	A01	0 to 1300 °C	4
	KA2	0 to 1600 °F	4	U	U01	-199.9 to +600.0 °C	4
	KA3	0 to 2502 °F	4	L	L04	0.0 to 900.0 °C	4
J	J01	0 to 200 °C	4	PR40-20	F02	0 to 1800 °C	5
	J02	0 to 400 °C	4		FA2	0 to 3200 °F	5
	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				

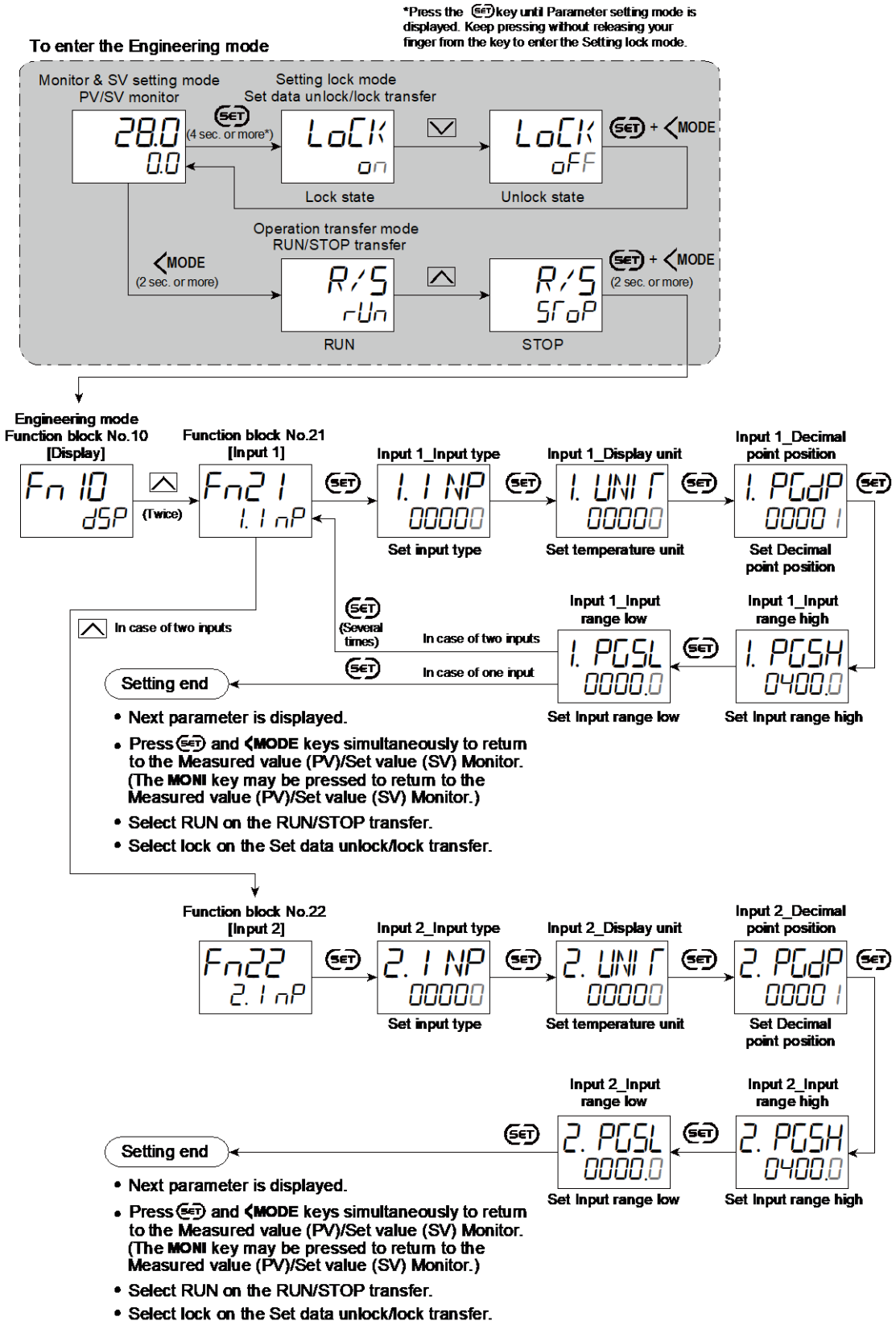
RTD input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits**
PT100	D01	-199.9 to +649.0 °C	4	Pt100	D21	-200.0 to +200.0 °C	5
	D04	-100.0 to +100.0 °C	4		D27	0.00 to +50.00 °C	4
	D05	-100.0 to +200.0 °C	4		D34	-100.00 to +100.00 °C	5
	D06	0.0 to 50.0 °C	4		D35	-200.0 to +850.0 °C	5
	D07	0.0 to 100.0 °C	4		DA1	-199.9 to +999.9 °F	4
	D08	0.0 to 200.0 °C	4		DA9	0.0 to 500.0 °F	4
	D09	0.0 to 300.0 °C	4	JPt100	P08	0.0 to 200.0 °C	4
	D10	0.0 to 500.0 °C	4		P29	-100.00 to +100.00 °C	5
	D12	-199.9 to +600.0 °C	4		P30	-200.0 to +640.0 °C	5

Voltage/Current input

Input type	Code	Range	No. of digits**	Input type	Code	Range	No. of digits
0 to 10 mV DC	101	Programmable range -199999 to +99999	5	1 to +5 V DC	601	Programmable range -19999 to +99999	5
0 to 100 mV DC	201		5	0 to 20 mA DC	701		5
0 to 1 V DC	301		5	4 to 20 mA DC	801		5
0 to 5 V DC	401		5	-10 to +10V DC	904		5
0 to 10 V DC	501		5	-5 to +5 V DC	905		5

Setting procedure



5.2 Switching Functions Using Digital Inputs (DI)

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

- RUN/STOP transfer
- Auto/Manual transfer
- Select function for Input 2 transfer *
  (Remote/Local transfer, Cascade mode transfer, PV select transfer or 2-loop control/Differential temperature control)
  * The function selected at Select function for Input 2 is switchable.
- Interlock release
- Peak/Bottom holds release
- Selection of Autotuning (AT)
- Set data Unlock/Lock
- Direct/Reverse action
- Memory area

Number of Digital input (DI)

Maximum 6 points (4 points when the optional communication (RS-422A) is selected)

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	RUN/STOP	RUN/STOP	RUN/STOP	RUN/STOP	RUN/STOP	RUN/STOP
2	AUTO/MAN (1/2)	AUTO/MAN (1/2)	AUTO/MAN (1/2)	AUTO/MAN (1/2)	AUTO/MAN (1/2)	AUTO/MAN (1/2)
3	AUTO/MAN (1)	AUTO/MAN (1)	AUTO/MAN (1)	AUTO/MAN (1)	AUTO/MAN (1)	AUTO/MAN (1)
4	AUTO/MAN (2)	AUTO/MAN (2)	AUTO/MAN (2)	AUTO/MAN (2)	AUTO/MAN (2)	AUTO/MAN (2)
5	REM/LOC	REM/LOC	REM/LOC	REM/LOC	REM/LOC	REM/LOC
6	Interlock release	Interlock release	Interlock release	Interlock release	Interlock release	Interlock release
7	Hold reset (1/2)	Hold reset (1/2)	Hold reset (1/2)	Hold reset (1/2)	Hold reset (1/2)	Hold reset (1/2)
8	Hold reset (1)	Hold reset (1)	Hold reset (1)	Hold reset (1)	Hold reset (1)	Hold reset (1)
9	Hold reset (2)	Hold reset (2)	Hold reset (2)	Hold reset (2)	Hold reset (2)	Hold reset (2)
10	AT ON/OFF (1/2)	AT ON/OFF (1/2)	AT ON/OFF (1/2)	AT ON/OFF (1/2)	AT ON/OFF (1/2)	AT ON/OFF (1/2)
11	AT ON/OFF (1)	AT ON/OFF (1)	AT ON/OFF (1)	AT ON/OFF (1)	AT ON/OFF (1)	AT ON/OFF (1)
12	AT ON/OFF (2)	AT ON/OFF (2)	AT ON/OFF (2)	AT ON/OFF (2)	AT ON/OFF (2)	AT ON/OFF (2)
13	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock
14	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action
15	2 areas					
16	8 areas without SET	⊠	⊠			
17	8 areas with SET	⊠	⊠	⊠		
18	16 areas without SET	⊠	⊠	⊠		
19	16 areas with SET	⊠	⊠	⊠	⊠	
20	Area jump					

▒: The Setting range of DI2 to DI6 is from 0 to 14. Values 15 or larger cannot be set.

⊠: When any of 16, 17, 18, and 19 is set for DI1, DI2 to DI5 (which are crossed out with ⊠) are used for switching the Memory area and not settable.

Explanation of functional setting

RUN/STOP:	RUN/STOP transfer
AUTO/MAN (1/2):	Auto/Manual transfer (Common to Input 1/Input 2)
AUTO/MAN (1):	Auto/Manual transfer (Input 1 only)
AUTO/MAN (2):	Auto/Manual transfer (Input 2 only) [1)]

REM/LOC:	Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/ Differential temperature control)
Interlock release:	Release of Interlock
Hold reset (1/2):	Release of Peak or Bottom hold value (Common to Input 1/ Input 2)
Hold reset (1):	Release of Peak or Bottom hold value (Input 1 only)
Hold reset (2):	Release of Peak or Bottom hold value (Input 2 only)
AT ON/OFF (1/2):	Autotuning (AT) ON/OFF (Common to Input 1/Input 2)
AT ON/OFF (1):	Autotuning (AT) ON/OFF (Input 1 only)
AT ON/OFF (2):	Autotuning (AT) ON/OFF (Input 2 only)
Unlock/Lock:	Set data unlock/lock
Direct/Reverse action:	Switching between direct and reverse actions (Common to Input 1/Input 2) [2)]
2 areas:	Memory area transfer 2 points (without area set signal)
8 areas without SET:	Memory area transfer 8 points (without area set signal) [3)] DI2 and DI3 are not settable in this setting.
8 areas with SET:	Memory area transfer 8 points (with area set signal) [4)] DI2, DI3 and DI4 are not settable in this setting.
16 area without SET:	Memory area transfer 16 points (without area set signal) [4)] DI2, DI3 and DI4 are not settable in this setting.
16 area with SET:	Memory area transfer 16 points (with area set signal) [5)] DI2, DI3, DI4 and DI5 are not settable in this setting.
Area jump:	Move to the linked area No. (If area is not specified, the jump destination is the current area No. + 1)

[1)] Only when two inputs are available.
[2)] Only when control action setting for Input 1 or Input 2 is any of 0, 1, 8, and 9.
[3)] Only when setting of control action of Input 1 or Input 2 is any of 0 and 1.
[4)] Only when six or more Digital inputs (DI) are available.

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 selected as follows using the open/close action of the contact.

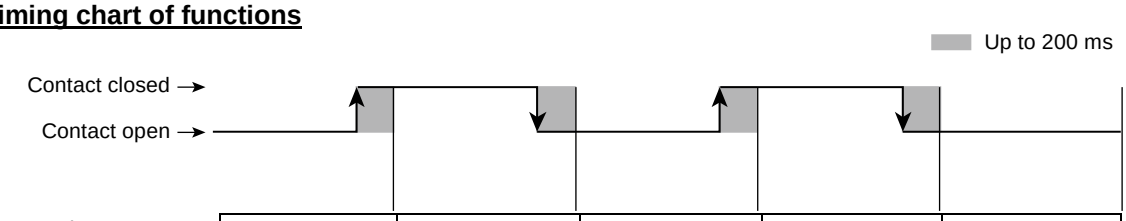
Function		Contact close	Contact open
RUN/STOP transfer		RUN	STOP
Auto/Manual transfer		Auto mode	Manual mode
Remote/Local transfer [1)]	Remote/Local transfer	Remote mode	Local mode
	PV select transfer [2)]	Input 2	Input 1
	2-loop control/ Differential temperature control	Differential temperature control	2-loop control
	Cascade mode transfer (Slave single)	Cascade control	Slave single control
	Cascade mode transfer (Master single)	Cascade control	Master single control
Set data unlock/lock transfer		Lock	Unlock
Direct/Reverse action transfer		Direct action	Reverse action

[1)] Only one of the functions is available
[2)] When “1: Switch by signal” is selected in Function block No. 58: Selection of PV select trigger (Engineering mode).

Switching between Direct/Reverse action is available, only while the instrument is at STOP. Switching is not available during RUN. Setting the contact at RUN beforehand will perform switching when the instrument enters the STOP mode. If “Input 1_Control action” or “Input 2_Control action” is set to “0: PID control with Autotuning (direct action)” or “1: PID control with Autotuning (reverse action),” PID action is switched between reverse and direction actions.

The above open/close action can be reversed (reversing the functions of open and close). Can be set in Function block No. 23: DI logic invert (Engineering mode).

Timing chart of functions



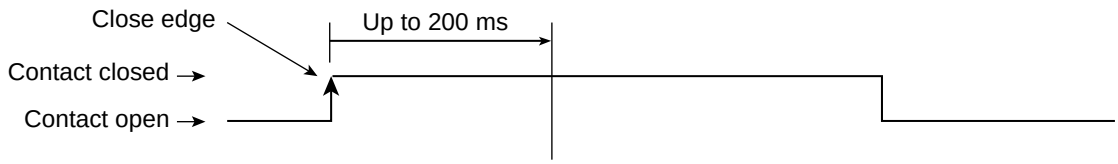
RUN/STOP	STOP	RUN	STOP	RUN	STOP
Auto/Manual	Manual	Auto	Manual	Auto	Manual
Remote/Local	Local	Remote	Local	Remote	Local
PV select transfer	Input 1	Input 2	Input 1	Input 2	Input 1
2-loop/Differential temperature	2-loop control	Differential temp. control	2-loop control	Differential temp. control	2-loop control
Cascade	Slave/Master single	Cascade	Slave/Master single	Cascade	Slave/Master single
Unlock/lock	Unlock	Lock	Unlock	Lock	Unlock
Direct/Reverse action	Reverse action	Direct action	Reverse action	Direct action	Reverse action

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

● Interlock release, Peak/Bottom hold release

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

Timing chart for releasing interlock, peak and bottom hold



Interlock	Interlock state	Interlock release
Peak/Bottom hold	Peak/Bottom hold state	Peak/Bottom hold release

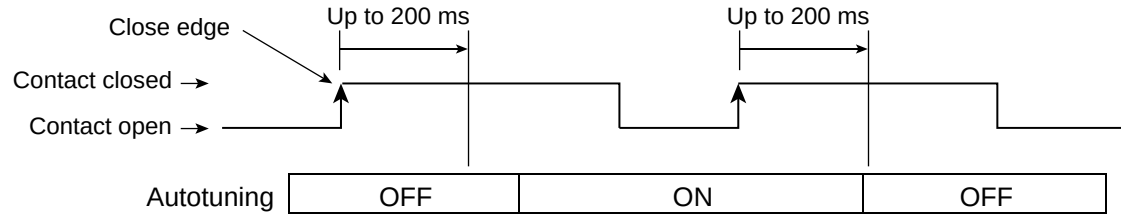
NOTE After the contact is transferred, it takes “up to 200 ms” until the action of this instrument is actually selected.

● Autotuning (AT) ON/OFF

Through the detection of the close edge, Autotuning (AT) ON/OFF is switched.
If Input 1 and Input 2 are common, priority is given to the AT start. (Refer to the table below.)

Status before AT on/off switching		Status after AT on/off switching	
Input 1	Input 2	Input 1	Input 2
in PID control	in PID control	in PID control	in PID control
during AT	in PID control	during AT	in PID control
in PID control	during AT	in PID control	during AT
during AT	during AT	during AT	during AT

ON/OFF timing chart of Autotuning (AT)



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

● Memory area transfer

Selection of Memory area No. can be obtained through such contact status as shown below.

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

—: Open ×: Closed

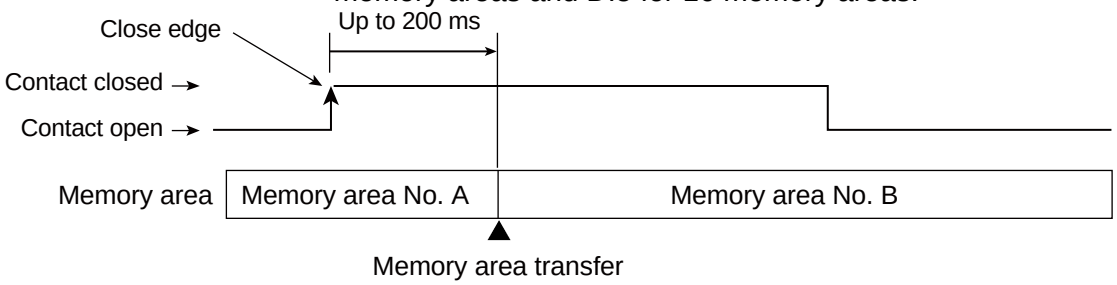
: DI1 is 15

: DI1 is either 16 or 17

: DI1 is either 18 or 19

Memory area transfer 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 area SET signal. The area SET signal contact is: DI4 for 8 memory areas and DI5 for 16 memory areas.



NOTE After the contact is transferred, it takes "up to 200 ms" until the action of this instrument is actually selected.

• Without SET signal ···· First select the memory area using contacts, then wait for 0.5 to 5.0 seconds (set in Function block No. 23: Area switching time (without area set signal) (Engineering mode).

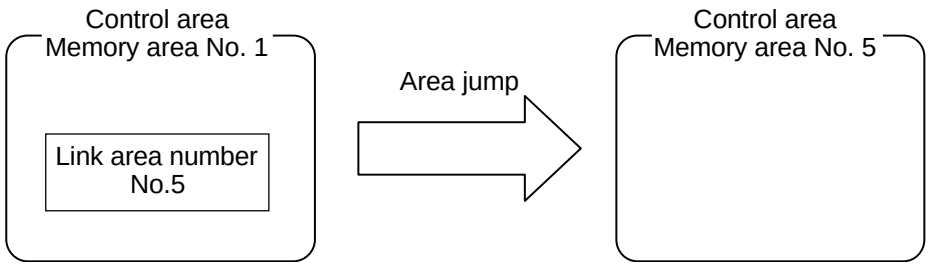
To change the Memory area without using the SET signal, "External mode" must be set in Control area Local/External transfer (Operation transfer mode).

● Area jump

The memory area will be switched to the area set in the "Link area number" in the Parameter setting mode after the Close edge or Open edge has been detected. If the "Link area number" is not specified, the area number (which is the current number* + 1) will be selected.

* In case the "Link area number" is not specified and the current control area No. is 16, the area will not be changed.

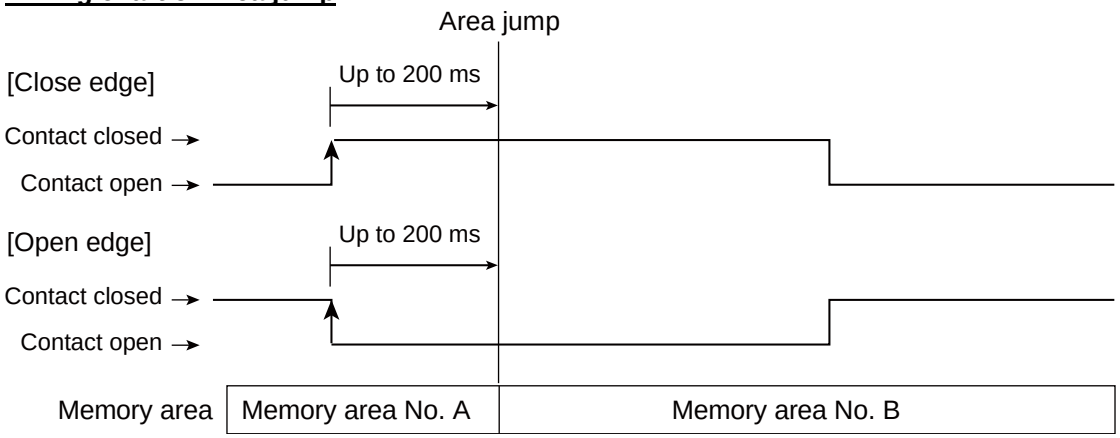
Example: If the current control area is "Memory area No. 1" and the "Link area number" (set in area No. 1) is "No. 5," the memory area will be changed to No. 5 from No. 1 after the Area jump.



To perform an Area jump

"Digital input 1 (DI1) Close edge" or "Digital input 1 (DI1) Open edge," or both of these must be selected in Select Trigger type for Memory area transfer (Parameter setting mode).

Timing chart of Area jump



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

When “Event 1 to 4” are selected at the Select Trigger type for Memory area transfer in the Parameter setting mode of the memory area, the area jump will be performed in case the preset event happens.

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

● **RUN/STOP transfer**

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
RUN	RUN	RUN	
	STOP	STOP	Priority to STOP
STOP	RUN		
	STOP		

● **Auto/Manual transfer**

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
Auto mode	Auto mode	Auto mode	
	Manual mode	Manual mode	Priority to manual mode
Manual mode	Auto mode		
	Manual mode		

● **Remote/Local transfer**

Remote/Local transfer

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
Remote mode	Remote mode	Remote mode	
	Local mode	Local mode	Priority to Local mode
Local mode	Remote mode		
	Local mode		

PV select transfer

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
Input 2	Input 2	Input 2	
	Input 1	Input 1	Priority to Input 1
Input 1	Input 2		
	Input 1		

2-loop control/Differential temperature control transfer

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
Differential temperature control	Differential temperature control	Differential temperature control	
	2-loop control	2-loop control	Priority to 2-loop control
2-loop control	Differential temperature control		
	2-loop control		

Cascade mode transfer (Slave/Master single control)

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	
Cascade control	Cascade control	Cascade control	
	Slave/Master single control	Slave/Master single control	Priority to Slave/Master single control
Slave/Master single control	Cascade control		
	Slave/Master single control		

● **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	Priority is given to lock status
Lock state	Unlock state		
	Lock state		

Functions like “Interlock release”, “Peak hold/Bottom hold release”, “Autotuning on/off”, “Memory area transfer (with SET signal)”, and “Area jump” basically conform to the operation via front keys, through communication, or via digital inputs.

Parameter setting

● **DI1 function selection [Engineering mode: Function block No. 23 (Fn23)]**

Parameter symbol	Data range	Factory set value
dI SL 1	0: No function 1: RUN/STOP transfer 2: Auto/Manual transfer (Common to Input 1 and 2) 3: Input 1_Auto/Manual transfer 4: Input 2_Auto/Manual transfer [1)] 5: Remote/Local transfer [2)] (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) 6: Interlock release 7: Hold reset (Common to Input 1 and 2) 8: Input 1_Hold reset	0

	9: Input 2_Hold reset [1] 10: Autotuning (AT) (Common to Input 1 and 2) 11: Input 1_Autotuning (AT) 12: Input 2_Autotuning (AT) [1] 13: Set data unlock/lock transfer 14: Direct/Reverse action transfer 15: Memory area transfer (2 points, without area set signal) 16: Memory area transfer (8 points, without area set signal) 17: Memory area transfer (8 points, with area set signal) 18: Memory area transfer (16 points, without area set signal) 19: Memory area transfer (16 points, with area set signal) [3] 20: Area jump	

[1] Only when two inputs are available

[2] The function selected in Select function for Input 2 is switchable.

[3] Only when six or more Digital inputs (DI) are available (Only when optional communication is not selected)

● DI2 function selection [Engineering mode: Function block No. 23 (Fn23)]

Parameter symbol	Data range	Factory set value
dI SL2	0: No function 1: RUN/STOP transfer 2: Auto/Manual transfer (Common to Input 1 and 2) 3: Input 1_Auto/Manual transfer 4: Input 2_Auto/Manual transfer [1] 5: Remote/Local transfer [2] (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) 6: Interlock release 7: Hold reset (Common to Input 1 and 2) 8: Input 1_Hold reset 9: Input 2_Hold reset [1] 10: Autotuning (AT) (Common to Input 1 and 2) 11: Input 1_Autotuning (AT) 12: Input 2_Autotuning (AT) [1] 13: Set data unlock/lock transfer 14: Direct/Reverse action transfer	0

[1] Only when two inputs are available

[2] The function selected in Select function for Input 2 is switchable.

● DI3 function selection [Engineering mode: Function block No. 23 (Fn23)]

Parameter symbol	Data range	Factory set value
dI SL3	Same as DI2 function selection	0

● DI4 function selection [Engineering mode: Function block No. 23 (Fn23)]

Parameter symbol	Data range	Factory set value
dI SL4	Same as DI2 function selection	0

● DI5 function selection [Engineering mode: Function block No. 23 (Fn23)]

Parameter symbol	Data range	Factory set value
dI SL5	Same as DI2 function selection	0

📖 “DI5 function selection” will not be displayed when the optional communication function is selected.

● DI6 function selection [Engineering mode: Function block No. 23 (Fn23)]

Parameter symbol	Data range	Factory set value
dI SL6	Same as DI2 function selection	0

📖 “DI6 function selection” will not be displayed when the optional communication function is selected.

- **DI logic invert [Engineering mode: Function block No. 23 (Fn23)]**

Parameter symbol	Data range	Factory set value
dI INV	0 to 31 0: No logic invert +1: RUN/STOP transfer +2: Auto/Manual transfer +4: Remote/Local transfer * (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) +8: Set data unlock/lock transfer +16: Direct/Reverse action transfer To select two or more functions, sum each value.	0

* The function selected in "Select function for Input 2" can be switched.

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

- **Area switching time (without area set signal) [Engineering mode: Function block No. 23 (Fn23)]**

Parameter symbol	Data range	Factory set value
dI TIM	1 to 5 seconds	2

📖 "Area switching time (without area set signal)" is available when any one of 15, 16, and 18 are set in "DI1 function selection".

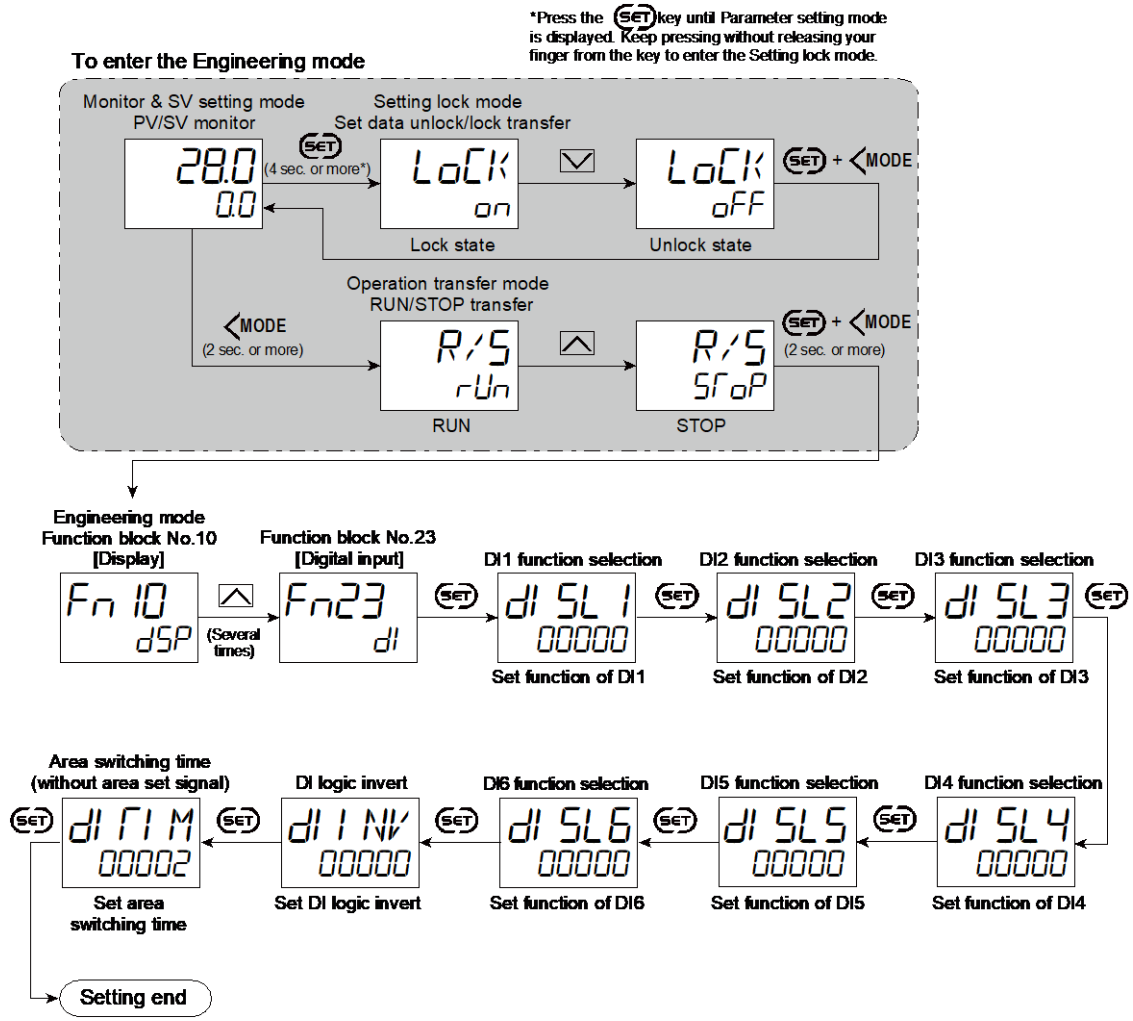
- **Control area Local/External transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
L/E	LoC: Local mode EyT: External mode	LoC

📖 To display "Control area Local/External transfer", choose "15, 16, or 18" in DI1 function selection.

📖 When "External mode" is set in "Control area Local/External transfer," control area cannot be switched via key operations.

Setting procedure



- Next parameter is displayed.
- Press SET and <MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

5.3 Correcting Input

PV bias 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

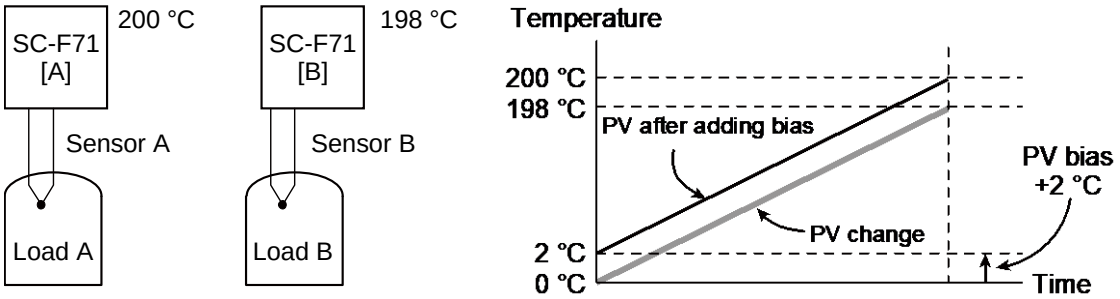
- **PV bias**

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:
SC-F71 [A]: 200 °C SC-F71 [B]: 198 °C
To correct the Measure value (PV) of SC-F71 [B], add bias of +2 °C by PV bias:

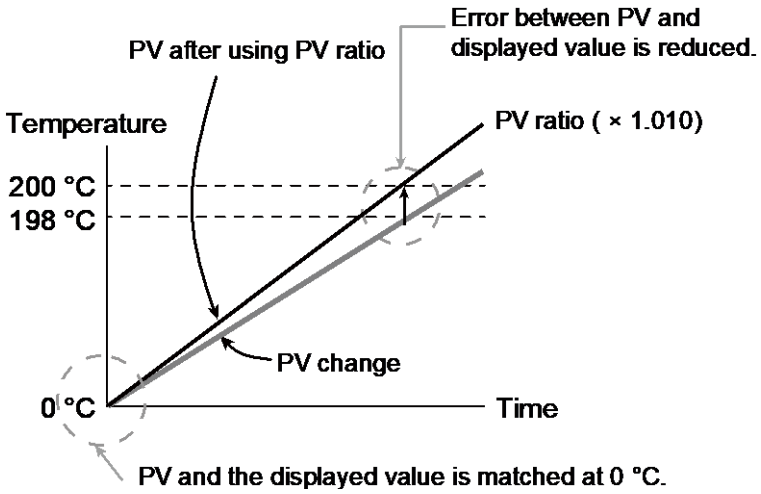
Displayed value = Measured value (PV) + PV bias = 198 °C + 2 °C = 200 °C



- **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.)

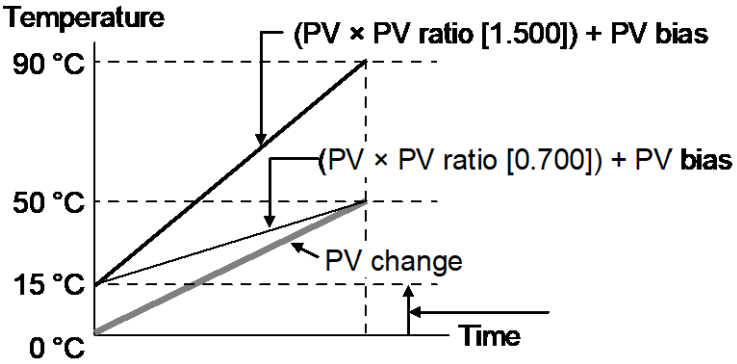
Displayed value = Measured value (PV) × PV ratio = 198 °C × 1.010 = 199.98 °C



● **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
Displayed value = 50 × 0.700 + 15 = 50 °C

PV ratio = 1.500
Displayed value = 50 × 1.500 + 15 = 90 °C



Parameter setting

● **Input 1_PV bias [Setup Setting Mode: Setting group No. 21 (5n2 1)]**

Parameter symbol	Data range	Factory set value
1. Pb	- (Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: - (PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	0

● **Input 2_PV bias (RS bias) [Setup Setting Mode: Setting group No. 22 (5n22)]**

Parameter symbol	Data range	Factory set value
2. Pb	Input 2_PV bias - (Input 2_Input span) to +(Input 2_Input span) RS bias - (Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	0

📖 When Remote setting input is supplied, it is displayed as RS bias.

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

● **Input 1_PV ratio [Setup Setting Mode: Setting group No. 21 (5n2 1)]**

Parameter symbol	Data range	Factory set value
1. PR	0.500 to 1.500	1.000

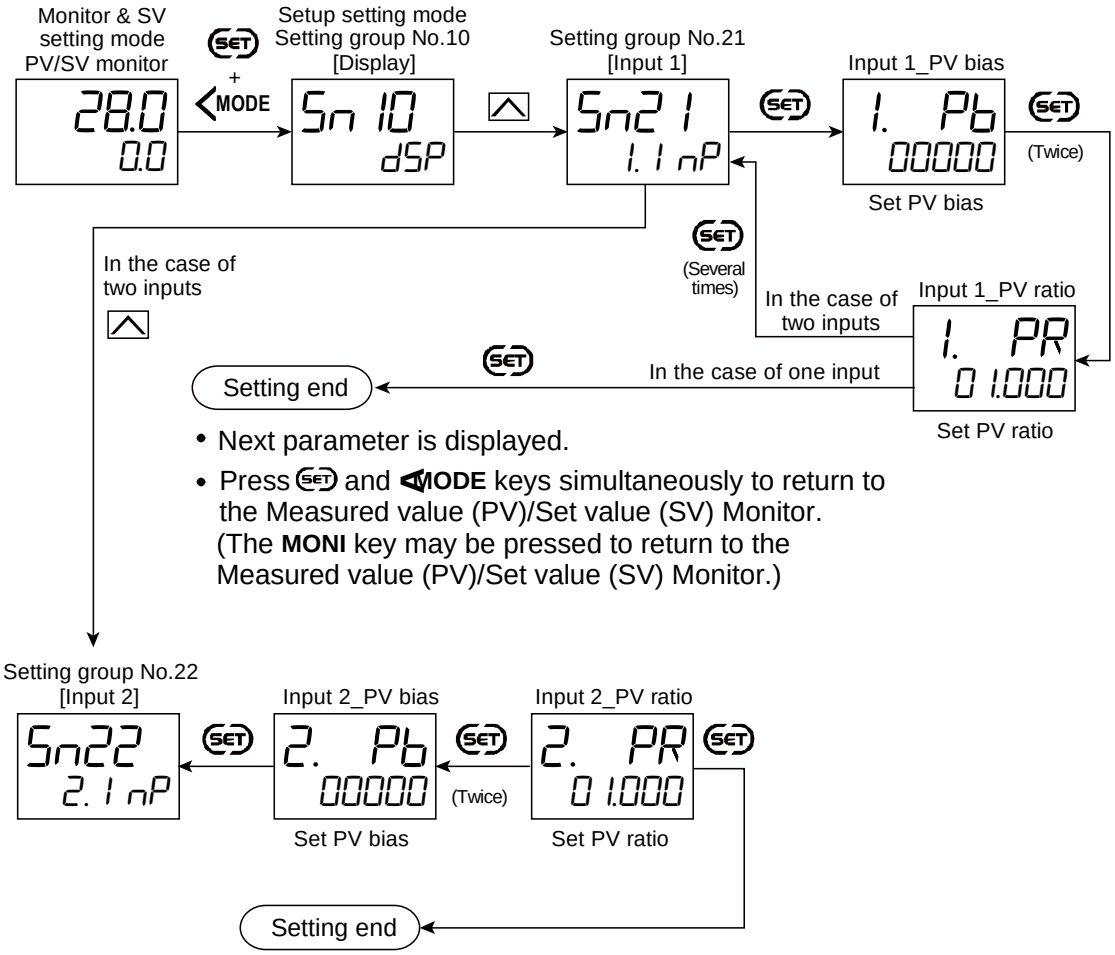
● **Input 2_PV ratio [Setup Setting Mode: Setting group No. 22 (5n22)]**

Parameter symbol	Data range	Factory set value
2. PR	Input 2_PV ratio: 0.500 to 1.500 RS ratio: 0.001 to 9.999	1.000

📖 When Remote setting input is supplied, it is displayed as PV ratio.

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

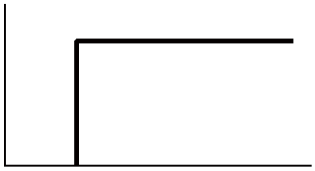
- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

5.4 Preventing the Input Flicker

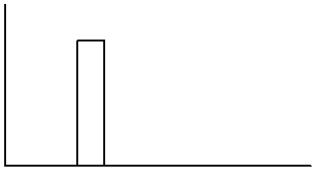
To prevent the input flicker, PV digital filter with the first-order lag calculation is provided.

Description of function

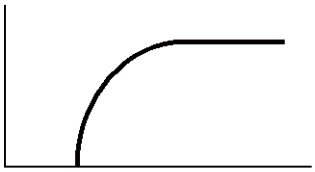
PV digital filter is software designed to reduce variance of PV caused by noise. Effect of Input noise can be reduced by setting time constant of PV digital filter based on the controlled object requirement and its level of noise. Setting a value too small leads to a poor result of PV digital filter;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



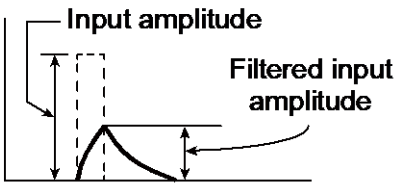
Actual PV



Pulse input by noise



PV after setting PV digital filter



Parameter setting

- **Input 1_PV digital filter [Setup Setting Mode: Setting group No. 21 (SG21)]**

Parameter symbol	Data range	Factory set value
1. dF	0.0 to 100.0 seconds 0.0: Filter OFF	0.0

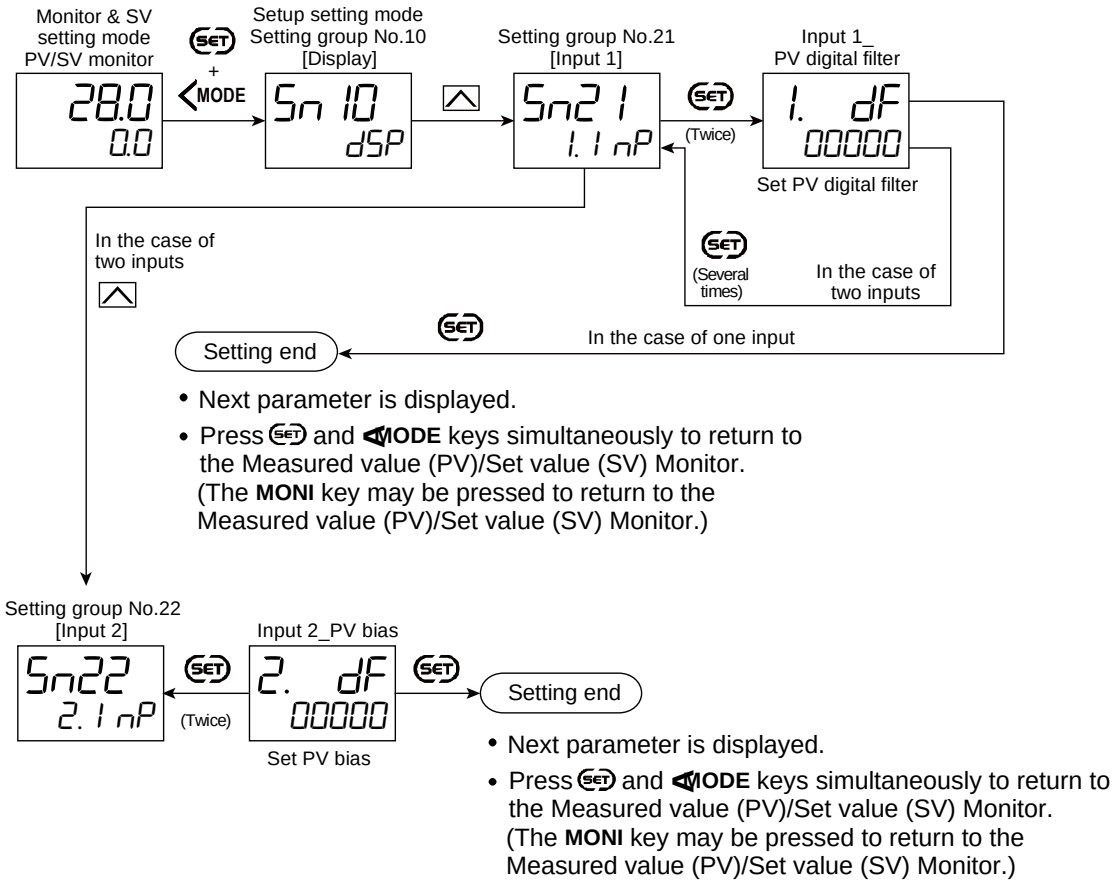
- **Input 2_PV digital filter (RS digital filter) [Setup Setting Mode: Setting group No. 22 (SG22)]**

Parameter symbol	Data range	Factory set value
2. dF	0.0 to 100.0 seconds 0.0: Filter OFF	0.0

📖 When Remote setting input is supplied, it is displayed as RS digital filter.

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



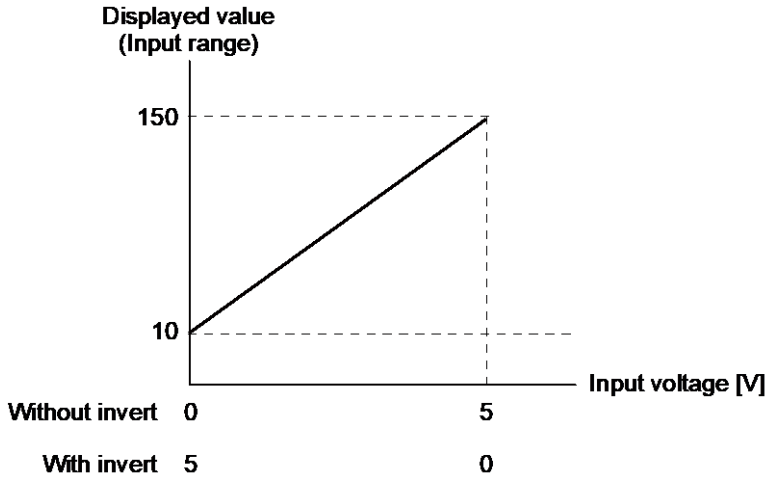
5.5 Inverting the Input

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



The left graph illustrates the signal when Input voltage is 5 V.
The displayed value without the Invert function is “10.”
The displayed value with the Invert function is “150.”

Parameter setting

- **Input 1_Inverting input [Engineering mode: Function block No. 21 (Fn2 1)]**

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

📖 To display “Input 1_Inverting input”, choose “Current” or “Voltage” in Function block No. 21: Input 1_Input type (Engineering mode).

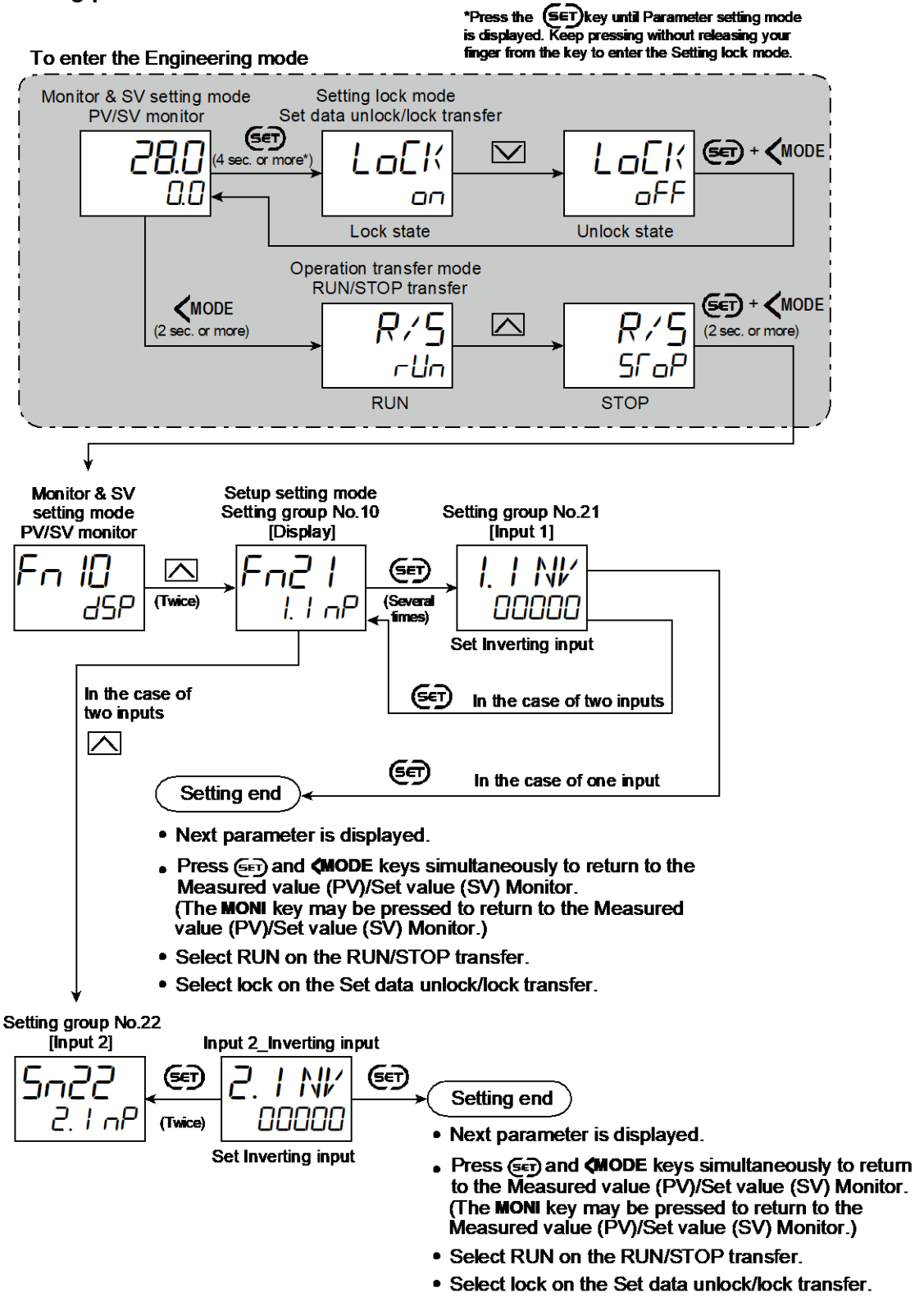
- **Input 2_Inverting input [Engineering mode: Function block No. 22 (Fn22)]**

Parameter symbol	Data range	Factory set value
2. 1 INV	0: Unused 1: Used	0

📖 To display “Input 2_Inverting input”, choose “Current” or “Voltage” in Function block No. 22: Input 2_Input type (Engineering mode).

📖 Not displayed when “No function” or “Remote setting input” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



5.6 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**

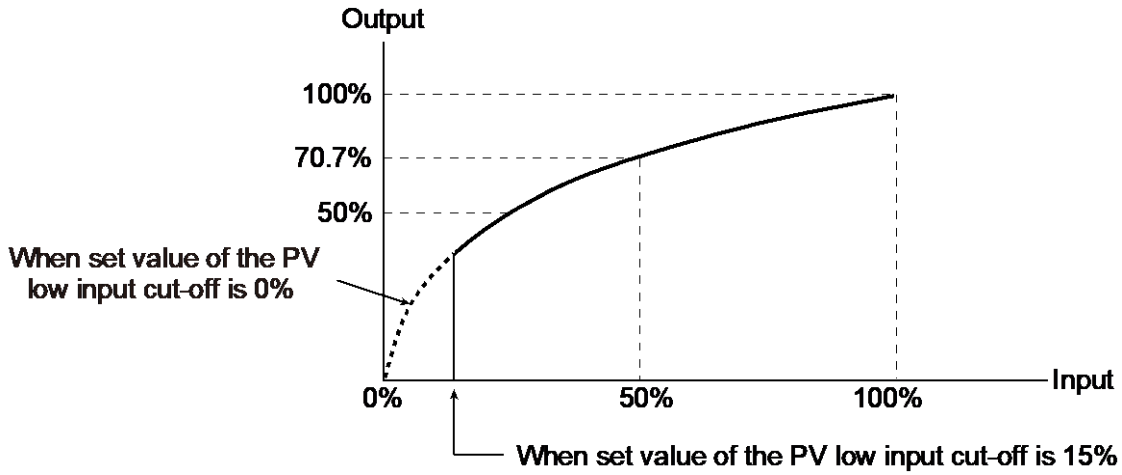
When using a differential pressure type flow transmitter, the Measured value (PV) is computed by Square root extraction.

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 → $\sqrt{\ }$ (Square root extraction) → PV to be used for flow control and displayed

- **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

- **Input 1_Square root extraction [Engineering mode: Function block No. 21 (Fn2 1)]**

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

To display “Input 1_Square root extraction”, choose “Current” or “Voltage” in Function block No. 21: Input 1_Input type (Engineering mode), AND choose “0 to 2” in Function block No. 51: Input 1_Control action (Engineering mode).

● **Input 2_Square root extraction [Engineering mode: Function block No. 22 (Fn22)]**

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

📖 To display “Input 2_Square root extraction,” choose “Current” or “Voltage” in Function block No. 22: Input 2_Input type (Engineering mode), AND choose “0 to 1: PID control” in Function block No. 52: Input 2_Control action (Engineering mode).

📖 Not displayed when “No function” or “Remote setting input” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

● **Input 1_PV low input cut-off [Setup Setting Mode: Setting group No. 21 (Sn21)]**

Parameter symbol	Data range	Factory set value
1. PLC	0.00 to 25.00% of Input 1_Input span (When Control with PV select: 0.00 to 25.00% of PV select input span)	0.00

📖 To display “Input 1_PV low input cut-off”, choose “Voltage/Current input” in Input type, AND choose “1: Used” in Function block No. 21: Input 1_Square root extraction (Engineering mode).

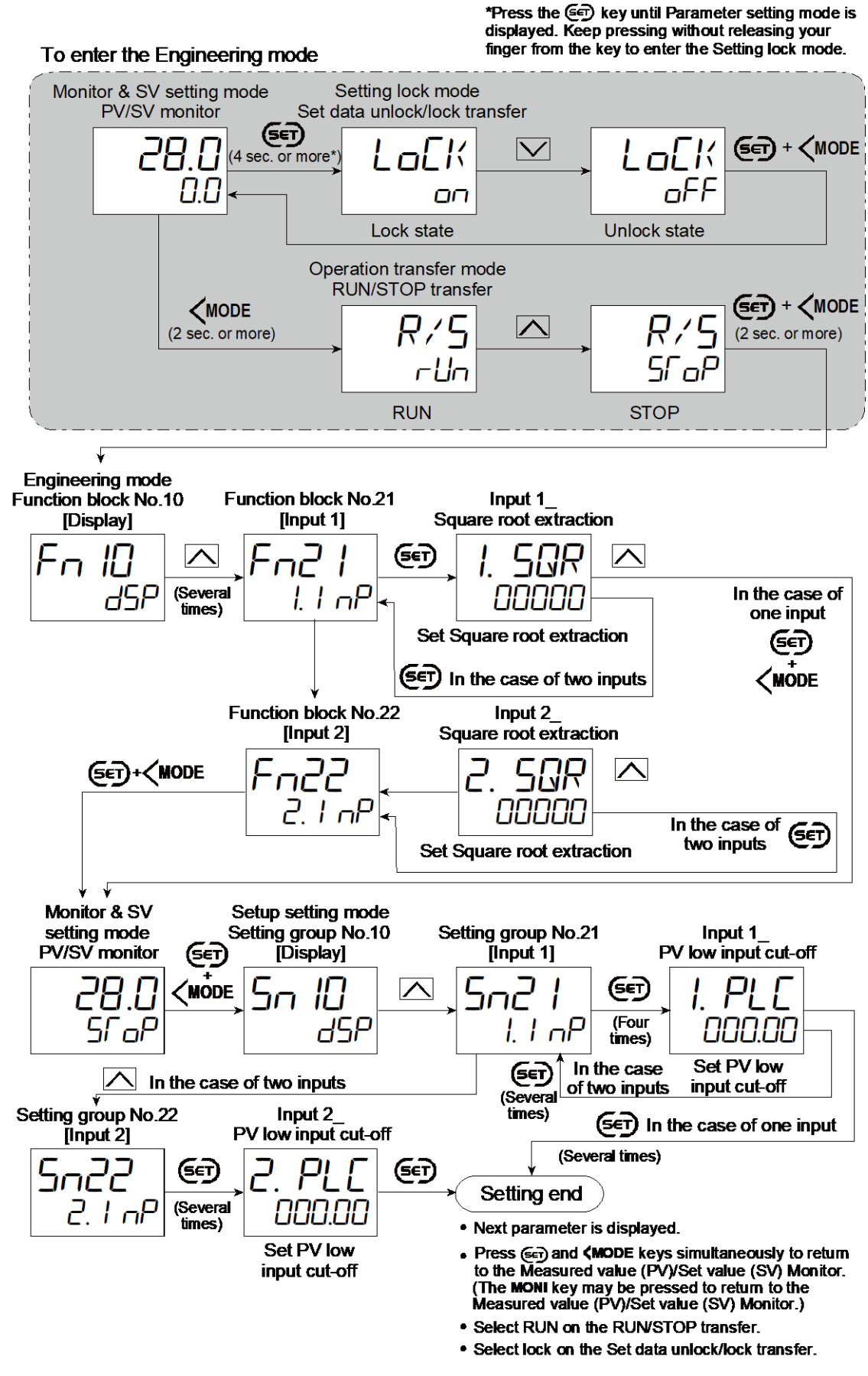
● **Input 2_PV low input cut-off [Setup Setting Mode: Setting group No. 22 (Sn22)]**

Parameter symbol	Data range	Factory set value
2. PLC	0.00 to 25.00% of Input 2_Input span (When Control with PV select: 0.00 to 25.00% of PV select input span)	0.00

📖 To display “Input 2_PV low input cut-off”, choose “Voltage/Current input” in Input type, AND choose “1: Used” in Function block No. 22: Input 2_Square root extraction (Engineering mode).

📖 Not displayed when “No function” or “Remote setting input” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



5.7 Changing Error Handling at Input Error

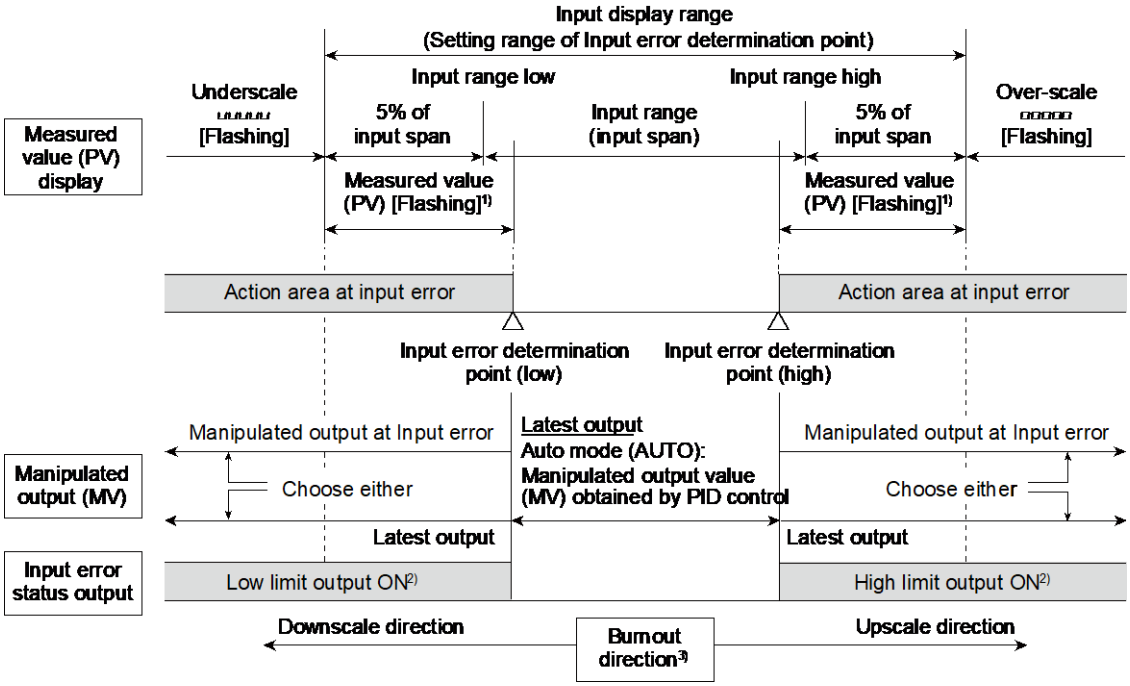
The measures for input errors can be selected from Input burnout direction, Input error determination point, Manipulated output value at Input error, PV flashing display at input error, and Input error status output.

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 mode and control stop mode, action and output will not be taken for input errors.

- **Input error determination point is set within the input range**

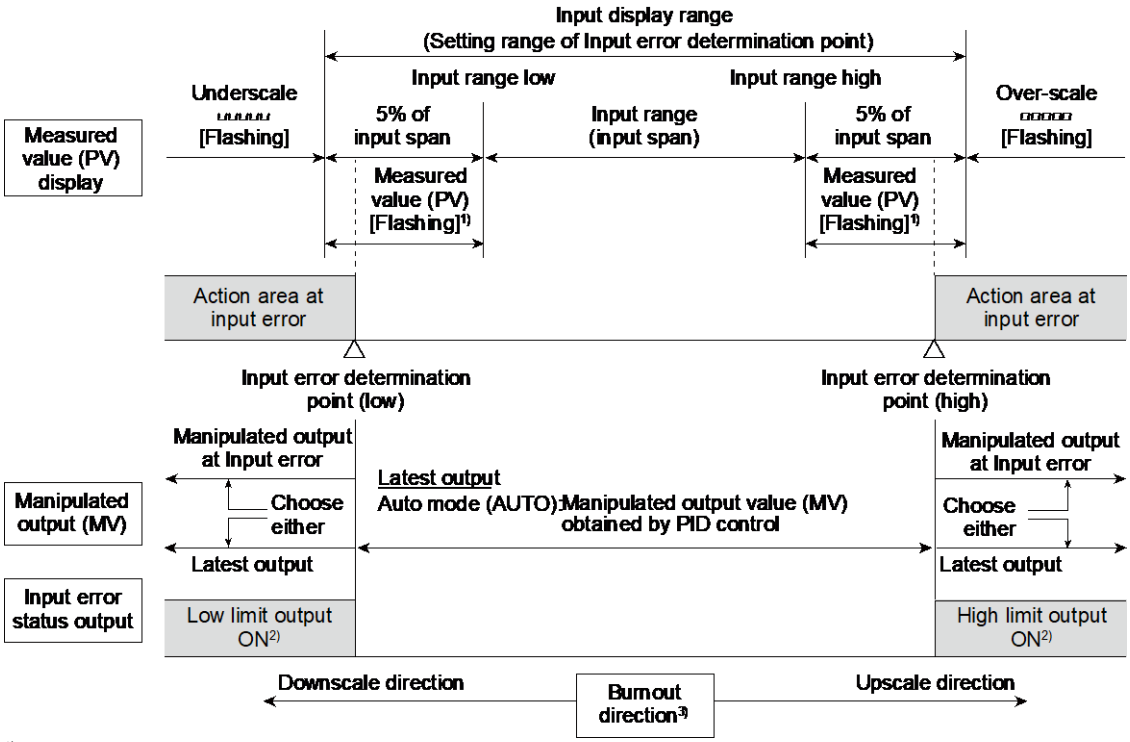


[1] Flashing can be suppressed by setting Function block No. 10: PV flashing display at input error (Engineering mode).
[2] Refer to “Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection” in 6.1 Changing Output Assignment for Input error status output.
[3] Setting Burnout direction is available 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 for the input range of each input.

Refer to 6.1 Changing Output Assignment for Input error status output.

● Input error determination point is set outside the input range



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

2) Refer to “Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection” in 6.1 Changing Output Assignment for Input error status output..

3) Setting Burnout direction is available 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 for the input range of each input.

☞ Refer to 6.1 Changing Output Assignment for Input error status output.

In the case of control with dual inputs, the action at input error is conducted independently on each of Input 1 and Input 2. However, exceptional cases are shown below in which Action at input error may be slightly different.

● Cascade control

Switching is possible between Cascade control and Master single control or Cascade control and Slave single control. Action at input error of each case is as follows.

	Cascade control	Master single control	Slave single control
Input error determination	• Input 1 is determined at Input 1_Input error determination point. • Input 2 is determined at Input 2_Input error determination point. Whichever is triggered by input error.	Input 1 is determined at Input 1_Input error determination point.	Input 2 is determined at Input 2_Input error determination point.
Action at input error	Action selected for Input 1_Action input error.	Action selected for Input 1_Action input error.	Action selected for Input 1_Action input error.
Manipulated output value at input error	Input 1_Manipulated output value at input error	Input 1_Manipulated output value at input error	Input 1_Manipulated output value at input error

[Action at input error for cascade control]

The settings of Action at input error high and low are conflicting each other and when both Input 1 and Input 2 go to an input error state.

Input 1_Action input error	Input 2_Action input error	Control action
1: Manipulated output value at input error (Manual mode)	2: Manipulated output value at input error (Auto mode)	Input 1_Manipulated output value at input error" is output in Manual mode
2: Manipulated output value at input error (Auto mode)	1: Manipulated output value at input error (Manual mode)	"Input 1_Manipulated output value at input error" is output in Auto mode
0: Control continues	1: Manipulated output value at input error (Manual mode)	Input 1_Manipulated output value at input error" is output in Manual mode
1: Manipulated output value at input error (Manual mode)	0: Control continues	Input 1_Manipulated output value at input error" is output in Manual mode
0: Control continues	2: Manipulated output value at input error (Auto mode)	"Input 1_Manipulated output value at input error" is output in Auto mode
2: Manipulated output value at input error (Auto mode)	0: Control continues	"Input 1_Manipulated output value at input error" is output in Auto mode

● 2-loop control/Differential temperature control

	Input 1 is abnormal	Input 2 is abnormal
Input error determination	Input 1 is determined at Input 1_ Input error determination point.	Input 2 is determined at Input 2_ Input error determination point.
Action at input error	Action selected for Input 1_Action input error.	Input 1 side: "Input 1_Manipulated output value at input error" is output [fixed] Input 2 side: Action selected for Input 2_Action input error.
Manipulated output value at input error	Input 1_Manipulated output value at input error	Input 1_Manipulated output value at input error Input 2_Manipulated output value at input error

● Input circuit error alarm

	Input 1 is abnormal	Input 2 is abnormal
Input error determination	Input 1 is determined at Input 1_ Input error determination point.	Input 2 is determined at Input 2_ Input error determination point.
Action at input error	Action selected for Input 1_Action input error.	Even if Input 2 is in input error, Action at input error will not be taken. [1)]
Manipulated output value at input error	Input 1_Manipulated output value at input error	

[1)] When (Input 2 − Input 1) exceeds the Input circuit error alarm set value, Action at input error is the action defined in Input 1_Action input error.

● Control with PV select

	Input 1 is abnormal	Input 2 is abnormal
Input error determination	Input 1 is determined at Input 1_ Input error determination point.	Input 2 is determined at Input 2_ Input error determination point.
Action at input error	When the Input 1 is used: Action selected for Input 1_Action input error. When the Input 2 is used: No Action at input error	When the Input 1 is used: No Action at input error When the Input 2 is used: Action selected for Input 1_Action input error.
Manipulated output value at input error	Input 1_Manipulated output value at input error	Input 1_Manipulated output value at input error

Parameter setting

- **PV flashing display at input error [Engineering mode: Function block No. 10 (Fn 10)]**

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

- **Input 1_Input error determination point (high) [Engineering mode: Function block No. 21 (Fn2 1)]**

Parameter symbol	Data range	Factory set value
1. PoV	Input 1_Input error determination point (low) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	Input 1_Input range high + (Input 1_5% of input span)

- **Input 1_Input error determination point (low) [Engineering mode: Function block No. 21 (Fn2 1)]**

Parameter symbol	Data range	Factory set value
1. PUN	Input 1_Input range low - (Input 1_5% of input span) * to Input 1_Input error determination point (high) [Varies with the setting of the Decimal point position.] * When Input type of Input 1 is RTD, low limit value is about 2 Ohms. (Pt100: -245.5 °C (-409.8 °F), JPt100: -237.6 °C (-395.7 °F))	Input 1_Input range low - (Input 1_5% of input span)

- **Input 2_Input error determination point (high) [Engineering mode: Function block No. 22 (Fn22)]**

Parameter symbol	Data range	Factory set value
2. PoV	Input 2_Input error determination point (low) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	Input 2_Input range high + (Input 2_5% of input span)

📖 Not displayed when “No function” or “Remote setting input” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Input error determination point (low) [Engineering mode: Function block No. 22 (Fn22)]**

Parameter symbol	Data range	Factory set value
2. PUN	Input 2_Input range low - (Input 2_5% of input span) * to Input 2_Input error determination point (high) Varies with the setting of the Decimal point position. * When Input type of Input 2 is RTD, low limit value is about 2 Ohms. (Pt100: -245.5 °C (-409.8 °F), JPt100: -237.6 °C (-395.7 °F))	Input 2_Input range low - (Input 2_5% of input span)

📖 Not displayed when “No function” or “Remote setting input” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Burnout direction [Engineering mode: Function block No. 21 (Fn2 1)]**

Parameter symbol	Data range	Factory set value
1. boS	0: Upscale 1: Downscale	0

📖 To display “Input 1_Burnout direction”, choose “thermocouple (TC)” or “Low voltage (0 to 100 mV DC, 0 to 10 mV DC)” in Function block No. 22: “Input 2_Input type” (Engineering mode), AND choose “0, 1, 2, 8 or 9” in Function block No. 51: Input 1_Control action (Engineering mode).

- **Input 2_Burnout direction [Engineering mode: Function block No. 22 (Fn22)]**

Parameter symbol	Data range	Factory set value
2. boS	0: Upscale 1: Downscale	0

📖 To display “Input 2_Burnout direction”, choose “Thermocouple (TC)” or “Low voltage (0 to 100 mV DC, 0 to 10 mV DC)”in Function block No. 22: “Input 2_Input type” (Engineering mode), AND choose “0, 1, 8 or 9” in Function block No. 52: Input 2_Control action (Engineering mode).

📖 Input 2_Input type is not displayed when “No function” is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Action (high) input error [Engineering mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1.AoVE	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2

- **Input 1_Action (low) input error [Engineering mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1.AUNE	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2

- **Input 2_Action (high) input error [Engineering mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2.AoVE	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2

📖 To display “Input 2_Action (high) input error”, choose “2-loop control/Differential temperature input” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Action (low) input error [Engineering mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2.AUNE	0: Control continues (with the latest output) 1: Manipulated output value at input error (Manual mode) The operation mode is switched to the Manual mode and the Input 1_Manipulated output value at input error is output. 2: Manipulated output value at input error (Auto mode) The operation mode remains in the Auto mode and the Input 1_Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2

To display “Input 2_Action (low) input error”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Manipulated output value at input error [Engineering mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. PSM	Heating/Cooling PID control: -105.0 to +105.0% Other control: -5.0 to +105.0%	Heating/Cooling PID control: 0.0 Other control: -5.0

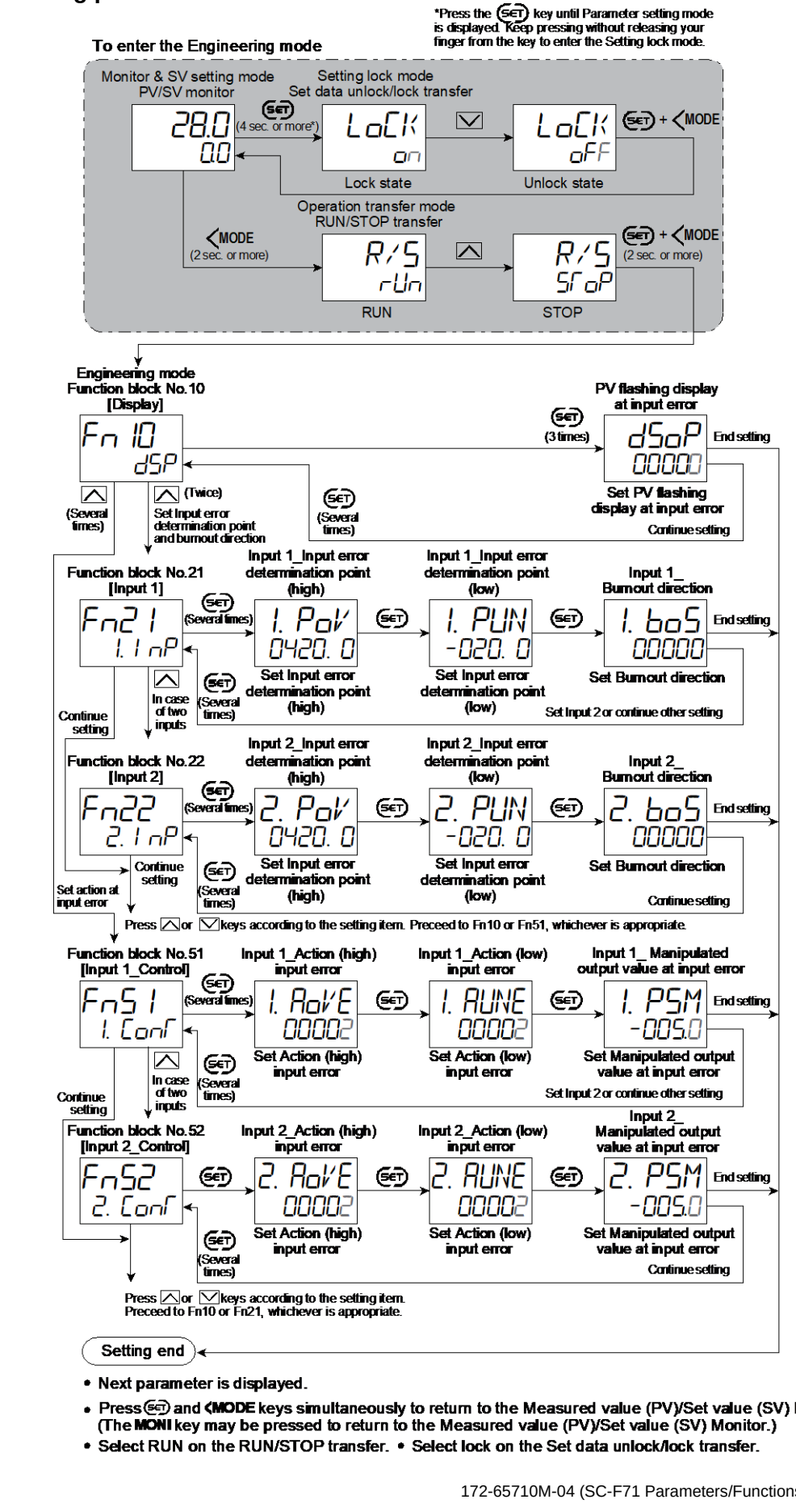
For Heating/Cooling PID control, output is produced from the heat side when the setting is positive (+) and output is produced from the cool side when the setting is negative (-).

- **Input 2_Manipulated output value at input error [Engineering mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. PSM	-5.0 to +105.0%	-5.0

To display “Input 2_Manipulated output value at input error”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Mon (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer. • Select lock on the Set data unlock/lock transfer.

5.8 Using Dual Input Function

This instrument has an optional dual input function which can be configured as follows.

- **Remote setting input function**

The instrument uses an input signal from Input 2 as a remote signal and sets it to the Input 1_Set value (SV). Remote setting input can be supplied if it is specified at the time of order.

☞ Refer to 8.10 Using Remote Setting Input for details.

- **2-loop control function**

The instrument performs two independent control using Input 1 and 2. The 2-loop control can be configured to Differential temperature control, and vice versa.

☞ Refer to 8.11 Executing 2-Loop Control for 2-loop control.

- **Differential temperature control function**

With this function, temperature control of Input 1 is performed by setting a temperature difference between Input 2 and Input 1. The 2-loop control can be configured to Differential temperature control, and vice versa.

☞ Refer to 8.12 Executing Differential Temperature Control for details.

- **Control with PV select**

This function uses two inputs and allows the sensors to be switched from one to another depending on the temperature of the controlled object (high or low temperatures).

☞ Refer to 8.13 Executing Control with PV Select for Control with PV select..

- **Cascade control**

Cascade control is available where Input 1 is used as a Master and Input 2 as a Slave. Cascade control is available in two control modes; “Slave single control or Cascade control” and “Master single control or Cascade control.”

☞ Refer to 8.14 Executing Cascade Control for Cascade control.

- **Input circuit error alarm function**

The instrument uses two inputs to detect an error from the difference in input between the two.

☞ Refer to 7.7 Preventing Control with Input Errors (Input Circuit Error Alarm)..

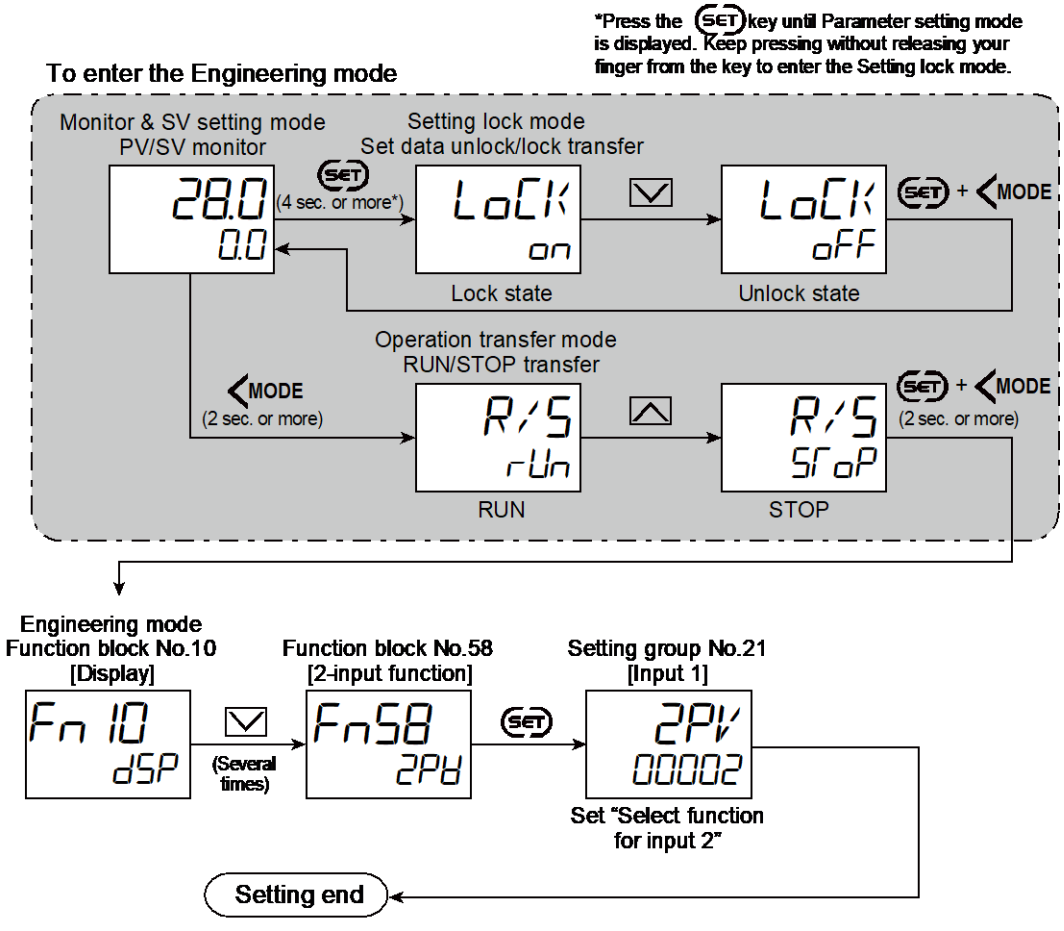
Parameter setting

- **Select function for Input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 When pressure control operation [MC-(V)COS(R)] is selected: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

☞ Refer to 4. Parameters that are Initialized/Modified when Setting is Changed for the parameters that are initialized or changed when the Select function for Input 2 is changed.

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

6. Output Function

6.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output]

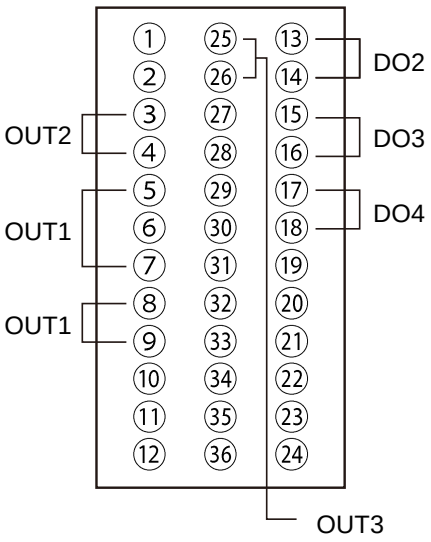
SC-F71 has such hardware outputs of OUT1 to 3 (3 points) and DO1 to 4 (4 points) as shown below. The following output signals are assigned to each output terminal.

- Control output (Settable only between OUT1 and OUT3)
- Retransmission output (Settable only between OUT1 and OUT3)
- Logic calculation output [Event, Input error status]
- Instrument Status Output
  [RUN, Manual mode, Remote mode, Autotuning (AT), While Set value (SV) is changing, Communication monitoring result, FAIL]

Description of function

Output signals **[**Control Output, Retransmission Output, Logic Calculation Output, or Instrument Status Output**]** are assigned to the output terminals (OUT1 to 3, DO1 to 4).

● Position of output terminals



● Details of functions assigned to OUT1 to 3

Setting	Assigned functions
0	No assignment
1	Input 1_Control output [heat-side] or [open-side]
2	Input 1_Control output [cool-side] or [close-side]
3	Input 2_Control output
4	Retransmission output
5	Logic calculation output [Event, Input error]
6	RUN state output
7	Input 1_Manual mode state output
8	Input 2_Manual mode state output
9	Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select)
10	Input 1_Autotuning (AT) state output
11	Input 2_Autotuning (AT) state output
12	Output while Set value of Input 1 is changing
13	Output while Set value of Input 2 is changing
14	Output of the communication monitoring result
15	FAIL output

[Explanation of the setting]

- Input 1_Control output [heat-side] or [open-side]:
  Assignable to Input 1. When Heating/Cooling PID control is selected for Input 1, this output is used as heating output.
- Input 1_Control output [cool-side] or [close-side]:
  This output is available when Heating/Cooling PID control is selected for Input 1. If Heating/Cooling PID control is selected, this output is used as a cooling output.
- Input 2_Control output
  Assignable to Input 2. This output is available when 2-loop control (including Differential temperature control) or Cascade control is selected for Select function for Input 2.
- Retransmission output:
  Retransmission output type needs to be specified later. Retransmission output scaling is also available.

  ☞ Refer to 6.3 Using Retransmission Output for Retransmission output.
- Logic calculation output [Event, 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 Logic calculation selection.
- RUN state output:
  Output turns on while the instrument is in RUN mode.
- Input 1_Manual mode state output:
  Output turns on while the Input 1 is in Manual mode.
- Input 2_Manual mode state output:
  Output turns on while the Input 2 is in Manual mode.
- Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select)
  Output turns on while the instrument is in the remote mode, cascade control, differential temperature control, or when Input 2 of Control with PV select is used.
- Input 1_Autotuning (AT) state output:
  Output turns on while the Input 1 is in the Autotuning (AT).
- Input 2_Autotuning (AT) state output:
  Output turns on while the Input 2 is in the Autotuning (AT).
- Output while Set value of Input 1 is changing:
  Output turns on while the Input 1_Set value (SV) is changing due to Soft start/ Setting change rate limiter.
- Output while Set value of Input 2 is changing:
  Output turns on while the Input 2_Set value (SV) is changing due to Soft start/ Setting change rate limiter.
- 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 will be unavailable.

● Details of functions assigned to DO1 to 4

Setting	Assigned functions
0	No assignment
1	Logic calculation output [Event, Input error status]
2	RUN state output
3	Input 1_Manual mode state output
4	Input 2_Manual mode state output
5	Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select)
6	Input 1_Autotuning (AT) state output
7	Input 2_Autotuning (AT) state output
8	Output while Set value of Input 1 is changing
9	Output while Set value of Input 2 is changing
10	Output of the communication monitoring result
11	FAIL output
12	Input 1_Control error
13	Input 2_Control error

[Explanation of the setting]

- Input 1_Control error: Turns ON when error (abnormality) occurs in Input 1_ Pressure control. This is only available when pressure control operation [MC-(V)COS(R)] is selected for Input 1_Control action.
- Input 2_Control error: Turns ON when error (abnormality) occurs in Input 2_ Pressure control. This is only available when pressure control operation [MC-(V)COS(R)] is selected for Input 2_Control action.

Refer to [Explanation of the setting] in “Details of functions assigned to OUT1 to OUT3” for other settings.

● 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.

Setting	Assigned functions
0	No assignment
1	Event 1
2	Event 2
4	Event 3
8	Event 4
16	Input 1_Input error high
32	Input 1_Input error low
64	Input 2_Input error high
128	Input 2_Input error low

Example
To select Event 1 output and Input 1_Input error output high, set as follows.
・Event 1 = 1
・Input 1_Input error high = 16
1 + 16 = 17
So, set 17

[Explanation of the setting]

- Event:
  Output turns on when the instrument is in the event state.
  You also need to set Event assignment, Event type, Event hold action, Event differential gap, Event timer, and Event set value.
  ☞ Refer to 7.1 Using Event Function for details.

- Input error high:
  Output turns on when the Measured value (PV) exceeds the Input error determination point (high).
  Under the conditions of an available Input circuit error alarm, when the Measured value of Input 2 goes over the Set value of the Input circuit error alarm and the measured value of Input 1, the Input error high alarm of Input 1 will turn on.

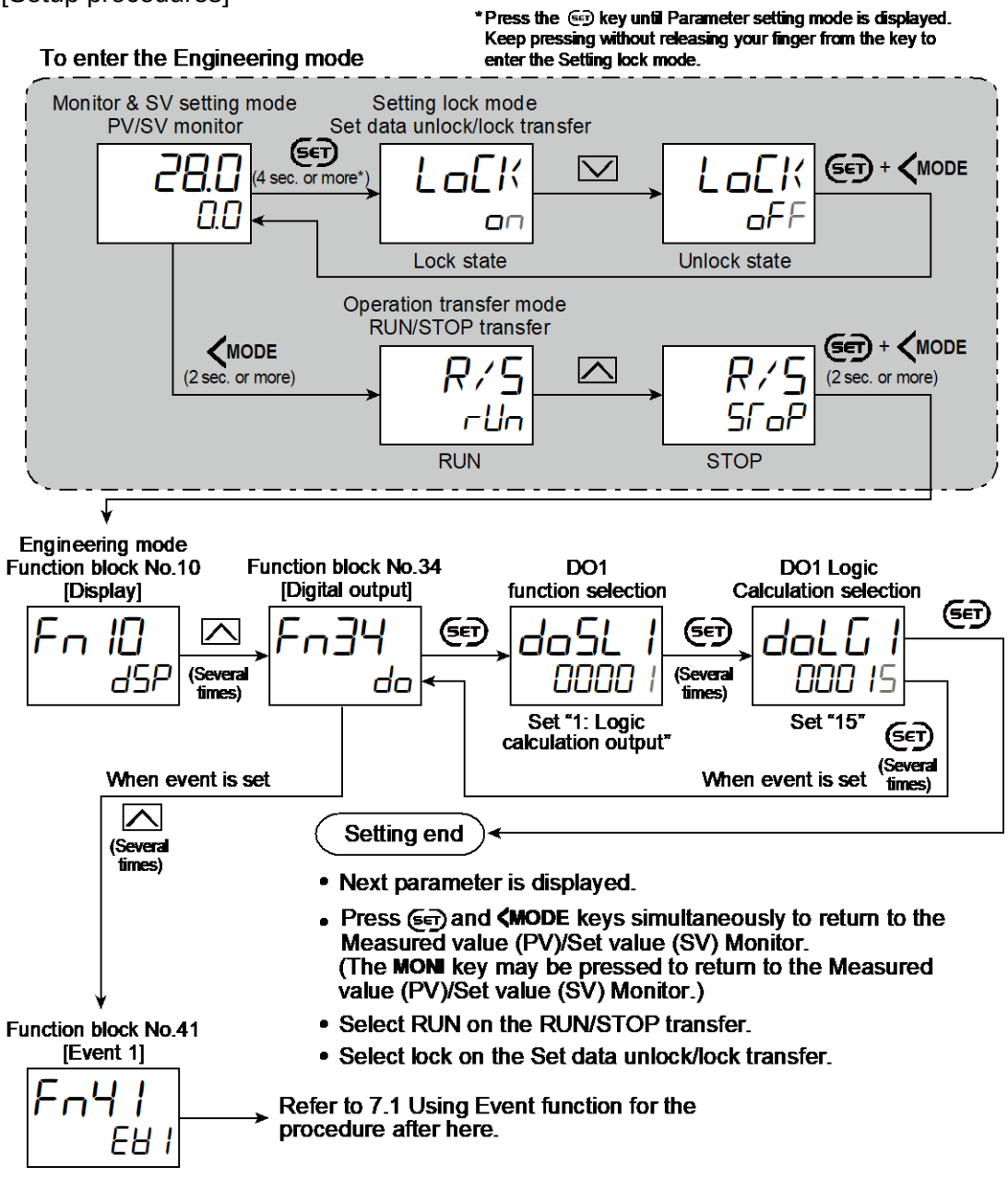
- Input error low:
  Output turns on when the Measured value (PV) exceeds the Input error determination point (low).
  Under the conditions of an available Input circuit error alarm, when the Measured value of Input 2 falls below over the Set value of the Input circuit error alarm and the measured value of Input 1, the Input error low alarm of Input 1 will turn on.

Setting example

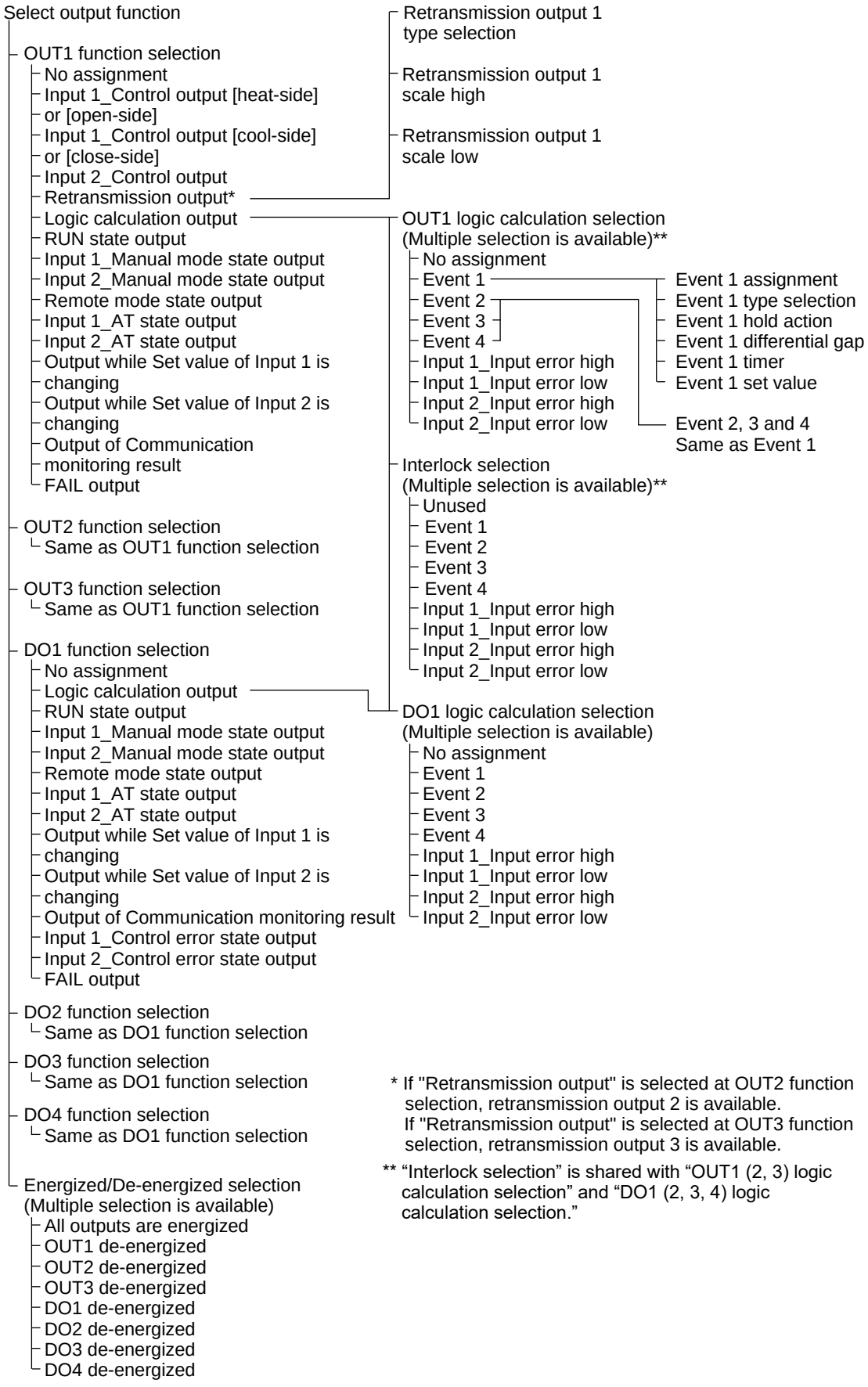
To provide Event 1 to Event 4 from DO1 as a logic *OR* output.

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]



Output function map



* If "Retransmission output" is selected at OUT2 function selection, retransmission output 2 is available.
If "Retransmission output" is selected at OUT3 function selection, retransmission output 3 is available.

** “Interlock selection” is shared with “OUT1 (2, 3) logic calculation selection” and “DO1 (2, 3, 4) logic calculation selection.”

Parameter setting

- **OUT1 function selection [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
oSL1	0: No assignment 1: Input 1_Control output [heat-side] or [open-side] 2: Input 1_Control output [cool-side] or [close-side] 3: Input 2_Control output 4: Retransmission output 5: Logic calculation output (Event, Input error) 6: RUN state output 7: Input 1_Manual mode state output 8: Input 2_Manual mode state output 9: Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select) 10: Input 1_Autotuning (AT) state output 11: Input 2_Autotuning (AT) state output 12: Output while Set value of Input 1 is changing 13: Output while Set value of Input 2 is changing 14: Output of the communication monitoring result 15: FAIL output	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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
oSL2	Same as OUT1 function selection	4

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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
oSL3	Same as OUT1 function selection	4

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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, Input error) 2: RUN state output 3: Input 1_Manual mode state output 4: Input 2_Manual mode state output 5: Remote mode state output (Cascade control state output, Output of differential temperature control state, Input 2 state output of Control with PV select) 6: Input 1_Autotuning (AT) state output 7: Input 2_Autotuning (AT) state output 8: Output while Set value of Input 1 is changing 9: Output while Set value of Input 2 is changing 10: Output of the communication monitoring result 11: FAIL output 12: Output Input 1_Control error state [1)] 13: Output Input 2_Control error state [1)]	0

[1)] Available only when “Pressure control operation [MC-(V)COS(R)] is selected in “Control action”.

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

Parameter symbol	Data range	Factory set value
doSL2	Same as DO1 function selection	0

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

Parameter symbol	Data range	Factory set value
doSL3	Same as DO1 function selection	0

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

Parameter symbol	Data range	Factory set value
doSL4	Same as DO1 function selection	0

- **OUT1 logic calculation selection [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
oLG1	0 to 255 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	0

- **OUT2 logic calculation selection [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
oLG2	Same as OUT1 logic calculation selection	0

- **OUT3 logic calculation selection [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
oLG3	Same as OUT1 logic calculation selection	0

- **DO1 logic calculation selection [Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doLG1	Same as OUT1 logic calculation selection	0

- **DO2 logic calculation selection [Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doLG2	Same as OUT1 logic calculation selection	0

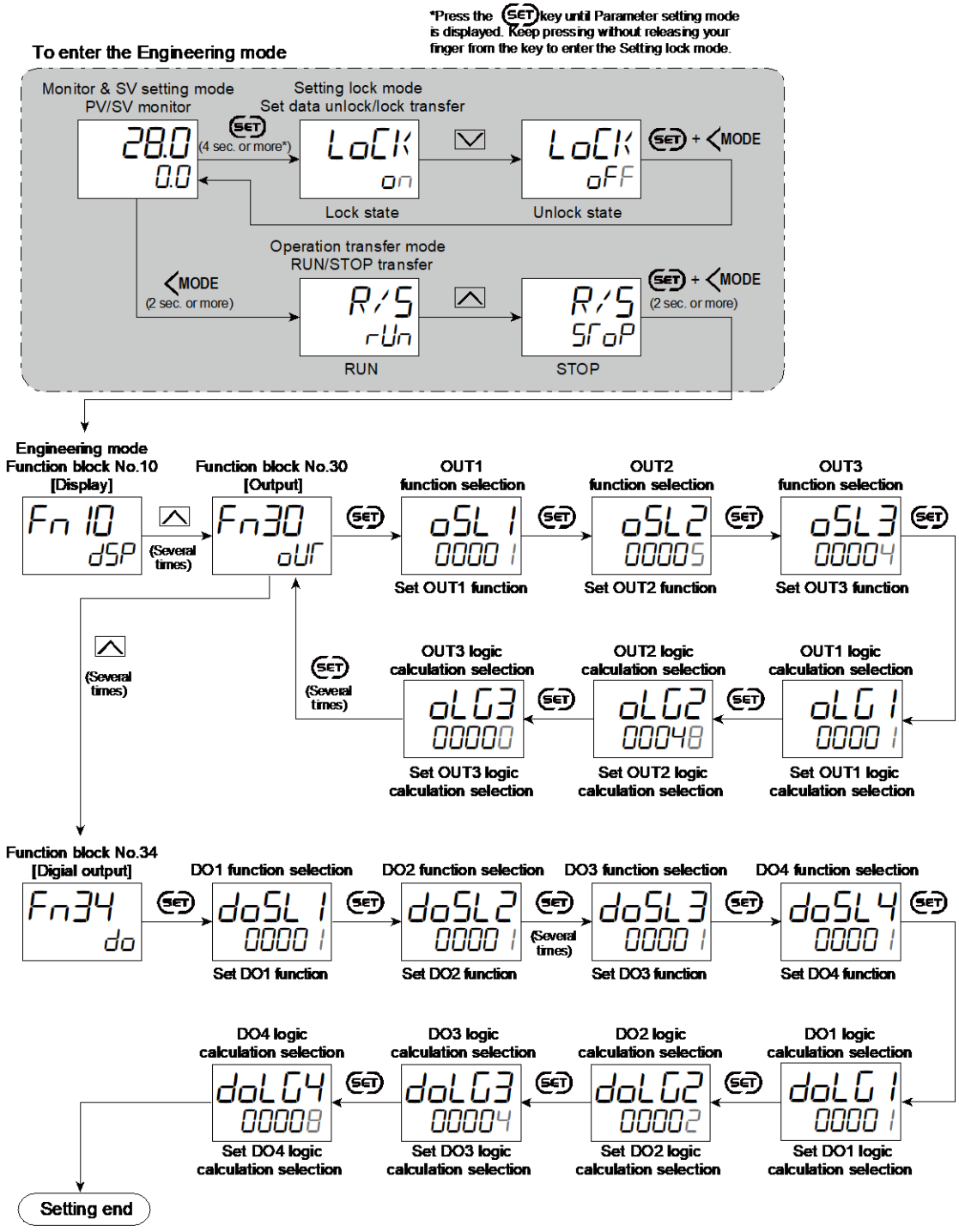
- **DO3 logic calculation selection [Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doLG3	Same as OUT1 logic calculation selection	0

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

Parameter symbol	Data range	Factory set value
doLG4	Same as OUT1 logic calculation selection	0

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

6.2 Changing Output Type of OUT3

OUT3 is produced as a universal output. Output type can be changed even after the purchase.

Description of function

Output 3 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)

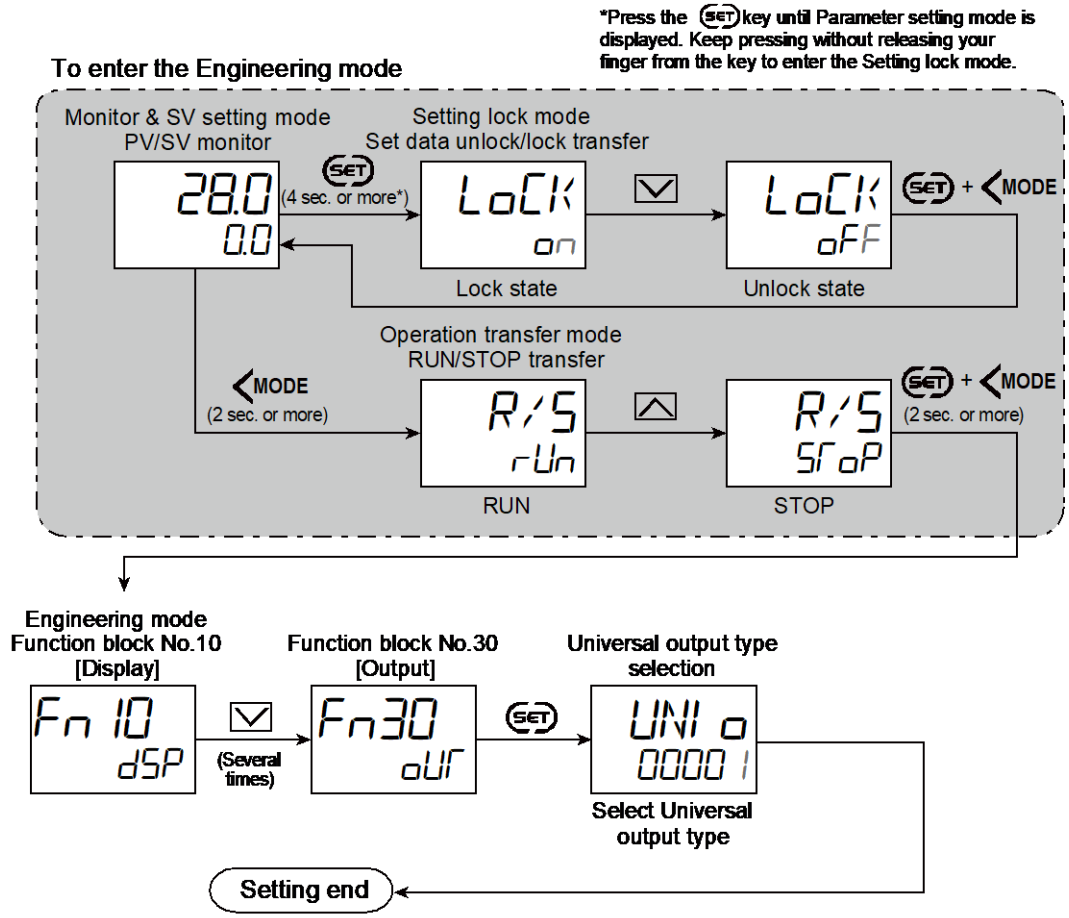
Parameter setting

- **Universal output type selection (OUT3) [Engineering Mode: Function block No. 30 (Fn30)]**

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

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Universal output type selection (OUT3) is changed.

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

6.3 Using Retransmission Output

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

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.

☞ Refer to 6.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output] for OUT1 to 3 function selection..

● Details of Retransmission output type

Setting	Assigned functions
0	No retransmission output
1	Input 1_Measured value (PV) Input 1_Measured value (PV) is output.
2	Input 1_Local SV Input 1_Set value (SV) is output. The local SV is the SV set. If the set value is changed, irrespective of the Soft start/Setting change rate limiter whether or not it is set, the new set value will be used as soon as the value is changed.
3	Input 1_SV monitor value Input 1_Set value (SV) is output. The SV monitor value is the monitored value of the set value (SV). If a Soft start/Setting change rate limiter is set, the set value starts changing according to the setting when the setting is changed.
4	Input 1_Deviation [Input 1_Measured value (PV) − Input 1_Set value (SV)] is output.
5	Input 1_Manipulated output value [heat-side] Input 1_Manipulated output value [heat-side] is output.
6	Input 1_Manipulated output value [cool-side] Input 1_Manipulated output value [cool-side] is output.
7	Input 2_Measured value (PV) Input 2_Measured value (PV) is output.
8	Input 2_Local SV Input 2_Set value (SV) is output. The local SV is the SV set. If the set value is changed, irrespective of the Soft start/Setting change rate limiter whether or not it is set, the new set value will be used as soon as the value is changed.
9	Input 2_SV monitor value Input 2_Set value (SV) is output. The SV monitor value is the monitored value of the set value (SV). If a Soft start/Setting change rate limiter is set, the set value starts changing according to the setting when the setting is changed.
10	Input 2_Deviation [Input 2_Measured value (PV) − Input 2_Set value (SV)] is output.
11	Input 2_Manipulated output value Input 2_Manipulated output value is output.
12	Remote setting input value [1)] Remote setting input value is output.
13	Measured value (PV) of differential temperature input Measured value (PV) of Differential temperature input [Input 1_Measured value (PV) - Input 2_Measured value (PV)] is output.

[1)] Available when “Remote setting input” is selected in Select function for Input 2.

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, Input 1_Measured value (PV), Input 1_Local SV, Input 1_ SV monitor value and Remote setting input value: Input 1_Input range low to Input 1_ Input range high
(When Control with PV select: PV select input range low to PV select input range high)
[Varies with the setting of the Decimal point position.]
Input 1_Deviation: -(Input 1_Input span) to +(Input 1_Input span)
[Varies with the setting of the Decimal point position.]
Input 2_Measured value (PV), Input 2_Local SV and Input 2_SV monitor value: Input 2_ Input range low to Input 2_Input range high
[Varies with the setting of the Decimal point position.]
Input 2_Deviation: -(Input 2_Input span) to +(Input 2_Input span)
[Varies with the setting of the Decimal point position.]
Manipulated output value: -5.0 to +105.0%
Measured value (PV) of differential temperature input: -(Input 1_Input span) to +(Input 1_Input span)
[Varies with the setting of the Decimal point position.]

Parameter setting

● **Retransmission output 1 type [Engineering Mode: Function block No. 31 (Fn31)]**

Parameter symbol	Data range	Factory set value
Ao1	0: No retransmission output 1: Input 1_Measured value (PV) 2: Input 1_Local SV 3: Input 1_SV monitor value 4: Input 1_Deviation 5: Input 1_Manipulated output value [heat-side] 6: Input 1_Manipulated output value [cool-side] 7: Input 2_Measured value (PV) 8: Input 2_Local SV 9: Input 2_SV monitor value 10: Input 2_Deviation 11: Input 2_Manipulated output value 12: Remote setting input value 13: Measured value (PV) of differential temperature input	0

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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 (Fn31)]**

Parameter symbol	Data range	Factory set value
AHS1	No retransmission output, Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value and Remote setting input value: Input 1_Input range low to Input 1_Input range high (When Control with PV select: V select input range low to PV select input range high) [Varies with the setting of the Decimal point position.] Input 1_Deviation: −(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.] Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range low to Input 2_Input range high [Varies with the setting of the Decimal point position.] Input 2_Deviation: −(Input 2_Input span) to +(Input 2_Input span) [Varies with the setting of the Decimal point position.] Manipulated output value: −5.0 to +105.0% Measured value (PV) of differential temperature input: −(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	No retransmission output, Input 1_ Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range high (Control with PV select: PV select input range high) Input 1_Deviation: +(Input 1_Input span) Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range high Input 2_Deviation: +(Input 2_Input span) Manipulated output value: 100.0 Measured value (PV) of differential temperature input: 100

- **Retransmission output 1 scale low [Engineering Mode: Function block No. 31 (Fn31)]**

Parameter symbol	Data range	Factory set value
ALS1	Same as Retransmission output 1 scale high	No retransmission output, Input 1_Measured value (PV), Input 1_Local SV, Input 1_SV monitor value, and Remote setting input value: Input 1_Input range low (Control with PV select: PV select input range low) Input 1_Deviation: −(Input 1_Input span) Input 2_Measured value (PV), Input 2_Local SV, and Input 2_SV monitor value: Input 2_Input range low Input 2_Deviation: −(Input 2_Input span) Manipulated output value: 0.0 Measured value (PV) of differential temperature input: -100

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

Parameter symbol	Data range	Factory set value
Ao2	Same as Retransmission output 1	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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
AHS2	Same as Retransmission output 1 scale high	Same as Retransmission output 1 scale high

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

Parameter symbol	Data range	Factory set value
ALS2	Same as Retransmission output 1 scale low	Same as Retransmission output 1 scale low

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

Parameter symbol	Data range	Factory set value
Ao3	Same as Retransmission output 1	3

📖 To display “Retransmission output 3 type”, choose “Current output” in Function block No. 30: Universal output type selection” (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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
AHS3	Same as Retransmission output 1 scale high	Same as Retransmission output 1 scale high

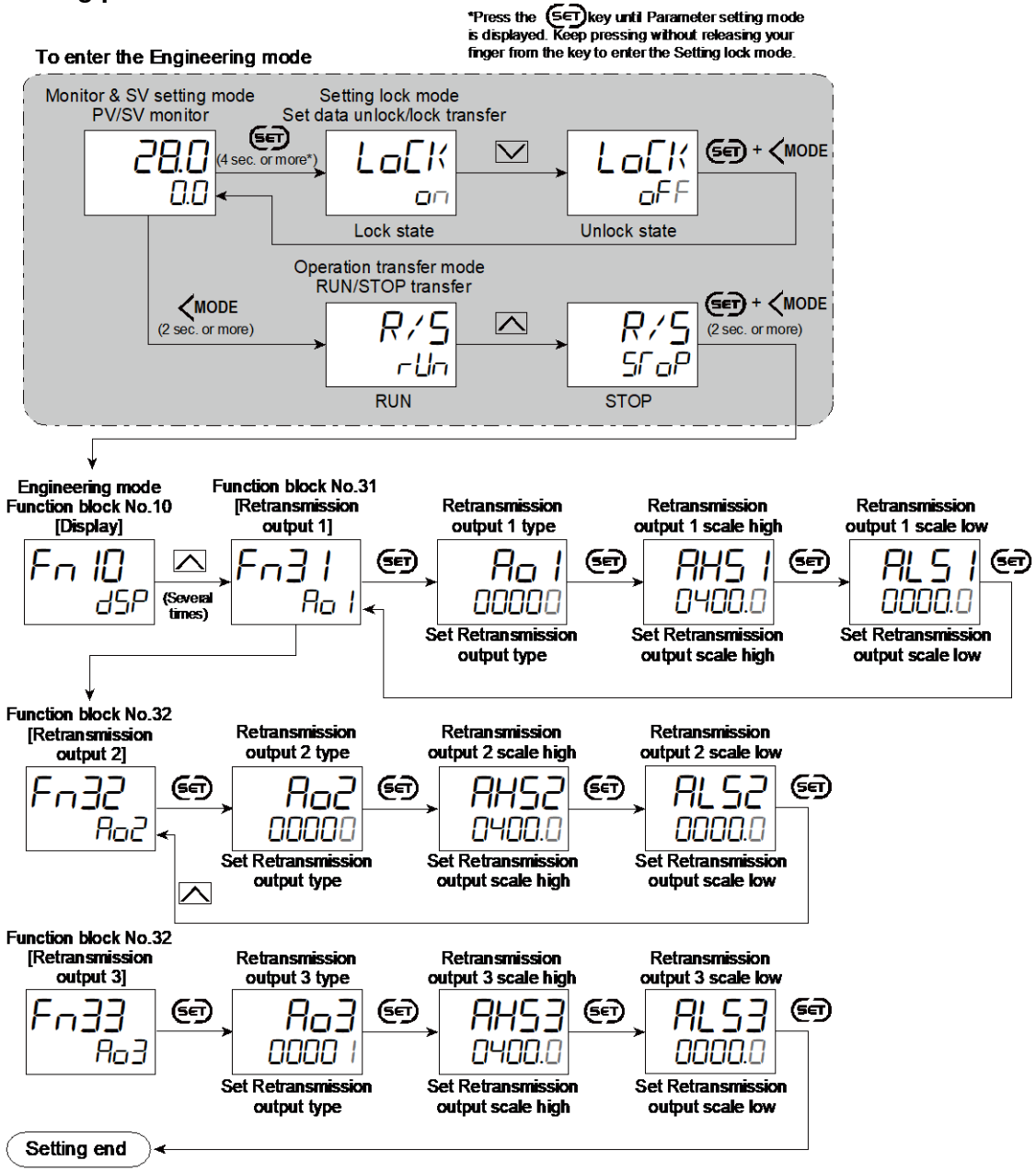
📖 To display “Retransmission output 3 scale high”, choose “Current output” in Function block No. 30: Universal output type selection” (Engineering mode).

- **Retransmission output 3 scale low [Engineering Mode: Function block No. 33 (Fn33)]**

Parameter symbol	Data range	Factory set value
ALS3	Same as Retransmission output 1 scale low	Same as Retransmission output 1 scale low

📖 To display “Retransmission output 3 scale low”, choose “Current output” in Function block No. 30: Universal output type selection” (Engineering mode).

Setting procedure



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

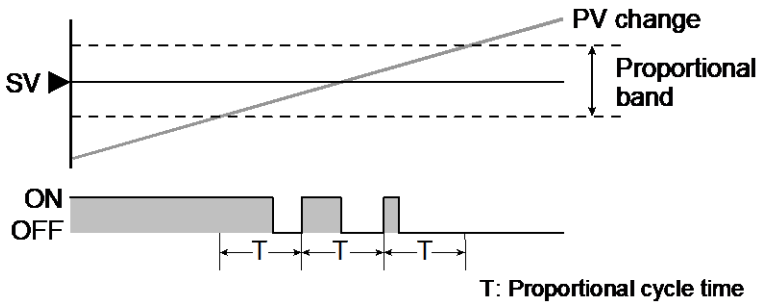
6.4 Changing Proportional Cycle Time

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.



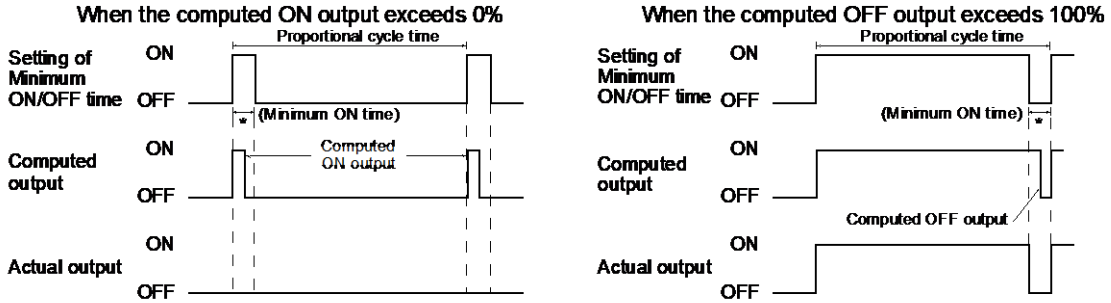
More precise control can be achieved by shortening Proportional cycle time, however, the life of operating unit (Relay etc.) can be shortened based on the feature of the specific controlled object

- **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 available 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 available 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

- **OUT3 proportional cycle time [Setup Setting Mode: Setting group No. 30 (Sn30)]**

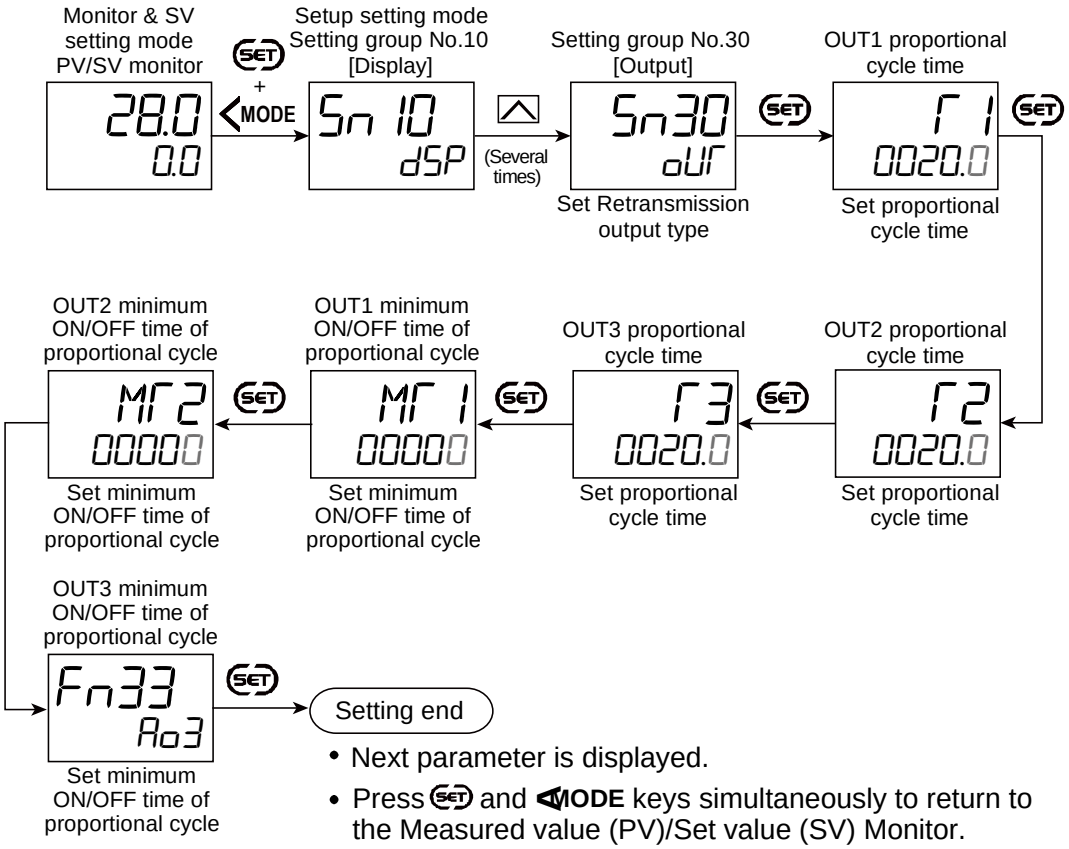
Parameter symbol	Data range	Factory set value
r3	0.1 to 100.0 seconds	2.0

To display “OUT3 proportional cycle time”, choose “Voltage pulse output” in Function block No. 30: Universal output type selection” (Engineering mode).

- **OUT3 minimum ON/OFF time of proportional cycle [Setup Setting Mode: Setting group No. 30 (Sn30)]**

Parameter symbol	Data range	Factory set value
MR3	0 to 1000 ms	0

To display “OUT3 minimum ON/OFF time of proportional cycle”, choose “Voltage pulse output” in Function block No. 30: Universal output type selection (Engineering mode).



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

6.5 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

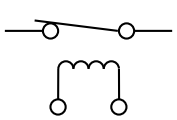
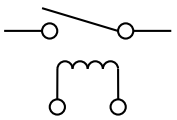
● Outputs selectable to energize or de-energize

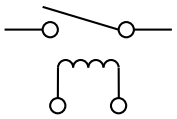
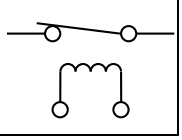
Logic calculation output: Event, Input error status
Instrument Status Output: RUN, Manual mode, Remote mode, Autotuning (AT), While Set value (SV) is changing, Communication monitoring result

● 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
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%)

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 at STOP

Irrespective of setting Energize/De-energize, the output state at STOP is as follows.
If “Output action at control stop” in Function block No. 30 (Engineering mode) is set to continue the action, setting of Energize/De-energize remains available.

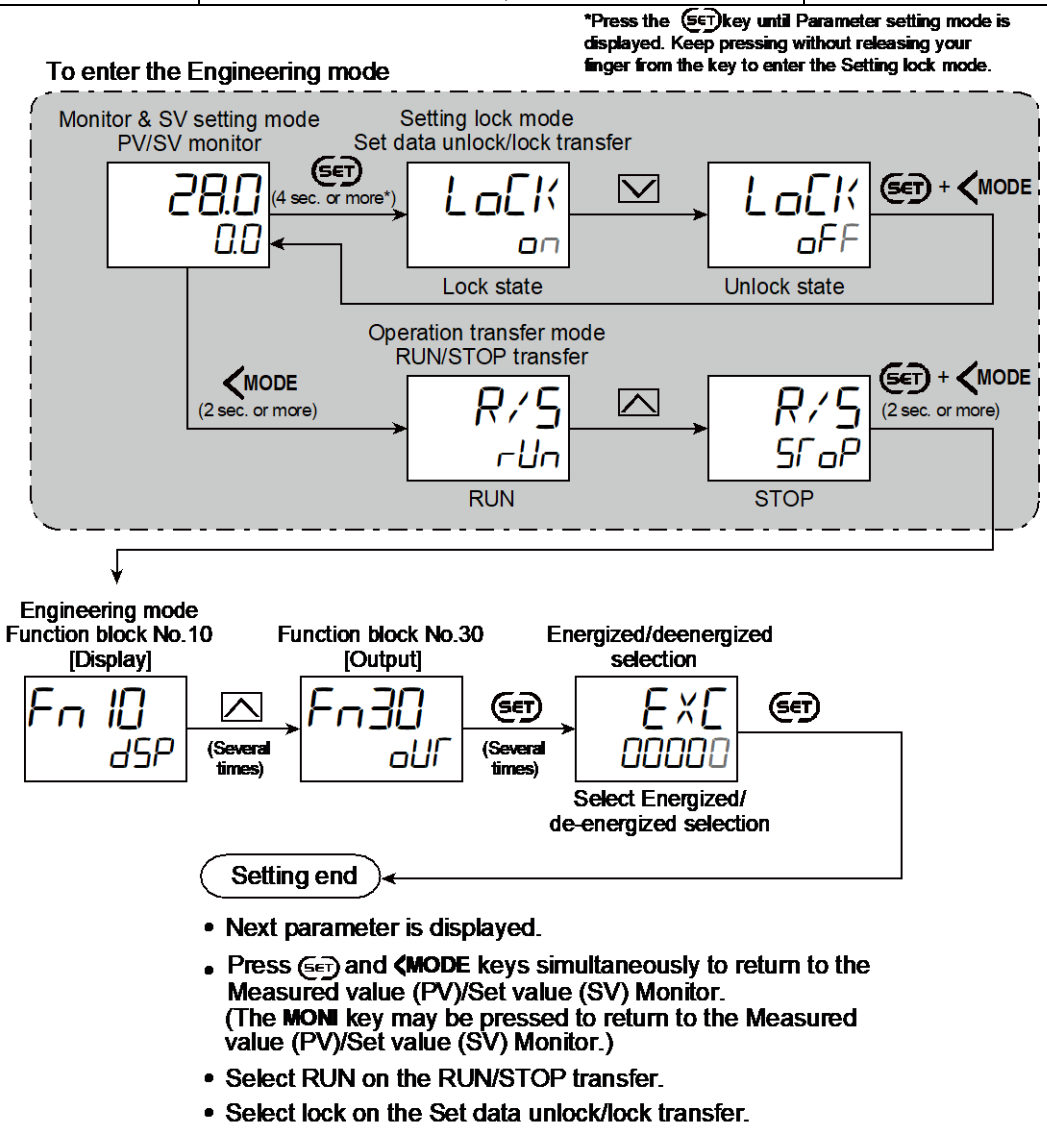
Output type	Output state
Voltage pulse output	OFF
Current output	Outputs the minimum output current (0%)

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	0

	To select two or more functions, sum each value.	

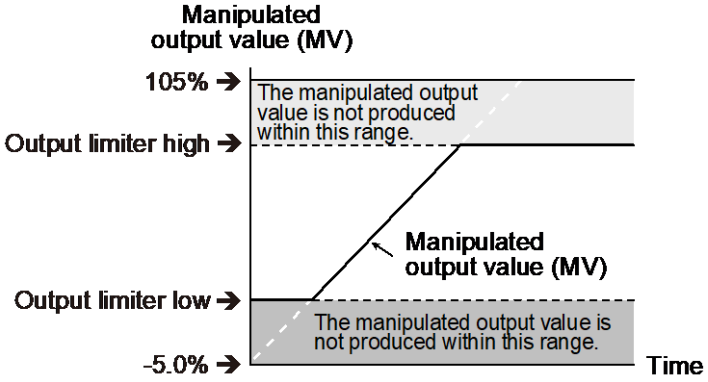


6.6 Limiting Output

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 available in ON/OFF control.

Parameter setting

- **Input 1_Output limiter high [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. oLH	Input 1_Output limiter low [heat-side] to 105.0%	105.0

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Output limiter high [heat-side] is changed.

- **Input 1_Output limiter low [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. oLL	-5.0% to Input 1_Output limiter high [heat-side]	-5.0

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Output limiter low [heat-side] is changed.

- **Input 2_Output limiter high [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. oLH	Input 2_Output limiter low to 105.0%	105.0

To display “Input 2_Output limiter high”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Output limiter high is changed.

- **Input 2_Output limiter low [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. oLL	-5.0% to Input 2_Output limiter high	-5.0

To display “Input 2_Output limiter low”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Output limiter low is changed.

- **Input 1_Output limiter high [cool-side] [Parameter Setting Mode: Parameter group No. 56 (*Pn56*)]**

Parameter symbol	Data range	Factory set value
1.oLHc	Input 1_Output limiter low [cool-side] to 105.0%	105.0

To display “Input 1_Output limiter high [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Output limiter high [cool-side] is changed.

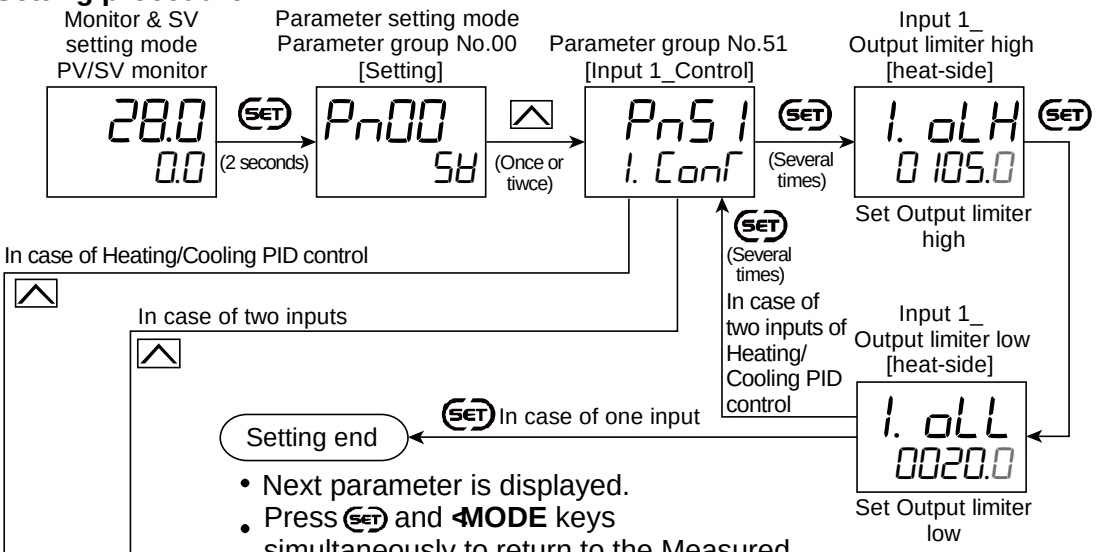
- **Input 1_Output limiter low [cool-side] [Parameter Setting Mode: Parameter group No. 56 (*Pn56*)]**

Parameter symbol	Data range	Factory set value
1.oLLc	−5.0% to Input 1_Output limiter high [cool-side]	−5.0

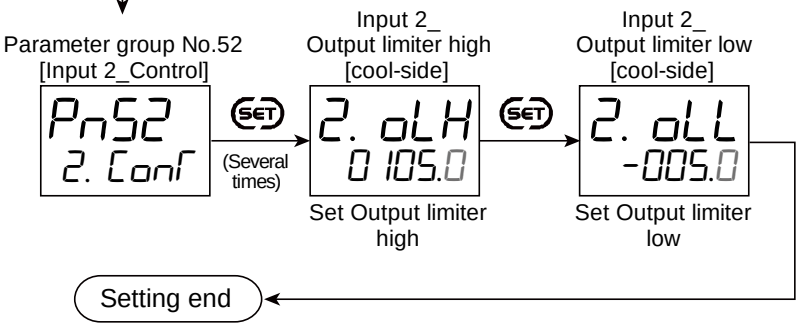
To display “Input 1_Output limiter low [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Output limiter low [cool-side] is changed.

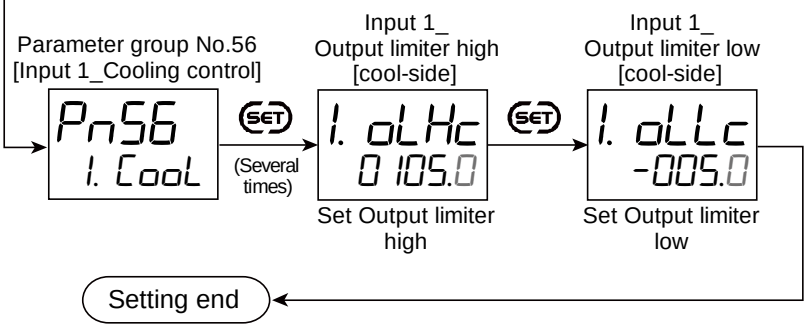
Setting procedure



- Next parameter is displayed.
- Press SET and **◂MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/ Set value (SV) Monitor.)



- Next parameter is displayed.
- Press SET and **◂MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)



- Next parameter is displayed.
- Press SET and **◂MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

6.7 Suppressing Sudden Change in Output (Output Change Rate Limiter)

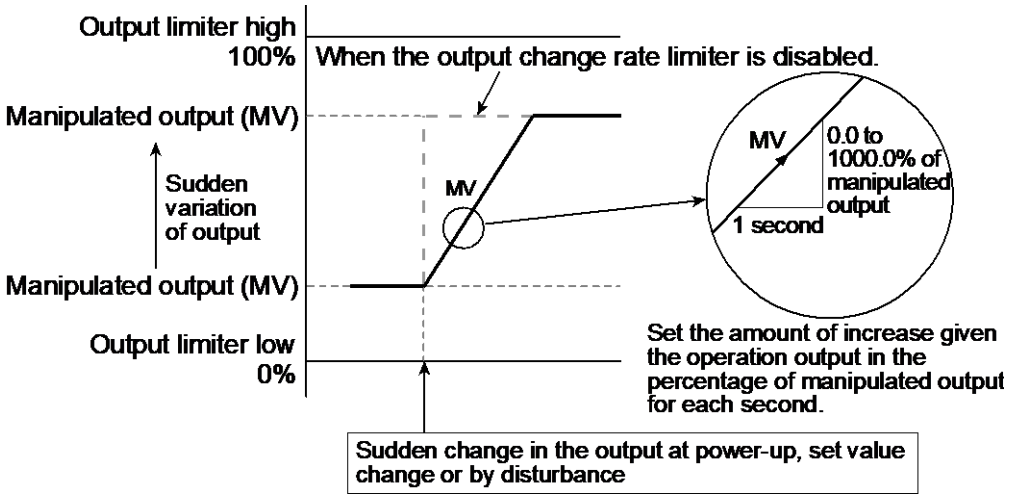
Output change rate limiter may be used to suppress sudden change in output at power on or at the time of set value change.

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 available.

- 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).

- When 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, appropriate PID constants may not be obtained by Autotuning
- The Output change rate limiter is particularly available when a sudden MV change may create uncontrollable situation cause a large current flow. Also, it is available especially when current output or voltage output is used as control output.
- Output change rate limiter may be also available in Manual mode (including communication). 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 will be unavailable when control is stopped (at STOP), when control action is an ON/OFF control or MC-(V)COS(R) Pressure control operation.

Parameter setting

- **Input 1_Output change rate limiter (up) [heat-side] [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. oRU	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

- **Input 1_Output change rate limiter (down) [heat-side] [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. oRd	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

- **Input 2_Output change rate limiter (up) [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. oRU	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

📖 To display “Input 2_Output change rate limiter (up)”, choose “2-loop control/ Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Output change rate limiter (down) [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. oRd	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

📖 To display “Input 2_Output change rate limiter (down)”, choose “2-loop control/ Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Output change rate limiter (up) [cool-side] [Engineering Mode: Function block No. 56 (Fn56)]**

Parameter symbol	Data range	Factory set value
1.oRUc	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

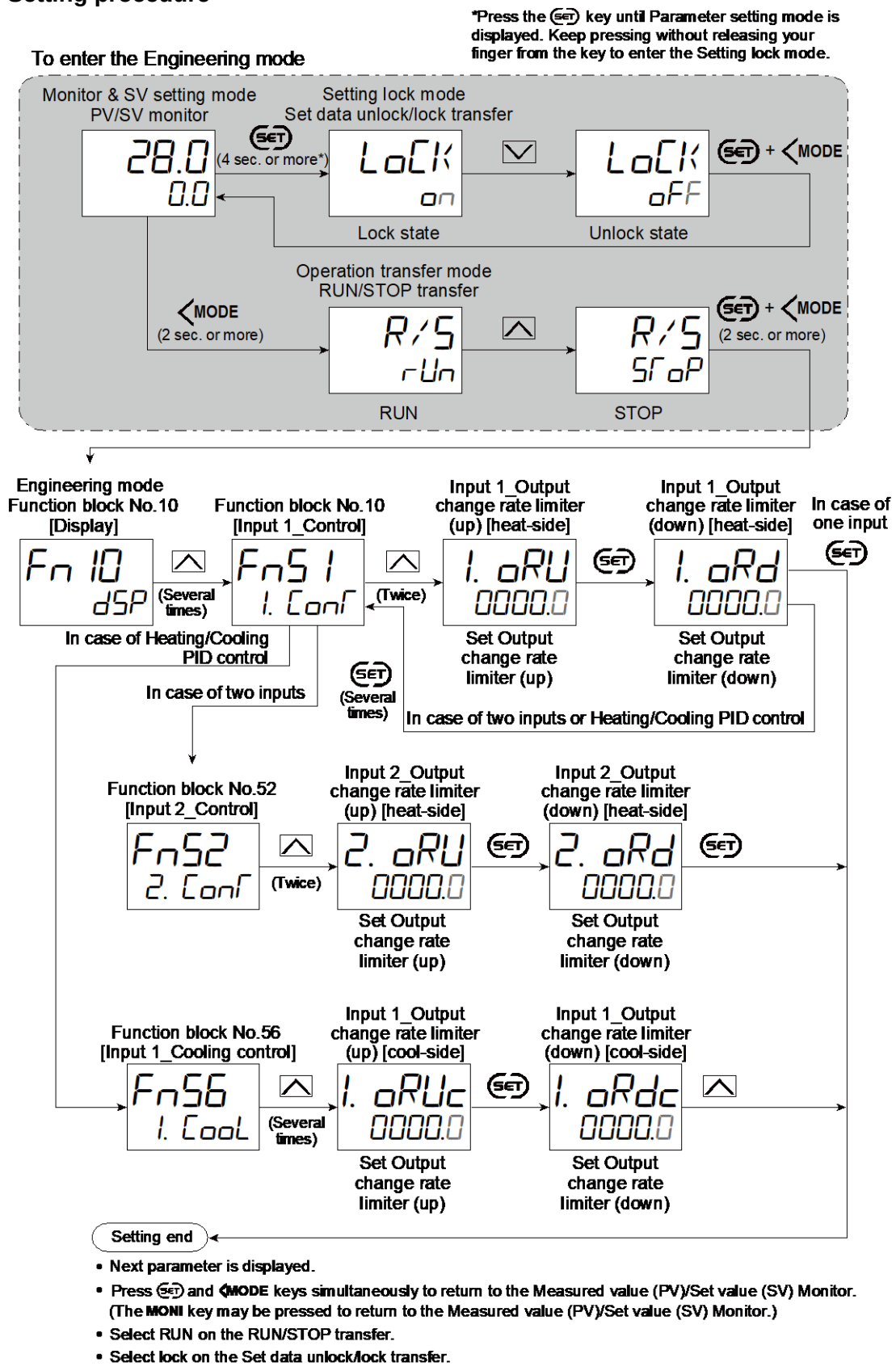
📖 To display “Input 1_Output change rate limiter (up) [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode).

- **Input 1_Output change rate limiter (down) [cool-side] [Engineering Mode: Function block No. 56 (Fn56)]**

Parameter symbol	Data range	Factory set value
1.oRdc	0.0 to 1000.0%/seconds of manipulated output 0.0: OFF	0.0

📖 To display “Input 1_Output change rate limiter (down) [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode)

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

6.8 Suppressing Sudden Change in Output (Balanceless Bumpless)

Balanceless bumpless may be used to suppress sudden output change when the control is transferred from Auto mode to Manual mode (or Manual mode to Auto mode).

Description of function

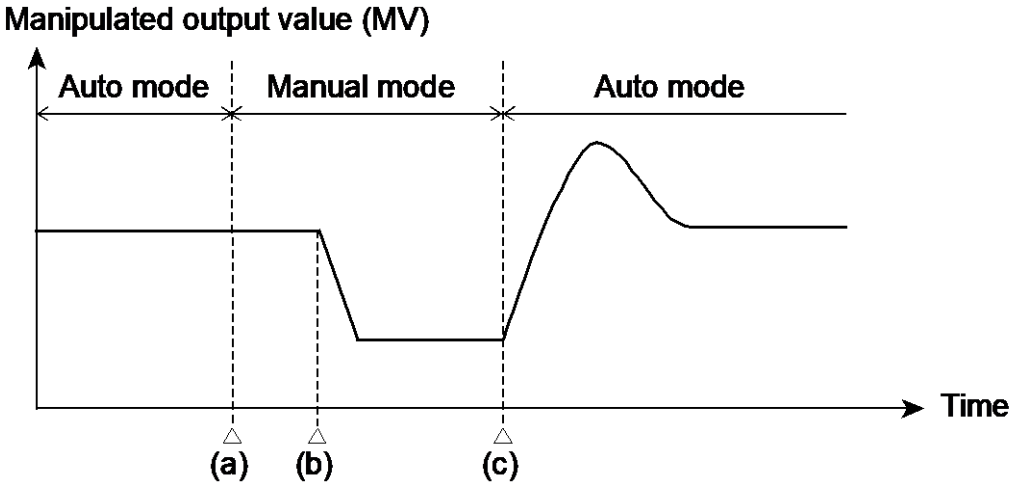
Manipulated output value, when transferred from Auto mode to Manual mode, depends on the setting of “Manual manipulated output value selection.” Selection of “Use the most recent manipulated output value” (balanceless bumpless function) or “Use the Manual manipulated output value*” (bump action) can be selected in “Manual manipulated output value selection.”

* The Manual manipulated output value is the last manipulated output value in Manual mode before the mode is transferred from Auto mode to Manual mode.
Note that the Manual manipulated output value can be preset in advance in the Setup setting mode before the mode is transferred to Manual mode.

When the mode is transferred from Manual mode to Auto mode, 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 Auto mode is transferred to Manual mode and vice versa.



(a) Transfer from Auto mode to Manual mode.
However, when the mode is transferred to Manual mode, the Manipulated output value used in Auto mode will be used as the manual output value in Manual mode.

(b) The manipulated output value is changed (Manual mode function)

(c) Transfer from Manual mode to Auto mode.
When the mode is transferred to Auto mode, the controller starts PID control based on the MV used in Manual mode.

- Bumpless action associated with Auto/Manual transfer at the time of memory area selection

This instrument allows Auto/Manual transfer at the time of Memory area selection. Selection of balanceless bumpless action and bump action can be made at the time of Auto/Manual transfer.

[Parameters to set up]

- Auto/Manual transfer selection (Area)

This setting is used to select whether the mode should be transferred to Auto mode or Manual mode at the time of Memory area selection. This setting is also used to select balanceless bumpless action or bump action at the time of Auto/Manual transfer.

- Manipulated output value (Area)

This setting is used to set a manipulated output value when Bump action is selected at the time of Auto/Manual selection (area). This setting is used in Auto mode and Manual mode in common.

📖 There are several ways to select a memory area.
Refer to 10.3 Storing the Control Related Settings (Memory Area Function) or the Quick Start Guide (172-65706M) for the selection by key operation. Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the selection by Digital input (DI).
Refer to 10.5 Executing Simple Program Operation or 10.6 Executing Simple Sequence Operation for the selection by Memory area soak time.

📖 Bumpless/Bump action by “Auto/Manual transfer selection (Area)” has a priority over the Bumpless/Bump action by “Manual manipulated output value selection.”

📖 Unavailable when “Pressure control operation [MC-(V)COS(R)]” is selected in Control action.

Parameter setting

- **Manual manipulated output value selection [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
MVFS	0: The last manipulated output value (Balanceless bumpless function) 1: Manual manipulated output value	0

- **Input 1_Manual manipulated output value [Setup Setting Mode: Setting group No. 51 (Sns1)]**

Parameter symbol	Data range	Factory set value
1. MMV	PID control, Position proportioning PID control: Input 1_Output limiter low [heat-side] to Input 1_ Output limiter high [heat-side] Heating/Cooling PID control: -(Input 1_Output limiter high [cool-side]) to +(Input 1_ Output limiter high [heat-side]) Pressure/Temperature control operation [MC-(V)COS(R)]: Input 1_Output limiter low [heat-side] to whichever the smaller value of either "calculated value from Input 1_Pressure (temperature) limiter" or "Input 1_Output limiter high [heat-side]	PID control, Pressure or Temperature control by MC-(V)COS(R): −5.0 Heating/Cooling PID control: 0.0

Heating/Cooling PID control has exceptional conditions as follows for the data range when:

(1) Input 1_Output limiter high [cool-side] is less than or equal to 0.0%
- Input 1_Output limiter low [heat-side] is less than or equal to 0.0%: 0.0 % to +(Input 1_Output limiter high [heat-side])
- Input 1_Output limiter low [heat-side] is less than or equal to 0.0%: Input 1_Output limiter low [heat-side] to Input 1_Output limiter high [heat-side]

(2) Input 1_Output limiter high [heat-side] is less than or equal to 0.0%
- Input 1_Output limiter low [cool-side] is less than or equal to 0.0%: -(Input 1_Output limiter high [cool-side]) to 0.0%
- Input 1_Output limiter low [cool-side] is greater than 0.0%: -(Input 1_Output limiter high [cool-side]) to -(Input 1_Output limiter low [cool-side])

(3) Fixed at 0.0% in the following cases:
Input 1_Output limiter high [cool-side] less than or equal to 0.0%, AND Input 1_Output limiter high [heat-side] less than or equal to 0.0%

- **Input 2_Manual manipulated output value [Setup Setting Mode: Setting group No. 52 (SnS2)]**

Parameter symbol	Data range	Factory set value
2. M.MV	PID control: Input 2_Output limiter low to Input 2_Output limiter high Pressure/Temperature control operation [MC-(V)COS(R)]: Input 2_Output limiter low [heat-side] to whichever the smaller value of either "calculated value from Input 2_Pressure (temperature) limiter" or "Input 2_Output limiter high [heat-side]. When STOP is set, Input 2_Output limiter low [heat-side] to Input 2_Output limiter high [heat-side]	-5.0

📖 To display “Input 2_Manual manipulated output value”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Auto/Manual transfer selection (Area) [Parameter Setting Mode: Parameter group No. 70 (PnA0)]**

Parameter symbol	Data range	Factory set value
1A/M.A	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump)	0

- **Input 1_Manipulated output value (Area) [Parameter Setting Mode: Parameter group No. 70 (PnA0)]**

Parameter symbol	Data range	Factory set value
1. MV.A	Heating/Cooling PID control: -105.0 to +105.0% Other:-5.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 1_Auto/Manual transfer selection (Area)]	Heating/Cooling PID control:0.0 Other: -5.0%

- **Input 2_Auto/Manual transfer selection (Area) [Parameter Setting Mode: Parameter group No. 70 (PnA0)]**

Parameter symbol	Data range	Factory set value
2A/M.A	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump)	0

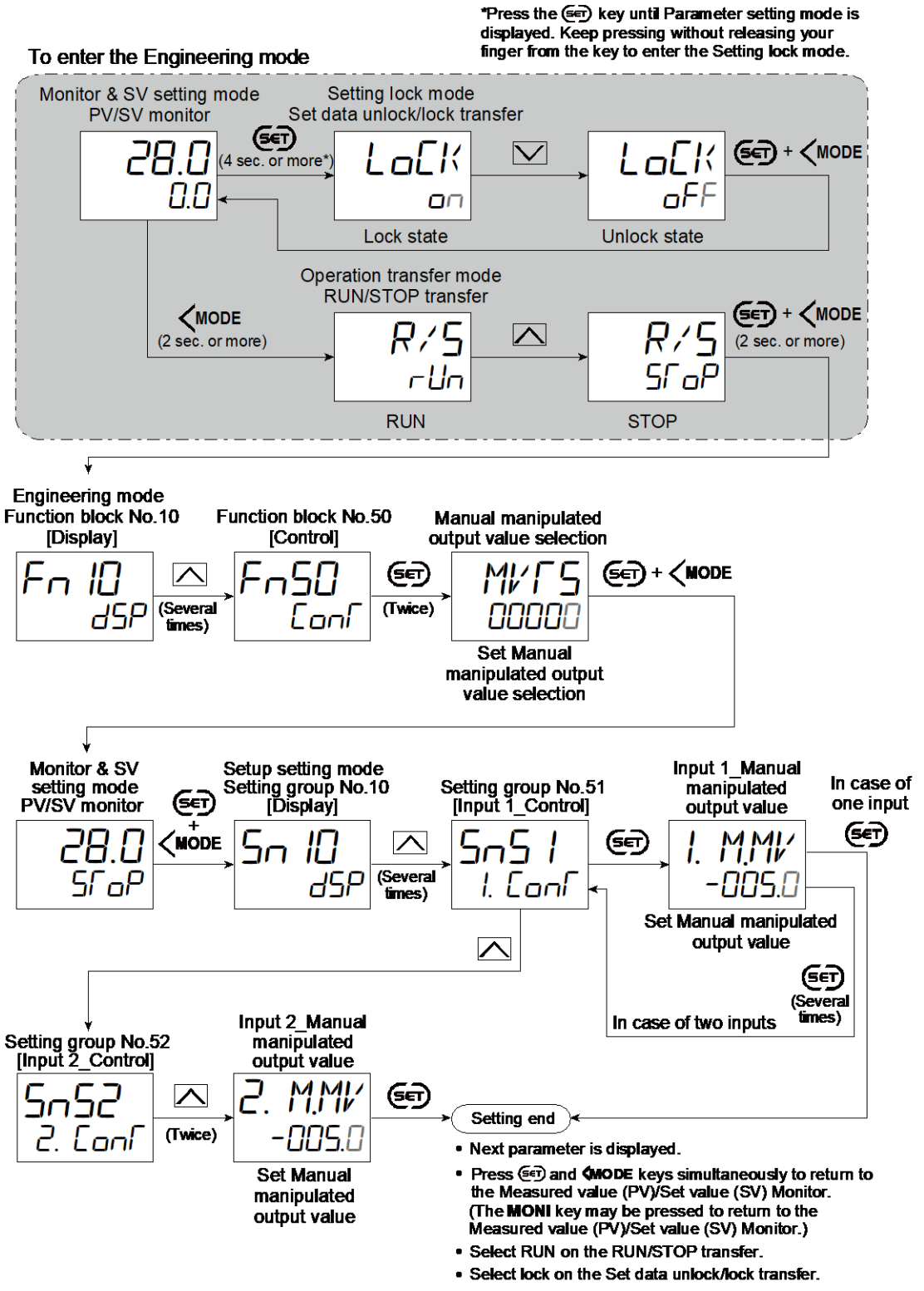
📖 To display “Input 2_Auto/Manual transfer selection (Area)”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Manipulated output value (Area) [Parameter Setting Mode: Parameter group No. 70 (PnA0)]**

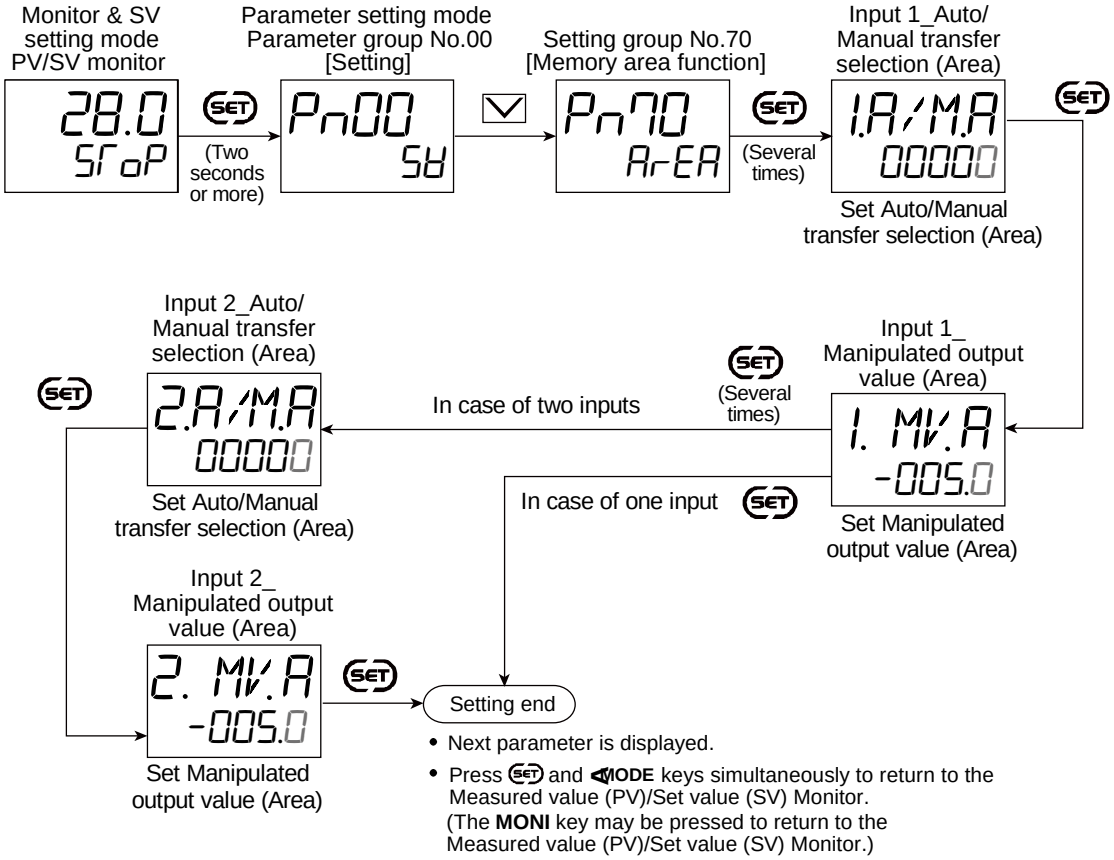
Parameter symbol	Data range	Factory set value
2. MV.A	-5.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 2_Auto/Manual transfer selection (Area)]	-5.0

📖 To display “Input 2_Manipulated output value (Area)”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



- **Setting "Auto/Manual transfer selection (Area)" and "Manipulated output value (Area)"**



6.9 Changing the Output Action While in Control Stop Mode

This instrument can continue supplying Retransmission output and Event outputs, or output Manipulated output value, even while Control is stopped.

Description of function

- Retransmission output, Logic calculation output, and Instrument status output while in Control stop mode

The following three types can be continued to output even while in control stop mode. Multi types can be selected.

- Retransmission output

Logic calculation output

- Other: -5.0% [Event, Input error status]
- Instrument Status Output [Manual mode, Remote mode, While Set value (SV) is changing, Communication monitoring result]

Continued output types while in "Control stop" cannot be selected by the output. For example, this combination is not available:
Event 1: Continue to output even while in Control stop. Event 2: Output to be stopped.
Selection can be made in the unit of Retransmission output, Logic operation output, Instrument status output.

- Manipulated output value at STOP

Manipulated output value at STOP is a function to produce the preset manipulated output value at Control STOP. In the case of Heating/Cooling PID control, Manipulated output value can be set on both sides of heating and cooling. Likewise, in case of a dual output type, manipulated output value can be set on both sides of Control output 1 and 2.

Parameter setting

- **Output action at control stop [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
55	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

- **Input 1_Manipulated output value at STOP [heat-side] [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. RMV	-5.0 to +105.0%	-5.0

- **Input 2_Manipulated output value at STOP [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. RMV	-5.0 to +105.0%	-5.0

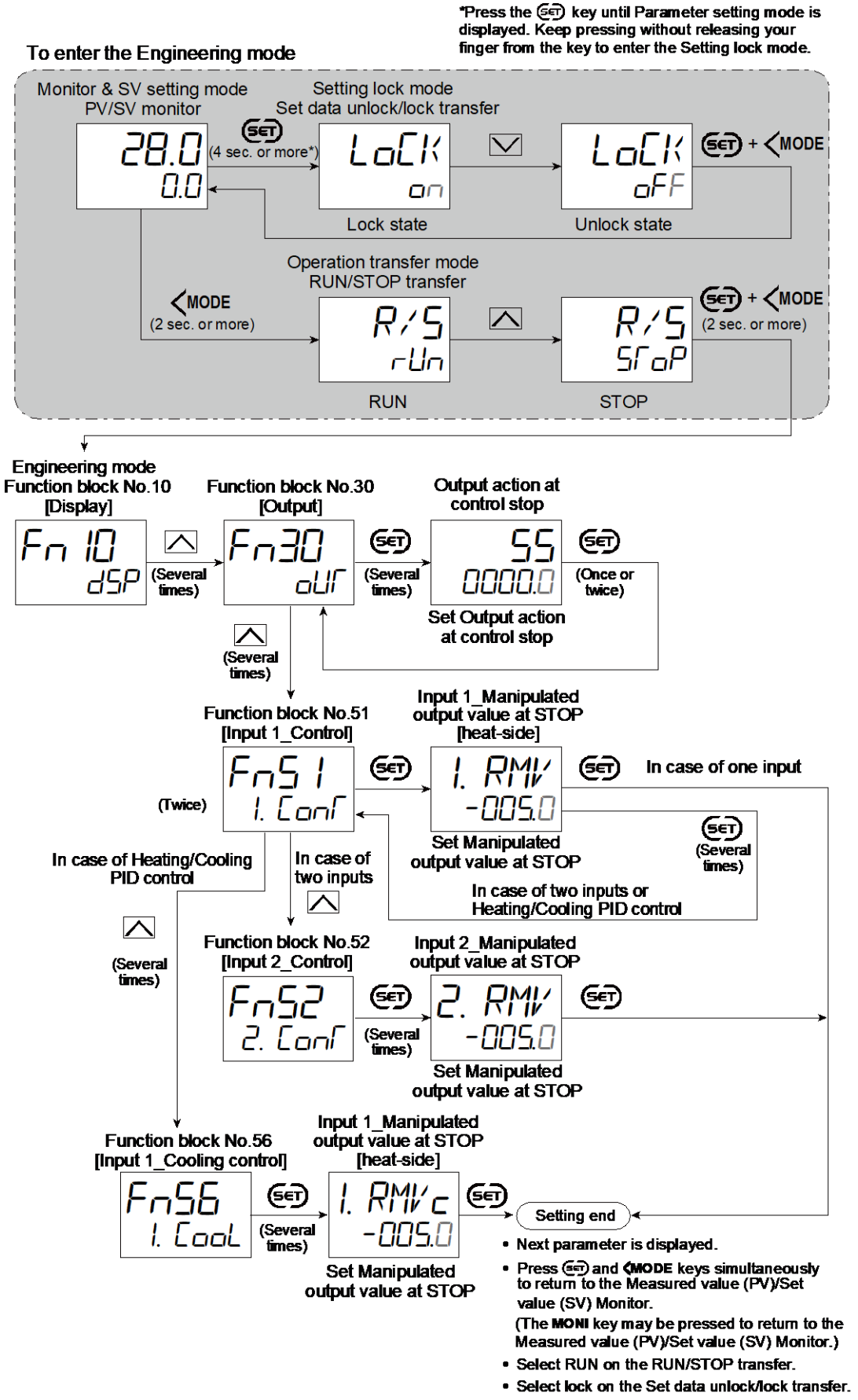
To display “Input 2_Manipulated output value at STOP”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Manipulated output value at STOP [cool-side] [Engineering Mode: Function block No. 56 (Fn56)]**

Parameter symbol	Data range	Factory set value
1.RMVc	-5.0 to +105.0%	-5.0

To display “Input 1_Manipulated output value at STOP [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode).

Setting procedure



6.10 Monitoring Manipulated Output Value

Manipulated output value can be monitored on this instrument.

Display contents

- **Input 1_Manipulated output value monitor [heat-side] [Monitor & SV Setting Mode]**

Parameter symbol	Data range	Factory set value
1. MV	–5.0 to +105.0%	

- **Input 1_Manipulated output value monitor [cool-side] [Monitor & SV Setting Mode]**

Parameter symbol	Data range	Factory set value
1. MVc	–5.0 to +105.0%	

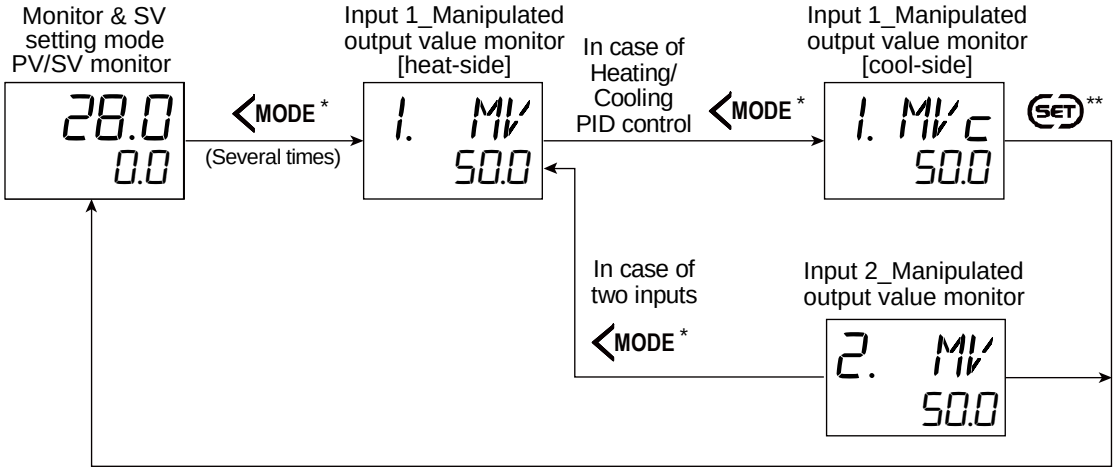
To display “Input 1_Manipulated output value monitor”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode).

- **Input 2_Manipulated output value monitor [Monitor & SV Setting Mode]**

Parameter symbol	Data range	Factory set value
2. MV	-5.0 to +105.0%	

To display “Input 2_Manipulated output value monitor”, choose “2-loop control/ Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Display operation

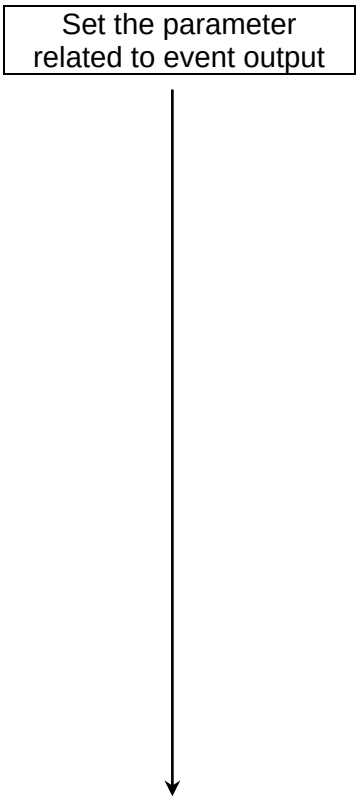


* The **MONI** key may be used instead.

** The **R.SET** key may be used to return.

7. Event Function

7.1 Using Event Function



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 at control stop

☞ Refer to 6.1 Changing Output Assignment 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 6.5 Changing Energizing/De-energizing Output for Energized/De-energized selection.

☞ Refer to 7.5 Keeping the Event State (Interlock Function) and 7.6 Releasing the Event State (Interlock Release) for Interlock function.

☞ Refer to 6.9 Changing the Output Action While in Control Stop Mode for Output action at control stop.

Set the following parameters:

- Event assignment
- Event type
- Event hold action
- Event differential gap
- Event timer

☞ Refer to 7.1.1 Changing input for event for event assignment.

☞ Refer to 7.1.2 Changing event type for event type.

☞ Refer to 7.1.3 Adding hold action to the event action) for event hold action.

☞ Refer to 7.1.4 Setting a differential gap in event action for event differential gap.

☞ Refer to 7.1.5 Preventing event from turning on due to a transient abnormal input for Event timer.

Set the Event set value.

☞ Refer to 7.1.7 Changing the event set value for event set value.

7.1.1 Changing input for event

On this instrument input signal can be individually set for each event.

- Input 1
- Input 2
- Differential temperature input

Description of function

There are four actions available for event; Deviation action, Input value action, Set value action, and Manipulated output value action. Each event uses its own value.

- **Deviation action**

For Input 1: Deviation = Input 1_Measured value (PV) – Input 1_Set value (SV)
For Input 2: Deviation = Input 2_Measured value (PV) – Input 2_Set value (SV)
For Differential temperature input: Deviation = Measured value (PV) of differential temperature input – Set value (SV) of differential temperature input

- **Input value action**

For Input 1: Input value = Input 1_Measured value (PV)
For Input 2: Input value = Input 2_Measured value (PV)
For Differential temperature input: Input value = Measured value (PV) of differential temperature input

- **Set value action**

For Input 1: Set value = Input 1_Set value (SV)
For Input 2: Set value = Input 2_Set value (SV)
For Differential temperature input: Set value = Set value (SV) of differential temperature input

- **Manipulated output value action**

For Input 1: Manipulated output value = Input 1_ Manipulated output value (MV)
For Input 2: Manipulated output value = Input 2_ Manipulated output value (MV)
For Differential temperature input: Manipulated output value = Input 1_Manipulated output value (MV)

Parameter setting

- **Event 1 assignment [Engineering Mode: Function block No. 41 (Fn4 1)]**

Parameter symbol	Data range	Factory set value
EVA1	1: Input 1 2: Input 2 3: Differential temperature input	1

To display “Event 1 assignment”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Event 1 assignment is changed.

- **Event 2 assignment [Engineering Mode: Function block No. 42 (Fn42)]**

Parameter symbol	Data range	Factory set value
EVA2	1: Input 1 2: Input 2 3: Differential temperature input	1

📖 To display “Event 2 assignment”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Event 2 assignment is changed.

- **Event 3 assignment [Engineering Mode: Function block No. 43 (Fn43)]**

Parameter symbol	Data range	Factory set value
EvA3	1: Input 1 2: Input 2 3: Differential temperature input	1

📖 To display “Event 3 assignment”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Event 3 assignment is changed.

- **Event 4 assignment [Engineering Mode: Function block No. 44 (Fn44)]**

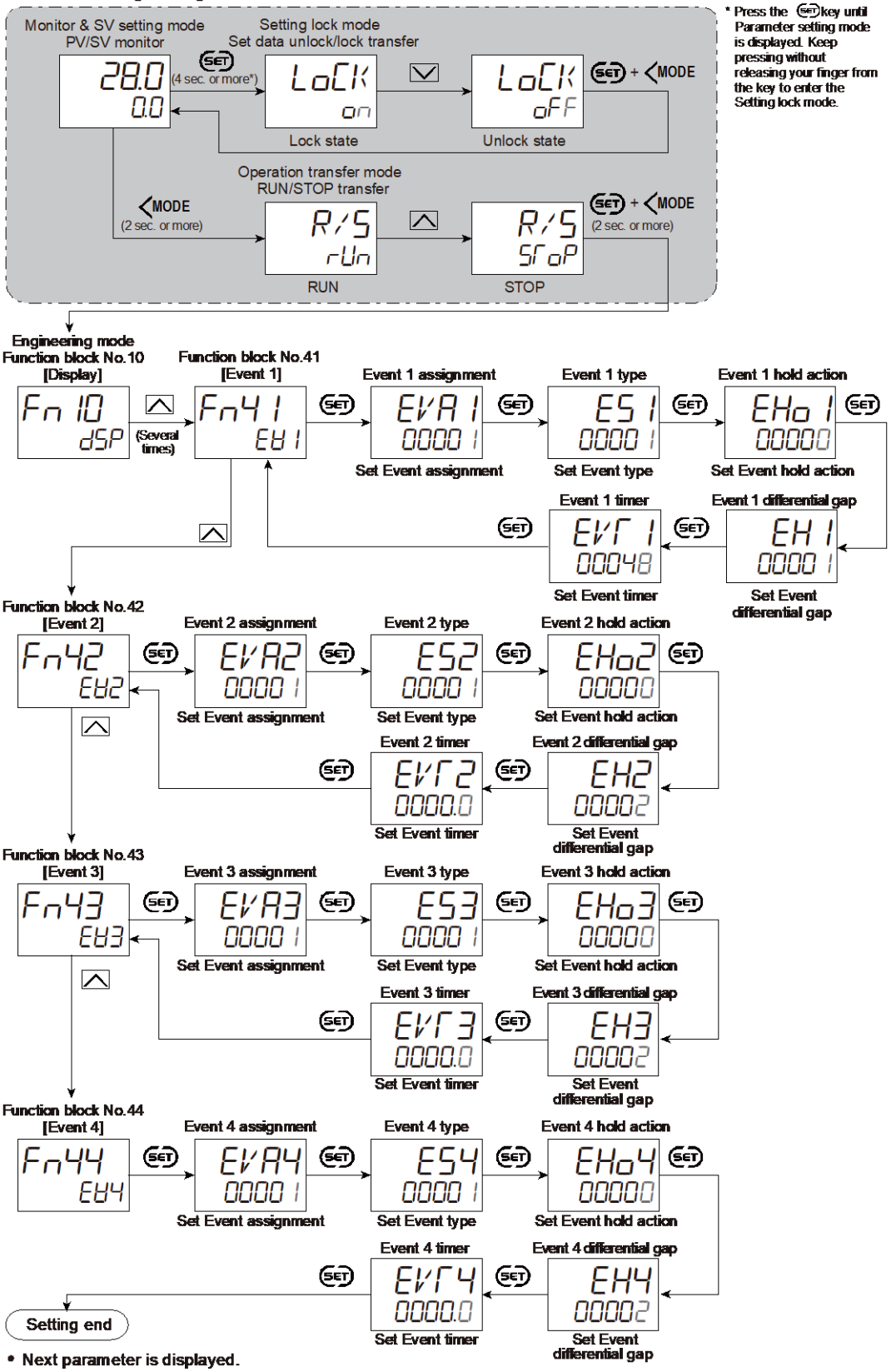
Parameter symbol	Data range	Factory set value
EvA4	1: Input 1 2: Input 2 3: Differential temperature input	1

📖 To display “Event 4 assignment”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Event 4 assignment is changed.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press SET and ❮MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

7.1.2 Changing event type

There are 24 types of event in total.

- Event type

Set value	Event type
0	None
1	Deviation high (Using SV monitor value) [1)]
2	Deviation low (Using SV monitor value) [1)]
3	Deviation high/low (Using SV monitor value) [1)]
4	Band (Using SV monitor value) [1)]
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)
8	SV low (Using SV monitor value)
9	Process high [2)]
10	Process low [2)]
11	Deviation high (Using local SV) [1)]
12	Deviation low (Using local SV) [1)]
13	Deviation high/low (Using local SV) [1)]
14	Band (Using local SV) [1)]
15	Deviation high/low (Using local SV) [High/Low individual setting] [1)]
16	Band (Using local SV) [High/Low individual setting] [1)]
17	SV high (Using local SV)
18	SV low (Using local SV)
19	MV high [heat-side] [2)]
20	MV low [heat-side] [2)]
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)]

Event type is set to 0 when shipped from the factory.

[1)] Event hold and re-hold action is available.

[2)] Event hold action is available.

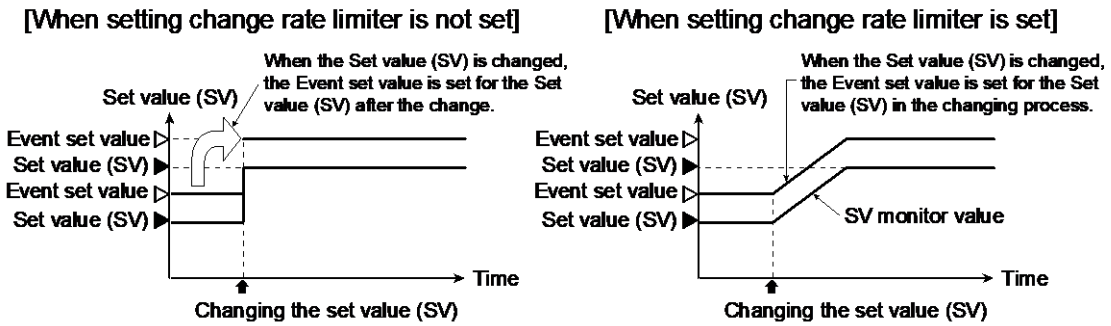
Description of function

- **Deviation action**

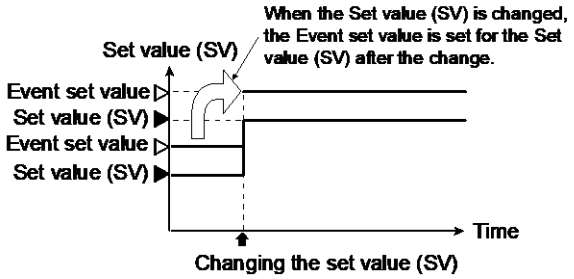
When the deviation (PV - SV) reaches the Event set value, event ON occurs.
SV monitor value type and local SV value type are available for Deviation action.

SV monitor value type	The Event set value is set for the SV monitor value. Soft start/Setting change rate limiter adjust the Event set value to follow the same change rate of SV monitor value. SV monitor value: SV monitor value is displayed in the Measured value (PV)/Set value (SV) monitor screen (Monitor & SV setting mode). When Soft start/Setting change rate limiter are set, the Set value (SV) in the changing process is displayed.
Local SV type	The Event set value is set for the Set value (SV) [Local SV]. Local SV: Local SV is displayed in the Measured value (PV)/Set value (SV) screen (Monitor & SV setting mode).

SV monitor value type



Local SV type



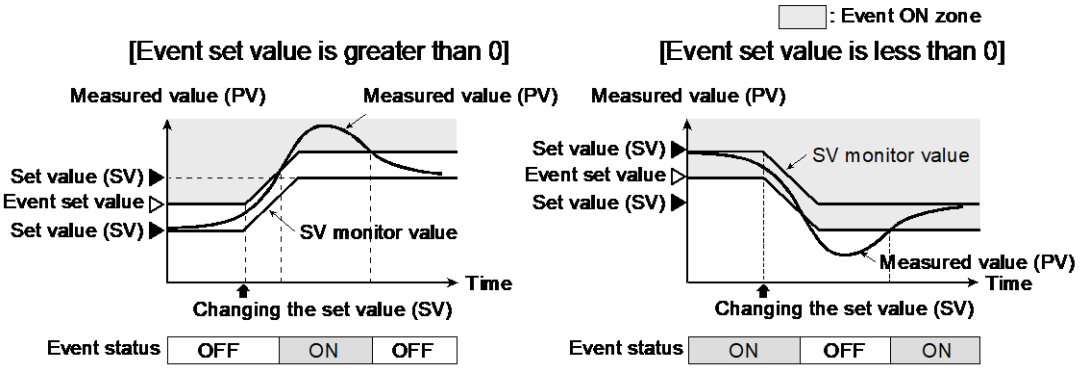
Local SV type has only one type of action on change with or without the Setting change rate limiter.

☞ Refer to 10.2 Eliminating a Sudden Set Value Change (Setting Change Rate Limiter) for the Setting change rate limiter.

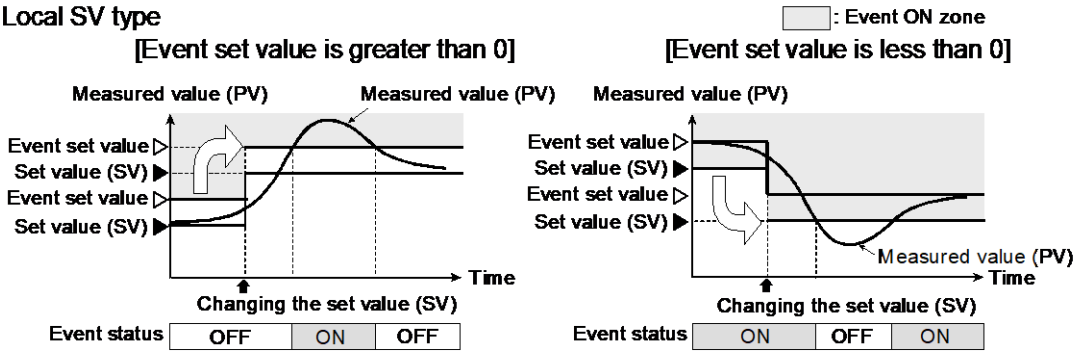
Some examples of Deviation high are described in the following:

Deviation high: When the deviation (PV – SV) is more than the Event set value, the event ON occurs.

SV monitor value type
(Example: When setting change rate limiter is set)



Local SV type

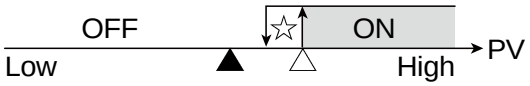


☞ Event turns ON or OFF in accordance with the differential gap setting. Refer to 7.1.4 Setting a differential gap in event action for Event differential gap.

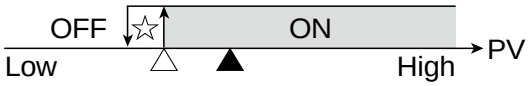
Diagrams of the Deviation action type are shown in the following:
ON: Event action turned on
OFF: Event action turned off
(▲: Set value (SV) △: Event set value ☆: Event differential gap)

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)



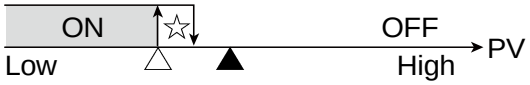
(Event set value is less than 0)



Deviation high
When the deviation (PV – SV) is less than the Event set value, the event ON occurs.

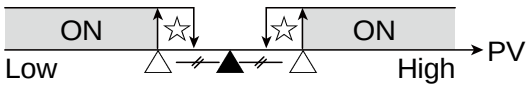
(Event set value is greater than 0)

(Event set value is less than 0)

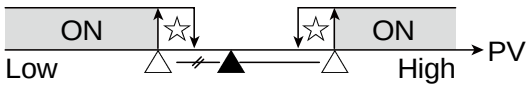


Deviation high/low
Two types of Deviation high/low action are available.
Without high/low individual setting:
When the absolute deviation | PV – SV | is more/less than the Event set values, the event ON occurs.
With high/low individual setting:
High action: When the deviation (PV – SV) is more than the 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)

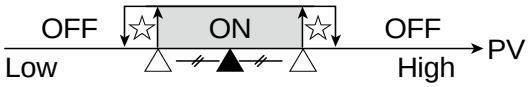


(With High/Low individual setting)

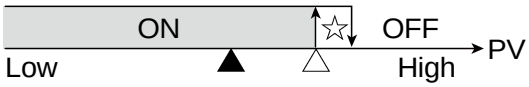


Band
Two types of Band action are available.
Without high/low individual setting:
When the absolute deviation | PV – SV | is within the Event set values, the event ON occurs.
With high/low individual setting:
High action: When the deviation (PV – SV) is less than the Event set value [high], the event 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)



● Set value action

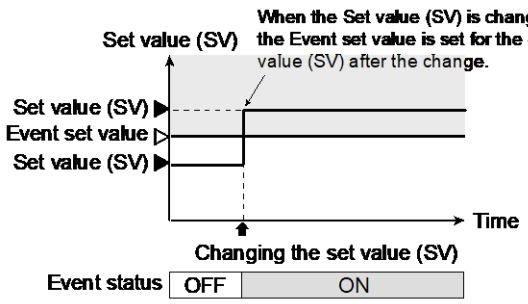
When the Set value (SV) reaches the Event set value, event ON occurs.
SV monitor value type and local SV value type are available for Set value action.

SV monitor value type	Event turns on when SV monitor value reaches Event set value. Setting change rate limiter turns on the event when the Set value (SV) in the changing process reaches Event set value. SV monitor value: SV monitor value is displayed in the Measured value (PV)/Set value (SV) monitor screen (Monitor display mode). When Setting change rate limiter is set, the Set value (SV) in the changing process is displayed.
Local SV type	Event turns on when Set value (SV) [Local SV] reaches Event set value. Local SV: Local SV is displayed in the Measured value (PV)/Set value (SV) screen (SV setting mode).

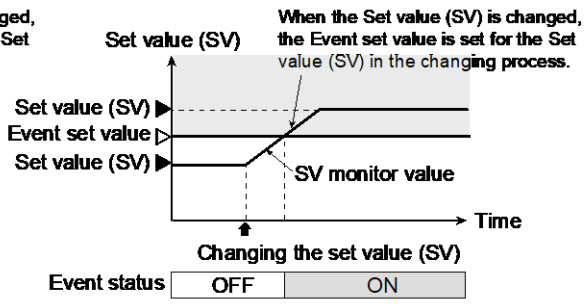
Some examples of SV high are described in the following:
SV high: When the Set value (SV) is more than the Event set value, the event ON occurs.

SV monitor value type

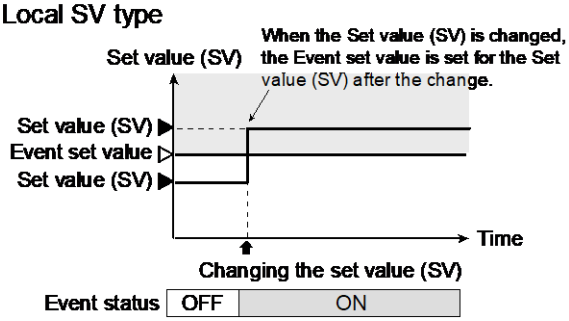
[When Soft start/Setting change rate limiter is not set]



[When Soft start/Setting change rate limiter is set]



Local SV type



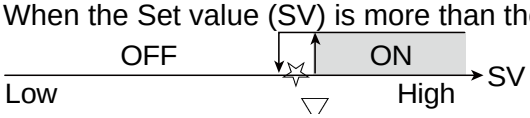
Local SV type has only one type of action on change with or without the Setting change rate limiter.

: Event ON zone

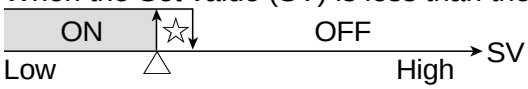
☞ Event turns ON or OFF in accordance with the differential gap setting. Refer to 7.1.4 Setting a differential gap in event action for Event differential gap.

Diagrams of the Set value action type are shown in the following:
ON: Event action turned on
OFF: Event action turned off
(▲: Set value (SV)　△: Event set value　☆: Event differential gap)

SV high
When the Set value (SV) is more than the Event set value, the event ON occurs.



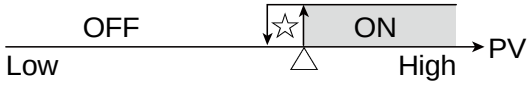
SV low
When the Set value (SV) is less than the Event set value, the event ON occurs.



- **Input value action**

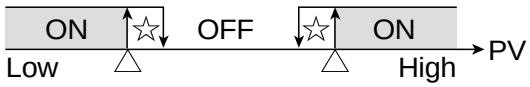
When the Measured value (PV) reaches the Event set value, event ON occurs.
ON: Event action turned on OFF: Event action turned off
(▲: Set value (SV) △: Event set value ☆: Event differential gap)

Process high
When the Measured value (PV) is more than the Event set value, the event ON occurs.

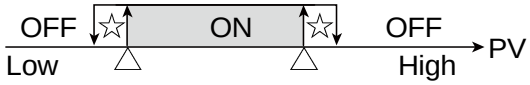


Process low
When the Measured value (PV) is less than the Event set value, the event ON occurs.

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)



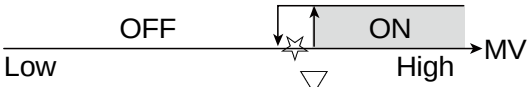
Process band
Process band action can be modified to high and low individual setting.
High action: When the Measured value (PV) is less than the Event set value [high], the event ON occurs.
Low action: When the Measured value (PV) is more than the Event set value [low], the event ON occurs.
(With High/Low 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
(▲: Set value (SV) △: 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 (Fn41)]**

Parameter symbol	Data range	Factory set value
ES1	0: None 1: Deviation high (Using SV monitor value) [1)] 2: Deviation low (Using SV monitor value) [1)] 3: Deviation high/low (Using SV monitor value) [1)] 4: Band (Using SV monitor value) [1)] 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) 8: SV low (Using SV monitor value) 9: Process high [2)] 10: Process low [2)] 11: Deviation high (Using local SV) [1)] 12: Deviation low (Using local SV) [1)] 13: Deviation high/low (Using local SV) [1)] 14: Band (Using local SV) [1)] 15: Deviation high/low (Using local SV) [High/Low individual setting] [1)] 16: Band (Using local SV) [High/Low individual setting] [1)] 17: SV high (Using local SV) 18: SV low (Using local SV) 19: MV high [heat-side] [2)] 20: MV low [heat-side] [2)] 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 action and re-hold action is available. [2)] Event hold action is available.	0

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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
ES2	Same as Event 1 type	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” 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	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Event 4 type is changed.

7.1.3 Adding hold action to the event action

This instrument can be added hold action or re-hold action 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 7.1.2 Setting of Event types for those events that are available with hold or re-hold action.

Description of function

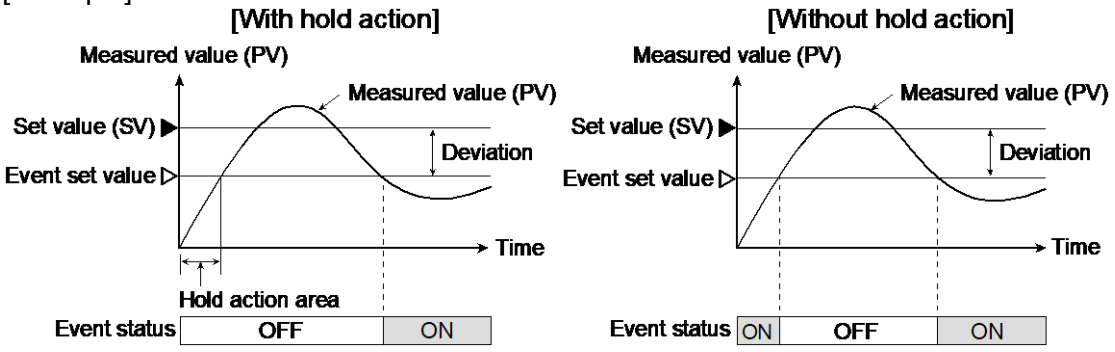
- **Hold action**

When hold action is ON, the event action is suppressed at start-up or STOP to RUN until the measured value has entered the non-event range.

Hold action will be cancelled when Measured value (PV) is in the Event status OFF area

- When the power is turned on
- When transferred from STOP (control STOP) to RUN (control RUN)

[Example] Difference between with and without hold action for deviation low

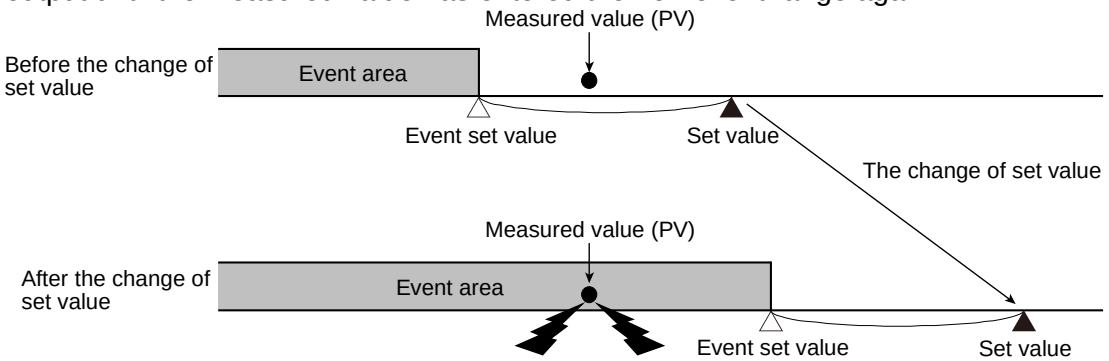


- **Re-hold action**

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 transferred from STOP (control STOP) to RUN (control RUN)	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.

The re-hold action will be unavailable for any of the following.

- Setting of Soft start or Setting change rate limiter is other than “0 (no function)”
- Remote mode
- Cascade control
- Differential temperature control

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.	0

- **Event 2 hold action [Engineering Mode: Function block No. 42 (Fn42)]**

Parameter symbol	Data range	Factory set value
EHo2	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.	0

- **Event 3 hold action [Engineering Mode: Function block No. 43 (Fn43)]**

Parameter symbol	Data range	Factory set value
EHo3	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.	0

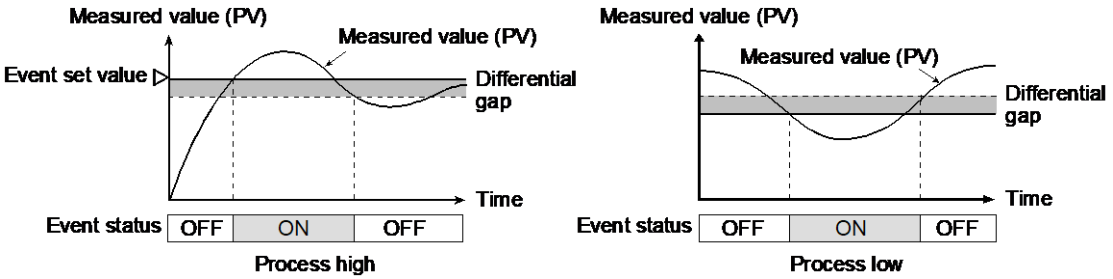
- **Event 4 hold action [Engineering Mode: Function block No. 44 (Fn44)]**

Parameter symbol	Data range	Factory set value
EHo4	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.	0

7.1.4 Setting a differential gap in event action

Description of function

When the measured value (PV) is around the Event set value, event output relay connections sometimes switch frequently between ON and OFF due to an unstable input signal. This 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: • If event assignment is set to either Input 1 or Differential temperature. 0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) • If event assignment is set to Input 2 0 to Input 2_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	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	Same as Event 1 differential gap	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 1 differential gap	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2% of input span MV: 0.2

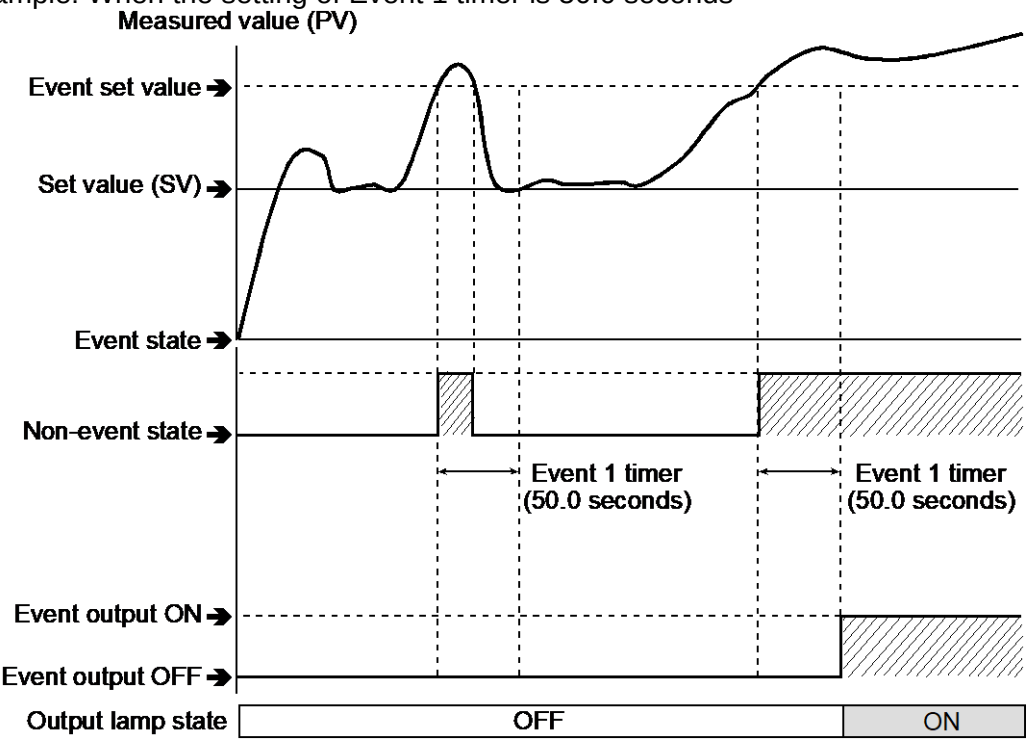
7.1.5 Preventing event from turning on due to a transient abnormal input

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 state 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. If an event state is cancelled while the event timer is activated, no event output is turned on.

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
- When set to the event state simultaneously with control changed to RUN (control start) from STOP (control stop).

📖 In the event hold 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
- Control is changed to STOP (control stop) from RUN (control start) while the Event timer is being activated
- Event state is cancelled while the event timer is activated

Parameter setting

- **Event 1 timer [Engineering Mode: Function block No. 41 (Fn41)]**

Parameter symbol	Data range	Factory set value
EVT 1	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
EVT2	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
EVT3	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
EVT4	0.0 to 600.0 seconds	0.0

7.1.6 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.

☞ Refer to 6.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output] for Event output assignment.

7.1.7 Changing the event set value

The Event set value can be set in Parameter group No. 40 in the Parameter setting mode. Since the Set value for Event 1 to 4 are included in the Memory area, up to 16 data can be stored per parameter.

☞ Refer to the the SC-F71 Quick Start Guide (172-65706M) or Instruction Manual [Hardware] (172-65709M) for how to set Event set values.

Refer to10.3 Storing the control related set values (Memory Area function) for Memory area transfer.

7.2 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 & SV setting mode.

Display contents

- **ALM lamp**

The event ON state can be verified with the ALM lamp. However, the instrument has only one ALM lamp which is turned on using the OR relation of the related functions. Combination of the states can be freely available. The setting can be done in Function block: ALM lamp lighting condition (Engineering mode).

[Events that illuminate the lamp]

- Event 1
- Event 2
- Event 3
- Event 4
- Input 1_Input error high
- Input 1_Input error low
- Input 2_Input error high
- Input 2_Input error low

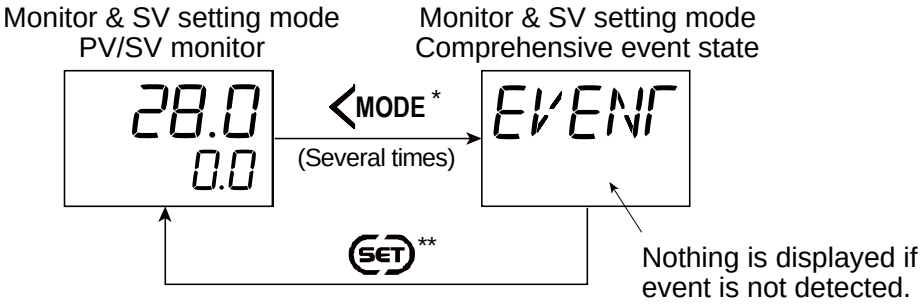
- **ALM lamp lighting condition [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
ALC	0 to 255 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	15

- **Comprehensive event state [Monitor & SV Setting Mode]**

Parameter symbol	Data range	Factory set value
EVENT	When an event occurs, the character of the occurring event is displayed on the Set value (SV) display unit. If two or more events occur at the same time, the relevant characters are displayed alternately every 0.5 seconds. EVT 1: Event 1 EVT2: Event 2 EVT3: Event 3 EVT4: Event 4 In1.UP: Input 1_Input error high In1.dn: Input 1_Input error low In2.UP: Input 2_Input error high In2.dn: Input 2_Input error low	—

Display operation



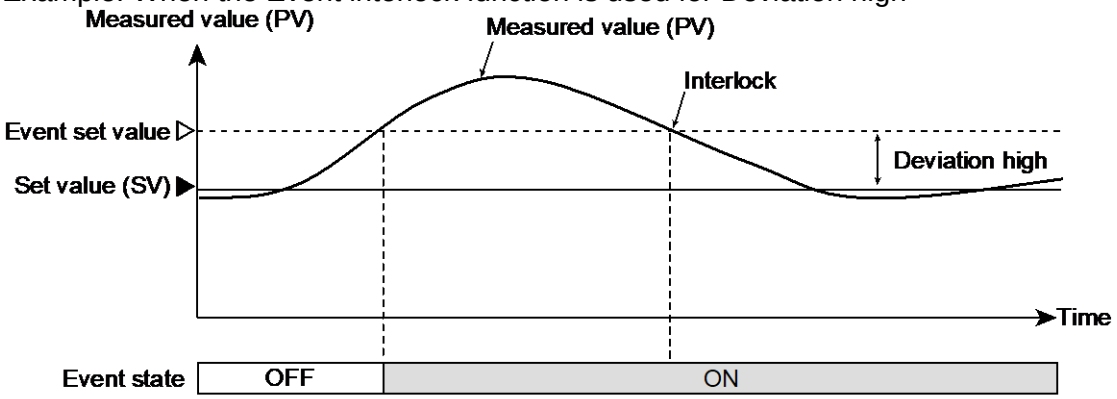
* The **MONI** key may be used instead.
** The **R.SET** key may be used to return.

7.3 Keeping the Event State (Interlock Function)

Description of function

The Event interlock function holds the event state (including 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 and Input error.

Example: When the Event interlock function is used for Deviation high



[Without Event hold action]

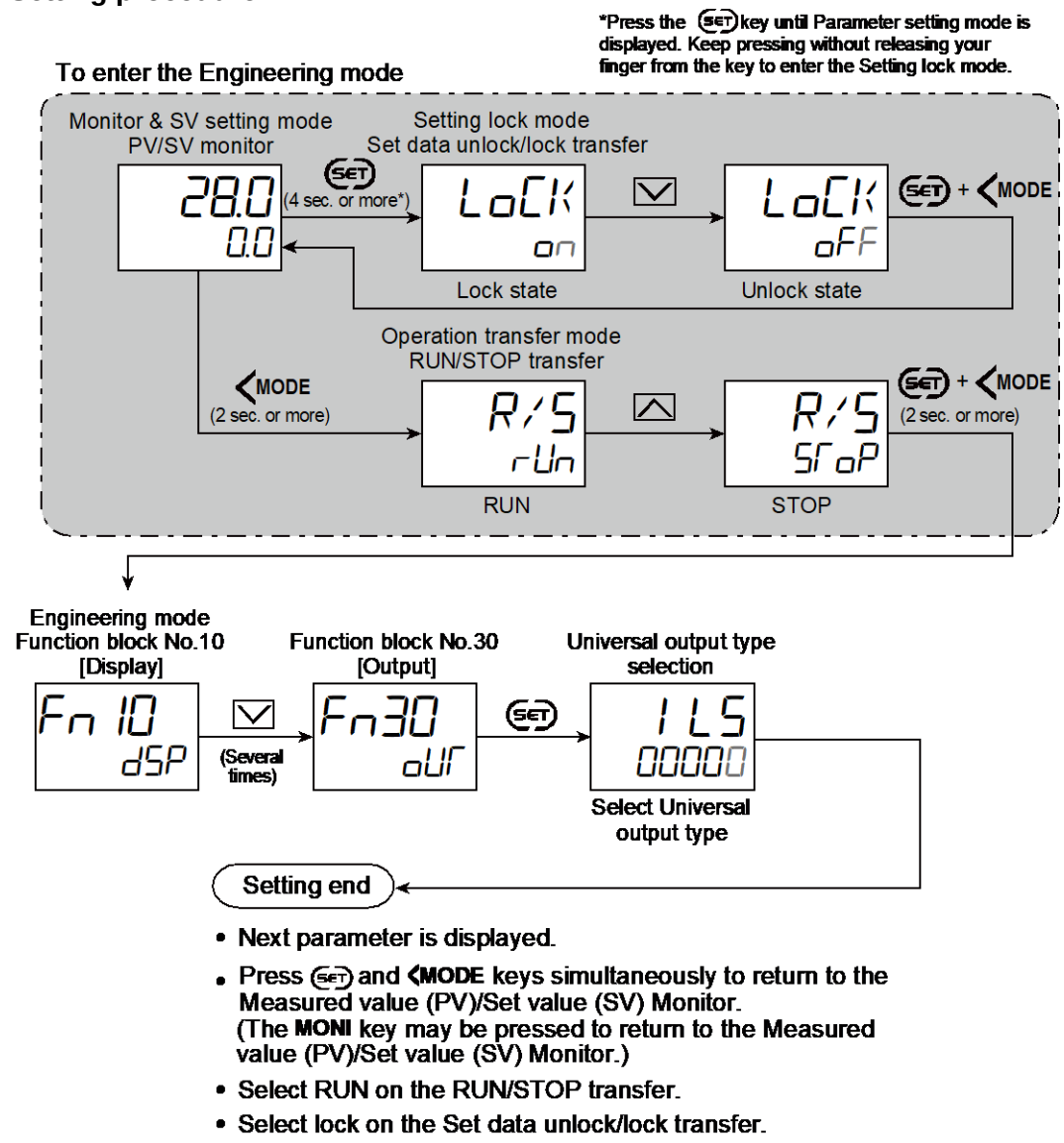
☞ Refer to 7.4 Releasing the Event State (Interlock Release) for the interlock release.

Parameter setting

- **Interlock selection [Engineering Mode: Function block No. 30 (Fn30)]**

Parameter symbol	Data range	Factory set value
ILS	0 to 255 0: Unused +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	0

Setting procedure



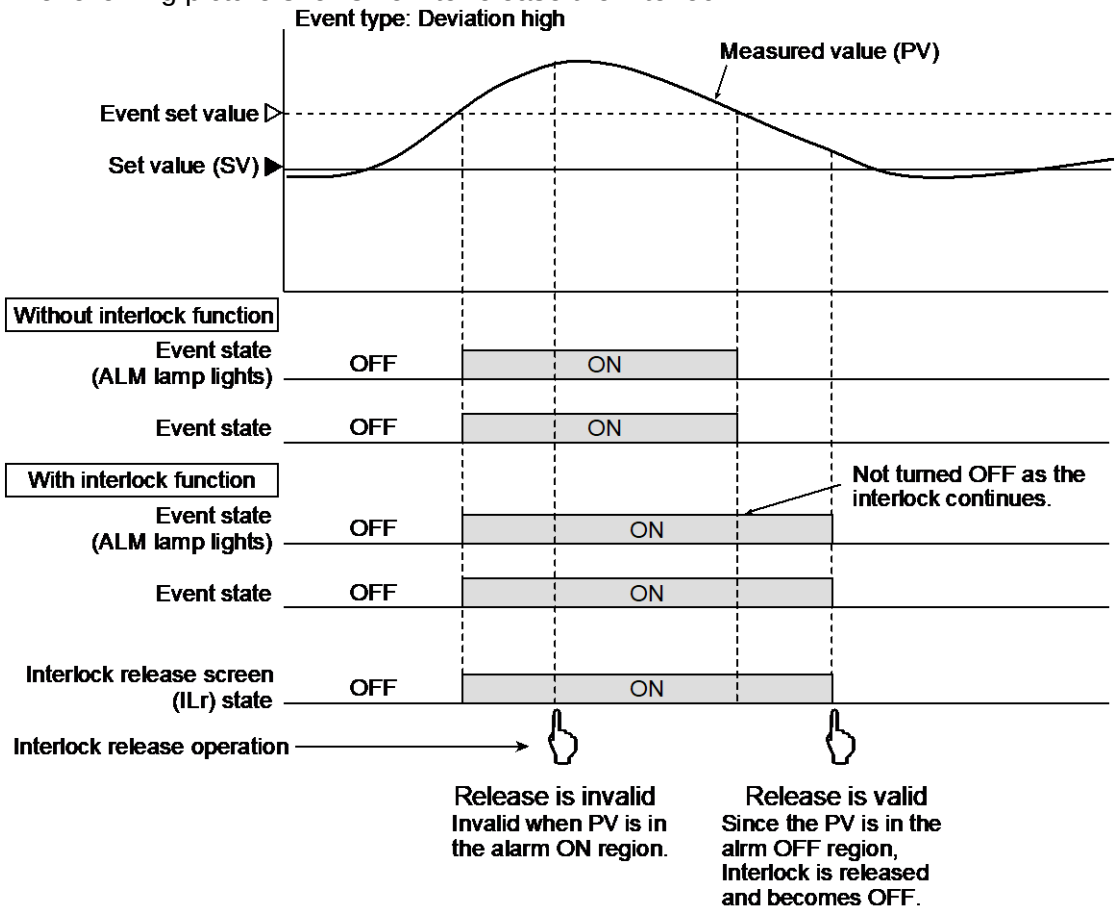
- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

7.4 Releasing the Event State (Interlock Release)

Description of function

The Event interlock function holds the event state (including 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 and input error that are in the interlock state and releases such events at one time whose interlock release conditions are met.

Refer to 5.2 Switching Functions Using Digital Inputs (DI) for Interlock release through Digital input (DI).

Refer to the SC-F71 Instruction Manual [Host Communication] (172-65711M) for Interlock release through Communication.

Parameter setting

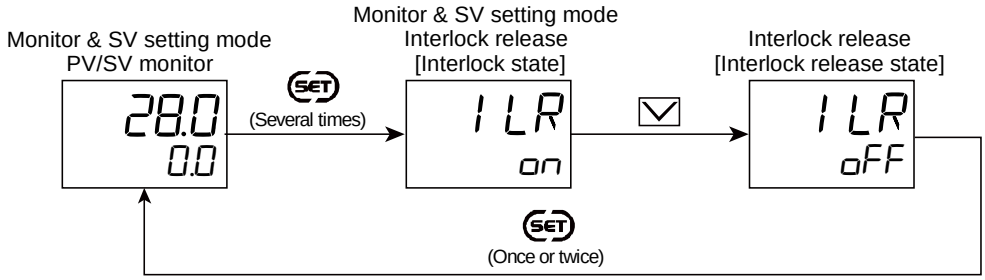
- **Interlock release[Monitor & SV Setting Mode]**

Parameter symbol	Data range	Factory set value
ILR	oFF: Interlock release on: Interlock state	oFF

To display “Interlock release”, choose a setting other than “oFF” in Function block No. 30: Inter lock selection (Engineering mode).

Setting procedure

After the Interlock is set, the Interlock release screen shows "on" automatically.

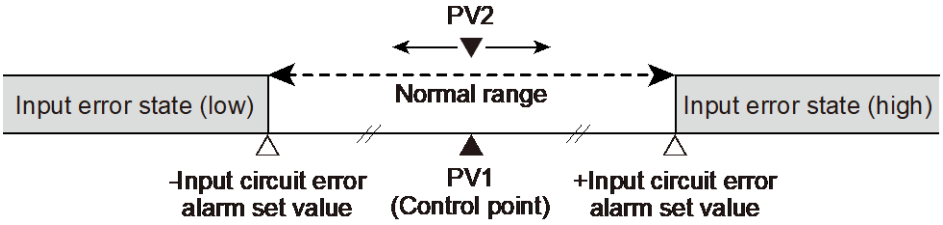


7.5 Preventing Control with Input Errors (Input Circuit Error Alarm)

Description of function

Input circuit error alarm uses two inputs (dual input circuits) and detects errors in the input circuit from the difference between two inputs.

When the difference between Input 1_Measured input (PV1) and Input 2_Measured input (PV2 - PV1) exceeds Input circuit error alarm set value, it is considered to be an input circuit error and "Input error state" starts.

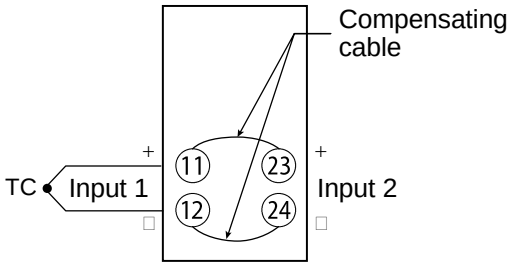


Determination of input circuit errors

- (PV1 + Input circuit error alarm set value) < PV2 … Input circuit error (high)
- (PV1 - Input circuit error alarm set value) > PV2 … Input circuit error (low)

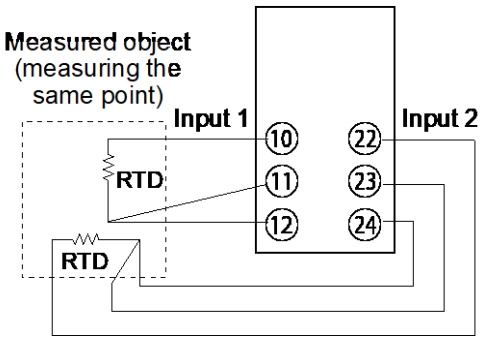
[Wiring example]

TC input

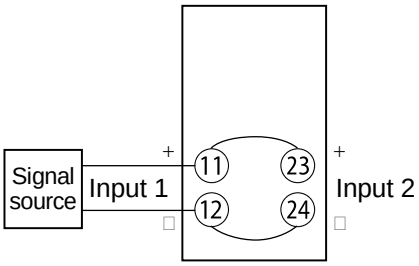


Parallel connection

RTD input

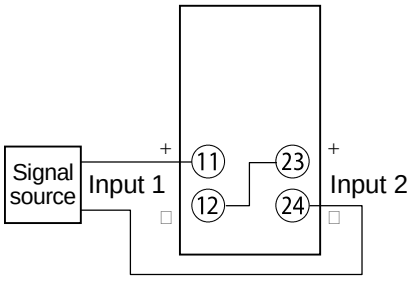


Voltage input



Parallel connection

Current input



Series connction

📖 Different input type can be specified for Input 1 and Input 2. Note that action may be different on each input.

📖 To also determine errors on external circuits, measure the same location on two external circuits and connect them as Input 1 and Input 2 respectively.

📖 To output “Input 1_Input error high/low,” output assignment must be set in advance. Refer to 6.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output] for output assignment.

📖 Irrespective of Input circuit error alarm setting, “Input 1_Input error high/low” conducts normal Input error alarm action.
Refer to 5.7 Changing Error Handling at Input Error When set to the event state simultaneously with power turned on operation at Input error action.

📖 Before using the Input circuit error alarm, check for errors in measured values between Input 1 and Input 2 which should be removed in advance using PV bias.

📖 The Input circuit error alarm function uses two inputs, but control using Input 2 is not available. However, lighting the ALM lamp and providing state output from Digital output (DO) are possible.

Parameter setting

- **Select function for Input 2 [Engineering Mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 When pressure control operation [MC-(V)COS(R)] is selected: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

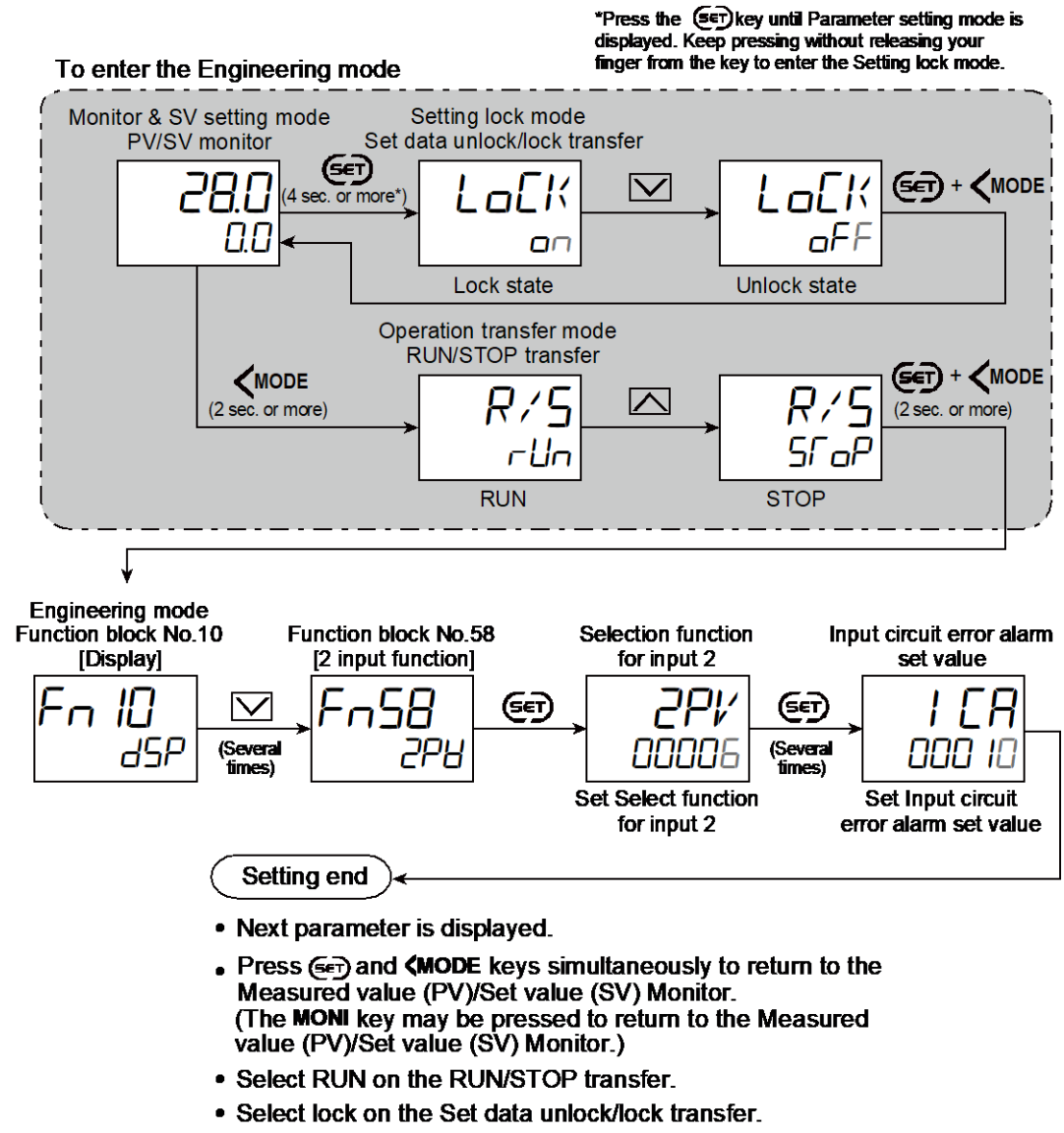
☞ Refer to “4. Parameters that are Initialized/Modified when setting is Changed” for the parameters that are initialized when the Select function for Input 2 is changed.

- **Input circuit error alarm set value [Engineering Mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
ICA	0 to Input 1_Input span 0: No function [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 10 V/I inputs: 5% of Input 1_ Input span

📖 To display “Input circuit error alarm set value”, choose “Input circuit error alarm” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

8. Control Function

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

8.1 Running/Stopping Control (RUN/STOP Transfer)

Choose whether to start (RUN) or stop (STOP) control. The RUN/STOP transfer can be made by Digital input (DI) or Communication (optional) other than the key operation. The factory set value is STOP. As soon as the controller is powered on, control is stopped.

- **State of this instrument when set to STOP mode**

STOP display		Displays the STOP symbol "SToP" on the SV, PV or MV displays. (Factory set value: SV displays)
Control output	PID control	"Input 1_Manipulated output value at STOP [heat-side]" is output. (Factory set value: -5.0%) "Input 2_Manipulated output value at STOP" * is output. (Factory set value: -5.0%) * In the case of 2-loop control/Differential temperature control
	Heating/Cooling PID control	Heat-side: "Input 1_Manipulated output value at STOP [heat-side]" is output. (Factory set value: -5.0%)
Logic calculation output		According to the setting contents of Output action at STOP (Factory set value: OFF)
Retransmission output		
Instrument status output		
Autotuning or Startup tuning		AT cancelled (PID constants are not updated.)

☞ Refer to 9.4 Changing the Display Position of STOP during the Control Stop for STOP display selection.

☞ Refer to 6.9 Changing the Output Action While in Control Stop Mode for Action selection at STOP mode.

- **State of this instrument when set to RUN mode**

Operation when transferred to RUN from STOP is in accordance with the Hot/Cold start selection setting.

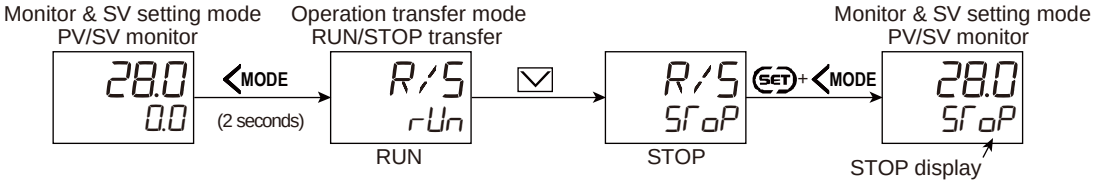
☞ Refer to 8.19 Changing the Action at Power ON (Hot/Cold Start) for Hot/Cold start.

☞ Refer to the SC-F71 Instruction Manual [Host communication] (172-65711M) for RUN/STOP switching by communication (optional).

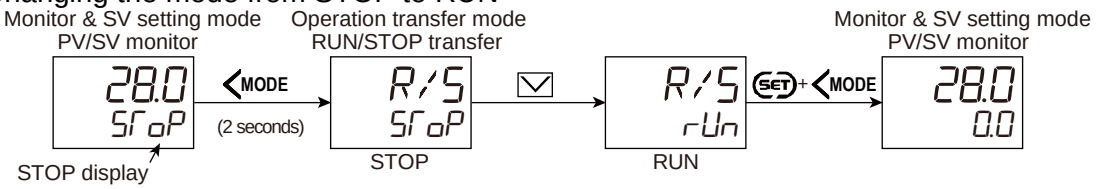
Setting procedure

- **Selection by front key operation**

Changing the mode from RUN to STOP



Changing the mode from STOP to RUN

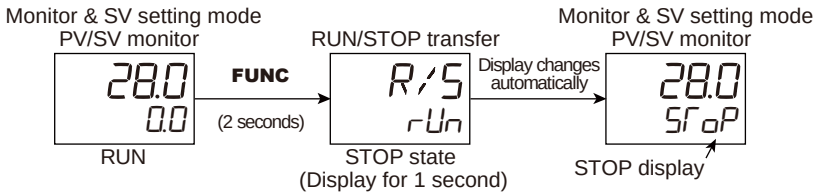


- **Changing the mode with the direct key**

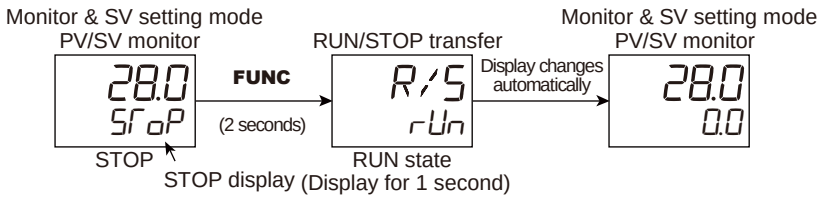
Assigning the “RUN/STOP transfer” function to the FUNC key facilitates the RUN/STOP switching.
RUN/STOP transfer function is assigned to the FUNC key at the time of shipment for immediate use.
Each time FUNC key is pressed, RUN and STOP are toggled.

☞ Refer to 10.8 Accessing some functions directly (FUNC key) for FUNC key assignment.

Changing the mode from RUN to STOP



Changing the mode from STOP to RUN



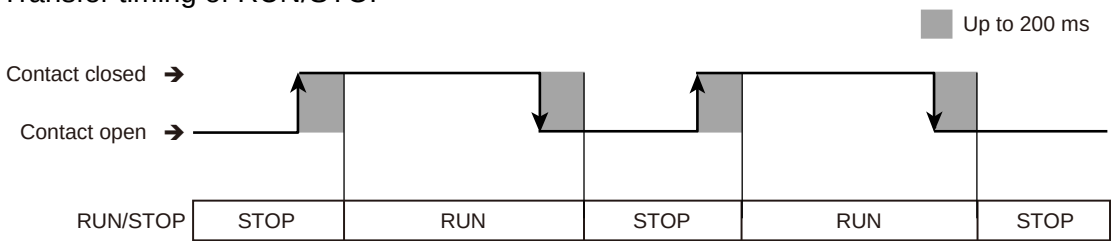
Selection of key action is possible from “Press once” and “Press and hold” to enable the switching. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

- **Switching the mode with Digital Input (DI)**

To switch the RUN/STOP using the Digital Input (DI), use “DI function selection” in Function block No. 23 (Engineering mode).

☞ Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the Digital input (DI) assignment.

Transfer timing of RUN/STOP



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

The above switching action can be inverted (The functions at contact close and contact open can be swapped). This setting can be configured at “DI logic invert.” Refer to 5.2 Switching Functions Using Digital Inputs (DI) for details.

- **RUN/STOP transfer state**

The table below shows the actual RUN/STOP modes and displays under different combinations of settings by Key operation, Communication, and Digital input (DI).

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status	STOP display
RUN	RUN	RUN	—
	STOP	STOP	dSTP
STOP	RUN		KSTP
	STOP		STOP *

* The instrument without RUN/STOP switching by DI will have the same display.

STOP character display

Monitor & SV setting mode
PV/SV monitor

STOP with the key
(No RUN/STOP tranfer by DI)

Monitor & SV setting mode
PV/SV monitor

STOP with the key
RUN/STOP tranfer by DI:RUN

Monitor & SV setting mode
PV/SV monitor

STOP with the DI
RUN/STOP tranfer by key:RUN

The display position of STOP can be changed. Refer to 9.4 Changing the Display Position of STOP during the Control Stop for details.

8.2 Changing Control Action

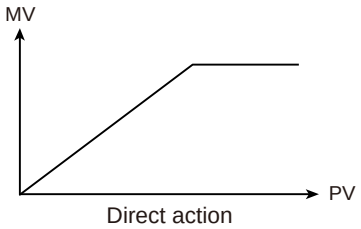
Refer to the following 6 types of control action:

- PID control (direct action)
- PID control (reverse action)
- ON/OFF action
- Heating/Cooling PID control (Cooling linear type)
- MC-COS(R)/MC-VCOS(R) Pressure control
- MC-COS(R)/MC-VCOS(R) Temperature control

When the control mode is set to Cascade control which uses two measured inputs, the selectable control action is limited to “PID control (direct action),” “PID control (reverse action),” or “ON/OFF action.”

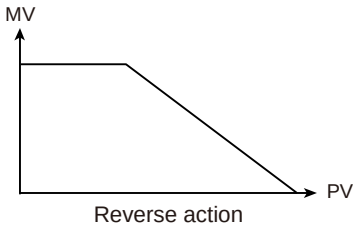
PID control (direct action)

The Manipulated output value (MV) increases as the Measured value (PV) increases. This action is used generally for cooling control.



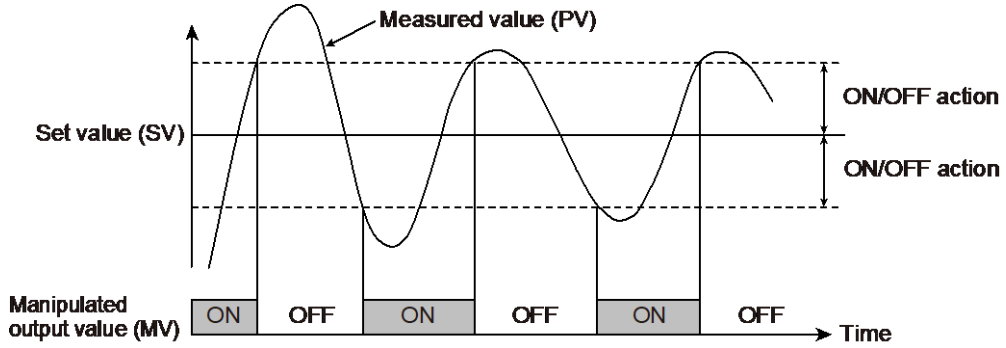
PID control (reverse action)

The Manipulated output value (MV) decreases as the Measured value (PV) increases. This action is used generally for heating control.



ON/OFF action

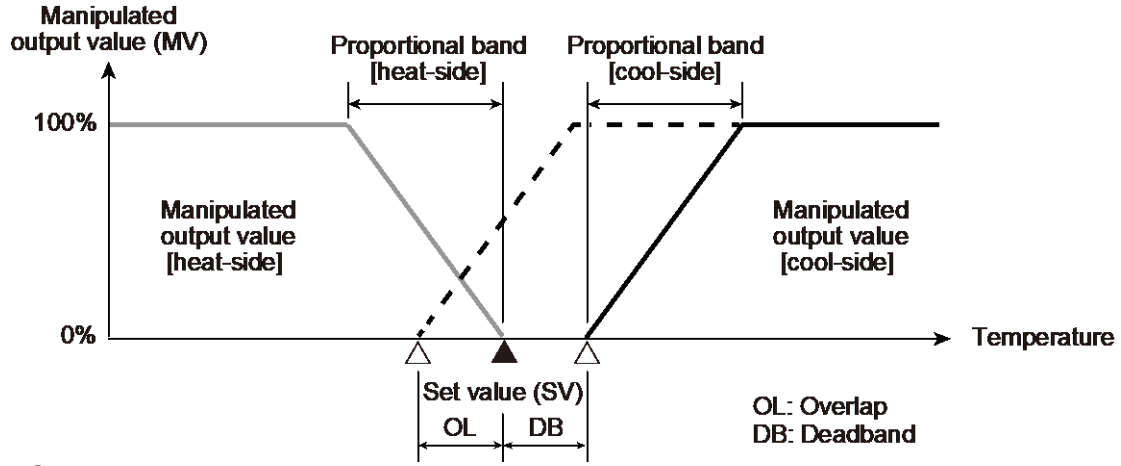
ON/OFF control is possible when the Proportional band [heat-side] is set to 0. In ON/OFF control with Reverse action, when the Measured value (PV) is smaller than the Set value (SV), the Manipulated output (MV) is 100% or ON. When the PV is higher than the SV, the MV is 0% or OFF. Differential gap setting prevents control output from repeating ON and OFF too frequently.



☞ Refer to 8.6 Controlling with ON/OFF Action for ON/OFF action.

Heating/Cooling PID control

In Heating/Cooling control, only one controller enables heating and cooling control.



☞ Refer to 8.7 Controlling with Heating/Cooling Action for Heating/Cooling PID control.

MC-COS(R)/MC-VCOS(R) Pressure control

Pressure control performed in combination with the TLV control valve for steam, MC-COS/MC-VCOS series.

By controlling the steam pressure with TLV proprietary algorithms that utilizes the characteristics of the COS (VCOS) series, accuracy and responsiveness that exceeds conventional control valves can be achieved.

☞ Refer to 8.8 Using with MC-COS/MC-VCOS for information on MC-COS(R)/ MC-VCOS(R) pressure control operation.

MC-COS(R)/MC-VCOS(R) Temperature control

Temperature control performed in combination with the TLV control valve for steam, MC-COS/MC-VCOS series.

The control algorithm is PID control (reverse action), however by using this device with a COS (or VCOS) series steam pressure reducing valve, the steam supply pressure can be controlled. In addition, it has characteristics that are not easily affected by external disturbances such as pressure fluctuations at the primary side of heat source steam.

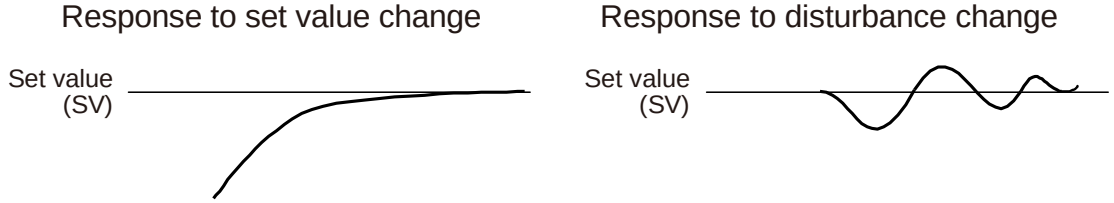
☞ Refer to 8.8 Using with MC-COS/MC-VCOS for information on MC-COS(R)/ MC-VCOS(R) pressure control operation.

PID control

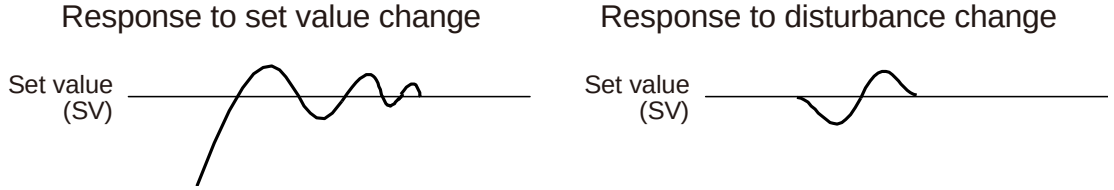
PID control is a control method of achieving stabilized control result by setting P (Proportional band), I (Integral time) and D (Derivative time) constants, and is widely used. However, with this PID control, if P, I and D values are set to focus on “better response to control set value change,” “response 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 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 Heating/Cooling PID control.

Ordinary PID control

P, I and D constants set so as to be in good response to set value change

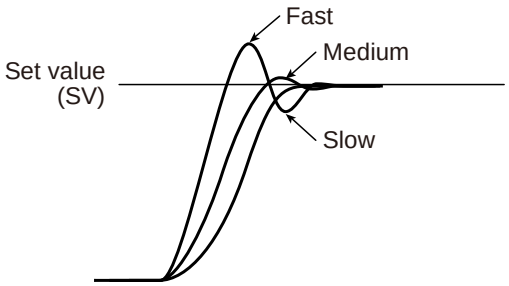


P, I and D constants set so as to be in good response to disturbance

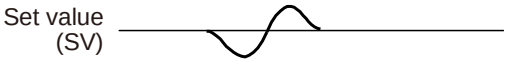


PID control

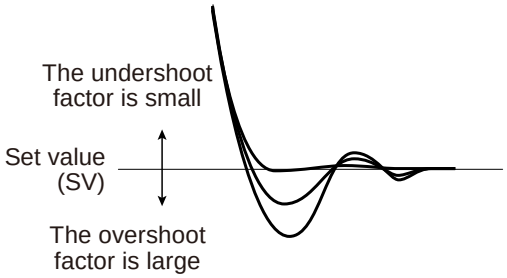
Response to set value change



Response to disturbance change



Restriction of undershooting when the set value (SV) is lowered



Parameter setting

- **Input 1_Control action [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 2: Heating/Cooling PID control with Autotuning [Cooling linear type] 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] For cascade control, only 0 or 1 are selectable. For PV select, only 0, 1 or 2 are selectable.	Product identification code specified at the time of order.

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 1_Control action is changed.

- **Input 2_Control action [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] 2: n/a For cascade control, only 0 or 1 are selectable.	1

📖 To display “Input 2_Control action”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 2_Control action is changed.

- **Input 1_Control response parameter [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. RPT	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	PID control: 0 Heating/Cooling PID control: 2

📖 To display “Input 1_Control response parameter”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

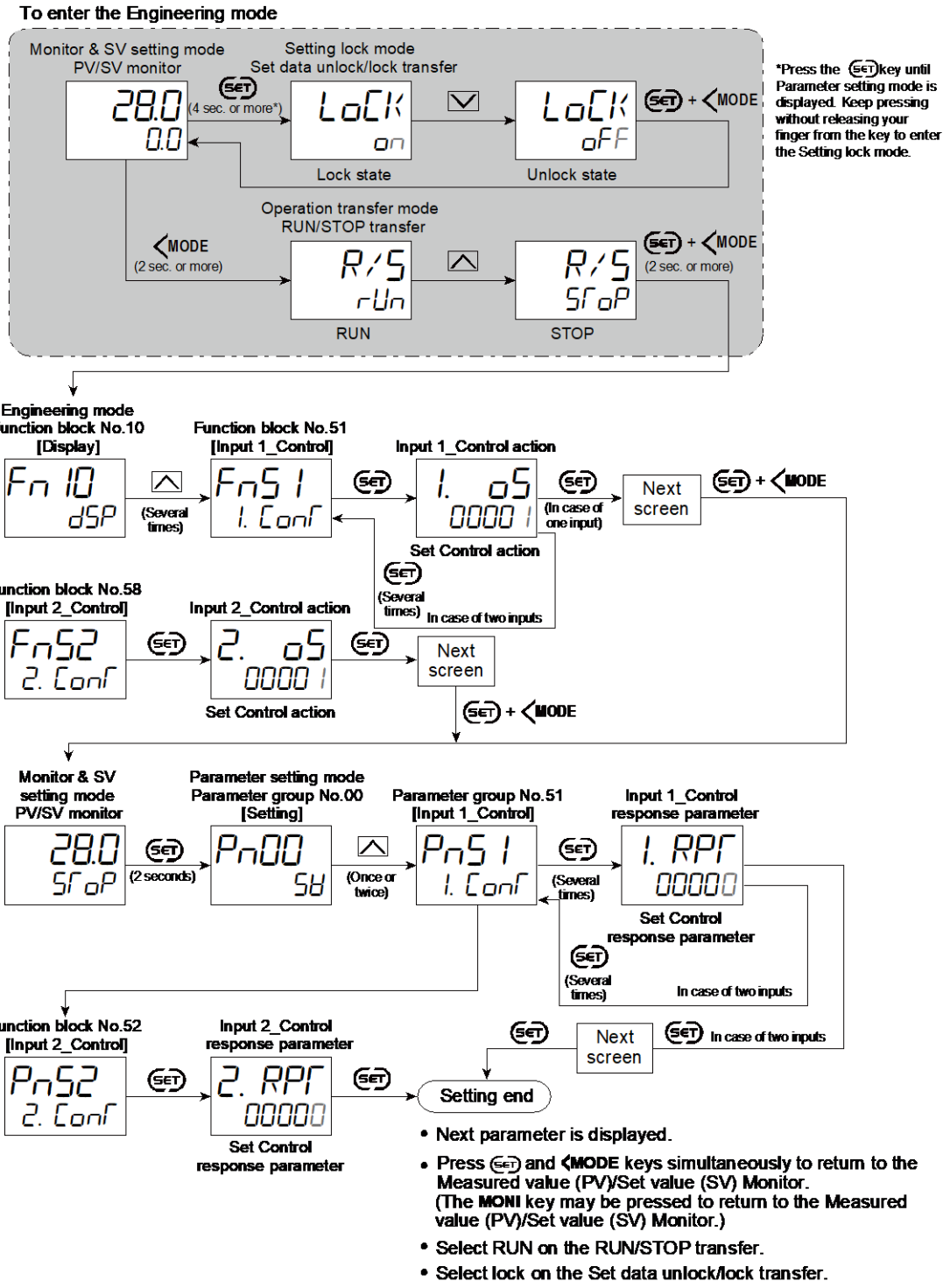
- **Input 2_Control response parameter [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. RPT	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	0

📖 To display “Input 2_Control response parameter”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

8.3 Setting PID Values Automatically (Autotuning)

Autotuning (AT) automatically measures, computes and sets the optimum PID values. Autotuning (AT) can be used for PID control (Direct action/Reverse action) and Heating/Cooling PID control.

☞ Refer to 8.14 Executing Cascade Control for Autotuning (AT) during the Cascade control.

Description of function

- **Parameters computed by Input 1_Autotuning (AT)**

- Input 1_Proportional band [heat-side]
- Input 1_Integral time [heat-side]
- Input 1_Derivative time [heat-side]
- Input 1_Proportional band [cool-side] (Only for Heating/Cooling PID control)
- Input 1_Integral time [cool-side] (Only for Heating/Cooling PID control)
- Input 1_Derivative time [cool-side] (Only for Heating/Cooling PID control)

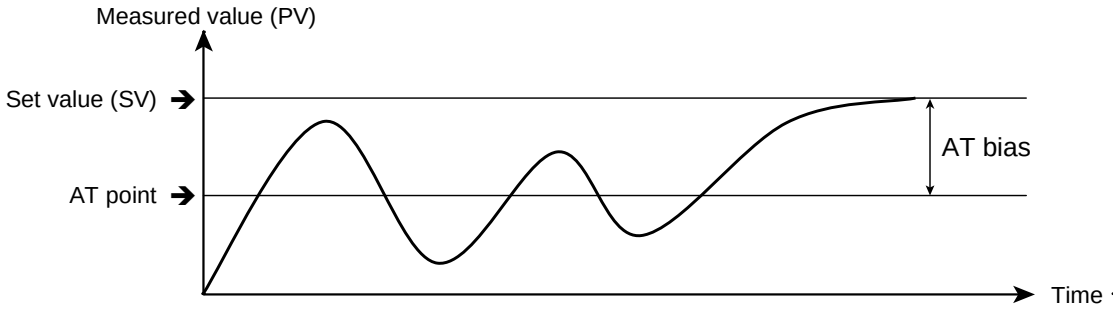
- **Parameters computed by Input 2_Autotuning (AT)**

- Input 2_Proportional band
- Input 2_Integral time
- Input 2_Derivative time

- **AT bias**

The AT bias is used to prevent overshoot during Autotuning in the application which does not allow overshoot even during Autotuning. The Autotuning method uses ON/OFF control at the set value to compute the PID values. However, if overshoot is a concern during 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.

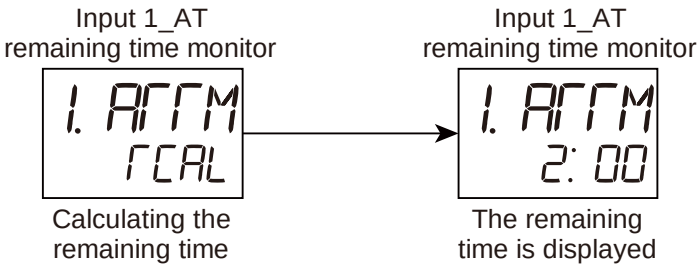


- **AT remaining time monitor**

Displays the remaining time until Autotuning (AT) is completed.
(Display range: 0 hours 00 minutes to 48 hours 00 minutes)

The SV display shows “TCAL” 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 Autotuning (AT).
  - Displays “1” during Autotuning (AT).
  - Displays “0” when Autotuning (AT) is completed.
  - When 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.
    - 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 Autotuning (AT) is changed to PID control.
    - When the instrument is switched to STOP by RUN/STOP transfer.
    - When the instrument is switched to Manual mode using Auto/Manual transfer.
    - When the instrument is switched to Remote mode using Remote/Local transfer.
    - When the instrument is switched to Cascade/Single.
    - When the memory area is changed.

    -2: Aborted. Abnormal input.
    - When the Measured value (PV) has entered the Input error range.
      [Input error range: Input error determination point high ≥ Measured value (PV), Input error determination point low ≤ 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.
    Error in the calculation of the values in Cascade control and Control with PV select.

- **Caution for using Autotuning (AT)**
  - When a temperature change (UP and/or Down) is 1 °C or less per minute during Autotuning (AT), 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).

☞ Refer to 8.5 Setting PID Values Manually for the manual setting of PID values.

● **Requirements for Autotuning (AT) start**

Start Autotuning (AT) when all following conditions are satisfied:
To start Autotuning (AT), go to Operation transfer mode.

Operation state	RUN/STOP transfer	RUN
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
	Autotuning (AT) setting	PID control (State before starting AT)
Parameter setting	Input 1_PID control and Temperature control operation [MC-(V)COS]	Input 1_Output limiter high [heat-side] > 0% Input 1_Output limiter low [heat-side] < 100%
	Input 2_PID control and Temperature control operation [MC-(V)COS]	Input 2_Output limiter high > 0% Input 2_Output limiter low < 100%
	Heating/Cooling PID control	Input 1_Output limiter high [heat-side] > 0% Input 1_Output limiter low [heat-side] < 100% Input 1_Output limiter high [cool-side] > 0% Input 1_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) ≥ Measured value (PV), Input error determination point (low) ≤ Measured value (PV)]	

● **Requirements for Autotuning (AT) cancellation**

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 Autotuning (AT) was activated.

☞ Refer to “AT/ST status monitor” on the previous page for details.

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.

Parameter setting

● **Input 1_Autotunning (AT) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
1. AT U	oFF: PID control on: Start Autotuning When Autotuning (AT) is finished, the control will automatically return to “oFF.”	oFF

📖 To display “Input 1_Autotuning (AT)”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode).

● **Input 2_Autotunning (AT) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value

2. AT U	oFF: PID control on: Start Autotuning When Autotuning (AT) is finished, the control will automatically return to "oFF."	oFF

To display "Input 2_Autotunning (AT)", choose "2-loop control/Differential temperature control" in Function block No.58: Select function for Input 2 (Engineering mode), AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_AT bias [Setup Setting Mode: Setting group No. 53 (Sn53)]**

Parameter symbol	Data range	Factory set value
1. AT b	-(Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: -(PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	0

To display "Input 1_AT bias", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_AT bias [Setup Setting Mode: Setting group No. 54 (Sn54)]**

Parameter symbol	Data range	Factory set value
2. AT b	-(Input 2_Input span) to +(Input 2_Input span) [Varies with the setting of the Decimal point position.]	0

To display "Input 2_AT bias", choose "2-loop control/Differential temperature control" in Function block No.58: Select function for Input 2 (Engineering mode), AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode)

- **Input 1_AT remaining time monitor [Setup Setting Mode: Setting group No. 53 (Sn53)]**

Parameter symbol	Data range	Factory set value
1.AT TM	0 hours 00 minutes to 48 hours 00 minutes	—

To display "Input 1_AT remaining time monitor", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_AT remaining time monitor [Setup Setting Mode: Setting group No. 54 (Sn54)]**

Parameter symbol	Data range	Factory set value
2.AT TM	0 hours 00 minutes to 48 hours 00 minutes	—

To display "Input 2_AT remaining time monitor", choose "2-loop control/ Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_AT/ST status monitor [Setup Setting Mode: Setting group No. 53 (5n53)]**

Parameter symbol	Data range	Factory set value
1.rUNE	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.	—

To display “Input 1_AT/ST status monitor”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 2_AT/ST status monitor [Setup Setting Mode: Setting group No. 54 (5n54)]**

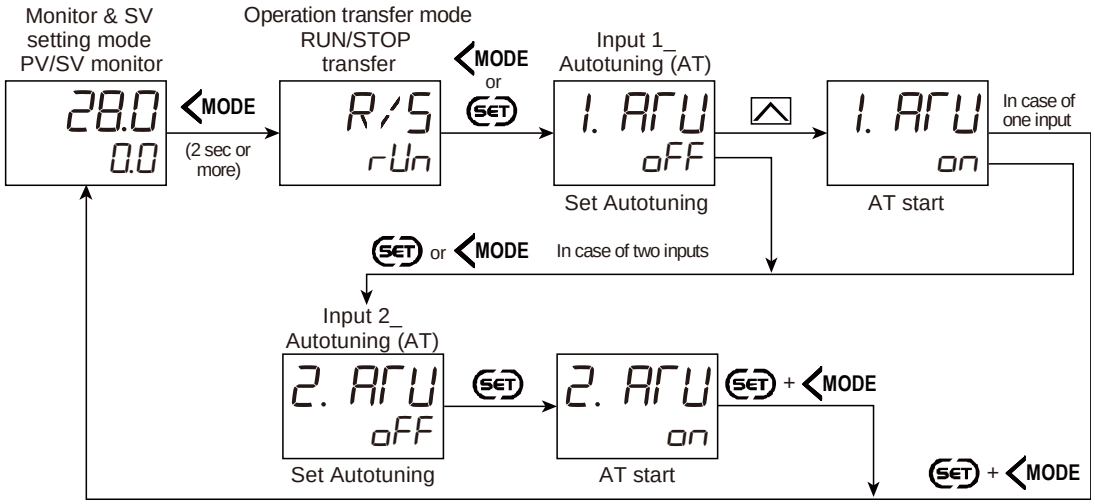
Parameter symbol	Data range	Factory set value
2.rUNE	0: AT/ST complete 1: AT running now 2: ST running now -1: Aborted. Setting changed. -2: Aborted. Abnormal input. -3: Aborted. Timeout. -4: Aborted. Abnormal calculated values.	—

To display “Input 2_AT/ST status monitor”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

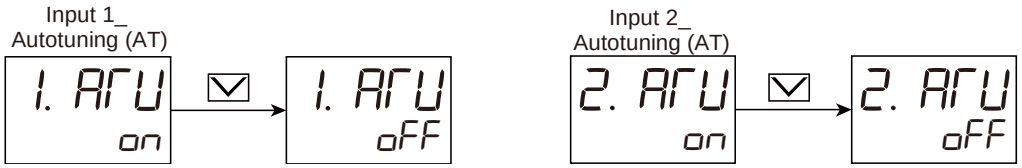
Setting procedure

- **Start Autotuning (AT)**

Before start AT, refer to ●Requirements for Autotuning (AT) start. Make sure that all required conditions to start AT are satisfied.



Aborting Autotuning (AT)



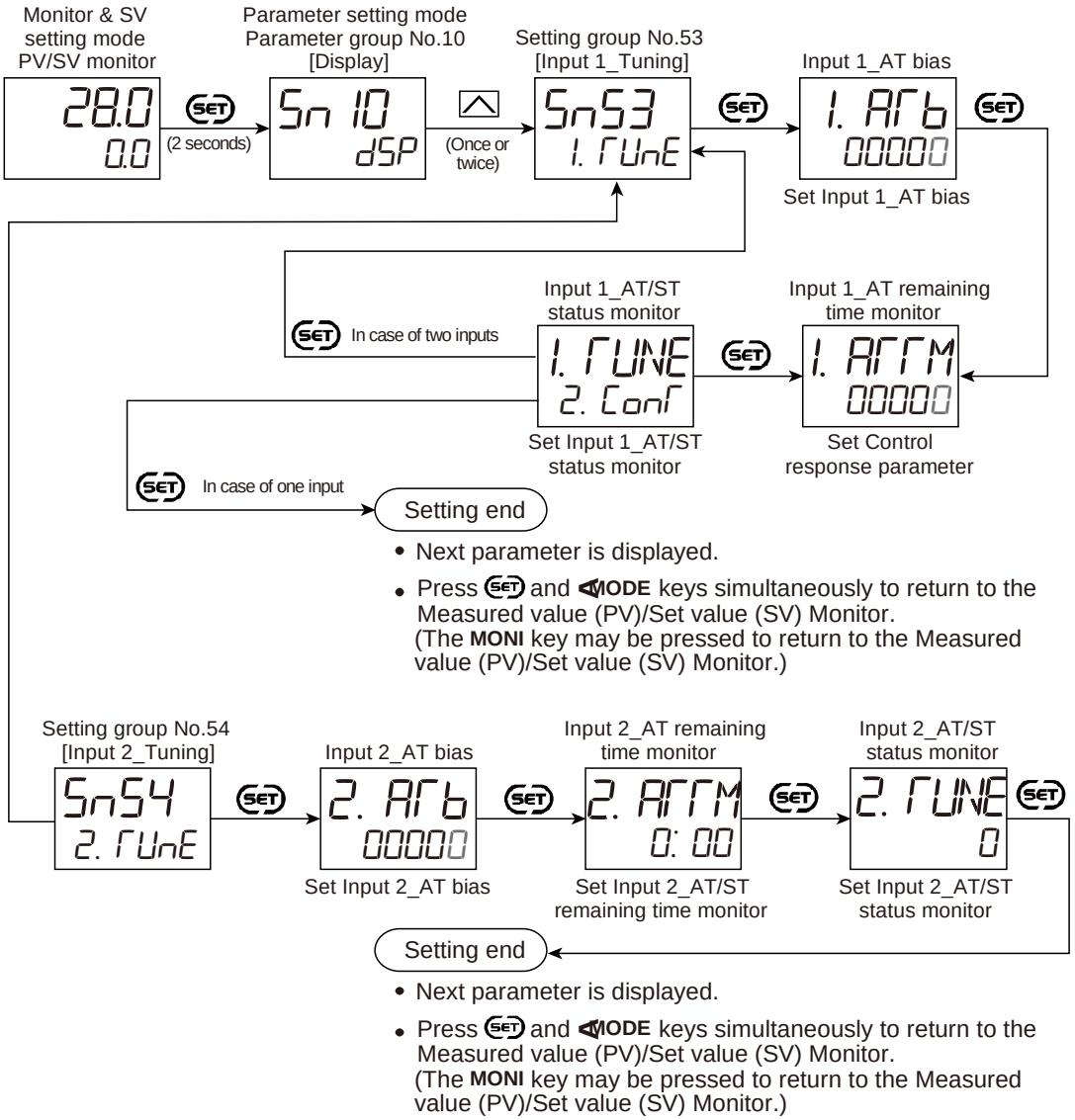
The AT lamp blinks during Autotuning (AT).

When Autotuning (AT) is finished, the control will automatically return to "oFF: PID control" and the AT lamp turns off.

Autotuning (AT) can be started by Digital input (DI). Refer to "5.2 Switching Functions Using Digital Inputs (DI)" for assigning Digital input (DI).

Autotuning (AT) can be started by a key operation of the direct key (FUNC key). Refer to 10.8 Accessing some functions directly (FUNC key) for details.

- **Setting AT bias. Check the AT remaining time and AT/ST status.**

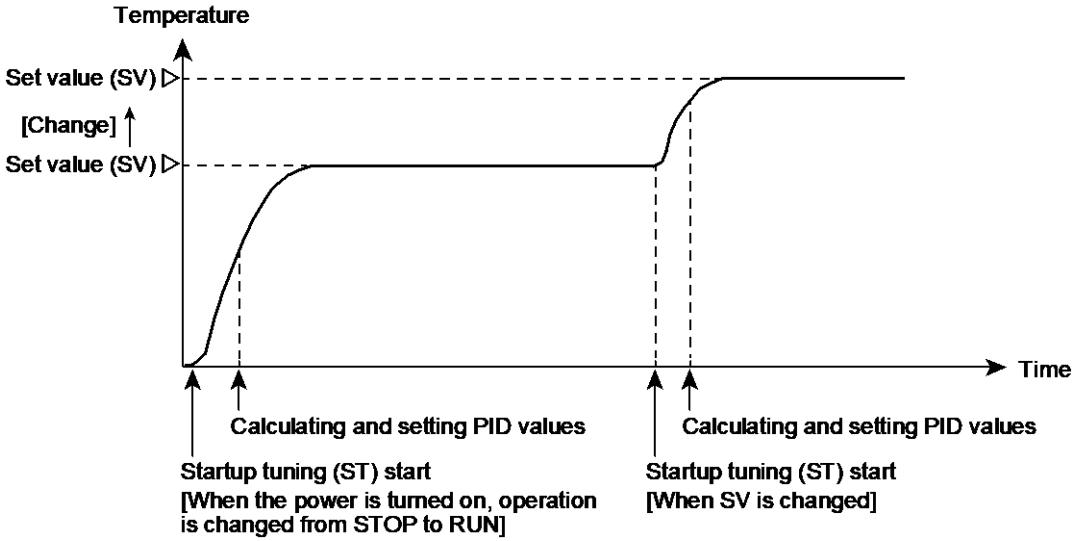


8.4 Setting PID Values Automatically (Startup tuning)

Startup tuning (ST) is a function which automatically computes and sets the PID values (Proportional band: heat-side only) from the response characteristics of the controlled system at power ON, transfer from STOP to RUN, and Set value (SV) change.

Description of function

- As simple autotuning, the PID values can be found in a short time without disturbing controllability for controlled systems with slow response at power ON.
- For controlled systems which require different PID values for each temperature setting, the PID values can be found for each Set value (SV) change.



- The setting items related to 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 STOP to RUN, or the Set value (SV) is changed.	Engineering mode
	1	When the power is turned on or operation is changed from STOP to RUN.	
	2	When the Set value (SV) is changed.	
Execution method	oFF (Factory set value)	ST unused	Operation transfer mode
	on1	Execute once	
	on2	Execute always	

When Startup tuning (ST) function is activated in Heating/Cooling PID control, only heat-side PID values are calculated and changed. Startup tuning (ST) is not available when the temperature is downward. (PID values for cooling cannot be calculated)

If Startup tuning (ST) is started when the ST start condition is at power on or switching from STOP to RUN, the control will start with Hot start 2 even if the setting is Hot start 1. Refer to 8.19 Changing the Action at Power ON (Hot/Cold Start) for Hot/Cold start setting.

- **AT/ST status monitor**

Displays the execution status of Startup tuning (ST).

- Displays “2” during Startup tuning (ST).
- Displays “0” when Startup tuning (ST) is completed.
- When Startup tuning (ST) is aborted, the display shows -1 up to -4 depending on the reason of the abort.

  -1: Aborted. Setting changed.
  - When 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 [heat-side] or low [heat-side] is changed.
  - When the instrument is switched to STOP by RUN/STOP transfer.
  - When the instrument is switched to Manual mode using Auto/Manual transfer.
  - When the instrument is switched to Remote mode using Remote/Local transfer.
  - When the setting of the Level PID action selection is “2: Switching by the Measured value (PV).”

  -2: Aborted. Abnormal input.
  When the Measured value (PV) has entered the Input error range.
  [Input error range: Input error determination point high ≥ Measured value (PV), Input error determination point low ≤ Measured value (PV)]

  -3: Aborted. Timeout.
  When Startup tuning (ST) will not end approximately 100 minutes after it has been started.

  -4: Aborted. Abnormal calculated values.
  - When the input was switched by Control with PV select.
  - Startup tuning (ST) internal error, etc.

- **Caution for using Startup tuning (ST)**

- For Startup tuning (ST) at power ON or transfer from STOP to RUN, always set the heater power to ON simultaneously with the start of tuning or before the start of tuning.
- Start Startup tuning (ST) in the state in which the temperature differential of the Measured value (PV) and Set value (SV) at the start of Startup tuning (ST) is twice the Proportional band, or greater.
- If in Heating/Cooling PID control, activate 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 Autotuning (AT).
- When the manipulated output value may be limited by the Output limiter setting, the optimum PID values may not be calculated by Startup tuning (ST).
- When setting the Output change rate limiter, the optimum PID values may not be computed by Startup tuning (ST).
- When setting the Soft start/Setting change rate limiter, the optimum PID values are not obtained even when Startup tuning (ST) is executed at Set value (SV) change.
- When Startup tuning (ST) is started at power on, priority is given to Startup tuning (ST) and the Proactive function will not start.

- **Requirements for Startup tuning (ST) start**

Begin Startup tuning (ST) when all following conditions are satisfied:

Operation state	RUN/STOP transfer	RUN
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
	Autotuning (AT) setting	PID control
Parameter setting	Startup tuning (ST) is set to ON (Execute once, Execute always)	
	Output limiter high ≥ 0.1%, Output limiter low ≤ 99.9% [Heating/Cooling PID control type: Output limiter high (heat-side) ≥ 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) ≥ Input value ≥ 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) [Heating/Cooling PID control]	
Output value state	At startup, output is changed and saturated at the Output limiter high or the Output limiter low [Heating/Cooling PID control type: Output limiter high (heat-side)].	

- **Requirements for Startup tuning (ST) cancellation**

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 Startup tuning (ST) was activated.

☞ Refer to "AT/ST status monitor" for details.

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

- **Input 1_Startup tuning (ST) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
1. STU	oFF: ST unused on 1: Execute once * on2: Execute always * When ST is finished, the control will automatically return to "oFF."	oFF

To display "Input 1_Startup tuning (ST) ", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 2_Startup tuning (ST) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
2. STU	oFF: ST unused on 1: Execute once * on2: Execute always * When ST is finished, the control will automatically return to "oFF."	oFF

To display "Input 2_Startup tuning (ST) ", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_AT/ST status monitor [Setup Setting Mode: Setting group No. 53 (5n53)]**

Parameter symbol	Data range	Factory set value
1.TUNE	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.	—

To display “Input 1_AT/ST status monitor”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 2_AT/ST status monitor [Setup Setting Mode: Setting group No. 54 (5n54)]**

Parameter symbol	Data range	Factory set value
2.TUNE	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.	—

To display “Input 2_AT/ST status monitor”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

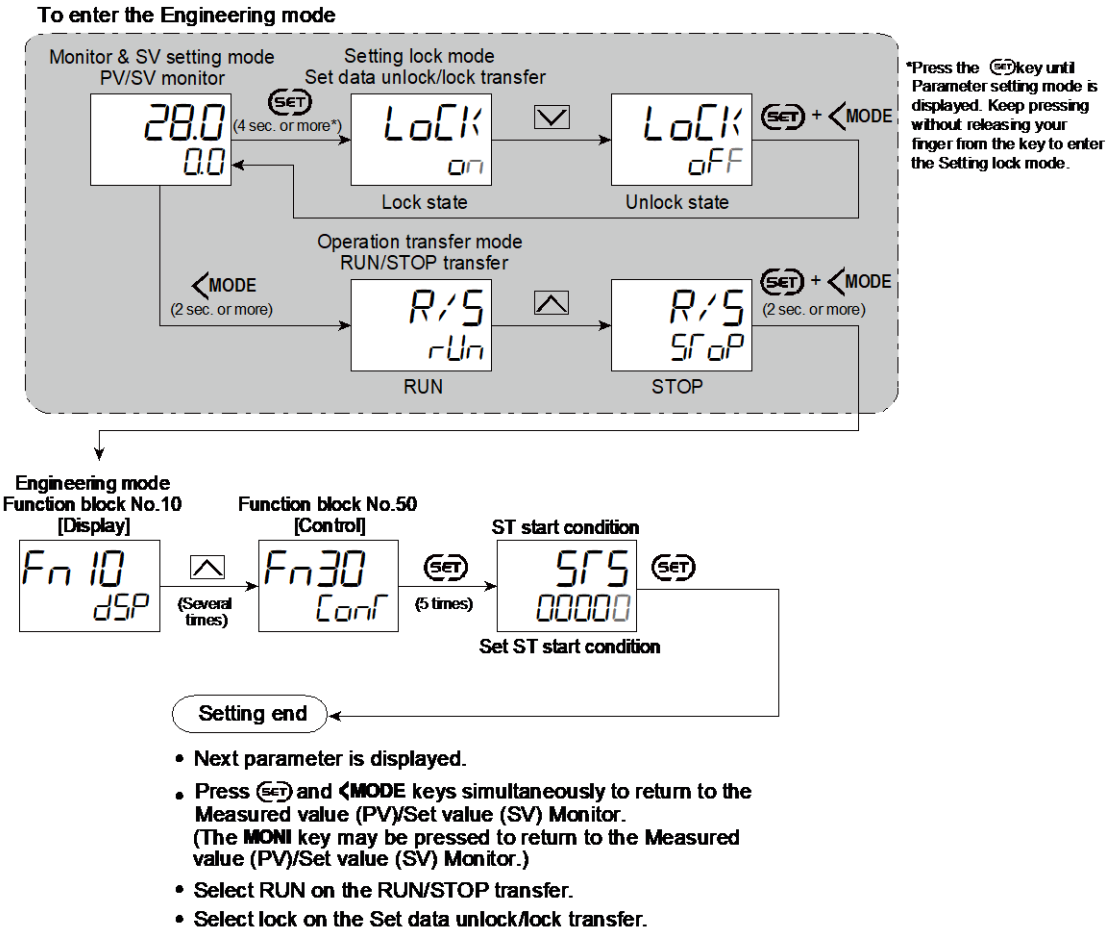
- **ST start condition [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
STS	0: Activate Startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the Set value (SV) is changed. 1: Activate Startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN. 2: Activate Startup tuning (ST) function when the Set value (SV) is changed.	0

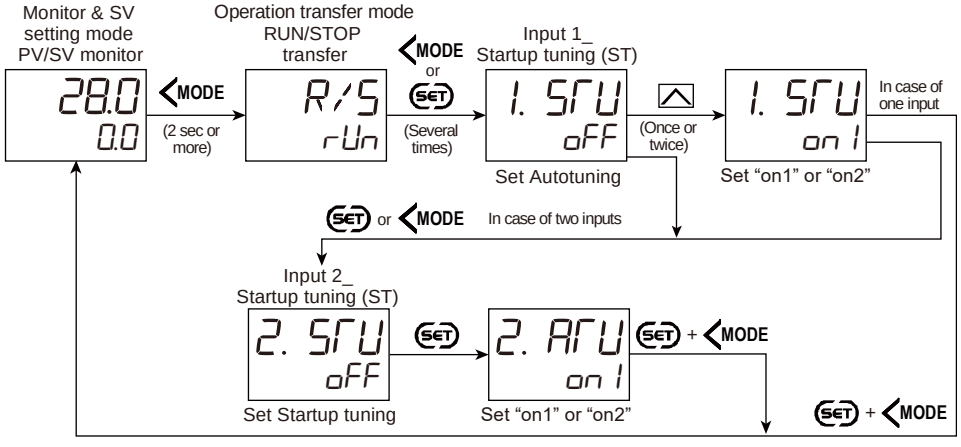
To display “Startup tuning conditions (ST)”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode), OR choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode) AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

Setting procedure

● Set ST start condition



● Set Startup tuning (ST)



● Start Startup tuning (ST)

Before starting ST, refer to Requirements for Startup tuning (ST) start. Make sure that all required conditions to start 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.
- Stop the control once (STOP) and start the control again (RUN).
- Change the Set value (SV).

The AT lamp lights during Startup tuning (ST).

After completion of Startup tuning (ST), the AT lamp goes off.
When Startup tuning setting is "on !: Execute once", the setting will go back to "oFF: ST unused."

8.5 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)

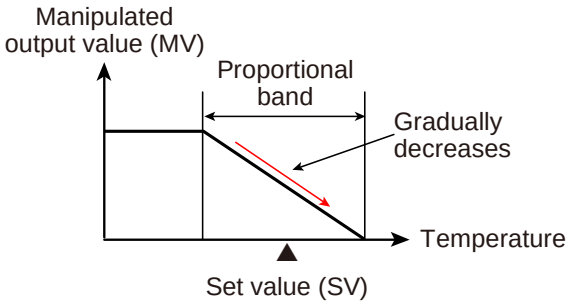
Refer to 8.3 Setting PID Values Automatically (Autotuning) for Autotuning (AT) function. Also refer to 8.4 Setting PID Values Automatically (Startup tuning) for Startup tuning (ST) function.

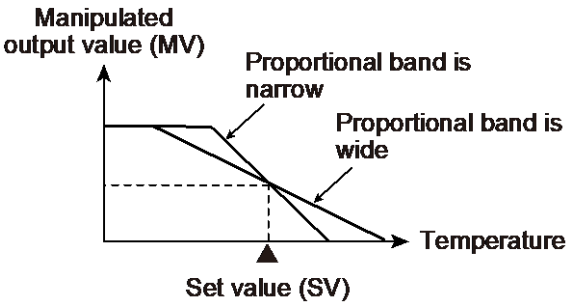
Description of function

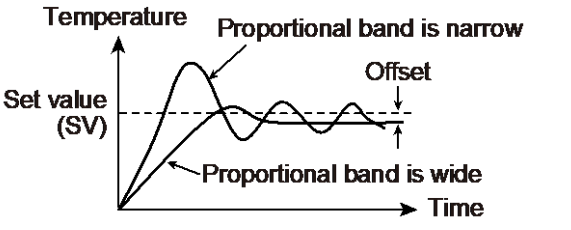
Critical parameters of PID control such as Proportional action (Proportional band: P), Integral action (Integral time: I), and Derivative action (Derivative time: D) are explained below. Note that this explanation is based on the reverse action (heating control). With the direct action (cooling control), 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.

☞ Refer to 8.6 Controlling with ON/OFF Action for ON/OFF action.

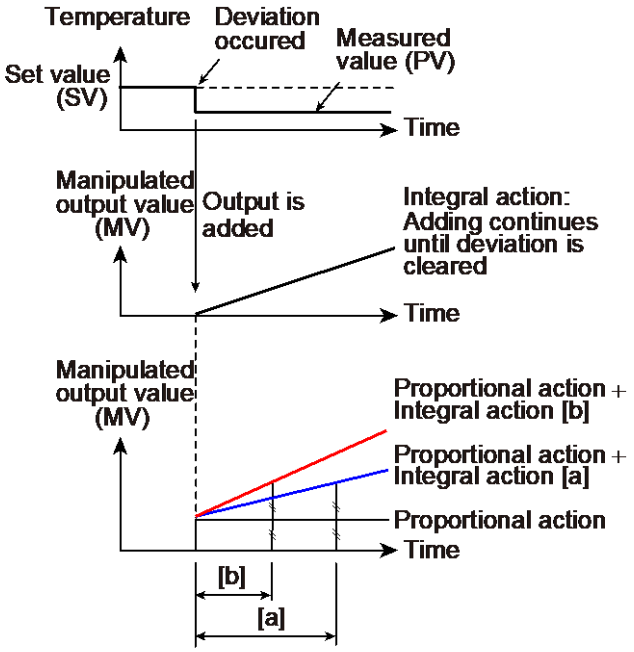
- **Integral action**

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 in 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.



[a]: Integral time of Integral action [a]
[b]: Integral time of Integral action [b]

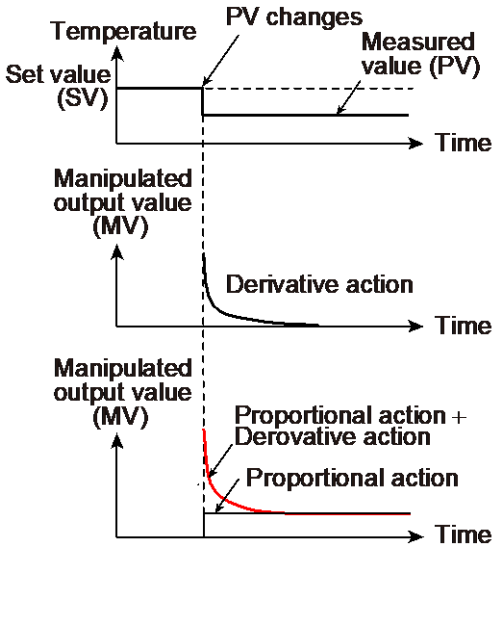
- **Derivative action**

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.

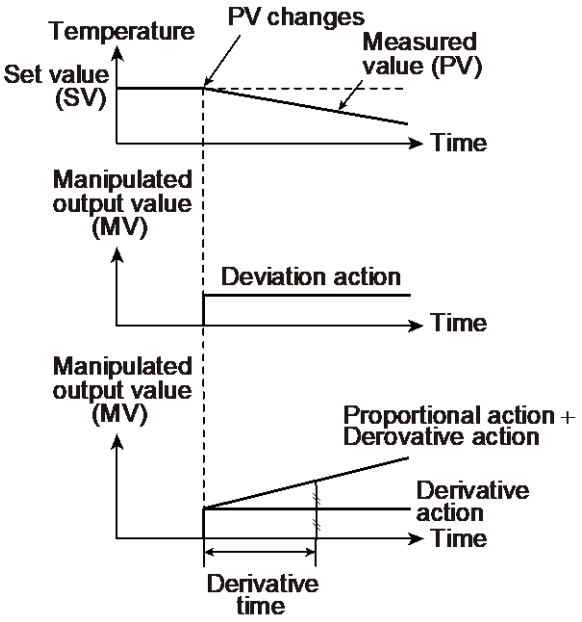
The strength of the Derivative action is expressed in the Derivative time. The Derivative time is the time until the Manipulated output value (MV) by the Proportional action gets equal to the Manipulated output value (MV) by the Derivative action when the Measured value (PV) changes at a constant rate.

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.



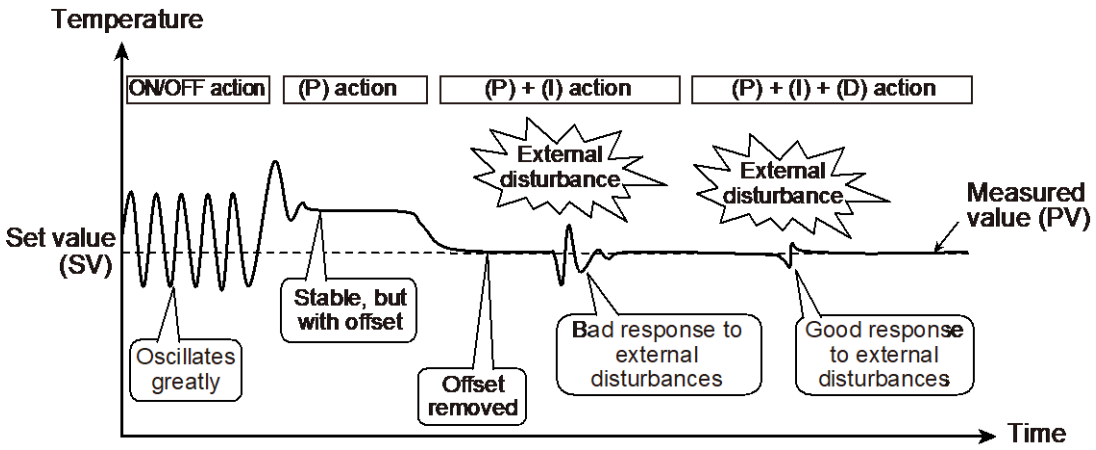
PV changes stepwise



PV gradually changes
(PV changes at a constant rate)

- **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)**

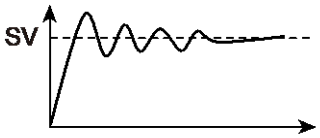
In some applications PID values calculated and obtained through Autotuning (AT) and Startup tuning (ST) may not be appropriate. In such a case the PID values need to be adjusted manually. Attempt this adjustment referring to the following.

The sample here shows a general tendency. Control results depend on the controlled object and combinations of control constants.

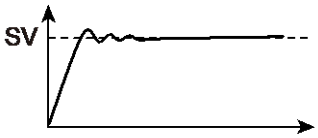
[Adjustment of Proportional band (P)]

Setting the proportional band as small as possible enables the Set value (SV) to be reached faster without overshoot.

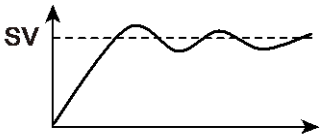
However, if the proportional band is set too narrow, it will cause hunting and the manipulated output (MV) will oscillate.



Proportional band is set too narrow

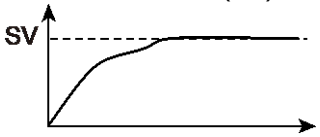
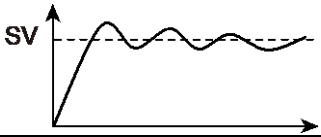


Proportional band is appropriately set



Proportional band is set too wide

[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

- **Input 1_Proportional band [heat-side] [Parameter Setting Mode: Parameter group No. 51 (*Pn51*)]**

Parameter symbol	Data range	Factory set value
1. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0% of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 1_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [heat-side]", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No. 51: Input 1_ Control action (Engineering mode).

- **Input 2_Proportional band [Parameter Setting Mode: Parameter group No. 52 (*Pn52*)]**

Parameter symbol	Data range	Factory set value
2. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 2_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 2_Proportional band", choose "2-loop control/Differential temperature control" or "Cascade control" in Function block No.58: Select function for Input 2", AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action

(Engineering mode).

- **Input 1_Proportional band [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. Pc	TC/RTD inputs: 1 (0.1, 0.01) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 1 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0% of Input 1_Input span (When Control with PV select: 0.1 to 1000.0% of PV select input span)	TC/RTD inputs: 30 V/I inputs: 3.0

To display “Input 1_Proportional band [cool-side]”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band [heat-side] in the same memory area.

- **Input 1_Integral time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. I	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 “Input 1_Integral time [heat-side]”, select other than MC-(V)COS(R) pressure control for “Input 1_Control action” in Engineering mode: Function block No. 51. Additionally, a value other than 0 must also be entered in the Input 1_Proportional band in the same memory area.

- **Input 2_Integral time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2 I	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 “Input 2_Integral time”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Input 1_Integral time [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. Ic	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 “Input 1_Integral time [cool-side]”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band in the same memory area.

- **Input 1_Derivative time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. 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 “Input 1_Derivative time [heat-side]”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band in the same memory area.

- **Input 2_Derivative time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. 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

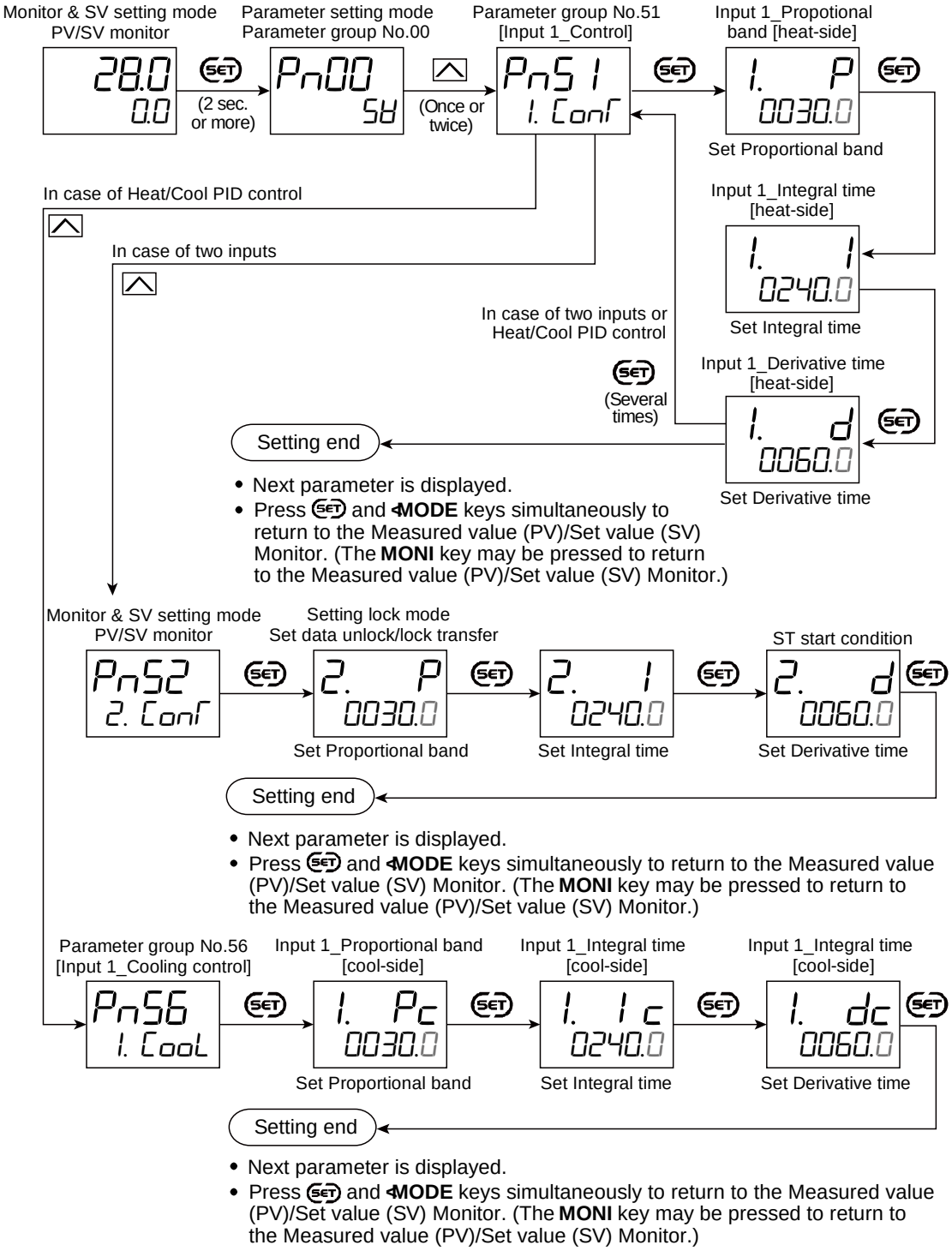
To display “Input 2_Derivative time”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Input 1_Derivative time [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. 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 “Input 1_Derivative time [cool-side]”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band in the same memory area.

Setting procedure



8.6 Controlling with ON/OFF Action

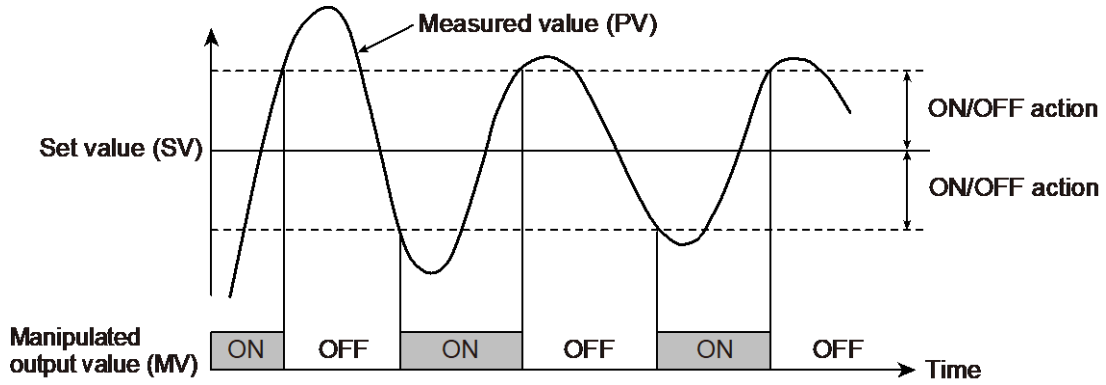
In ON/OFF control, the Manipulated output value (MV) is turned on or off depending on the Measured value (PV) whether it is above or below the Set value (SV).

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 will be unavailable.

- **Cooling control with ON/OFF action**

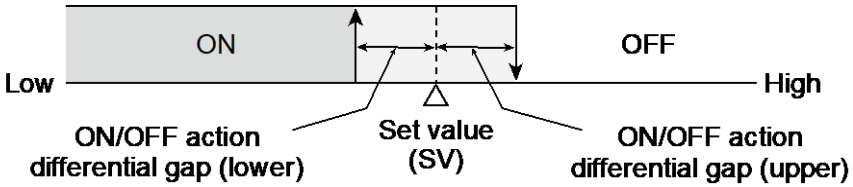
The process of Input 1 can be controlled with the ON/OFF action for the Cooling side (direct action) by setting zero to the Input 1_Proportional band [heat-side] after “0: PID control (direct action)” is set in Function block No. 51: Input 1_Control action (Engineering mode).
The process of Input 2 can be controlled with the ON/OFF action for the Cooling side (direct action) by setting zero to the Input 2_Proportional band after “0: PID control (direct action)” is set in Function block No. 52: Input 2_Control action (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.

- **Heating/Cooling control with ON/OFF action**

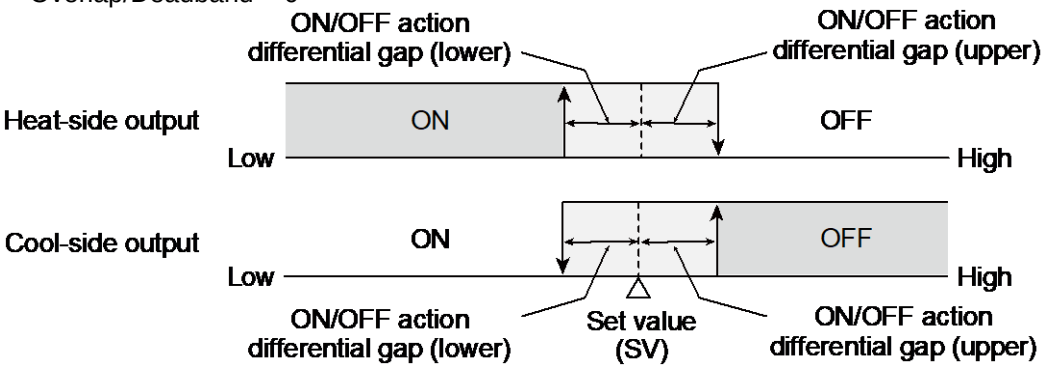
Go to “Input 1_Control action” in Function block No.51 (Engineering mode).
Select any one from “2: Heating/Cooling PID control [water cooling]”, “3: Heating/Cooling PID control [air cooling]”, or “4: Heating/Cooling PID control [Cooling linear type]” and set “0” at the Input 1_Proportional band [heat-side].
Then, the controller starts Heating/Cooling control with ON/OFF action.

Manipulated output for ON/OFF action [at Heating control]

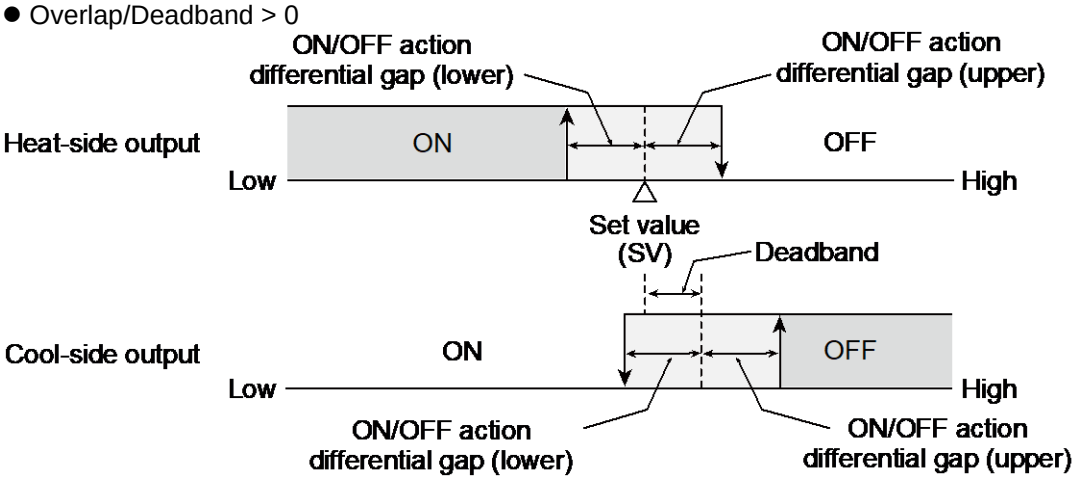


Manipulated output for ON/OFF action [at Heating/Cooling control]

● Overlap/Deadband = 0



● Overlap/Deadband > 0



Parameter setting

● Input 1_Proportional band [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn5 1)]

Parameter symbol	Data range	Factory set value
1. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0% of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 1_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [heat-side]", chose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No. 51: Input 1_Control action (Engineering mode).

- **Input 2_Proportional band [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 2_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 2_Proportional band", choose "2-loop control/Differential temperature control" or "Cascade control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_ON/OFF action differential gap (upper) [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. oHH	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 1_Input span (When Control with PV select: 0.0 to 100.0 % of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1

To display "Input 1_ON/OFF action differential gap (upper)", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band [heat-side] in the same memory area.

- **Input 1_ON/OFF action differential gap (lower) [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. oHL	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 1_Input span (When Control with PV select: 0.0 to 100.0% of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1

To display "Input 1_ON/OFF action differential gap (lower)", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No. 51: Input 1_Control action (Engineering mode). Additionally, a value 0 must also be entered in the Input 1_Proportional band [heat-side] in the same memory area.

- **Input 2_ON/OFF action differential gap (upper) [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. oHH	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 2_Input span (When Control with PV select: 0.0 to 100.0% of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1

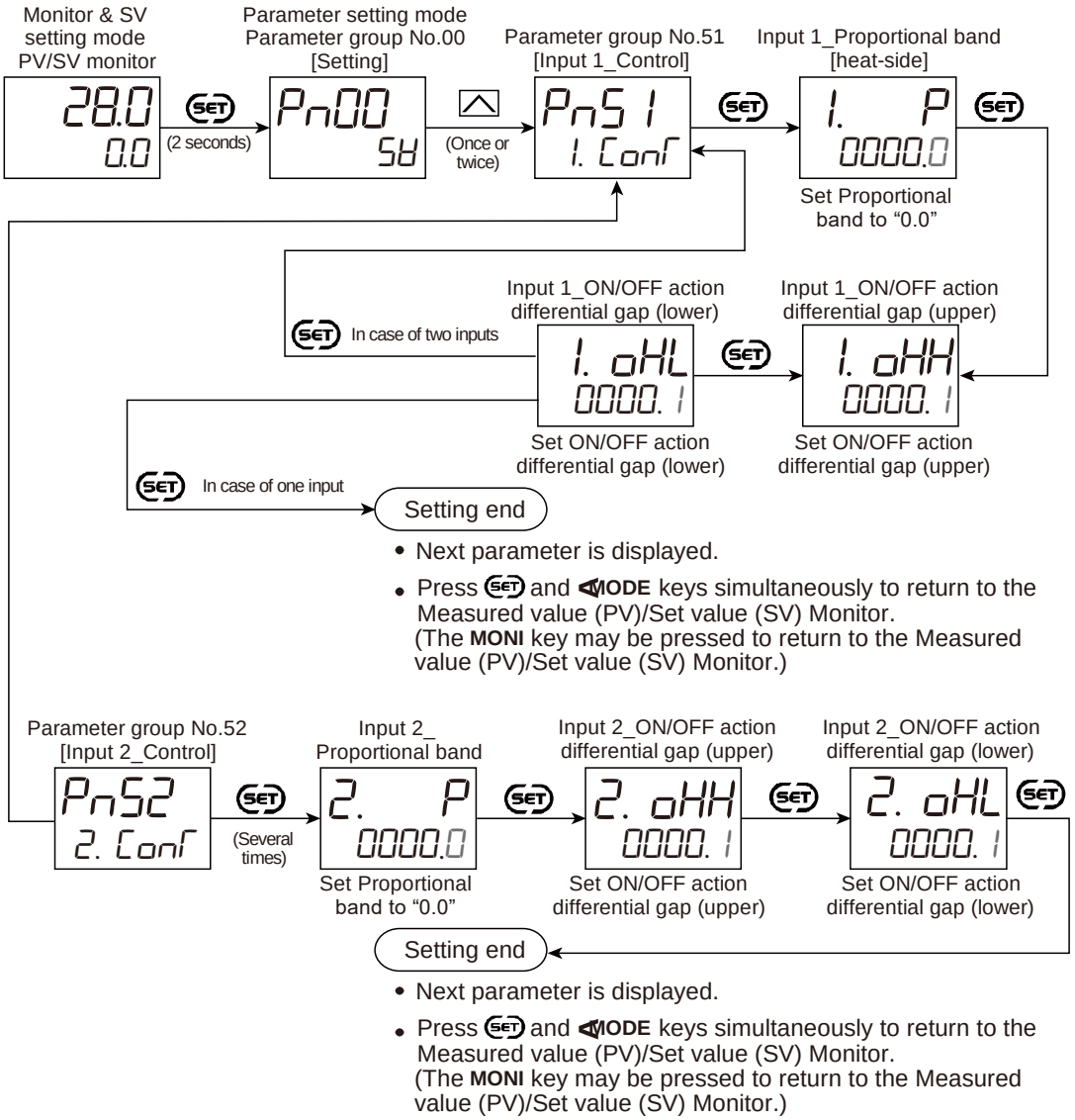
To display “Input 2_ON/OFF action differential gap (upper) “, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Input 2_ON/OFF action differential gap (lower) [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. oHL	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0% of Input 2_Input span (When Control with PV select: 0.0 to 100.0% of PV select input span)	TC/RTD inputs: 1 V/I inputs: 0.1

To display “Input 2_ON/OFF action differential gap (lower) “, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value 0 must also be entered in the Input 2_Proportional band in the same memory area.

Setting procedure



8.7 Controlling with Heating/Cooling Control

With Heating/Cooling 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.

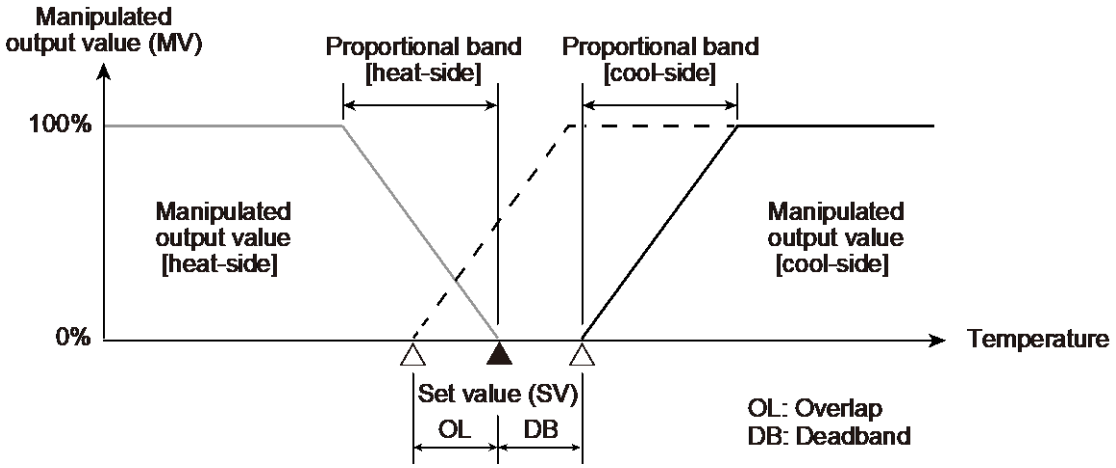
Description of function

- **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.

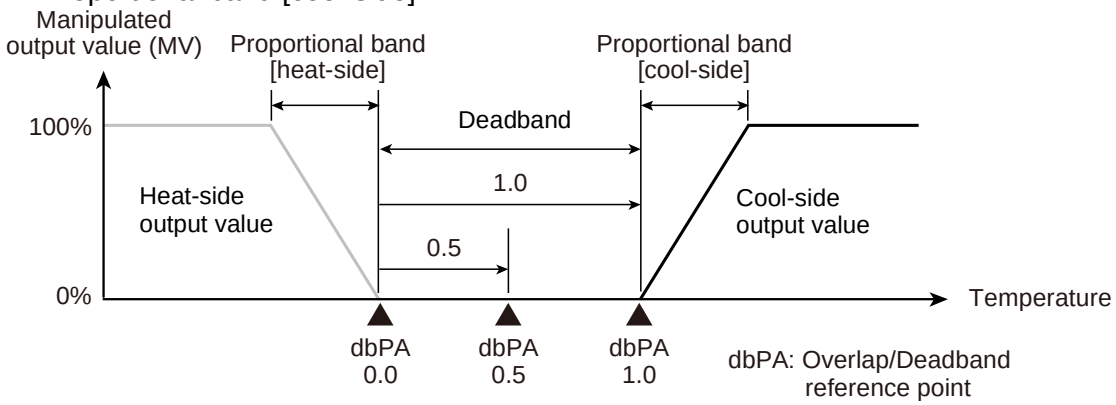
- **Overlap/Deadband**

Heating/Cooling 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.



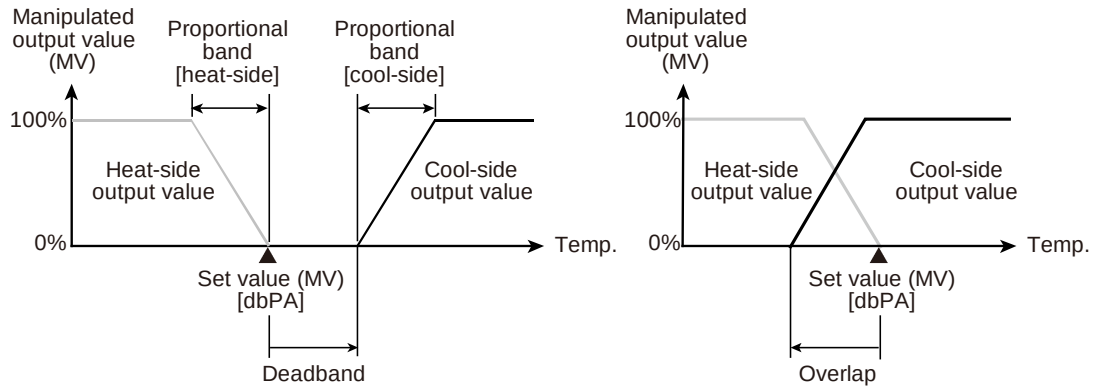
[Overlap/Deadband reference point]
Each Set value (SV) for the Heating/Cooling PID control becomes the Overlap/Deadband reference point.

- 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].



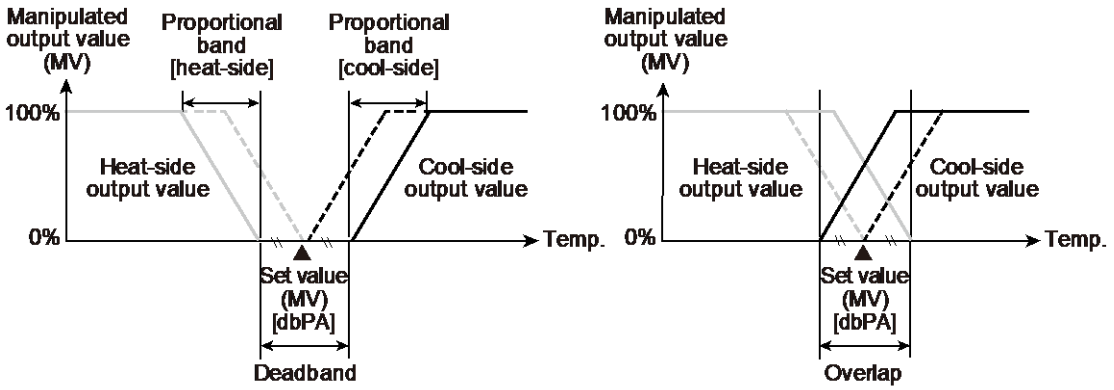
Example: Difference in Overlap/Deadband reference point

[Overlap/Deadband reference point: 0.0]



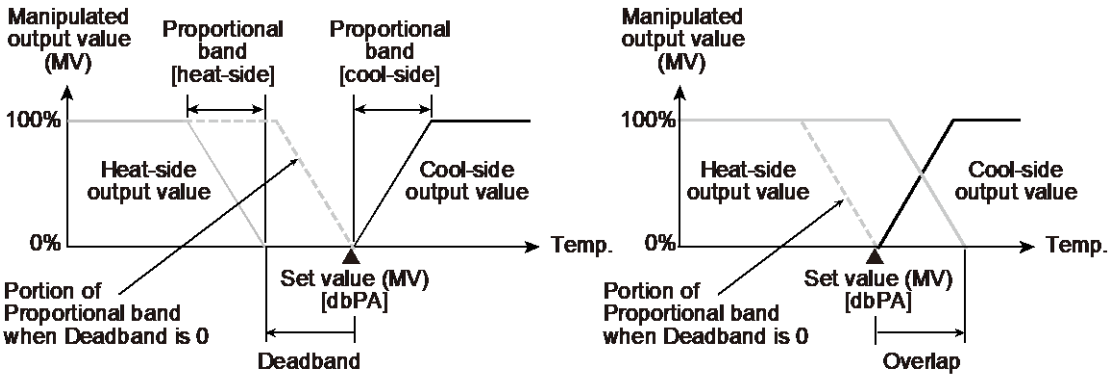
dbPA: Overlap/Deadband reference point

[Overlap/Deadband reference point: 0.5]



and ---: Portion of Proportional band when Deadband is 0
dbPA: Overlap/Deadband reference point

[Overlap/Deadband reference point: 1.0]

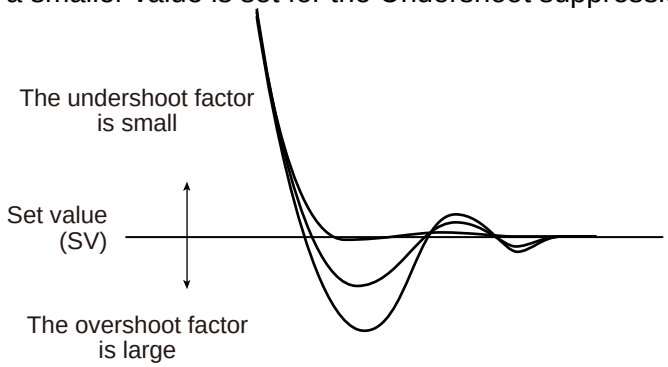


dbPA: Overlap/Deadband reference point

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

- **Input 1_Proportional band [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0% of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 1_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [heat-side]", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Proportional band [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. Pc	TC/RTD inputs: 1 (0.1, 0.01) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 1 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0% of Input 1_Input span (When Control with PV select: 0.1 to 1000.0% of PV select input span)	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [cool-side]", choose "Heating/Cooling PID control" in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band [heat-side] in the same memory area.

- **Input 1_Integral time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. I	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 "Input 1_Integral time [heat-side]", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_ Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band in the same memory area.

- **Input 1_Integral time [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. 1c	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 “Input 1_Integral time [cool-side]”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band in the same memory area.

- **Input 1_Derivative time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. 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 “Input 1_Derivative time [heat-side]”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band [heat-side] in the same memory area.

- **Input 1_Derivative time [cool-side] [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. 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 “Input 1_Derivative time [cool-side]”, choose “Heating/Cooling PID control” in Function block No. 51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_ Proportional band [heat-side] in the same memory area.

- **Input 1_Overlap/Deadband [Parameter Setting Mode: Parameter group No. 56 (Pn56)]**

Parameter symbol	Data range	Factory set value
1. db	TC/RTD inputs: -(Input 1_Input span)to +(Input 1_Input span) (When Control with PV select: -(PV select input span) to +(PV select 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 1_Input span (When Control with PV select: -100.0 to +100.0% of PV select 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 “Input 1_Overlap/Deadband”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Control action [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 2: Heating/Cooling PID control with Autotuning [Cooling linear type] 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] For cascade control, only 0 or 1 are selectable. For PV select, only 0, 1 or 2 are selectable.	Product identification code specified at the time of order.

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 1_Control action is changed.

- **Undershoot suppression factor [Engineering Mode: Function block No. 56 (Fn56)]**

Parameter symbol	Data range	Factory set value
US	0.000 to 1.000	1.000

📖 To display “Undershoot suppression factor”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode).

- **Overlap/Deadband reference point [Engineering Mode: Function block No. 56 (Fn56)]**

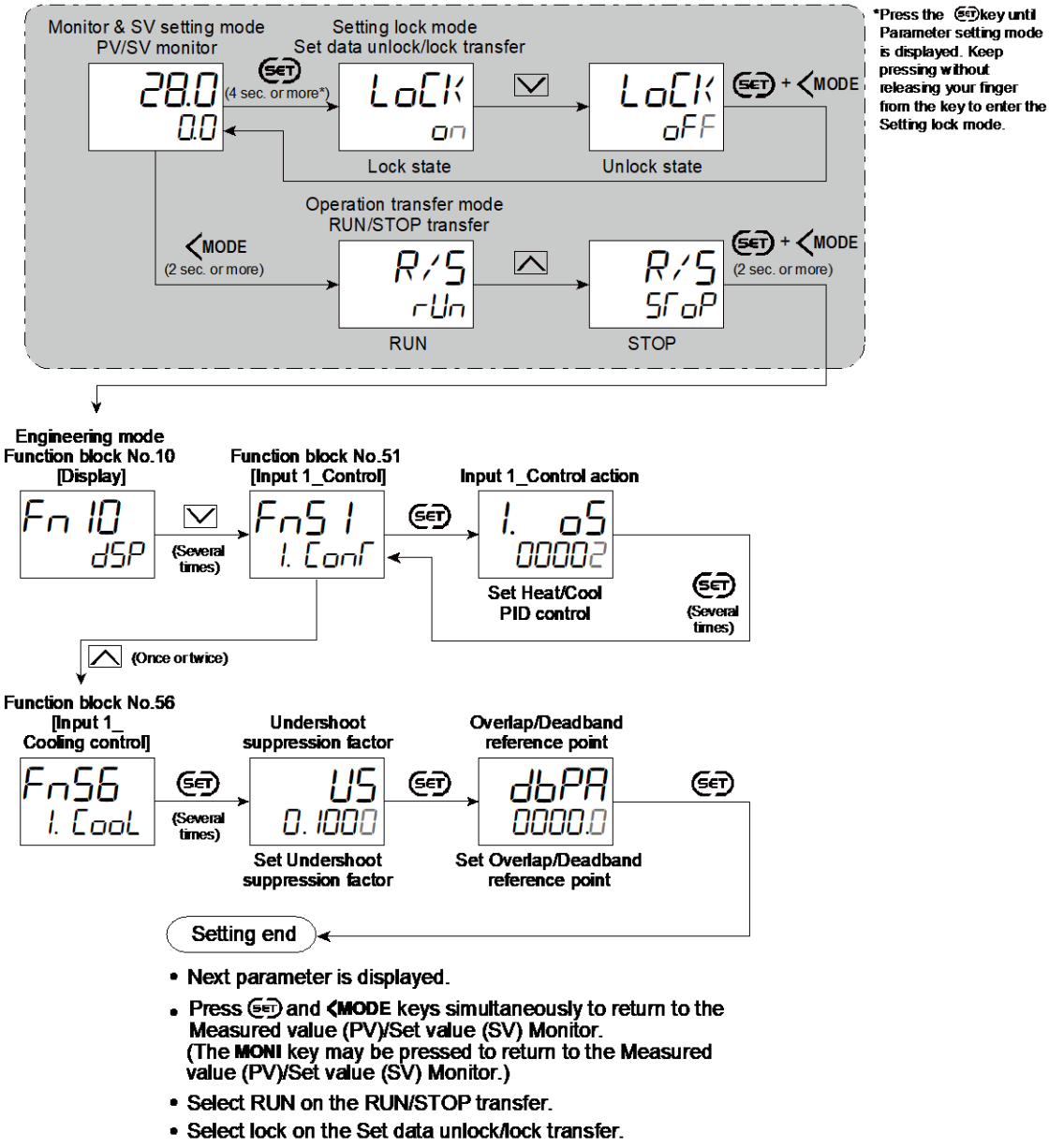
Parameter symbol	Data range	Factory set value
dbPA	0.0 to 1.0	0.0

📖 To display “Overlap/Deadband reference point”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode).

Setting procedure

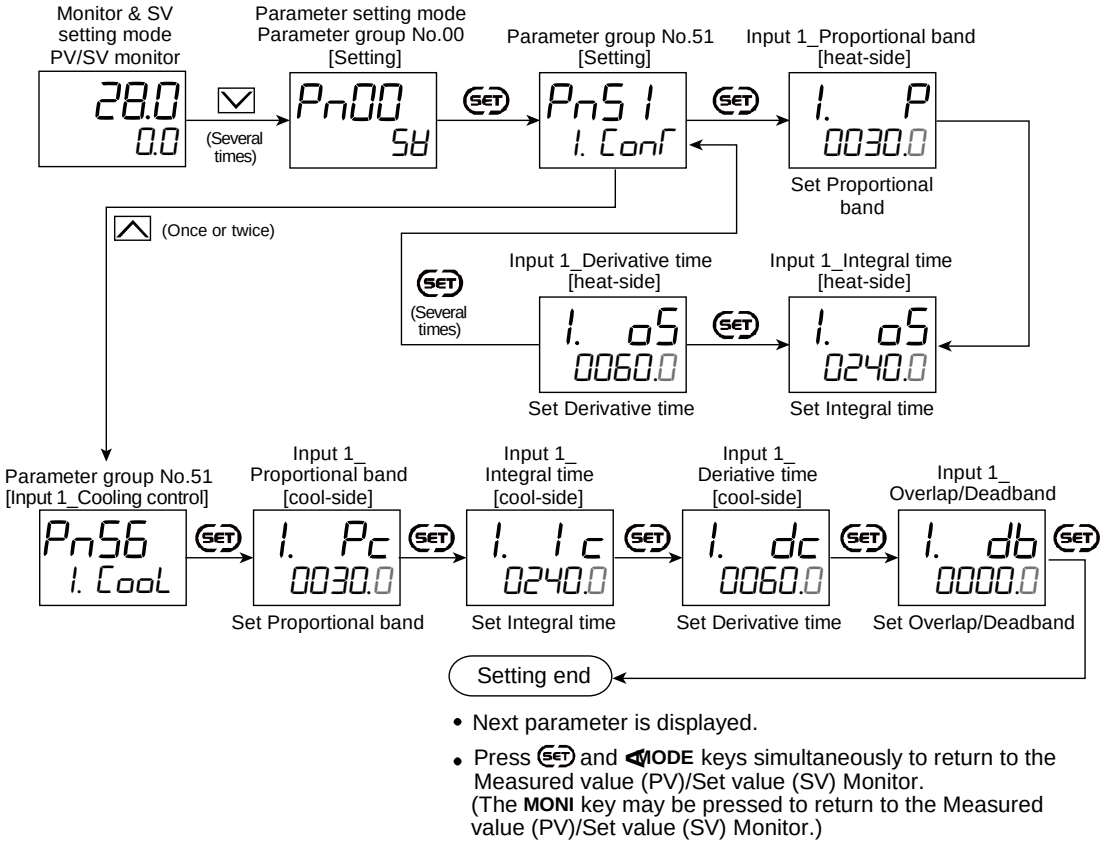
● Selecting Heating/Cooling PID control

To enter the Engineering mode



- Next parameter is displayed.
- Press and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

- **Setting parameters for Heating/Cooling PID control**



The Parameters in Heating/Cooling PID control can be calculated also in Autotuning (AT) (Overlap/Deadband is excluded).
Refer to 8.3 Setting PID Values Automatically (Autotuning) for Autotuning (AT).

8.8 Using with MC-COS/MC-VCOS

The SC-F71 is the only controller that controls TLV steam control valves MC-COS/MC-COSR and MC-VCOS/MC-VCOSR series.
MC-COS(R)/MC-VCOS(R) series combines an automatic pressure reducing valve with a control valve. The sensing and feedback control with the controller together with the control mechanism of the valve itself achieves a hybrid control.

- **Valve coefficient**

The valve coefficient is a value individually determined for TLV steam control valves MC-COS(R) series and MC-VCOS(R) series.
These products use the valve coefficient to control the combined control valve with the optimum control output value and to control the steam pressure for the secondary side of the control valve.
Therefore, when MC-COS(R) series and MC-VCOS(R) series are used in combination with the equipment, it is necessary to set the valve coefficient of the control valve to be used with the equipment.

* This function is only available when pressure control operation is selected. Control output value will be calculated with PID control algorithm when temperature control operation is selected.

NOTE: The pressure unit to be entered for the pressure value is defined by the valve

coefficient F. Parameters to be entered in pressure units, such as measurement input range, target set value, and alarm set value, must be entered in the pressure units defined by the valve coefficient F. If the pressure unit and the parameter do not match, the product will not operate properly.

NOTE: To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate), refer to the "Converting valve coefficient" section to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.

- **Converting valve coefficient**

Valve coefficient value for MC-COS(R) and MC-VCOS(R) are indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.
The value of the valve coefficient F indicates the unit of pressure used for control. Values of other valve coefficients A to E vary depending on the unit system. When control is performed with a pressure unit different from the value of F indicated in the product, or the pressure unit used for control is changed, it is necessary to convert the valve coefficient according to the pressure unit to be used.
Valve coefficients A, C and E need to be changed. The value obtained by multiplying the current valve coefficient described in the valve coefficient plate by the correction coefficient shown in Table 8-1-1, 8-1-2, 8-2-1, or 8-2-2 become the valve coefficient in the new pressure unit system. It is not necessary to change the values of valve coefficients b and d.

☞ Refer to “Input 1_Valve coefficient F” and “Input 2_Valve coefficient F” for pressure unit indicated by the value of Valve coefficient F.

Table 8-1-1 Correction factor of valve coefficient A and C

Current unit system \ New unit system	kg/cm^{2}G (F=0)	barg (F=1)	psig (F=2)	kPaG (F=3)	MPaG (F=4)
kg/cm^{2}G (F=0)	—	1.01970	0.70307	1.01970	1.01970
barg (F=1)	0.98067	—	0.68948	1.00000	1.00000
psig (F=2)	1.42230	1.45040	—	1.45040	1.45040
kPaG (F=3)	0.98067	1.00000	0.68948	—	1.00000
MPaG (F=4)	0.98067	1.00000	0.68948	1.00000	—

Table 8-1-2 Correction factor of valve coefficient A and C

Current unit system \ New unit system	mmHg (F=10)	mbar (F=11)	inHg (F=12)	psi (F=13)	kPa (F=14)
mmHg (F=10)	—	0.75006	2.54000	0.51715	0.75006
mbar (F=11)	1.33320	—	3.38600	0.68948	1.00000
inHg (F=12)	0.39370	0.29530	—	0.20360	0.29530
psi (F=13)	1.93370	1.45040	4.91200	—	1.45040
kPa (F=14)	1.33320	1.00000	3.38600	0.68948	—

Table 8-2-1 Correction factor of valve coefficient E

Current unit system \ New unit system	kg/cm^2 G (F=0)	barg (F=1)	psig (F=2)	kPaG (F=3)	MPaG (F=4)
kg/cm^{2}G (F=0)	—	0.98067	1.42230	0.98067	0.98067

barg	(F=1)	1.01970	—	1.45040	1.00000	1.00000
psig	(F=2)	0.70307	0.68948	—	0.68948	0.68948
kPaG	(F=3)	1.01970	1.00000	1.45040	—	1.00000
MPaG	(F=4)	1.01970	1.00000	1.45040	1.00000	—

Table 8-2-2 Correction factor of valve coefficient E

Current unit system \ New unit system		mmHg (F=10)	mbar (F=11)	inHg (F=12)	psi (F=13)	kPa (F=14)
mmHg	(F=10)	—	1.33320	0.39370	1.93370	1.33320
mbar	(F=11)	0.75006	—	0.29530	1.45040	1.00000
inHg	(F=12)	2.54000	3.38600	—	4.91200	3.3600
psi	(F=13)	0.51715	0.68948	0.20360	—	0.68948
kPa	(F=14)	0.75006	1.00000	0.29530	1.45040	—

[Conversion example]
When using the MC-COS-16, whose valve coefficient is currently displayed in kg/cm^{2}G, in a new unit system such as psig:
Current valve coefficient
A: 552 b: 340 C: 369 d: 1425 E: 594 F: 0
The valve coefficient A and C are converted by referring to Table 1-1. The conversion factor from the current unit system (kg/cm^{2}G) to the new unit system (psig) is 0.70307. Therefore, new valve coefficients are;
A = 552 × 0.70307 = 388.09464 ≈ 388 *
C = 369 × 0.70307 = 259.43283 ≈ 259 *
* Rounded to the nearest whole number.
The valve coefficient E is converted by referring to Table 2-1. The conversion factor from the current unit system (kg/cm^{2}G] to the new unit system (psig) is 1.42230. Therefore, new valve coefficients are;
E = 594 × 1.42230 = 844.8462 ≈ 845 **
** Rounded to the nearest whole number.
As a result of the above conversion, the values of new valve coefficients A to F are as follows.
A: 388 b: 340 C: 259 d: 1425 E: 845 F: 2

8.8.1 Controlling by using with MC-COS/MC-VCOS (pressure control)

Steam pressure supplied to the secondary side of the control valve can be controlled with the pressure control valve for steam MC-COS(R)/MC-VCOS(R) series.
By controlling the steam pressure with TLV proprietary algorithms for pressure reducing valve for steam, COS (VCOS) series, accuracy and responsiveness exceeding normal control valves can be achieved.

Parameter setting

- **Input 1_Control action [Engineering Mode: Function block No. 51 (FnS 1)]**

Parameter symbol	Data range	Factory set value
1. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action)	Product identification code specified at the

	2: Heating/Cooling PID control with Autotuning [Cooling linear type] 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] For cascade control, only 0 or 1 are selectable. For PV select, only 0, 1 or 2 are selectable.	time of order.

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 1_Control action is changed.

- **Input 1_Valve coefficient A to E [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. A	-1999 to 9999	0
1. b	-1999 to 9999	0
1. C	-1999 to 9999	0
1. d	-1999 to 9999	0
1. E	-1999 to 9999	0

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 1_Valve coefficient A to E”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No. 51: Input 1_Control action (Engineering mode).

- **Input 1_Valve coefficient F [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. F	When Input 1_Control action is set to 3 to 6 or 8: 0: kg/cm^{2}G 1: barg 2: psig 3: kPaG 4: MPaG When Input 1_Control action is set to 7 or 9: 10: mmHg/Torr 11: mbar 12: inHg 13: psi 14: kPa NOTE: To use a pressure unit other than the valve coefficient F indicated on the valve coefficient plate, refer to the "Converting valve coefficient" section in "8.8 Using with MC-COS/MC-VCOS" in the instruction manual (parameters/functions) to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	Product identification code specified at the time of order.

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 1_Valve coefficient F”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-

(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Pressure standard for Valve coefficient F [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. GSL	0: Atmospheric (gauge) pressure standard 1: Absolute pressure standard	Product identification code specified at the time of order.

To display "Input 1_Pressure standard for Valve coefficient F", choose "7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 1_Control valve selection [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. VSL	0: MC-VCOS(R) 1: PC-VCOS(R)	0

To display "Input 1_Control valve selection", choose "7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

NOTE PC-VCOS(R) is an old model control valve for MC-VCOS(R). Choose "1" when PC-VCOS(R) is used with equipment.

- **Input 1_Pressure (temp) limiter [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. PrL	When Input 1_Control action is set to 3 to 7: Input 1_Input range low to Input 2_Input range high When Input 1_Control action is set to 8: Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99 Coefficient F = 1 (barg) 0.00 to 99.99 Coefficient F = 2 (psig) 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999 Coefficient F = 4 (MPaG) 0.000 to 9.999 When Input 1_Control type is set to 9: The smaller value of 0.0 to Input 1_Input range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 1_ Display unit When Input type is set to V/I input: Input 1_Temperature limiter unit When 0 (0.0, 0.00, 0.000) and Input 1_Pressure (Temp) Limiter function OFF [Varies with the setting of the Decimal point position except when Input 1_Control action is set to "8".]	Input 1_Control type is a setting other than 7: 0 Input 1_Control type is set to 7: Input 1_Input range high

To display "Input 1_Pressure (Temp) limiter", choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Return bias [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. ob	-50.0 to 50.0%	0.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 1_Regression equation bias", choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_ Response speed self-learning selection [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. tMF	0: Yes 1: No	0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 1_Response speed self-learning selection", choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 1_ No. of corrective actions [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. Pc1	0 to 99 times (99: unlimited times)	99

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 1_No. of corrective actions", choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_ Corrective action repeat [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. Pc2	0: Yes 1: No	1

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 1_Corrective action repeat”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_ Corrective actions for ramp control [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. Pc3	0: Yes 1: No	0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users’ applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 1_Corrective actions for ramp control”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_ Lower range of corrective action amount [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. oLb	0.0 to 105.0%	20.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users’ applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 1_Lower range of corrective action amount”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_ Upper range of corrective action amount [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. oHb	0.0 to 105.0%	20.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users’ applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 1_Upper range of corrective action amount”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Dead zone [Parameter Setting Mode: Parameter group No. 51 (Pn5 1)]**

Parameter symbol	Data range	Factory set value
1.MCdb	0 to 10% of input_1 span [Position of decimal point depends of Input 1_Valve coefficient F]	See Table 8-3

📖 To display “Input 1_Dead zone”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

Table 8-3 Factory set value of Dead zone

Control action*	Valve coefficient F (pressure unit)									
	0	1	2	3	4	10	11	12	13	14
3	0.03	0.03	0.4	3	0.003	—	—	—	—	—
4	0.04	0.04	0.4	4	0.004	—	—	—	—	—
5	0.10	0.10	1.5	10	0.010	—	—	—	—	—
6	0.10	0.10	1.5	10	0.010	—	—	—	—	—
7	—	—	—	—	—	7	10	0.3	0.14	1

* Set value for the control operation set in Function block No. 51: Input 1_Control action (1. Cont)

- **Input 2_Control action [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] 2: n/a For cascade control, only 0 or 1 are selectable.	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 2_Control action is changed.

- **Input 2_Valve coefficient A to E [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. A	-1999 to 9999	0
2. b	-1999 to 9999	0
2. C	-1999 to 9999	0
2. d	-1999 to 9999	0
2. E	-1999 to 9999	0

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 2_Valve coefficient A to E”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Valve coefficient F [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. F	When Input 2_Control type is set to 3 to 6 or 8: 0: kg/cm^{2}G 1: barg 2: psig	Same as Input 1_Valve coefficient F (pressure unit)

	3: kPaG 4: MPaG When Input 2_Control type is set to 7 or 9: 10: mmHg/Torr 11: mbar 12: inHg 13: psi 14: kPa NOTE: To use a pressure unit other than the valve coefficient F indicated on the valve coefficient plate, refer to the "Converting valve coefficient" section in "8.8 Using with MC-COS/MC-VCOS" in the instruction manual (parameters/functions) to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 2_Valve coefficient F”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Pressure standard for Valve coefficient F [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. GSL	0: Atmospheric (gauge) pressure standard 1: Absolute pressure standard	Same as pressure standard for Input 1_Valve coefficient F

📖 To display “Input 2_Pressure standard for Valve coefficient F”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Control valve selection [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. VSL	0: MC-VCOS(R) 1: PC-VCOS(R)	0

📖 To display “Input 2_Control valve selection”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

📖 **NOTE** PC-VCOS(R) is an old model control valve for MC-VCOS(R). Choose “1” when PC-VCOS(R) is used with equipment.

- **Input 2_Pressure (temp) limiter [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. PrL	When Input 2_Control type is set to 3 to 7: Input 2_Input range low to Input 2_Input range high When Input 2_Control type is set to 8: Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99	When Input 2_Control type is a setting other than 7: 0 When Input 2_Control type is set to 7: Input 2_Input

	Coefficient F = 1 (barg) 0.00 to 99.99 Coefficient F = 2 (psig) 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999 Coefficient F = 4 (MPaG) 0.000 to 9.999 When Input 1_Control type is set to 9: The smaller value of 0.0 to Input 2_Input range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 2_ Display unit When Input type is set to V/I input: Input 2_Temperature limiter unit When 0 (0.0, 0.00, 0.000) and Input 2_Pressure (Temp) Limiter function OFF [Varies with the setting of the Decimal point position when Input 2_Control action is a setting other than “8”.]	range high

To display “Input 2_Pressure (Temperature) limiter”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Regression equation bias [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. ob	-50.0 to 50.0%	0.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users’ applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 2_Regression equation bias”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Response speed self-learning selection [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. tMF	0: Yes 1: No	0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users’ applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display “Input 2_Response speed self-learning selection”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_No. of corrective actions [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. Pc 1	0 to 99 times (99: unlimited times)	99

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 2_No. of corrective actions", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Corrective action repeat [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. Pc2	0: Yes 1: No	1

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 2_Corrective action repeat", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Corrective actions for ramp control [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. Pc3	0: Yes 1: No	0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 2_Corrective actions for ramp control", choose "2-loop control/ Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Lower range of corrective action amount [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. oLb	0.0 to 105.0%	20.0

NOTE Do not change the factory set value.

TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 2_Lower range of corrective action amount", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Upper range of corrective action amount [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. oHb	0.0 to 105.0%	20.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

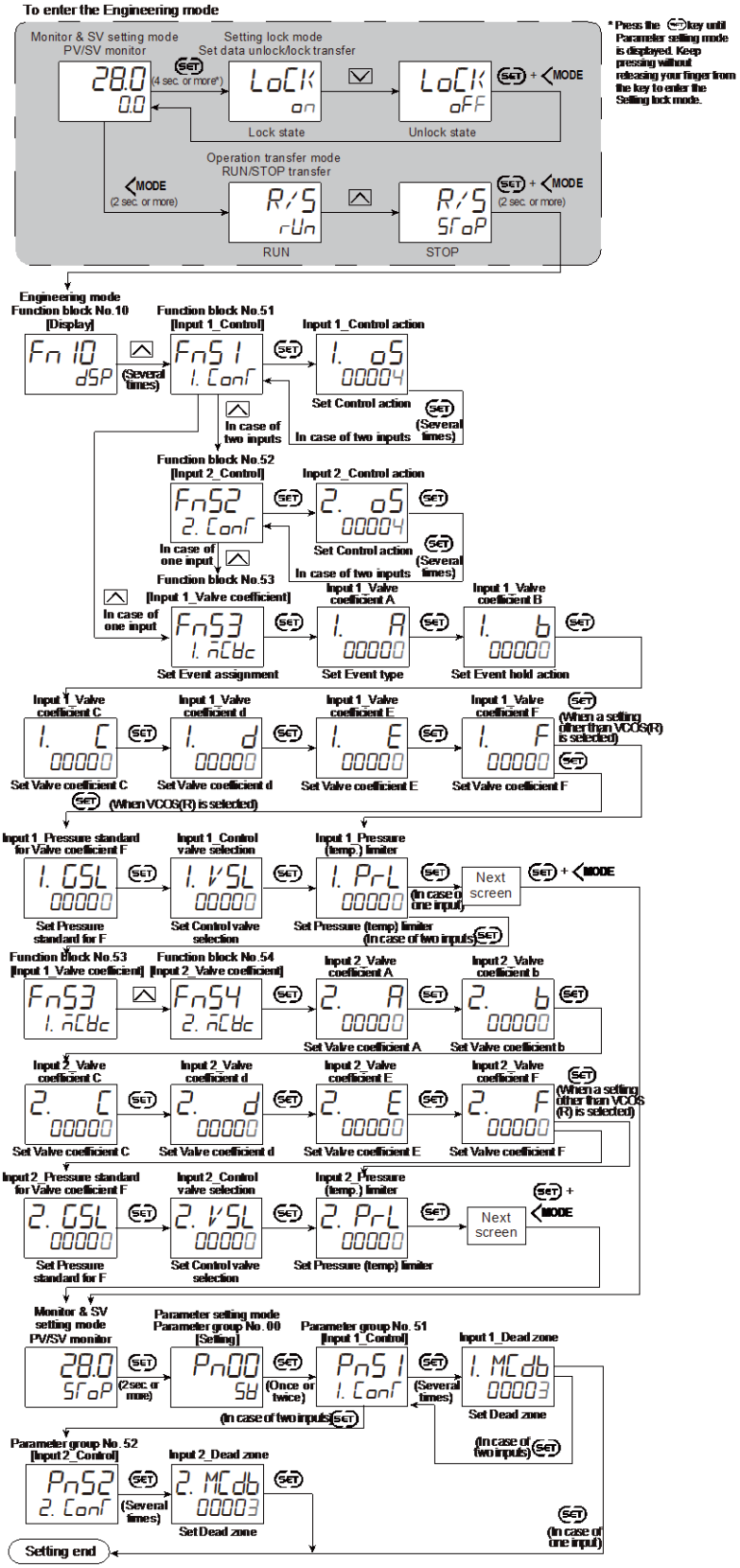
To display "Input 2_Upper range of corrective action amount", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Dead zone [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2.MCdb	0 to 10% of Input 2_Span [Decimal point position depends on the settings for Input 2_ Valve coefficient F]	See Table 8-3

To display "Input 2_Dead zone", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

Setting procedure



8.8.2 Controlling by combining with MC-COS/MC-VCOS (temperature control)

Temperature control can be performed by combining the controller with MC-COS/MC-COSR or MC-VCOS/MC-VCOSR series steam control valves.
The control algorithm is PID control (reverse action), however by using MC-COS/MC-COSR or MC-VCOS/MC-VCOSR series, which include steam pressure reducing valves, the supply pressure of steam as a heat source can be controlled, enabling temperature control.
In addition, the valves are not easily affected by external disturbances such as pressure fluctuations of the heat source steam on the primary side of the valve.

Parameter setting

- **Input 1_Control action [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 2: Heating/Cooling PID control with Autotuning [Cooling linear type] 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] For cascade control, only 0 or 1 are selectable. For PV select, only 0, 1 or 2 are selectable.	Product identification code specified at the time of order.

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized when the Input 1_Control action is changed.

- **Input 1_Valve coefficient A to E [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. A	-1999 to 9999	0
1. b	-1999 to 9999	0
1. C	-1999 to 9999	0
1. d	-1999 to 9999	0
1. E	-1999 to 9999	0

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 1_Valve coefficient A to E”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Valve coefficient F [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. F	When Input 1_Control action is set to 3 to 6 or 8: 0: kg/cm^{2}G 1: barg 2: psig 3: kPaG 4: MPaG When Input 1_Control action is set to 7 or 9: 10: mmHg/Torr 11: mbar 12: inHg 13: psi 14: kPa NOTE: The pressure unit to be entered for the pressure value is defined by the valve coefficient F. To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate), refer to the "Converting valve coefficient" section to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	Product identification code specified at the time of order.

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 1_Valve coefficient F”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Pressure (temp) limiter [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. PrL	When Input 1_Control action is set to 3 to 7: Input 1_Input range low to Input 2_Input range high When Input 1_Control action is set to 8: Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99 Coefficient F = 1 (barg) 0.00 to 99.99 Coefficient F = 2 (psig) 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999 Coefficient F = 4 (MPaG) 0.000 to 9.999 When Input 1_Control action is set to 9: The smaller value of 0.0 to Input 1_Input range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 1_ Display unit When Input type is set to V/I input: Input 1_Temperature limiter unit When 0 (0.0, 0.00, 0.000) and Input 1_Pressure (Temp) Limiter function OFF [Varies with the setting of the Decimal point position when Input 2_Control action is a setting other than “8”.]	Input 1_Control type is a setting other than 7: 0 Input 1_Control type is set to 7: Input 1_Input range high

📖 To display “Input 1_Pressure (Temperature) limiter”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Temperature limiter unit [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1.PruN	0: °C 1: °F	Product identification code specified at the time of order.

📖 To display “Input 1_Temperature limiter unit”, choose “9: Temperature control

operation [MC-(V)COS(R)]" in Function block No.51: Input 1_Control action (Engineering mode), AND choose "Current" or "Voltage input" in Function block No. 21: Input 1_Input type (Engineering mode).

- **Input 1_Return bias [Engineering Mode: Function block No. 53 (Fn53)]**

Parameter symbol	Data range	Factory set value
1. ob	-50.0 to 50.0%	0.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 1_Regression equation bias", choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_Control action [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. oS	0: PID control with Autotuning (direct action) 1: PID control with Autotuning (reverse action) 3: Pressure control operation [MC-COS(R)-3] 4: Pressure control operation [MC-COS(R)-16, 15 to 50 mm] 5: Pressure control operation [MC-COS(R)-16, 65 to 150 mm] 6: Pressure control operation [MC-COS(R)-21] 7: Pressure control operation [MC-VCOS(R)] 8: Temperature control operation [MC-COS(R)-16] 9: Temperature control operation [MC-VCOS(R)] 2: n/a For cascade control, only 0 or 1 are selectable.	1

Refer to "4. Parameters that are Initialized/Modified when Setting is Changed" for the parameters that are initialized or changed when the Select function for input 2 is changed.

- **Input 2_Valve coefficient A to E [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. A	-1999 to 9999	0
2. b	-1999 to 9999	0
2. C	-1999 to 9999	0
2. d	-1999 to 9999	0
2. E	-1999 to 9999	0

Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

To display "Input 2_Valve coefficient A to E", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

Input 2_Valve coefficient F [Engineering Mode: Function block No. 54 (Fn54)]

Parameter symbol	Data range	Factory set value
2. F	When Input 2_Control action is set to 3 to 6 or 8: 0: kg/cm^{2}G 1: barg 2: psig 3: kPaG 4: MPaG When Input 2_Control action is set to 7 or 9: 10: mmHg/Torr 11: mbar 12: inHg 13: psi 14: kPa NOTE: The pressure unit to be entered for the pressure value is defined by the valve coefficient F. To use a pressure unit other than the valve coefficient F (indicated on the valve coefficient plate), refer to the "Converting valve coefficient" section to convert the valve coefficient and change the valve coefficient F along with valve coefficients A, C, and E.	Same as Input 1_Valve coefficient F

☞ Valve coefficient value (A to F) is indicated in the valve coefficient plate (attached) on the MC-(V)COS(R), which is also indicated on the valve coefficient tag when the equipment is new.

📖 To display “Input 2_Valve coefficient F”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” or “8 and 9 (Temperature control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Pressure (temp) limiter [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. PrL	When Input 2_Control action is set to 3 to 7: Input 1_Input range low to Input 2_Input range high When Input 2_Control action is set to 8: Valve coefficient Coefficient F = 0 (kg/cm^{2}G): 0.00 to 99.99 Coefficient F = 1 (barg) 0.00 to 99.99 Coefficient F = 2 (psig) 0.0 to 999.9 Coefficient F = 3 (kPaG): 0 to 9999 Coefficient F = 4 (MPaG) 0.000 to 9.999 When Input 2_Control action is set to 9: The smaller value of 0.0 to Input 1_Input range high or 140.0 °C (280.0 °F) Select the temperature unit according to the following conditions: When Input type is set to Temperature input: Input 2 Display unit When Input type is set to V/I input: Input 2_Temperature limiter unit When 0 (0.0, 0.00, 0.000) and Input 2_Pressure (Temp) Limiter function OFF [Varies with the setting of the Decimal point position when Input 2_Control action is a setting other than “8”.]	Input 2_Control action is a setting other than 7: 0 Input 2_Control action is set to 7: Input 2_Input range high

📖 To display “Input 2_Pressure (Temperature) limiter”, choose “2-loop control/

Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 2_Temperature limiter unit [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2.PruN	0: °C 1: °F	Same as Input 1_ Temperature limiter unit

To display "Input 2_Temperature limiter unit", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "9: Temperature control operation [MC-VCOS(R)] in Function block No. 52: Input 2_Control action (Engineering mode), AND choose "Current" or "Voltage input" in Function block No. 22: Input 2_Input type (Engineering mode).

- **Input 2_Return bias [Engineering Mode: Function block No. 54 (Fn54)]**

Parameter symbol	Data range	Factory set value
2. ob	-50.0 to 50.0%	0.0

NOTE Do not change the factory set value.
TLV engineers may change the value to adjust the controllability after checking the users' applications and conditions. Unnecessary changes to values may affect controllability. Please contact TLV for details.

To display "Input 2_Regression equation bias", choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose "3 to 7 (Pressure control operation [MC-(V)COS(R)])" or "8 and 9 (Temperature control operation [MC-(V)COS(R)])" in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_ Proportional band [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) Input: 0.0 to 1000.0% of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 1_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [heat-side]", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Integral time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. 1	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 “Input 1_Integral time [heat-side]”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band in the same memory area.

- **Input 1_Derivative time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. d	1 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 “Input 1_Deriative time [heat-side]”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band in the same memory area.

- **Input 1_Control response parameter [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. RPT	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	PID control: 0 Heating/Cooling PID control: 2

To display “Input 1_Control response parameter”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_ Proportional band [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_Input span (Unit: °C [°F]) (2When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) Input: 0.0 to 1000.0 % of Input 1_Input span (2When Control with PV select:: 0.0 to 1000.0 % of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting “Temperature control operation [MC-(V)COS(R)] is selected in Input 2_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display “Input 2_Proportional band”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_ Control action (Engineering mode).

- **Input 2_Integral time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. 1	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 “Input 2_Integral time”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Input 2_Derivative time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. d	1 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 “Input 2_Derivative time”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

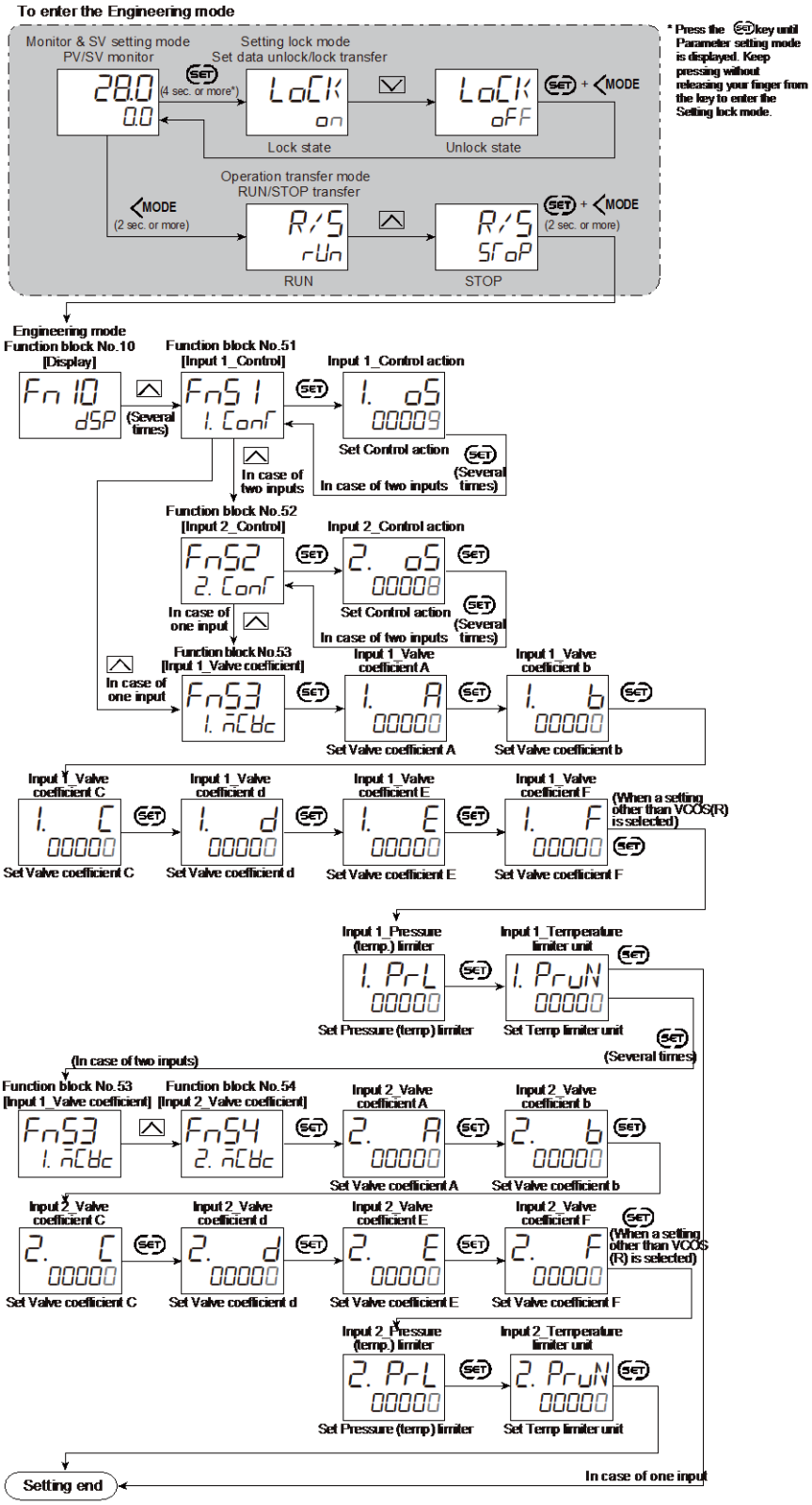
- **Input 2_Control response parameter [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. RPr	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	0

To display “Input 2_Control response parameter”, choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-VCOS(R)])” in Function block No. 52: Input 2_Control action (Engineering mode).

Setting procedure

- **Selecting control action and setting valve coefficient**



- **Setting PID constant**

PID control is employed as the control algorithm of temperature control of the MC-COS(R)/MC-VCOS(R) series, therefore, the PID constant must be set for operation.

8.9 Controlling with Manual Control

To conduct the Manual control, you need to select the Manual mode using the Auto/Manual transfer.
The Auto/Manual transfer can be made by a key operation, Digital input (DI) or communication (optional).

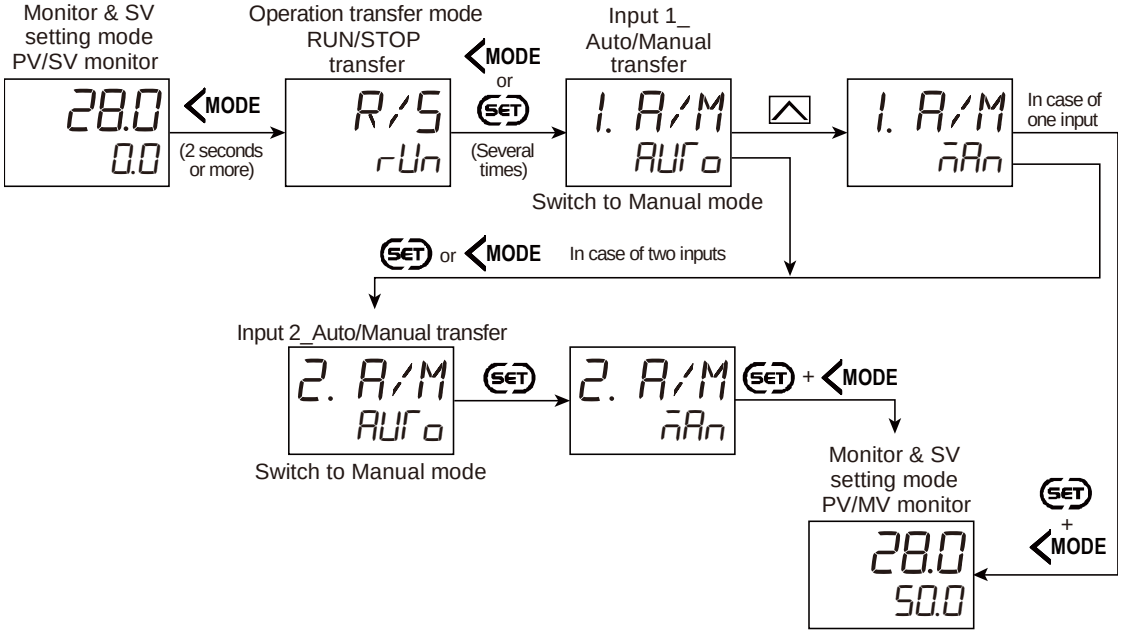
☞ Refer to the SC-F71 Instruction Manual [Host communication] (172-65711M) for the Auto Manual transfer through communication.

☞ Refer to 6.8 Suppressing Sudden Change in Output (Balanceless Bumpless) for the Manipulated output value (balanceless bumpless) associated with the Auto/Manual transfer.

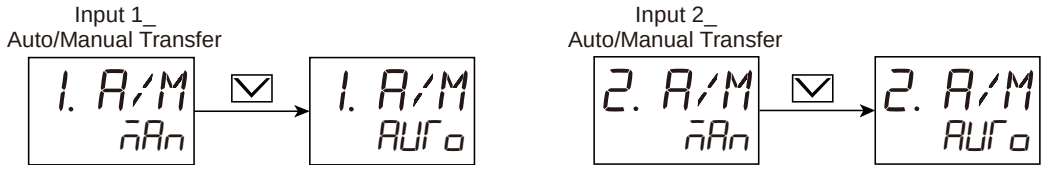
Setting procedure

- **Selection by front key operation**

Transfer Auto mode to Manual mode



Transfer Manual mode to Auto mode



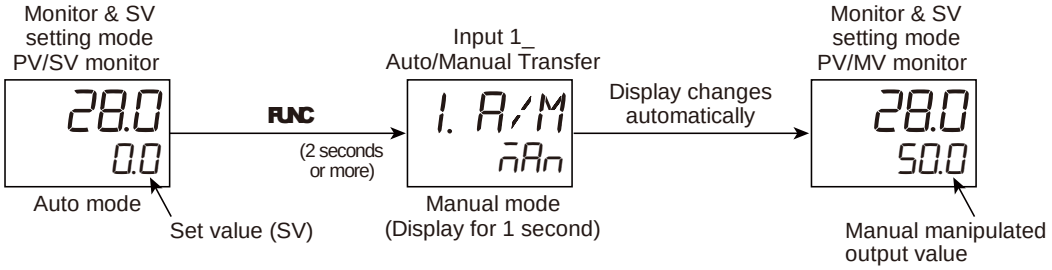
During manual mode, the Manual (MAN) mode lamp is lit.
Refer to P. 8-59 for the Display position of the lamp.

- **Changing the mode with the direct key**

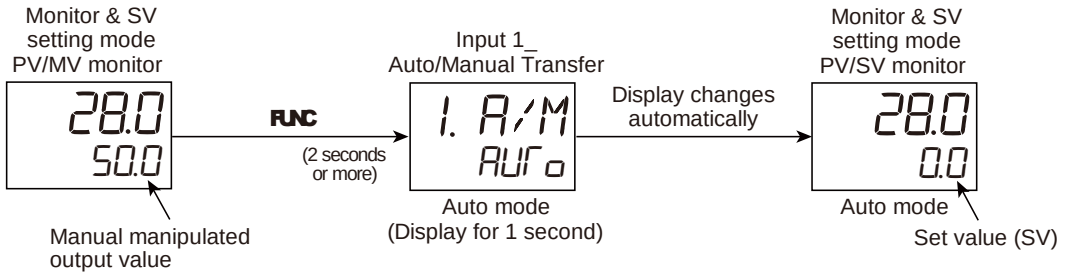
Assigning the “Auto/Manual transfer” function to the FUNC key facilitates the Auto/Manual switching.
Each time FUNC key is pressed, Auto mode and Manual mode are toggled.

☞ Refer to 10.8 Accessing some functions directly (FUNC key) for the “FUNC key assignment”.

Transfer Auto mode to Manual mode (Input 1_Auto/Manual transfer)



Transfer Manual mode to Autol mode (Input 1 Auto/Manual transfer)



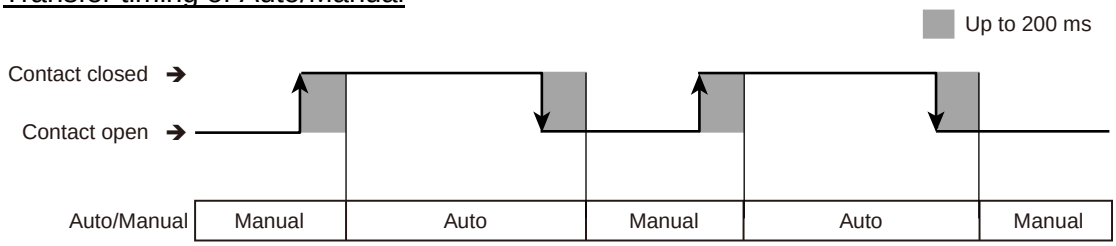
Selection of key action is possible from “Press once” and “Press and hold” to enable the switching. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

- **Switching the mode with Digital Input (DI)**

To switch the Auto/Manual using the Digital Input (DI), use “DI function selection” in Function block No. 23 (Engineering mode).

☞ Refer to 5.2 Switching Functions Using Digital Inputs (DI) for assigning functions to the Digital input (DI).

Transfer timing of Auto/Manual



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

The above switching action can be inverted (The functions at contact close and contact open can be swapped). This setting can be done at “DI logic invert.” For details, refer to 5.2 Switching Functions Using Digital Inputs (DI).

- **Auto/Manual transfer state**

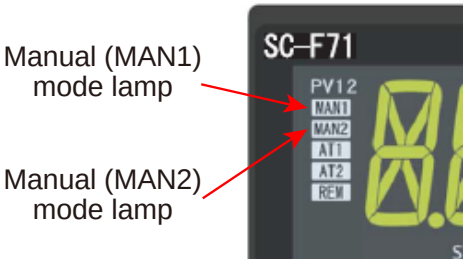
The table below shows the actual Auto/Manual modes and displays under different combinations of settings by Key operation, Communication, and Digital input (DI).

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Auto mode	Auto mode	Auto mode
	Manual mode	Manual mode
Manual mode	Auto mode	
	Manual mode	

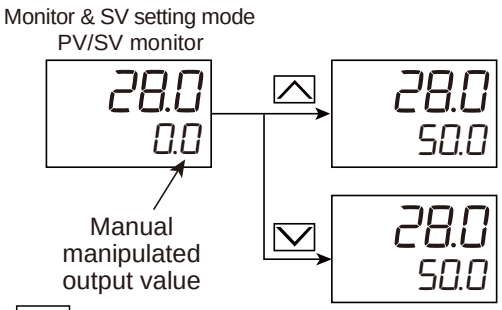
- **Setting Manipulated output value in Manual mode**

In the Manual mode, the Manipulated output value (MV) can be manually set. Make sure the Manual mode lamp is on (the instrument is in the manual mode) before starting the operation.

[Position of the Manual mode lamp]



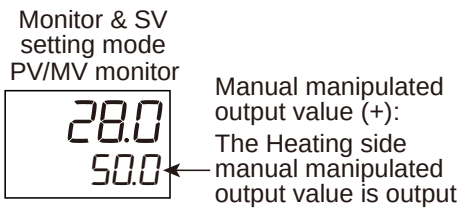
[Adjusting the output]

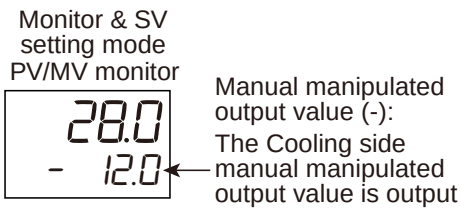


- ∧ key: Increase the Manipulated output value (MV).
- ∨ key: Decrease the Manipulated output value (MV).
- Press and hold the ∧ key or ∨ key makes numeric value change faster.

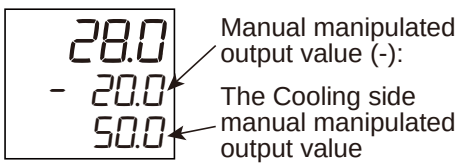
For Heating/Cooling PID control:

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.





When the Manipulated output value is selected, priority is given to the display of the Heating side manual manipulated output value. When the Manual manipulated output value enters the negative range, the output is transferred to the Cooling side manual manipulated



output value.

Parameter setting

- **Input 1_Auto/Manual transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
1. A/M	AUTo: Auto mode Man: Manual mode	Man

- **Input 2_Auto/Manual transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
2. A/M	AUTo: Auto mode Man: Manual mode	Man

📖 To display “Input 2_Auto/Manual transfer”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

8.10 Using Remote Setting Input

The Remote setting input uses the external signal (Input 2) as the Input 1_set value (SV). To use the Remote setting input, the mode must be switched to the Remote mode with the Remote/Local transfer. The Remote/Local transfer can be made by a key operation, Digital input (DI) or Communication (optional).

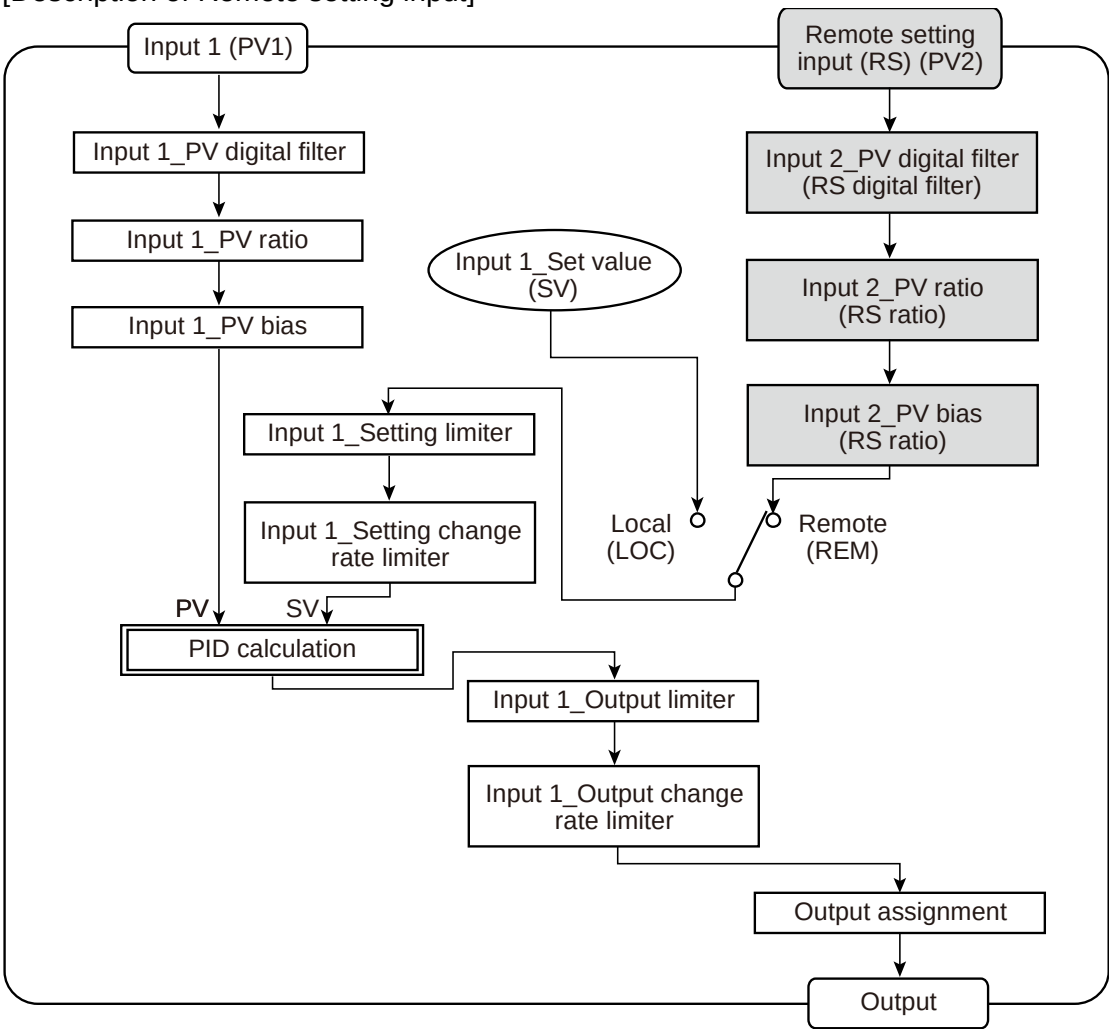
📖 To use “Remote setting input”, choose “Remote setting input” in Function block No. 58: Select function for Input 2 (Engineering mode).

📖 The signal type of the Remote setting input can be set in Function block No. 22: Input 2_Input type (Engineering mode).

☞ Refer to the Instruction SC-F71 [Host communication] (172-65711M) for Remote/Local transfer through communication.

Description of function

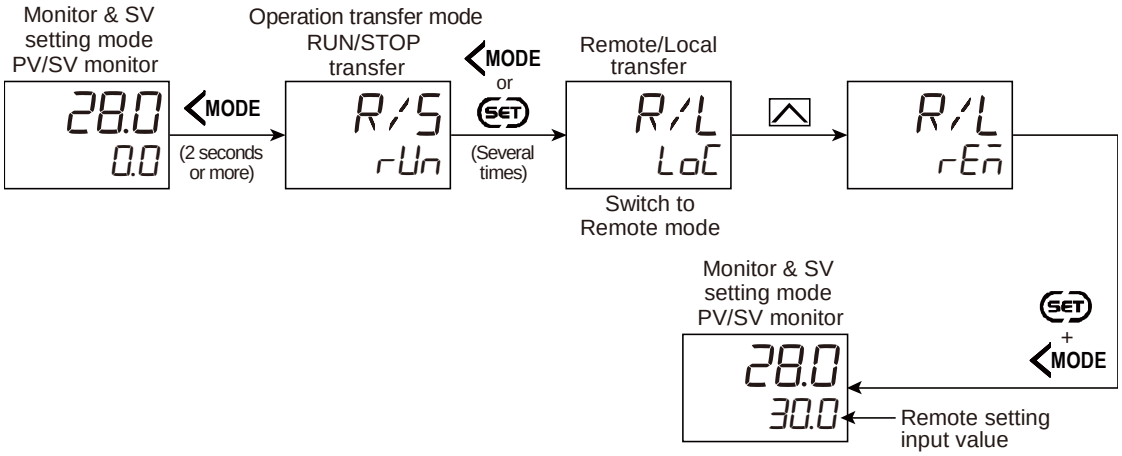
[Description of Remote setting input]



Mode transfer

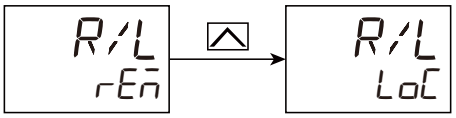
- **Selection by front key operation**

Transfer Local mode to Remote mode



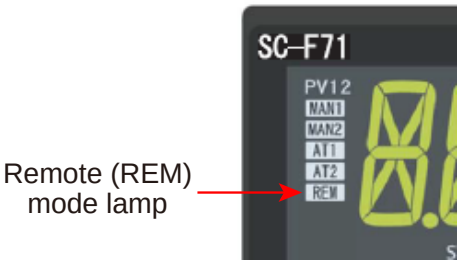
Transfer Remote mode to Local mode

Remote/Local transfer



During the Remote mode, the Remote (REM) mode lamp lights on.

[Position of the Remote mode lamp]



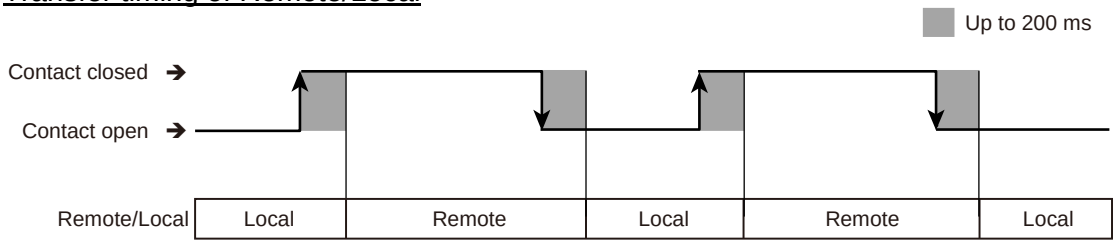
The FUNC key may be configured to switch between Remote and Local. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

- **Switching the mode with Digital Input (DI)**

To switch the Remote/Local using the Digital Input (DI), use “DI function selection” in Function block No. 23 (Engineering mode).

Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the Digital input (DI) assignment.

Transfer timing of Remote/Local



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

The above switching action can be inverted (The functions at contact close and contact open can be swapped). This setting can be done at “DI logic invert.” Refer to 5.2 Switching Functions Using Digital Inputs (DI) for details.

- **Remote/Local transfer state**

The table below shows the actual Remote/Local modes and displays under different combinations of settings by Key operation, Communication, and Digital input (DI).

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Remote mode	Remote mode	Remote mode
	Local mode	Local mode
Local mode	Remote mode	
	Local mode	

Parameter setting

- **Remote/Local transfer**

[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
R/L	When "Remote setting input" is selected at Select function for input 2 LoC: Local mode rEn: Remote mode	LoC

To display "Remote/Local transfer", choose "Remote setting input" in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Input type [Engineering Mode: Function block No. 22 (Fn22)]**

Parameter symbol	Data range		Factory set value
2. INP	0: TC input K	13: RTD input Pt100	Same as Input 1_Input type
	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 W5Re/W26Re	21: Voltage input –10 to +10 V DC	
	9: TC input PL II	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		

Input 2_Input type is not displayed when "No function" is selected in Function block No. 58: Select function for Input 2 (Engineering mode).

Refer to "4. Parameters that are Initialized/Modified when Setting is Changed" for the parameters that are initialized or changed when the Input 2_input type is changed.

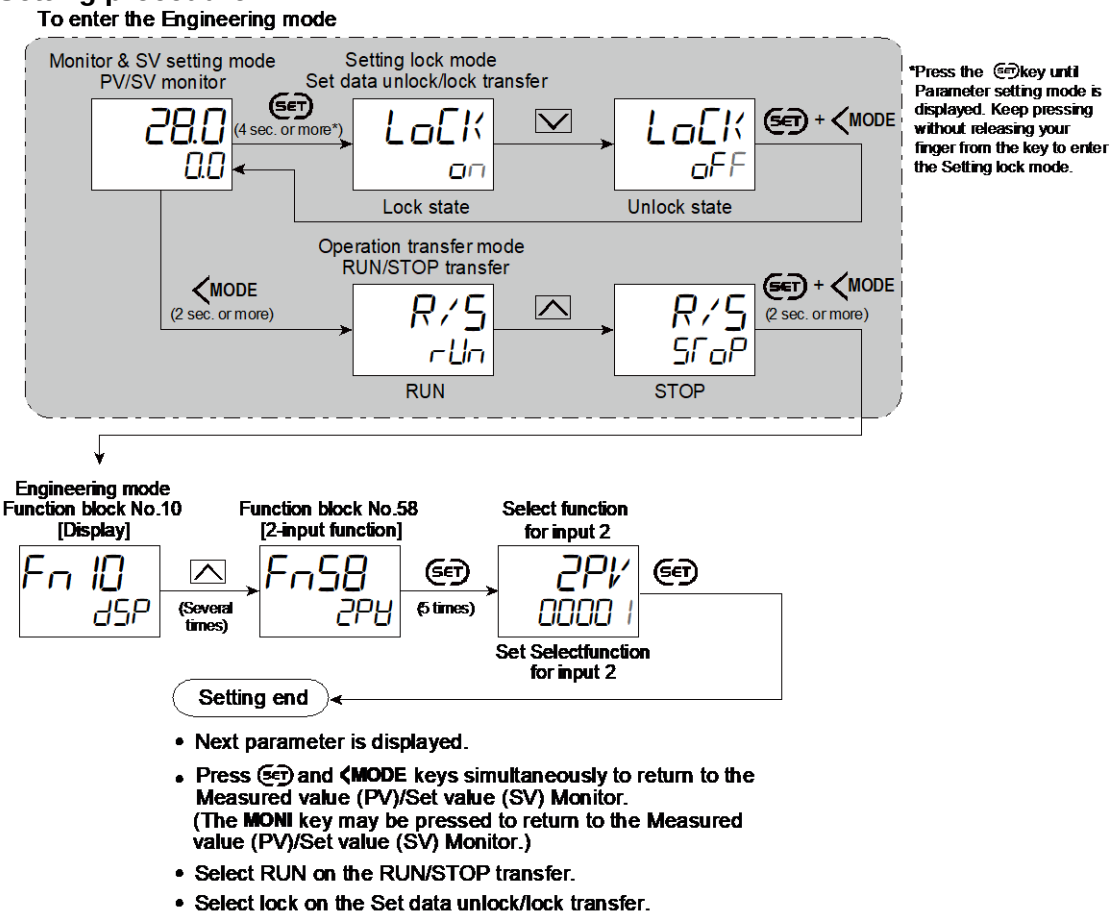
- **Select function for input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 Pressure/temperature control operation [MC-(V)COS(R)]: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

Refer to "4. Parameters that are Initialized/Modified when Setting is Changed" for the parameters that are initialized or changed when the Select function for input 2 is changed.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

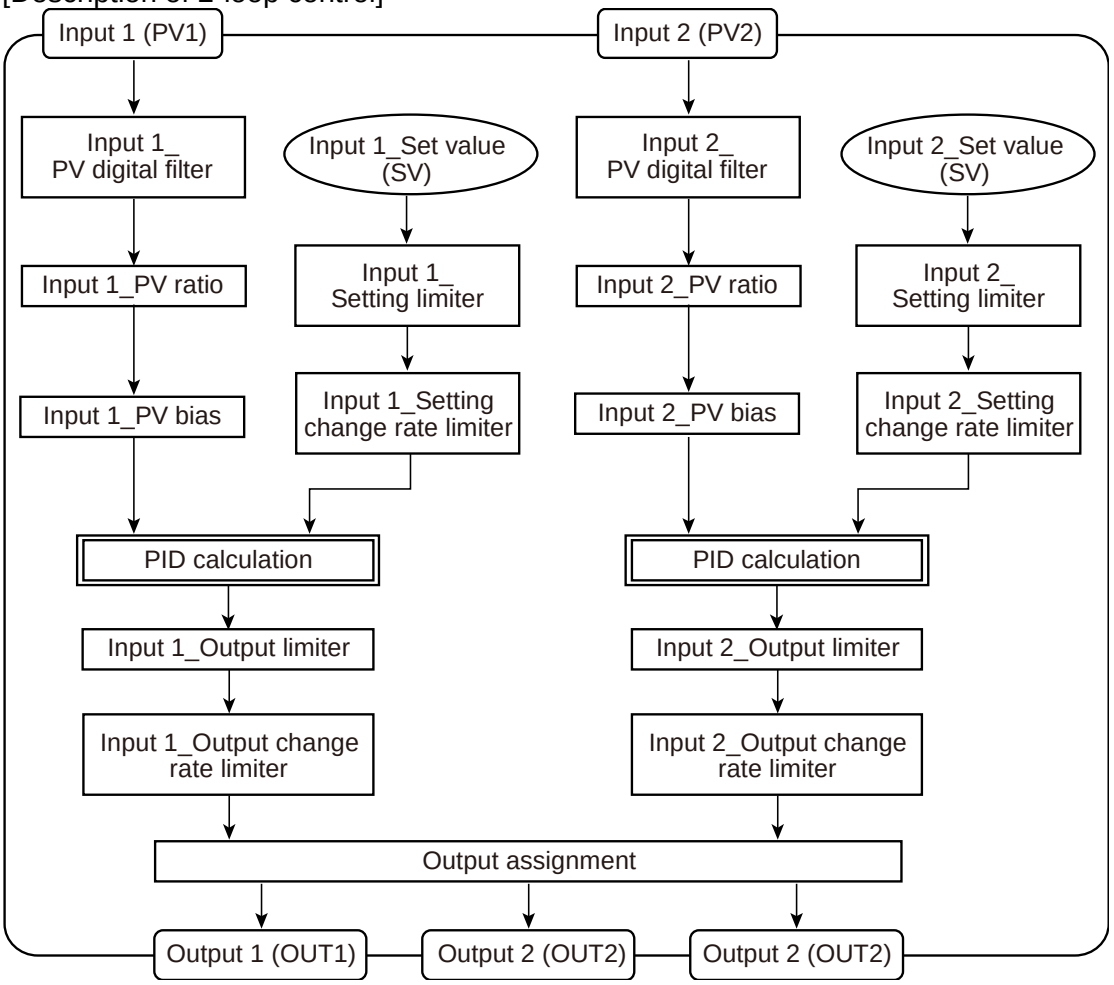
8.11 Executing 2-loop control

When two inputs are supplied, independent dual loop control can be performed on Input 1 and Input 2.

Description of function

The 2-loop control enables two single loop control on a single instrument.
Input 1 and Input 2 are independent from each other and setting must be done separately on each channel.

[Description of 2-loop control]

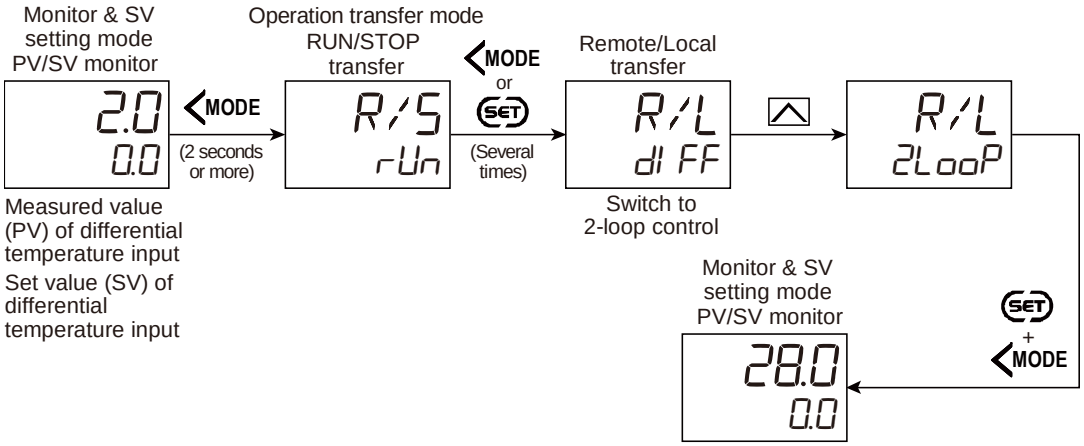


☞ The 2-loop control and the Differential temperature control are switchable. For the detail of the Differential temperature control, refer to 8.12 Executing Differential temperature control.

Mode transfer

- **Selection by front key operation**

Transfer Differential temperature control to 2-loop control

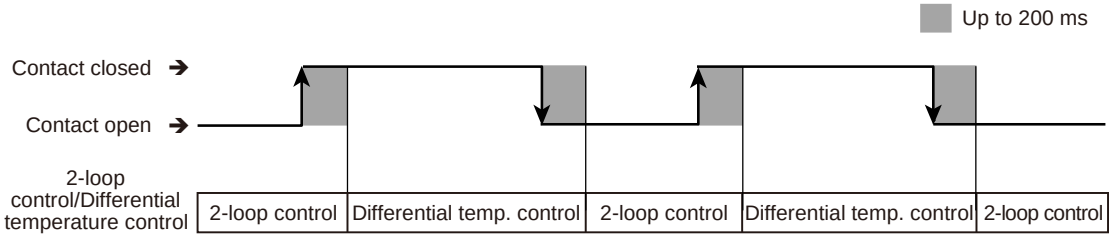


- **Switching the mode with Digital Input (DI)**

To switch the Remote/Local (2-loop control/ Differential temperature control) using the Digital Input (DI), use “DI function selection” in Function block No. 23 (Engineering mode).

☞ Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the Digital input (DI) assignment.

Transfer timing of Remote/Local(2-loop control/ Differential temperature control)



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

The functions at contact close and contact open can be swapped). This setting can be done at “DI logic invert.” Refer to 5.2 Switching Functions Using Digital Inputs (DI) for details.

- **Remote/Local transfer (2-loop control/ Differential temperature control) state**

The table below shows the actual 2-loop control/ Differential temperature control status and displays under different combinations of settings by Key operation, Communication, and Digital input (DI).

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Differential temperature control	Differential temperature control	Differential temperature control
	2-loop control	2-loop control
2-loop control	Differential temperature control	
	2-loop control	

Parameter setting

- **Remote/Local transfer (2-loop control/Differential temperature control) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
R/L	When "2-loop control/Differential temperature control" is selected at Select function for input 2 2LooP: 2-loop control dIFF: Differential temperature control	2LooP

To display "Remote/Local transfer" (2-loop control/Differential temperature control), choose "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Select function for input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 Pressure/temperature control operation [MC-(V)COS(R)]: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

Refer to "4. Parameters that are Initialized/Modified when Setting is Changed" for the parameters that are initialized or changed when the Select function for input 2 is changed.

8.12 Executing Differential temperature control

Input 1 is controlled by setting a temperature difference between Input 1 and Input 2.

Description of function

Differential temperature control is conducted, while Input 1 is used as Control temperature and Input 2 is used as Reference temperature.
Temperature difference is set on Input 1 against Input 2, and the Input 1 is controlled so that the set temperature difference could be obtained. As the input 2 can also be controlled, the differential temperature control is possible while keeping the reference temperature constant.

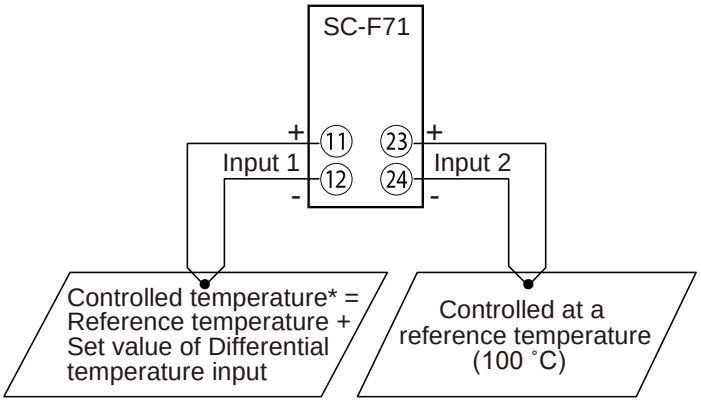
In case of Differential temperature control, the Input 1_Set value (SV) is not used for control. The Input 1_Monitor Set value (SV)* of is used in actual control.

* Input 1_Monitor Set value (SV) = Controlled temperature = Input 2_Measured value (PV) [Reference temperature] + Set value of Differential temperature input

[Example] Control is done with the Reference temperature (PV of Input 2) at 100 °C, and the Input 1 is controlled by the Differential temperature.

* Example of Controlled temperature when the set value of Differential temperature input is set as follows.

Set value of Differential temperature input	Controlled temperature
-50 °C	50 °C
0 °C	100 °C
100 °C	200 °C



The sensor type used on Input 1 and Input 2 can be different respectively.

[Setting items]

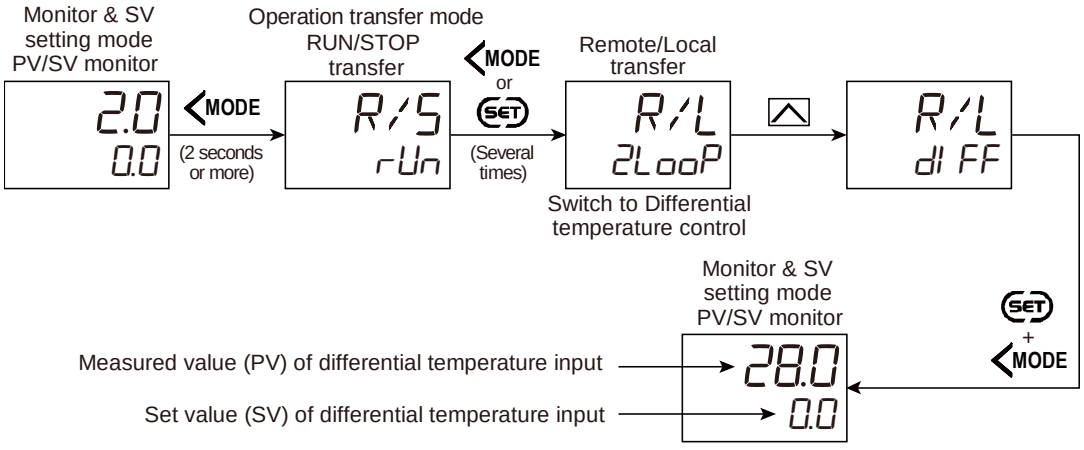
- Remote/Local transfer (2-loop control/Differential temperature control) [Operation transfer mode]
  Transfer to Differential temperature control
- Input 2_Set value (SV) [Parameter setting mode: Parameter group No. 00]: Setting Reference temperature (2. SV)
- Set value of Differential temperature input [Parameter setting mode: Parameter group No. 00]: Setting Differential temperature (dSV)
- Select 2-loop control/Differential temperature control in function block No. 58: Select function for input 2 (Engineering mode)
- Other items required for controlling Input 1 and Input 2 (e.g. setting PID values)

The 2-loop control and the Differential temperature control are switchable. For the detail of the 2-loop control, refer to 8.11 Executing 2-loop control.

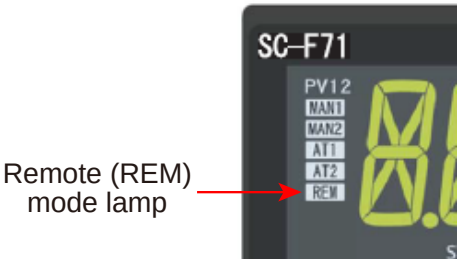
Mode transfer

- **Selection by front key operation**

Transfer 2-loop control to Differential temperature control



During the Differential temperature control, the Remote (REM) mode lamp lights on.
[Position of the Remote mode lamp]



The FUNC key may be configured to switch between 2-loop control and Differential temperature control. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

Refer to 8.11 Executing 2-loop control for Mode transfer by other than the front key.

Parameter setting

- **Remote/Local transfer (2-loop control/Differential temperature control) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
R/L	When “2-loop control/Differential temperature control” is selected at Select function for input 2 2LooP: 2-loop control dIFF: Differential temperature control	2LooP

To display “Remote/Local transfer” (2-loop control/Differential temperature control), choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Set value (SV) [Parameter Setting Mode: Parameter group No. 00 (Pn00)]**

Parameter symbol	Data range	Factory set value
2. SV	Input 2_Setting limiter low to Input 2_Setting limiter high [Varies with the setting of the Decimal point position.]	0

To display “Input 2_Set value (SV)”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Set value (SV) of differential temperature input [Parameter Setting Mode: Parameter group No. 00 (Pn00)]**

Parameter symbol	Data range	Factory set value
dSV	−(Input 1_Input span) to +(Input 1_Input span) [Varies with the setting of the Decimal point position.]	0

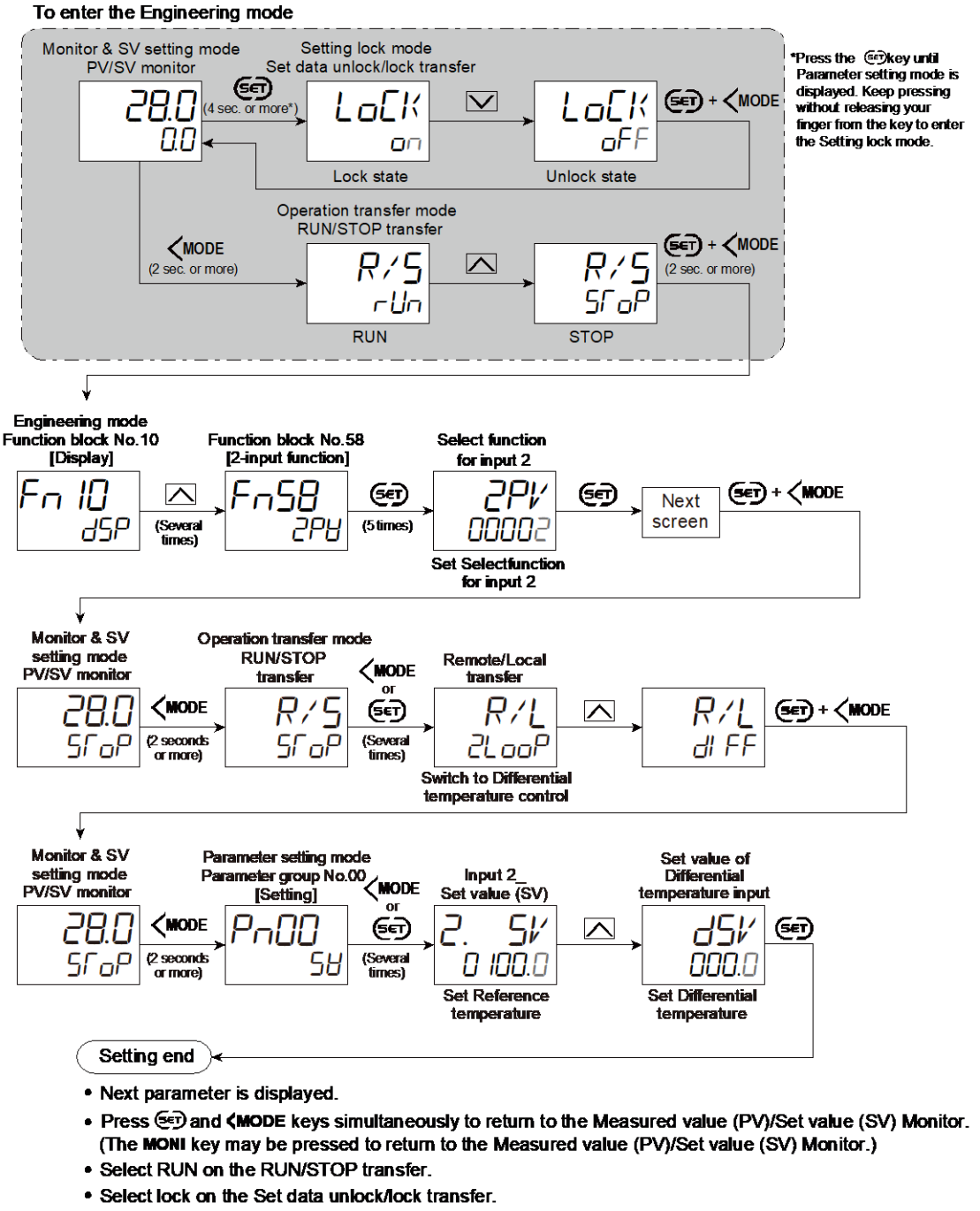
To display “Set value (SV) of differential temperature input”, choose “2-loop/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode) and switch to “Differential temperature control” in “Remote/Local transfer”.

- **Select function for input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 Pressure/temperature control operation [MC-(V)COS(R)]: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6.	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized or changed when the Select function for input 2 is changed.

Setting procedure



- Next parameter is displayed.
- Press SET and ❮MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

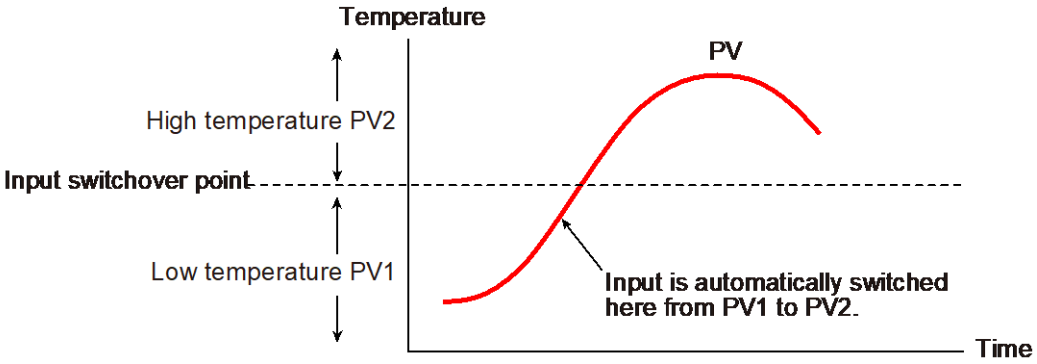
8.13 Executing Control with PV select

The Control with PV select is a function to control by switching between two inputs for high and low temperature ranges when two different sensors are used in the single controlled object.

Description of function

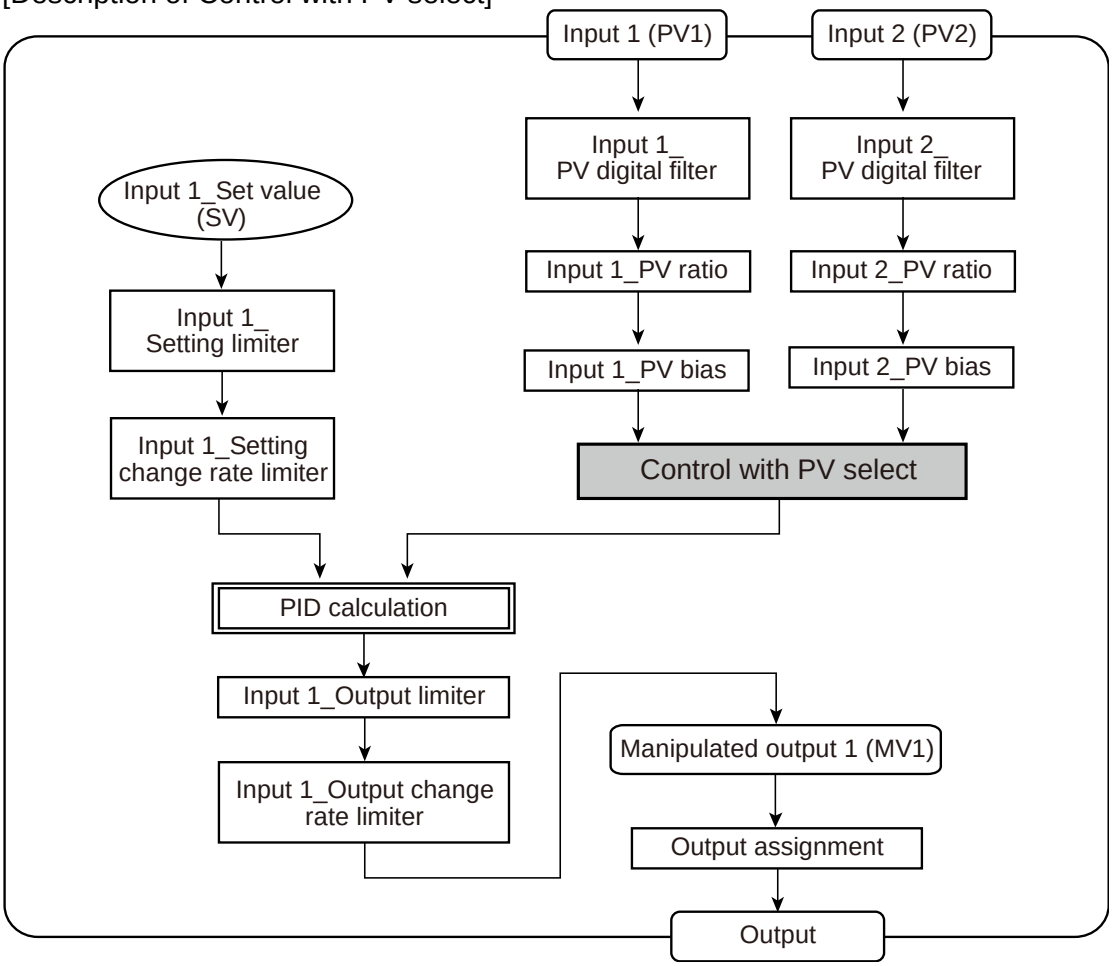
In the Control with PV select, two inputs are used by switching between them: Input 1 (for low temperature range as PV1) and Input 2 (for high temperature range as PV2). Parameters on the Input 1 are used for control computation. Output is also provided on the Input 1 side as Manipulated output 1 (MV1).

[Pictorial explanation of Input switchover]



There are two ways to switch between Input 1 (PV1) and Input 2 (PV2): Switch using the set value and switch by using signal (key operation, digital input, and communication).

[Description of Control with PV select]



- **Switching by Set value**

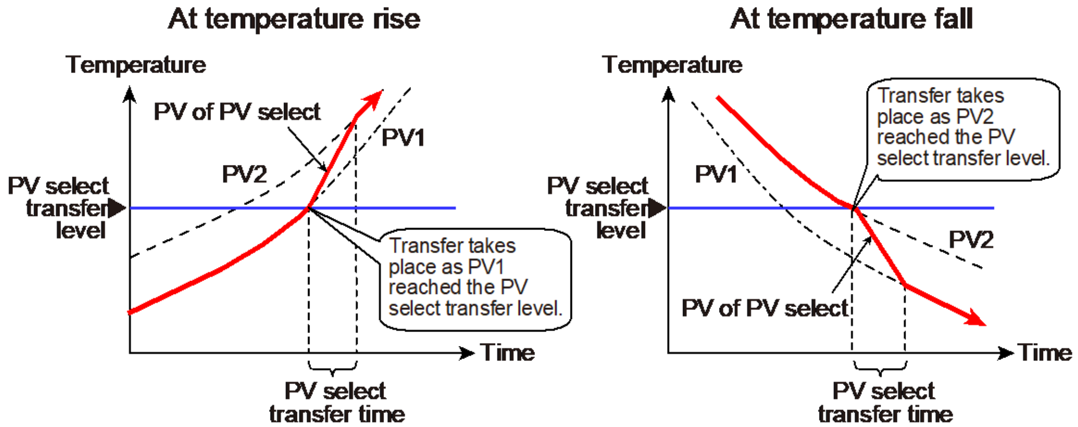
The set value (PV select transfer level) is set and used as a trigger for switching between Input 1 (PV1) and Input 2 (PV2). When this set value is exceeded, the present input is transferred to the other.
When the PV select transfer time is set, the transfer action takes place in the set period correcting the input.

[Direction of input switchover]
At temperature rise: PV1 to PV2
At temperature fall: PV2 to PV1

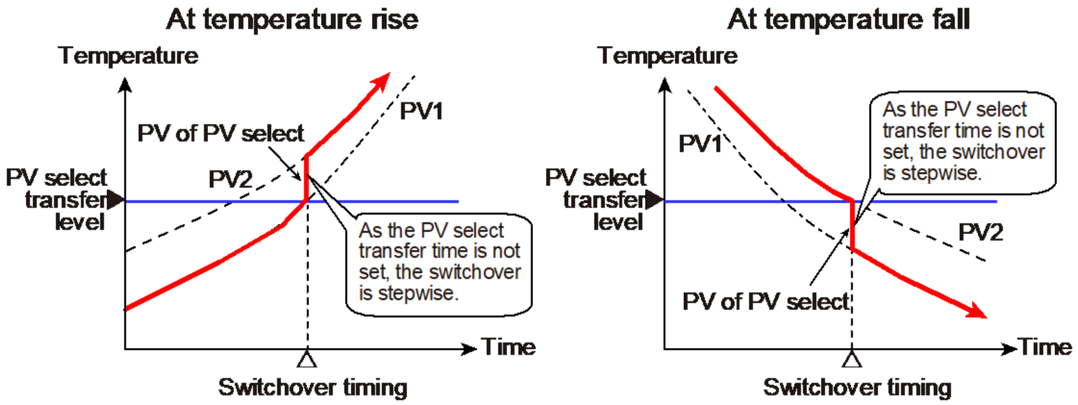
Legend
- · - · - · - · : Input 1 (PV1)
- - - - - - - - : Input 2 (PV2)
———— (red line): PV select Measured value (PV)

- When PV1 is smaller than PV2

When the PV select transfer time is set

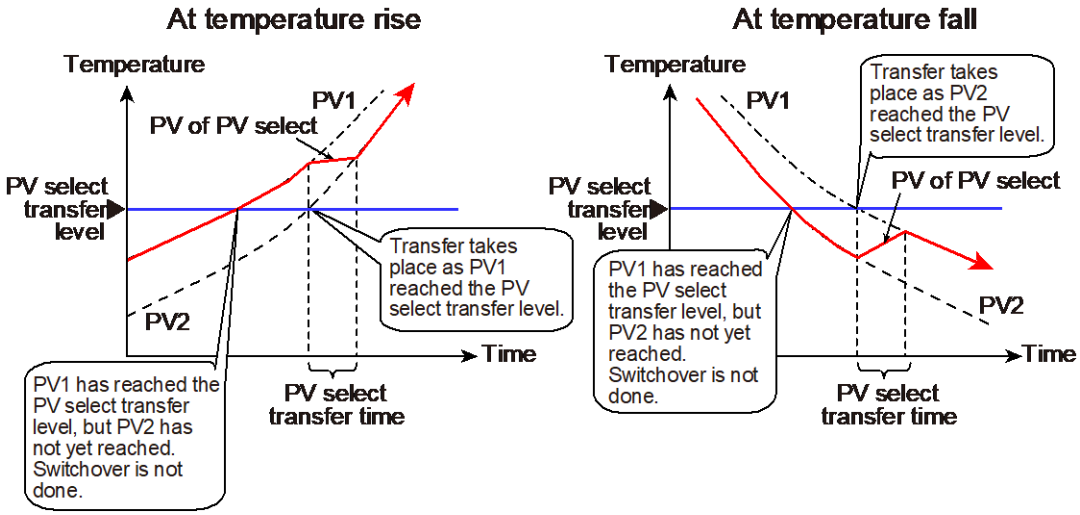


When the PV select transfer time is not set (Set value: 0.0)

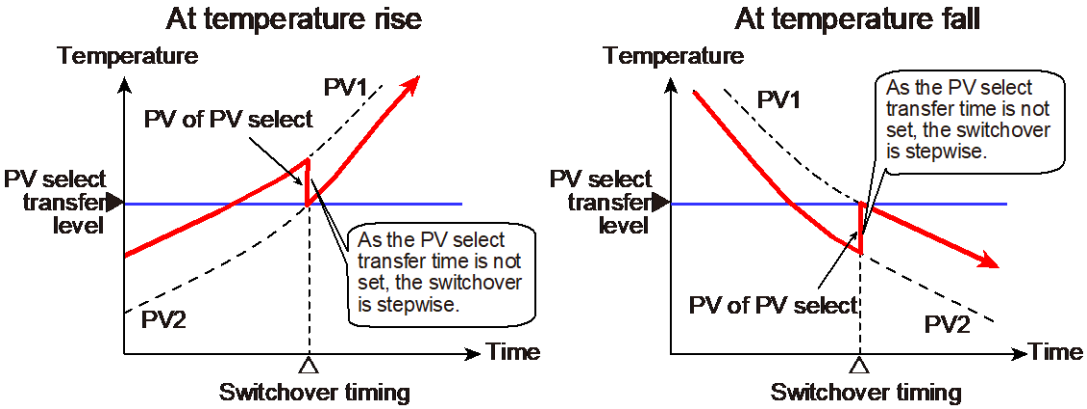


- When PV1 > PV2

  When the PV select transfer time is set



  When the PV select transfer time is not set (Set value: 0.0)



- **Switchover by signal (key operation, digital input, and communication)**

The switchover between Input 1 (PV1) and Input 2 (PV2) is done by using key operation, digital input or communication.
When the PV select transfer time is set, the transfer action takes place in the set period correcting the input.

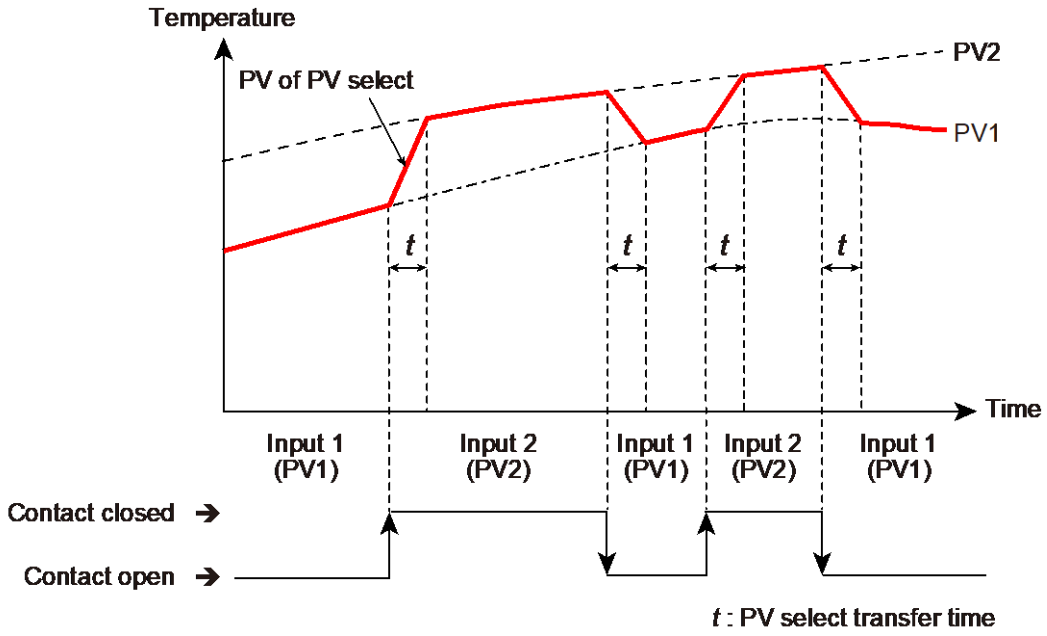
In the case of switchover by the signal (key operation, digital input, or communication), there are no restrictions on the switchover direction of the inputs whether the temperature is on the rise or on the decline.

Refer to the SC-F71 Instruction Manual [Host communication] (172-65711M) for the input switchover through communication.

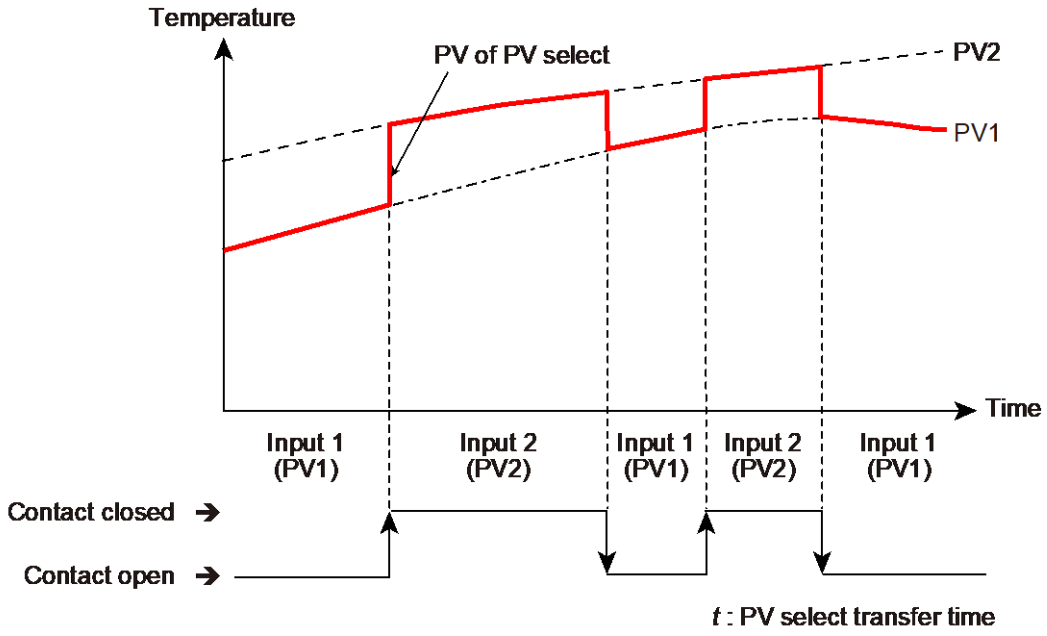
- Switching the input with Digital Input (DI)

Legend
: Input 1 (PV1)
: Input 2 (PV2)
: PV select Measured value (PV)

When the PV select transfer time is set

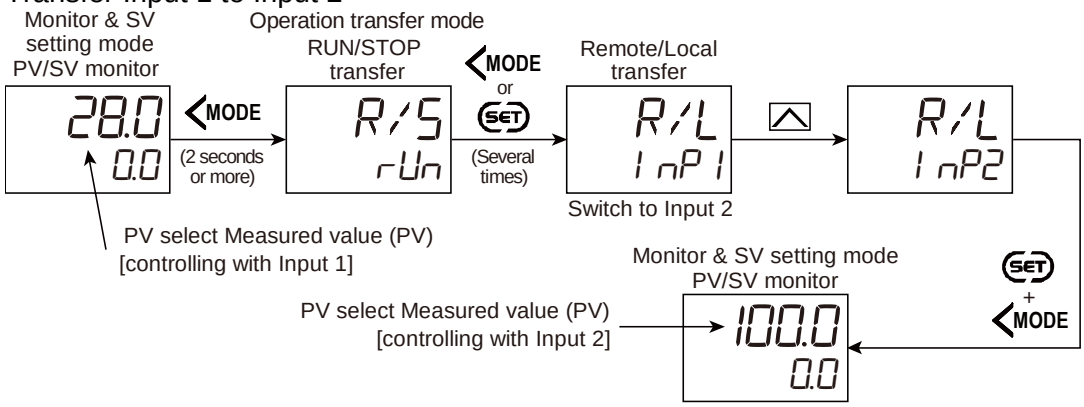


When the PV select transfer time is not set (Set value: 0.0)

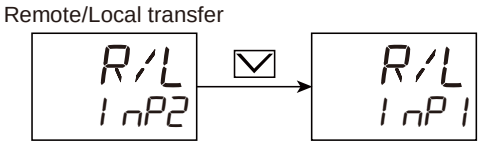


- Selection by front key operation

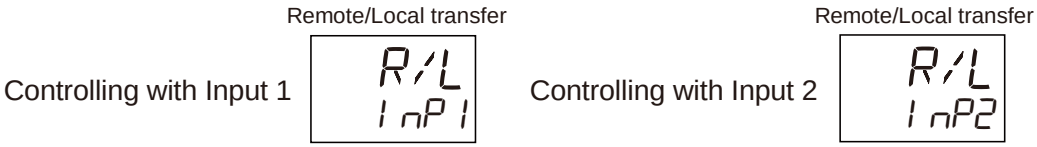
  Transfer Input 1 to Input 2



Transfer Input 2 to Input 1

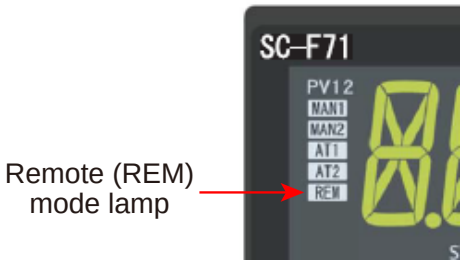


During the switchover by the set value (PV select transfer level), Remote/Local transfer (PV switchover) is not possible, but the transfer status can be checked on the Remote/Local transfer (PV switchover) screen to see if the control is done by Input 1 or Input 2.



The Remote (REM) mode lamp lights on when the “Input 2 is used” as the Measured value (PV) of the PV select and “when Input 1 is switched to Input 2.” When “Input 1 is used” and “when Input 2 is switched to Input 1”, the Remote (REM) mode lamp goes off.

[Position of the Remote mode lamp]



The FUNC key may be configured to switch between Input 1 and Input 2. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

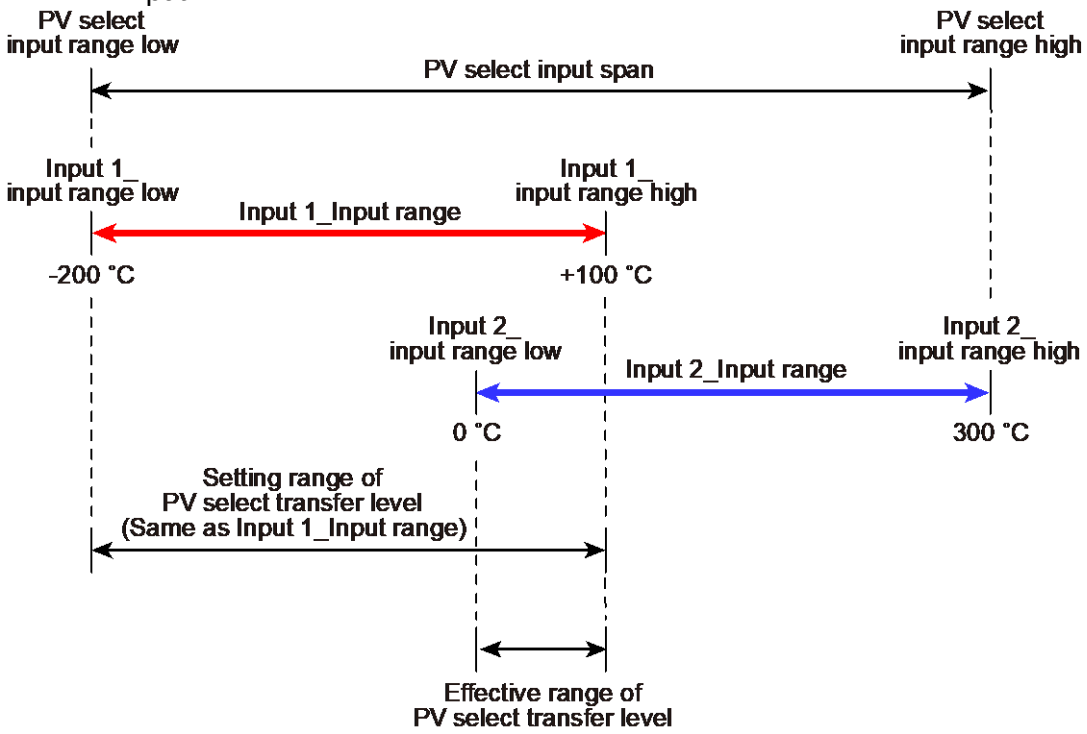
Input range and input span of the PV select

The “PV select input span”, the “PV select input range high” and the “PV select iput range low” mean “Input span”, “Input range high” and “Input range low” at the time of Control with PV select respectively.

The setting range is as follows.

- PV select input range high: Input range high of Input 1 and Input 2, whichever is larger
- PV select input range low: Input range low of Input 1 and Input 2, whichever is smaller
- PV select input span: PV select input range low up to PV select input range high

[Example] When there is a relation as follows between the Input range of Input 1 and Input 2.



In the above example, the effective range of the PV select transfer level is 0 to 100 ºC. This means that the action when the PV select transfer level is set somewhere between -200 ºC and 0 ºC is equal to the action of the 0 ºC setting.

When the input is transferred after the start of Startup tuning (ST), ST will be aborted. In the case of Autotuning (AT), if the input is transferred after the output has been transferred, AT will be aborted.

When either one of Input 1 (PV1) or Input 2 (PV2) is disconnected, the PV select transfer time will be unavailable.

Parameter setting

- **Remote/Local transfer (Control with PV select) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
R/L	When “Control with PV select” is set to Select function for Input 2 InP1: Input 1 InP2: Input 2	InP1

To display “Remote/Local transfer” (Control with PV select), choose “Control with PV select” in Function block No. 58: Select function for Input 2 (Engineering mode).

When “Switching by level” is set to “Selection of PV select trigger”, the parameter becomes display only.

- **PV select transfer level [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
2PV.LV	Input 1_Input range low to Input 1_Input range high [Varies with the setting of the Decimal point position.]	Input 1_Input range high

To display “PV select transfer level”, choose “Control with PV select” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **PV select transfer time [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
2PV.TM	0.0 to 100.0 seconds	0.0

To display “PV select transfer time”, choose “Control with PV select” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Select function for input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 Pressure/temperature control operation [MC-(V)COS(R)]: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized or changed when the Select function for input 2 is changed.

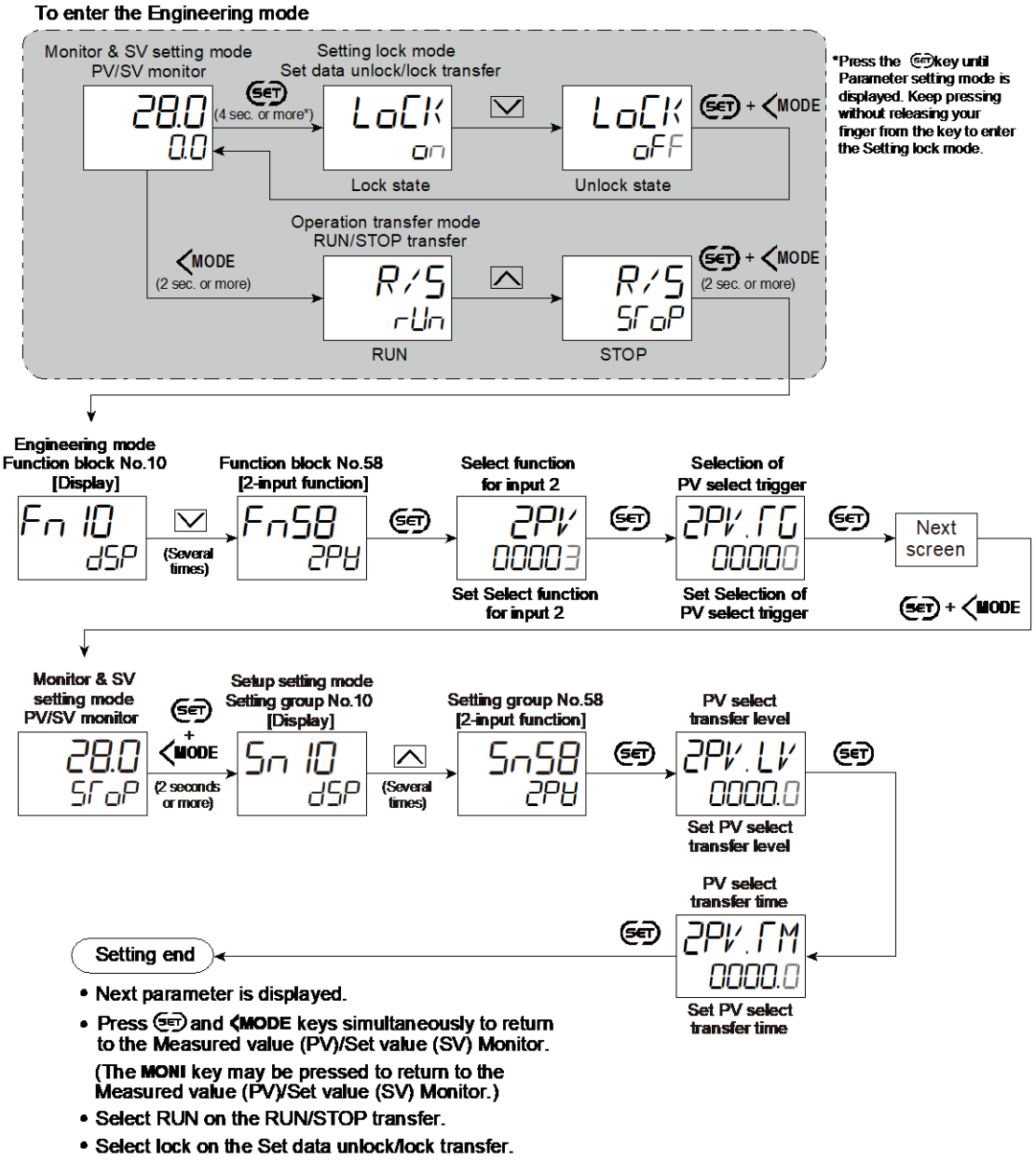
- **Selection of PV select trigger [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV.TG	0: Switching by level 1: Switching by signal (Key, DI and Communication)	0

To display “Selection of PV select trigger”, choose “Control with PV select” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

8.14 Executing Cascade Control

During the Cascade control, the measured value of the controlled object is monitored by the Master, and depending on the deviation between the target value (set value) and the actual value, the set value of the Slave is adjusted. The controlled object is controlled by the Slave to bring the measured value of the controlled object to the target value.

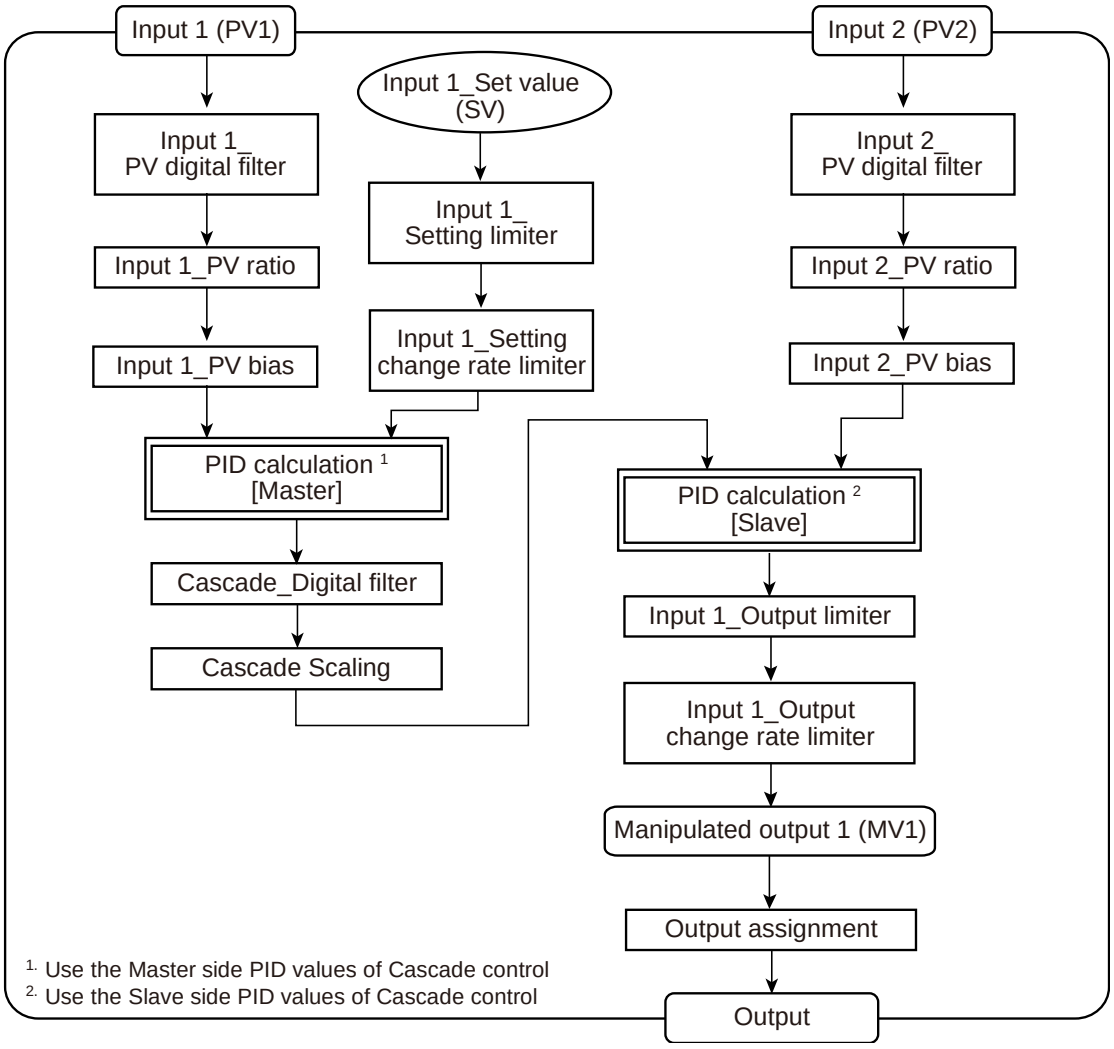
On the SC-F71, Input 1 can be assigned to the Master and Input 2 to the Slave respectively to conduct Cascade control on a single instrument. The use of Autotuning (AT) exclusively designed for the Cascade control allows the PID values of both the Master and the Slave to be calculated.

Description of function

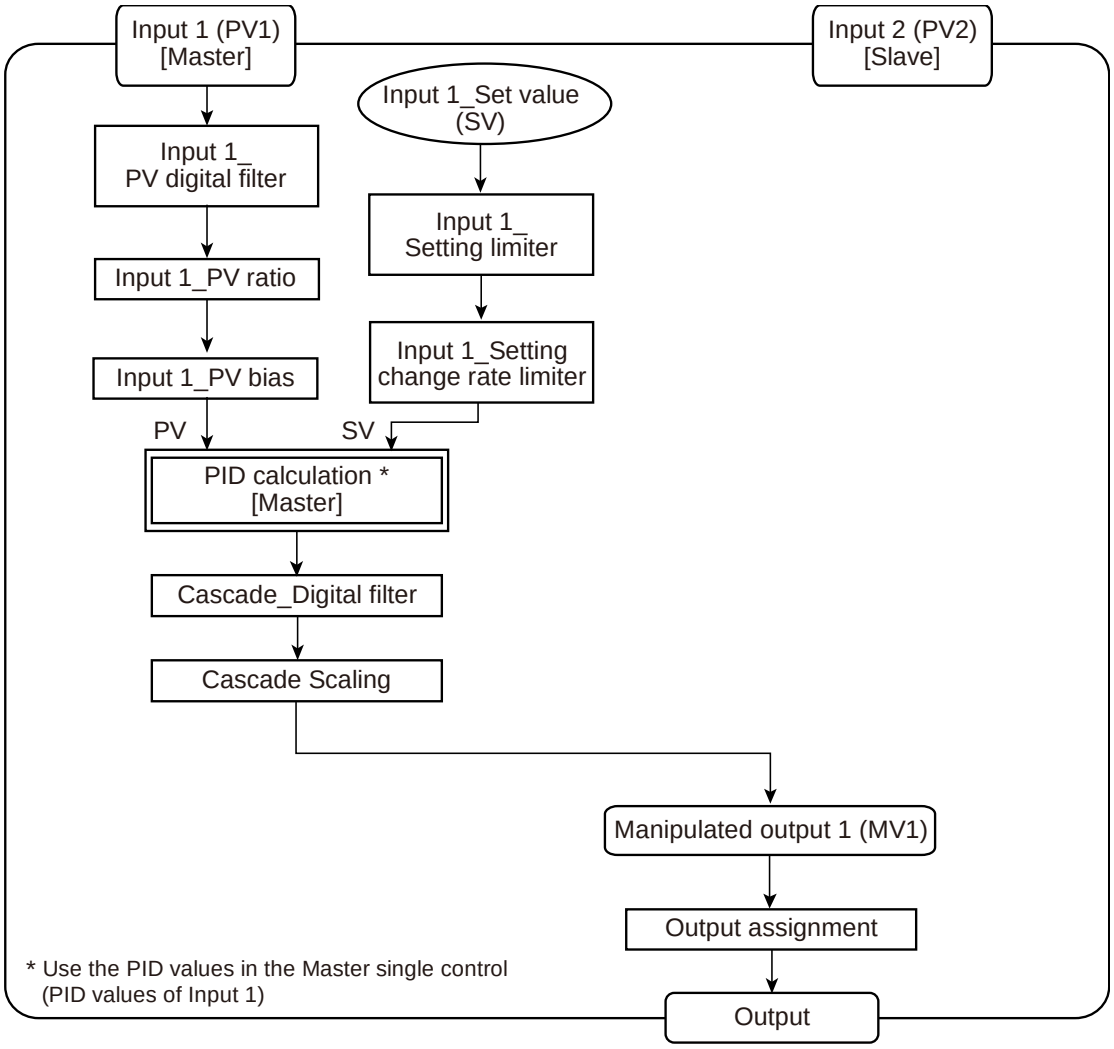
The Cascade control has two types; One is to switch between “Cascade control” and “Master single control” and the other is to switch between “Cascade control” and “Slave single control.”

The internal processing of the control is described below.

[Description of Cascade control]

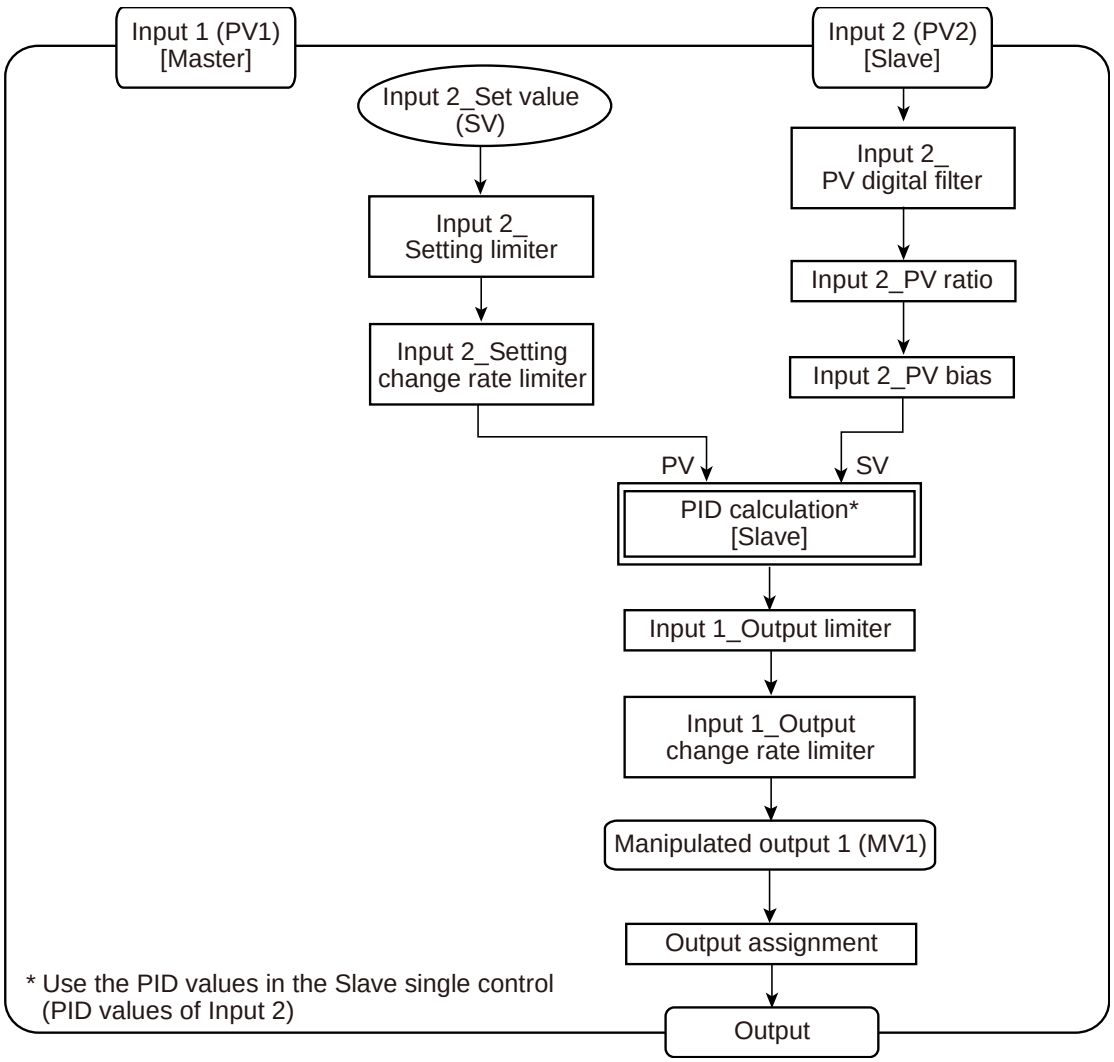


[Description of Master single control]



To switch between “Cascade control” and “Master single control”, choose “Cascade control (Master single ↔ Cascade)” in Function block No. 58: Select function for Input 2 (Engineering mode).

[Description of Slave single control]



To switch between “Cascade control” and “Slave single control”, choose “Cascade control (Slave single ↔ Cascade)” in Function block No. 58: Select function for Input 2 (Engineering mode).

● Autotuning (AT) at Cascade control

During the Cascade control, four types of PID values can be calculated with the use of Autotuning (AT) exclusively developed for the Cascade control.

- Types of PID values

Types of PID values	Calculated values
Master side PID values of Cascade control	Cascade_Proportional band (master-side), Cascade_Integral time (master-side), Cascade_Derivative time (master-side)
Slave side PID values of Cascade control	Cascade_Proportional band (slave-side), Cascade_Integral time (slave-side), Cascade_Derivative time (slave-side)
PID values in Master single control (PID values of Input 1)	Input 1_Proportional band, Input 1_Integral time, Input 1_Derivative time
PID values in Slave single control (PID values of Input 2)	Input 2_Proportional band, Input 2_Integral time, Input 2_Derivative time

- Cascade_AT mode

  There are two types of Autotuning (AT) for the Cascade control; Easy adjustment and Load factor adjustment.

  Easy adjustment: Autotuning (AT) is executed once. Control reference level* is not calculated.

  Load factor adjustment: Autotuning (AT) is executed twice. Control reference level* is calculated.

  * Control reference level is the data used for PID value calculation for Cascade control. In the case of TC input/RTD input, there is no need of calculating the Control reference level and Autotuning (AT) in the Easy adjustment can be used. In the case of Voltage/Current inputs, the Control reference level must be calculated and Autotuning (AT) in the Load factor adjustment must be used.

- PID values calculated by AT in different control modes

Control	Cascade AT mode		Types of PID values				Control reference level	
	Master-side	Slave-side	Master-side PID values of Cascade control	Slave-side PID values of Cascade control	PID values in Master single control	PID values in Slave single control	Master-side	Slave-side
Cascade control	Easy adjustment (AT once)	Easy adjustment (AT once)	✓	✓	✓	✓	—	—
	Easy adjustment (AT once)	Load factor adjustment (AT twice)	✓	✓	✓	✓	—	✓
	Load factor adjustment (AT twice)	Easy adjustment (AT once)	✓	✓	✓	✓	✓	—
	Load factor adjustment (AT twice)	Load factor adjustment (AT twice)	✓	✓	✓	✓	✓	✓
Master single control	Easy adjustment (AT once)	Note	✓	—	✓	—	—	—
	Load factor adjustment (AT twice)	Note	✓	—	✓	—	✓	—
Slave single control	Note	Easy adjustment (AT once)	—	✓	—	✓	—	—
	Note	Load factor adjustment (AT twice)	—	✓	—	✓	—	✓

Note: Setting is ignored. ✓: Calculated —: Not calculated

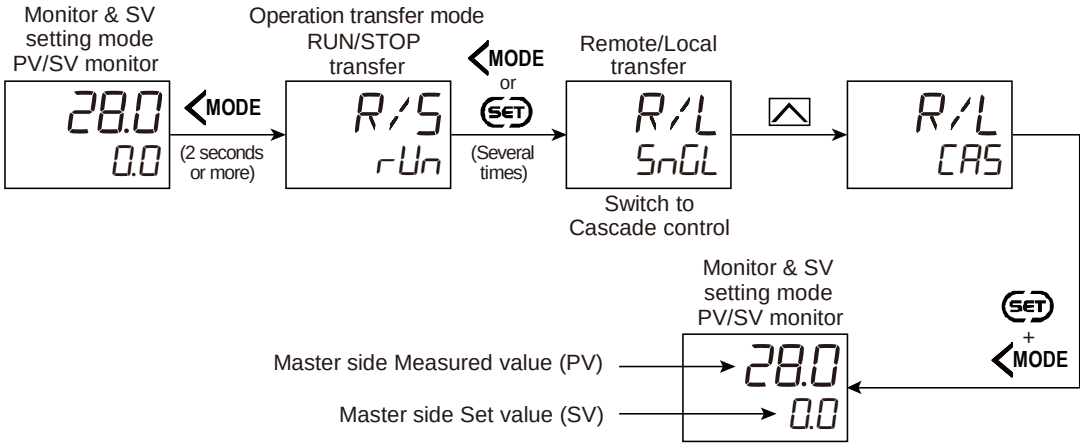
When executing Autotuning (AT) of the Cascade control, always use “Input 1_Autotuning (AT)” in the Operation transfer mode.

When executing Autotuning (AT) for the Cascade control, make sure that the set values (SV) of the Master and the Slave are properly set.

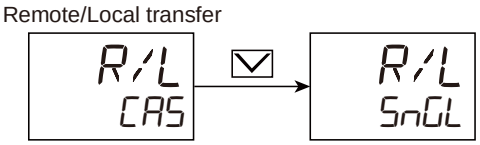
Switching between Cascade and Single

- **Selection by front key operation**

Single control (Master single or Slave single) → Cascade control

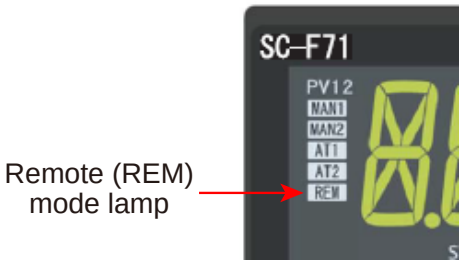


Cascade control → Single control (Master single or Slave single)



During the Cascade control mode, the Remote (REM) mode lamp lights on.

[Position of the Remote mode lamp]



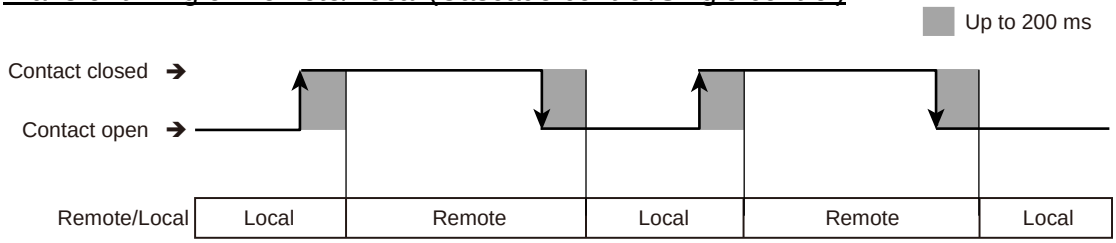
The FUNC key may be configured to switch between Cascade control and Single control. Refer to 10.8 Accessing some functions directly (FUNC key) for details.

- **Switching the mode with Digital Input (DI)**

To switch the Remote/Local (Cascade control) using the Digital Input (DI), use “DI function selection” in Function block No. 23 (Engineering mode).

Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the Digital input (DI) assignment.

Transfer timing of Remote/Local (Cascade control/Single control)



NOTE After the contact is transferred, it takes "up to 200 ms" until the action of this instrument is actually selected.

The above switching action can be inverted (The functions at contact close and contact open can be swapped). This setting can be done at "DI logic invert." Refer to 5.2 Switching Functions Using Digital Inputs (DI) for details.

- **Remote/Local transfer (Cascade control) state**

The table below shows the actual Cascade control/Single control status and displays under different combinations of settings by Key operation, Communication, and Digital input (DI).

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Cascade control	Cascade control	Cascade control
	Single control (Master/Slave)	Single control (Master/Slave)
Single control (Master/Slave)	Cascade control	
	Single control (Master/Slave)	

Parameter setting

- **Remote/Local transfer (Cascade control) [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
R/L	When "Cascade control" is selected at Select function for input 2 SnGL: Single control (Master single or Slave single) CAS: Cascade control	SnGL

To display "Remote/Local transfer" (Cascade control), choose "Cascade control" in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Proportional band [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn5 1)]**

Parameter symbol	Data range	Factory set value
1. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 1_Input span (Unit: °C [°F]) (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0% of Input 1_Input span (When Control with PV select: 0.0 to 1000.0% of PV select input span) 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting "Temperature control operation [MC-(V)COS(R)] is selected in Input 1_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display "Input 1_Proportional band [heat-side]", choose a setting other than "3 to 7 (Pressure control operation [MC-(V)COS(R)])" in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 1_Integral time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. 1	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 “Input 1_Integral time [heat-side] “, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band [heat-side] in the same memory area.

- **Input 1_Derivative time [heat-side] [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. 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 “Input 1_Derivative time [heat-side]”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band [heat-side] in the same memory area.

- **Input 2_Proportional band [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. P	TC/RTD inputs: 0 (0.0, 0.00) to Input 2_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 2_Input span 0 (0.0, 0.00): ON/OFF action NOTE: 0 (0.0, 0.00) cannot be set when a setting “Temperature control operation [MC-(V)COS(R)] is selected in Input 2_control action.	TC/RTD inputs: 30 V/I inputs: 3.0

To display “Input 2_Proportional band”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_ Control action (Engineering mode).

- **Input 2_Integral time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. 1	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 “Input 2_Integral time”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Input 2_Derivative time [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. 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 “Input 2_Derivative time”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_ Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band in the same memory area.

- **Cascade_Proportional band (master-side) [Setup Setting Mode: Setting group No. 58 (Sn58)]**

Parameter symbol	Data range	Factory set value
MAS.P	TC/RTD inputs: 1 (0.1, 0.01) to Input 1_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 1_Input span	TC/RTD inputs: 30 V/I inputs: 3.0

To display “Cascade_Proportional band (master-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Integral time (master-side) [Setup Setting Mode: Setting group No. 58 (Sn58)]**

Parameter symbol	Data range	Factory set value
MAS.I	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 “Cascade_Integral time (master-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Derivative time (master-side) [Setup Setting Mode: Setting group No. 58 (Sn58)]**

Parameter symbol	Data range	Factory set value
MAS.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 “Cascade_Derivative time (master-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Proportional band (slave-side) [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
SLV.P	TC/RTD inputs: 1 (0.1, 0.01) to Input 2_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 2_Input span	TC/RTD inputs: 30 V/I inputs: 3.0

📖 To display “Cascade_Proportional band (slave-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Integral time (slave-side) [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
SLV.I	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 “Cascade_Integral time (slave-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Derivative time (slave-side) [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
SLV.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 “Cascade_Derivative time (slave-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Digital filter [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
C.dF	0.0 to 100.0 seconds 0.0: Filter OFF	10.0

📖 To display “Cascade_Digital filter”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Scale high [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
C.SCH	Cascade_Scale low to Input 2_Setting limiter high [Varies with the setting of the Decimal point position.]	Input 2_Setting limiter high

📖 To display “Cascade_Scale high”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade_Scale low [Setup Setting Mode: Setting group No. 58 (5n58)]**

Parameter symbol	Data range	Factory set value
C.SCL	Input 2_Setting limiter low to Cascade_Scale high [Varies with the setting of the Decimal point position.]	Input 2_Setting limiter low

📖 To display “Cascade_Scale low”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Select function for input 2 [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
2PV	0: No function 1: Remote setting input 2: 2-loop control/Differential temperature control 3: Control with PV select 4: Cascade control (Slave single ↔ Cascade) * 5: Cascade control (Master single ↔ Cascade) * 6: Input circuit error alarm PID control: 0 to 6 Pressure/temperature control operation [MC-(V)COS(R)]: 0 to 2, 6 Heating/Cooling control: 0 to 3, 6	1

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are initialized or changed when the Select function for input 2 is changed.

- **Cascade _AT mode (master-side) [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
MAS.AT	0: Easy adjustment (AT: one cycle) 1: Load factor adjustment (AT: 2 cycles)	TC/RTD inputs: 0 V/I inputs: 1

📖 To display “Cascade_AT mode (master-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Cascade _AT mode (slave-side) [Engineering mode: Function block No. 58 (Fn58)]**

Parameter symbol	Data range	Factory set value
SLV.AT	0: Easy adjustment (AT: one cycle) 1: Load factor adjustment (AT: 2 cycles)	TC/RTD inputs: 0 V/I inputs: 1

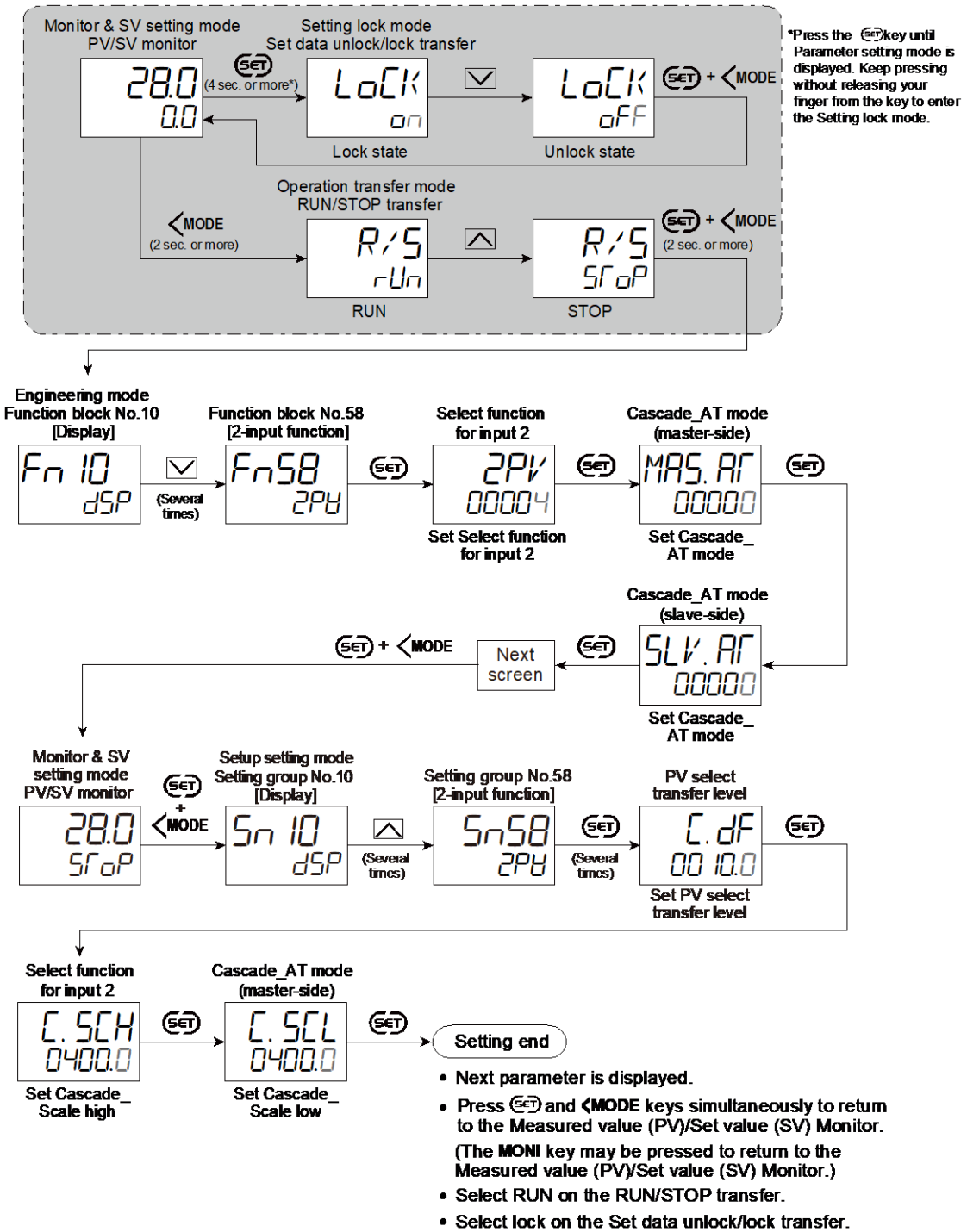
📖 To display “Cascade_AT mode (slave-side)”, choose “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure

Calculating the PID values for Cascade control (Slave single ↔ Cascade) using AT

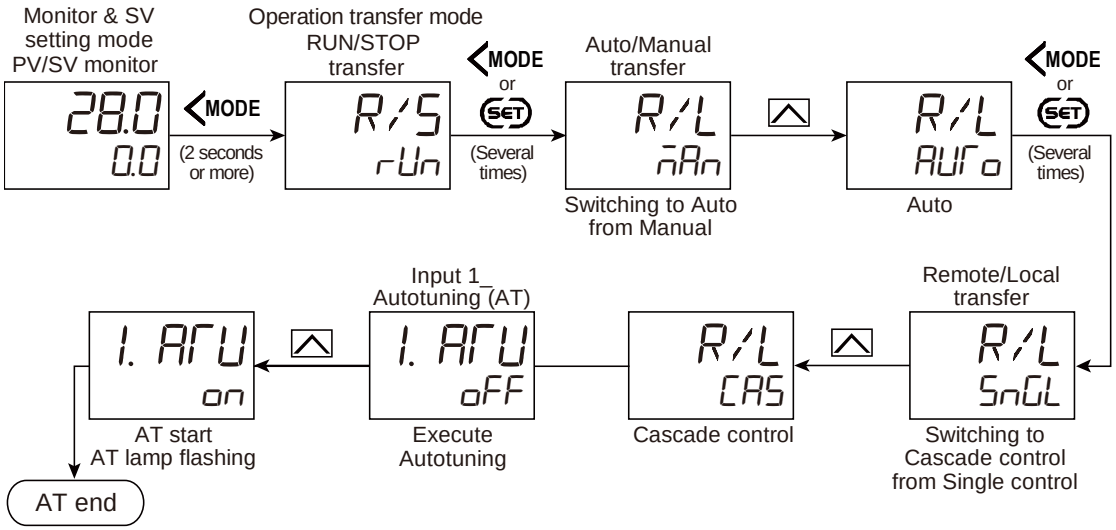
- **Cascade control related setting**

To enter the Engineering mode



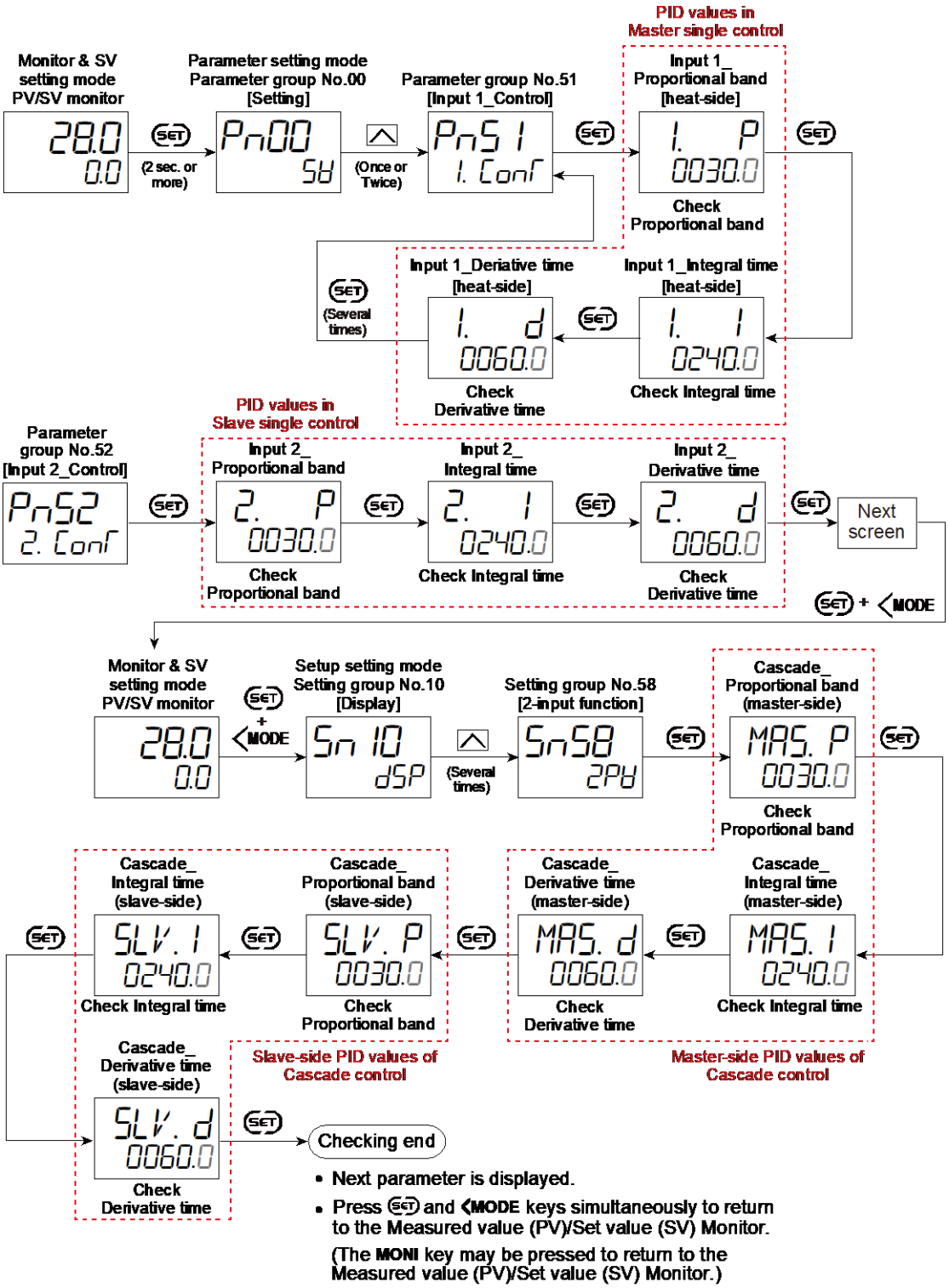
- Next parameter is displayed.
- Press and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

● Switching to Cascade control and executing AT



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

● Checking PID values

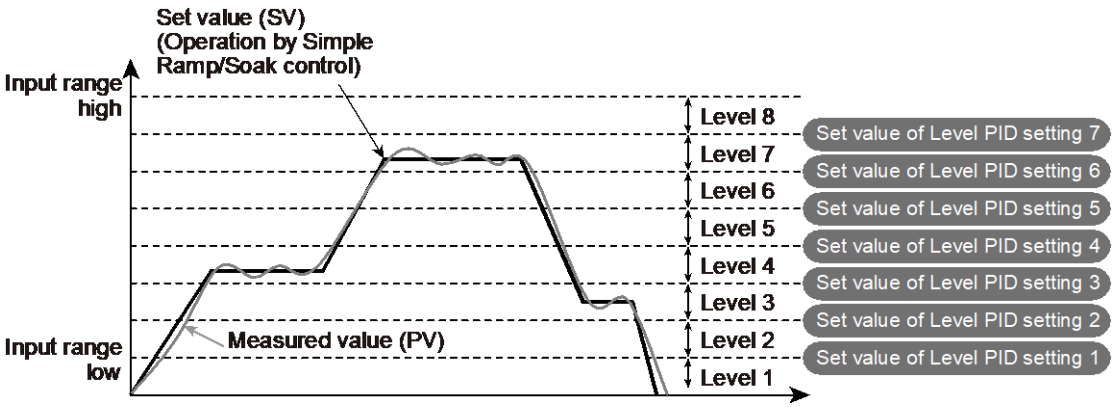


8.15 Controlling with Level PID

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 and Output limiter high/low.

Description of function

- Set the values such as PID values of each level to the Memory area 1 to 8 (PID memory 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 Memory area appropriate to the level.
- Different levels can be set at Input 1 and Input 2.



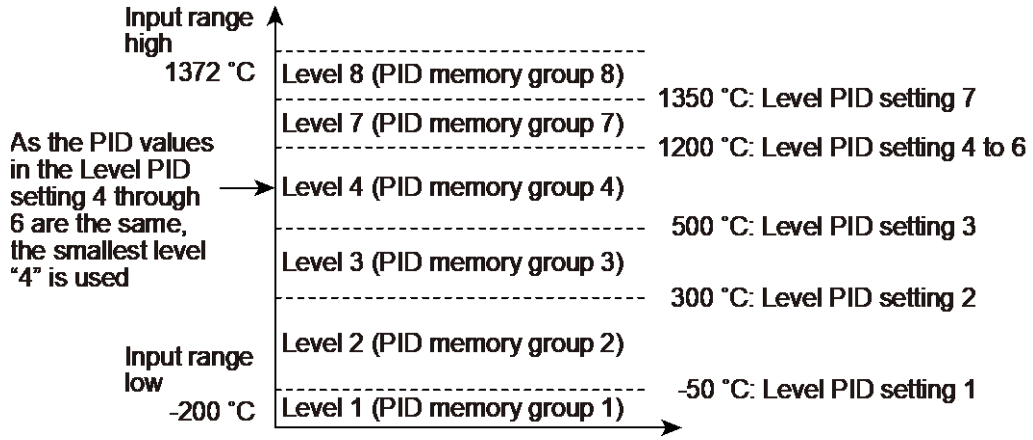
- **Memory area to be used for level**

The memory area 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 memory group	Description	Memory area
Level 8	PID memory group 8	Level PID setting 7 < Set value (SV) or Measured value (PV) ≤ Input range high	Memory area 8
Level 7	PID memory group 7	Level PID setting 6 < Set value (SV) or Measured value (PV) ≤ Level PID setting 7	Memory area 7
Level 6	PID memory group 6	Level PID setting 5 < Set value (SV) or Measured value (PV) ≤ Level PID setting 6	Memory area 6
Level 5	PID memory group 5	Level PID setting 4 < Set value (SV) or Measured value (PV) ≤ Level PID setting 5	Memory area 5
Level 4	PID memory group 4	Level PID setting 3 < Set value (SV) or Measured value (PV) ≤ Level PID setting 4	Memory area 4
Level 3	PID memory group 3	Level PID setting 2 < Set value (SV) or Measured value (PV) ≤ Level PID setting 3	Memory area 3
Level 2	PID memory group 2	Level PID setting 1 < Set value (SV) or Measured value (PV) ≤ Level PID setting 2	Memory area 2
Level 1	PID memory group 1	Input range low ≤ Set value (SV) or Measured value (PV) ≤ Level PID setting 1	Memory area 1

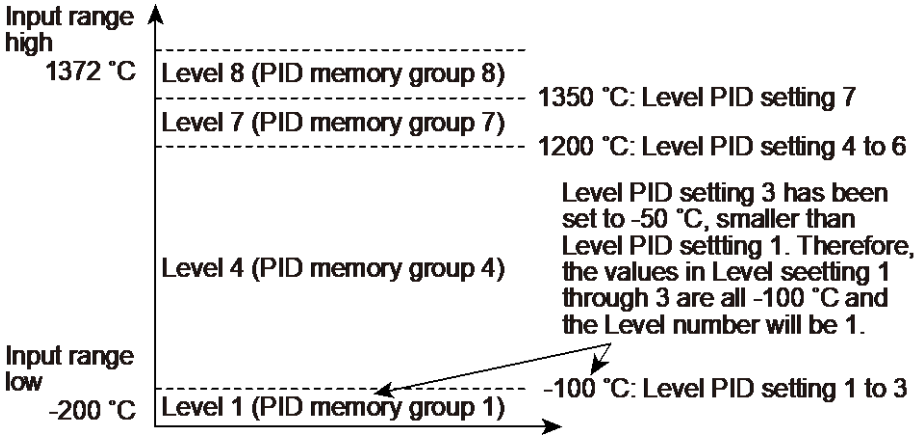
- When two or more levels have the same setting, the values with a smaller level number will be available and used.

  [Example 1] Values in Level PID setting 4 through 6 are the same.



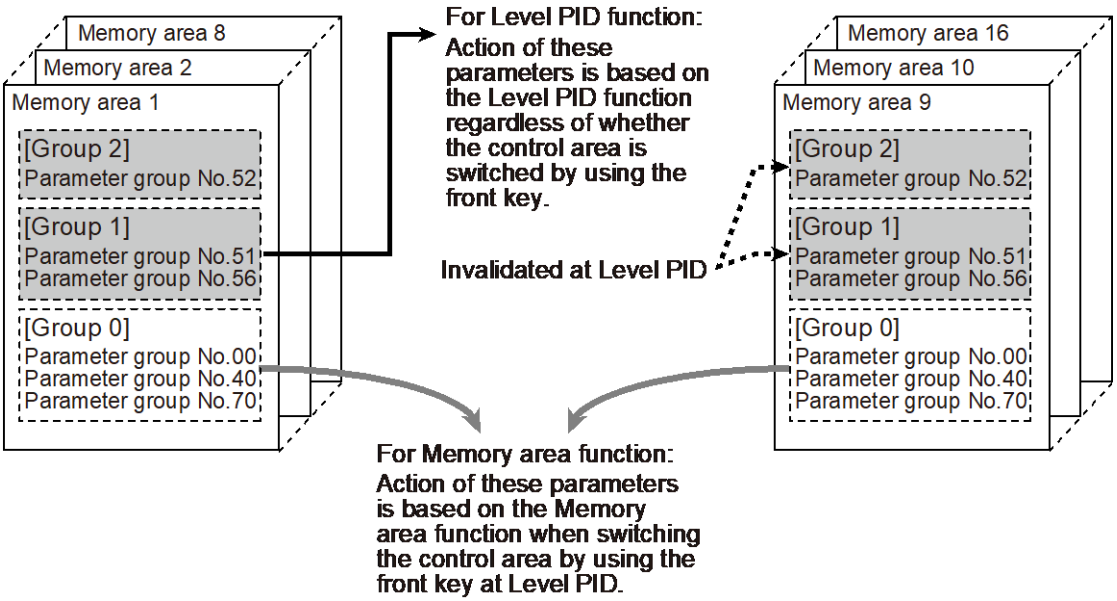
- If the Level PID setting is set ignoring the order of the level Nos., the Level PID values in the set range will be the same and the smallest level number is used. (See Example 2)

  [Example 2] Level PID setting 3 in Example 1 has been changed to -100 ºC.

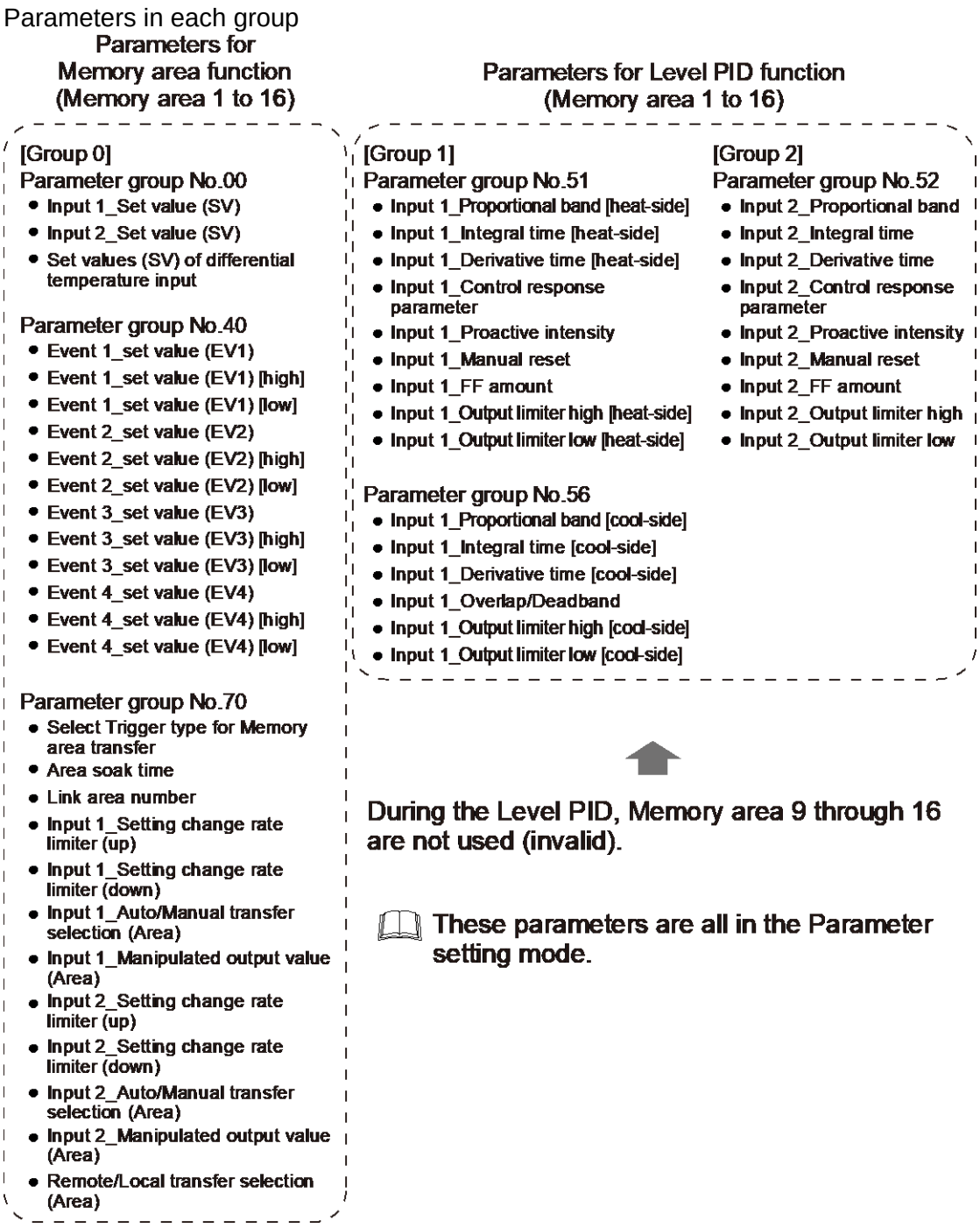


- **Parameters of Memory area at Level PID**

When using Level PID, parameters of Memory area are separated to be used for the Level PID function and the regular Memory area function.



Parameters of Memory area (at Level PID)



- **Parameters for Level PID function**

In Memory areas 1 through 8, the parameters in [Group 1] and [Group 2] are used as parameters for Level PID. Setting in Memory areas 9 through 16 will be ignored.

Memory area number for the control area can be changed by the front key, communication, Digital input (DI), Simple ramp/soak function or Simple sequence function; however, the parameters for Level PID function of the changed Memory area are unavailable.

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 Memory area appropriate to the level.

To use regular Memory area function

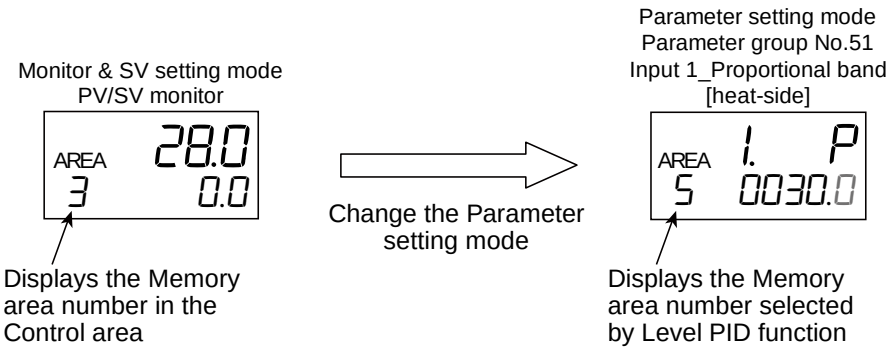
Input 1_Level PID action selection in Function block No. 51 (Engineering mode) and Input 2_Level PID action selection in Function block No. 52 (Engineering mode) can be used as a regular Memory area function in the case of “Switching by Memory area number” (Factory set value).

Memory area display at Level PID

PID values used for control are changed by the Level PID, but the control area is not influenced. This means that the Memory area No. on the PV/SV monitor screen in the Monitor & SV setting mode remains unchanged.

To check the Memory area No. actually used by the Level PID, locate the parameter used in the Level PID in the Parameter setting mode. Then, the actual Memory No. will be displayed. (See the example below)

[Example] In this example, Area 3 is displayed on the instrument (as a control area). Parameter “P” is displayed to show the Memory area No. actually used by the Level PID.



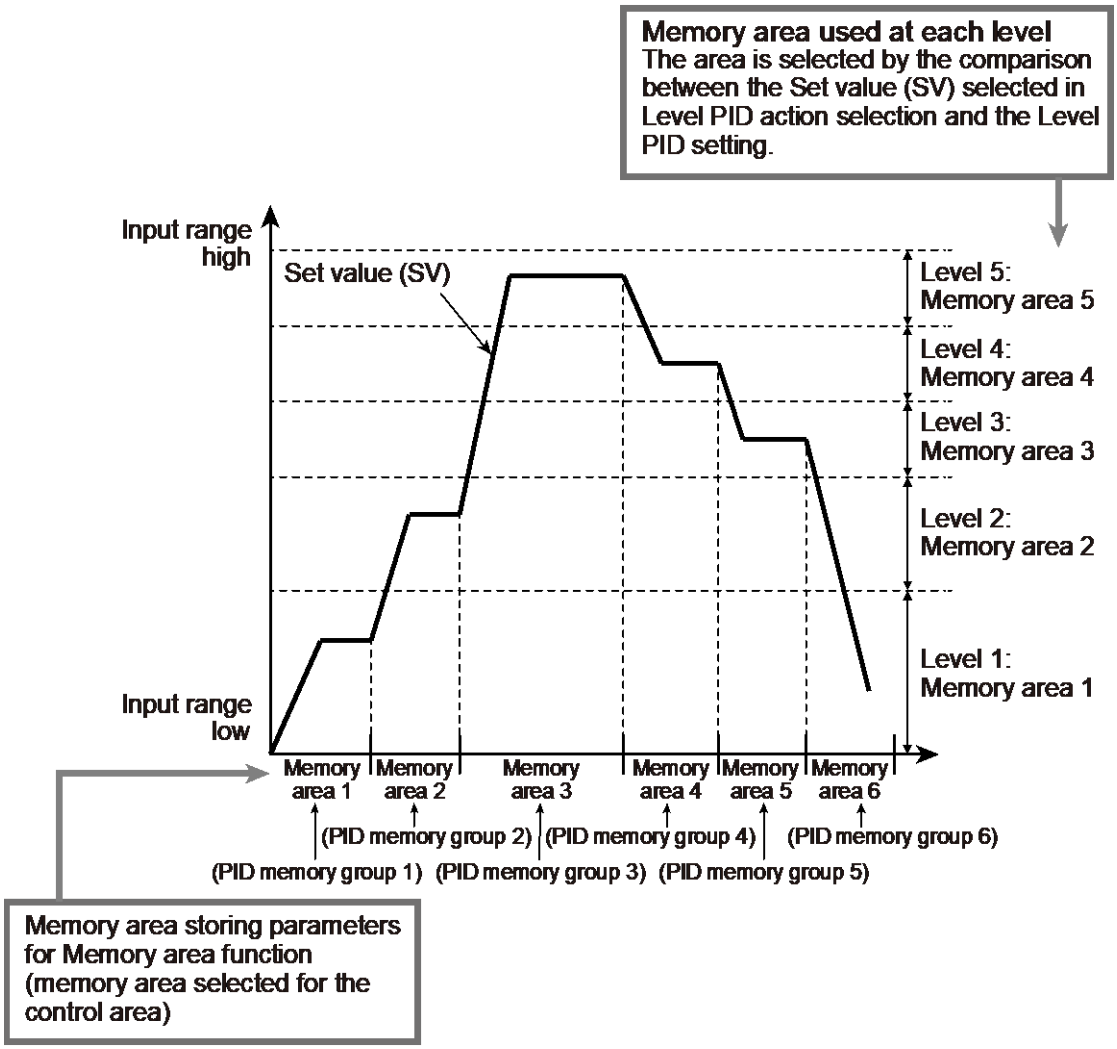
- **Parameters for Memory area function**

In Memory areas 1 through 16, parameters in [Group 0] can be used for the regular Memory area function. The parameters for the changed Memory area will be available by switching the Memory areas of the control area by the front key, communication, Digital input (DI), Simple ramp/soak function or Simple sequence function.

Refer to Parameters in each group for the parameters in Group 0.

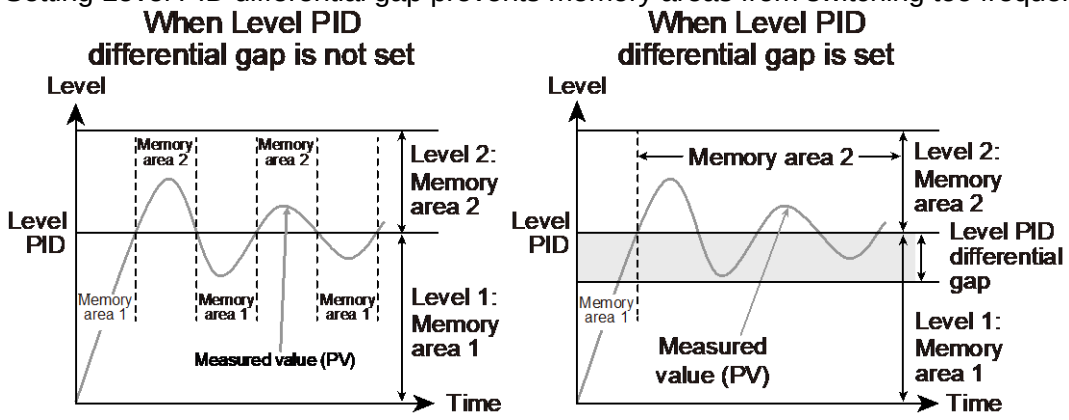
- **Example of action of the Memory area when setting simple ramp/soak program at Level PID**

[When “1: Switching by Set value (SV) (Level PID action)” is selected in Level PID action selection]



- **Level PID differential gap**

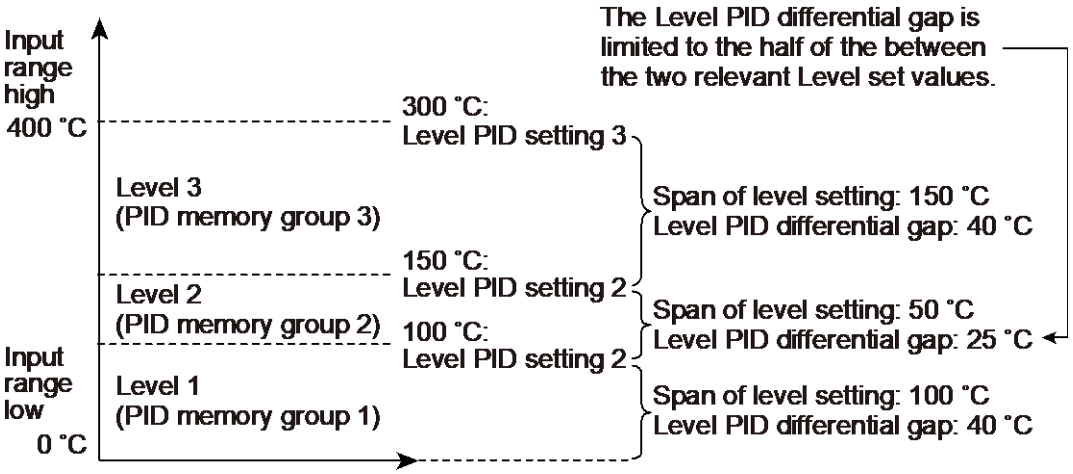
When setting “Switch by Measured value (PV)” to Level PID action:
The Memory areas storing the parameters for Level PID function may switch frequently by the fluctuation of the input when the Measured value (PV) is close to the Level PID set value.
Setting Level PID differential gap prevents memory areas from switching too frequently.



When setting “Switch by Set value (SV)” to Level PID action:
The setting of Level PID differential gap is available; 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 forcedly limited to the half of the range between the two relevant Level set values.

[Example] When Level PID differential gap is “40 °C”

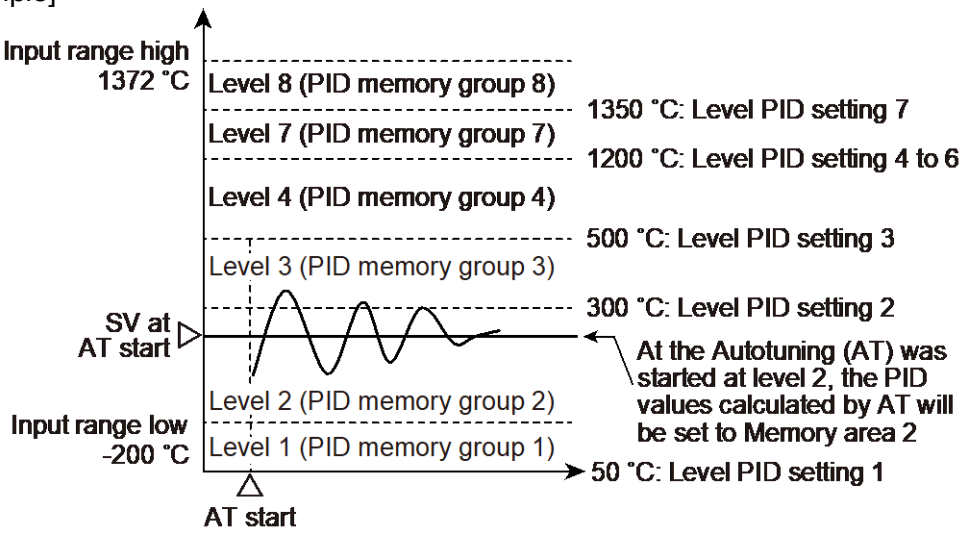


- **Autotuning (AT) at Level PID**

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 memory area which has the Set value (SV) at the time of Autotuning (AT) start.

[Example]



- **Level PID at Differential temperature control**

When the Level PID action selection is “Switching by Set value (SV)”:
Level PID is done at the Input 1_Monitor Set value (SV)*.

* Input 1_Monitor Set value (SV) = Input 2_Measured value (PV) + Set value of Differential temperature input

When the Level PID action selection is “Switching by Measured value (PV)”:
Level PID is done at the Measured value (PV) Input 1.

The Level PID will not work at the Set value (SV) or Measured value (PV) of the Differential temperature input.

Parameter setting

- **Input 1_Level PID setting 1 to Input 1_Level PID setting 7 [Setup Setting Mode: Setting group No. 51 (Sn51)]**

Parameter symbol	Data range	Factory set value
1.LEV 1	Input 1_Input range low to Input 1_Input range high (When Control with PV select: PV select input range low to PV select input range high) [Varies with the setting of the Decimal point position.] Input 1_Level PID settings 1 to 7 always maintain the following relation. (Input 1_Level PID setting 1) ≤ (Input 1_Level PID setting 2) ≤ (Input 1_Level PID setting 3) ≤ (Input 1_Level PID setting 4) ≤ (Input 1_Level PID setting 5) ≤ (Input 1_Level PID setting 6) ≤ (Input 1_Level PID setting 7)	Input 1_Input range high (Control with PV select: PV select input range high)
1.LEV 2		
1.LEV 3		
1.LEV 4		
1.LEV 5		
1.LEV 6		
1.LEV 7		

To display “Input 1_Level PID setting 1 to Input 1_Level PID setting 7”, choose “1 (Switching by Set value (SV))” or “2 (Switching by Measured value (MV))” in Function block No. 51: Input 1_Level PID action selection (Engineering mode), AND choose a setting other than “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-VCOS(R)])” in Function block No. 52: Input 2_Control action (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when Input 1_Level PID setting is changed.

- **Input 2_Level PID setting 1 to Input 2_Level PID setting 7 [Setup Setting Mode: Setting group No. 52 (Sn52)]**

Parameter symbol	Data range	Factory set value
2.LEV 1	Input 2_Input range low to Input 2_Input range high [Varies with the setting of the Decimal point position.] Input 2_Level PID settings 1 to 7 always maintain the following relation. (Input 2_Level PID setting 1) ≤ (Input 2_Level PID setting 2) ≤ (Input 2_Level PID setting 3) ≤ (Input 2_Level PID setting 4) ≤ (Input 2_Level PID setting 5) ≤ (Input 2_Level PID setting 6) ≤ (Input 2_Level PID setting 7)	Input 2_Input range high
2.LEV 2		
2.LEV 3		
2.LEV 4		
2.LEV 5		
2.LEV 6		
2.LEV 7		

To display “Input 2_Level PID setting 1 to Input 1_Level PID setting 7”, choose “Switching by Set value (SV)” or “Switching by Measured value (PV)” in Function block No. 58: Input 2_Level PID action selection (Engineering mode) AND choose “2-loop control/Differential temperature control”, or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when Input 2_Level PID setting is changed.

- **Input 1_Level PID action selection [Engineering mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1.LPId	0: Switching by Memory area number 1: Switching by Set value (SV) (Level PID action) 2: Switching by Measured value (PV) (Level PID action)	0

📖 To display “Input 1_Level PID action selection”, choose a setting other than “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_Level PID action selection [Engineering mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2.LPId	0: Switching by Memory area number 1: Switching by Set value (SV) (Level PID action) 2: Switching by Measured value (PV) (Level PID action)	0

📖 To display “Input 2_Level PID action selection”, choose settings other than “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_Level PID differential gap [Engineering mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. LHS	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2

📖 To display “Input 1_Level PID differential gap”, choose settings other than “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

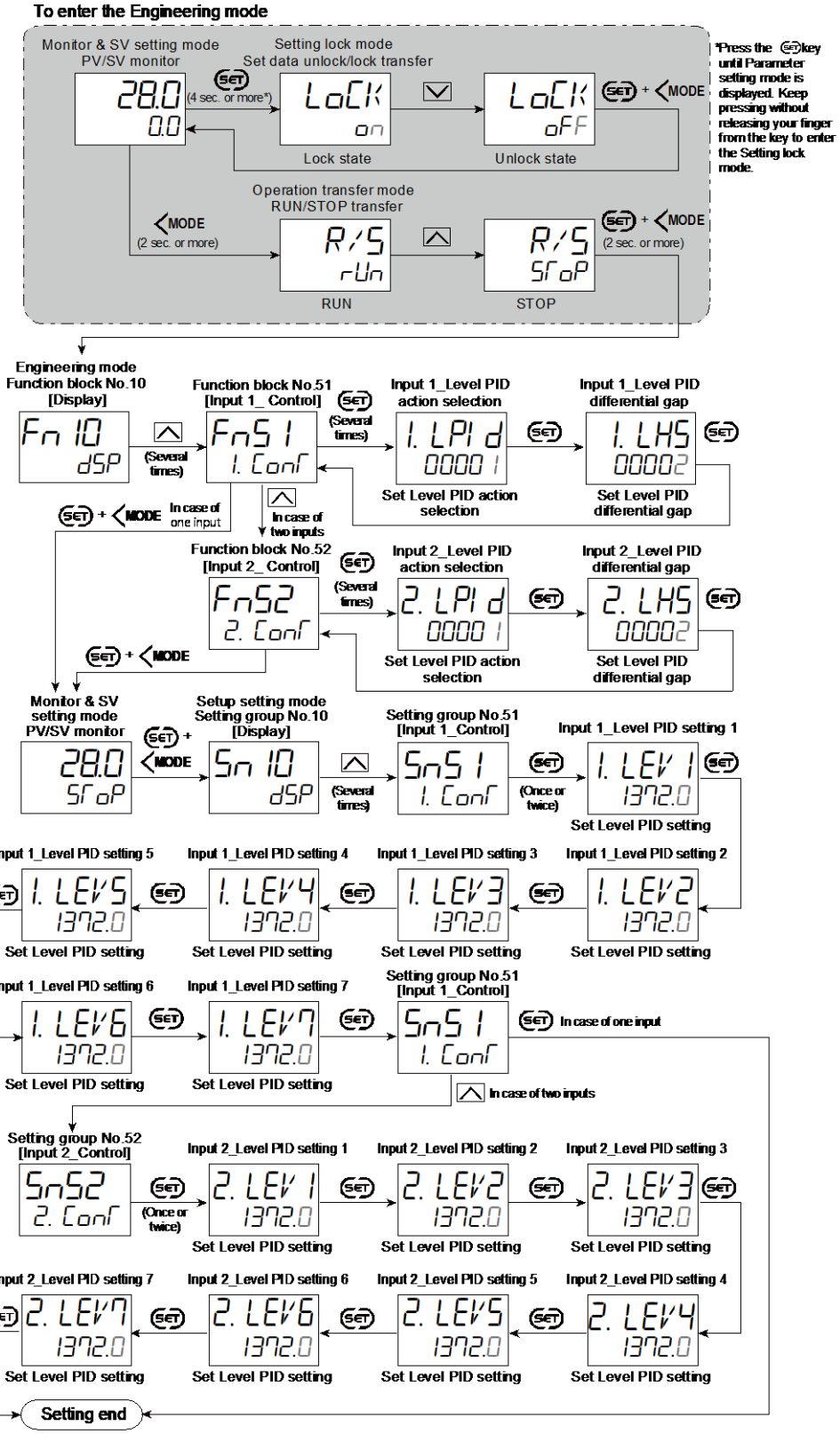
- **Input 2_Level PID differential gap [Engineering mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. LHS	0 to Input 2_Input span [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2

📖 To display “Input 2_Level PID differential gap”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

8.16 Eliminating Offset Inherent to Proportioning Control (Manual Reset)

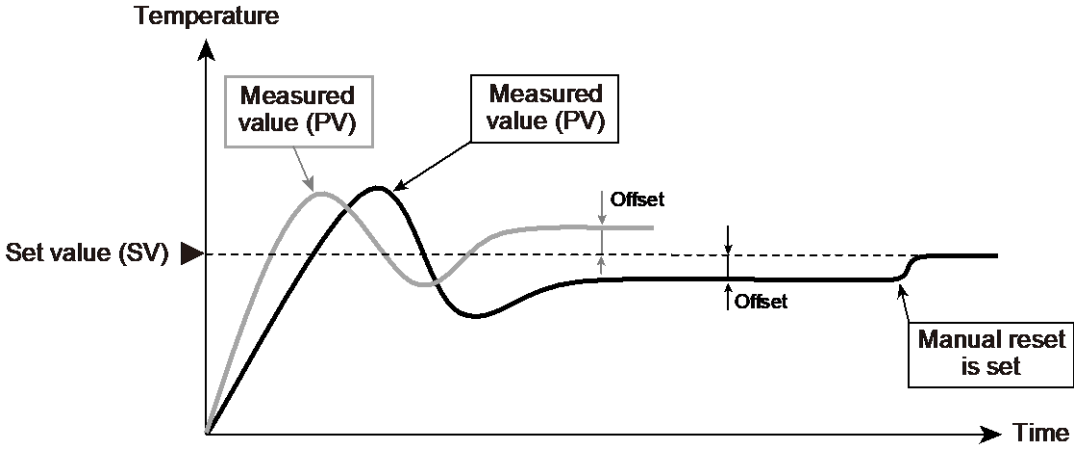
In order to eliminate the offset occurring in Proportional (P) control, the Manipulated output value is manually corrected.

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.



Manual reset is available when the Integral time is 0 (0.0, 0.00).

Parameter setting

- **Input 1_Manual reset [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. MR	-100.0 to +100.0%	0.0

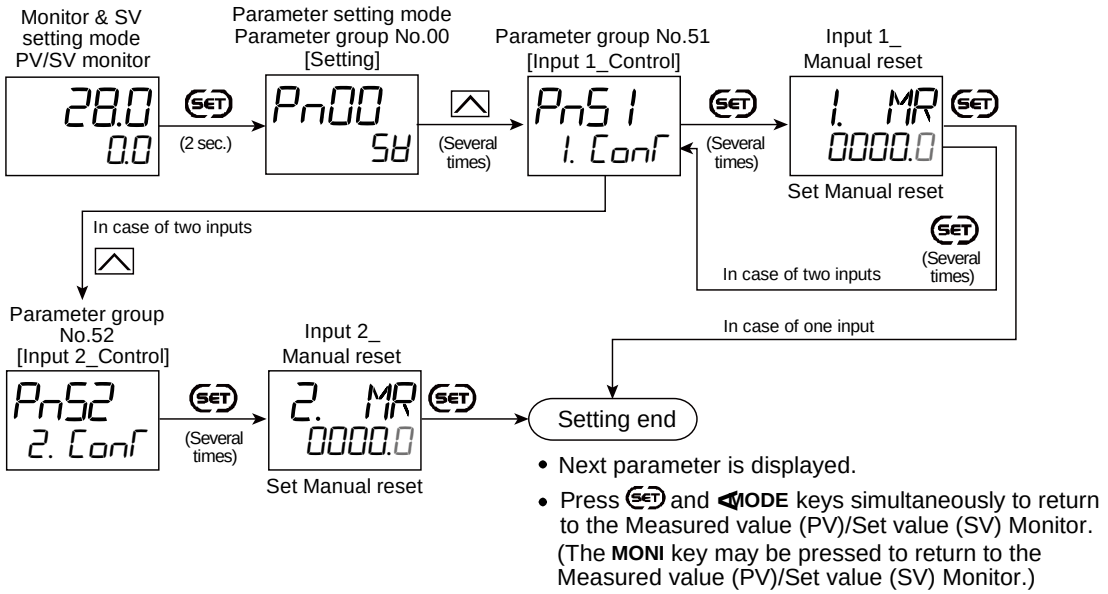
To display “Input 1_Manual reset”, choose “Heating/Cooling PID control” in Function block No.51: Input 1_Control action (Engineering mode). Additionally, a value 0 must also be entered in the Input 1_Integral time [heat-side] in the same memory area.

- **Input 2_Manual reset [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. MR	-100.0 to +100.0%	0.0

To display “Input 2_Manual reset”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, value 0 must also be entered in the Input 1_Integral time in the same memory area.

Setting procedure



8.17 Continuing Stable Control after the Operation Transfer (SV Tracking)

This function is used to follow (keep tracking of) the other set value in another mode (control) that was used before the change of the set value. This is useful to suppress a sudden change of the set value when the operation mode is changed.

Description of function

The SV tracking can be selected at the time of switching between Remote/Local and Auto/Manual. The functions can be selected independently or together.

- **SV tracking at the time of Remote/Local transfer**

The SV tracking at the time of Remote/Local transfer may be effective in such switching actions.

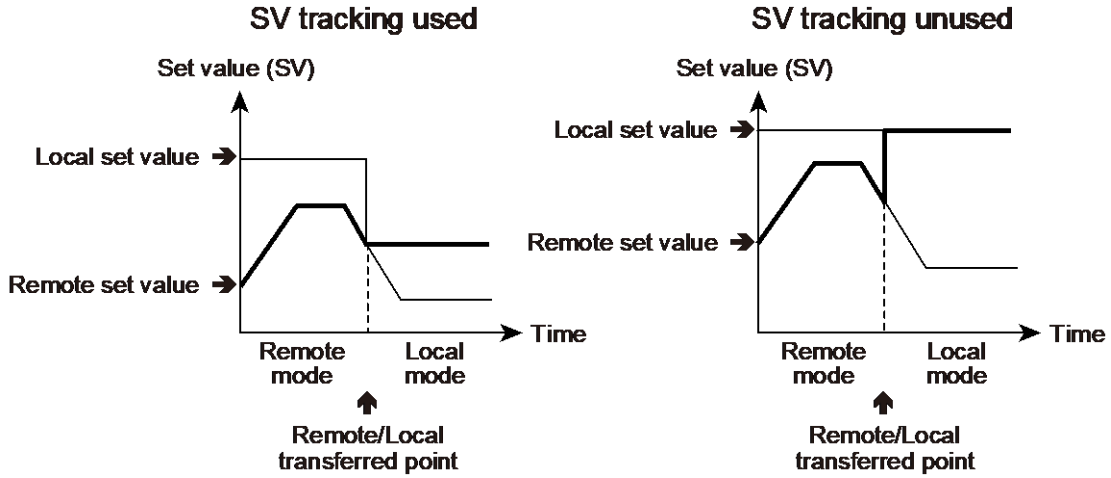
- Switching between Remote and Local mode
- Switching between 2-loop control and Differential temperature control
- Switching between Cascade control and Slave single control

<u>Switching between Remote and Local mode</u>

When the operation mode is switched from Remote to Local mode, the Local set value follows the Remote set value just before the switching (tracking).

[Change of set values when switched from Remote to Local mode]

Operation mode:	Remote mode ⟶ Local mode	
SV tracking used	Remote set value	Remote set value just before switching
SV tracking unused	Remote set value	Local set value



The SV tracking does not function at the time of switching from Local mode to Remote mode.

Switching between 2-loop control and Differential temperature control

When the Differential temperature control is switched to 2-loop control, the Input 1_ Set value (SV) follows the Input 1_set value monitor [PV just before the switching + Set value of Differential temperature control].

In case of Differential temperature control, the Input 1_Set value (SV) is not used for control. The Input 1_Monitor Set value (SV)* of is used in actual control.

* Input 1_Monitor Set value (SV) = Controlled temperature
= Input 2_Measured value (PV) [Reference temperature] + Set value of Differential temperature input

[Change of set values when switched from Differential temperature control to 2-loop control]

Control: Differential temperature control ⟶ 2-loop control		
Set value used (Input 1)	Input 1_Set value monitor	Input 1_Set value (SV)
SV tracking used	Input 1_Set value (SV) = Input 1_Set value (SV) Input 1_Set value monitor = Input 2_PV + Set value of Differential temperature input	Input 1_Set value (SV) = Input 2_PV just before the switching + Set value of Differential temperature input Input 1_Set value monitor = Input 2_PV + Set value of Differential temperature input
SV tracking unused	Input 1_Set value (SV) = Input 1_Set value (SV) Input 1_Set value monitor = Input 2_PV + Set value of Differential temperature input	Input 1_Set value (SV) = Input 1_Set value (SV) Input 1_Set value monitor = Input 1_Set value (SV)

The SV tracking does not function at the time of switching from 2-loop control to Differential temperature control.

Switching between Cascade control and Slave single control

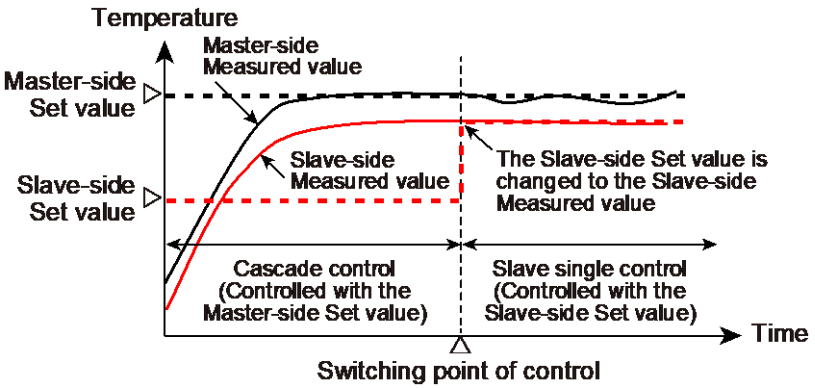
- When the Cascade control is switched to the Slave single control, the set value of Input 2 (slave-side) follows the Input 2_Measured value (PV) just before the switching
- When the Slave single control is switched to the Cascade control, the set value of Input 1 (master-side) follows the Input 1_Measured value (PV) just before the switching

[Change of set values when switched from Cascade control to Slave single control]

Control:	Cascade control ⟶	Slave single control
SV tracking used	Input 1_Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Set value according to the Manipulated output of Input 1 (master-side)	Input 1_Set value (master-side) = Input_1 Set value (master-side) Input 2_Set value (slave-side) = Measured value of Input 2 (slave-side) just before the switching
SV tracking unused	Input 1_Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Set value according to the Manipulated output of Input 1 (master-side)	Input 1_Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Input 2_Set value (slave-side)

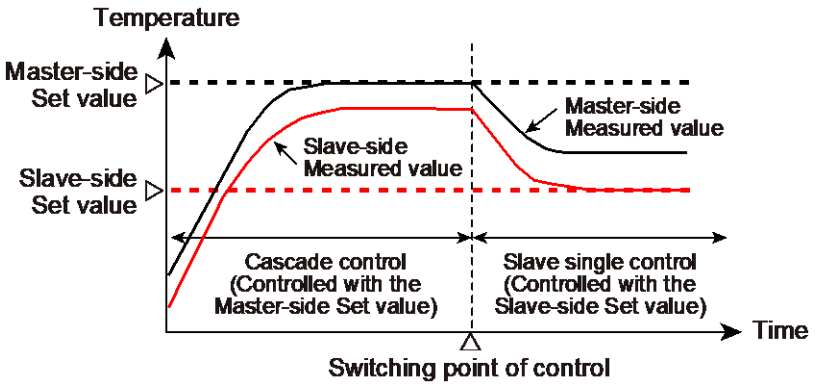
SV tracking used

When the Cascade control is switched to the Slave single control, the Slave-side set value tracks the Slave-side measured value, switching without fluctuation can be achieved.



SV tracking unused

When the Cascade control is switched to the Slave-single control, if the Slave-side measured value and the Slave side set value are not the same, fluctuation of the PV is caused.

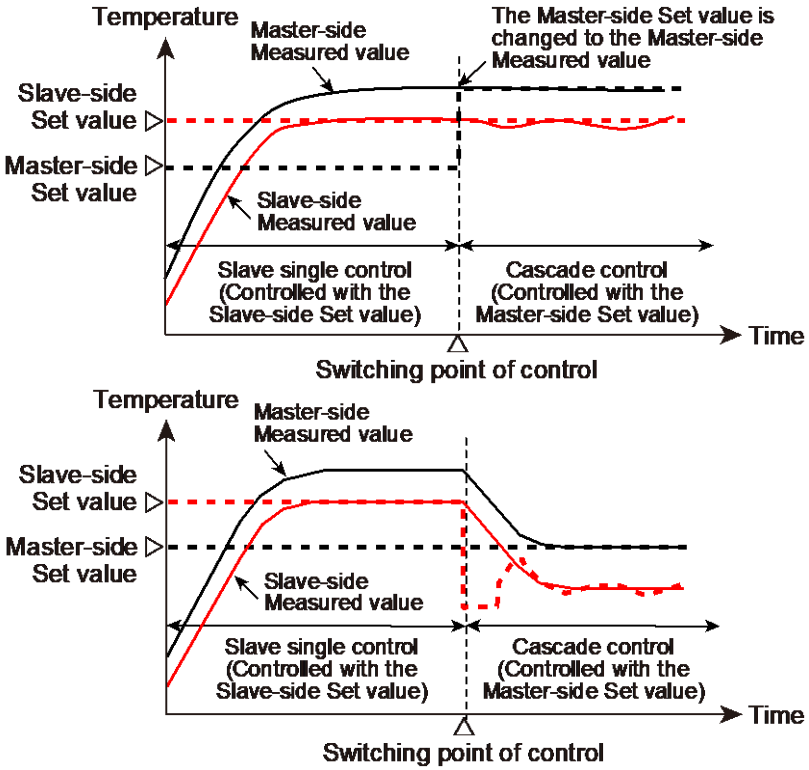


[Change of set values when switched from Slave single control to Cascade control]

Control:	Slave single control ⟶	Cascade control
SV tracking used	Input 1_Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Input 2_Set value (slave-side)	Input 1_Set value (master-side) = Measured value of Input 1 (master-side) just before the switching Input 2_Set value (slave-side) = Set value according to the Manipulated output of Input 1 (master-side)
SV tracking unused	Input 1_Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Input 2_Set value (slave-side)	Input 1_ Set value (master-side) = Input 1_Set value (master-side) Input 2_Set value (slave-side) = Set value according to the Manipulated output of Input 1 (master-side)

SV tracking used
When the Slave single control is switched to the Cascade control, the Master-side set value tracks the Master-side measured value, switching without fluctuation can be achieved.

SV tracking unused
When the Slave single control is switched to the Cascade control, if the Master-side set value and the Master-side measured value are not the same, fluctuation of the PV is caused.



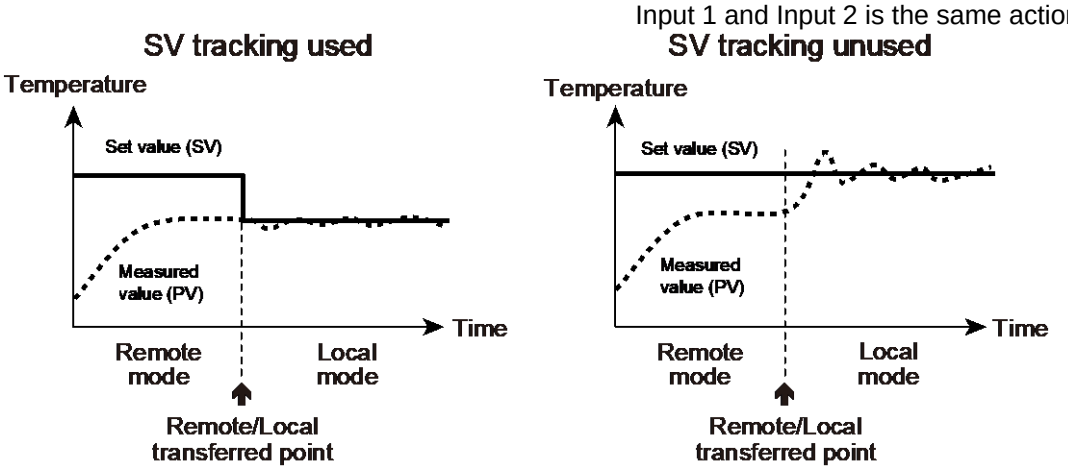
- **SV tracking at the time of Auto/Manual transfer**

When the Manual mode is switched to the Auto mode, the Set value (SV) follows the Measured value (PV) just before the switching.

[Change of set values when switched from Manual mode to Auto mode]

Operation mode: Manual mode ⟶ Auto mode		
SV tracking used	Set value (SV) = Set value (SV) Measured value (PV) = Measured value (PV)	Set value (SV) = Measured value (PV) just before the switching Measured value (PV) = Measured value (PV)
SV tracking unused	Set value (SV) = Set value (SV) Measured value (PV) = Measured value (PV)	Set value (SV) = Set value (SV) Measured value (PV) = Measured value (PV)

Input 1 and Input 2 is the same action



The SV tracking does not function at the time of switching from Auto mode to Manual mode.

SV tracking does not function at the time of Auto/Manual switching at the Differential temperature control.

Parameter setting

- **Input 1_Auto/Manual transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
1. A/M	AUTo: Auto mode mAn: Manual mode	mAn

- **Input 2_Auto/Manual transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
2. A/M	AUTo: Auto mode mAn: Manual mode	mAn

To display “Input 2_Auto/Manual transfer”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Remote/Local transfer [Operation Transfer Mode]**

Parameter symbol	Data range	Factory set value
R/L	When “Remote setting input” is selected at Select function for input 2 LoC: Local mode rEm: Remote mode	LoC
	When “Cascade control” is selected at Select function for input 2 SnGL: Single control (Master single or Slave single) CAS: Cascade control	SnGL
	When “2-loop control/Differential temperature control” is selected at Select function for input 2 2LooP: 2-loop control dIFF: Differential temperature control	2LooP

To display “Remote/Local transfer”, choose “Remote setting input”, “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

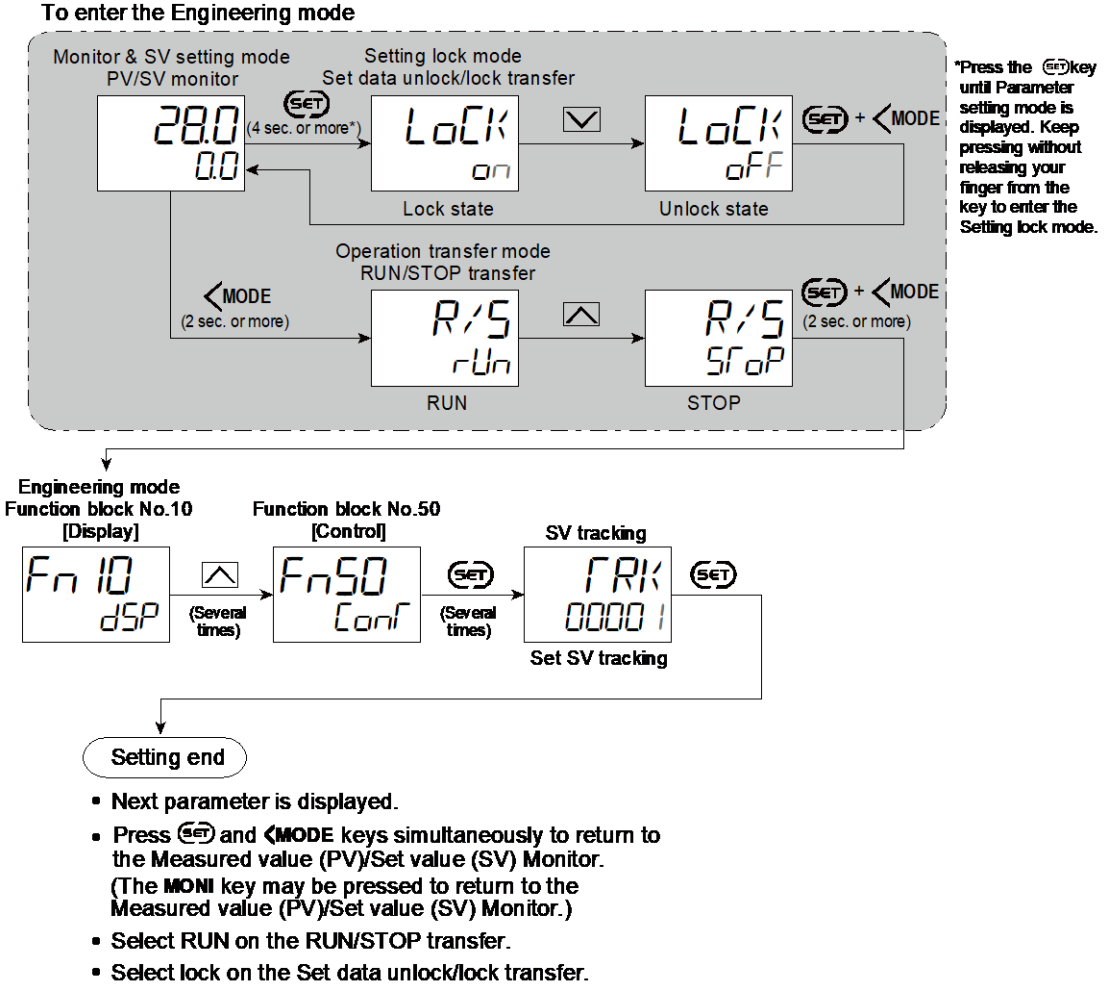
- **SV tracking [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
TRK	0 to 3 0: No SV tracking function +1: SV tracking at transferring Remote/Local, Cascade mode, or 2-loop control/Differential temperature control +2: SV tracking at transferring Auto/Manual To select two or more functions, sum each value.	1

Setting procedure

- **SV tracking setting**

To enter the Engineering mode



- Next parameter is displayed.
- Press and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

☞ Refer to 8.9 Controlling with Manual Control for operating Auto/Manual switching.

☞ Refer to 8.10 Using Remote Setting Input for operating Remote/Local switching.

8.18 Suppressing Overshoot

Overshoot can be suppressed at PID control at the time of startup (power on, control stop to start), Set value (SV) change, and external disturbances.

Overshoot during the transition from Ramp to Soak can be prevented, when the Setting change rate limiter is used.

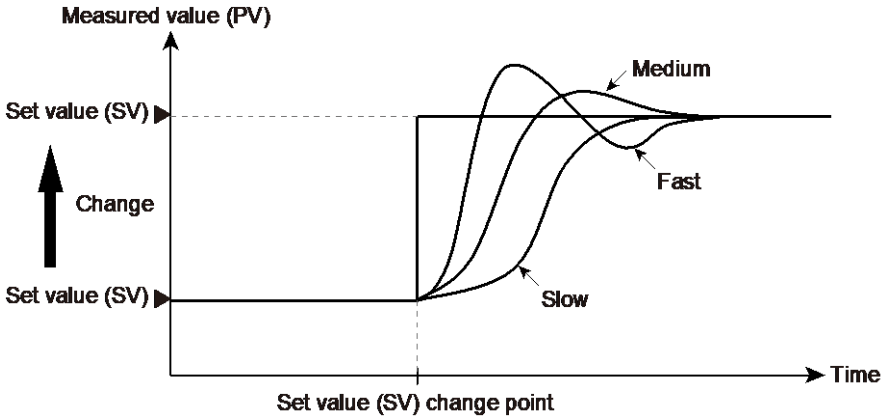
Description of function

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.”

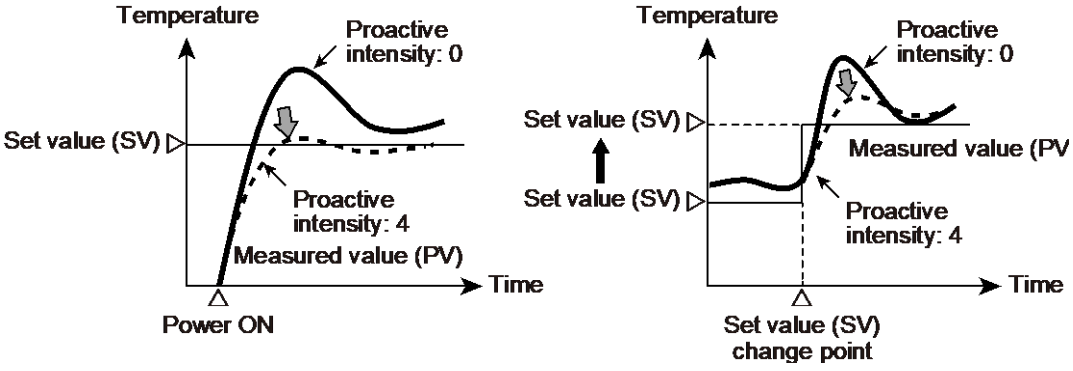
Fast	Selected when rise time needs to be shortened (operation needs to started fast). However in this case, slight overshooting may not be avoided.
Medium	Middle between “Fast” and “Slow.” Overshooting when set to “Medium” becomes less than that when set to “Fast.”
Slow	Selected when no overshooting 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 to start), 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).

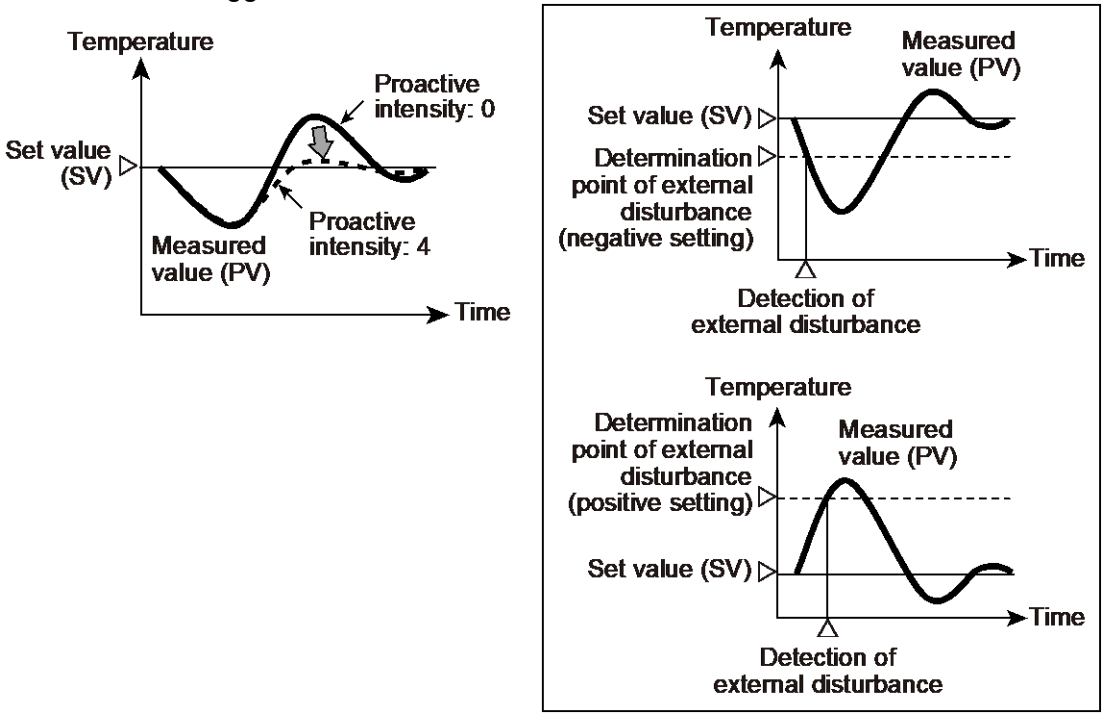
Startup (power on, control stop to start), Set value (SV) change



When external disturbance occurs

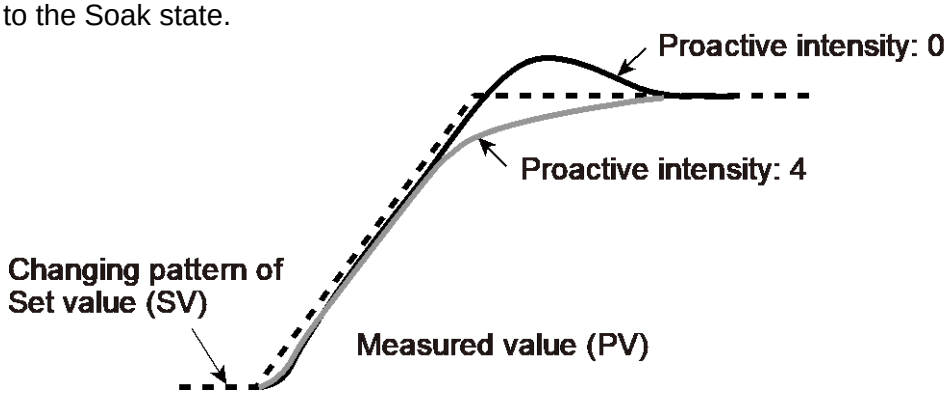
Overshoot can be suppressed when external disturbance occurs.

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.



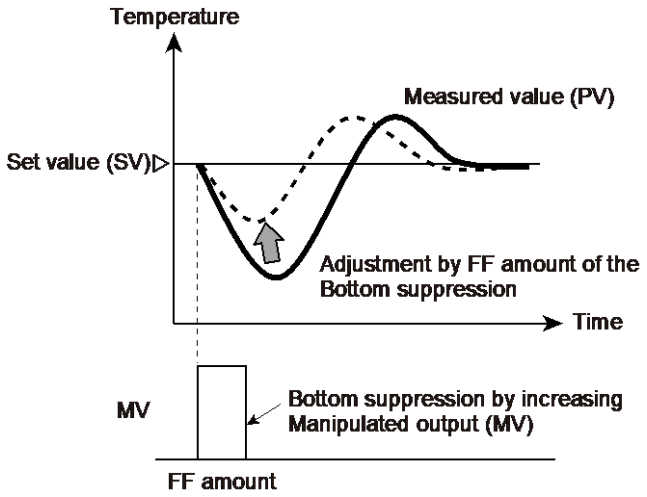
During Ramp control (Change of SV by Setting change rate limiter)

Overshoot can be suppressed when the temperature is in transition from the Ramp state to the Soak state.



- **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 off FF amount. Trigger signal can be input through communication in the case of Forced addition of FF amount.

Parameter setting

- **Input 1_Control response parameter [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. RPT	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	PID control: 0 Heating/Cooling PID control: 2

To display “Input 1_Control response parameter”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_Control action (Engineering mode).

- **Input 2_Control response parameter [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. RPT	0: Slow 1: Medium 2: Fast [When P or PD action is selected, this setting will be unavailable]	0

To display “Input 2_Control response parameter”, choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_Proactive intensity [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1.PACT	0 to 4 0: No function	2

To display “Input 1_Proactive intensity”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 1_Proportional band [heat-side] and the Input 1_ Integral time in the same memory area.

- **Input 2_Proactive intensity [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2.PACT	0 to 4 0: No function	2

To display “Input 2_Proactive intensity”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band and the Input 2_Integral time in the same memory area.

- **Input 1_FF amount [Parameter Setting Mode: Parameter group No. 51 (Pn51)]**

Parameter symbol	Data range	Factory set value
1. FF	-100.0 to +100.0%	0.0

To display “Input 1_FF amount”, choose “1 or 2” in Function block No. 57: Bottom suppression function (Engineering mode), AND select other than MC-(V)COS(R) pressure control for “Input 1_Control action” in Engineering mode: Function block No. 51. Additionally, a value other than 0 must also be entered in Input 1_Proportional band [heat-side] and Input 1_Integral time [heat-side] in the same memory area.

- **Input 2_FF amount [Parameter Setting Mode: Parameter group No. 52 (Pn52)]**

Parameter symbol	Data range	Factory set value
2. FF	-100.0 to +100.0%	0.0

To display “Input 2_FF amount”, choose “1 (FF amount is added by level)” or “2 (FF amount is forcibly added)” in Function block No. 57: Bottom suppression function (Engineering mode), AND choose “2-loop control/Differential temperature control” or “Cascade control”, AND choose a setting other than “3 to 7 (Pressure control operation [MC-VCOS(R)])” in Function block No. 52: Input 2_Control action (Engineering mode). Additionally, a value other than 0 must also be entered in the Input 2_Proportional band [heat-side] and the Input 2_Integral time in the same memory area.

- **FF amount learning [Setup Setting Mode: Setting group No. 57 (SnS7)]**

Parameter symbol	Data range	Factory set value
FFSr	0 to 3 0: No learning +1: Learn Input 1 +2: Learn Input 2 To select two or more functions, sum each value.	0

To display “FF amount learning,” choose 1 or 2 in Function block No. 57: Bottom suppression function (Engineering mode) AND a choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No. 51: Input 1_Control action (Engineering mode, OR choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (in Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

- **Input 1_Determination point of external disturbance [Setup Setting Mode: Setting group No. 57 (SnS7)]**

Parameter symbol	Data range	Factory set value
1.ExdU	-(Input 1_Input span) to +(Input 1_Input span) (When Control with PV select: -(PV select input span) to +(PV select input span)) [Varies with the setting of the Decimal point position.]	-1

To display “Input 1_Determination point of external disturbance”, choose “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.51: Input 1_ Control action (Engineering mode).

- **Input 2_Determination point of external disturbance [Setup Setting Mode: Setting group No. 57 (SnS7)]**

Parameter symbol	Data range	Factory set value
2.ExdU	-(Input 2_Input span) to +(Input 2_Input span) [Varies with the setting of the Decimal point position.]	-1

To display “Input 2_Determination point of external disturbance”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_Control action (Engineering mode).

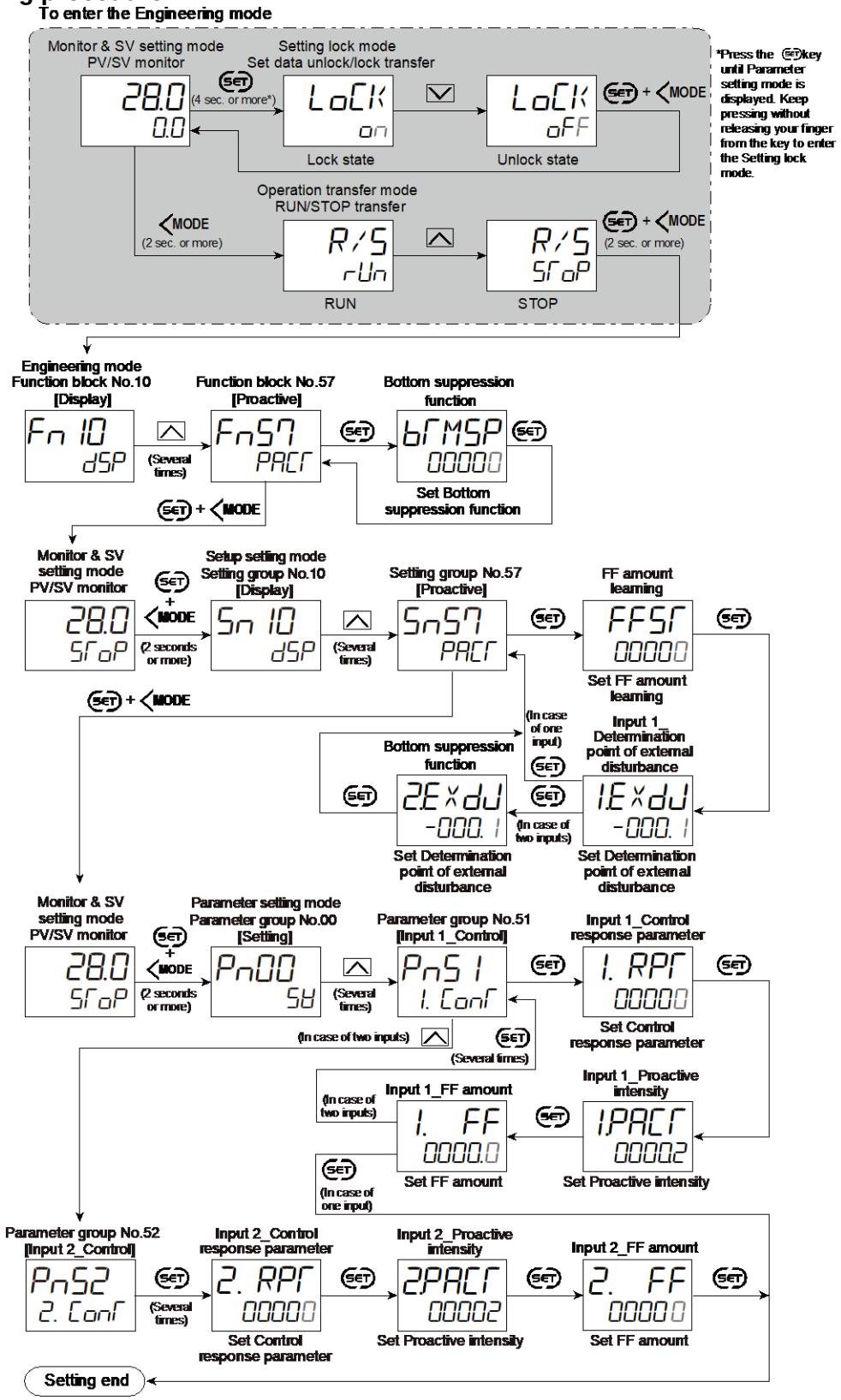
- **Bottom suppression function [Engineering Mode: Function block No. 57 (FnS7)]**

Parameter symbol	Data range	Factory set value
brMSP	0: No function 1: FF amount is added by level 2: FF amount is forcibly added	0

To display the “Bottom suppression function”, choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No. 51: Input 1_Control action (Engineering mode), OR “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode), AND choose a setting other than “3 to 7 (Pressure control operation [MC-(V)COS(R)])” in Function block No.52: Input 2_ Control action (Engineering mode).

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

8.19 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
- RUN/STOP selection when power is restored
- MAN/AUTO selection when power is restored
- LOC/REM selection when power is restored
- LOC/EXT selection when power is restored
- Output value selection when power is restored

In addition, the start action can also be selected from the aforementioned settings when switching from STOP to RUN, in cases other than power failures.

Description of function

- **Hot/Cold start**

Recovery action from power failure can be selected from the following.

For PID control or Heating/Cooling 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	Auto mode	Computed control output value[2)]
		Manual mode	Output limiter low
Cold start	Manual control mode	Output limiter low	
STOP start	Started in the Reset mode regardless of the Operation mode before power failure[1)]	Manipulated output value (MV) at STOP	
Action to follow when power is restored	Adheres to the setting for RUN/STOP selection when power is restored, MAN/AUTO selection when power is restored, LOC/REM selection when power is restored, LOC/EXT selection when power is restored	Adheres to the setting for output value selection when power is restored	

Factory set value: Action to follow when power is restored

[1)] If changed to RUN from STOP by RUN/STOP transfer after start, set to the operation mode before power failure occurs.

[2)] The result of control computation varies with the control response parameter.

If Startup tuning (ST) function is executed or an automatic temperature rise is made just when the power is turned on or selection is made from STOP to RUN as one of the startup conditions, control starts at Hot start 2 even if set to Hot start 1 (factory set value).

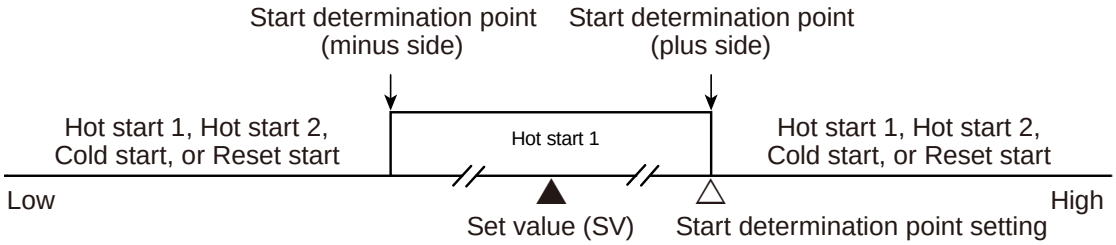
- **Start determination point**

Determination point of Hot start 1 is set. 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 started 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.

The start determination point is set to “0” when shipped, therefore the procedure below is not performed, and operation is started in the start condition selected in “Hot/cold start”.



During Cascade control: Determined for Master side (Input 1) only.
In the case of Master single control and Slave single control, according to the setting of each input.

Action upon power failure for 2-loop control is as follows:

- Hot start 1, Hot start 2, Cold start and Action to follow when power is restored
  Control is started in a mode according to the start determination point.
- STOP start
  Starts in Hot start 1 when Input 1 or Input 2 stays within the start determination point. Starts in STOP start when both of Input 1 and Input 2 are outside the start determination point.

Parameter setting

- **Hot/Cold start [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
Pd	0: Hot start 1 1: Hot start 2 2: Cold start 3: STOP start 4: Action to follow when power is restored [1)]	0

[1)] Adheres to the setting for RUN/STOP selection when power is restored, MAN/AUTO selection when power is restored and when switching to RUN, LOC/REM selection when power is restored and when switching to RUN, LOC/EXT selection when power is restored and when switching to RUN, Output value selection when power is restored.

- **Input 1_Start determination point [Engineering Mode: Function block No. 51 (Fn51)]**

Parameter symbol	Data range	Factory set value
1. PdA	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	0

- **Input 2_Start determination point [Engineering Mode: Function block No. 52 (Fn52)]**

Parameter symbol	Data range	Factory set value
2. PdA	0 to Input 2_Input span 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	0

To display “Input 2_Start determination point”, choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **RUN/STOP selection when power is restored [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
rUnSL	0: STOP 1: RUN 2: Operation immediately before power cut	0

- **MAN/AUTO selection when power is restored [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
MANSL	0: MAN 1: AUTO 2: Operation immediately before power cut	0

- **LOC/REM selection when power is restored [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
REMSL	0: LOCAL [1)] 1: REMOTE [1)] 2: Operation immediately before power cut	0

[1)] Depending on the selected item for “Select function for Input 2”, this will be LOCAL/REMOTE, Single control/Cascade control, Input 1/ Input 2 or 2-loop control/Differential temperature control.

Refer to “Remote/Local transfer” in 3.4 Operation Transfer Mode [C] for details.

- **LOC/EXT selection when power is restored [Engineering Mode: Function block No. 50 (Fn50)]**

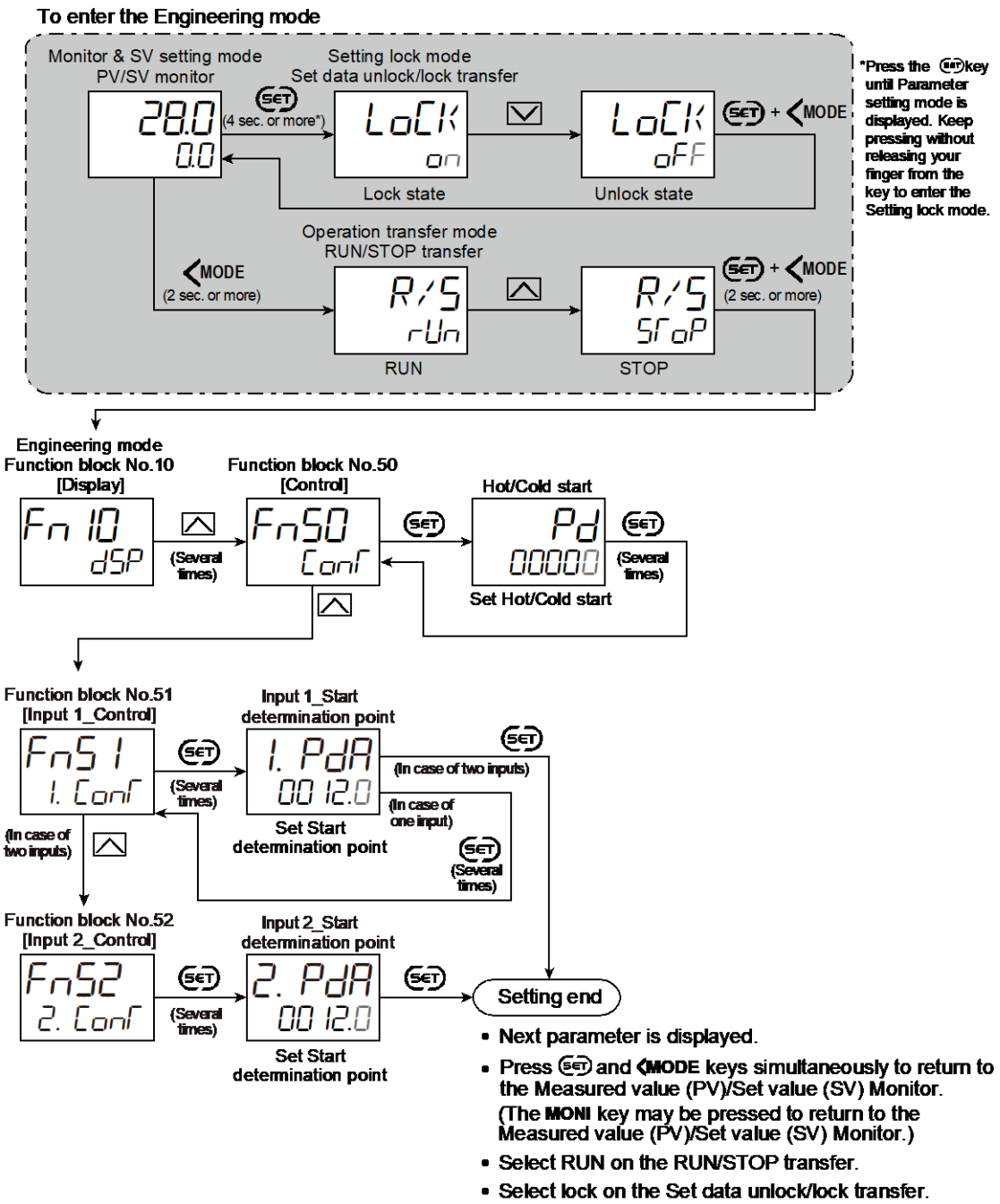
Parameter symbol	Data range	Factory set value
ExSL	0: LOC 1: EXT 2: Operation immediately before power cut	0

- **Output value selection when power is restored [Engineering Mode: Function block No. 50 (Fn50)]**

Parameter symbol	Data range	Factory set value
MVSL	0: 0% 1: Output limiter low 2: Operation immediately before power cut	0

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

9. Display-related Functions

9.1 Grouping Necessary Screens (Parameter Select Function)

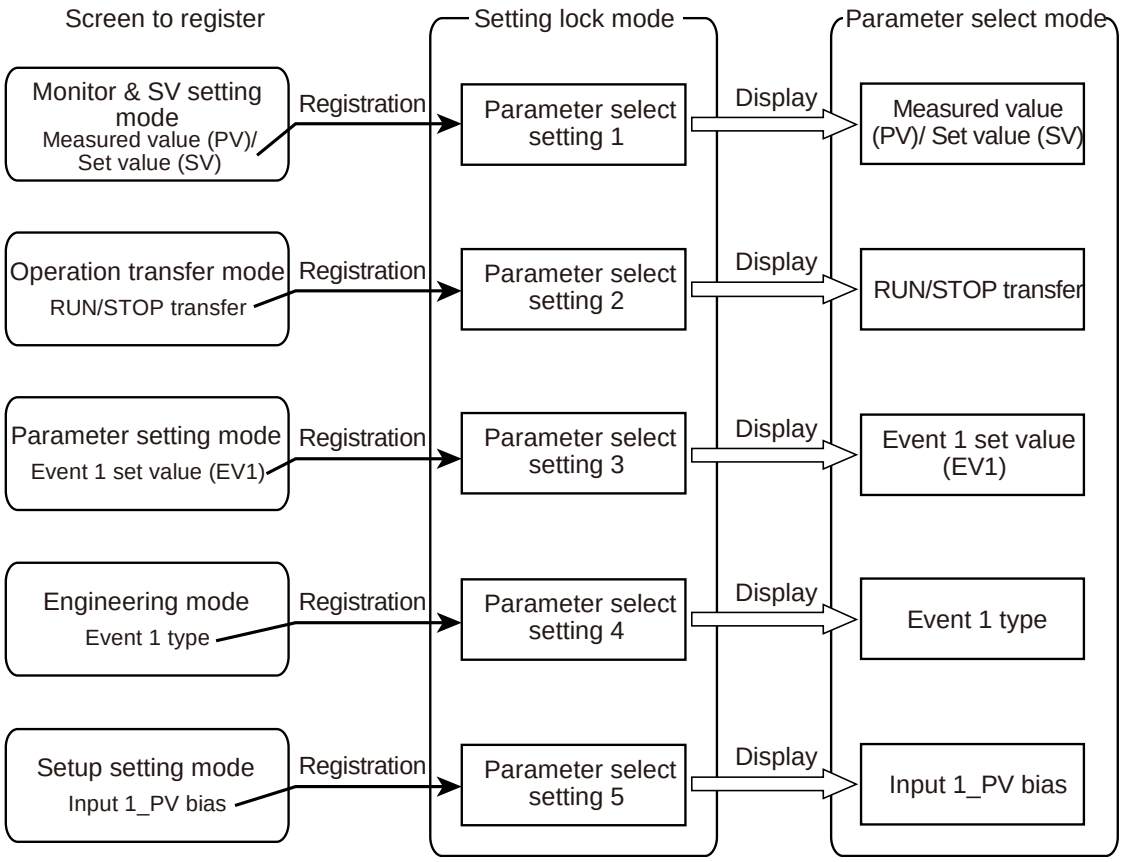
This instrument has a function that allows a user to specify desired screens to be displayed. This function is called “Parameter select function.” Up to 16 screens can be grouped together.

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.

The Setting lock mode screen and the Function block No. 91 (Engineering mode) cannot be registered with the Parameter select function.

[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.

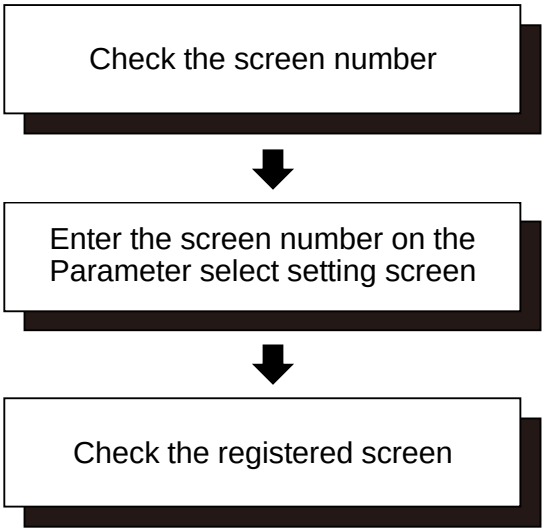
There are two ways to register screens.
- Screen number entry: Enter the screen No. on the Parameter select setting screen.
- Direct registration: Display the desired screen and register it through key operations.

- **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 9.1 List of screen numbers for details.

[To register screens]



Find the desired screen No. by referring to 9.1 List of screen numbers.

Display the “Parameter select setting screen” in the Setting lock mode and enter the desired screen number to register. (A maximum of 16 screens can be registered.)

Switch the mode to the Parameter select mode to see that the registered screen is properly displayed.

[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)

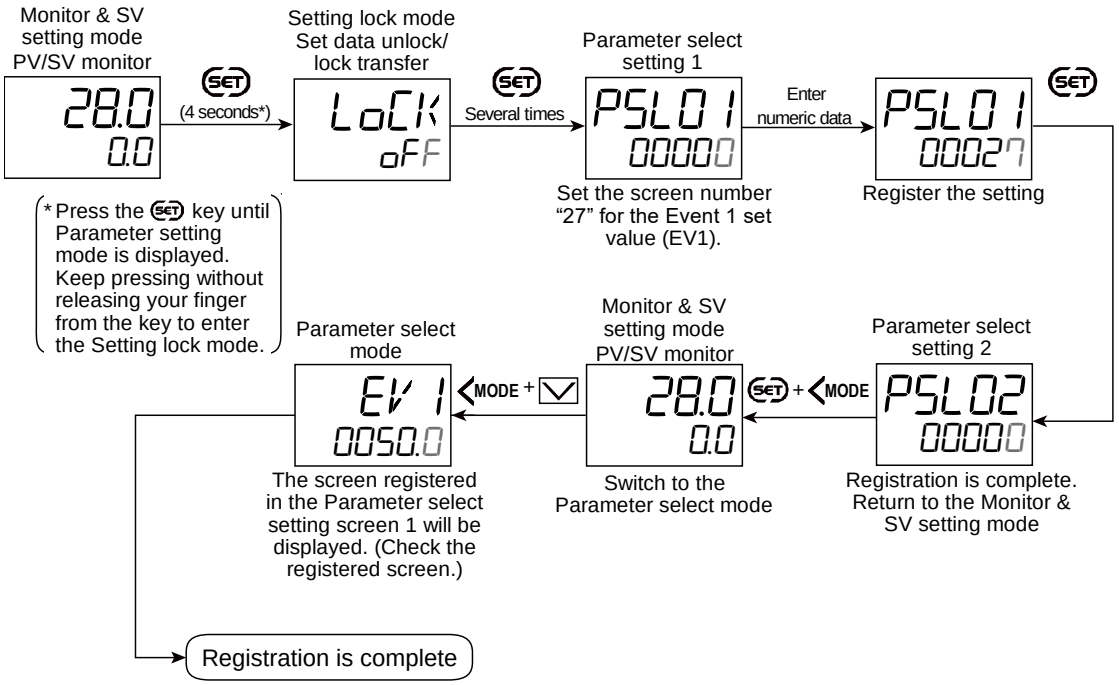
Parameter select mode: Displayed screens

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.

Control must be stopped before attempting the direct registration.

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]

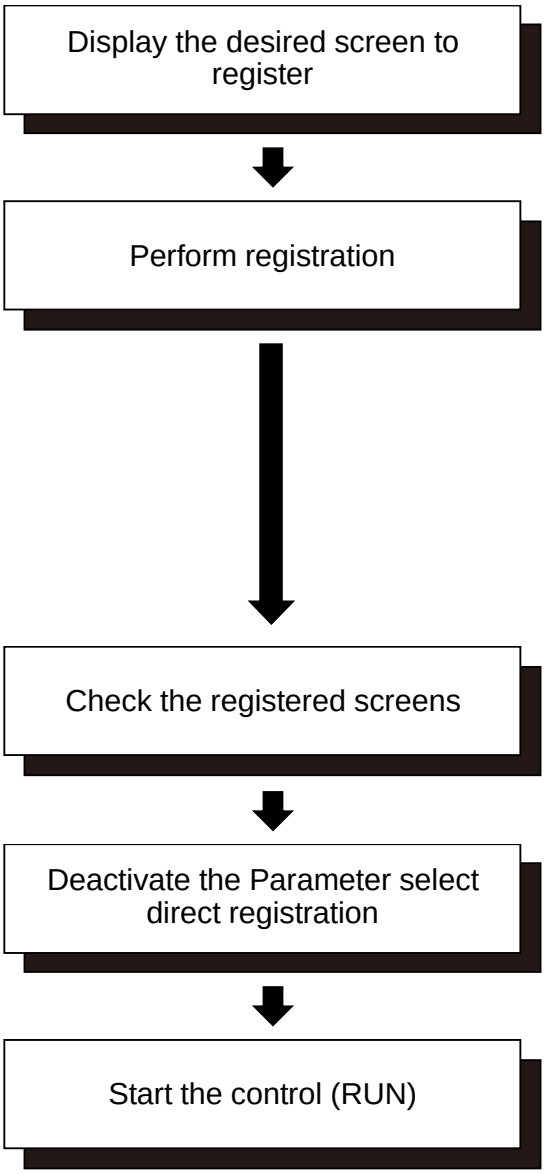
Stop the control (STOP)

Stop the control to make a direct registration.

Archive the Parameter select direct registration

Call the “Parameter select direct registration” screen and enable the direct registration.

When the direct registration is set to ON, modes are forced to be data lock state except the Setting lock mode.



Display the desired screen to register.

Press the ∧ and ∨ keys simultaneously, then the displayed screen will be registered in the Parameter select setting screen.

When the direct registration is accepted, the Parameter select setting screen No. will be displayed about one second on the SV display. When the data is registered into the Parameter select setting screen 2, "PSL02" will be displayed.

Change the mode to the Parameter select mode to check the registered screen.

To release the Set data lock state, call the "Parameter select direct registration" screen and disable the direct registration.

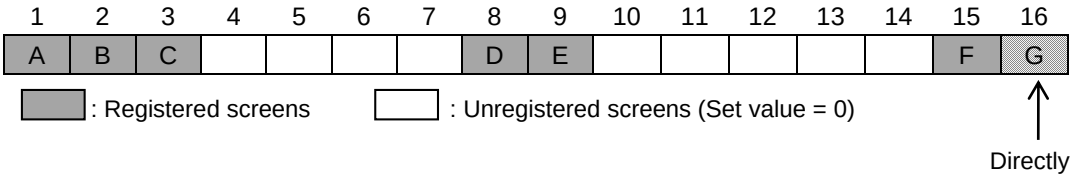
Start the control.

[Registering screens and display (2)]

This example is of direct registration for "[Registered screen and display (1)]".

- When directly registered

Setting lock mode: Parameter select setting screen (for registration)



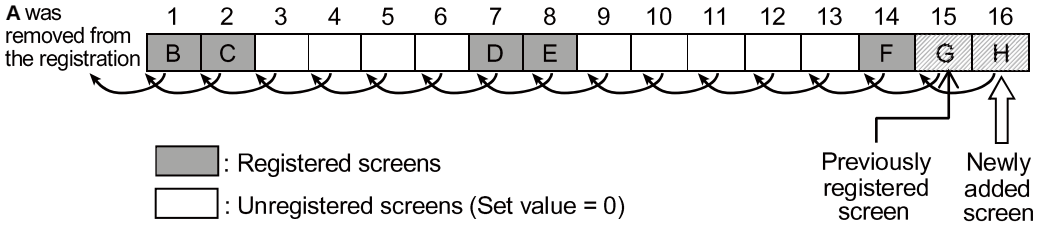
Parameter select mode: Displayed screens

Only registered screens are grouped for display.

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.

- Registering further screens

Setting lock mode: Parameter select setting screen (for registration)



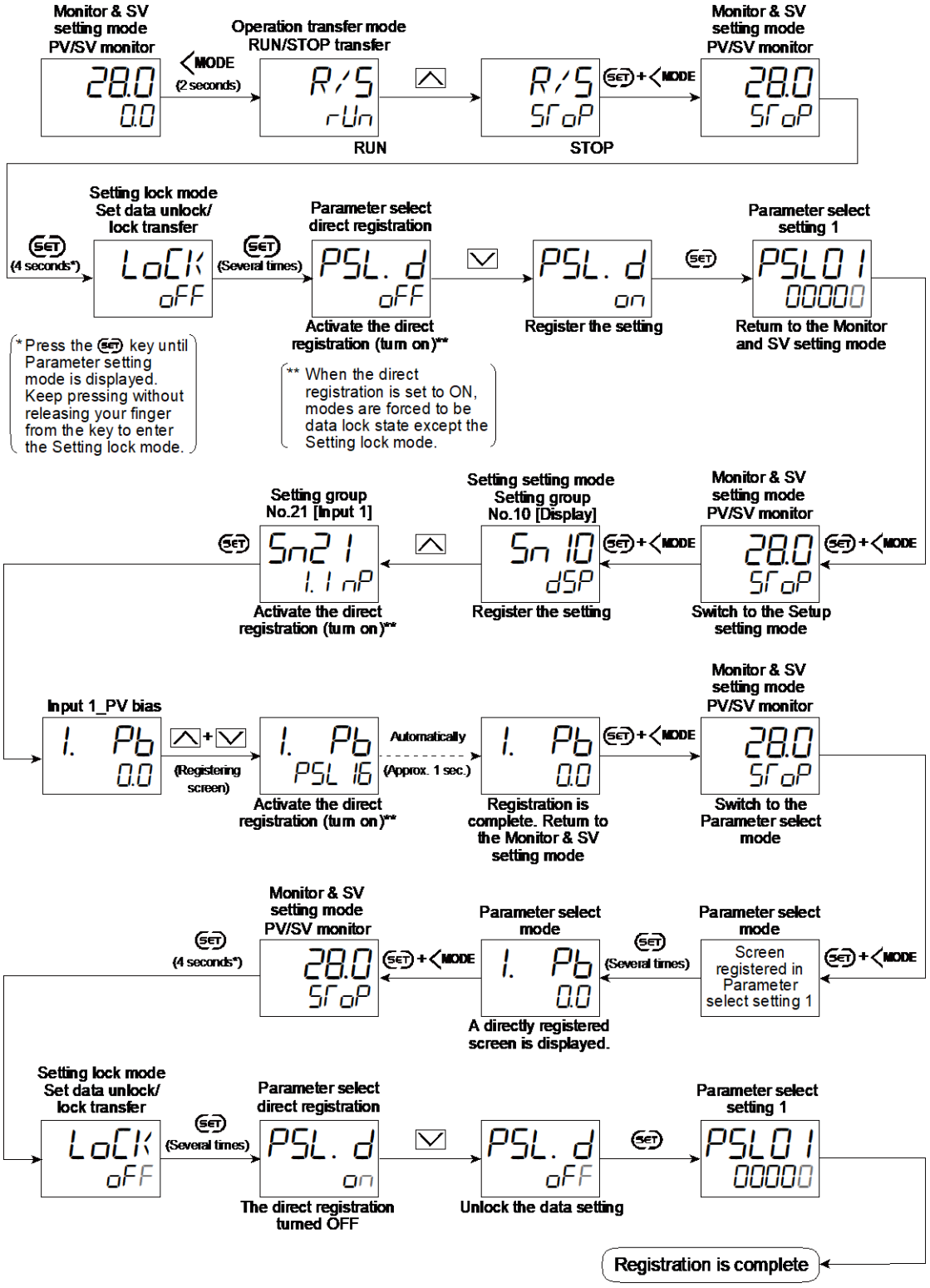
Parameter select mode: Displayed screens

Only registered screens are grouped for display.

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.

[Example of Direct registration]

This is an example to make a direct registration of “Input 1_PV bias” in the Setting group 21 in the Setup setting mode under the state of the “[Registered screen and display (1)]”.



Parameter setting

- **Parameter select direct registration [Setting Lock Mode]**

Parameter symbol	Data range	Factory set value
PSL.d	oFF: Direct registration: OFF on: Direct registration: ON	oFF

To allow “Parameter select direct registration”, Control must be stopped (STOP).

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
PSL01 to PSL16	0: No registration 1 to 351 (Screen No.) Refer to Table 9.1 List of screen numbers for details.	0

Table 9-1 List of screen numbers

No.	Name	Mode
1	Input 1_Measured value (PV) monitor [1] Input 1_Set value (SV) monitor [2]	Monitor & SV setting mode
2	Input 2_Measured value (PV) monitor Input 2_Set value (SV) monitor [3] [4]	
3	Measured value (PV) of differential temperature input monitor Set value (SV) of differential temperature input (SV) monitor [2]	
4	Input 1_Measured value (PV) Input 2_Measured value (PV)	
5	Remote setting input value monitor	
6	Input 1_Manipulated output value monitor [heat-side]	
7	Input 1_Manipulated output value monitor [cool-side]	
8	Input 2_Manipulated output value monitor	
9	Comprehensive event state	
10	Memory area soak time monitor	
11	Input 1_Soft start remaining time	
12	Input 2_Soft start remaining time	
13	Interlock release	
14	Memory area transfer	
15	RUN/STOP transfer	Operation transfer mode
16	Input 1_Autotuning (AT)	
17	Input 2_Autotuning (AT)	
18	Input 1_Startup tuning (ST)	
19	Input 2_Startup tuning (ST)	
20	Input 1_Auto/Manual transfer	
21	Input 2_Auto/Manual transfer	
22	Remote/Local transfer Cascade mode transfer PV select transfer 2-loop control/Differential temperature control transfer	
23	Control area Local/External transfer	
24	Input 1_Set value (SV)	Parameter setting mode: Parameter group No.00 (Pn00)
25	Input 2_Set value (SV)	
26	Set value (SV) of differential temperature input (SV)	
27	Event 1 set value (EV1) Event 1 set value (EV1) [high]	Parameter setting mode: Parameter group No.40 (Pn40)
28	Event 1 set value (EV1') [low]	
29	Event 2 set value (EV2) Event 2 set value (EV2) [high]	
30	Event 2 set value (EV2') [low]	
31	Event 3 set value (EV3) Event 3 set value (EV3) [high]	
32	Event 3 set value (EV3') [low]	
33	Event 4 set value (EV4) Event 4 set value (EV4) [high]	
34	Event 4 set value (EV4') [low]	

[1] Measured value (PV) of the PV select under the Control with PV select.

[2] Input 1_Manual manipulated output value when Input 1 is in Manual mode.

[3] Input 1_Manual manipulated output value when the control is Cascade control in the Manual mode.

[4] Input 2_Manual manipulated output value when the control is 2-loop control and when Input 2 is in Manual mode.

No	Name	Mode
35	Input 1_Proportional band [heat-side]	Parameter setting mode Parameter group No.51 (Pn51)
36	Input 1_Integral time [heat-side]	
37	Input 1_Derivative time [heat-side]	
38	Input 1_ON/OFF action differential gap (upper)	
39	Input 1_ON/OFF action differential gap (lower)	
40	Input 1_Control response parameter	
41	Input 1_Proactive intensity	
42	Input 1_Manual reset	
43	Input 1_FF amount	
44	Input 1_Output limiter high [heat-side]	
45	Input 1_Output limiter low [heat-side]	
46	Input 1_Dead zone	
47	Input 2_Proportional band	Parameter setting mode Parameter group No.52 (Pn52)
48	Input 2_Integral time	
49	Input 2_Derivative time	
50	Input 2_ON/OFF action differential gap (upper)	
51	Input 2_ON/OFF action differential gap (lower)	
52	Input 2_Control response parameter	
53	Input 2_Proactive intensity	
54	Input 2_Manual reset	
55	Input 2_FF amount	
56	Input 2_Output limiter high	
57	Input 2_Output limiter low	
58	Input 2_Dead zone	
59	Input 1_Proportional band [cool-side]	Parameter setting mode Parameter group No.56 (Pn56)
60	Input 1_Integral time [cool-side]	
61	Input 1_Derivative time [cool-side]	
62	Input 1_Overlap/Deadband	
63	Input 1_Output limiter high [cool-side]	
64	Input 1_Output limiter low [cool-side]	
65	Select Trigger type for Memory area transfer	Parameter setting mode Parameter group No.70 (Pn70)
66	Area soak time	
67	Link area number	
68	Input 1_Soft start time (up)	
69	Input 1_Soft start time (down)	
70	Input 1_Setting change rate limiter (up)	
71	Input 1_Setting change rate limiter (down)	
72	Input 1_Auto/Manual transfer selection (Area transfer)	
73	Input 1_Manipulated output value (Area transfer)	
74	Input 2_Soft start time (up)	
75	Input 2_Soft start time (down)	
76	Input 2_Setting change rate limiter (up)	
77	Input 2_Setting change rate limiter (down)	
78	Input 2_Auto/Manual transfer selection (Area transfer)	
79	Input 2_Manipulated output value (Area transfer)	
80	Remote/Local transfer selection (Area transfer)	

No	Name	Mode
81	Display update cycle	Setup setting mode: Setting group No.10 (5n10)
82	Input 1_PV bias	Setup setting mode: Setting group No.21 (5n21)
83	Input 1_PV digital filter	
84	Input 1_PV ratio	
85	Input 1_PV low input cut-off	
86	Input 2_PV bias (RS bias)	Setup setting mode: Setting group No.22 (5n22)
87	Input 2_PV digital filter (RS digital filter)	
88	Input 2_PV ratio (RS ratio)	
89	Input 2_PV low input cut-off	
90	OUT3 proportional cycle time	Setup setting mode: Setting group No.30 (5n30)
91	OUT3 minimum ON/OFF time of proportional cycle	
92	Input 1_Manual manipulated output value	Setup setting mode: Setting group No.51 (5n51)
93	Input 1_Level PID setting 1	
94	Input 1_Level PID setting 2	
95	Input 1_Level PID setting 3	
96	Input 1_Level PID setting 4	
97	Input 1_Level PID setting 5	
98	Input 1_Level PID setting 6	
99	Input 1_Level PID setting 7	
100	Input 2_Manual manipulated output value	Setup setting mode: Setting group No.52 (5n52)
101	Input 2_Level PID setting 1	
102	Input 2_Level PID setting 2	
103	Input 2_Level PID setting 3	
104	Input 2_Level PID setting 4	
105	Input 2_Level PID setting 5	
106	Input 2_Level PID setting 6	
107	Input 2_Level PID setting 7	
108	Input 1_AT bias	Setup setting mode: Setting group No.53 (5n53)
109	Input 1_AT remaining time monitor	
110	Input 1_AT/ST status monitor	
111	Input 2_AT bias	Setup setting mode: Setting group No.54 (5n54)
112	Input 2_AT remaining time monitor	
113	Input 2_AT/ST status monitor	
114	FF amount learning	Setup setting mode: Setting group No.57 (5n57)
115	Input 1_Determination point of external disturbance	
116	Input 2_Determination point of external disturbance	
117	Cascade_Proportional band (master-side)	Setup setting mode: Setting group No.58 (5n58)
118	Cascade_Integral time (master-side)	
119	Cascade_Derivative time (master-side)	
120	Cascade_Proportional band (slave-side)	
121	Cascade_Integral time (slave-side)	
122	Cascade_Derivative time (slave-side)	
123	Cascade_Digital filter	
124	Cascade_Scale high	
125	Cascade_Scale low	
126	PV select transfer level	
127	PV select transfer time	
128	Input 1_Overshoot prevention feature	Setup setting mode: Setting group No.59 (5n59)
129	Input 2_Overshoot prevention feature	Setup setting mode: Setting group No.60 (5n60)
130	Input 1_Peak hold monitor	Setup setting mode: Setting group No.91 (5n91)
131	Input 1_Bottom hold monitor	
132	Input 1_Hold reset	
133	Input 2_Peak hold monitor	
134	Input 2_Bottom hold monitor	
135	Input 2_Hold reset	
136	STOP display selection	Engineering mode: Function block No.10 (Fn10)
137	ALM lamp lighting condition	
138	PV flashing display at input error	
139	Show/Hide Input 1_SV	
140	Show/Hide Input 2_SV	
141	Show/Hide Input 1_MV	
142	Show/Hide Input 2_MV	
143	Select hidden items in Monitor mode	
144	Select hidden items in Operation transfer mode	
145	Data registration	Engineering mode: Function block No.11 (Fn11)
146	FUNC key assignment	
147	FUNC key operation selection	
148	Input 1_Input type	Engineering mode: Function block No.21 (Fn21)
149	Input 1_Display unit	
150	Input 1_Decimal point position	
151	Input 1_Input range high	
152	Input 1_Input range low	
153	Input 1_Input error determination point (high)	
154	Input 1_Input error determination point (low)	
155	Input 1_Temperature compensation calculation	
156	Input 1_Burnout direction	
157	Input 1_Square root extraction	
158	Input 1_Inverting input	
159	Input 2_Input type	Engineering mode: Function block No.22 (Fn22)
160	Input 2_Display unit	
161	Input 2_Decimal point position	
162	Input 2_Input range high	
163	Input 2_Input range low	
164	Input 2_Input error determination point (high)	
165	Input 2_Input error determination point (low)	
166	Input 2_Temperature compensation calculation	
167	Input 2_Burnout direction	
168	Input 2_Square root extraction	
169	Input 2_Inverting input	
170	DI1 function selection	Engineering mode: Function block No.23 (Fn23)
171	DI2 function selection	
172	DI3 function selection	
173	DI4 function selection	
174	DI5 function selection	
175	DI6 function selection	
176	DI logic invert	
177	Area switching time (without area set signal)	
178	OUT1 function selection	Engineering mode: Function block No.30 (Fn30)
179	OUT2 function selection	
180	OUT3 function selection	
181	OUT1 logic calculation selection	
182	OUT2 logic calculation selection	
183	OUT3 logic calculation selection	
184	Energized/De-energized selection	
185	Interlock selection	
186	Output action at control stop	
187	Event action during MAN mode	

188	OUT1 type selection	
189	OUT2 type selection	
190	Universal output type selection (OUT3)	
191	Retransmission output 1 type	Engineering mode: Function block No.31 (Fn31)
192	Retransmission output 1 scale high	
193	Retransmission output 1 scale low	
194	Retransmission output 2 type	Engineering mode: Function block No.32 (Fn32)
195	Retransmission output 2 scale high	
196	Retransmission output 2 scale low	
197	Retransmission output 3 type	Engineering mode: Function block No.33 (Fn33)
198	Retransmission output 3 scale high	
199	Retransmission output 3 scale low	
200	DO1 function selection	Engineering mode: Function block No.34 (Fn34)
201	DO2 function selection	
202	DO3 function selection	
203	DO4 function selection	
204	DO1 logic calculation selection	
205	DO2 logic calculation selection	
206	DO3 logic calculation selection	
207	DO4 logic calculation selection	
208	Event 1 assignment	Engineering mode: Function block No.41 (Fn41)
209	Event 1 type	
210	Event 1 hold action	
211	Event 1 differential gap	
212	Event 1 timer	
213	Event 2 assignment	Engineering mode: Function block No.42 (Fn42)
214	Event 2 type	
215	Event 2 hold action	
216	Event 2 differential gap	
217	Event 2 timer	
218	Event 3 assignment	Engineering mode: Function block No.43 (Fn43)
219	Event 3 type	
220	Event 3 hold action	
221	Event 3 differential gap	
222	Event 3 timer	
223	Event 4 assignment	Engineering mode: Function block No.44 (Fn44)
224	Event 4 type	
225	Event 4 hold action	
226	Event 4 differential gap	
227	Event 4 timer	
228	Hot/Cold start	Engineering mode: Function block No.50 (Fn50)
229	RUN/STOP selection when power is restored	
230	MAN/AUTO selection when power is restored	
231	LOC/REM selection when power is restored	
232	LOC/EXT selection when power is restored	
233	Output value selection when power is restored	
234	Manual manipulated output value selection	
235	SV tracking	
236	Integral/Derivative time decimal point position	
237	ST start condition	
238	Input 1_Control action	Engineering mode: Function block No.51 (Fn51)
239	Input 1_Output change rate limiter (up) [heat-side]	
240	Input 1_ Output change rate limiter (down) [heat-side]	
241	Input 1_Action (high) input error	
242	Input 1_Action (low) input error	
243	Input 1_Manipulated output value at input error	
244	Input 1_ Manipulated output value at STOP [heat-side]	
245	Input 1_Start determination point	
246	Input 1_Level PID action selection	
247	Input 1_Level PID differential gap	
248	Input 2_Control action	Engineering mode: Function block No.52 (Fn52)
249	Input 2_Output change rate limiter (up) [heat-side]	
250	Input 2_Output change rate limiter (down) [heat-side]	
251	Input 2_Action (high) input error	
252	Input 2_Action (low) input error	
253	Input 2_Manipulated output value at input error	
254	Input 2_Manipulated output value at STOP	
255	Input 2_Start determination point	
256	Input 2_Level PID action selection	
257	Input 2_Level PID differential gap	
258	Input 1_Valve coefficient A	Engineering mode: Function block No.53 (Fn53)
259	Input 1_Valve coefficient b	
260	Input 1_Valve coefficient C	
261	Input 1_Valve coefficient d	
262	Input 1_Valve coefficient E	
263	Input 1_Valve coefficient F	
264	Input 1_Pressure standard for valve coefficient F	
265	Input 1_Control valve selection	
266	Input 1_Pressure (Temperature) limiter	
267	Input 1_Temperature limiter unit	
268	Input 1_Regression equation bias	
269	Input 1_Response speed self-learning selection	
270	Input 1_Response speed learning parameter t1 0up	
271	Input 1_Response speed learning parameter t2 0down	
272	Input 1_Response speed learning parameter t3 set up	
273	Input 1_Response speed learning parameter t4 set down	
274	Input 1_Response speed learning parameter L1 0up	
275	Input 1_Response speed learning parameter L2 0down	
276	Input 1_Response speed learning parameter L3 set up	
277	Input 1_Response speed learning parameter L4 set down	
278	Input 1_Response speed learning parameter S1 0up	
279	Input 1_Response speed learning parameter S2 0down	
280	Input 1_Response speed learning parameter S3 set up	
281	Input 1_Response speed learning parameter S4 set down	
282	Input 1_No. of corrective actions	
283	Input 1_Corrective action repeat	
284	Input 1_Corrective actions for ramp control	
285	Input 1_Lower range of corrective action amount	
286	Input 1_Upper range of corrective action amount	
287	Input 2_Valve coefficient A	Engineering mode: Function block No.54 (Fn54)
288	Input 2_Valve coefficient b	
289	Input 2_Valve coefficient C	
290	Input 2_Valve coefficient d	
291	Input 2_Valve coefficient E	
292	Input 2_Valve coefficient F	
293	Input 2_Pressure standard for	

	valve coefficient F	
294	Input 2_Control valve selection	
295	Input 2_Pressure (Temperature) limiter	
296	Input 2_Temperature limiter unit	
297	Input 2_Regression equation bias	
298	Input 2_Response speed self-learning selection	
299	Input 2_Response speed learning parameter t1 0up	
300	Input 2_Response speed learning parameter t2 0down	
301	Input 2_Response speed learning parameter t3 set up	
302	Input 2_Response speed learning parameter t4 set down	
303	Input 2_Response speed learning parameter L1 0up	
304	Input 2_Response speed learning parameter L2 0down	
305	Input 2_Response speed learning parameter L3 set up	
306	Input 2_Response speed learning parameter L4 set down	
307	Input 2_Response speed learning parameter S1 0up	
308	Input 2_Response speed learning parameter S2 0down	
309	Input 2_Response speed learning parameter S3 set up	
310	Input 2_Response speed learning parameter S4 set down	
311	Input 2_No. of corrective actions	
312	Input 2_Corrective action repeat	
313	Input 2_Corrective actions for ramp control	
314	Input 2_Lower range of corrective action amount	
315	Input 2_Upper range of corrective action amount	
316	Input 1_Output change rate limiter (up) [cool-side]	Engineering mode: Function block No.56 (Fn56)
317	Input 1_Output change rate limiter (down) [cool-side]	
318	Input 1_Manipulated output value at STOP [cool-side]	
319	Undershoot suppression factor	
320	Overlap/Deadband reference point	
321	Bottom suppression function	Engineering mode: Function block No.57 (Fn57)
322	Select function for input 2	Engineering mode: Function block No.58 (Fn58)
323	Cascade_AT mode (master-side)	
324	Cascade_AT mode (slave-side)	
325	Selection of PV select trigger	
326	Input circuit error alarm set value	
327	Selection of Communication protocol	Engineering mode: Function block No.60 (Fn60)
328	Device address	
329	Communication speed	
330	Data bit configuration	
331	Interval time	
332	Communication response monitor	
333	Register type	Engineering mode: Function block No.62 (Fn62)
334	Register start number (High-order 4-bit)	
335	Register start number (Low-order 16-bit)	
336	Monitor item register bias	
337	Setting item register bias	
338	Instrument link recognition time	
339	PLC response waiting time	
340	PLC communication start time	
341	Slave register bias	
342	Number of recognizable devices	
343	Soft start/Setting change rate limiter selection	Engineering mode: Function block No.70 (Fn70)
344	Soft start time selection	
345	Soft start start time selection	
346	Setting change rate limiter unit time	
347	Soak time unit	
348	Input 1_Setting limiter high	Engineering mode: Function block No.71 (Fn71)
349	Input 1_Setting limiter low	
350	Input 2_Setting limiter high	Engineering mode: Function block No.72 (Fn72)
351	Input 2_Setting limiter low	

9.2 Hiding Unnecessary Screens

On this instrument, a specified range of screens can be hidden. Below are screens that can be hidden.

- Monitor screen in the Monitor & SV setting mode
- Screens in the Operation transfer mode
- Screens restricted by the Blind function

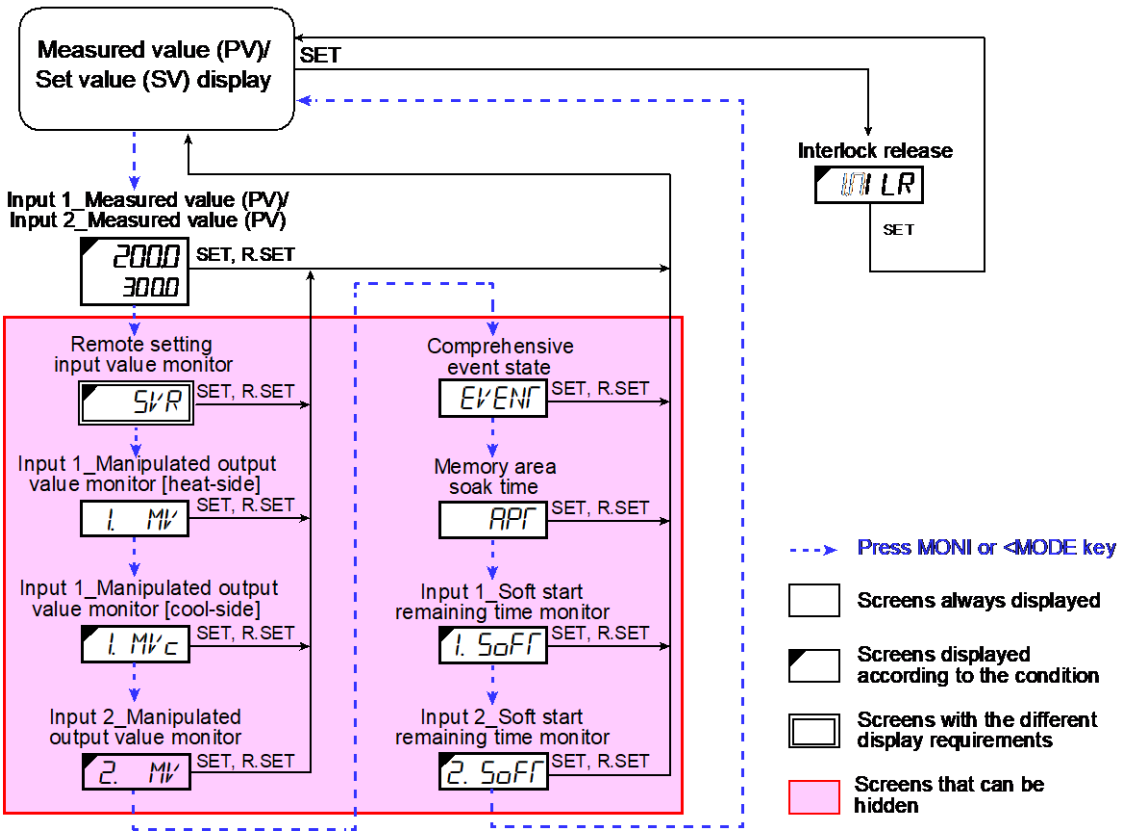
9.2.1 Hide the monitor screen in the Monitor & SV setting mode

Show/Hide selection of the monitor screens in the Monitor & SV setting mode is available in Function block No. 10: Select hidden items in Monitor mode (Engineering mode).

[Applicable screens]

- Remote setting input value monitor
- Manipulated output value (MV) monitor *
  Input 1_Manipulated output value monitor [heat-side], Input 1_Manipulated output value monitor [cool-side], Input 2_Manipulated output value monitor
- Comprehensive event state
- Memory area soak time
- Soft start remaining time**
  Input 1_Soft start remaining time, Input 2_Soft start remaining time,
  * Setting is done at “Manipulated output value (MV) monitor”
  ** Setting is done at “Soft start remaining time”

[Operating navigation in the Monitor & SV setting mode]

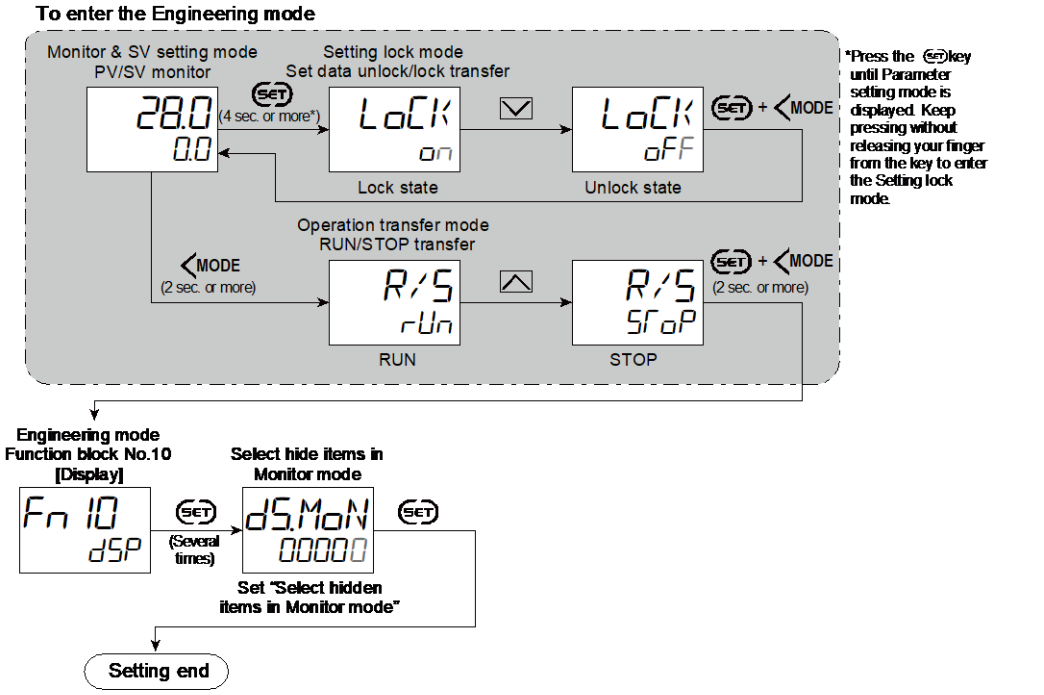


Parameter setting

- **Select hidden items in Monitor mode [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
dSMoN	0 to 31 0: Show all +1: Remote setting input value monitor +2: Manipulated output value (MV) monitor +4: Current transformer (CT) monitor +8: Comprehensive event state +16: Memory area soak time To select two or more functions, sum each value.	0

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

9.2.2 Hiding screens in Operation transfer mode

Show/Hide selection of the screens in the Operation transfer mode is available in Function block No. 10: Select hidden items in Operation transfer mode (Engineering mode).

[Applicable screens]

- RUN/STOP transfer
- Autotuning (AT)*: Input 1_Autotuning (AT), Input 2_Autotuning (AT)
- Startup tuning (ST)*: Input 1_Startup tuning (ST), Input 2_Startup tuning (ST)
- Auto/Manual transfer: Input 1_Auto/Manual transfer, Input 2_Auto/Manual transfer
- Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/ Differential temperature control)
- Control area Local/External transfer

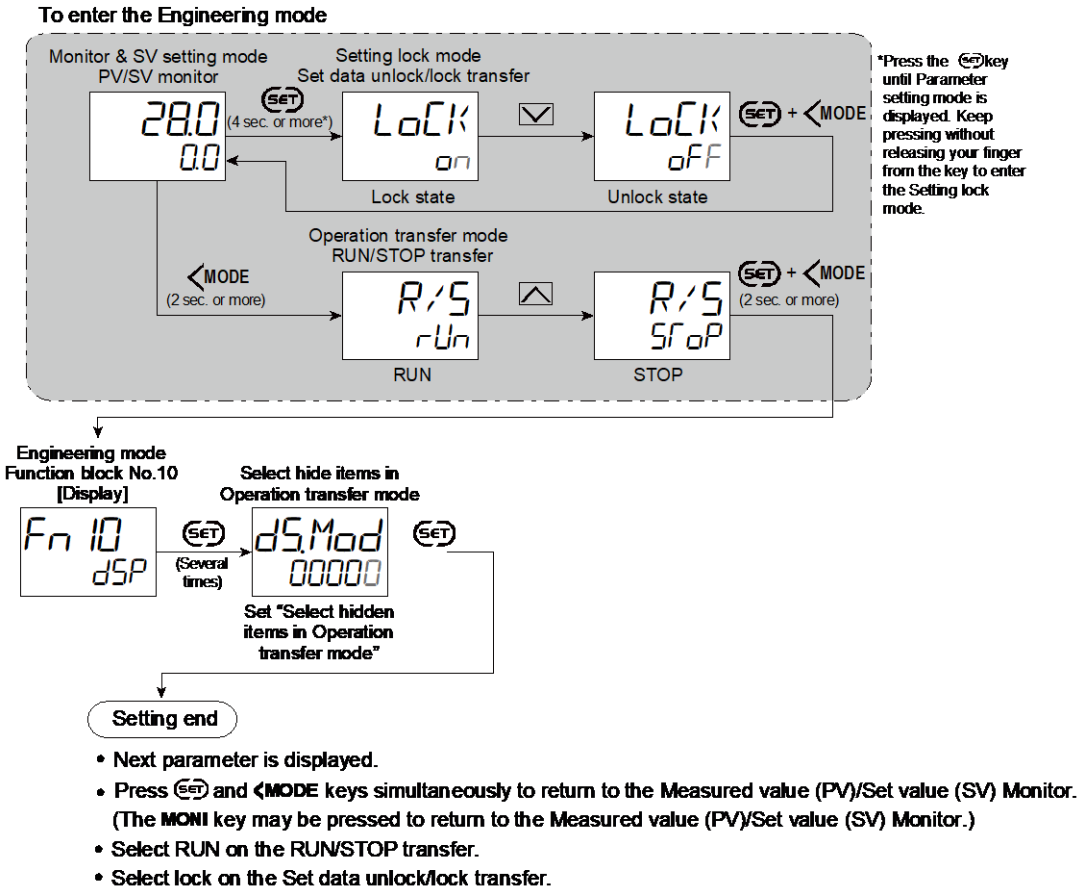
* Setting is done at “Autotuning (AT)” and “Startup tuning (ST).”

Parameter setting

- **Select hidden items in Operation transfer mode [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
dS.Mod	0 to 63 0: Show all +1: RUN/STOP transfer +2: Autotuning (AT) +4: Startup tuning (ST) +8: Auto/Manual transfer +16: Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) +32: Control area Local/External transfer To select two or more functions, sum each value.	0

Setting procedure



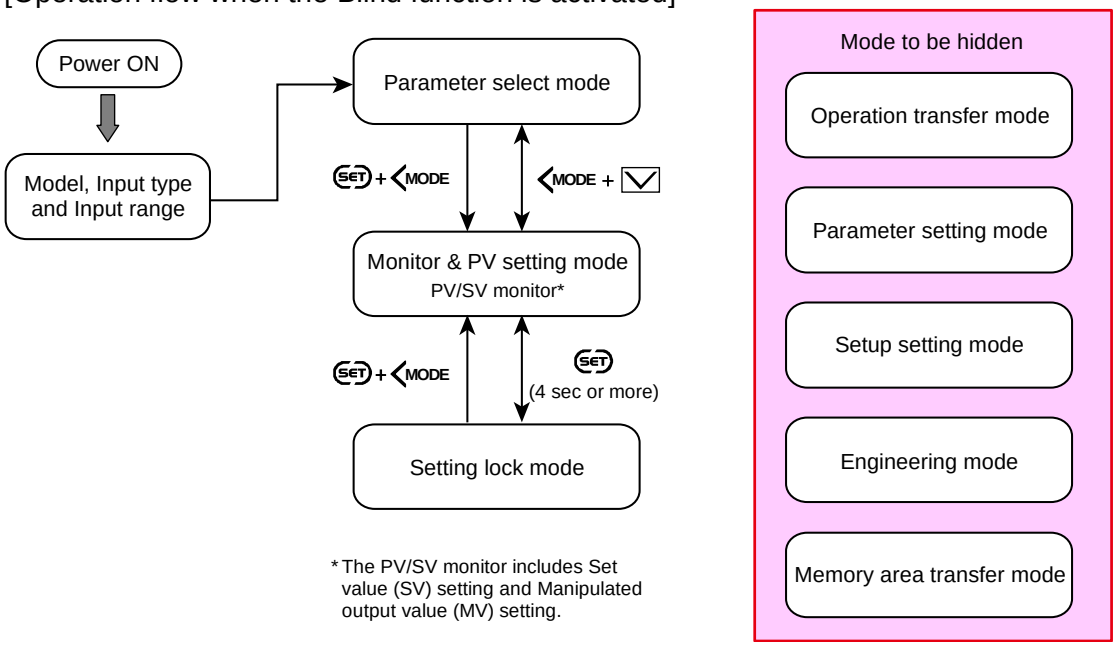
- Next parameter is displayed.
- Press and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

9.2.3 Hiding the screen using the Blind function

The Blind function is used to hide all screens except Parameter select mode, Setting lock mode, and Measured value (PV)/Set value (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. When 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]



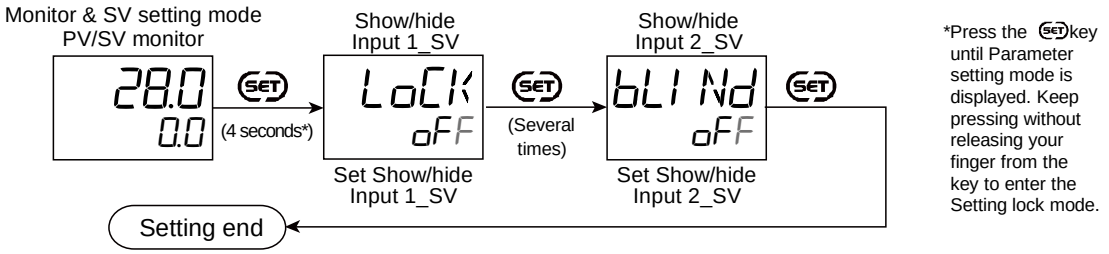
* The PV/SV monitor includes Set value (SV) setting and Manipulated output value (MV) setting.

Parameter setting

- **Select Blind function [Setting Lock Mode]**

Parameter symbol	Data range	Factory set value
bLInd	oFF: Blind function: OFF on: Blind function: ON	oFF

Setting procedure



*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.

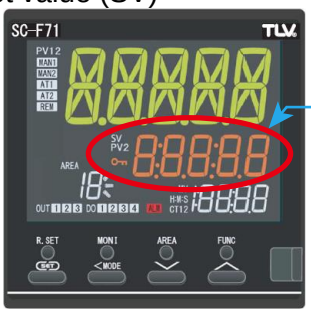
- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

9.3 Hiding the Display of the Set Value (SV)

On the normal PV/SV monitor screen, the Set value (SV) is displayed on the set value (SV) display unit. This display can be turned OFF.

Description of function

Display of Set value (SV)



Set value (SV) display
The Set value (SV) is displayed here.
The display can be turned OFF.

Parameter setting

- **Show/Hide Input 1_SV [Engineering Mode: Function block No. 10 (Fn 10)]**

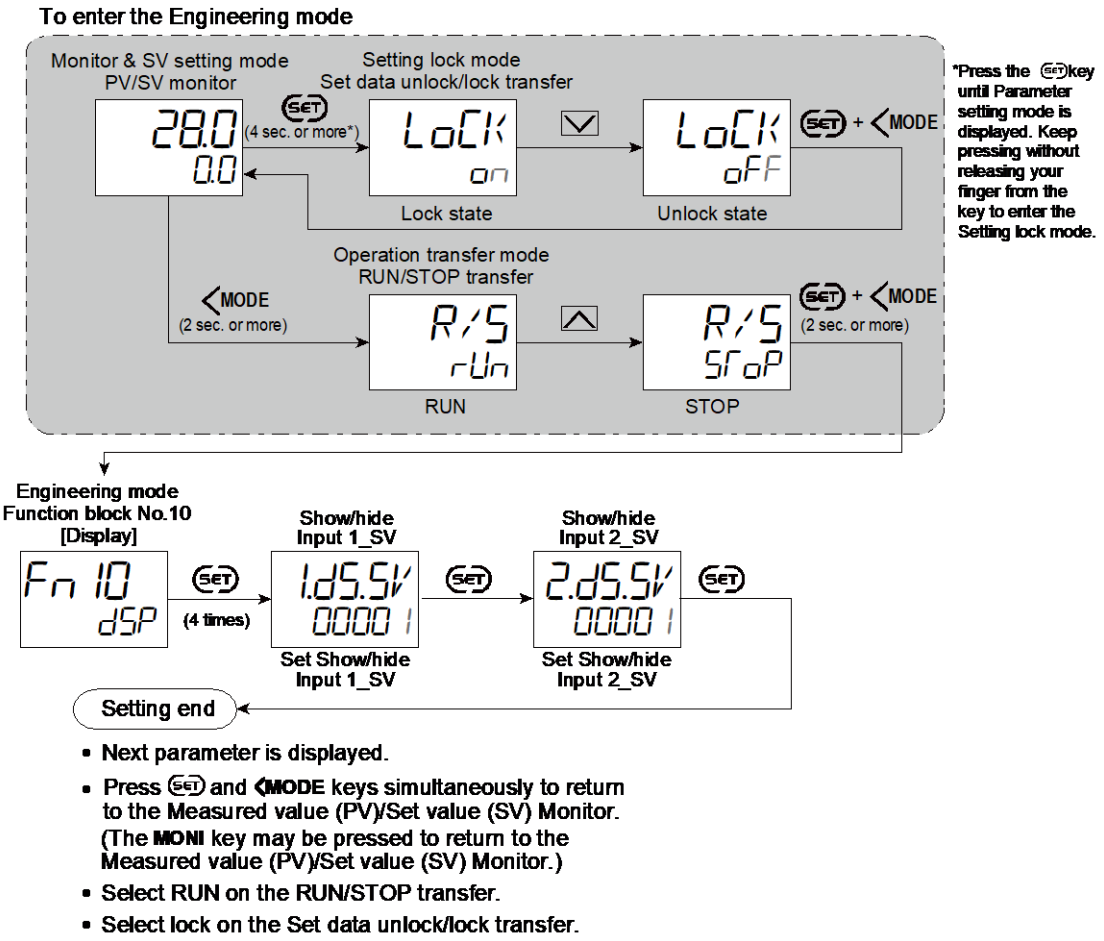
Parameter symbol	Data range	Factory set value
1.d5.5V	0: Hide Input 1_SV 1: Show Input 1_SV	1

- **Show/Hide Input 2_SV [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
2.d5.5V	0: Hide Input 2_SV 1: Show Input 2_SV	1

To display “Show/Hide Input 2_SV”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



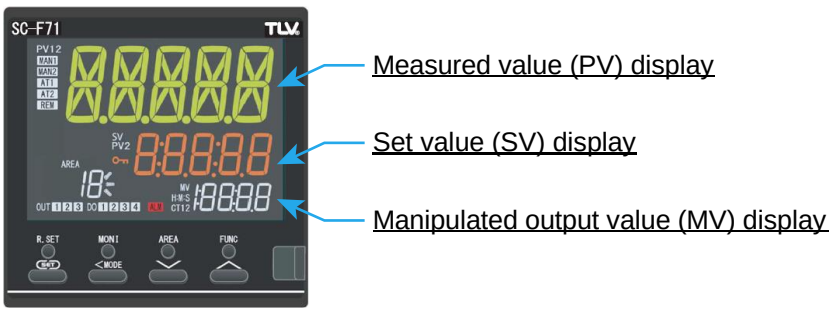
- Next parameter is displayed.
- Press and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

9.4 Changing the Display Position of STOP during the Control Stop

The display position of "SToP" showing the control stop state can be changed.

Description of function

The position of the STOP display can be specified; Measured value (PV) display, Set value (SV) display, or Manipulated output value (MV) display.

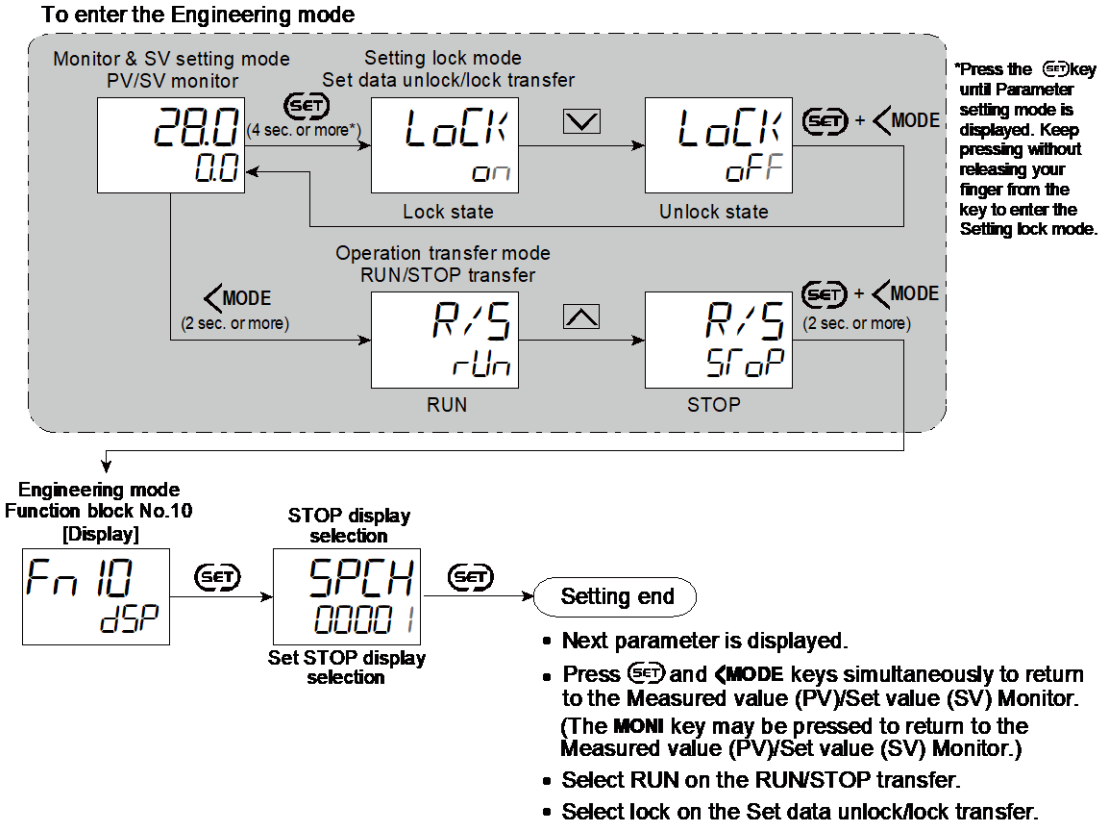


Parameter setting

- **STOP display selection [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
SPCH	0: Stop on PV display 1: Stop on SV display 2: Stop on MV display	1

Setting procedure



9.5 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.

- Event 1
- Event 2
- Event 3
- Event 4
- Input 1_Input error high
- Input 1_Input error low
- Input 2_Input error high
- Input 2_Input error low

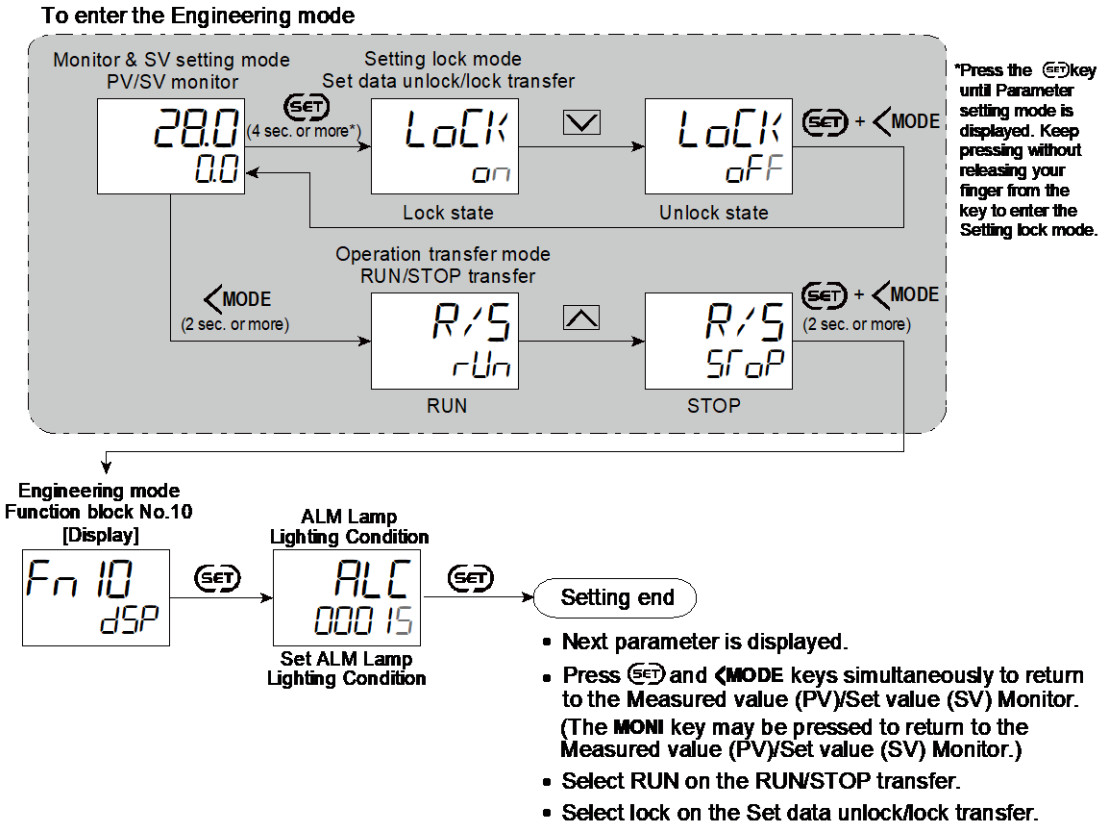
Factory set ranges

Parameter setting

- **ALM lamp lighting condition [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
ALC	0 to 255 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Input 1_Input error high +32: Input 1_Input error low +64: Input 2_Input error high +128: Input 2_Input error low To select two or more functions, sum each value.	15

Setting procedure



- Next parameter is displayed.
- Press (SET) and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

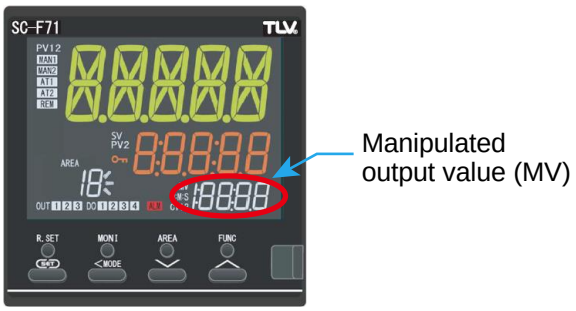
9.6 Changing the Display Contents of the MV Display

While the SC-F71 is monitoring the Measured value (PV) and the Set value (SV), the MV display can be configured to change the display contents.

Description of function

The MV display can display the following data.

- Manipulated output value (MV)
- Memory area soak time
- Soft start remaining time
- Hide



Display of Show Memory area soak time
When the Soak time unit is set to “2”, the time is displayed as follows depending on the time to be displayed.

Time	Time unit	Lamp	Example
2 hour or more	Hours: Minutes	H:M	H:M 2:06 (2 hours 6 minutes)
1 hour 00 minutes 00 seconds to 1 hour 59 minutes 59 seconds	Hours: Minutes: seconds	H:M:S	H:M:S 1:08:45 (1 hour 8 minutes 45 seconds)
0 minutes 00 seconds to 59 minutes 59 seconds	Minutes: seconds	M:S	M:S 37:09 (37 minutes 9 seconds)

Parameter setting

- **Show/Hide Input 1_MV [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
1.d5.MV	0: Hide 1: Show Input 1_Manipulated output value (MV) 2: Show Memory area soak time * 3: Show Soft start time display *	1

* The time unit depends on the setting of Soak time unit in Function block No. 70 (Engineering mode).

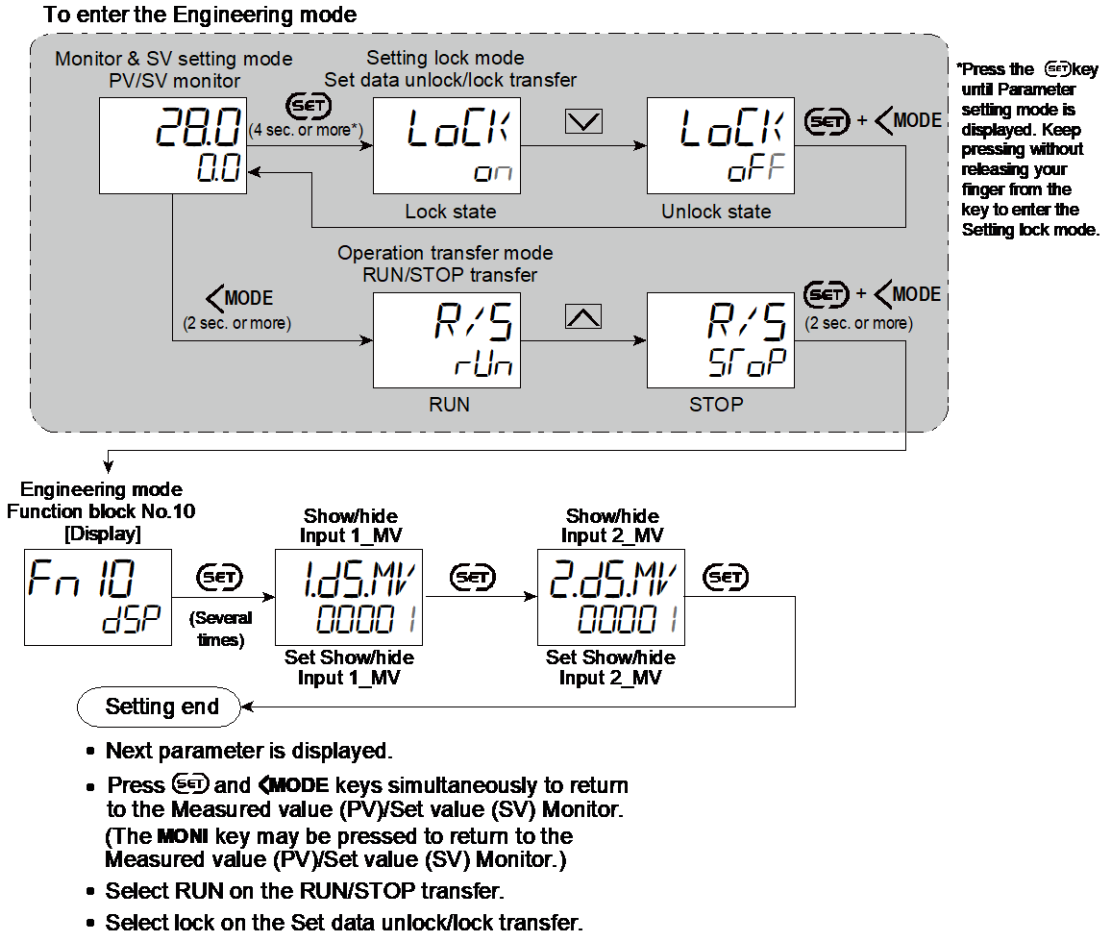
- **Show/Hide Input 2_MV [Engineering Mode: Function block No. 10 (Fn 10)]**

Parameter symbol	Data range	Factory set value
2.d5.MV	0: Hide 1: Show Input 2_Manipulated output value (MV) 2: Show Memory area soak time * 3: Show Soft start time display *	1

* The time unit depends on the setting of Soak time unit in Function block No. 70 (Engineering mode).

To display “Show/Hide Input 2_MV”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting procedure



- Next parameter is displayed.
- Press and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

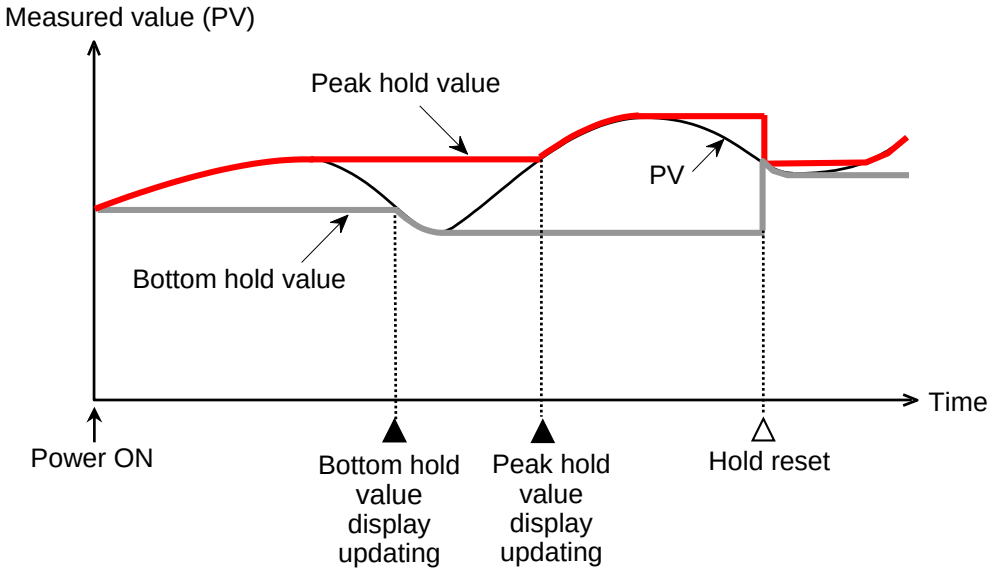
9.7 Checking Input Peak Value/Bottom Value

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 Hold reset screen.



Peak/Bottom hold action description

Parameter setting

- **Input 1_Peak hold monitor [Setup Setting Mode: Setting group No. 91 (5n9 1)]**

Parameter symbol	Data range	Factory set value
1.PHLd	Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—

- **Input 2_Peak hold monitor [Setup Setting Mode: Setting group No. 91 (5n9 1)]**

Parameter symbol	Data range	Factory set value
2.PHLd	Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—

To display “Input 2_Peak hold monitor”, choose “Cascade control”, “Control with PV select”, “2-loop control/Differential temperature control” or “Input circuit error alarm” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Bottom hold monitor [Setup Setting Mode: Setting group No. 91 (5n9 1)]**

Parameter symbol	Data range	Factory set value
1.bHLd	Input 1_Input range low - (Input 1_5% of input span) to Input 1_Input range high + (Input 1_5% of input span) [Varies with the setting of the Decimal point position.]	—

- **Input 2_Bottom hold monitor [Setup Setting Mode: Setting group No. 91 (5n9 1)]**

Parameter symbol	Data range	Factory set value
2.bHLd	Input 2_Input range low - (Input 2_5% of input span) to Input 2_Input range high + (Input 2_5% of input span) [Varies with the setting of the Decimal point position.]	—

To display “Input 2_Bottom hold monitor”, choose “Cascade control”, “Control with PV select”, “2-loop control/Differential temperature control” or “Input circuit error alarm” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Hold reset [Setup Setting Mode: Setting group No. 91 (Sn91)]**

Parameter symbol	Data range	Factory set value
1.HLdR	HoLd: Hold rESEr: Reset Returns to Hold state automatically after reset.	HoLd

Note that the both of the peak and the bottom hold values are reset at a time by the hold reset operation.

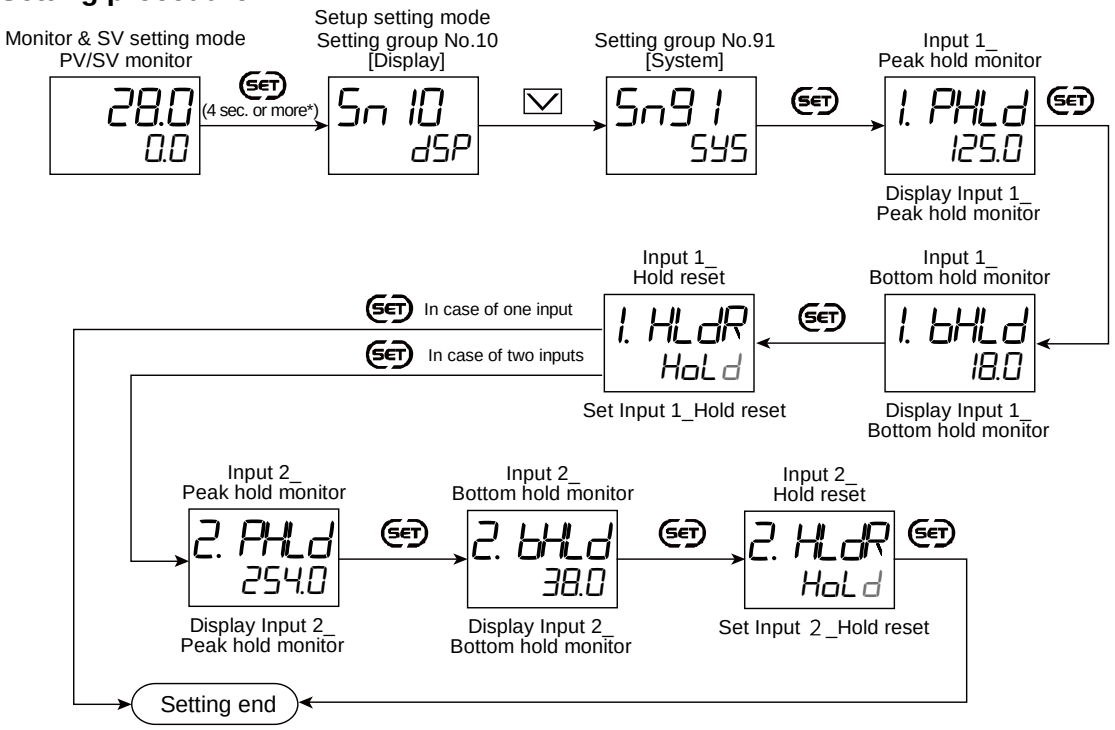
- **Input 2_Hold reset [Setup Setting Mode: Setting group No. 91 (Sn91)]**

Parameter symbol	Data range	Factory set value
2.HLdR	HoLd: Hold rESEr: Reset Returns to Hold state automatically after reset.	HoLd

To display “Input 2_Hold reset”, choose Cascade control, Control with PV select, 2-loop control/Differential temperature control, or Input circuit error alarm in Function block No. 58: Select function for input 2 (Engineering mode).

Note that the both of the peak and the bottom hold values are reset at a time by the hold reset operation.

Setting procedure



- Next parameter is displayed.
- Press SET and ◀MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

9.8 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 screens**

The PV/SV monitor screen which comes at the beginning in the Monitor & SV setting mode. When the instrument has two inputs, PV/SV on the Input 2 is also covered.

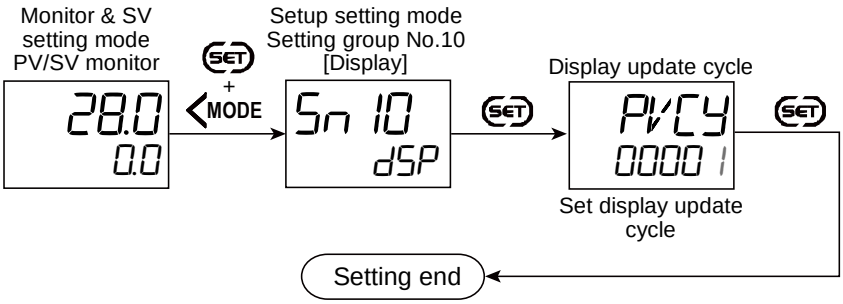
The Manipulated output value (MV) displayed on the Manipulated output value (MV) display is also covered.

Parameter setting

- **Display update cycle [Setup Setting Mode: Setting group No. 10 (Sn 10)]**

Parameter symbol	Data range		Factory set value
PVCY	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	
	* Selecting 1 for Cascade control or 2-loop control/ temperature differential control will result in a display update cycle of 100 ms		

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

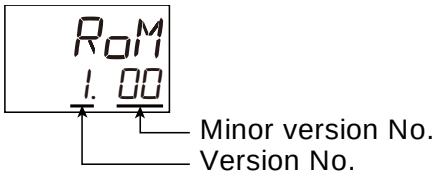
9.9 Checking the Instrument Information

If an error occurs and when you contact us, you are requested to provide us with the product identification code and specification. You can check the ROM version, product identification 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**

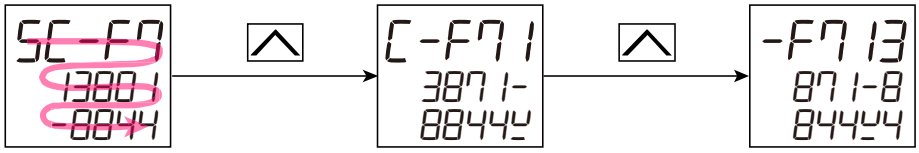
[Example]



- **Product identification code monitor**

Displays the product identification code of the instrument. As the product identification code is too long to be displayed on a single screen, it can be scrolled left and right with ∧ and ∨ keys.

Example: Product identification code is SC-F713801-8844*4NH1NN/2 303
SC-F71 comes with three display units; PV, SV and MV are displayed.



SC-F7
13801
-8844

The product identification code scrolls from the PV display to the SV display continously over two displays.

C-F71
3801-
8844*

The UP key was pressed once. The product identification code was scrolled one digit left.

-F713
801-8
844*4

The UP key was pressed once more. The displayed characters were scrolled one more.

- **Instrument number monitor**

Displays the serial number of the instrument.

Refer to “Character Symbols” for reading the displayed characters.

Alternatively, you can check the product identification code, serial number and suffix code on the label on the side of the instrument if you are unable to check the information on the display.

- **Integrated operating time**

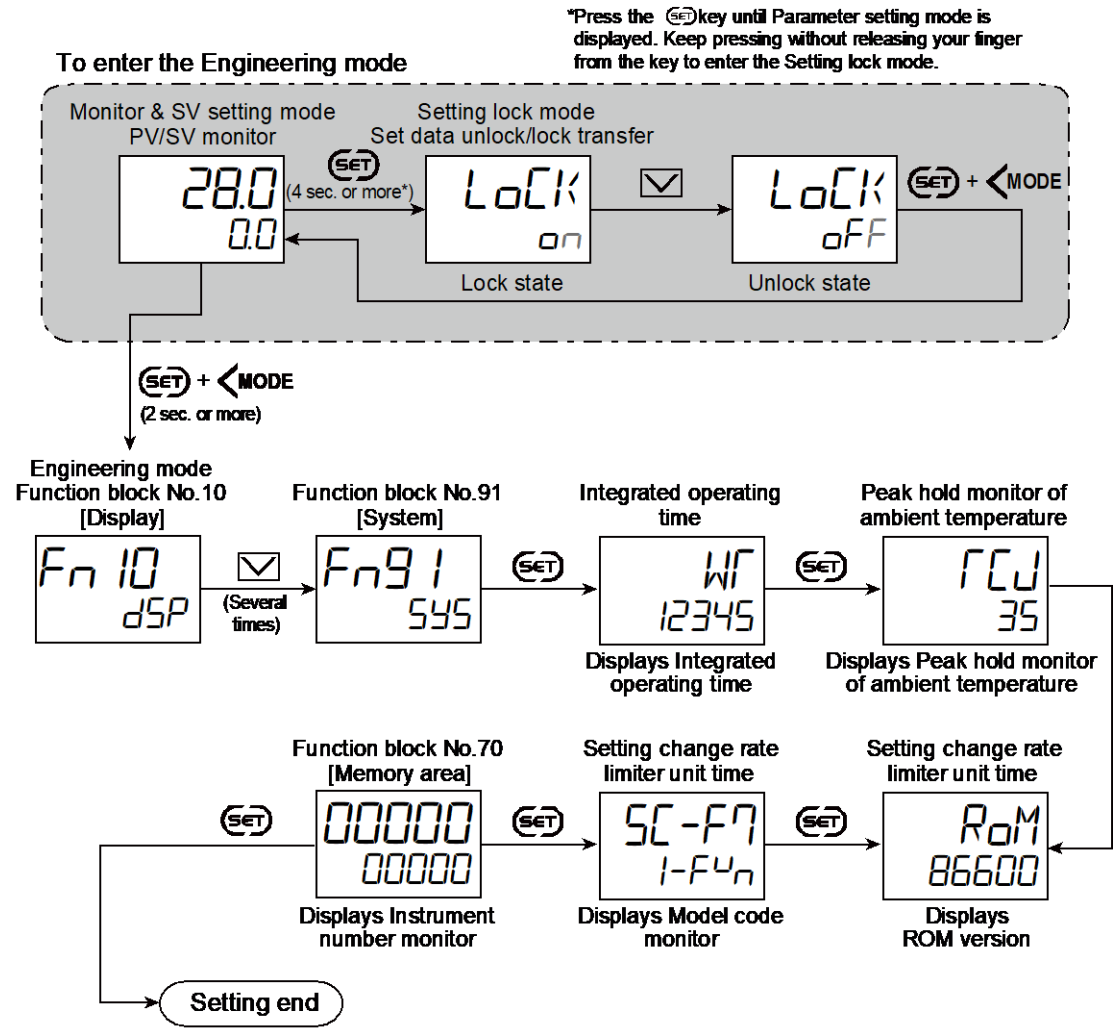
As soon as the instrument is turned on, “1” is added. Thereafter, “1” is accumulated for each hour.

- **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 SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

10. Setting and Key Operation

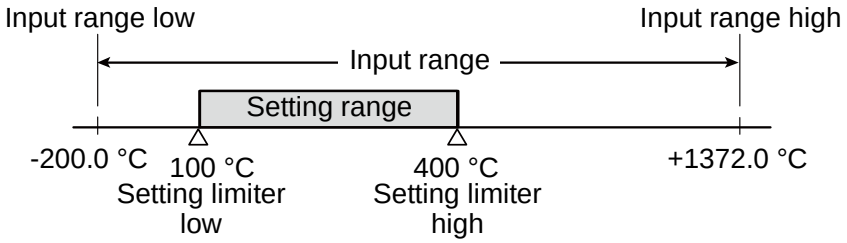
10.1 Limiting the Setting Range of Set Value (SV)

To limit the setting range of the Set value (SV), Setting limiter is used.

Description of function

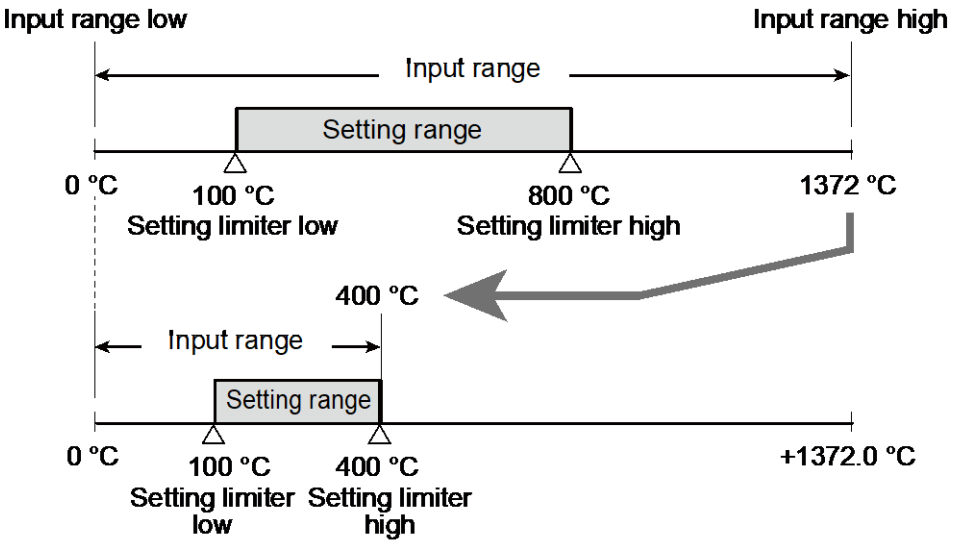
Setting limiter is a function to limit the setting range of the Set value (SV) within the input range.

Example: The input range is from -200.0 to +1372.0 °C, the Setting limiter high is 400.0 °C, and the Setting limiter low is 0.0 °C.

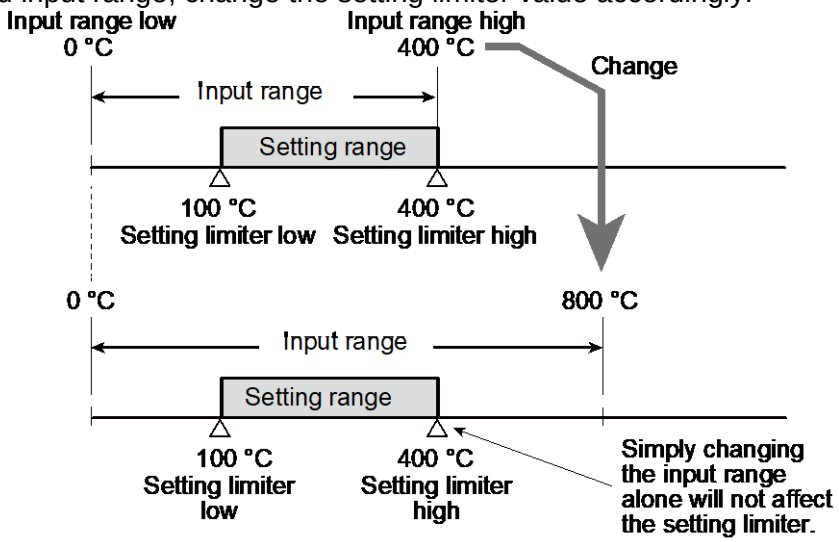


When the input range is changed, the setting limiter may be also changed according to the changed setting.

[Example 1]
Input 1_Input range is 0 to 1372 °C, Input 1_Setting limiter high is 800 °C. Changing the Input 1_Input range high to 400 °C will change the Setting limiter high to 400 °C accordingly.



[Example 2]
When the Input 1_Input range is 0 to 400 °C and the Input 1_Setting limiter high is 400 °C, changing the Input 1_Input range high to 800 °C will not affect the setting limiter value. In this case the Input 1_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

- **Input 1_Setting limiter high [Engineering Mode: Function block No. 71 (Fn71)]**

Parameter symbol	Data range	Factory set value
1. SLH	Input 1_Setting limiter low to Input 1_Input range high (When Control with PV select: Input 1_Setting limiter low to PV select input range high) [Varies with the setting of the Decimal point position.]	Input 1_Input range high (Control with PV select: PV select input range high)

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Setting limiter high is changed.

- **Input 2_Setting limiter high [Engineering Mode: Function block No. 72 (Fn72)]**

Parameter symbol	Data range	Factory set value
2. SLH	Input 2_Setting limiter low to Input 2_Input range high [Varies with the setting of the Decimal point position.]	Input 2_Input range high

📖 To display “Input 2_Setting limiter high”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Setting limiter high is changed.

- **Input 1_Setting limiter low [Engineering Mode: Function block No. 71 (Fn71)]**

Parameter symbol	Data range	Factory set value
1. SLL	Input 1_Input range low to Input 1_Setting limiter high (When Control with PV select: PV select input range low to Input 1_Setting limiter high) [Varies with the setting of the Decimal point position.]	Input 1_Input range low (Control with PV select: PV select input range low)

☞ Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 1_Setting limiter low is changed.

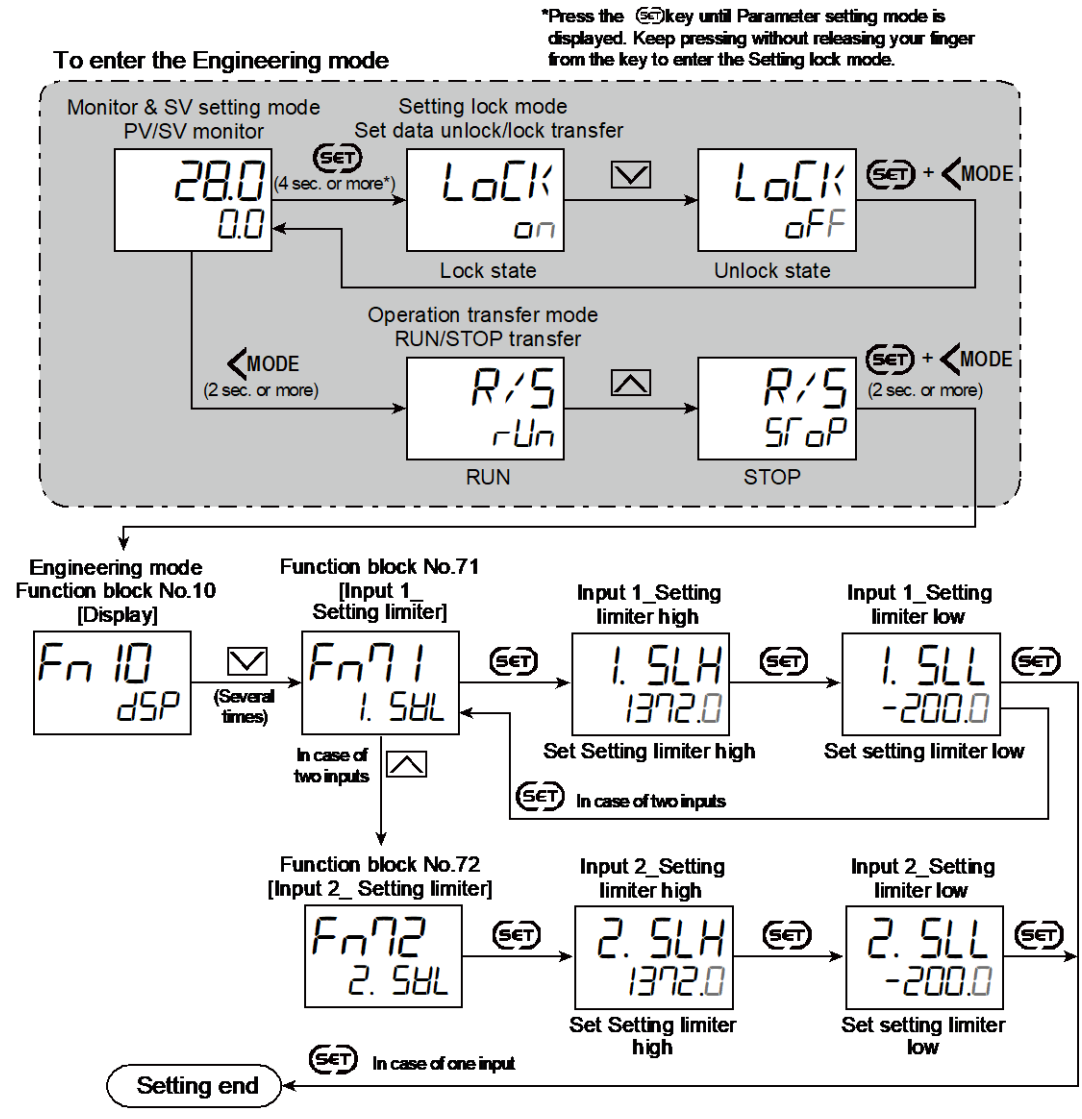
- **Input 2_Setting limiter low [Engineering Mode: Function block No. 72 (Fn72)]**

Parameter symbol	Data range	Factory set value
2. SLL	Input 2_Input range low to Input 2_Setting limiter high [Varies with the setting of the Decimal point position.]	Input 2_Input range low

To display “Input 2_Setting limiter low”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Input 2_Setting limiter low is changed.

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

10.2 Eliminating a Sudden Set Value Change (Setting Change Rate Limiter)

This function allows the Set value (SV) to change gradually, not rapidly or not at a time, when the Set value (SV) is changed.

10.2.1 Limiting the set value (SV) change rate (Setting change rate limiter)

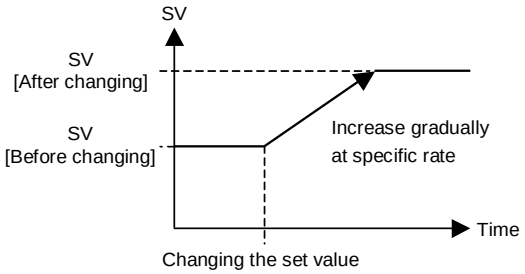
Description of function

This function is to allow the Set value (SV) to be automatically changed at specific rates when a new Set value (SV).

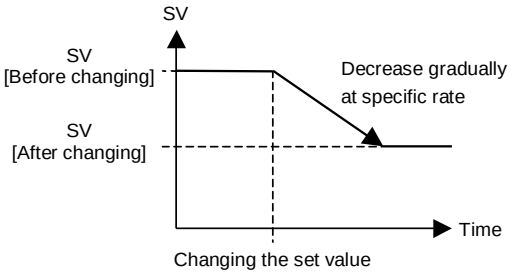
Setting the Setting change rate limiter unit time parameter and the Setting change rate limiter (up and down) will enable setting the changing rate (setting change rate limiter/unit time) of the Setting change rate limiter (up or down).

[Application examples of Setting change rate limiter]

- **Increasing the SV to a higher value**



- **Decreasing the SV to a lower value**



When the Setting change rate limiter is used, the Set value (SV) will also ramp up or ramp down by the function at power-on and operation mode change from STOP to RUN.

When the Set value (SV) is changed by the Memory area transfer function, the Setting change rate limiter functions from the Set value (SV) before the change (transfer) toward the set value after the change (transfer).

If the Autotuning (AT) function is activated while the Set value (SV) is ramping up or ramping down by the Setting change rate limiter, AT will starts after the Set value (SV) finishes ramp-up or ramp-down by the limiter, and the controller is in PID control mode until AT starts.

When the value of Setting change rate limiter is changed during normal operation, the ramp-up or ramp-down rate will be changed unless the SV already has finished ramp-up or ramp-down by the function.

When Setting change rate limiter is a setting other than “OFF: No function (disabled)” and when the Event type is set to a SV monitor value, the Event re-hold function by the Set value (SV) change is unavailable. However, the Event re-hold function by the Set value (SV) change is available for events using a local SV

During the Remote mode, the Input 1_Setting change rate limiter will function to Remote setting input value.

Input 2_Setting change rate limiter will be unavailable during Cascade control.

Parameter setting

- **Soft start/Setting change limiter selection [Engineering mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SWRS	0: Soft start 1: Setting change rate limiter	0

- **Setting change limiter unit time [Engineering mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SWRT	1 to 3600 seconds	60

- **Input 1_Setting change rate limiter (up) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.SWRU	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: No function [Varies with the setting of the Decimal point position.]	0

- **Input 2_Setting change rate limiter (up) [Parameter Setting Mode: Parameter groupNo. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.SWRU	0 to Input 2_Input span 0: No function [Varies with the setting of the Decimal point position.]	0

📖 To display “Input 2_Setting change rate limiter (up)”, choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Setting change rate limiter (down) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.SWRd	0 to Input 1_Input span (When Control with PV select: 0 to PV select input span) 0: No function [Varies with the setting of the Decimal point position.]	0

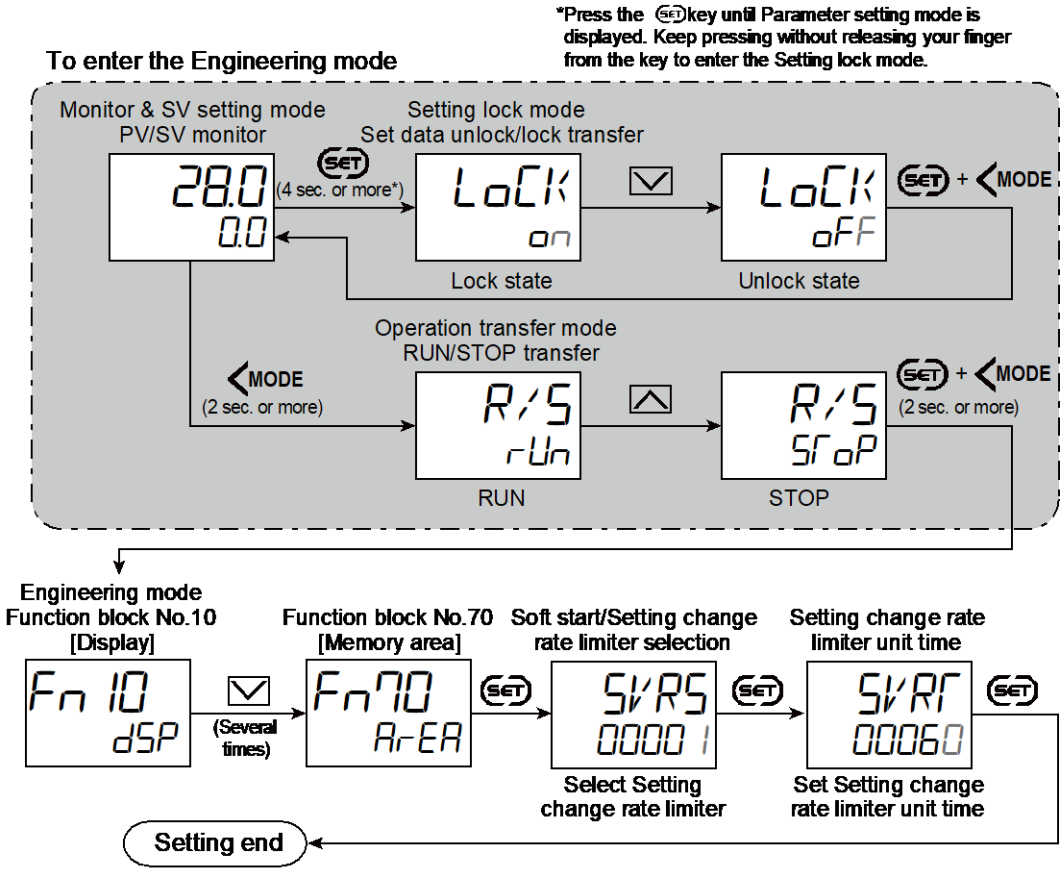
- **Input 2_Setting change rate limiter (down) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.SWRd	0 to Input 2_Input span 0: No function [Varies with the setting of the Decimal point position.]	0

📖 To display “Input 2_Setting change rate limiter (down)”, choose “2-loop control/ Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

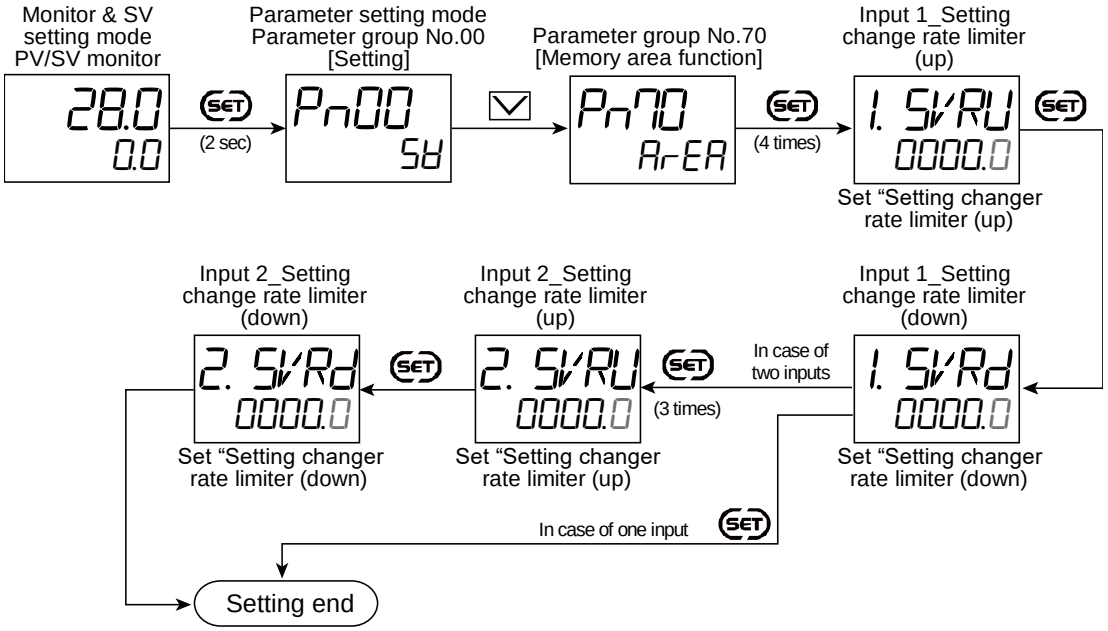
Setting procedure

- **Set the Setting change rate limiter unit time parameter**



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

- **Set the Setting change rate limiter (up/down)**



- Next parameter is displayed.
- Press (SET) and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

10.2.2 Setting the time to change the set value (SV) (Soft start)

Description of function

Soft start is a function that allows to set the time until the set value (SV) reaches the changed value when the set value (SV) is changed.
Changing the set value (SV) upon setting the Soft start time means that the set value (SV) will gradually change from the start point until the set value (SV) over the time set by the user. The start point can be selected from either the measured value (PV) at the time the set value (SV) was changed, or from the zero point.

📖 If selecting Zero point start for Soft start start time, the set value (SV) at the time when the set value (SV) was changed will become 0.

📖 When the set value (SV) is changed by the Memory area transfer function, the Setting change rate limiter operates from the pre-change set value (SV) until the post-change set value (SV) is reached.

📖 If the Setting change rate limiter or the set value (SV) are changed during soft start, the Soft start time is recalculated and operation continues. Refer to "Action when the set value is changed during soft start" for details.

📖 When Setting change rate limiter is set to a value other than "0" and when the Event type is set to an SV monitor value, the Event re-hold function by the set value (SV) change is invalid. However, the event using a local SV will have the Event re-hold function by the set value (SV) change valid.

📖 Soft start will be invalid for the remote setting input value while remote mode is

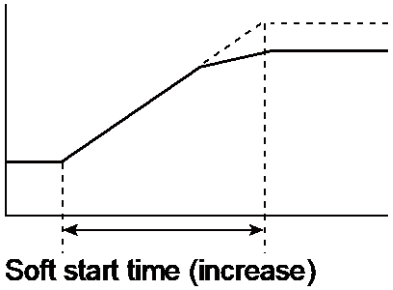
selected.

Input 2 soft start will be invalid when cascade control is selected.

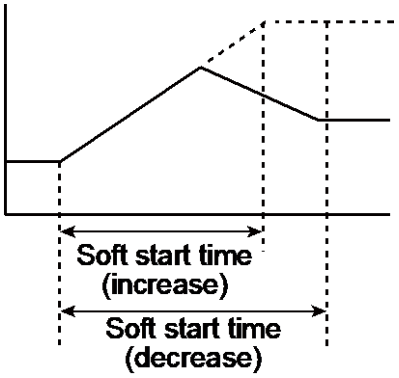
- **Action when the set value is changed during Soft start**

When the set value (SV) is changed during the soft start

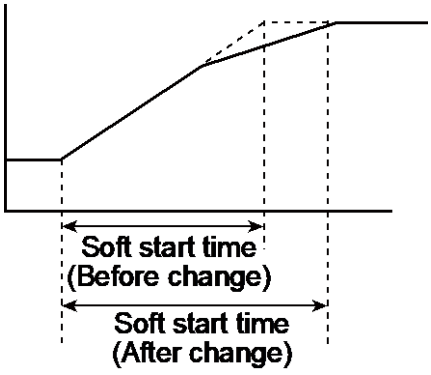
1) When the set value (SV) is changed in an increasing direction



2) When the set value (SV) is changed in an increasing → decreasing direction

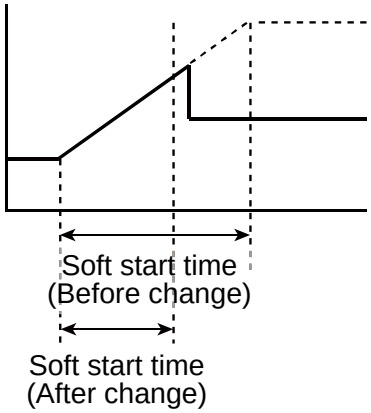


- **When the Soft start time is changed during Soft start**

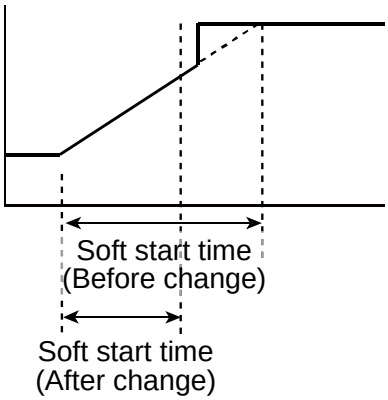


- **When changing the Soft start time or set value (SV) during Soft start, if the time passed exceeds the Soft start time setting, Soft start will be in a complete state.**

1) When the set value (SV) is changed

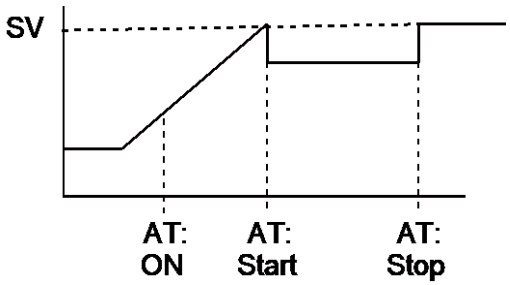


2) When the Soft start time is changed



- **Set value (SV) value when Autotuning (AT) is executed by applying Autotuning (AT) bias during Soft start**

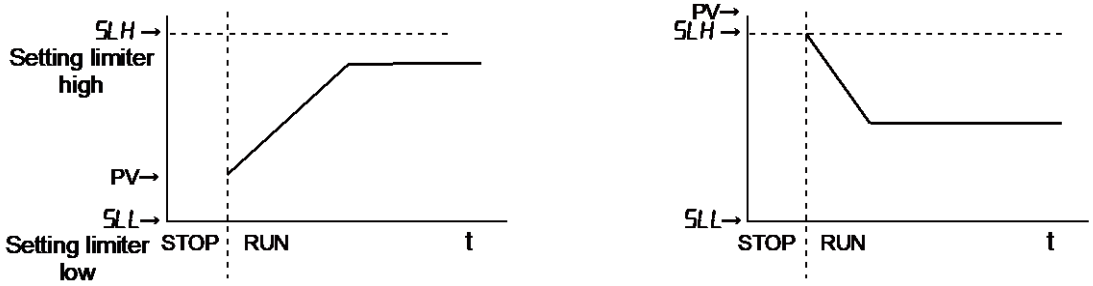
Autotuning (AT) starts after the Soft start is finished.



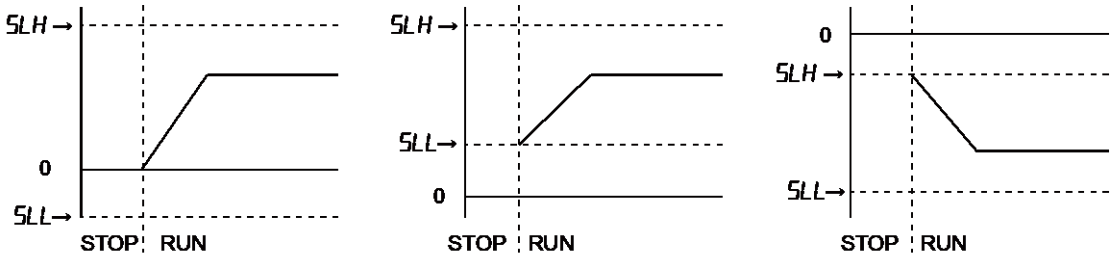
- **Selecting the Soft start start time**

Set value (SV) value at the power on or start of the Soft start function by STOP→ RUN can be set.

1) Set value start



2) Zero start



Parameter setting

- **Soft start/Setting change rate limiter [Engineering mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SWRS	0: Soft start 1: Setting change rate limiter	0

- **Soft start time select [Engineering mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SWTS	0: m.s 1: h.m	0

- **Soft start start time select [Engineering mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SWSS	0: Measured value start 1: Zero point start	0

- **Input 1_Soft start time increase [Parameter setting mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.SFTU	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [The time unit depends on the setting of Soft start time unit.]	0:00 (0 minutes 00 seconds)

- **Input 2_Soft start time increase [Parameter setting mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.SFTU	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [The time unit depends on the setting of Soft start time unit.]	0:00 (0 minutes 00 seconds)

📖 To display “Input 2_Soft start time increase”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 1_Soft start time decrease [Parameter setting mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.SFTd	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [The time unit depends on the setting of Soft start time unit.]	0:00 (0 minutes 00 seconds)

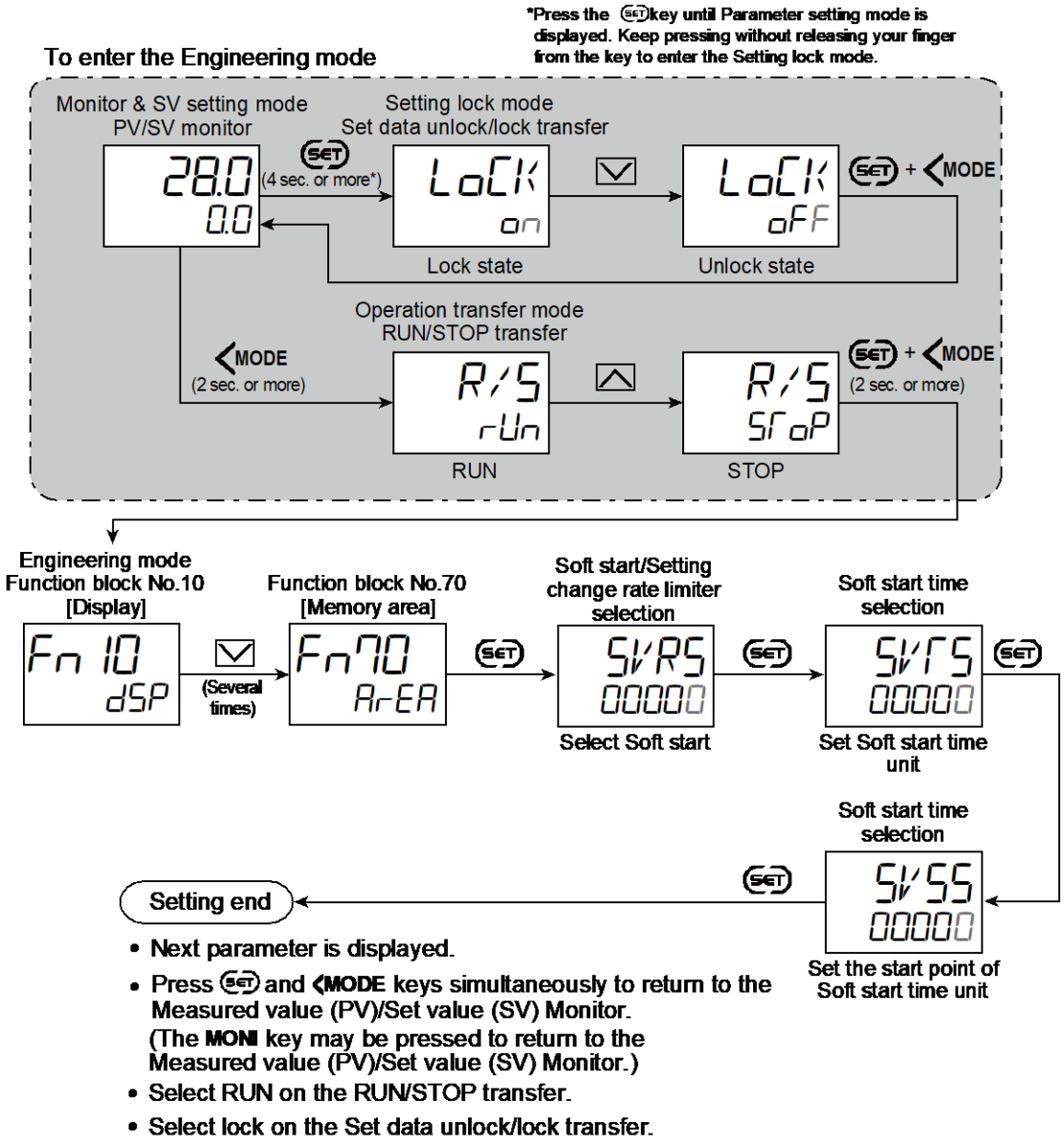
- **Input 2_Soft start time decrease [Parameter setting mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.SFTd	0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds [The time unit depends on the setting of Soft start time unit.]	0:00 (0 minutes 00 seconds)

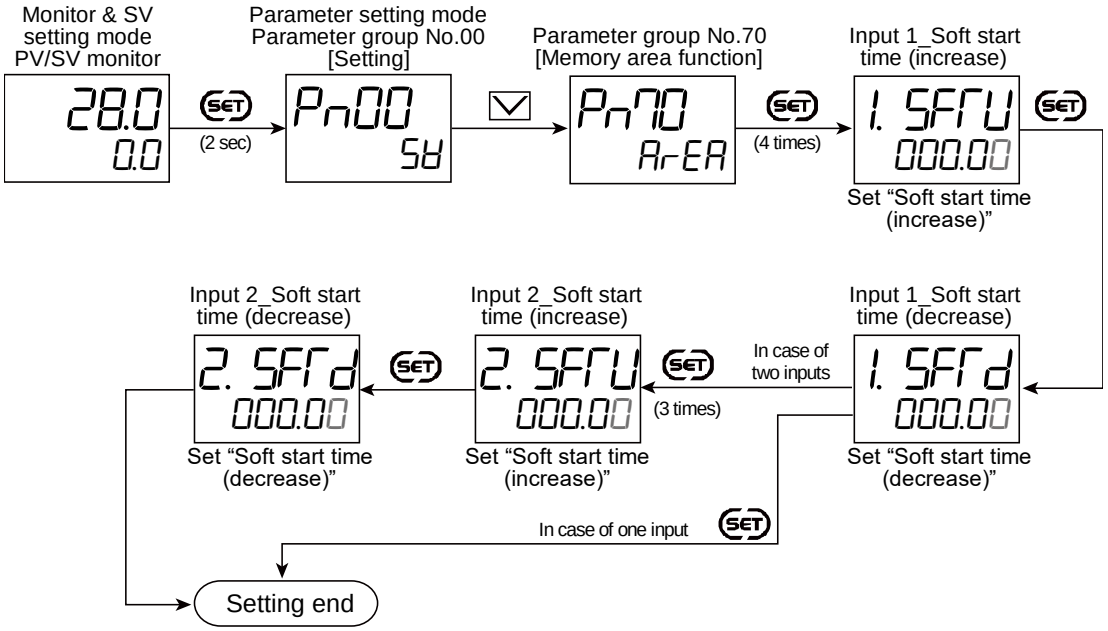
📖 To display “Input 2_Soft start time decrease”, choose “2-loop control/Differential temperature control” or “Cascade control” in Function block No. 58: Select function for Input 2 (Engineering mode).

Setting Procedure

- **Setting Soft start function**



● Setting soft start time increase/decrease



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

10.3 Storing the Control Related Set Values (Memory Area Function)

This function allows PID related parameters such as a Set value (SV) to be stored as an area and up to 16 areas.

Description of function

The Memory area function is to store up to 16 areas of parameters such as a Set value (SV). Parameters that can be stored in an area are those inside the Parameter setting mode*. One of the Areas is used for control, and the currently selected area is Control area. Storing set values according to work processes in a location called “area” allows a necessary set of set values for the work process to be retrieved only by changing the area number. Parameters inside the Parameter setting mode are categorized into six groups by the setting contents.
These parameters are categorized into three groups during the “Level PID” function.
* ON/OFF action differential gap (upper) and (lower) are excluded.

- Memory area parameters of Parameter group No. 00 (*Pn00*) [Set value (SV)]

Input 1_Set value (SV)
Input 2_Set value (SV)
Set value (SV) of differential temperature input

- Memory area parameters of Parameter group No. 40 (*Pn40*) [Event]

Event 1 set value (EV1) or Event 1 set value (EV1) [high]
Event 1 set value (EV1’) [low]
Event 2 set value (EV2) or Event 2set value (EV2) [high]
Event 2 set value (EV2’) [low]
Event 3 set value (EV3) or Event 3set value (EV3) [high]
Event 3 set value (EV3’) [low]
Event 4 set value (EV4) or Event 4set value (EV4) [high]
Event 4 set value (EV4’) [low]

- Memory area parameters of Parameter group No. 51 (*Pn51*) [Input 1_Control]

Input 1_Proportional band [heat-side]	Input 1_Manual reset
Input 1_Integral time [heat-side]	Input 1_FF amount
Input 1_Derivative time [heat-side]	Input 1_Output limiter high [heat-side]
Input 1_Control response parameter	Input 1_Output limiter low [heat-side]
Input 1_Proactive intensity	Input 1_Dead zone

- Memory area parameters of Parameter group No. 52 (*Pn52*) [Input 2_Control]

Input 2_Proportional band	Input 2_Manual reset
Input 2_Integral time	Input 2_FF amount
Input 2_Derivative time	Input 2_Output limiter high
Input 2_Control response parameter	Input 2_Output limiter low
Input 2_Proactive intensity	Input 2_Dead zone

- Memory area parameters of Parameter group No. 56 (*Pn56*) [Input_1 Cooling control]

Input 1_Proportional band [cool-side]
Input 1_Integral time [cool-side]
Input 1_Derivative time [cool-side]
Input 1_Overlap/Deadband
Input 1_Output limiter high [cool-side]
Input 1_Output limiter low [cool-side]

- Memory area parameters of Parameter group No. 70 (Pn70) [Memory area]

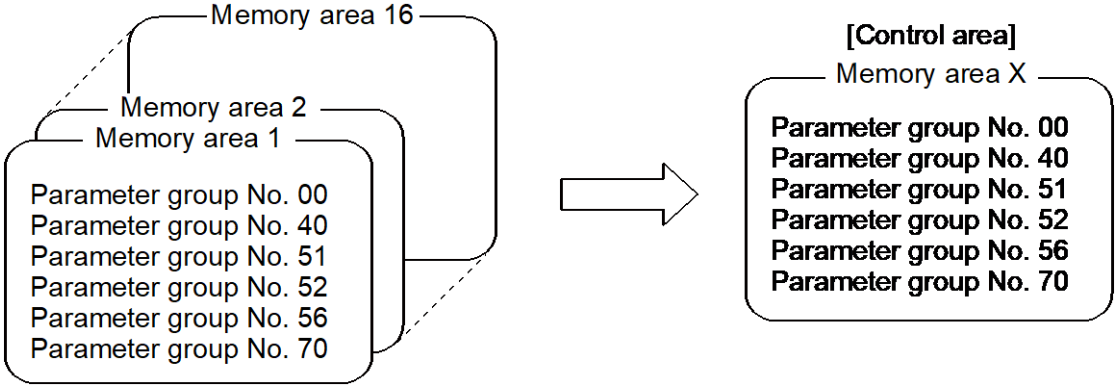
Select Trigger type for Memory area transfer	Input 1_Manipulated output value (Area)
Area soak time	Input 2_Soft start time (increase)
Link area number	Input 2_Soft start time (decrease)
Input 1_Soft start time (increase)	Input 2_Setting change rate limiter (up)
Input 1_Soft start time (decrease)	Input 2_Setting change rate limiter (down)
Input 1_Setting change rate limiter (up)	Input 2_Auto/Manual transfer selection (Area)
Input 1_Setting change rate limiter (down)	Input 2_Manipulated output value (Area)
Input 1_Auto/Manual transfer selection (Area)	Remote/Local transfer selection (Area)

[Groups used during the Level PID]

- Group 0: Parameter group No. 00, No. 40 and No. 70
- Group 1: Parameter group No. 51, No. 56
- Group 2: Parameter group No. 52

☞ Refer to 8.15. Controlling with Level PID for Level PID function.

- **Structural image of Memory area**



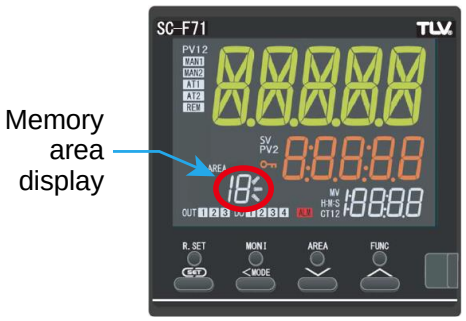
The following four parameters are used in common in all Memory areas, and therefore are not included in the Memory area.

Parameter group No. 51:	Input 1_ON/OFF action differential gap (upper)
	Input 1_ON/OFF action differential gap (lower)
Parameter group No. 52:	Input 2_ON/OFF action differential gap (upper)
	Input 2_ON/OFF action differential gap (lower)

Transferring the Control area

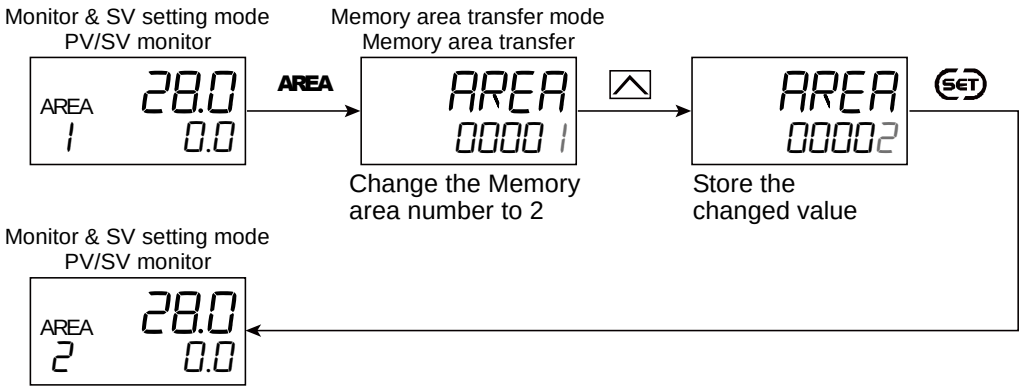
The Control area is displayed on the Memory area display during the monitor display state. (See the right picture)
Control area can be transferred by Key operations, Digital input (DI), or communication. Memory area transfer by Memory Area Soak time is also possible.

☞ Refer to the SC-F71 Instruction Manual [Host communication] (172-65711M) for communication.



- **Selection by front key operation**

Changing the Control area from 1 to 2



- **Switching the Control area by Digital Input (DI)**

To switch the control area by Digital input (DI), the instrument must have an option (Digital input). The memory area transfer must be set at DI1 function selection.

To change the Control area by Digital input (DI), two methods are offered; Transfer using the SET signal input and transfer without the SET signal.

- With a SET signal: After the Memory area has been selected by the DI, close the contact of the SET signal so that the Control area is transferred.
- Without a SET signal input: After the Memory area has been selected by the DI, the Area will be automatically changed after the time period (0.5 to 5.0 seconds) set in Function block No. 23: Area switching time (without area set signal) (Engineering mode).

☞ Refer to 5.2 Switching Functions Using Digital Inputs (DI) for details.

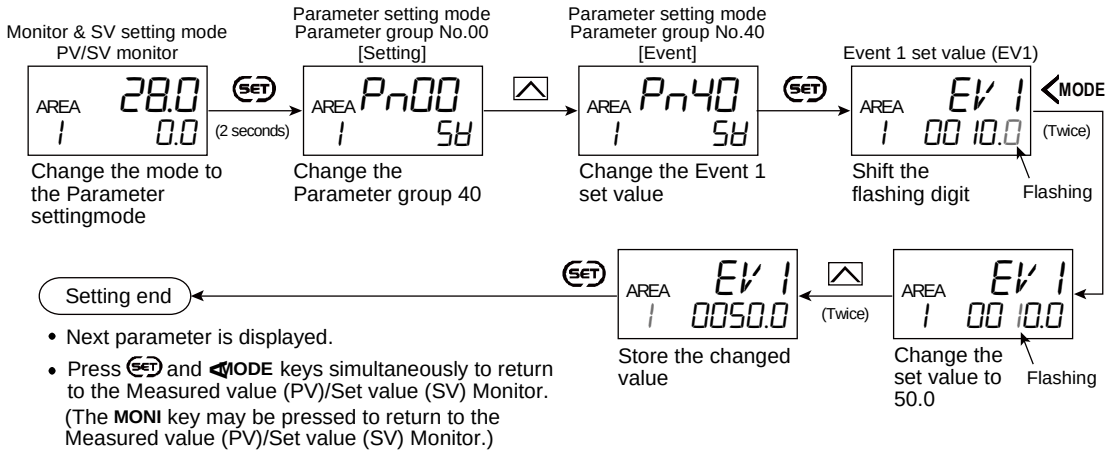
- **Switching the Control area by Area soak time**

Changing the Memory area by the Memory area soak time will need setting the Memory area No. to which the Memory area is switched.
Refer to 10.5 Running a Simple Ramp/Soak Operation or 10.6 Using a Simple Sequence Operation for details.

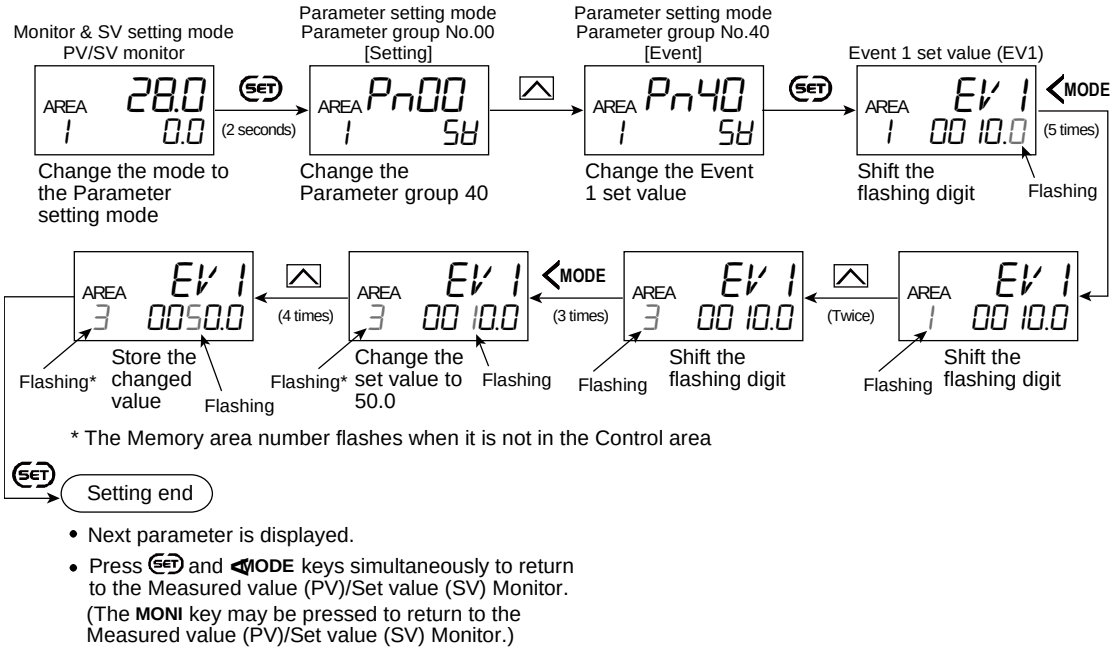
Changing the data in the Memory area

- **Change the Event 1 set value in the Control area (Memory area 1) from 10.0 to**

50.0



- **Change the Event 1 set value from 10.0 to 50.0 in Memory area 3 when the Control area is Memory area 1.**

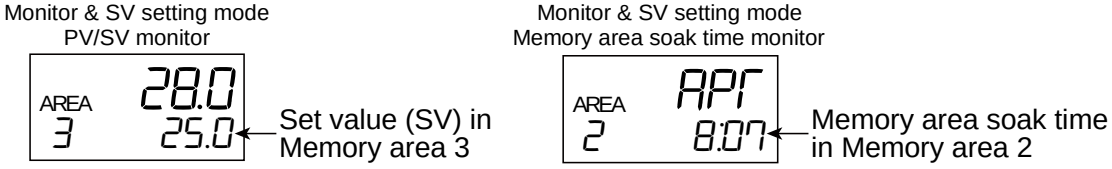


Memory area display

During the PV/SV monitor display, the Set value (SV) displayed on the SV display is the Set value (SV) in the Memory area No. now displayed on the Memory area display.

During the Monitor & SV setting mode display, the time displayed on the Memory area soak time is the time of the Memory area No. now displayed on the Memory area display.

[Example]



Parameter setting

- **Memory area transfer [Memory Area Transfer Mode]**

Parameter symbol	Data range	Factory set value
AREA	1 to 16	1

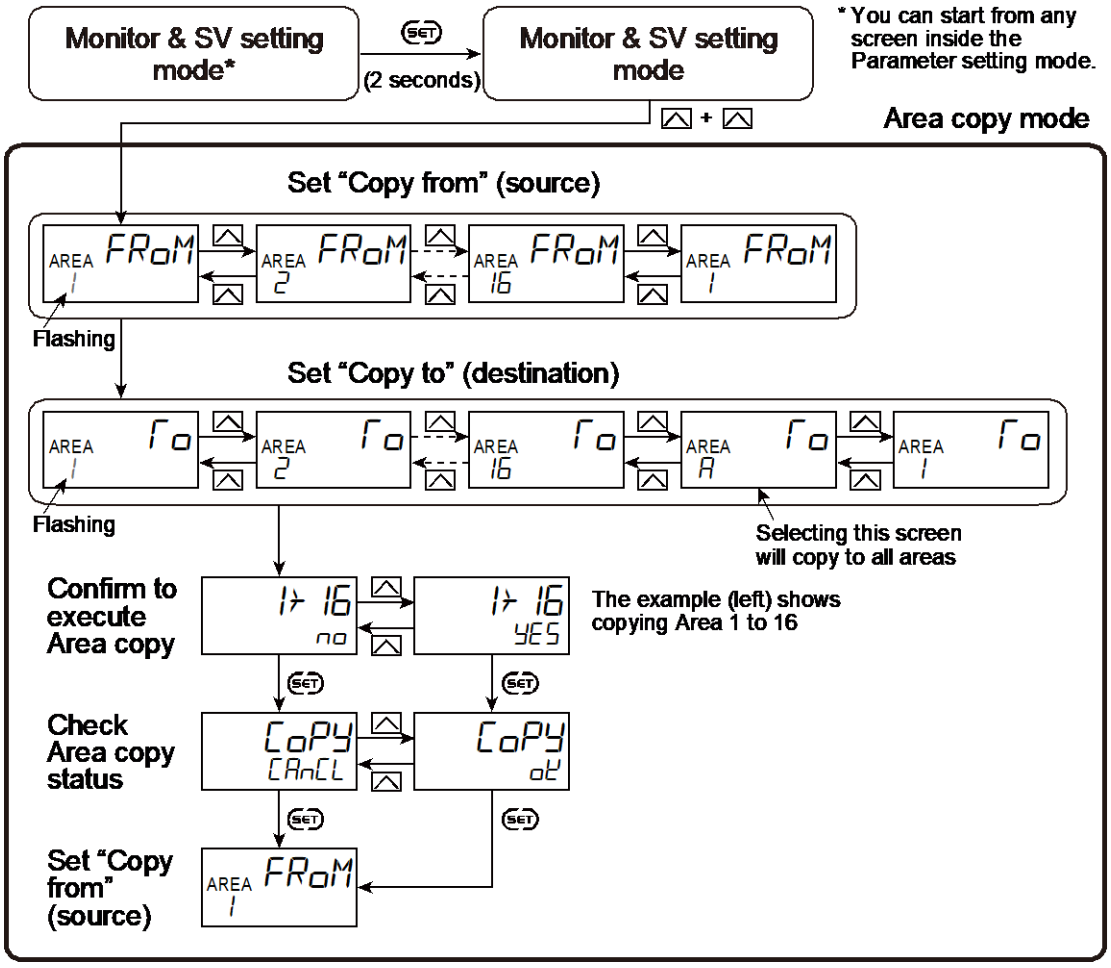
This parameter will not be displayed when “Memory area is not adjustable when the setting data is locked” is selected in “Setting lock mode”.

Refer to “4. Parameters that are Initialized/Modified when Setting is Changed” for the parameters that are automatically converted when the Memory area is changed.

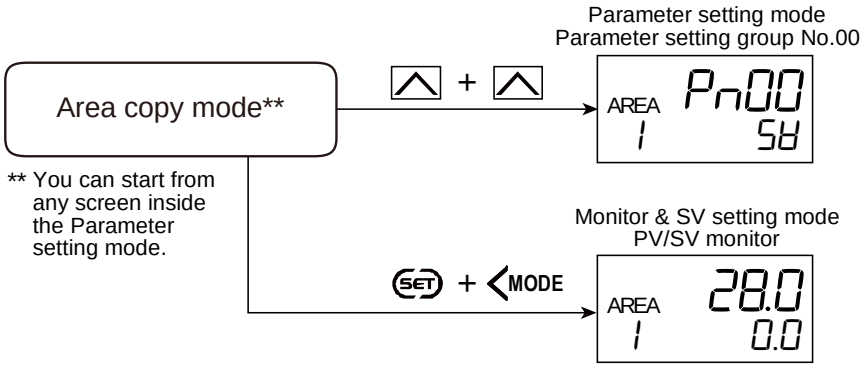
10.4 Copying the Data in Memory Area to Set Other Areas

Up to 16 Memory areas can be set, but it consumes time if Memory areas are set one after another. On this instrument, the data in the Memory area can be copied.

Screens for Area copy mode

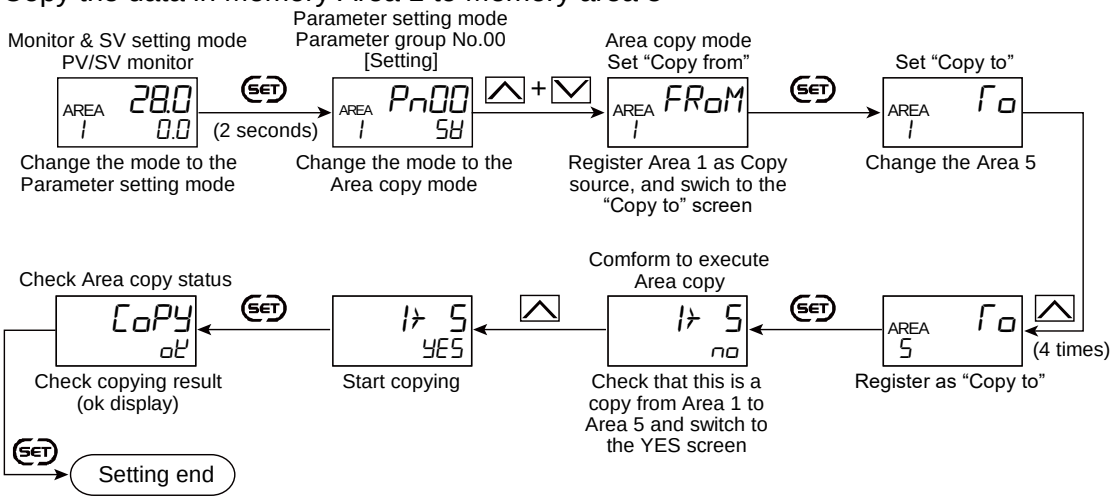


[To exit from Area copy mode]


Parameter setting mode
Parameter setting group No.00
Area copy mode**
+
AREA
1
Pn00
SV
** You can start from any screen inside the Parameter setting mode.
Monitor & SV setting mode
PV/SV monitor
SET
+
MODE
AREA
1
28.0
0.0

[Example Area copy]

Copy the data in Memory Area 1 to Memory area 5



- Next parameter is displayed.
- Press SET and **MODE** keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

10.5 Running a Simple Ramp/Soak Control

On this instrument multiple Memory areas can be linked to run a simple ramp/soak control.

Description of function

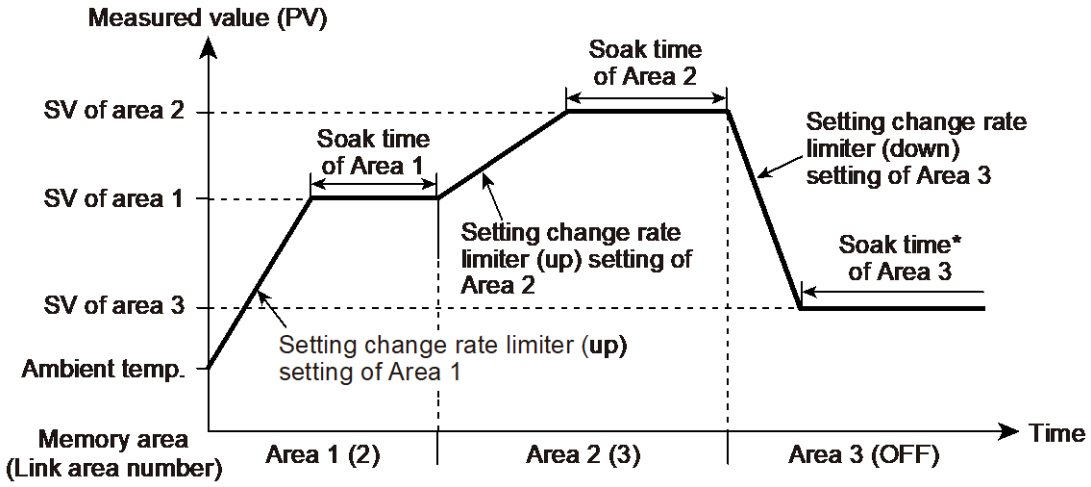
Simple Ramp/Soak control is possible by setting a Set value (SV), Setting change rate limiter (up/down), Area soak time, and Link area number in each memory area.

A term, hereinafter described as a ramp is a general term for the setting change rate limiter and the soft start time.

- Set value (SV): Sets the fixed set point control (control by fixed set value) desired value of each memory area.
- Setting change rate limiter: Sets the slope of the Set value (SV) which is raised or lowered at each unit time.
- Area soak time: Sets the fixed set point control time of each memory area.
- Link area number: Sets the memory area numbers for linking the corresponding memory areas.

Besides the above, the Setting change rate limiter unit time and Area soak time unit are set in the Engineering mode.

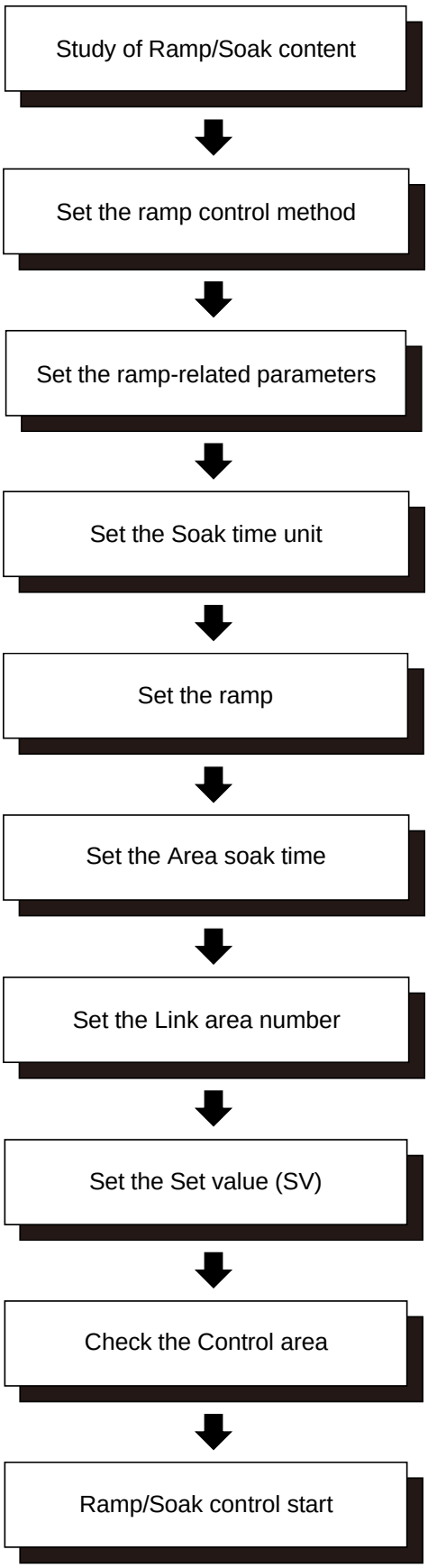
Example: Ramp/Soak control by linking Memory area 1 to 3



*** As the area soak time for memory area linked last becomes invalid, the state of SV3 reached continues.**

Refer to the “Memory area soak time monitor” in the Monitor & SV setting mode for checking the elapsed time in each area.
Memory area soak time can be displayed on the MV display. Refer to 9.6 Changing the Display Contents of the MV Display.

Operation flowchart



The Ramp/Soak control contents are studied, and the operation status is graphed, and the set values are summarized in a table in advance.

Settings before operation, Engineering mode: Fn70
Select the ramp control method from the setting change rate limiter and soft start

Settings before operation, Engineering mode: Fn70
Set the time unit and the start point of the soft start, and the unit time of the setting change rate limiter.

Settings before operation, Engineering mode: Fn70

Refer to the following Setting example;
Set at each memory area.

Parameter setting mode: Pn70
Set at each memory area.

Parameter setting mode: Pn70
Set at each memory area.

Parameter setting mode: Pn00
Set at each memory area.

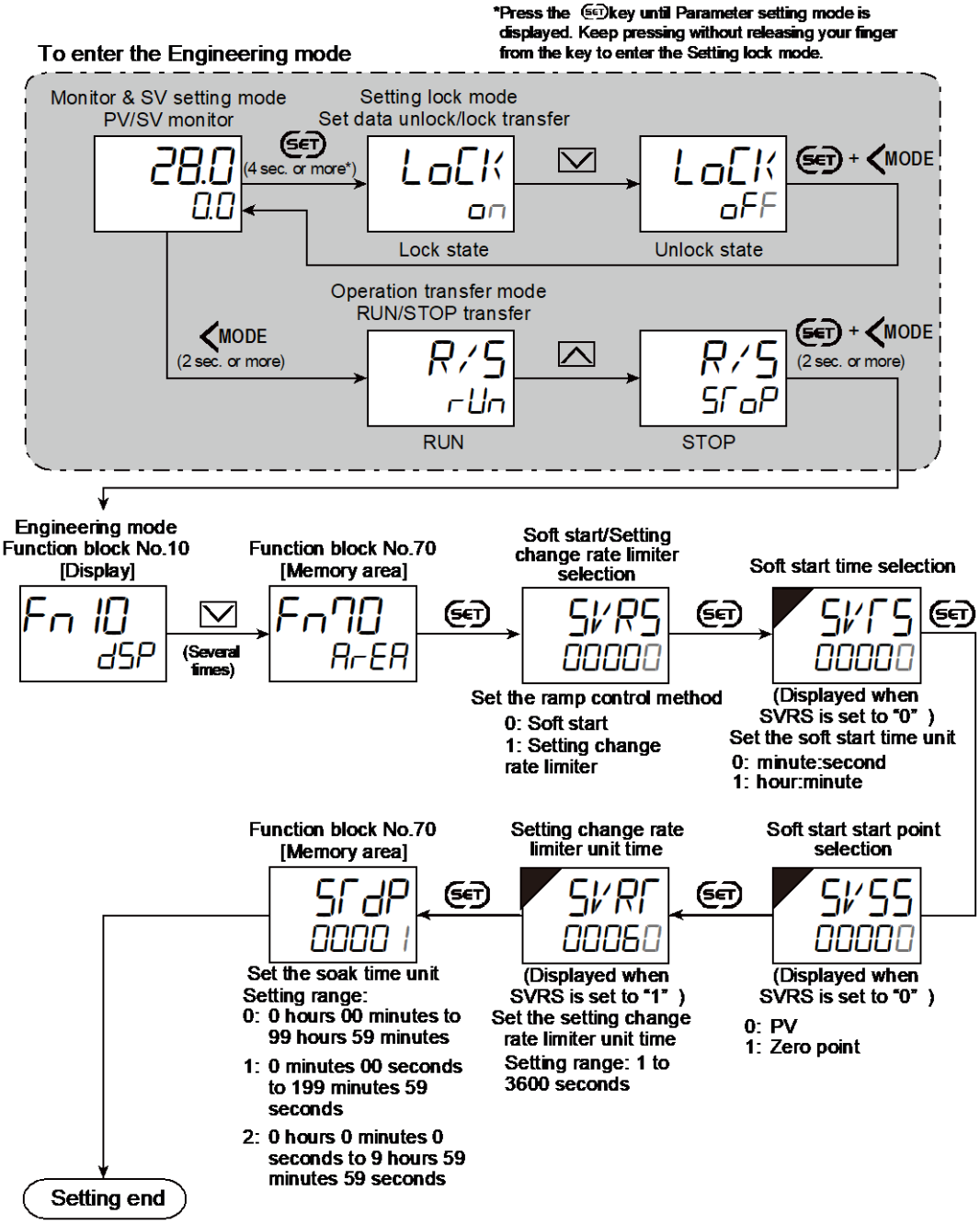
The start area is made the Control area before the start of Ramp/Soak control.

Changes from the STOP mode to the RUN mode, and starts Ramp/Soak control.

Settings before operation

When implementing Ramp/Soak control, it may be necessary to set the following items in advance.

- Function block No. 70 (Fn70): Setting change rate limiter unit time (Engineering mode)
- Function block No. 70 (Fn70): Soak time unit (Engineering mode)

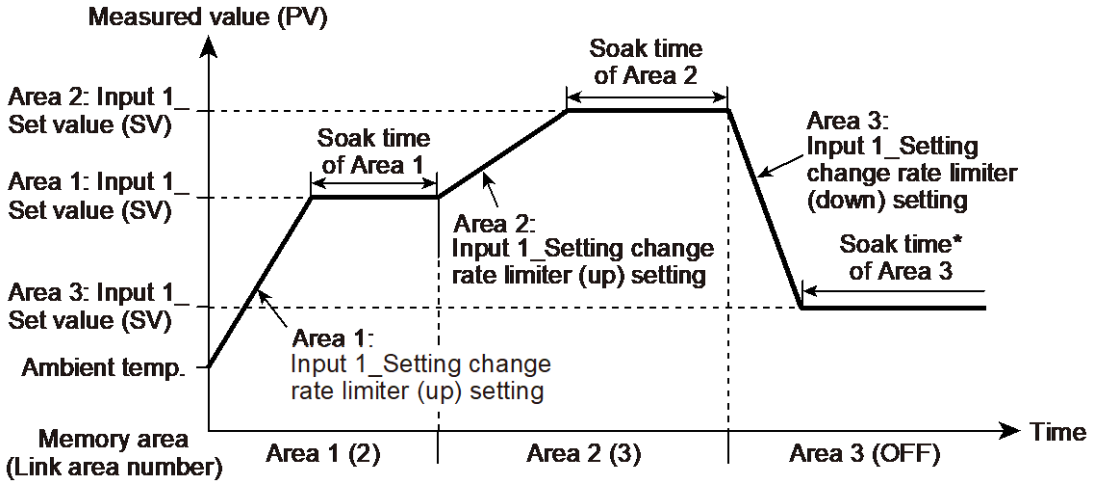


- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

Setting example

This section uses the following sample of Ramp/Soak control to describe the setting procedures.

[Example: Ramp/Soak control by linking Memory area 1 to 3]



	Area 1	Area 2	Area 3
Input 1_Set value (SV)	150.0 °C	200.0 °C	50.0 °C
Input 1_Setting change rate limiter (up)	4.0 °C/min. (60 sec.)	2.0 °C/ min. (60 sec.)	OFF
Input 1_Setting change rate limiter (down)	OFF	OFF	9.0 °C/min. (60 sec.)
Area soak time	30 minutes	40 minutes	0 minutes *
Link area number	2	3	OFF

* In this example, the Area soak time for memory area 3 is set. However, as the Area soak time for the memory area linked last will be unavailable, the state of SV3 is maintained.

Step 1: Study the Ramp/Soak control content.

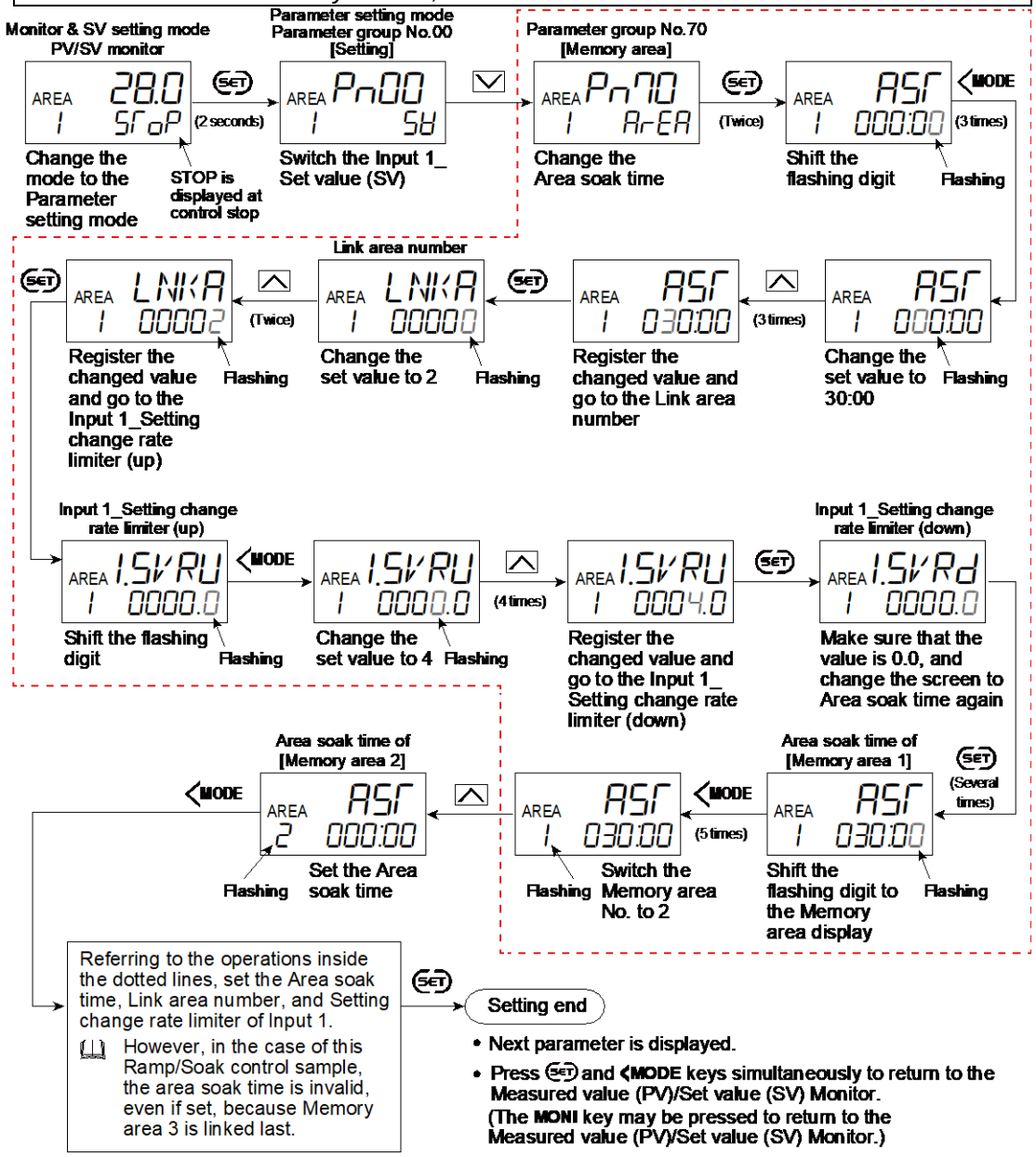
The Ramp/Soak control contents are studied and Ramp/Soak status is graphed and the set values of each memory area are summarized in a table as shown above.

Step 2: Set the Setting change rate limiter unit time and Soak time unit.

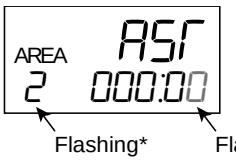
Refer to Settings before operation in 10.5 Running a Simple Ramp/Soak Control and set the Setting change rate limiter unit time and Area soak time (In this example, the factory set values are used for both). Since control stops (STOP) at this time, go directly to the next step.

- Setting change rate limiter unit time: 60 seconds [factory set value]
- Soak time unit: 1 (0 minutes 00 seconds to 199 minutes 59 seconds) [factory set value]

Step 3: Set the Setting change rate limiter, Area soak time and Link area number to each of Memory area 1, 2 and 3.

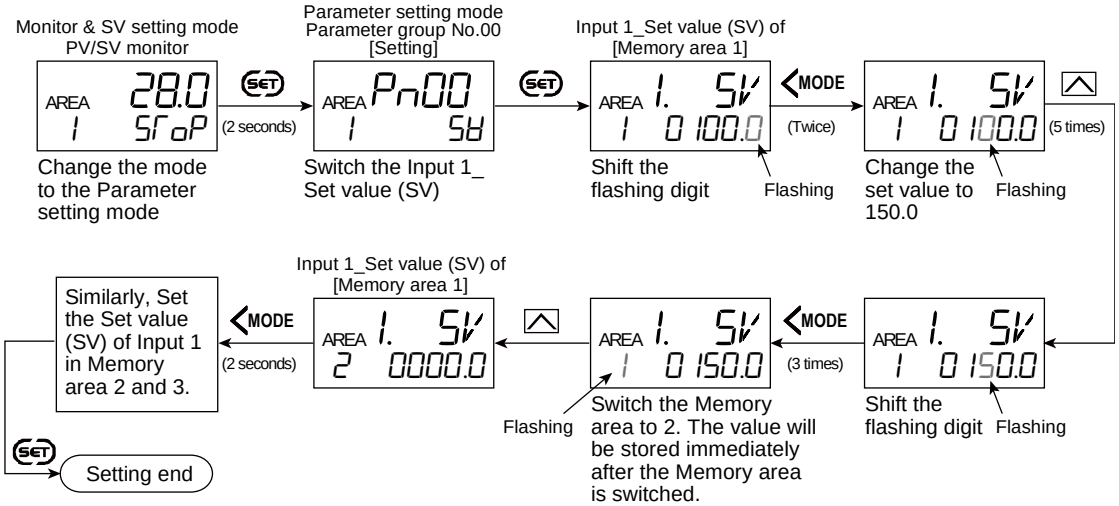


The Memory area number flashes when a Memory area other than that in the Control area is displayed.



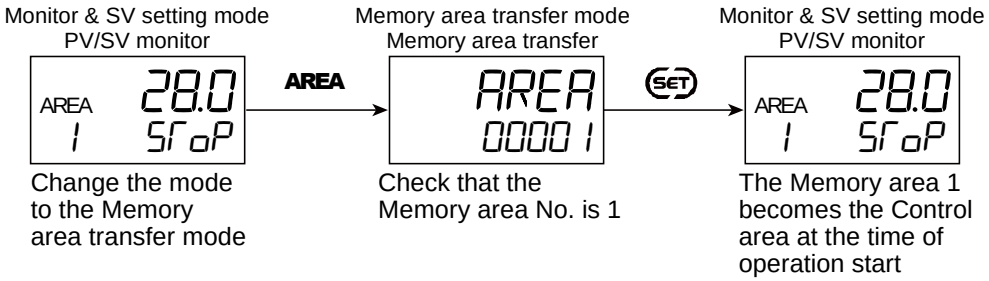
(* Area other than Control area is displayed)

Step 4: Set the SV to each of Memory area 1, 2 and 3.

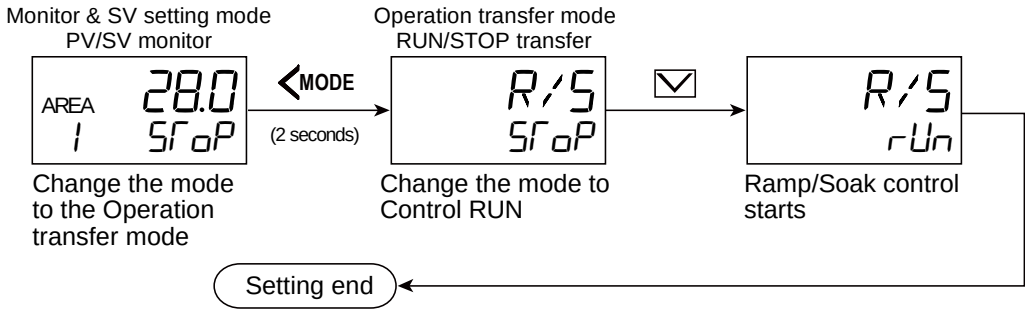


- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

Step 5: Check the control area number.



Step 6: Change from STOP mode to RUN mode



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

Parameter setting

- **Area soak time [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
ASr	0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds 0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds Data range of Area soak time can be selected on the Soak time unit.	0:00 (0 minutes 00 seconds)

- **Link area number [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
LNKA	0 to 16 0: No link	0

- **Soak time unit [Engineering Mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SrdP	0: 0 hours 00 minutes to 99 hours 59 minutes 1: 0 minutes 00 seconds to 199 minutes 59 seconds 2: 0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds	1

10.6 Using a Simple Sequence Operation

On this instrument, multiple Memory areas can be linked to run a simple sequence operation in each Memory area.

Description of function

Simple sequence operation is possible by setting a Set value (SV), Setting change rate limiter (up/down), Select Trigger type for Memory area transfer, Area soak time, Link area number, Auto/Manual transfer selection (Area), Manipulated output value (Area), and Remote/Local transfer selection (Area) in each memory area.

- Set value (SV): Sets the fixed set point control (control by fixed set value) desired value of each memory area.
- Setting change rate limiter: Sets the slope of the Set value (SV) which is raised or lowered at each unit time.
- Soft start time: Sets the time to gradually increase or decrease to reach the target set value.
- Select Trigger type for Memory area transfer: Select a trigger type to switch the Memory area. Memory area will be switched by generated events or contact status of Digital input (DI). To use the generated events as a switching method, setting up the event function is required. To use the Digital input (DI) as a switching method, “Area jump” must be preset in the DI function selection.

  ☞ Refer to 7.2 Using Event Function for the Event function. Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the DI function selection.
- Area soak time: Sets the fixed set point control time of each memory area.
- Link area number: Sets the memory area numbers for linking the corresponding memory areas.
- Auto/Manual transfer selection (Area): Select the operation mode (Auto mode or Manual mode) at the time of switching the memory area. Selection between “Bump” or “Bumpless” is available both in Auto and Manual modes.

When the SV tracking function is selected at the time of switching from Manual to Auto mode, the Set value (SV) of the Memory area will be ignored.

Refer to 6.8 Suppressing Sudden Change in Output (Balanceless Bumpless) for Bumpless action at the time of switching between Auto/Manual, .

Refer to 8.17 Continuing Stable Control after the Operation Transfer (SV Tracking) for the SV tracking function.

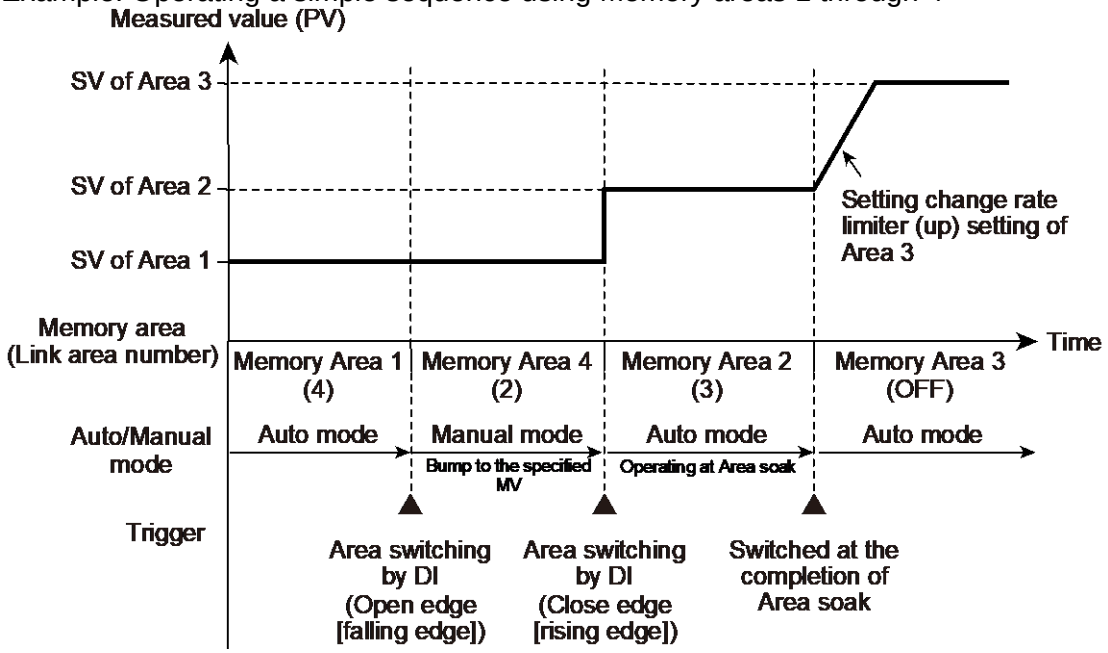
- Manipulated output value (Area): When either “Auto mode (bump)” or “Manual mode (bump)” is selected in the Auto/Manual transfer selection (Area), the Manipulated output value just after the switching is complete needs to be set here.
- Remote/Local transfer selection (Area): Select the Operation mode at the time of Memory area switching. The operation mode depends on the action selected in Select function for input 2.
  - Remote setting input: Remote mode/Local mode switching
  - Cascade control: Cascade control/Single control switching
  - Control with PV select: Input 1/Input 2 switching
  - 2-loop control/Differential temperature control: 2-loop control/Differential temperature control switching

When the SV tracking function is selected at the time of the operation mode transfer, the operation mode follows the action set in the SV tracking.

Refer to 8.17 Continuing Stable Control after the Operation Transfer (SV Tracking) for the SV tracking function.

Besides the above, the Setting change rate limiter unit time and Area soak time unit are set in the Engineering mode

Example: Operating a simple sequence using Memory areas 1 through 4



- **Description of operation**

1. Memory area 1: Operation mode: Auto mode
   Control target: Set value (SV) of Memory area 1
   Area soak time: 0:00 (No function)
   Link area number: 4
   Memory area switching trigger: Open edge (falling edge) of Digital input (DI1)
2. Memory area 4: Operation mode: Switched from Auto mode to Manual mode
   Control output: Bumps to the value specified by the Manipulated output value (Area)
   Area soak time: 0:00 (No function)
   Link area number: 2
   Memory area switching trigger: Close edge (rising edge) of Digital input (DI1)
3. Memory area 2: Operation mode: Switched from Manual mode to Auto mode
   Control target: Set value (SV) of Memory area 2
   Area soak time: 10 minutes
   Link area number: 3
   Memory area switching trigger: 0 (No assignment)
   Area is switched after the completion of the Area soak.
4. Memory area 3: Operation mode: Auto mode continues
   Control target: After changing the Set value (SV) by the Setting change rate limiter, control is done using the Set value (SV) in Memory area 3.
   Area soak time: In this example, the Area soak time for memory area 3 is set. However, as the Area soak time for the memory area linked last will be unavailable, the state of SV3 reached continues.
   Link area number: 0 (No function)
   Memory area switching trigger: 0 (No assignment)

📖 When both of Area soak time and Select trigger type for memory area transfer are available, the switching takes place based on the *OR*-logic.

Parameter setting

- **Select Trigger type for Memory area transfer [Parameter Setting Mode: Parameter group No. 70 (*Pn70*)]**

Parameter symbol	Data range	Factory set value
rAGA	0 to 63 0: No assignment +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Digital input 1 (DI1) Close edge +32: Digital input 1 (DI1) Open edge To select two or more functions, sum each value.	0

☞ To use the generated events as a switching method, setting up the event function is required. To use the Digital input (DI) as a switching method, “Area jump” must be preset in the DI function selection. Refer to 7.2 Using Event Function for the Event function. Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the DI function selection.

- **Area soak time [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
ASr	0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds 0 hours 00 minutes to 99 hours 59 minutes 0 minutes 00 seconds to 199 minutes 59 seconds Data range of Area soak time can be selected on the Soak time unit.	0:00 (0 minutes 00 seconds)

- **Link area number [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
LNKA	0 to 16 0: No link	0

- **Input 1_Auto/Manual transfer selection (Area) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.A/M.A	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump)	0

- **Input 1_Manipulated output value (Area) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
1.MV.A	PID control, Position proportioning PID control: -5.0 to +105.0% Heating/Cooling PID control: -105.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 1_Auto/Manual transfer selection (Area)]	PID control, Position proportioning PID control: -5.0 Heating/Cooling PID control: 0.0

- **Input 2_Auto/Manual transfer selection (Area) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.A/M.A	0: No transfer 1: Auto mode (bumpless) 2: Auto mode (bump) 3: Manual mode (bumpless) 4: Manual mode (bump)	0

📖 To display “Input 2_Auto/Manual transfer selection (Area)”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Input 2_Manipulated output value (Area) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
2.MV.A	-5.0 to +105.0% [When settings either 2: Auto mode (bump) or 4: Manual mode (bump) is selected in Input 2_Auto/Manual transfer selection (Area)]	-5.0

📖 To display “Input 2_Manipulated output value (Area)”, choose “2-loop control/Differential temperature control” in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Remote/Local transfer selection (Area) [Parameter Setting Mode: Parameter group No. 70 (Pn70)]**

Parameter symbol	Data range	Factory set value
R/L.A	• When "Remote setting input" is selected in Select function for Input 2 [1)] 0: No transfer 1: Local mode 2: Remote mode	0
	• When "Cascade control" is selected in Select function for Input 2 [2)] 0: No transfer 1: Single control 2: Cascade control	
	• When "Control with PV select" is selected in Select function for Input 2 [3)] 0: No transfer 1: Input 1 2: Input 2	
	• When "2-loop control/Differential temperature control" is selected in Select function for Input 2 [4)] 0: No transfer 1: 2-loop control 2: Differential temperature control	

[1)] Displayed when "Remote setting input" is selected in "Select function for Input 2."
[2)] Displayed when "Cascade control" is selected in "Select function for Input 2."
[3)] Displayed when "Control with PV select" is selected in "Select function for Input 2."
[4)] Displayed when "2-loop control/Differential temperature control" is selected in "Select function for Input 2", AND when in "2-loop control", "Input 1_Control action" and "Input 2_Control action" is set to "PID control" or "PID Heating/Cooling control".

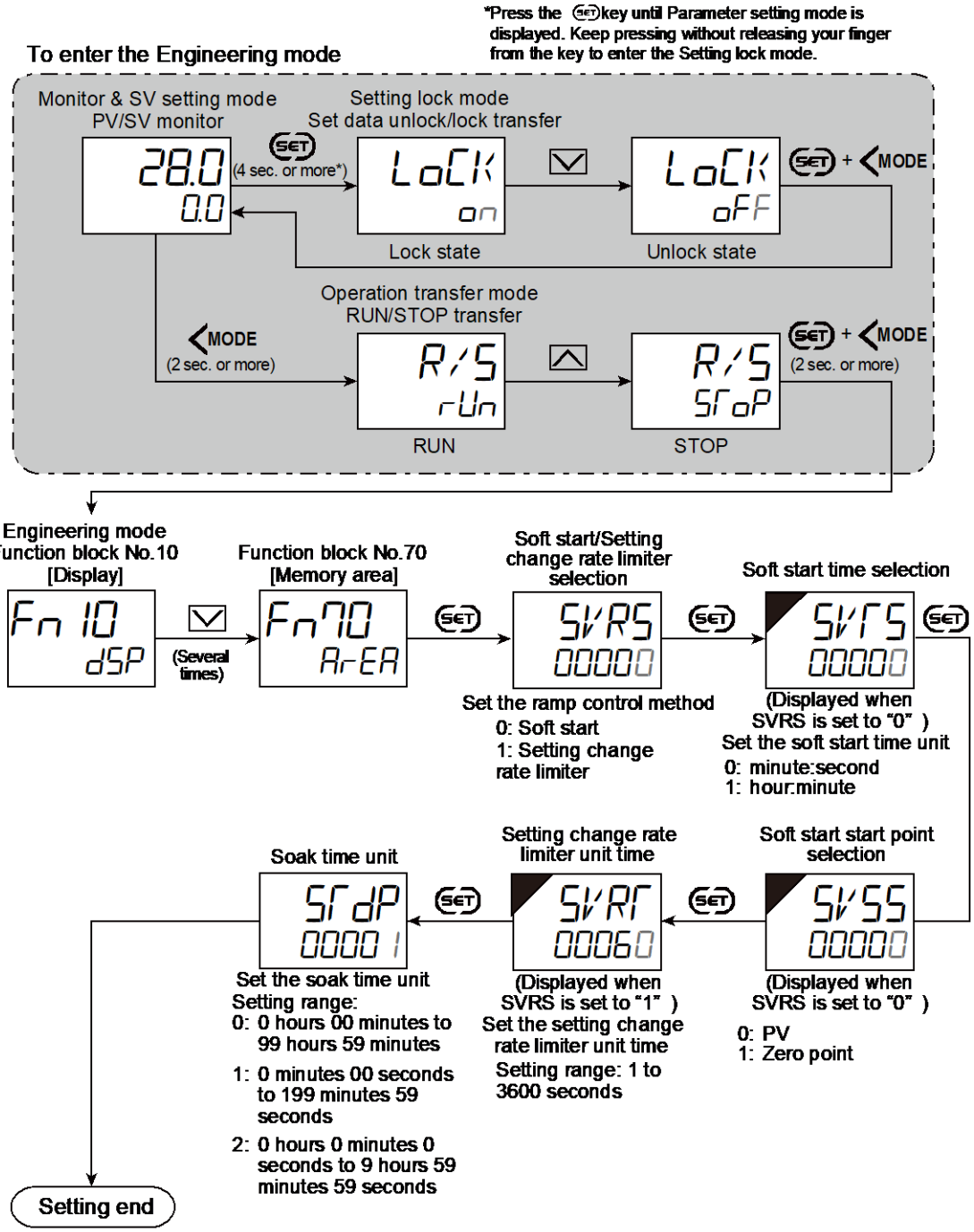

To display "Remote/Local transfer selection (Area)", choose "Remote setting input", "Cascade control", "Control with PV select", or "2-loop control/Differential temperature control" in Function block No. 58: Select function for Input 2 (Engineering mode).

- **Soak time unit [Engineering Mode: Function block No. 70 (Fn70)]**

Parameter symbol	Data range	Factory set value
SrdP	0: 0 hours 00 minutes to 99 hours 59 minutes 1: 0 minutes 00 seconds to 199 minutes 59 seconds 2: 0 hours 00 minutes 00 seconds to 9 hours 59 minutes 59 seconds	1

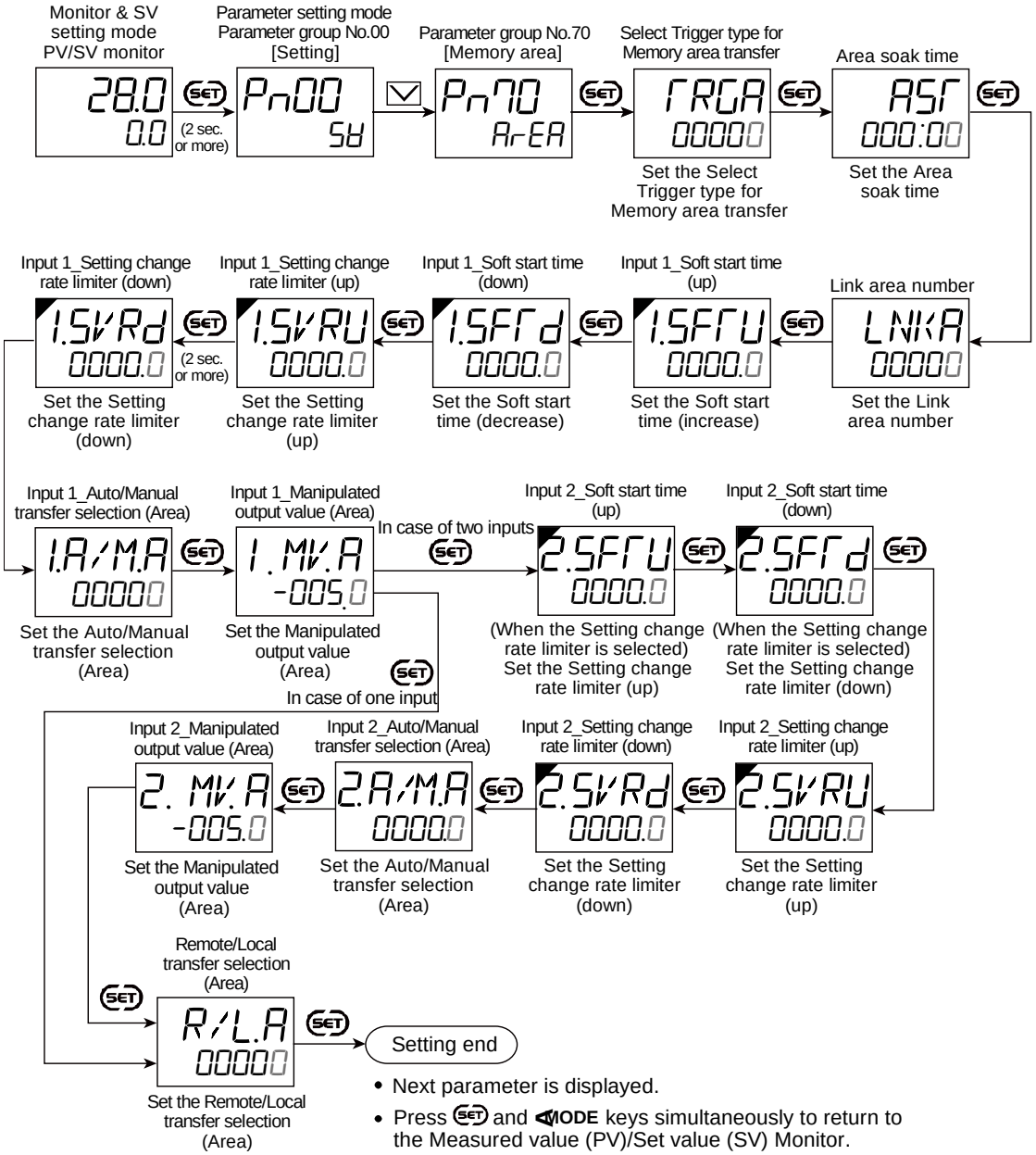
Setting procedure

- **Set the Setting change rate limiter unit time parameter and Soak time unit**



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

● Set the simple sequence related set items



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor. (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

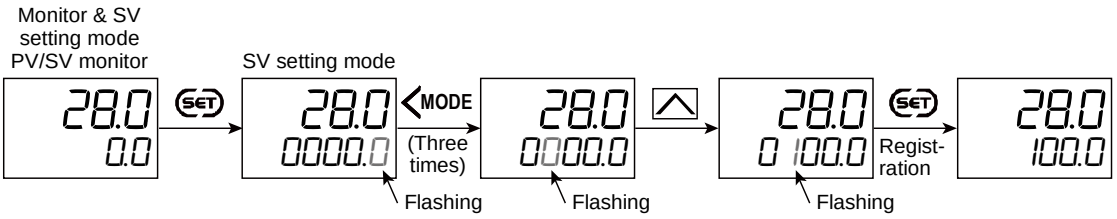
10.7 Registering a Set Value (SV) Without Pressing the SET Key

Basically the SET key must be pressed to register the data after changing the value of parameters.
There is another way of registering the Set value (SV) which takes in the changed data 2 seconds after the change.

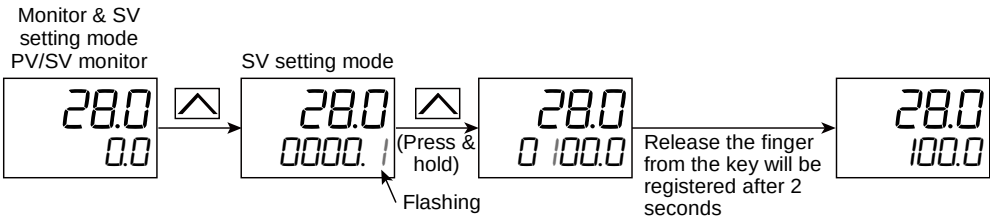
Description of function

[Example: Changing the Set value (SV) to 100.0]

- To register the value by pressing the SET key (SET key method)



- To register the value without pressing the SET key (Direct method)



- To set the Set value (SV) in the PV/SV monitor, press the ∧ or ∨ key.
- Keep pressing the ∧ or ∨ key to accelerate the speed of increase/decrease.
- In the above explanation, the value is changed by using the ∧ or ∨ key, but MODE key may be used to shift the blinking digit to change the value digit by digit.

To use a registration method without pressing the SET key, go to “Data registration” in Function Block No. 11 (Engineering mode).

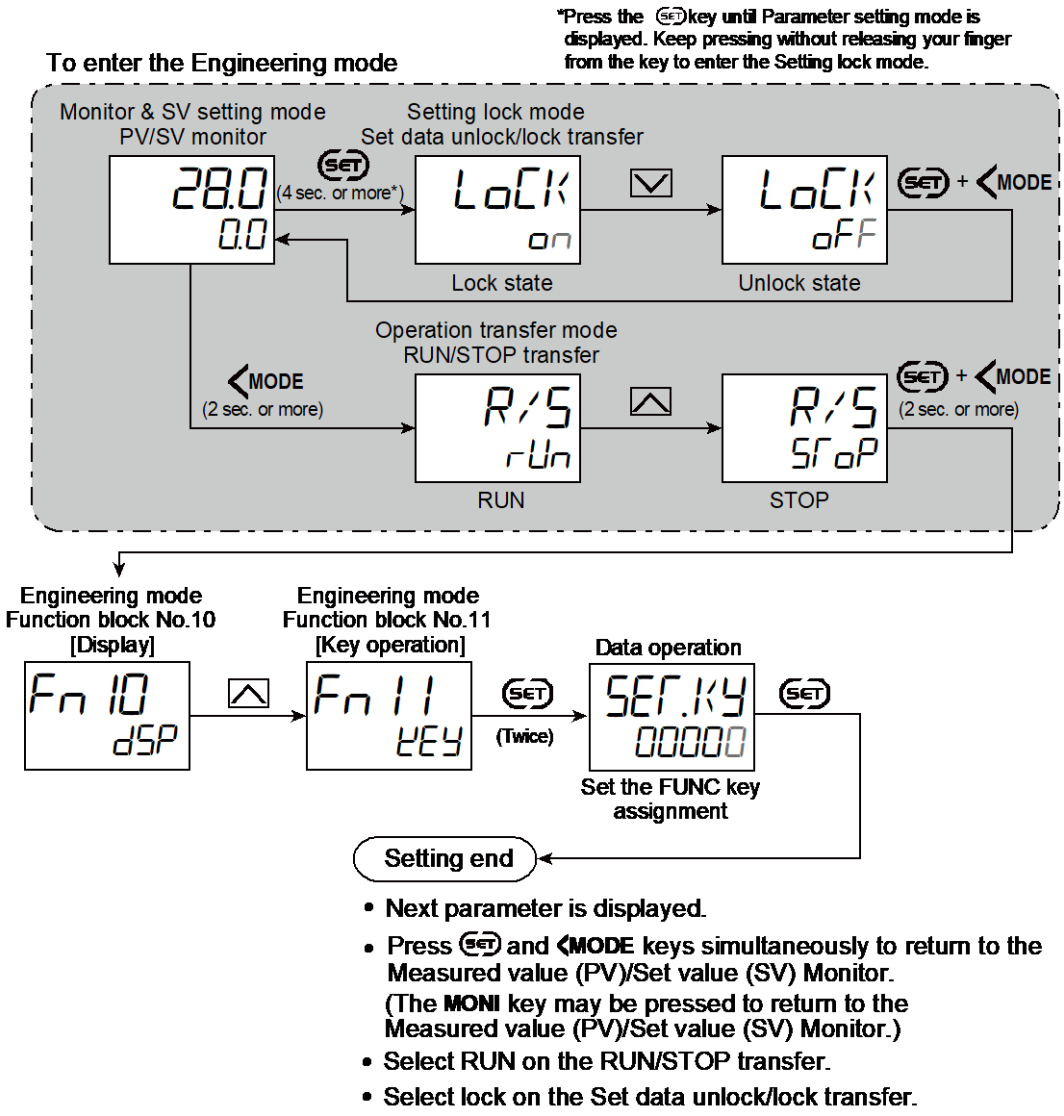
Registration without pressing the SET key is only applicable to the Set value (SV). Other parameters are not available in this method. Available mode is Monitor & SV setting mode only.

Parameter setting

- **Data registration [Engineering Mode: Function block No. 11 (Fn11)]**

Parameter symbol	Data range	Factory set value
SET.KY	0: SET key method Used to register the Set value (SV) using the SET key. 1: Direct registration Used to register the Set value (SV) without pressing the SET key.	0

Setting procedure



10.8 Accessing Some Functions Directly (FUNC Key)

SC-F71 has a FUNC key which allows a specified function to be assigned to it.

Description of function

Functions assignable to the FUNC key

- RUN/STOP transfer: A
- Autotuning (AT) (Common to Input 1 and 2): B
- Input 1_Autotuning (AT): B
- Input 2_Autotuning (AT): B
- Auto/Manual transfer (Common to Input 1 and 2): A
- Input 1_Auto/Manual transfer: A
- Input 2_Auto/Manual transfer: A
- Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control): A
- Control area Local/External transfer: A
- Interlock release: C

- Hold reset (Common to Input 1 and 2): C
- Input 1_Hold reset: C
- Input 2_Hold reset: C
- Set data unlock/lock transfer: A
- Area jump: D
- Parameter setting mode display switching: E

Explanation of key action
A: Mode is changed for every press of the key.
B: Function is turned on and off for every press of the key.
C: Function is released or reset by pressing the key.
D: Pressing the key switches the memory area to the preset area set in the Link area number in the Parameter setting mode. When the Link area number is not specified, a memory area with the number of the current control area number +1 will be used.
E: Pressing the key switches to Parameter setting mode → Setup setting mode → Engineering mode → Parameter setting mode.

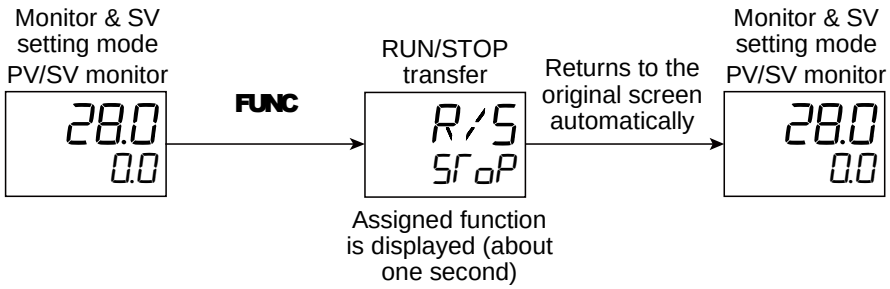
📖 Refer to 5.2 Switching Functions Using Digital Inputs (DI) for the action of each function.

📖 Selection of key action is possible from “Press once” and “Press and hold” to enable the switching.

📖 The function assigned to the FUNC key is accessible even when the Set data lock is used.

- **Displays when switched by the FUNC key**

[Example] RUN/STOP switching is assigned to the FUNC key



Parameter setting

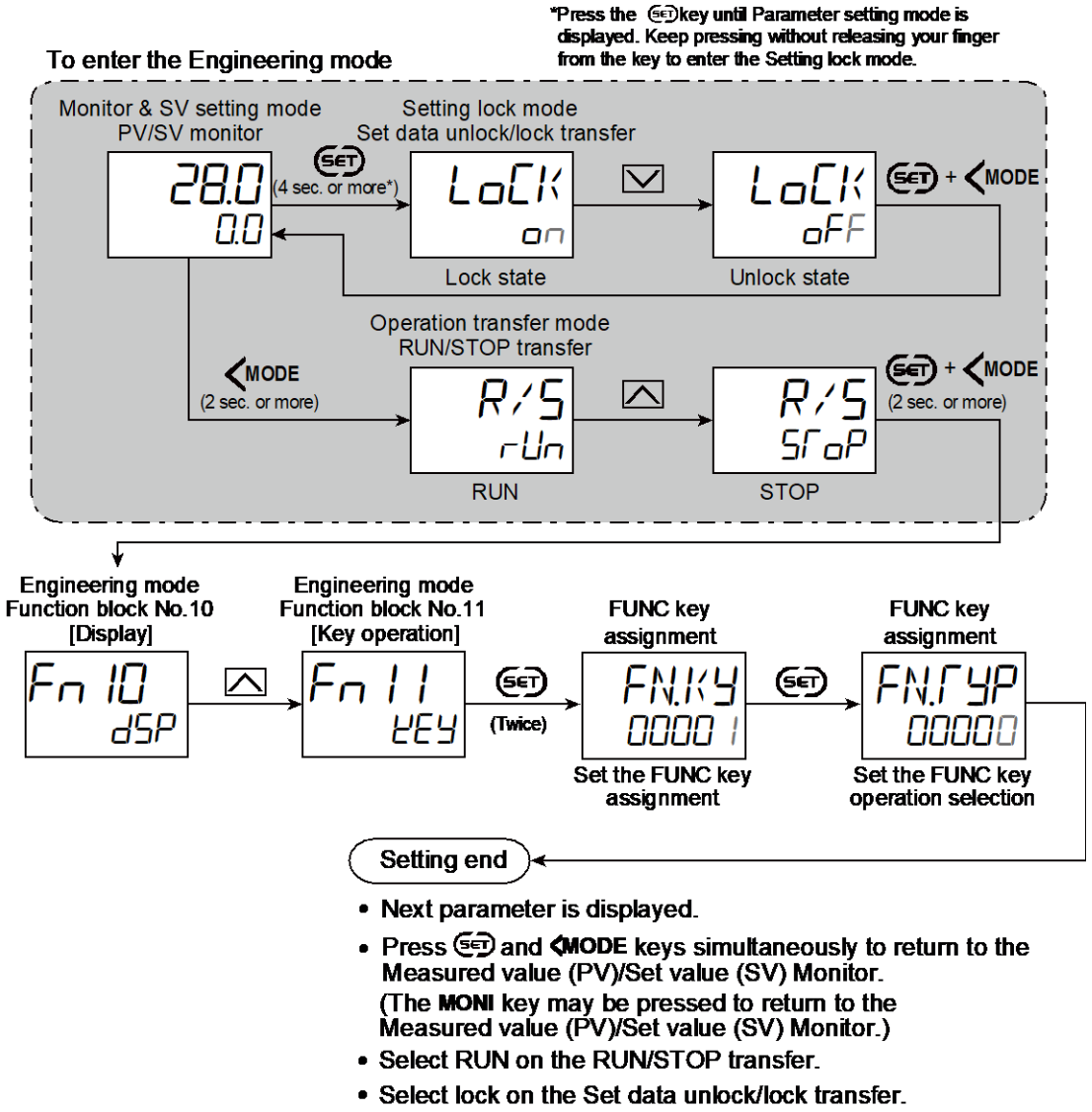
- **FUNC key assignment [Engineering Mode: Function block No. 11 (Fn11)]**

Parameter symbol	Data range	Factory set value
FNKY	0: Unused 1: RUN/STOP transfer 2: Autotuning (AT) (Common to Input 1 and 2) 3: Input 1_Autotuning (AT) 4: Input 2_Autotuning (AT) 5: Auto/Manual transfer (Common to Input 1 and 2) 6: Input 1_Auto/Manual transfer 7: Input 2_Auto/Manual transfer 8: Remote/Local transfer (Cascade mode transfer, PV select transfer, 2-loop control/Differential temperature control) 9: Control area Local/External transfer 10: Interlock release 11: Hold reset (Common to Input 1 and 2) 12: Input 1_Hold reset 13: Input 2_Hold reset 14: Set data unlock/lock transfer 15: Area jump 16: Parameter setting mode display switching	1

● FUNC key operation selection [Engineering Mode: Function block No. 11 (Fn 11)]

Parameter symbol	Data range	Factory set value
FN.TYP	0: Press once The function set at “FUNC key assignment” is activated upon a press of the FUNC key. 1: Press and hold The function set at “FUNC key assignment” is activated by holding the FUNC key pressed.	0

Setting procedure



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

10.9 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 mode. The Area lock restricts switching the Memory areas.

- **Set lock level**

  Select the mode to lock.

Setting lock mode
Set lock level

Set value 0: Unlock
1: Lock

SV setting mode* + Parameter select mode
* Set value (SV), Interlock release
Operation transfer mode
Parameter setting mode
Setup setting mode
Engineering mode

- **Area lock**

Select enable/disable Memory area switching.

Setting lock mode
Area lock

Set value 0: Memory area is adjustable when the setting data is locked.
1: Memory area is not adjustable when the setting data is locked.
(Memory area transfer mode is not displayed)

- **Set data unlock/lock transfer**

The parameter set with Set lock level and Area lock can be locked/unlocked.

Setting lock mode
Set data unlock/
lock transfer

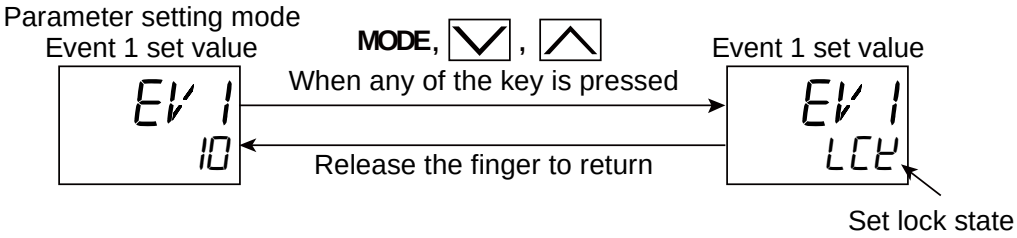
Set value oFF: Unlock state (Settings can be changed)
on: Lock state (Settings cannot be changed)
The Set lock indicator lights on in the lock state.

Set lock display

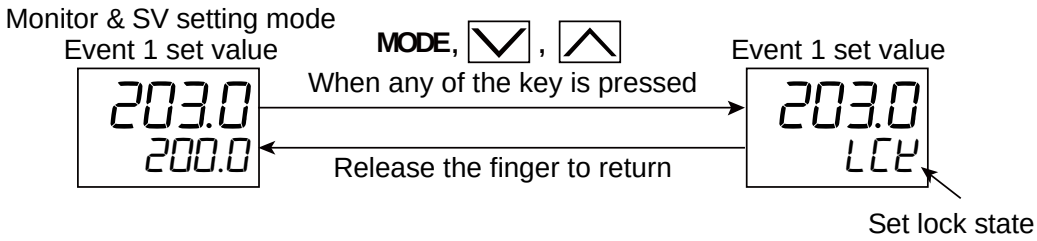
- **When the set value was likely to be changed during the Set data lock state**

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 "LCK" is displayed only while the relevant key is pressed. Releasing the finger from the key will return the display to the original.

Example 1: “Event 1 set value” screen when the Parameter setting mode is locked.



Example 2: “PV/SV monitor” screen when the SV setting mode is locked
(Direct method is selected in Function block No. 11 (Engineering mode))



Switching the Set data lock is available anytime irrespective or RUN or STOP state.

Parameter switching is available during the Set data lock state for checking the data. When the SV setting mode is locked, the Set value (SV) setting screen in the SV setting mode will not be displayed.

Even during the Set data lock state, setting through the communication (optional function) and selection of functions by the FUNC key is possible. It should be noted that when the parameters in the Engineering mode are changed, the instrument must be stopped (or stay in the STOP mode).

Parameter setting

- **Set data unlock/lock transfer [Setting Lock Mode]**

Parameter symbol	Data range	Factory set value
LoCK	oFF: Unlock state on: Lock state	oFF

- **Set lock level [Setting Lock Mode]**

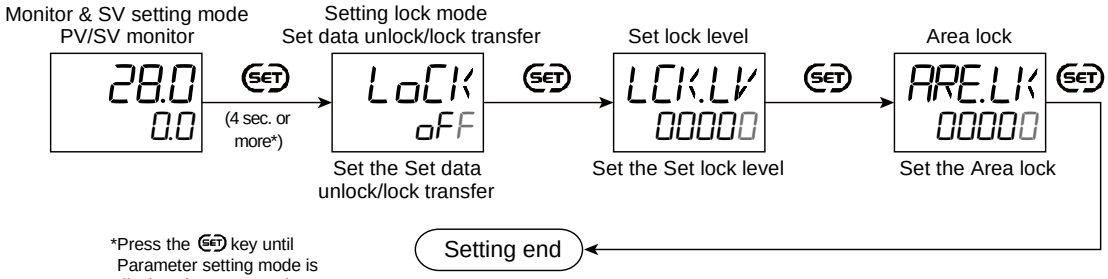
Parameter symbol	Data range	Factory set value
LCK.LV	Set Lock/Unlock at each digit. 00000 ← SV display 0: Unlock 1: Lock SV setting mode* + Parameter select mode * Set value (SV), Interlock release Operation transfer mode Parameter setting mode Setup setting mode Engineering mode	00000

- **Area lock [Setting Lock Mode]**

Parameter symbol	Data range	Factory set value
ARE.LK	0: Memory area is adjustable when the setting data is locked. 1: Memory area is not adjustable when the setting data is locked. (Memory area transfer mode is not displayed)	0

Setting procedure

Set data lock can be found in the Set data lock mode.



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The **MONI** key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)

10.10 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 in Function block No. 91: Initialize screen (Engineering mode), all the set values are initialized and reset to the factory set values.

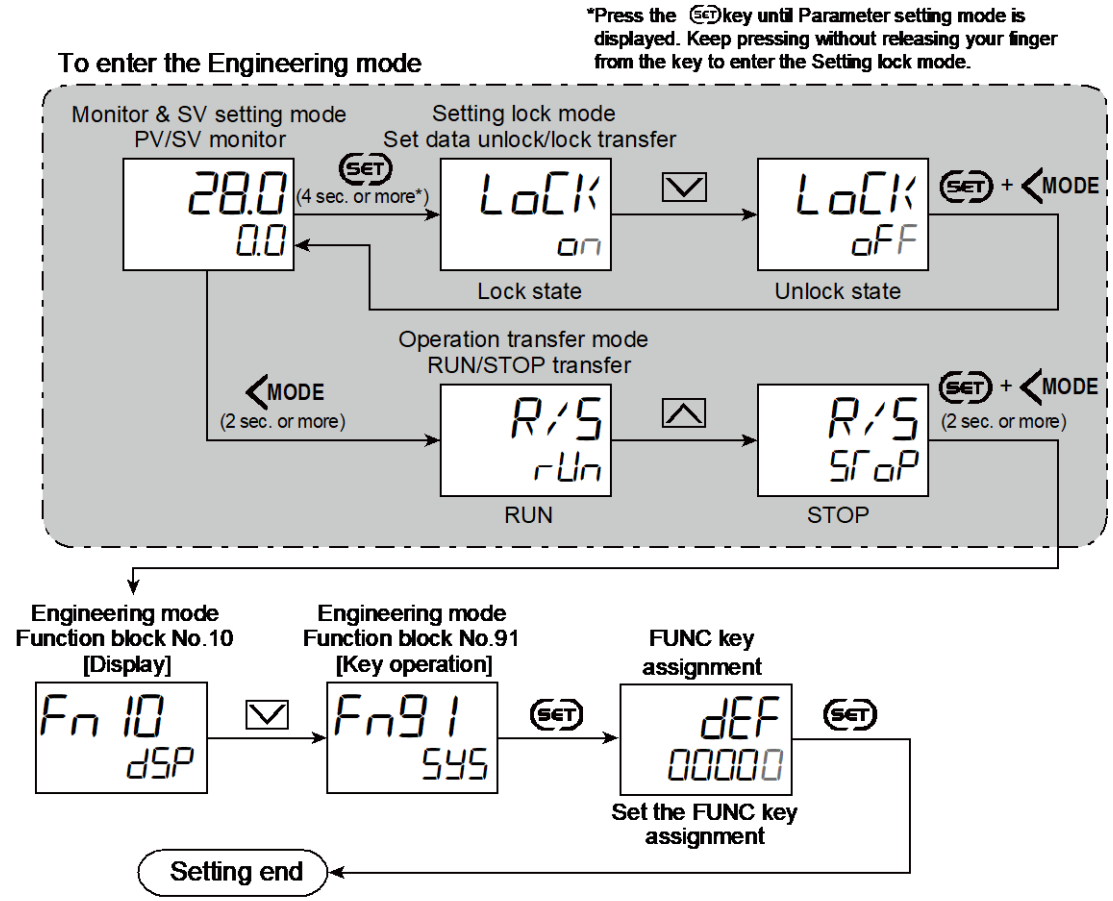
This action initializes and erases all the set values set so far. Record your setting separately if necessary. 3. Parameter List has a field for user set values which can be used for recording.

Parameter setting

- **Initialization [Engineering Mode: Function block No. 91 (Fn9 1)]**

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



- Next parameter is displayed.
- Press SET and MODE keys simultaneously to return to the Measured value (PV)/Set value (SV) Monitor.
  (The MONI key may be pressed to return to the Measured value (PV)/Set value (SV) Monitor.)
- Select RUN on the RUN/STOP transfer.
- Select lock on the Set data unlock/lock transfer.

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3. improper disassembly and reassembly, or inadequate inspection and maintenance by persons other than TLV or TLV group company personnel, or service representatives authorized by TLV; or
4. disasters or forces of nature or Acts of God; or
5. abuse, abnormal use, accidents or any other cause beyond the control of TLV, TII or TLV group companies; or
6. improper storage, maintenance or repair; or
7. operation of the Products not in accordance with instructions issued with the Products or with accepted industry practices; or
8. use for a purpose or in a manner for which the Products were not intended; or
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