(Not for use in Japan)

No. CP-SP-1448E

Single Loop Controller

Model C1M

User's Manual

for Installation and Configuration

Thank you for purchasing your Azbil Corporation product.

This manual contains information for ensuring the safe and correct use of the product.

Those designing or maintaining equipment that uses this product should first read and understand this manual. This manual contains information not only for installation, but also for maintenance, troubleshooting, etc. Be sure to keep it nearby for handy reference.

Azbil Corporation

Getting Up to Speed with model C1M

The quick reference guide on pages D-1 to D-8 summarizes key operations, parameters, and settings, and gives concrete operation examples using illustrations.

Try looking at these pages first, and then read the main text for details.

A separate color version of the quick guide printed on dirt-resistant paper is available for convenient use on the work site (document No. CP-SP-1450E).

Contact the azbil Group or a distributor for details.

NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.

In no event is Azbil Corporation liable to anyone for any indirect, special, or consequential damages as a result of using this product.

Safety Requirements

To reduce the risk of an electric shock resulting in personal injury, follow all safety notices in this document.

This symbol warns the user of a potential shock hazard.

The use of this product in a manner not specified by the manufacturer may impair its built-in safety features.

Do not replace any component except as specified by the manufacturer.

Wiring should be carried out by an experienced and qualified worker according to local regulations.

Be sure to mount a switch for shutting off the main power to this product within reach of the operator.

When wiring the power for this device, install a time-lag (T) fuse (rated current 0.5 A, rated voltage 250 V). (IEC 60127)

● Device Ratings

Voltage:	100 to 240 V AC (operating voltage: 85 to 264 V AC)
Frequency:	50/60 Hz
Power consumption:	8 VA max.

● Operating Environment

Do not operate this device in the presence of flammable liquids or vapors. Operation in such environments is a safety hazard.

Operating temperature:	−10 to +55 °C
Operating humidity:	10 to 85 % RH (without condensation)
Vibration:	0 to 5 m/s^2 (10 to 60 Hz)
Overvoltage category:	II (IEC 60364-4-443, IEC 60664-1)
Pollution degree:	2
Installation location:	indoors
Elevation:	2000 m max.

● Device Installation

This product should be installed in a panel to protect the operator from accidental contact with the rear terminals.

Common mode voltage of all I/O except for supply power and relay contact outputs: voltage to ground of 30 V_{rms} max., 42.4 V peak max., and 60 V DC max.

● Standards compliance

EN 61010-1, EN 61326-1 (for use in industrial locations)

During EMC testing, the reading or output may fluctuate by ±10 % FS (for MFB: ±30 % FS).

Conventions Used in This Manual

■ The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

⚠WARNING	**Warnings are indicated when mishandling this product may result in death or serious injury.**
⚠CAUTION	**Cautions are indicated when mishandling this product may result in minor injury or property damage only.**

■ In describing the product, this manual uses the icons and conventions listed below.

Indicates that caution is required in handling.

The indicated action is prohibited.

Be sure to follow the indicated instructions.

Handling Precautions:

Information to be aware of when handling.

Note: Indicates information that may be useful.

☞: Indicates an item or page to which the user may refer.

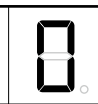
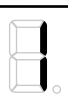
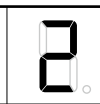
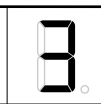
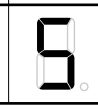
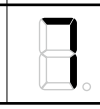
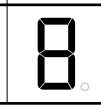
(1), (2), (3): Steps in a sequence or parts of a figure, etc.

[PARA], [MODE], etc. Indicates keys on this device.

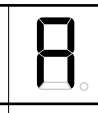
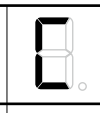
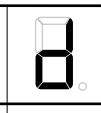
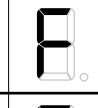
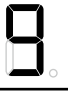
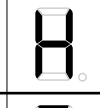
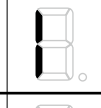
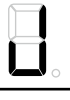
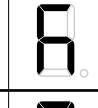
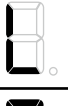
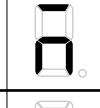
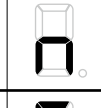
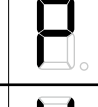
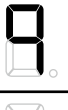
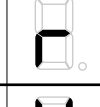
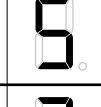
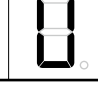
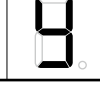
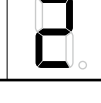
≫: Indicates the result of an operation, or the status after the operation.

● Numeric value and character display on LCD

Numeric values: The 7-segment LCD expresses numeric values as follows:

0		1		2		3		4	
5		6		7		8		9	

Alphabetical characters: The 7-segment LCD expresses alphabetical characters shown below. There are some alphabetical characters which are not displayed on the LED.

A a		B b		C c		D d		E e	
F f		G g		H h		I i		J j	
K k		L l		M m		N n		O o	
P p		Q q		R r		S s		T t	
U u		V v		Y y		Z z		–	

Handling Precautions:

- As shown above, the following are shown in the same way: the number 2 and the letter Z, the number 5 and the letter S, and the number 9 and the letter Q.

Safety Precautions

WARNING

To prevent electrical shock, this device must be installed in a location that is only accessible to people with appropriate knowledge about electrical safety. Install this device inside a control panel that cannot be opened without the use of a key or tool.
Do not use this device in an environment with conductive contamination, or with dry non-conductive contamination which can become conductive due to condensation, etc. Otherwise, problems such as tracking phenomena may damage parts, resulting in fire.
Be sure to use the fuse described in the specifications for the power wiring of this device. Otherwise, tracking phenomena or parts failure due to other factors may cause fire.
Be sure to check that the device has been correctly wired before turning on the power. Incorrect wiring of this device may cause device failure and also lead to a dangerous accident.
Before removing, mounting, or wiring this device, be sure to turn off the power to this device and all connected devices. After wiring this device, attach the separately sold terminal cover (model No. 84515888-001). Otherwise, there is a danger of electric shock.
Do not touch live parts such as the power terminals. There is a danger of electric shock.
Do not disassemble this device. There is a danger of electric shock or device failure.

CAUTION

Use this device within the operating ranges given in the specifications (for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Otherwise, there is a danger of fire or device failure.
Do not block the ventilation holes. There is a danger of fire or device failure.
Wire this device correctly in compliance with applicable standards, and use the power source and installation methods specified in this user's manual. Otherwise, there is a danger of fire, electric shock, or device failure.
Do not allow wire clippings, metal shavings, water, etc., to enter the case of this device. There is a danger of fire or device failure.
Firmly tighten the terminal screws to the torque listed in the specifications. Insufficient tightening may result in fire or electric shock.
Do not use unused terminals as relay terminals. There is a danger of fire, electric shock, or device failure.
Use the relays within the recommended service life. Otherwise, there is a danger of fire or device failure.
Use an appropriate overcurrent protection device (fuse, circuit breaker, etc.) with a sufficient breaking capacity for lines to which the relays of this device are connected to protect the circuits. Otherwise, there is a danger of fire or device failure.

⚠CAUTION

	If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Otherwise, there is a danger of fire or device failure.
	Do not operate the keys with a sharp object (such as a mechanical pencil tip, etc.). Doing so can cause device failure.
	To remove dirt from this device, wipe it with a soft dry cloth. **Never use an organic solvent such as paint thinner or benzene, or a detergent.**
	Do not use this device in wet places or with wet hands. **There is a danger of electric shock.**
	Do not use the PV input or current transformer input for measurement in a place that falls into measurement category II, III, or IV. There is a danger of fire, electric shock, or device failure.

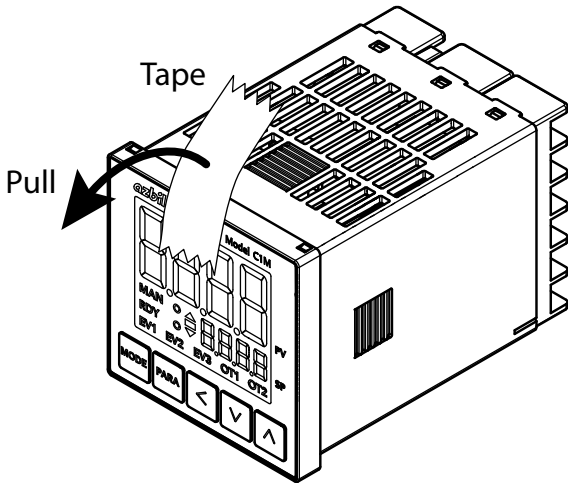
Before Using This Device

There is a film over the console on the front of this device to protect the surface.

After the installation and wiring work is completed, stick a piece of tape on the corner of the console and pull it in the direction indicated by the arrow below to remove the protective film.

[!] Handling Precautions:

- Removing the protective film with your fingernail may cause scratches on the console.



To ensure safe use of this product, use the latest firmware.

Note

- ☞ ■ Updating the firmware (p. 11-6) (for details on firmware updates)

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- A part of this product's software is licensed from Renesas Electronics Corporation.
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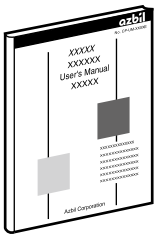
The Role of This Manual

There are five different manuals related to model C1M Single Loop Controller (hereafter "this device").
Read them as necessary for your specific requirements.
If you do not have a manual you require, please contact us or one of our dealers.
Alternatively, you can download the necessary manuals from https://aa-industrial.azbil.com/jp/en.

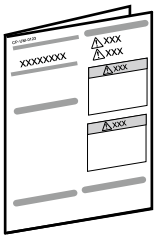


Single Loop Controller Model C1M User's Manual for Installation and Configuration
Document No. CP-SP-1448E

This manual.

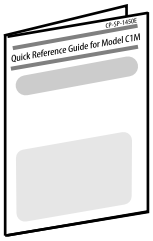
This manual describes the hardware and all functions of this device. Personnel in charge of the design, manufacture, operation, or maintenance of equipment that incorporates this device, or those in charge of communication software for equipment that uses this device's communication functions, should read this manual thoroughly.

This manual also describes the installation, wiring, connections for communication, functions and settings of this device, operating procedures, communication with a master station (PC, etc.), communication addresses, troubleshooting, and detailed specifications.



Single Loop Controller Model C1M User's Manual
Document No. CP-UM-5964JEC

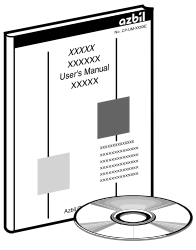
This manual is supplied with the product. It has descriptions in Japanese, English, and Chinese. Personnel in charge of the design or manufacture of equipment that incorporates this device should read this manual thoroughly. This manual covers safety precautions, installation, wiring, main specifications, and parameters of this device. For further information about operation, refer to the user's manual for installation and configuration.



Quick Reference Guide for Model C1M
Document No. CP-SP-1450E

For those using this device for the first time or for operators on the work site, this guide serves as a reference when specifying parameters.

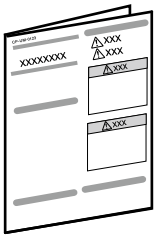
Key operations, menu flowcharts and parameter settings are described with color illustrations.



User's Manual for Detailed Functions of Smart Loader Package Model SLP-C1F for Single Loop Controller Model C1M/ C1A/C2/C3
Document No. CP-SP-1463E

This manual is supplied with Smart Loader Package model SLP-C1F.

This manual describes the software used on a PC to configure model C1M. Those designing or setting up equipment that uses model C1M should read this manual. The manual describes installation of the software into a PC, operation of the PC, various functions, and setup procedures.



Smart Loader Package Model SLP-C1F Installation Manual
Document No. CP-UM-5986JEC

This manual is supplied with the product. It has descriptions in Japanese, English, and Chinese. Personnel in charge of the design or manufacture of equipment that incorporates this device should read this manual thoroughly. This manual covers safety precautions, installation, wiring, main specifications, and parameters of this device. For further information about operation, refer to the user's manual on detailed functions.

Organization of This User's Manual

This manual is organized as shown below.

Quick Reference Guide

Parameters, settings, and concrete operation examples with illustrations.
For quick understanding of this device, read this section first.

Chapter 1. Overview

This product's applications, features, model selection, and part names and their functions. The terms introduced in this chapter are used in the subsequent descriptions, so make sure to understand them.

Chapter 2. Outline of Functions

Overview of functions and operations.

Chapter 3. Installation

Operating environment, installation procedures, necessary tools.

Chapter 4. Wiring

Wiring procedures and precautions, and connection examples.

Chapter 5. Functions

Detailed description of functions.

Chapter 6. Displayed Items and Settings

Displayed items and settings.

Chapter 7. CPL Communication Function

Communication with a host device (PC, PLC, etc.) using Azbil's standard CPL communication and RS-485.

Chapter 8. Modbus Communication Function

Communication with a host device (PC, PLC, etc.) using Modbus communication and RS-485.

Chapter 9. PLC Link Communication Function

Communication with a PLC using RS-485 without the need for special programs.

Chapter 10. List of Communication Data

A list of communication data in the memory of this device.

Chapter 11. Maintenance and Troubleshooting

Maintenance, inspection, and troubleshooting.

Chapter 12. Calibration and Inspection

Calibration to maintain accuracy for safe operation.

Chapter 13. Disposal

Disposal of this device when it is no longer used.

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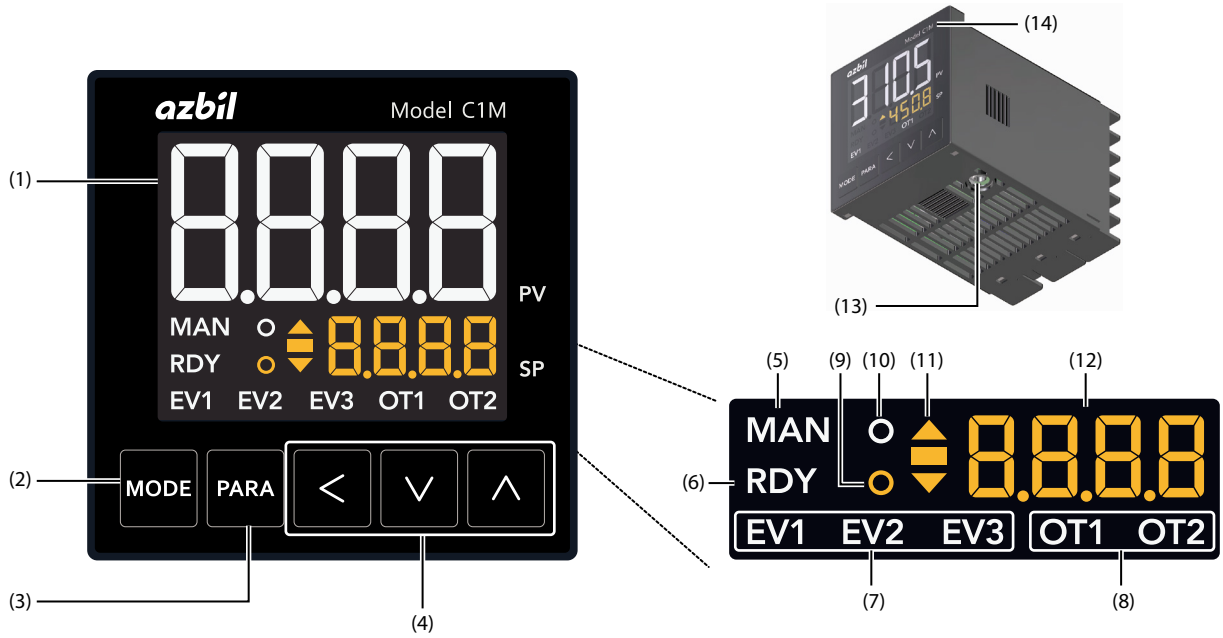
Quick Reference Guide for Model C1M

This guide offers a summary of key operations, parameter flowcharts, and settings, for convenient reference at the operation site This guide is made for repeated use. Dirt wipes off easily and even notes written with an oil-based felt-tip pen can be removed with an eraser.
If more detailed information on model C1M is needed, refer to the user's manual for installation and configuration (CP-SP-1448E).
The most convenient way to configure the C1M is with the Smart Loader Package (model No. SLP-C1FJA_). Please contact the azbil Group or a distributor for more information.



(1)	Upper display	Shows PV (present temperature, etc.) or items that can be set.
(2)	[MODE] key	Pressing this button shows the operation display. If it is held down for 1 second or longer, the preset operation (initial setting: AUTO/MANUAL selection) can be executed.
(3)	[PARA] key	Switches the display.
(4)	[＜], [∨], and [∧] keys	Used for incrementing/decrementing numeric values and performing arithmetic shift operations.
(5)	MAN mode indicator	Lights up in MANUAL mode.
(6)	RDY mode indicator	Lights up in READY (control stop) mode.
(7)	Event indicator	Lights up when the corresponding event output is ON.
(8)	Control output indicator	Lights up when the corresponding control output is ON.
(9)	Status indicator	Lights up according to the setting of the status indicator. (Default: Not used)
(10)	AT indicator	Flashes during AT execution.
(11)	Ramp indicator	Indicates the operation status of an SP ramp or a step operation.
(12)	Lower display	Shows SP (set temperature, etc.) and other settings.
(13)	Loader connector	Connected to the PC using the USB loader cable included with the Smart Loader Package.
(14)	Protective film	Protects the surface. Please remove the protective film before use.

Flowchart of Key Operations and Displays

When the power is turned ON

Power-on → all on → all off → sequential on and off → operation display (sequence takes about 9 s)

PV → SP → LSP group No. → SP → Step No. → Step remaining time → MV → MV for heating → MV for cooling

(2) (1)

Timer remaining time 3 → Internal event 3 delay time

[PARA] key *3 ← UF-8 *1 ← UF-7 ← UF-2 ← UF-1 ← t3.--

2-second press of [PARA] key

【MODE】 【SP】 【Event】 【PID】 【Parameter】 【Extended tuning】

(A)

(If AUTO) When changed from MANUAL to AUTO → (2)

(If MANUAL) When changed from AUTO to MANUAL → (1)

r---r
AT
ATER
dOLT
Udb1

[PARA] key *3

SP-1
PId1
rnP1
tIn1
SP-8
PId8
rnP8
tIn8

E1
E1Sb
E1HY
E1on
E1oF
ES
ESSb
ESHY
ESon
ESoF

P-1
I-1
d-1
rE-1
oL-1
oH-1
P-1C
I-1C
d-1C
oL1C
oH1C
P-8
I-8
d-8
rE-8
oL-8
oH-8
P-8C
I-8C
d-8C
oL8C
oH8C

CtrL
AtoL
AtoH
diFF
oFFS
FL
rA
bI
CyU
Cy
tPo
CyU2
Cy2
tPo2
tPty
SPU
SPd

AtTy
SPL9
At-P
At-I
At-d
AtPt
AtPu
CtrA
CL9

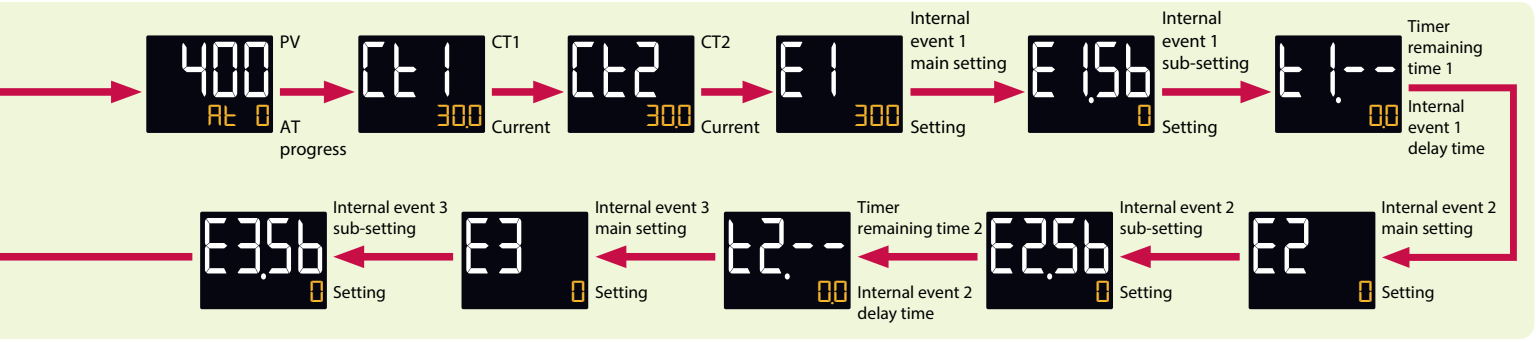
[PARA] key

2-second press of [PARA] key

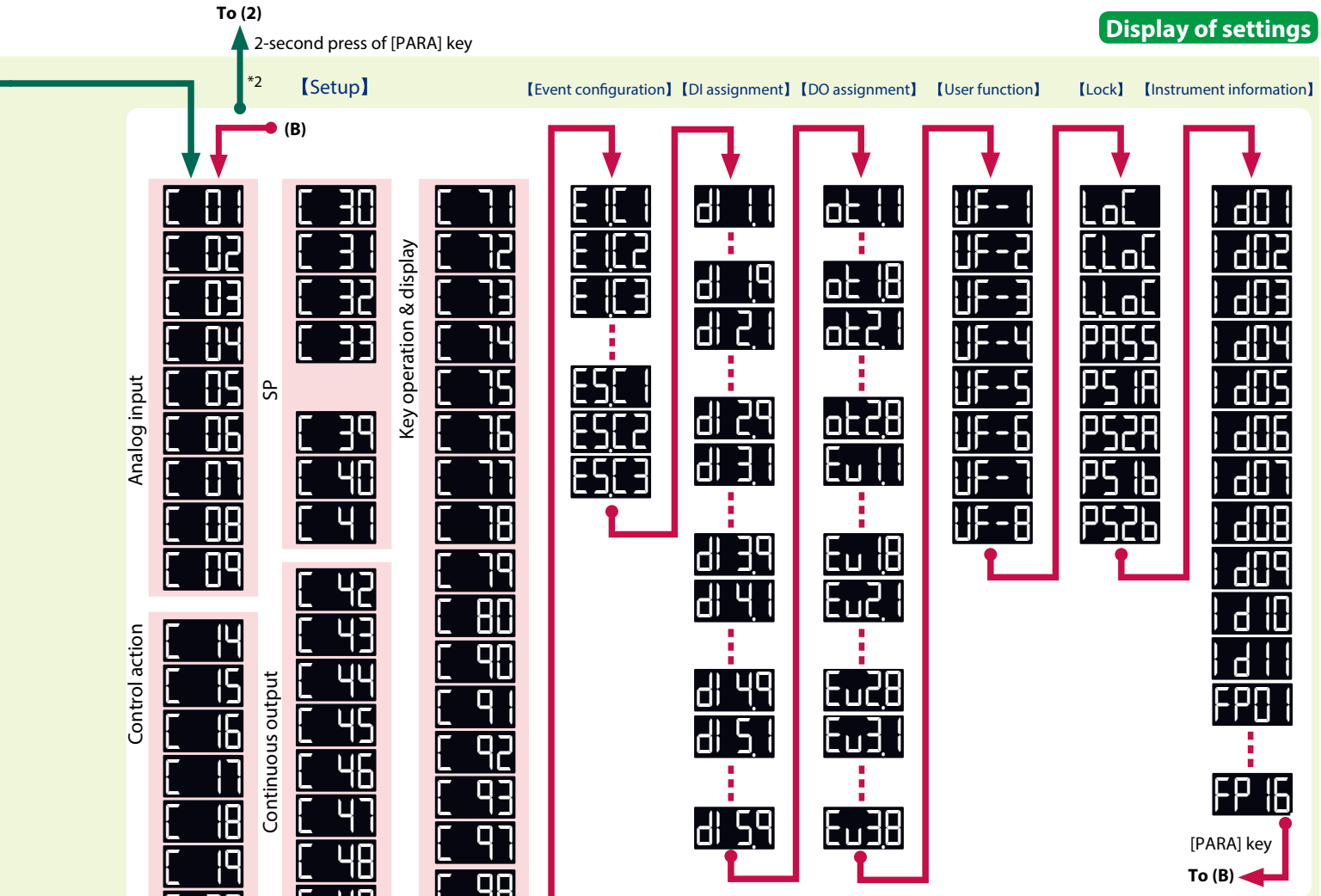
To (A)

○ Some items are not displayed depending on the availability of optional functions, model number, display setup (C73 to C78) and user level (C79).
○ Pressing the [PARA] key while changing the setting of an item will cancel the change, and the next item will be displayed.

Operation display



Display of settings



*1 The parameters and numerical values registered as user functions UF are displayed.
*2 If no key is pressed for 3 minutes, the display automatically returns to (2), the PV display.
*3 If the [＜] key is pressed while holding down the [PARA] key, various displays/settings can be navigated in reverse order.

■ Explanation of arrows
[PARA] key: →
2-second press of [PARA] key: →

■ Item selection in setup menus
[PARA] key (move to next item)
[PARA] + [＜] (to previous item)

Operation Examples

Red letters: Initial setup procedure

Blue letters: Procedure during operation

Setup of PV input range type

1 Press [MODE] once to show the operation display.

If the sensor has not been wired or is disconnected, an alarm for abnormal PV input (any one from AL01 to AL11) may appear on the upper display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

In ON/OFF control, r--r is on the upper display.

3 Hold down [PARA] for 2 s or longer again.

The setup screen showing the setting for C01 (PV input range type) is displayed.

4 Press [<], [∨], or [∧]. The rightmost digit on the lower display flashes and its value can be changed.

Select the range of the sensor (see the PV input range table) by pressing [<], [∨], or [∧].

Do not press any key for 2 s. The new value stops flashing and is now set.

Setup of event operation type

In this example, the operation type of event 1 is set to "deviation high limit."

1 Press [MODE] once to show the operation display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

3 Hold down [PARA] for 2 s or longer again.

The setup screen showing the setting for C01 (PV input range type) is displayed.

4 Press [PARA] several times. E1C1 is shown on the upper display and 0 on the lower display.

0 on the lower display means that no event is set.

5 Press [∨] or [∧]. The rightmost digit on the lower display flashes.

Press [∨] or [∧] until 4 is displayed. Do not press any key for 2 s. The new value stops flashing and is now set.

4 on the lower display means that the event operation type is "deviation high limit."

Use E2C1 to set the operation type for event 2, and E3C1 for event 3.

Execution of automatic tuning (AT)

AT forces ON/OFF of the MV a number of times (a limit cycle) to calculate PID values. Check that this operation does not create any problems for the associated equipment before executing AT.

1 Press [MODE] once to show the operation display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

3 Press [PARA] twice. AT is shown on the upper display and AToF on the lower display.

If the control method is ON/OFF control and if bit 3 (AT stop/start display) of C13 (mode display setup) is "0" (disabled), the parameter and setting are not displayed.

4 Press [∨] or [∧]. AToF flashes.

The display flashes only in RUN and AUTO modes, and only if there is no PV input error.
Also, if "AT stop/start" is set as the DI assignment, the display does not flash and the setting cannot be changed using the keys.

5 Press [∧] once. ATon flashes on the lower display.

6 Do not press any key for 2 s. ATon stops flashing and AT begins.

During AT, the AT indicator flashes.

When AT and the calculation of PID constants are done, the indicator turns off.

During the AT process, if the mode is changed to READY or MANUAL, if PV input is faulty, or if a power failure occurs, AT stops automatically without changing the PID constants. AT can also be stopped by changing the setting from ATon to AToF (return to step 3 above).

Setup of the SP

1 Press [MODE] once to show the operation display.

2 Check that the operation display shows the SP.

(If not, press [PARA] several times until it is displayed).

3 Press [<], [∨], or [∧]. The rightmost digit on the lower display flashes and its value can be changed. Change to the desired SP by pressing [<], [∨], or [∧].

Flashing means the setting has not been finalized.

If the SP limit function is enabled, a value exceeding the limit cannot be set. If you need to change the value, change the SP limit first.

4 Do not press any key for 2 s. The new value stops flashing and is now set.

If [MODE] is pressed while the setting is flashing, the status returns to that of step 1.

For highlighted steps (e.g., 4), if keys are locked, the setting does not flash and cannot be changed. To change the setting, cancel the key lock first.

RUN/READY mode selection

1 Press [MODE] once to show the operation display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

In ON/OFF control, r--r is on the upper display.

3 Press [PARA] once. r--r is shown on the upper display and rdY or rUn is shown on the lower display.

The current mode is indicated by rUn (RUN) or rdY (READY).

4 Press [∨] or [∧]. The lower display flashes.

If "RUN/READY selection" is set as the DI assignment, the display does not flash and the mode cannot be changed using the keys.

5 Press [∨] or [∧] to select rUn or rdY.

6 Do not press any key for 2 s. The new value stops flashing and the mode is now set.

Setup of PID values

1 Press [MODE] once to show the operation display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

3 Press [PARA] several times. P-1 (proportional band) is shown on the upper display and the present setting is shown on the lower display.

If the control method is ON/OFF control, the parameter and setting are not displayed.

4 Press [<], [∨], or [∧]. The rightmost digit on the lower display flashes and its value can be changed.

Change to the desired P value by pressing [<], [∨], or [∧].

Flashing means the setting has not been finalized.

The setting range of the proportional band is from 0.1 to 999.9 %.

5 Do not press any key for 2 s. The new value stops flashing and is now set.

If [MODE] is pressed while the setting is flashing, the status returns to that of step 1.

Use I-I for specifying the integral time (0–9999 s) and d-I for the derivative time (0–9999 s).

Setup of event value

1 Press [MODE] once to show the operation display.

2 Hold down [PARA] for 2 s or longer. The screen for specifying parameters is shown with A--M on the upper display.

3 Press [PARA] several times. E I is shown on the upper display and 0 on the lower display.

0 on the lower display means that the event main setting is "0."

4 Press [<], [∨], or [∧]. The rightmost digit on the lower display flashes and its value can be changed.

Change to the desired event setting by pressing [<], [∨], or [∧].

Flashing means the setting has not been finalized.

5 Do not press any key for 2 s. The new value stops flashing and is now set.

If [MODE] is pressed while the setting is flashing, the status returns to that of step 1.

Use E2 to specify the setting for event 2, and E3 for event 3.

6 To proceed to hysteresis setup, press [∨] twice or press [∧] several times. E IHY is shown on the upper display and 5 on the lower display.

5 on the lower display means that the hysteresis setting is "5."

7 Press [<], [∨], or [∧]. The rightmost digit on the lower display flashes and its value can be changed.

Change to the desired hysteresis setting by pressing [<], [∨], or [∧].

Do not press any key for 2 s. The new value stops flashing and is now set.

Use E2HY to specify the hysteresis setting for event 2, and E3HY for event 3.

Memo

Parameters

: Essential parameters for PV measurement and control
: Basic parameters
: Required when using optional functions

Operation settings

Display Left: upper display Right: lower display		Item	Contents	Initial value	Setting
Value (PV)	Value (SP)	SP (target value)	SP low limit to SP high limit	0	
LSP 1*1	LSP	LSP No. (the last digit)	1 to LSP system group (max. 8)	1	
SE 1-*1	Step remaining time	Step No., step remaining time	Not applicable Step No. indicates whether the process is ramp-up, ramp-down, or soak.	-	
oUt	Value	MV (Manipulated Variable)	-10.0 to +110.0 % Setting is enabled in MANUAL mode (value flashiing)	-	
HEAt	Value	Heat MV (Manipulated Variable)	Not applicable.	-	
CooL	Value	Cool MV (Manipulated Variable)	-10.0 to +110.0 %	-	
Value (PV)	AT 1*1	AT progress display (the last digit)	Not applicable.	-	
Ct 1	Value	CT current value 1	Not applicable.	-	
Ct2	Value	CT current value 2	Not applicable.	-	
E 1	Value	Internal Event 1 main setting	-1999 to +9999U or 0 to 9999U	0	
E 1Sb	Value	Internal Event 1 sub-setting		0	
t 1--*1	Value	Timer remaining time 1	Not applicable. Upper display: ON delay / OFF delay distinction is displayed.	-	
E2	Value	Internal Event 2 main setting	Same as Internal Event 1 main setting	0	
E2Sb	Value	Internal Event 2 sub-setting	Same as Internal Event 1 sub-setting	0	
t2--*1	Value	Timer remaining time 2	Same as Timer remaining time 1	-	
E3	Value	Internal Event 3 main setting	Same as Internal Event 1 main setting	0	
E3Sb	Value	Internal Event 3 sub-setting	Same as Internal Event 1 sub-setting	0	
t3--*1	Value	Timer remaining time 3	Same as Timer remaining time 1	-	

*1 Display example

Parameter settings

【Mode bank】

Display	Item	Contents	Initial value	Setting
A--M	AUTO/MANUAL	AUto: AUTO mode MAn: MANUAL mode	AUTO	
r--r	RUN/READY	rUn: RUN mode rdy: READY mode	RUN	
AT	AT execution/stop instructions	AtoF: AT stop Aton: AT execution	AT stop	
AtEr	Auto tuning error	ErnF: Normal Ern: Abnormal	Normal	
doLt	Release all DO latchs	Lton: Latch continue LtoF: Latch release	Latch continue	
Udb 1	User-defined bit	dboF: OFF dbon: ON	OFF	

【SP bank】

Display	Item	Contents	Initial value	Setting
SP-1 ~ SP-8	SP (for LSP1 to 8)	SP low limit to SP high limit	0	
PId1 ~ PId8	PID group number (for LSP1 to 8)	1 to 8	1	
rAP1 ~ rAP8	Ramp (for LSP1 to 8)	0 to 9999U	0	
tI A1 ~ tI A8	Soak time (for LSP1 to 8)	0.0 to 999.9 or 0 to 9999	0	

【Event bank】

Display		Item	Contents	Initial value	Setting
E 1 ~ E5		Internal Event 1 to 5 main setting	-1999 to +9999U or 0 to 9999U*	0	
E 1Sb ~ E5Sb		Internal Event 1 to 5 sub-setting		0	
E 1HY ~ E5HY		Internal Event 1 to 5 hysteresis	0 to 9999U*	5	
E 1on ~ E5on	●	Internal Event 1 to 5 ON delay time	0.0 to 999.9 or 0 to 9999	0	
E 1oF ~ E5oF	●	Internal Event 1 to 5 OFF delay time		0	

* The number of decimal places changes according to the operation type of the internal event.

【PID bank】

Display		Item	Contents	Initial value	Setting
P- 1 ~ P-8		Proportional band (1 to 8)	0.1 to 999.9 %	5.0	
I- 1 ~ I-8		Integration time (1 to 8)	0 to 9999 s (No integral control action when set at "0")*	120	
d- 1 ~ d-8		Derivative time (1 to 8)	0 to 9999 s (No derivative control action when set at "0")*	30	
rE- 1 ~ rE-8		Manual reset (1 to 8)	-10.0 to +110.0 %	50.0	
oL- 1 ~ oL-8	●	MV low limit (1 to 8)	-10.0 to +110.0 %	0.0	
oH- 1 ~ oH-8	●	MV high limit (1 to 8)	-10.0 to +110.0 %	100.0	
P- 1C ~ P-8C		Cool-side proportional band (1 to 8)	0.1 to 999.9 %	5.0	
I- 1C ~ I-8C		Cool-side integration time (1 to 8)	0 to 9999 s (No integral control action when set at "0")*	120	
d- 1C ~ d-8C		Cool-side derivative time (1 to 8)	0 to 9999 s (No derivative control action when set at "0")*	30	
oL 1C ~ oL8C	●	Cool-side MV low limit (1 to 8)	-10.0 to +110.0 %	0.0	
oH 1C ~ oH8C	●	Cool-side MV high limit (1 to 8)	-10.0 to +110.0 %	100.0	

* The number of decimal places changes according to the setting for C23 (integral time and derivative time decimal point position).

【Parameter bank】

	Display		Item	Contents	Initial value	Setting
Control	Ctrl		Control method	0: ON/OFF control 1: Fixed PID	0 or 1	
	AtoL		MV low limit at AT	-10.0 to +110.0 %	0.0	
	AtoH		MV high limit at AT	-10.0 to +110.0 %	100.0	
	dIFF		ON/OFF control differential	0 to 9999U	5	
	oFFS	●	ON/OFF control operating point offset	-1999 to +9999U	0	
PV	FL		PV filter	0.0 to 120.0 s	0.0	
	rA	●	PV ratio	0.001 to 9.999	1.000	
	bI		PV bias	-1999 to +9999U	0	
Time proportional output	CyU	●	Time proportional cycle unit 1	0: Unit of 1 s 1: Fixed at 0.5 s 2: Fixed at 0.25 s 3: Fixed at 0.1 s	0	
	Cy		Time proportional cycle 1	5 to 120 s or 1 to 120 s (5 to 120 s when output includes relay output)	10 or 2	
	tPo		Time proportional minimum ON/OFF time 1	Set value: 0 If either one of the conditions below is true, 250 ms applies. Otherwise, 1 ms applies. · MV1 is set for relay output or event output in DO assignment. · Time proportional cycle is 10 s or longer. Set value: 1–250 If MV1 is set for relay output or event output in DO assignment, 1–49: 50 ms applies. 50–250: The set value applies.	0	
	CyU2	●	Time proportional cycle unit 2	0: Unit of 1 s 1: Fixed at 0.5 s 2: Fixed at 0.25 s 3: Fixed at 0.1 s	0	
	Cy2		Time proportional cycle 2	5 to 120 s or 1 to 120 s (5 to 120 s when output includes relay output)	10 or 2	
	tPo2		Time proportional minimum ON/OFF time 2	Set value: 0 If either one of the conditions below is true, 250 ms applies. Otherwise, 1 ms applies. · MV2 is set for relay output or event output in DO assignment. · Time proportional cycle is 10 s or longer. Set value: 1–250 If MV2 is set for relay output or event output in DO assignment, 1–49: 50 ms applies. 50–250: The set value applies.	0	
	tPLy	●	Time proportional cycle mode	0: Controllability aiming type 1: Operation end service life aiming type (Only ON/OFF operation within Time proportional cycle)	0 or 1	
SP	SPU	●	SP up ramp (U/min)	0 to 9999U (No ramp when set at 0.0U)	0.0	
	SPd	●	SP down ramp (U/min)		0.0	

U (unit): The smallest unit of an industrial quantity (℃, Pa, L/min, etc.) of a PV range

【Extended tuning bank】

Display		Item	Contents	Initial value	Setting
AtLy		AT type	0: Normal 1: Immediate response 2: Stable*	1	
SPLg	●	SP lag constant	0.0 to 999.9	0.0	
At-P	●	AT Proportional Band adjust	0.00 to 99.99	1.00	
At-I	●	AT Integral time adjust	0.00 to 99.99	1.00	
At-d	●	AT Derivative time adjust	0.00 to 99.99	1.00	
AtPt	●	Type of MV switching point at AT	0: Default (2/3 of initial PV and SP) 1: SP 2: PV	0	
AtPu	●	MV switching point PV in AT	-1999 to +9999U	0	
Ctrl	●	Control algorithm	0: PID (Conventional PID) 1: Ra-PID (High-performance PID)	0	
CLg	●	Cooling Gain	-10.0 to +110.0 %	30.0	

* Normal = standard control characteristics, immediate response = control with quick response to external disturbance, stable = control with less PV fluctuation

Setup bank, etc., settings

【Setup bank】

	Display		Item	Contents	Initial value	Setting
Analog input	C 01		PV input range type	For details, refer to the PV Input Range Table	Depends on the model	
	C 02		Temperature unit	0: Centigrade (°C) 1: Fahrenheit (°F)	0	
	C 03	●	Reference junction compensation (Cold junction compensation)	0: Performed (internal) 1: Not performed (external)	0	
	C 04		Decimal point position	0: No decimal point 1 to 3: 1 to 3 digits below decimal point	0	
	C 05		PV range low limit	When the PV input type is DC voltage/DC current, -1999 to +9999U	0	
	C 06		PV range high limit		1000	
	C 07	●	SP low limit	PV input range low limit to PV input range high limit	-	
	C 08	●	SP high limit		-	
	C 09	●	PV square root extraction dropout	0.0 to 100.0 % (PV square root extraction is not performed when set at 0.0.)	0.0	
Control action	C 14		Control action (Direct/Reverse)	0: Heat control (Reverse action) 1: Cool control (Direct action)	0	
	C 15	●	Output operation at PV alarm	0: Control calculation is continued. 1: Output at PV alarm is output.	0	
	C 16	●	Output at PV alarm	-10.0 to +110.0 %	0.0	
	C 17	●	Output at READY (Heat)	-10.0 to +110.0 %	0.0	
	C 18	●	Output at READY (Cool)	-10.0 to +110.0 %	0.0	
	C 19	●	Output operation at changing AUTO/MANUAL	0: Bumpless transfer 1: Preset	0	
	C 20	●	Preset MANUAL value	-10.0 to +110.0 %	0.0 or 50.0	
	C 21	●	Initial output type (mode) of PID control	0: Auto 1: Not initialized 2: Initialized	0	
	C 22	●	Initial output of PID control	-10.0 to +110.0 %	0.0 or 50.0	
	C 23	●	Integral time and derivative time decimal point position	0: XXXX (No decimal point) 1: XXX.X 2: XX.XX 3: X.XXX	0	
	C 26		Heat/Cool control	0: Not used 1: Individual PID 2: Common PID	0	
	C 28		Heat/Cool control dead zone	-100.0 to +100.0 %	0.0	
SP	C 30		LSP system group	1 to 4	1	
	C 31		SP ramp type	0: Standard 1: Multi-ramp 2: Step operation: When the power is turned ON again, the step operation is stopped (READY) 3: Step operation: When the power is turned ON again, the step operation is reset	0	
	C 32	●	SP ramp unit	0: 0.1U/s 1: 0.1U/min 2: 0.1 U/h	1	
	C 33		STEP time unit	0: 0.1 s 1: 1 s 2: 1 min	2	
	C 34		STEP PV start	0: None 1: Up start 2: Down start	0	
	C 35		STEP loop	0: Stop 1: Loop 2: Final step continued	0	
	C 36		CT1 operation type	0: Heater burnout detection 1: Current value measurement	0	
	C 37		CT1 output	0 to 1: Control output 1 to 2 2 to 4: Event output 1 to 3	0	
	C 38		CT1 measurement wait time	30 to 300 ms	30	
	C 39		CT2 operation type	Same as CT1	0	
	C 40		CT2 output	Same as CT1	0	
	C 41		CT2 measurement wait time	Same as CT1	30	
Continuous output	C 42		Control output 1 range	1: 4 to 20 mA 2: 0 to 20 mA	1	
	C 43		Control output 1 type	0: MV 1: Heat MV 2: Cool MV 3: PV 4: PV before ratio, bias, and filter 5: SP 6: Deviation 7: CT1 current value 8: CT2 current value 9: Invalid 10: SP+MV 11: PV+MV	0	
	C 44		Control output 1 scaling low limit	-1999 to +9999U	0.0	
	C 45		Control output 1 scaling high limit		100.0	
	C 46		Control output 1 MV scaling bandwidth	0 to 9999U (Valid when control output 1 type is 10 or 11)	200	
	C 47		Control output 2 range	Same as control output 1	1	
	C 48		Control output 2 type	Same as control output 1	3	
	C 49		Control output 2 scaling low limit	Same as control output 1	0	
	C 50		Control output 2 scaling high limit	Same as control output 1	1000	
	C 51		Control output 2 MV scaling bandwidth	Same as control output 1	200	
Communication	C 64		Communication type	0: CPL 1: Modbus/ASCII 2: Modbus/RTU 3: PLC-Link communication	0	
	C 65		Station address	0 to 127 (Communication is disabled when set at "0".)	0	
	C 66		Transmission speed (bps)	0: 4800 1: 9600 2: 19200 3: 38400	2	
	C 67		Data format (Data length)	0: 7 bits 1: 8 bits	1	
	C 68		Data format (Parity)	0: Even parity 1: Odd parity 2: None parity	0	
	C 69		Data format (Stop bit)	0: 1 bit 1: 2 bits	0	
	C 70	●	Communication minimum response time	1 to 250 ms	3	
Key operation & display	C 71	●	Key operation type	0: Standard type 1: Special type	0	
	C 72		[MODE] key function	0: Invalid 1: AUTO/MANUAL selection 2: RUN/READY selection 3: AT execution/stop instructions 4: LSP group selection 5: Release all DO latches 6: Invalid 7: User-defined bit 1 selection 8: Invalid	1	
	C 73	●	MODE display setup (Sum of the weighting)	Bit 0: AUTO/MANUAL display (Enabled: +1) Bit 1: RUN/READY display (Enabled: +2) Bit 2: Invalid Bit 3: AT Stop/Start display (Enabled: +8) Bit 4: Release all DO latches display (Enabled: +16) Bit 5: User-defined bit 1 ON/OFF display (Enabled: +32) Bit 6 to 7: Invalid	255	
	C 74	●	PV/SP display setup (Sum of the weighting)	Bit 0: PV display (Enabled: +1) Bit 1: SP display (Enabled: +2) Bit 2: LSP group number display (Enabled: +4) Bit 3 to 7: Invalid	15	
	C 75	●	MV display setup (Sum of the weighting)	Bit 0: MV display (Enabled: +1) Bit 1: Heat MV/cool MV display (Enabled: +2) Bit 2: Invalid Bit 3: AT progress display (Enabled: +8) Bit 4 to 7: Invalid	15	
	C 76	●	EV display setup (Operation display)	0: Not displayed 1: Set value of Internal event 1 is displayed 2: Set values of Internal event 1 to 2 are displayed 3: Set values of Internal event 1 to 3 are displayed	0	
	C 77	●	Event remaining time display setup (Operation display)	0: Not displayed 1: Internal event 1 is displayed 2: Internal event 1 to 2 is displayed 3: Internal event 1 to 3 is displayed	0	
	C 78	●	CT input current value display setup (Operation display)	0: Not displayed 1: CT1 current value is displayed 2: CT1 to 2 current values are displayed	1	
Key operation & display	C 79		User level	0: Simple configuration 1: Standard configuration 2: Advanced configuration	0	
	C 80	●	Status indicator	0: Not used 1: Flashing while data is sending through RS-485 communication. 2: Flashing while data is receiving through RS-485 communication. 3: Logical OR of all DI statuses 4: Invalid (OFF)	0	
	C 90	●	Number of CT1 turns	0: 800 turns 1 to 40: CT turns divided by 100	8	
	C 91	●	CT1 number of power wire passes	0: 1 time 1 to 6: Number of times	1	
	C 92	●	Number of CT2 turns	0: 800 turns 1 to 40: CT turns divided by 100	8	
	C 93	●	CT2 number of power wire passes	Same as CT1 number of power wire passes	1	
	C 97		PV input failure (under range) type	0: -10 %FS 1: -5 mV (This setting is applicable if C01 (PV input range type) is set for sensor type B (No.17) or PR40-20 (No. 23))	0	
	C 98		Sampling period	1: 50 ms 2: 100 ms 3: 300 ms 4: 500 ms	1	

Items marked with ● in the tables are displayed if standard configuration or advanced configuration is selected for the user level.
To change the user level, see **Changing the user level** at the bottom right of this page.

EuCF 【Event configuration bank】

Display		Item	Contents	Initial value	Setting
E IC 1 ~ E5C 1		Internal event 1 to 5 Configuration 1	See "Event types."	0	
E IC2 ~ E5C2		Internal event 1 to 5 Configuration 2	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		
		1st digit: Direct/Reverse	0: Direct 1: Reverse	0	
		2nd digit: Standby	0: None 1: Standby 2: Standby + Standby at SP change	0	
		3rd digit: EVENT state at READY	0: Continue 1: Forced OFF	0	
		4th digit: Undefined	0	0	
E IC3 ~ E5C3	●	Internal event 1 to 5 Configuration 3	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		
		1st digit: Alarm OR	0: None 1: Alarm direct + OR operation 2: Alarm direct + AND operation 3: Alarm reverse + OR operation 4: Alarm reverse + AND operation	0	
		2nd digit: Special OFF	0: As usual 1: When the event set value (main setting) is 0, the event is "OFF".	0	
		3rd digit: Delay time unit	0: 0.1 s 1: 1 s 2: 1 min	0	
		4th digit: Undefined	0	0	

dI 【DI assignment bank】

Display		Item	Contents	Initial value	Setting
dI 11 ~ dI 51		Internal contact 1 to 5 Operation type	0: No function 1: LSP group selection (0/+1) 2: LSP group selection (0/+2) 3: LSP group selection (0/+4) 4: PID group selection (0/+1) 5: PID group selection (0/+2) 6: PID group selection (0/+4) 7: RUN/READY selection 8: AUTO/MANUAL selection 9: Invalid 10: AT execution/stop instructions 11: Invalid 12: Control action direct/reverse 13: SP Ramp enabled/disabled 14: PV Hold 15: PV Maximum value hold 16: PV Minimum value hold 17: Timer Stop/Start 18: Release/continue all DO latches 19: Advance 20: SP Step Hold	0	
dI 12 ~ dI 52	●	Internal contact 1 to 5 Input bit operation	0: Not used (Default input) 1: Function 1 ((A and B) or (C and D)) 2: Function 2 ((A or B) and (C or D)) 3: Function 3 (A or B or C or D) 4: Function 4 (A and B and C and D)	0	
dI 13 ~ dI 53	●	Internal contact 1 to 5 Input assignment A	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1) 2: DI1 3: DI2 4 to 9: Invalid 10 to 14: Internal event 1 to 5 15 to 17: Invalid 18 to 21: User-defined bit 1 to 4 22: MANUAL 23: READY 24: Invalid 25: AT running 26: During SP ramp 27: Invalid 28: All alarm 29: PV alarm 30: Invalid 31: [MODE] key status 32: Event output 1 terminal status 33: Control output 1 terminal status	0, 2–5	
dI 14 ~ dI 54	●	Internal contact 1 to 5 Input assignment B		0	
dI 15 ~ dI 55	●	Internal contact 1 to 5 Input assignment C		0	
dI 16 ~ dI 56	●	Internal contact 1 to 5 Input assignment D		0	
dI 17 ~ dI 57	●	Internal contact 1 to 5 Polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		
		1st digit: Polarity A	0: Direct 1: Reverse	0	
		2nd digit: Polarity B		0	
		3rd digit: Polarity C		0	
		4th digit: Polarity D		0	
dI 18 ~ dI 58	●	Internal contact 1 to 5 Polarity	0: Direct 1: Reverse	0	
dI 19 ~ dI 59	●	Internal contact 1 to 5 Internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	

do 【DO assignment bank】

Display		Item	Contents	Initial value	Setting
ot 11 ~ ot21 Eu 11 ~ Eu31	●	Control output 1 to 2, event output 1 to 3 Operation type	0: Default output 1: MV1 2: MV2 3 to 6: Function 1 to 4	0	
ot 12 ~ ot22 Eu 12 ~ Eu32	●	Control output 1 to 2, event output 1 to 3 Output assignment A	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1) 2 to 6: Internal Event 1 to 5 7 to 13: Invalid 14: MV ON/OFF status 1 15: MV ON/OFF status 2 16,17: Invalid 18: DI1 19: DI2 20 to 25: Invalid 26 to 30: Internal contact 1 to 5 31 to 33: Invalid 34 to 37: User-defined bit 1 to 4 38: MANUAL 39: READY 40: Invalid 41: AT running 42: During SP ramp 43: Invalid 44: Alarm 45: PV alarm 46: Invalid 47: [MODE] key status 48: Event output 1 terminal status 49: Control output 1 terminal status	2–4, 14, 15	
ot 13 ~ ot23 Eu 13 ~ Eu33	●	Control output 1 to 2, event output 1 to 3 Output assignment B		0	
ot 14 ~ ot24 Eu 14 ~ Eu34	●	Control output 1 to 2, event output 1 to 3 Output assignment C		0	
ot 15 ~ ot25 Eu 15 ~ Eu35	●	Control output 1 to 2, event output 1 to 3 Output assignment D		0	
ot 16 ~ ot26 Eu 16 ~ Eu36	●	Control output 1 to 2, event output 1 to 3 Polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		
		1st digit: Polarity A	0: Direct 1: Reverse	0	
		2nd digit: Polarity B		0	
		3rd digit: Polarity C		0	
		4the digit: Polarity D		0	
ot 17 ~ ot27 Eu 17 ~ Eu37	●	Control output 1 to 2, event output 1 to 3 Polarity	0: Direct 1: Reverse	0	
ot 18 ~ ot28 Eu 18 ~ Eu38	●	Control output 1 to 2, event output 1 to 3 Latch	0: None 1: Latch (Latch at ON) 2: Latch (Latch at OFF except for initialization at power ON)	0	

UF 【User function bank】

Display		Item	Contents	Initial value	Setting
UF- 1 ~ UF- 8	●	User function 1 to 8	-	-	

LoC 【Lock bank】

Display		Item	Contents	Initial value	Setting
LoC		Key lock	0: All settings can be specified. 1: Mode, event, operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 2: Operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 3: UF, lock, manual MV, and [MODE] key operation can be specified.	0	
CLoC	●	Communication lock	0: Unlocked 1: Locked	0	
LLoC	●	Loader lock	0: Unlocked 1: Locked	0	
PASS		Password display	0 to 15 (5: Password 1A to 2B display)	0	
PS 1A		Password 1A	0000 to FFFF (hex)	0000	
PS2A		Password 2A	0000 to FFFF (hex)	0000	
PS 1b		Password 1B	0000 to FFFF (hex)	0000	
PS2b		Password 2B	0000 to FFFF (hex)	0000	

Id 【Instrument information bank】

Display		Item	Contents	Initial value	Setting
Id 01	●	ROM ID	16: Fixed	Not Applicable	
Id02	●	ROM Version 1		Not Applicable	
Id03	●	ROM Version 2		Not Applicable	
Id04	●	Loader information		Not Applicable	
Id05	●	EST information		Not Applicable	
Id06	●	Manufacturing date code (year)	Subtract 2000 from the year. Example: "21" means the year 2021.	Not Applicable	
Id07	●	Manufacturing date code (month, day)	Month + day divided by 100. Example: "12.01" means the 1st day of December.	Not Applicable	
Id08	●	Serial No.		Not Applicable	
Id09	●	Model No.		Not Applicable	
Id 10	●	Model Information		Not Applicable	
Id 11	●	Production site code		Not Applicable	
FPO 1 ~ FP 16	●	Advanced function password 1 to 16	0000 to FFFF (hex)	0000	

! Precautions for setup

- The type of automatic tuning can be changed by ATTY (AT type) in the extended tuning bank. Specify the setting in accordance with the control characteristics.

Memo

Changing the user level

The user level can be selected from three options with [79. The number of available displays and settings decreases in the order: advanced → standard → simple. All items are displayed when advanced configuration is selected.

1 Press [MODE] once to show the operation display, and then hold down [PARA] for 2 s or longer.

The screen for specifying parameters is shown with A--n or r--r on the upper display.

2 Hold down [PARA] for 2 s or longer again. [01 is shown on the upper display.

3 Press [PARA] several times to change to [79 (user level).

4 Press [<], [V], or [^]. The lower display flashes.

Change to the desired setting by pressing [V] or [^].

0: Simple (initial value)
1: Standard
2: Advanced

Do not press any key for 2 s. The new value stops flashing and is now set.

PV input range table

【Thermocouple】

□□ 1 Setting	Sensor type	Range (Celsius)	Range (Fahrenheit)
1	K	-200 to +1200 °C	-300 to +2200 °F
2	K	0 to 1200 °C	0 to 2200 °F
3	K	0.0 to 800.0 °C	0 to 1500 °F
4	K	0.0 to 600.0 °C	0 to 1100 °F
5	K	0.0 to 400.0 °C	0.0 to 700.0 °F
6	K	-200.0 to +400.0 °C	-300 to +700 °F
9	J	0.0 to 800.0 °C	0 to 1500 °F
10	J	0.0 to 600.0 °C	0 to 1100 °F
11	J	-200.0 to +400.0 °C	-300 to +700 °F
13	E	0.0 to 600.0 °C	0 to 1100 °F
14	T	-200.0 to +400.0 °C	-300 to +700 °F
15	R	0 to 1600 °C	0 to 3000 °F
16	S	0 to 1600 °C	0 to 3000 °F
17	B	0 to 1800 °C	0 to 3300 °F
18	N	0 to 1300 °C	0 to 2300 °F
19	PL II	0 to 1300 °C	0 to 2300 °F
20	WRe5-26	0 to 1400 °C	0 to 2400 °F
21	WRe5-26	0 to 2300 °C	0 to 4200 °F
23	PR40-20	0 to 1900 °C	0 to 3400 °F
24	DIN U	-200.0 to +400.0 °C	-300 to +700 °F
25	DIN L	-100.0 to +800.0 °C	-150 to +1500 °F

: Initial value

【RTD】

□□ 1 Setting	Sensor type	Range (Celsius)	Range (Fahrenheit)
41	Pt100	-200 to +500 °C	-300 to +900 °F
42	JPt100	-200 to +500 °C	-300 to +900 °F
43	Pt100	-200 to +200 °C	-300 to +400 °F
44	JPt100	-200 to +200 °C	-300 to +400 °F
45	Pt100	-100.0 to +300.0 °C	-150 to +500 °F
46	JPt100	-100.0 to +300.0 °C	-150 to +500 °F
51	Pt100	-50.0 to +200.0 °C	-50.0 to +400.0 °F
52	JPt100	-50.0 to +200.0 °C	-50.0 to +400.0 °F
53	Pt100	-50.0 to +100.0 °C	-50.0 to +200.0 °F
54	JPt100	-50.0 to +100.0 °C	-50.0 to +200.0 °F
63	Pt100	0.0 to 200.0 °C	0.0 to 400.0 °F
64	JPt100	0.0 to 200.0 °C	0.0 to 400.0 °F
67	Pt100	0.0 to 500.0 °C	0.0 to 900.0 °F
68	JPt100	0.0 to 500.0 °C	0.0 to 900.0 °F

【DC voltage / DC current】

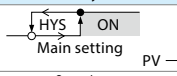
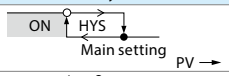
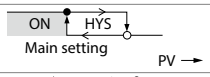
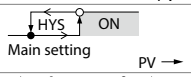
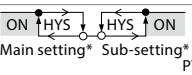
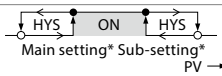
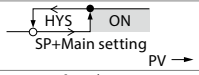
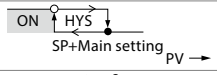
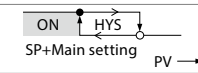
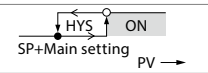
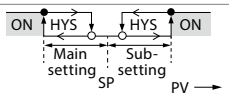
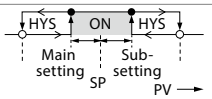
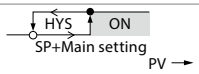
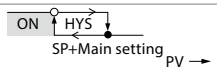
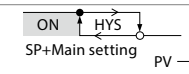
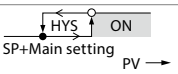
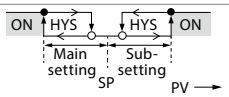
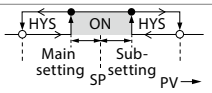
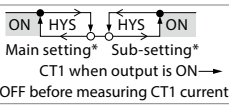
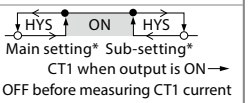
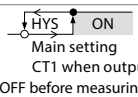
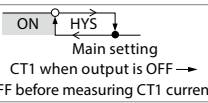
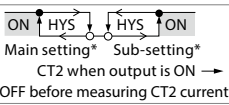
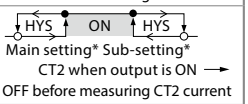
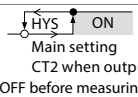
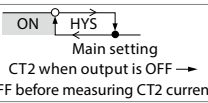
□□ 1 Setting	Sensor type	Range
84	0 to 1 V	The scaling range is -1999 to +9999U. The number of decimal places is changeable.
86	1 to 5 V	
87	0 to 5 V	
88	0 to 10 V	
89	0 to 20 mA	
90	4 to 20 mA	

Alarm codes

	Alarm code*1	Description	Cause	Corrective action
Input errors	AL01	PV input error (over range)	Sensor burnout, incorrect wiring	Check the wiring.
			Incorrect settings for PV range type, etc.	Check the PV range type (□□ 1) and other settings.
	AL02	PV input error (under range)	Sensor burnout, incorrect wiring	Check the wiring.
			Incorrect settings for PV range type, etc.	Check the PV range type (□□ 1) and other settings.
	AL03	Reference junction compensation (cold junction compensation) error	Measurement range error in terminal temperature at reference junction compensation	Make sure that the ambient temperature is within the specifications of this product.
		RTD input error	Sensor burnout, incorrect wiring	Check the wiring.
	AL11	Current transformer (CT) input error (over range)*2	Current input exceeding the high limit of the display range	• Use a current transformer with a number of turns that matches the display range. • Check the number of CT turns and the setting. • Check the setting and the number of times the power wire passes through the CT.
			Incorrect wiring	Check the wiring.
Instrument errors	AL70	A/D conversion error	A/D conversion unit failure	Turn the power off and then on again. If the alarm is triggered when the power is turned on again, replace the device.
	AL74	Nonvolatile memory error	Temporary communication error, corruption of data written, or failure of this device	
	AL80	Nonvolatile memory not initialized		
	AL81	Setting value area error*3		
	AL82	Adjustment value area error*3		
	AL83	Internal system error		
	AL84	Setting value initialization error		Turn the power off and then on again. If the alarm is triggered after turning the power on again, the problem can be corrected with the following procedure: • Initialize the settings • Write the setting again If this procedure does not correct the problem, replace the device.
	AL95	Setting value error		
	AL96	Adjustment value error		Turn the power off and then on again. If the alarm is triggered after turning the power on again, the problem can be corrected with the following procedure: • Restore adjustment values*4 If this procedure does not correct the problem, replace the device.

*1 Multiple alarms may occur at the same time. If the corrective action for one of the alarms says that the device should be replaced, it should be replaced.
*2 The error occurred because of CT input 1, 2, or both.
*3 This error may occur when updating the firmware.
*4 If the area in memory for restoring the adjustment value has been corrupted, the value cannot be restored.

Event types

Operation type	Setting	Direct action ●: ON/OFF changes at the value ○: ON/OFF changes when the value is exceeded	Reverse action ●: ON/OFF changes at the value ○: ON/OFF changes when the value is exceeded
No event	0	Always OFF	Always OFF
PV high limit	1		
PV low limit	2		
PV hogh/low limit	3		
Deviation high limit	4		
Deviation low limit	5		
Deviation high/low limit	6		
Deviation high limit (Final SP reference)	7		
Deviation low limit (Final SP reference)	8		
Deviation high/low limit (Final SP reference)	9		
Heater 1 burnout/ Overcurrent	16		
Heater 1 shortcircuit	17		
Heater 2 burnout/ Overcurrent	18		
Heater 2 shortcircuit	19		
Alarm (status)	23	ON if there is an alarm, otherwise OFF	OFF if there is an alarm, otherwise ON

: Initial value

* If the main setting is greater than the sub-setting, operations are performed with the settings automatically swapped.

Event types other than the above

Operation	
Type	Setting
SP high limit	10
SP low limit	11
SP high/low limit	12
MV high limit	13
MV low limit	14

Operation	
Type	Setting
MV high/low limit	15
Loop diagnosis 1	20
Loop diagnosis 2	21
Loop diagnosis 3	22
READY (status)	24

Operation	
Type	Setting
MANUAL (status)	25
AT running (status)	27
During SP ramp	28
Control direct action (status)	29
Timer (status)	32

Chapter 1. Overview

1 - 1 Overview

This is a compact controller (48 × 48 mm front panel) with the features below.

- LED display for excellent visibility
- Easy setting by [MODE], [PARA], and digit-change keys on the front panel.
- Input type: thermocouples (K, J, E, T, R, S, B, N, PLII, WRe5-26, PR40-20, DIN U, DIN L), resistance temperature detectors (Pt100, JPt100), current signals (4–20 or 0–20 mA DC), voltage signals (0–1, 1–5, 0–5, or 0–10 V DC).
- Control output type: relay, voltage pulse, current. These signals are assigned to control outputs 1 and 2 according to the model No. that the customer orders.
- Heating and cooling control using control output 2 and event relays
- ON/OFF control and PID control
- According to the specified model number, the 3 event outputs, 2 event outputs with independent contacts, 2 CT inputs, 2 digital inputs, and RS-485 communication can be combined.
- Loader connector as a standard feature
- Smart Loader Package (model SLP-C1F) can be used for easy reading and writing of parameters by connecting the included USB loader cable.
  With the SLP-C1F, the user can specify settings in a table format, operate this device, and monitor the control situation on the trend screen. There is no need to create programs for communicating with a host device.
- This product is compliant with the EU Directive and is CE-marked. (compliant with EN 61010-1, EN 61326-1, and EN IEC 63000)

■ Model Selection Table

Model selection of this device is shown below.

Basic model No.			Installation	Control output		PV input	Power	Options		Add'l proc. 1	Add'l proc. 2	Specifications	
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫	⓬	Digits	
C	1	M										Basic model No.	
			T									Screw terminal block	
												Control output 1	Control output 2
				R	0							Relay output (C.O. contacts)	None
				V	0							Voltage pulse output (for SSR drive)	No
				V	C							Voltage pulse output (for SSR drive)	Current output
				V	V							Voltage pulse output (for SSR drive)	Voltage pulse output (for SSR drive)
				C	0							Current output	None
				C	C							Current output	Current output
						T						Thermocouple input (K, J, E, T, R, S, B, N, PL II, WRe5/26, PR40/20, DIN U, DIN L)	
						R						RTD input (Pt100, JPt100)	
						L						DC voltage/current (0–1 V, 1–5 V, 0–5 V, 0–10 V DC; 0–20 mA DC, 4–20 mA DC)	
							A					AC power supply (100–240 V)	
								0	0			None	
								0	1			3 event relay outputs	
								0	2			3 event relay outputs, 2 current transformer inputs, 2 digital inputs	
								0	3			3 event relay outputs, 2 current transformer inputs, RS-485 comm.	
								0	4			2 event relay outputs (independent contacts)	
								0	5			2 event relay outputs (independent contacts), 2 current transformer inputs, 2 digital inputs	
								0	6			2 event relay outputs (independent contacts), 2 current transformer inputs, RS-485 comm.	
								0	9			RS-485 communication	
										0		None	
										D		With inspection report	
										Y		With traceability certificate	
											0	None	
											A	UL-compatible model	
											F	UL compatible model Fahrenheit temperature supportted (available soon)	

■ Accessories

Name	Qty.	Notes
Mounting bracket	1	When replacing, use model 84515488-001.
Gasket	1	When replacing, use model 84515487-001.
User's manual	1	Document No. CP-UM-5964JEC

■ Optional parts

Name	Model No.	Note (model No., etc.)
Mounting bracket	84515488-001	For maintenance of C1M or C1A
Gasket	84515487-001	For maintenance of C1M or C1A (qty. 20)
Hard cover	84515988-001	For C1M or C1A
Soft cover	84515985-001	For C1M or C1A
Terminal cover	84515888-001	For C1M or C1A (models with screw terminal block)
DIN rail mounting bracket	84515986-001	For C1M or C1A(models with screw terminal block)
Current transformer	QN206A*1	800 turns, hole diameter: 5.8 mm
	QN212A*1	800 turns, hole diameter: 12 mm
Smart Loader Package*2	SLP-C1FJA0	USB loader cable for C1M included
	SLP-C1FJA1	Without USB loader cable
	SLP-C1FJA3	USB loader cable for C1M (model 81441177-001) and USB loader cable for C1A/C2/C3 (model SLP-ULCJA0) included
USB loader cable*3	81441177-001	USB loader cable for C1M
L-shaped plug adapter	81441057-001	

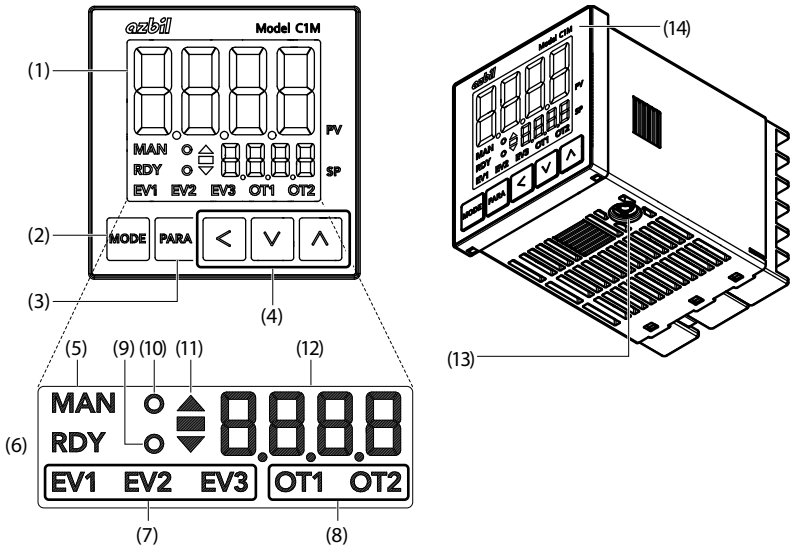
*1 Not UL-certified

*2. Ver. 2 and later support the C1A. Ver. 3 and later support the C2/C3.

*3. Hereafter "loader cable"

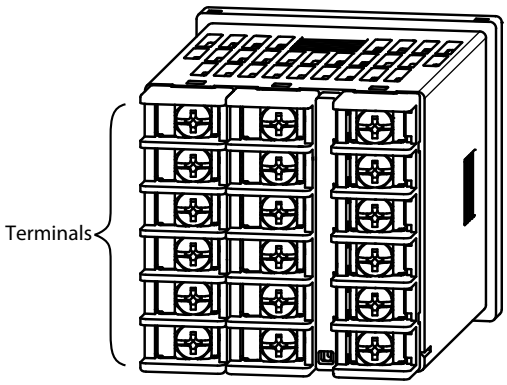
1 - 2 Names and Functions of Parts

■ Model C1M and its console



(1)	Upper display:	Shows PV (present temperature, etc.) or items that can be set.
(2)	[MODE] key:	Shows the operation display. If it is held down for 1 second or longer, the preset operation (initial setting: AUTO/MANUAL selection) can be executed.
(3)	[PARA] key:	Switches the display.
(4)	[<], [∨], and [∧] keys:	Used for incrementing/decrementing numeric values and shifting between digits of a number.
(5)	MAN mode indicator:	Lights up in MANUAL mode.
(6)	RDY mode indicator:	Lights up in READY (control stop) mode.
(7)	Event indicator:	Lights up when the corresponding event relay output is ON.
(8)	Control output indicator:	Lights up when the corresponding control output is ON.
(9)	Status indicator:	Lights up according to the setting of the status indicator (by default, not used).
(10)	AT indicator:	Flashes during AT execution.
(11)	Slope display	Shows the operation status during a step operation.
(12)	Lower display:	Shows the SP (set temperature, etc.) or other settings.
(13)	Loader connector:	Connected to the PC using the USB loader cable included with the Smart Loader Package.
(14)	Protective film:	Protects the surface. Remove the protective film before use.

■ Terminals

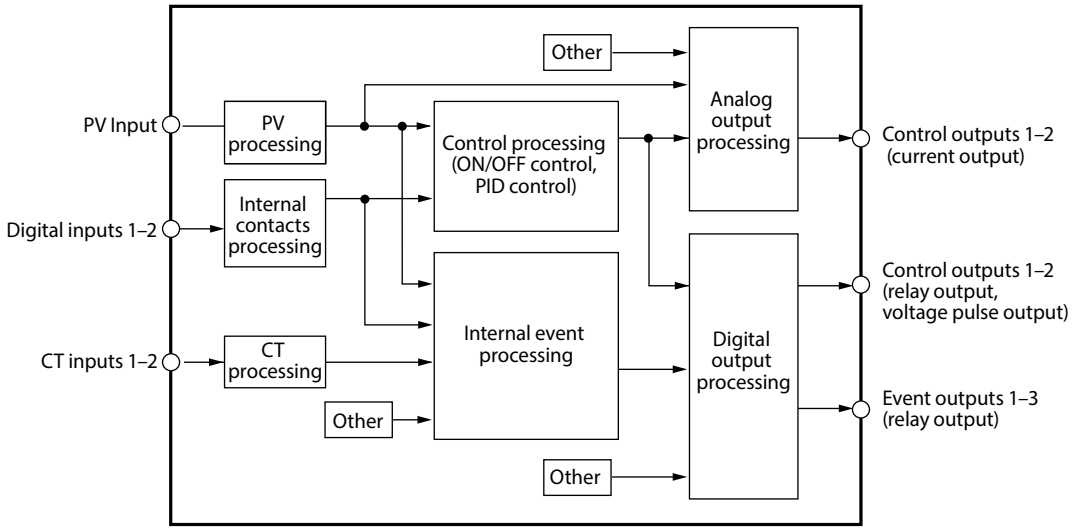


Terminals: Used to connect the power, inputs, outputs, etc.
M3 screws are used. For terminal connections, use crimp terminal lugs compatible with M3 screws.
The tightening torque of the terminal screws is 0.6 ± 0.1 N·m.

-MEMO-

Chapter 2. Outline of Functions

2 - 1 Input/Output Configuration



● PV input

The range and the sensor used for the PV input can be selected. Selectable options vary depending on the PV input type (T: thermocouple, R: resistance temperature detector, L: DC voltage/current) specified by the model number (digit ❼).

● Control output

If R (relay output) or V (voltage pulse output) is specified by the model number (digits ❺ and ❻), ON/OFF control output or time proportional output can be selected. For time proportional output, the time proportional cycle can be specified. If C (current output) is specified by the model number (digits ❺ and ❻), continuous output (analog output) is available, and scaling of the output can be set.

● Event output

For models with optional event outputs (digits ❾ and ❿), the alarm or control mode set for the event operation type is output as digital output (DO).

● Digital input

For models with optional digital inputs (digits❾ and ❿), the functions specified by DI assignment can be switched.

● Current transformer input

For models with optional current transformer inputs (digits ❾ and ❿), the heater burnout alarm can be output from the event output terminals.

2 - 2 Key Operation

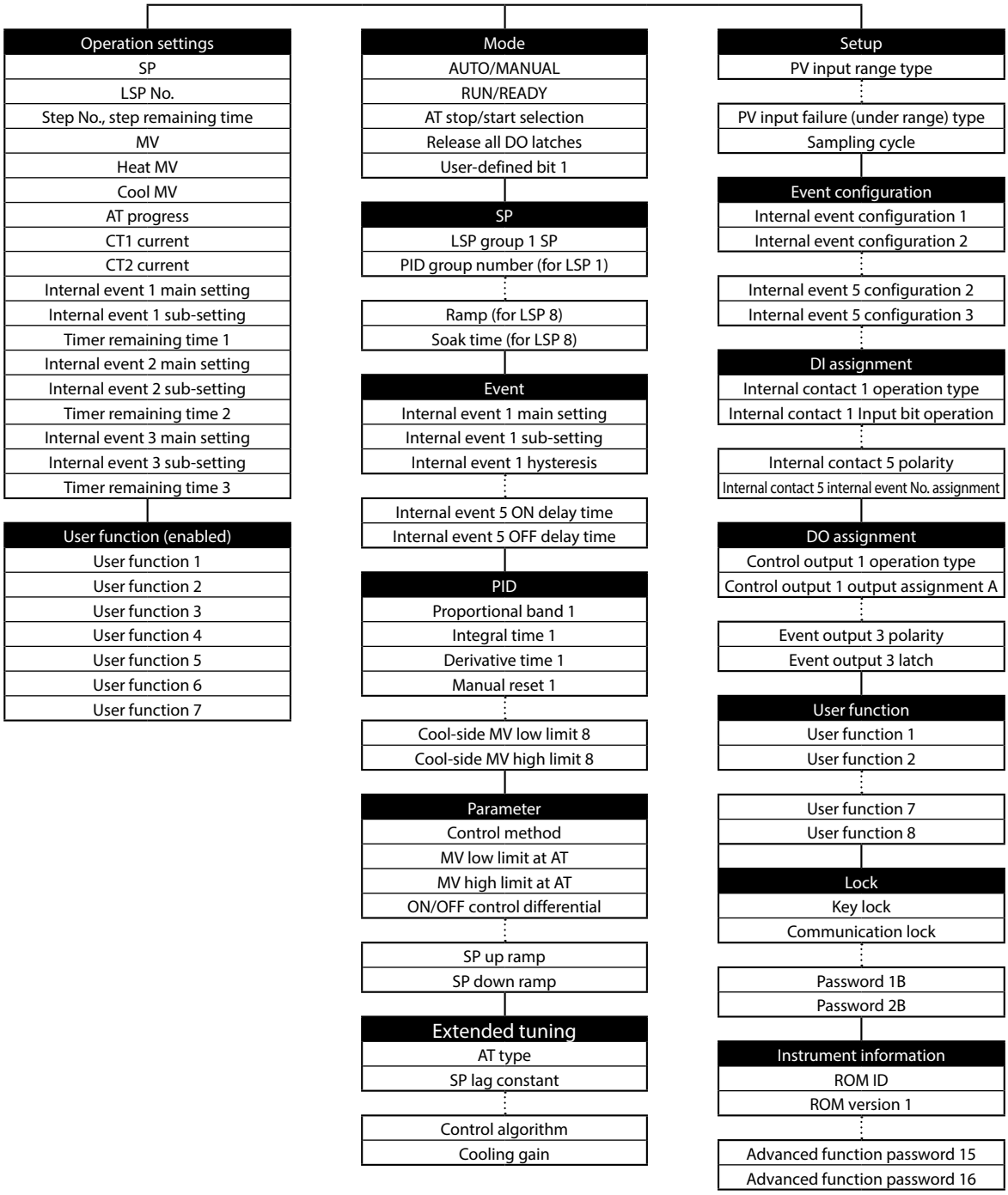
Various displays and settings can be called up to the console using keys.

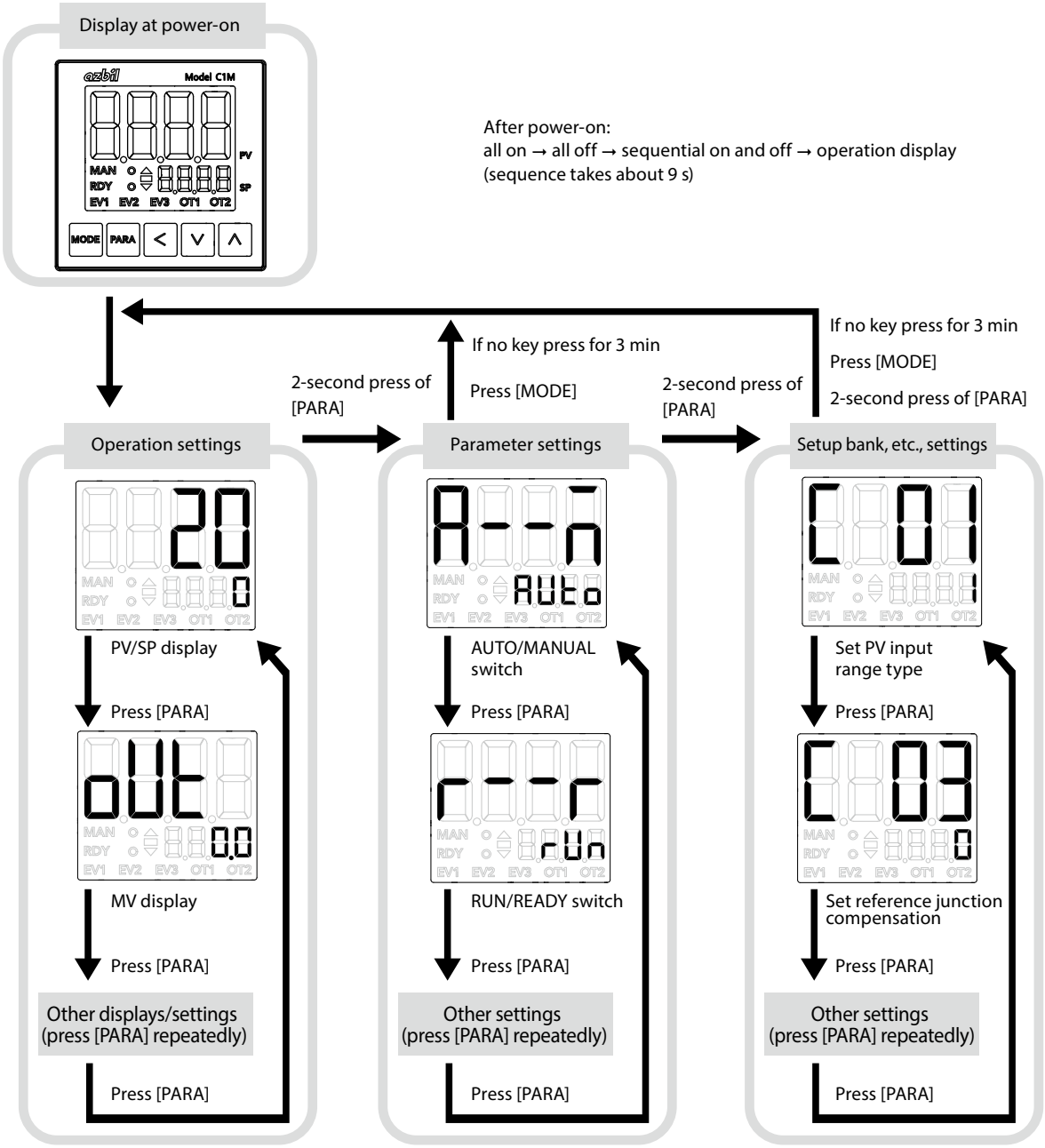
There are two key operation modes, standard and special, which can be selected in the setup bank.

Display transitions and use of keys in each mode are shown below.

■ Standard mode

If [7 1 (key operation mode) in the setup bank is set to 0, the keys operate in standard mode. In this mode, items that can be set are displayed in the order shown below.





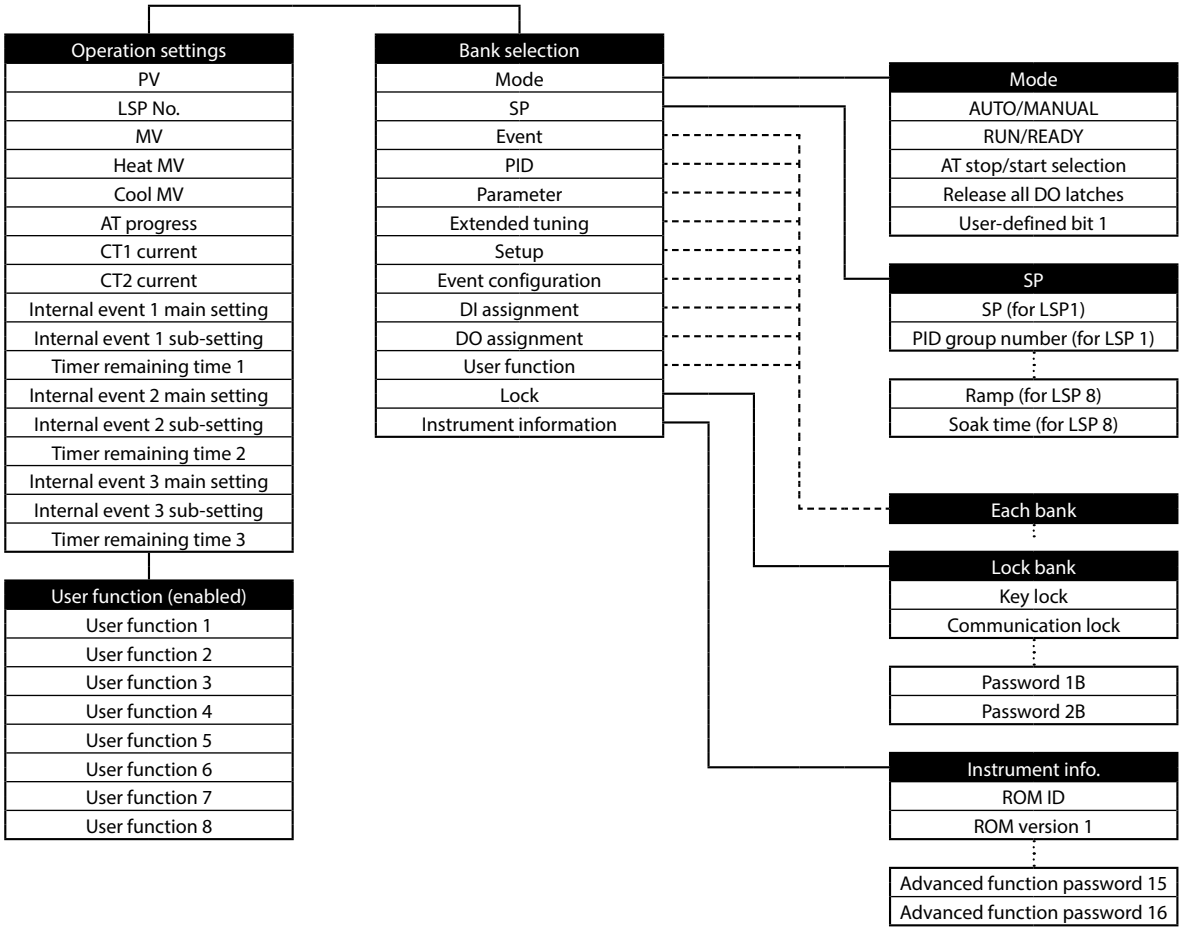
The displays and settings shown in this figure are illustrative examples. They may differ depending on the model and settings.

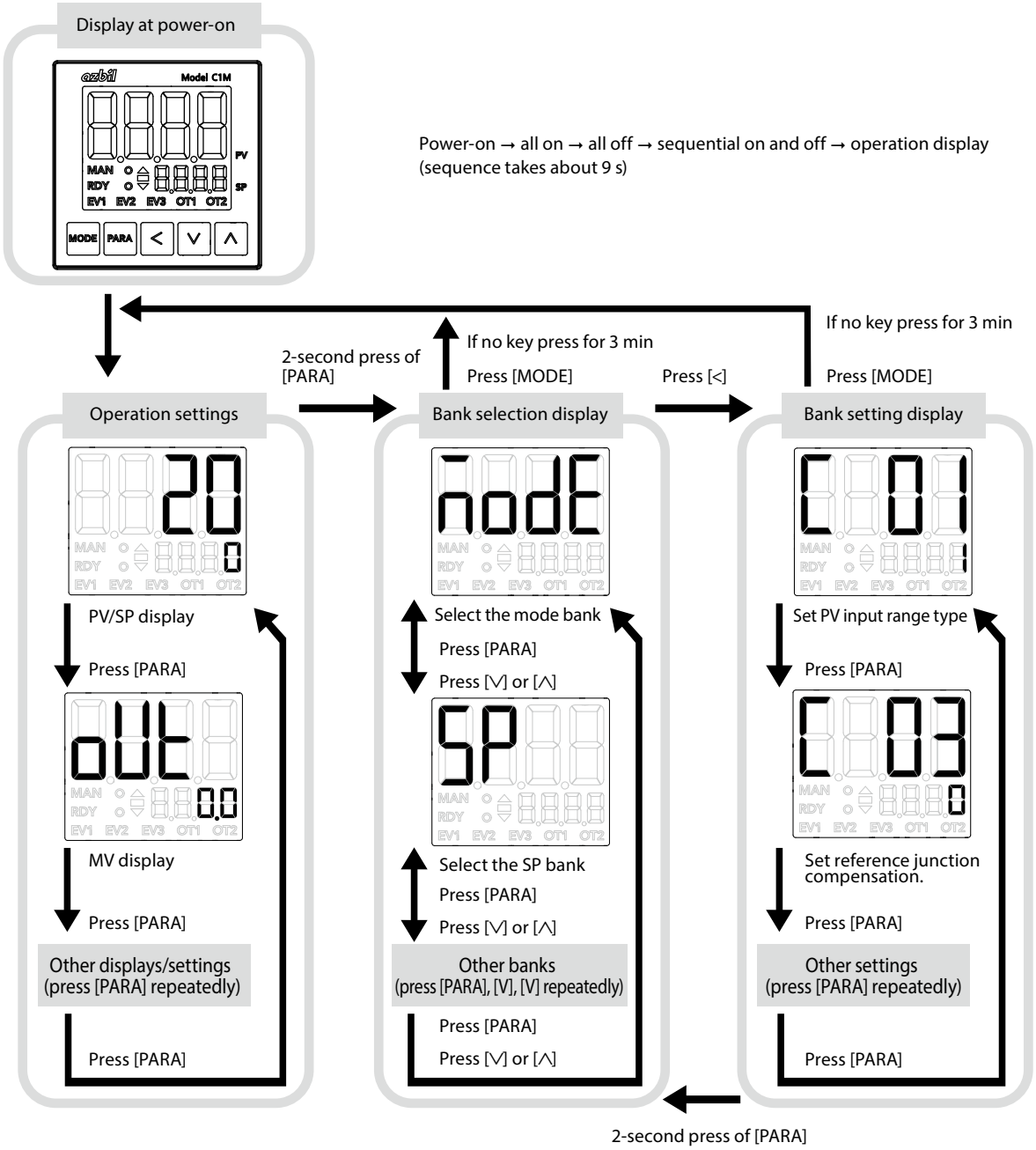
! Handling Precautions

- ☞ 6 - 1 Operation Settings (p. 6-1)
  6 - 2 Parameter Settings (p. 6-3)
  6 - 3 Setup Bank, etc., Settings (p. 6-19)
  (for details on operation settings, parameter settings, and setup bank settings, etc.)
- If [<] is pressed while holding down [PARA], various displays/settings can be navigated in reverse order. However, the keys can be used together this way only for a maximum of 2 seconds.

■ Special mode

If C71 (key operation mode) in the setup bank is set to 1, the keys operate in special mode. In this mode, items that can be set are displayed in the order shown below.





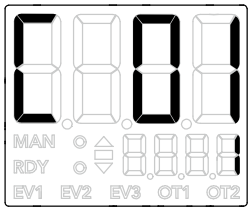
The display and setting shown in this figure are examples for explanation. They may differ depending on the model and settings.

Handling Precautions

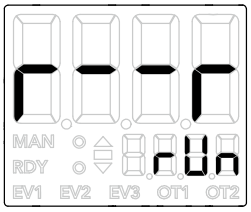
- ☞ 6 - 1 Operation Settings (p. 6-1)
6 - 2 Parameter Settings (p. 6-3)
6 - 3 Setup Bank, etc., Settings (p. 6-19)
(for details on operation settings, bank selection, items in banks)
The sections above describe the banks to which the settings belong.
- When operation settings and other items are displayed, if [<] is pressed while holding down [PARA], various displays/settings can be navigated in reverse order. However, the keys can be used together this way only for a maximum of 2 seconds.

■ How to set data

(1) Press [PARA] until the desired item is displayed.
☞ Display transitions and the use of [PARA] are described on pages 2-3 and 2-5.



When configuring C01 (PV input range type) in the setup bank

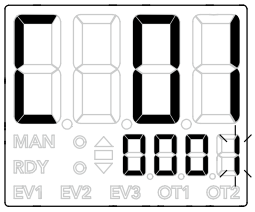


When switching between RUN and READY by the r--r parameter

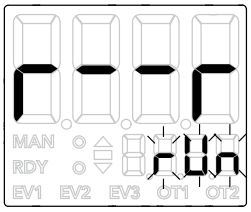
⇩

(2) Press [<], [∨], or [∧].

≫ If the lower display shows numbers, the value in the 1st digit will start flashing (blinking). If it shows characters, they will all start flashing.
For numbers, the flashing digit can be shifted and the flashing value can be incremented/decremented using [<], [∨], and [∧].
For characters, the entire flashing expression can be changed using [∨] and [∧].



The 1st digit of 0001 is flashing

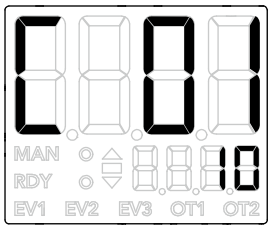


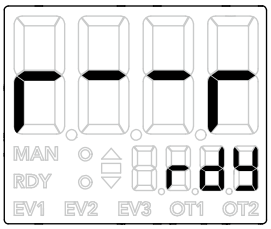
run is flashing

⇩

(3) Release the key and wait.

≫ The new value stops flashing after 2 seconds and is now set.





Handling Precautions

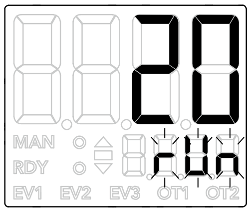
- If a value does not flash after [<], [∨], or [∧] is pressed, the value cannot be changed.
  For example, if the RUN/READY selection is set in the DI assignment bank, the device keys cannot be used to switch between RUN and READY.
- If pressing [∨] does not change the flashing value, press [∧], and vice versa.
- If [PARA] is pressed while the display is flashing, this device shows the next item without making any changes. If [MODE] is pressed while the display is flashing, this device shows the operation display without making any changes.
- The manipulated value (MV) displayed in MANUAL mode continues flashing even if you release the key. In this case, the flashing value is being output as the MV.

■ Using the [MODE] key

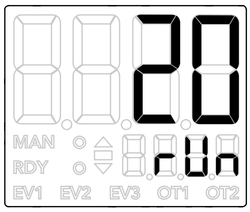
When the operation display is shown, press [MODE] for 1 second or longer to execute the switch that is set by C72 ([MODE] key function) in the setup bank.

The figures on the right show an example of pressing [MODE] when C72 is set to 2 (RUN/ READY selection).

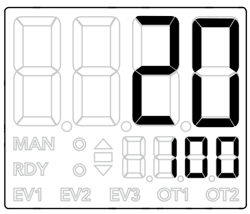
(1) If [MODE] is pressed when the PV and SP are displayed in READY mode, the lower display shows rUn flashing.



(2) If [MODE] is held down for 1 second or longer, the mode will switch from READY to RUN, and rUn stops flashing.



(3) When you release [MODE], the operation display is shown again.



Handling Precautions

- If C72 ([MODE] key function) in the setup bank is set to 0 (invalid), or if the specified switching operation is disabled, switching using [MODE] is not possible.
- If you press [MODE] when the screen for specifying settings (parameters, setup items, etc.) is displayed, this device shows the operation display, but continuing to press [MODE] will not change the setting. In this case, release [MODE] temporarily and then press it again.

■ User level

The user level can be selected from three options (simple, standard, advanced) with C79 (user level) in the setup bank.

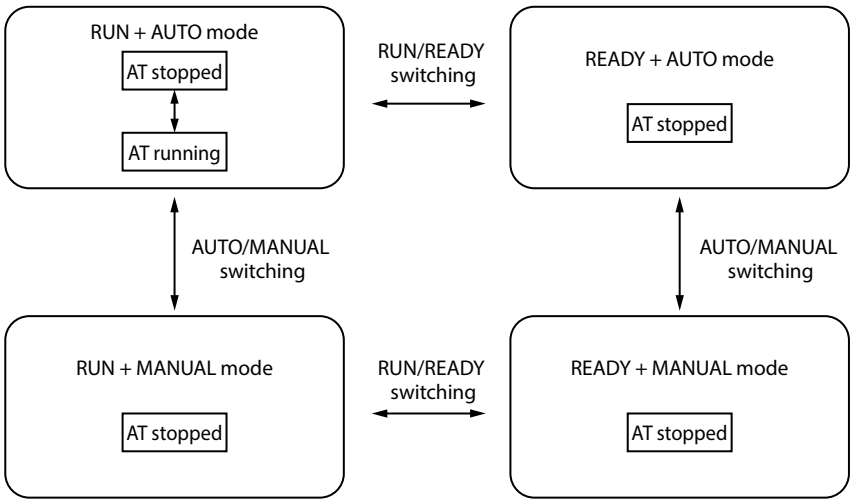
☞ Chapter 6. Displayed Items and Settings (for items that are displayed according to the user level)

Handling Precautions

- If the user level is changed, the displayed items will change but settings that have been made will remain valid. For example, if you set the user level to 2 (standard configuration) or 3 (advanced configuration) in order to configure advanced functions and then return the setting to 1 (simple configuration), the settings available for 2 and 3 will not be displayed, but the new settings will apply to the advanced functions.

2 - 3 Operation Modes

The transitions between operation modes are shown below.



RUN: The process is being controlled.

READY: The process is not being controlled.

AUTO: Automatic operation (this device automatically determines the MV)

MANUAL: Manual operation (the user can change the MV manually)

AT: Auto tuning (this device automatically sets the PID constants by generating limit cycles)

-MEMO-

Chapter 3. Installation

WARNING
To prevent electrical shock, this device must be installed in a location that is only accessible to people with appropriate knowledge about electrical safety. Install this device inside a control panel that cannot be opened without the use of a key or tool.
Do not use this device in an environment with conductive contamination, or with dry non-conductive contamination which can become conductive due to condensation, etc. **Otherwise, problems such as tracking phenomena may damage parts, resulting in fire.**
Before removing, mounting, or wiring this device, be sure to turn off the power to this device and all connected devices. After wiring this device, attach the separately sold terminal cover (model No. 84515888-001). Otherwise, there is a danger of electric shock.
Do not touch live parts such as the power terminals. There is a danger of electric shock.
Do not disassemble this device. There is a danger of electric shock or device failure.

CAUTION
Use this device within the operating ranges given in the specifications (for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Otherwise, there is a danger of fire or device failure.
Do not block the ventilation holes. There is a danger of fire or device failure.
Do not allow wire clippings, metal shavings, water, etc., to enter the case of this device. There is a danger of fire or device failure.

■ Installation location

Install this device as specified in Operating conditions (p. 14-5) and in a location that meets the following criteria:

- Common mode voltage of all I/O except for the supply power and relay contact outputs: voltage to ground of 30 V_{RMS} max., 42.4 V peak max., and 60 V DC max.
- Neither high nor low temperature/humidity
- No sulfide gas or other corrosive gases
- Little dust or soot
- Protected from direct sunlight, wind, and rain
- Little mechanical vibration or shock
- Not close to high voltage lines, welding machines, or other sources of electrical noise
- At least 15 meters away from the high voltage ignition device for a boiler, etc.
- No strong magnetic fields
- No flammable liquids or gases
- Indoors

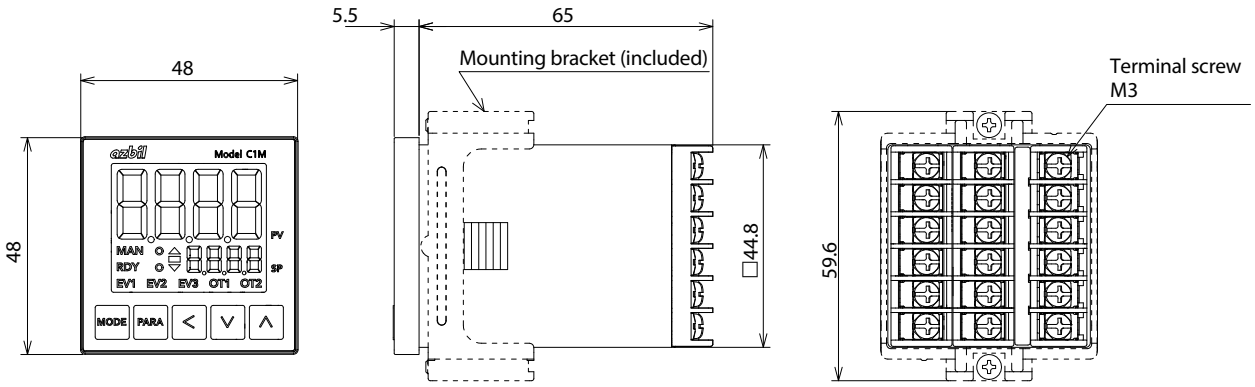
■ Mounting precautions

Pay attention to the following when mounting this device:

- Do not block the ventilation holes.
- When using fans or cooling equipment, make sure the air does not directly blow on this device.
- Mount this device horizontally with the back not raised or lowered more than 10°.
- Use a rigid panel whose thickness is no more than 8 mm.
- Do not tighten screws too tightly because the case may be deformed.

■ External dimensions

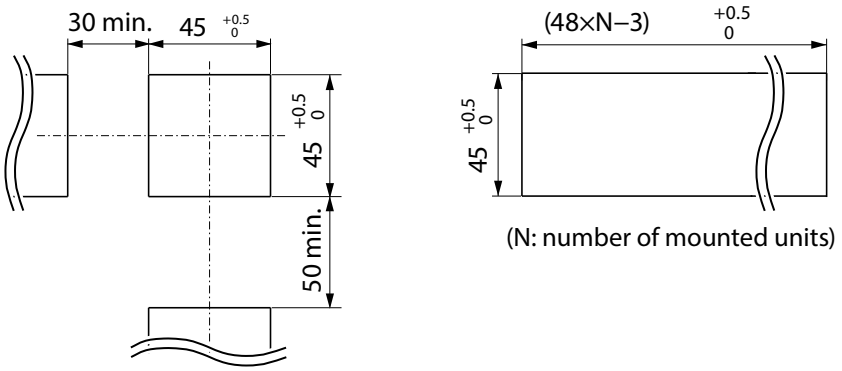
Unit: mm



■ Panel cutout dimensions

For a panel-mounted model, open a hole in the panel as shown below.

Unit: mm



Independent mounting

Gang mounting

! Handling Precautions

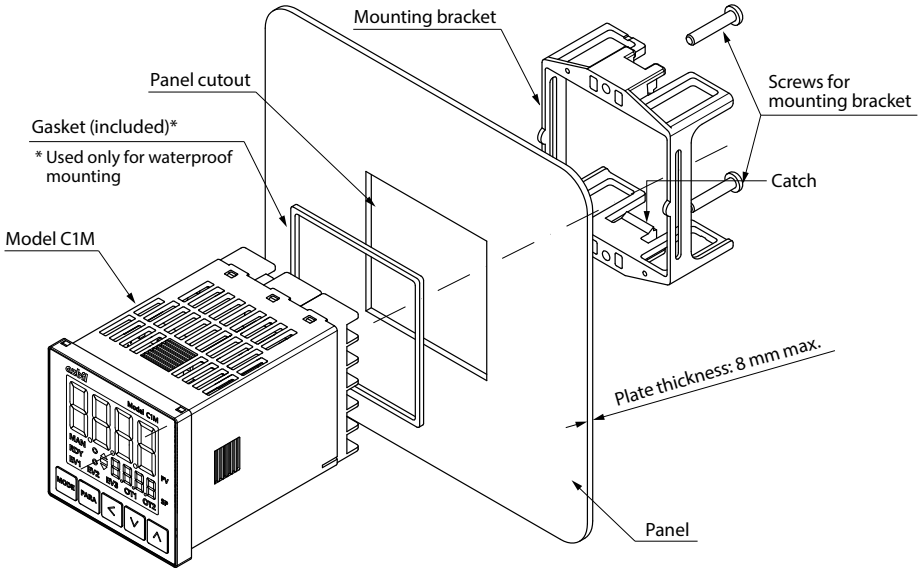
- The maximum allowable ambient temperature for gang-mounted products: 50 °C (two units), 45 °C (three or more units)
- When waterproofing and dust proofing are required, mount the units individually. If units are gang mounted, waterproofing and dust proofing performance cannot be maintained.
- Leave a space of at least 50 mm above and below this device.
- For gang mounting using a soft cover, open a hole of $(51 \times N-6)^{+0.5}_{0}$ mm.

■ Mounting method

- Mount this device horizontally with the back not raised or lowered more than 10°.
- Use a rigid panel whose thickness is no more than 8 mm.

● Waterproof mounting

Tools: Phillips-head screwdriver



(1) Place the gasket on the terminal side of this device and slide it to the back of the console.

(2) Insert this device from the front of the panel.

(3) Attach the mounting bracket from behind the panel.

(4) Push the mounting bracket onto the panel until the catches of the bracket are fully engaged with the grooves in this device.

(5) Tighten the screws at the top and bottom of the bracket.

[!] Handling Precautions

- To secure the bracket to the panel, tighten the screws of the supplied mounting bracket until the bracket can no longer move, and then further tighten each screw by only half a turn. Excessive tightening of the screws may deform the case.
- If units are gang mounted, waterproofing and dust proofing performance cannot be maintained.

● Standard mounting

For normal mounting (not waterproof/dustproof), skip step 1 of the above procedure and use step 2 and the rest of the procedure.

! Handling Precautions

- To secure the bracket to the panel, tighten the screws of the supplied mounting bracket until the bracket can no longer move, and then further tighten each screw by only half a turn. Excessive tightening of the screws may deform the case.

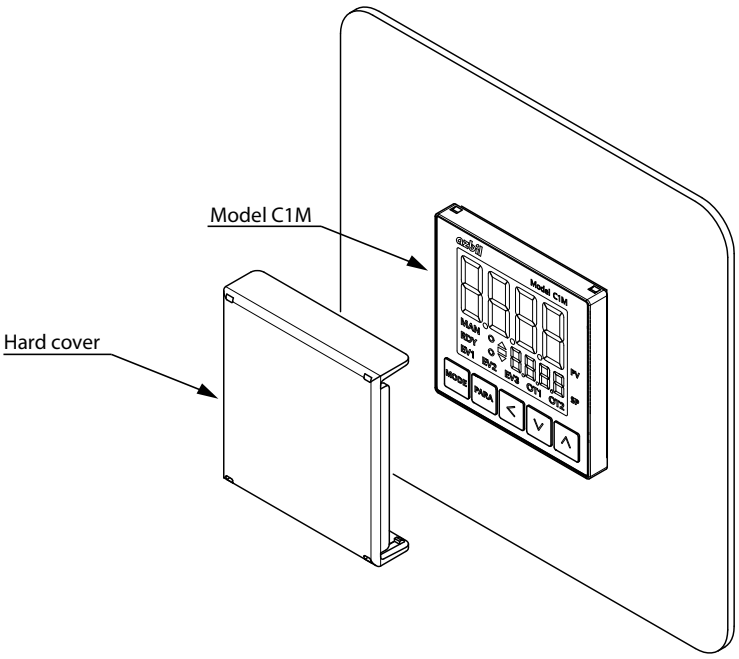
● Attaching the hard cover

The separately sold hard cover can be attached to the console.

It is useful for preventing accidental changing of the settings and to protect a device that is installed in a poor installation environment. The display can be viewed with the cover on.

To use the keys, remove the cover.

Items required: hard cover, part No. 84515988-001 (sold separately)



(1) Mount the C1M in a panel as shown in the figure above.

(2) Set the two protrusions on the top of the hard cover into the two dents on the top of the C1M.

(3) Push the bottom of the hard cover onto the C1M until it clicks into place.

-MEMO-

Chapter 4. Wiring

4 - 1 Wiring

WARNING
To prevent electrical shock, this device must be installed in a location that is only accessible to people with appropriate knowledge about electrical safety. Install this device inside a control panel that cannot be opened without the use of a key or tool.
Do not use this device in an environment with conductive contamination, or with dry non-conductive contamination which can become conductive due to condensation, etc. Otherwise, problems such as tracking phenomena may damage parts, resulting in fire.
Be sure to use the fuse described in the specifications for the power wiring of this device. Otherwise, tracking phenomena or parts failure due to other factors may cause fire.
Be sure to check that the device has been correctly wired before turning on the power. Incorrect wiring of this device may cause device failure and also lead to a dangerous accident.
Before removing, mounting, or wiring this device, be sure to turn off the power to this device and all connected devices. After wiring this device, attach the separately sold terminal cover (model No. 84515888-001). Otherwise, there is a danger of electric shock.
Do not touch live parts such as the power terminals. There is a danger of electric shock.

CAUTION
Wire this device correctly in compliance with applicable standards, and use the power source and installation methods specified in this user's manual. Otherwise, there is a danger of fire, electric shock, or device failure.
Do not allow wire clippings, metal shavings, water, etc., to enter the case of this device. There is a danger of fire or device failure.
Firmly tighten the terminal screws to the torque listed in the specifications. Insufficient tightening may result in fire or electric shock.
Do not use unused terminals as relay terminals. There is a danger of fire, electric shock, or device failure.
Use the relays within the recommended service life. Otherwise, there is a danger of fire or device failure.
Use an appropriate overcurrent protection device (fuse, circuit breaker, etc.) with a sufficient breaking capacity for lines to which the relays of this device are connected to protect the circuits. Otherwise, there is a danger of fire or device failure.
If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Otherwise, there is a danger of fire or device failure.

■ Symbols used in the terminal wiring label

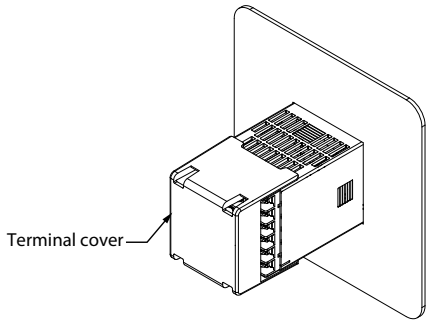
The following table shows the meaning of the symbols used in the terminal wiring label on the side of the device.

Symbol	Description
~	AC
⚠	Caution: risk of electrical shock
⚠	Caution: risk of device failure, electric shock, or fire due to wrong wiring Check the wiring and the wiring diagram.

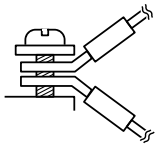
■ Wiring precautions

Pay attention to the following when wiring this device.

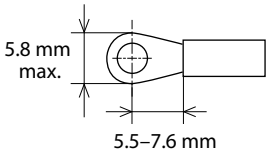
- Before wiring this device, verify its model No. and terminal Nos., which are written on the wiring diagram on the side of the device.
- Wire the power lines separately from input/output signal lines.
  Keep them at least 50 cm away from each other.
  Do not pass these two types of wiring through the same conduit or wiring duct.
- Do not use any terminals as relay terminals.
- Fasten to the correct tightening torque.
- To separately turn the power supply of this device on and off in instrumentation where current signals are input to multiple devices (including this device) connected in series, use the separately sold resistor (model No. 81401325) and set the range type to voltage.
- Connect a terminating resistor (120 Ω, ½ W or more recommended) to both ends of the RS-485 transmission line.
  However, if terminal resistance is not specified for other devices connected to the same transmission line, do not connect the resistor. If they do specify a resistor, use the highest resistance value specified, at least 120 Ω.
- Make sure that devices or equipment connected to the control outputs, PV inputs, CT inputs, or DI/Comm. of this device have reinforced insulation or double insulation suitable for their operating voltage and for this device's power.
- Attach the cover after wiring work.



- Remove the protective film from the LCD before use.
- Use 16–22 AWG cables.
- Be careful not to allow crimp terminals to touch adjacent terminals.



- Connect no more than two crimp terminal lugs to the same terminal screw. Bend the crimp terminal lugs in advance.
- Use crimp terminal lugs compatible with M3 screws.
  Recommended crimp terminal lug:
  V1.25-MS3, manufactured by J.S.T. Mfg. Co., Ltd.



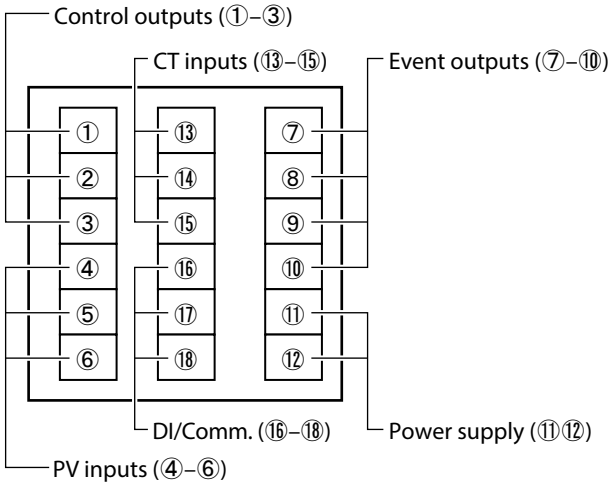
■ Precautions when turning on the device

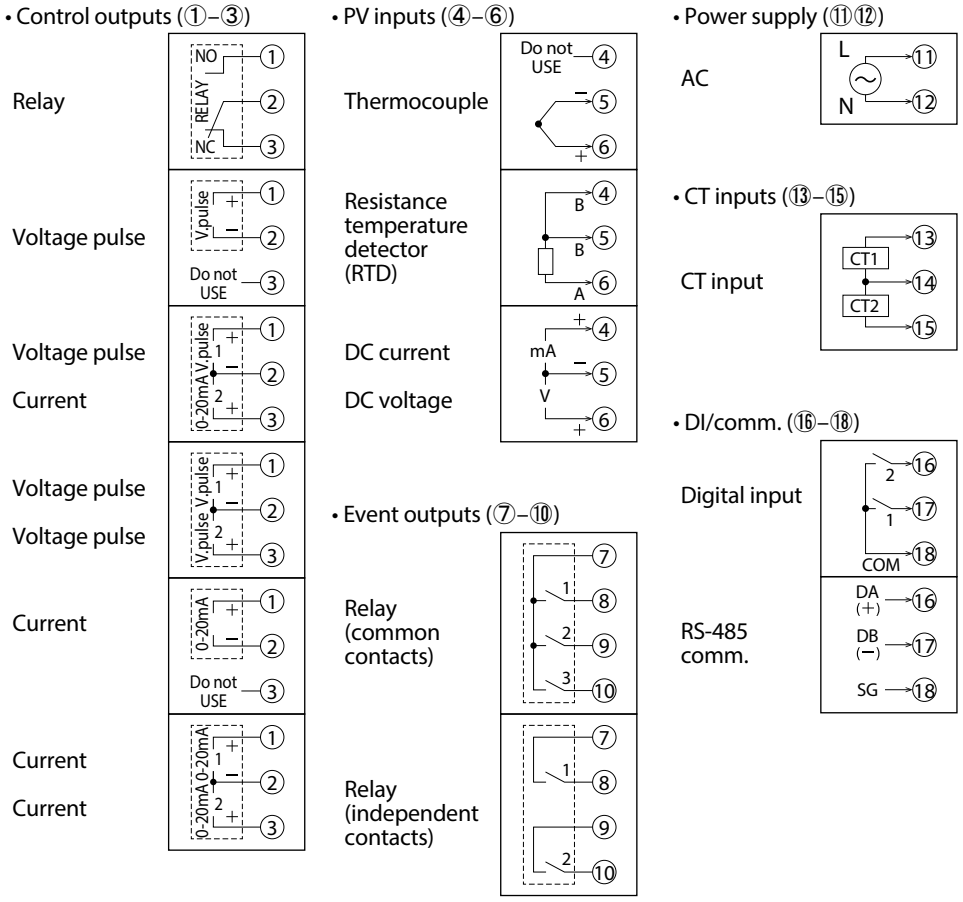
To ensure reliable operation, this device does not begin to operate for a maximum of nine seconds after power-on. To satisfy the specified accuracy, at least 30 minutes of warm-up time is required for this device.

■ Precautions for use

Make sure that the heater current does not exceed the allowable current specified in the specifications.

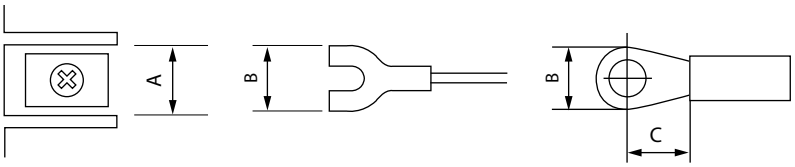
■ Wiring





● Recommended crimp terminal lugs

Use crimp terminal lugs compatible with M3 screws.

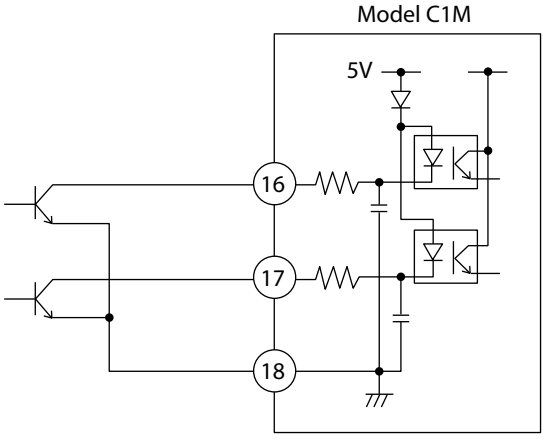


Mounting method	Compatible screw	Terminal dimensions (mm)			Compatible wire size	J.S.T. Mfg. Co., Ltd. Model No. (reference)
		A	B	C		
C1MT (for panel mounting)	M3	6.1	5.8 max.	5.5–7.6	0.3–1.2 mm^2 22–16 AWG	V1.25-MS3 (round terminals) V1.25 B3A (Y terminals)

! Handling Precautions

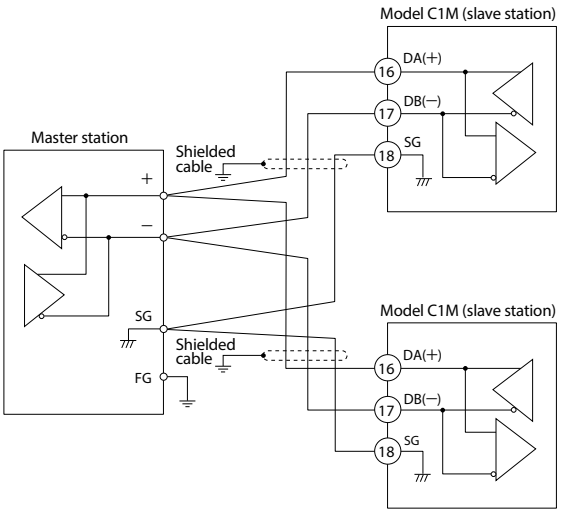
- If this device is installed where there is considerable vibration or shock, be sure to use round crimp terminal lugs to prevent wires from coming off the terminals.
- Be careful not to allow crimp terminal lugs to touch adjacent terminals.

■ Connecting open collector outputs to digital inputs

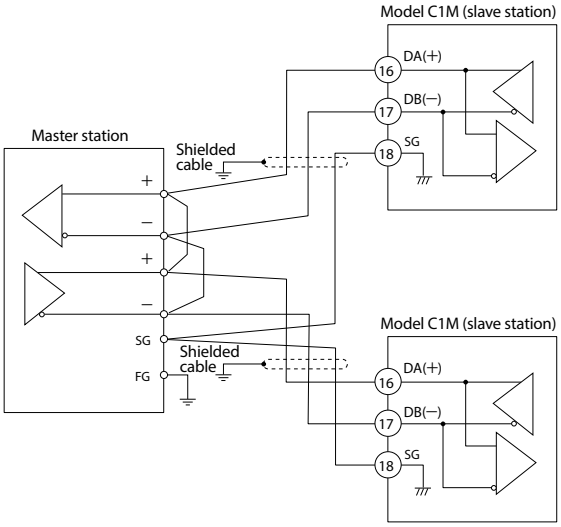


■ RS-485 communication connections

● If the system includes 3-wire devices only



●If the system includes 5-wire devices only



Important **Terminating resistor**

- Connect a terminating resistor (120 Ω, 1/2 W or more recommended) to both ends of the RS-485 transmission line.
- However, if terminal resistance is not specified for other devices connected to the same transmission line, do not connect the resistor. If they do specify a resistor, use the highest resistance value specified, at least 120 Ω.

! Handling Precautions

- Do not connect DA (+) to DB (–). Doing so might damage this device.
- Ground only one end of the shielded cable.
- Be sure to connect the signal ground (SG) terminals to each other. Otherwise, communication may be unreliable.

■ Connecting solid state relays (SSR)

To drive the SSR, controllers with voltage pulse outputs must be used. Specify a model No. that includes “V0,” “VC,” or “VV” (codes for control output).

An SSR can be roughly categorized as either a constant-current SSR or a resistance SSR. The following describes how to connect each type.

● Constant-current SSR

Check the following specifications of your SSR and the specification of the voltage pulse output of the C1M.

- Input current (maximum): If it is below the maximum current allowed for the voltage pulse output, the SSRs can be connected in parallel.
- Operating voltage: Check that the voltage between the voltage pulse output terminals is within the specified range.

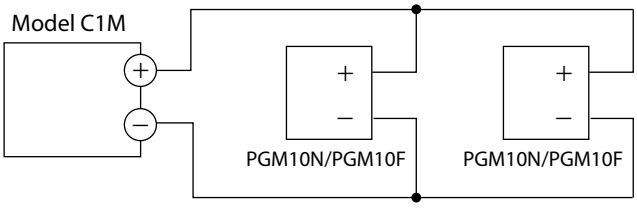
1. Azbil’s PGM10N or PGM10F

This example shows the calculation for the connection of this device and the PGM10N015.
For connection with other models, check the specifications of the model.

- Input current:
  Since the input current is 10 mA or less, up to two units (10 mA × 2 = 20 mA < 24 mA [maximum allowable current]) can be connected in parallel.
- Operating voltage:
  The input voltage of the SSR is 3.5 to 30 V. Therefore, the voltage between the terminals is within the specified range.

  Voltage between terminals (two PGM10N units)
  = Voltage when open − Internal resistance × Total drive current
  = 19 V DC ±15 % − 18 Ω ±0.5 % × 20 mA
  ≈16 to 21 V

Connection diagram



Number of connectable units

SSR	Connection	V0/VC model	VV model
PGM10N	Parallel	2 units max.	4 units max.*
PGM10F	Parallel	2 units max.	4 units max.*

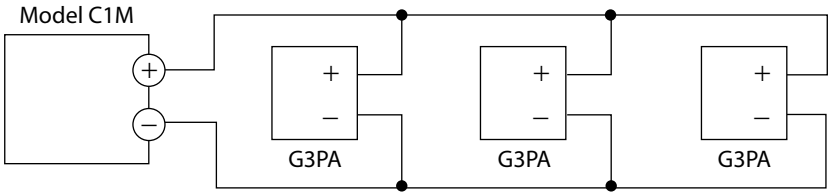
* Two units per output

2. Omron's G3PA, G3PE-_ _ _B, G3NA

- Input current:
  Since the input current is 7 mA or less, up to three units (7 mA × 3 = 21 mA < 24 mA [maximum allowable current]) can be connected in parallel.
- Operating voltage:
  The rated voltage is 5–24 V DC or 12–24 V DC. Therefore, the voltage between the terminals is within the specified range.

  Voltage between terminals (three G3PA units)
  = Voltage when open − Internal resistance × Total drive current
  = 19 V DC ±15 % − 18 Ω ±0.5 % × 21 mA
  ≈ 16 to 21 V

Connection diagram



Number of connectable units

SSR	Connection	V0/VC model	VV model
G3PA	Parallel	3 units max.	6 units max.*
G3PE-_ _ _B	Parallel	3 units max.	6 units max.*
G3NA	Parallel	3 units max.	6 units max.*

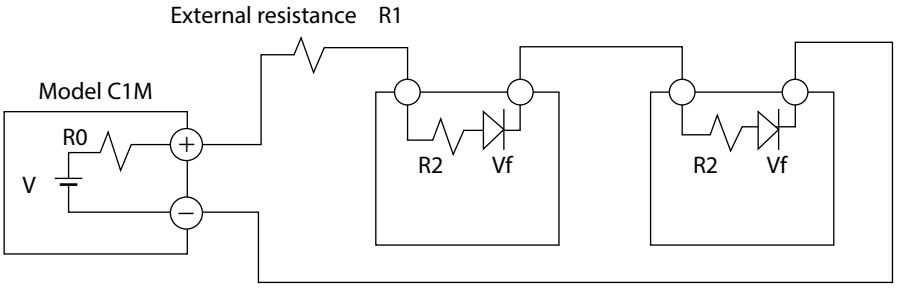
* Three units per output

● Resistance SSR

Connect an external resistor in series as needed so that the voltage between the input terminals of the SSR is within the specified range.

Example: when connecting two SSRs

Connection diagram



When connecting n units of the SSR, the voltage between the terminals of the SSR can be calculated by the expression below:

$((V \times R2) + Vf \times (R0 + R1)) \div (R0 + R1 + n \times R2)$

When n = 2 and external resistance R1 = 680 Ω, the result is:

V: 19 V ±15 %

R0: 18 Ω ±0.5 %

R1: 680 Ω

R2: 260 Ω

Vf: 1.1 V

Voltage between terminals

$= ((19 \times 260) + 1.1 \times (18 + 680)) \div (18 + 680 + 2 \times 260)$

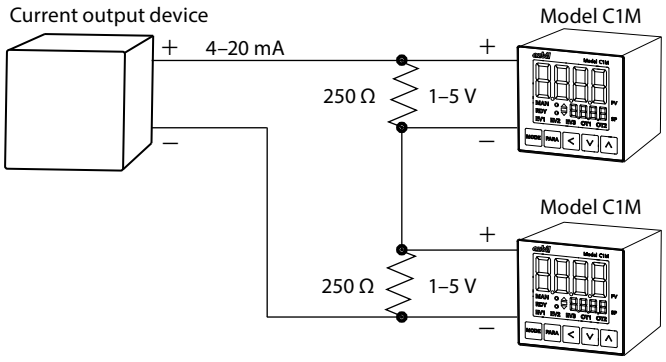
≈ 4.7 V

If the input voltage range of the SSR is 3–6 V, it can operate.

■ Connecting a current output device

When the power of this device is turned off, its current input circuit is disconnected.

When connecting a current output device to multiple C1M units whose power can be turned on and off individually, use the separately sold resistor (81401325) and specify a voltage input range.



■ Noise suppression measures

Use a single-phase instrument power supply to minimize the effect of electrical noise on this device.

If there is a large amount of electrical noise from the power supply, use an isolation transformer and a line filter.

(Azbil's line filter model No.: 81442557-001)

Use a CR filter for quick-rising noise.

(Azbil's CR filter model No.: 81446365-001)

[!] Handling Precautions

- If anti-noise measures are taken, do not bundle primary and secondary power lines of the isolation transformer together, and do not put them in the same conduit or duct.

4 - 2 Cables

For thermocouple input, connect the unshielded wires of the thermocouple to the PV input terminals.
If a thermocouple with a terminal block is used, or if the wiring distance is long, use compensating lead wires for connection with the terminals of this device.

Use shielded compensating lead wires.

- For inputs and outputs other than thermocouples, use JCS 4364 cables for low-power instruments or the equivalent (generally called twisted shielded cable for instrumentation use).
  The following cables are recommended.

Fujikura Dia Cable Ltd.	2 cores	IPEV-S-0.9 mm^2×1P
	3 cores	ITEV-S-0.9 mm^2×1T
Sumiden HST Cable Co., Ltd.	2 cores	JKPEV-S-0.9 mm^2×1P

Note: The model No. of the recommended cable may change without notice, so please contact the manufacturer.

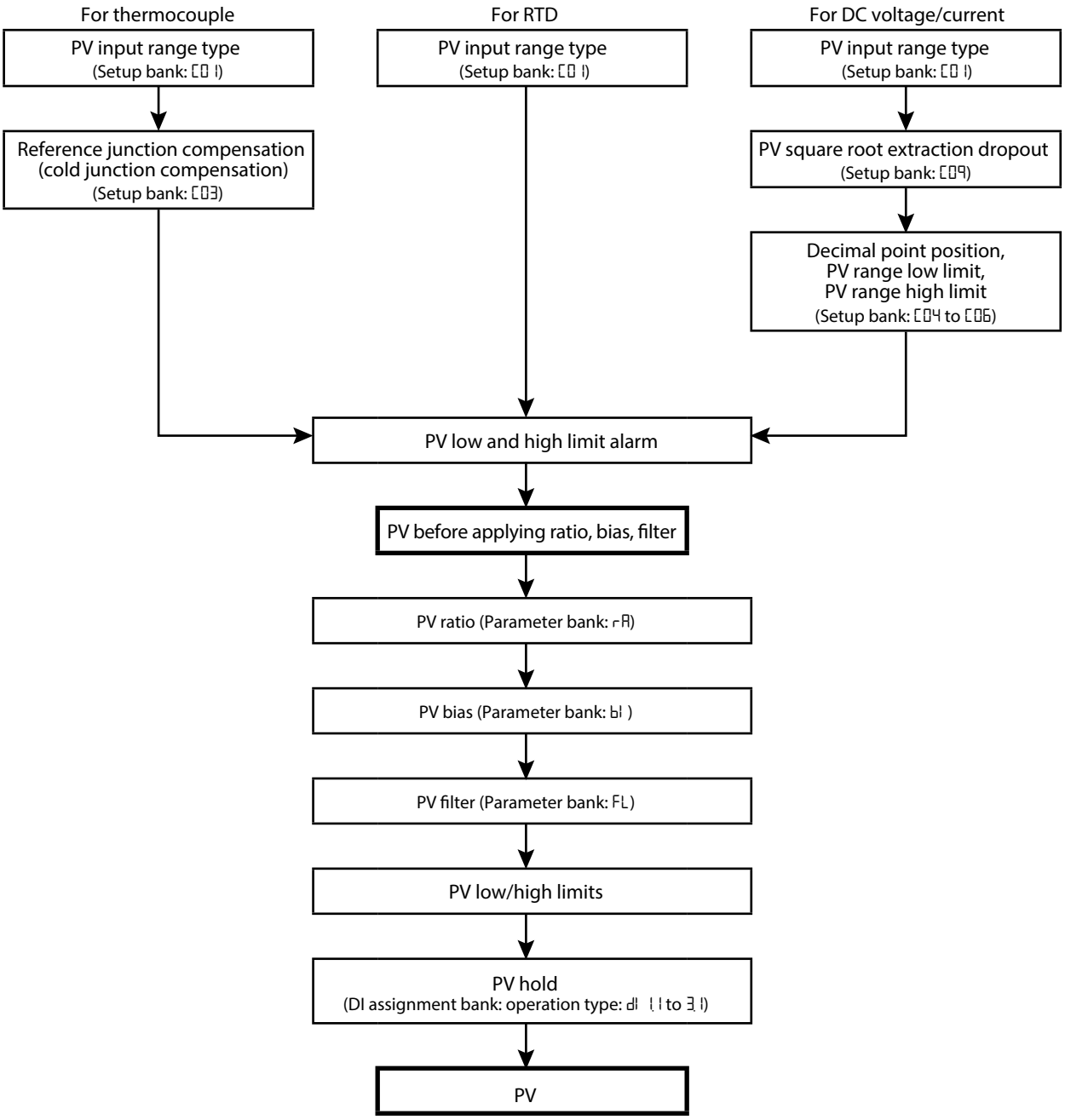
- If there is relatively little electromagnetic induction noise, shielded multi-core microphone cables (MVVS) can be used.

-MEMO-

Chapter 5. Functions

5 - 1 PV Input

The following is a functional block diagram for PV input.



■ PV input range type

For thermocouple and resistance temperature detector, the sensor type and the temperature range can be selected.

For DC voltage and DC current, the signal type can be selected.

Item (bank)	Display	Description	Initial value	User level
PV input range type (setup bank)	C 01	See the PV input range table.	Differs depending on the PV input type* specified by the model No.	Simple, standard, advanced

* For T (thermocouple) = 1, for R (RTD) = 41, for L (DC voltage/current) = 88

● PV input range table (thermocouple)

C01 setting	Sensor type	Range (Celsius)*1				C04 display*2	C04 setting range	C04 initial value*3
1	K	−200	to	+1200	°C	-	(Fixed)	0
2	K	0	to	1200	°C	-	(Fixed)	0
3	K	0.0	to	800.0	°C	✓	0–1	0
4	K	0.0	to	600.0	°C	✓	0–1	0
5	K	0.0	to	400.0	°C	✓	0–1	0
6	K	−200.0	to	+400.0	°C	✓	0–1	0
9	J	0.0	to	800.0	°C	✓	0–1	0
10	J	0.0	to	600.0	°C	✓	0–1	0
11	J	−200.0	to	+400.0	°C	✓	0–1	0
13	E	0.0	to	600.0	°C	✓	0–1	0
14	T	−200.0	to	+400.0	°C	✓	0–1	0
15	R*4	0	to	1600	°C	-	(Fixed)	0
16	S*4	0	to	1600	°C	-	(Fixed)	0
17	B*5	0	to	1800	°C	-	(Fixed)	0
18	N	0	to	1300	°C	-	(Fixed)	0
19	PLII	0	to	1300	°C	-	(Fixed)	0
20	WRe5-26	0	to	1400	°C	-	(Fixed)	0
21	WRe5-26	0	to	2300	°C	-	(Fixed)	0
23	PR40-20*6	0	to	1900	°C	-	(Fixed)	0
24	DIN U	−200.0	to	+400.0	°C	✓	0–1	0
25	DIN L	−100.0	to	+800.0	°C	✓	0–1	0

*1. If the display range is exceeded, this device continues displaying the maximum or minimum value that can be displayed.

*2. C04 is the setting of the decimal point position of the PV.

*3. C04 is reset to the initial value when C01 is changed.

*4. Accuracy Below 200 °C: ±9 °C

*5. Accuracy Below 260 °C: ±80 °C (reference value), 260 °C to below 600 °C: ±12 ° C, 600 °C to below 1000 °C: ±6 °C, 1000 °C or more: ±4.5 °C. Temperatures below 20 °C are not displayed.

*6. Accuracy Below 400 °C: not specified, 400 °C to below 1100 °C: ±40 °C, 1100 °C or more: ±12 °C.

C01 setting	Sensor type	Range (Fahrenheit)*1				C04 display*2	C04 setting range	C04 initial value*3
1	K	−300	to	+2200	°F	-	(Fixed)	0
2	K	0	to	2200	°F	-	(Fixed)	0
3	K	0	to	1500	°F	-	(Fixed)	0
4	K	0	to	1100	°F	-	(Fixed)	0
5	K	0.0	to	700.0	°F	✓	0–1	0
6	K	−300	to	+700	°F	-	(Fixed)	0
9	J	0	to	1500	°F	-	(Fixed)	0
10	J	0	to	1100	°F	-	(Fixed)	0
11	J	−300	to	+700	°F	-	(Fixed)	0
13	E	0	to	1100	°F	-	(Fixed)	0
14	T	−300	to	+700	°F	-	(Fixed)	0
15	R	0	to	3000	°F	-	(Fixed)	0
16	S	0	to	3000	°F	-	(Fixed)	0
17	B	0	to	3300	°F	-	(Fixed)	0
18	N	0	to	2300	°F	-	(Fixed)	0
19	PLII	0	to	2300	°F	-	(Fixed)	0
20	WRe5-26	0	to	2400	°F	-	(Fixed)	0
21	WRe5-26	0	to	4200	°F	-	(Fixed)	0
23	PR40-20	0	to	3400	°F	-	(Fixed)	0
24	DIN U	−300	to	+700	°F	-	(Fixed)	0
25	DIN L	−150	to	+1500	°F	-	(Fixed)	0

*1. If the display range is exceeded, this device continues displaying the maximum or minimum value that can be displayed.

*2. C04 is the setting of the decimal point position of the PV.

*3. C04 is reset to the initial value when C01 is changed.

● PV input range table (RTD)

C01 setting	Sensor type	Range (Celsius)*1				C04 display*2	C04 setting range	C04 initial value*3
41	Pt100	−200	to	+500	°C	-	(Fixed)	0
42	JPt100	−200	to	+500	°C	-	(Fixed)	0
43	Pt100	−200	to	+200	°C	-	(Fixed)	0
44	JPt100	−200	to	+200	°C	-	(Fixed)	0
45	Pt100	−100.0	to	+300.0	°C	✓	0–1	0
46	JPt100	−100.0	to	+300.0	°C	✓	0–1	0
51	Pt100	−50.0	to	+200.0	°C	✓	0–1	1
52	JPt100	−50.0	to	+200.0	°C	✓	0–1	1
53	Pt100	−50.0	to	+100.0	°C	✓	0–1	1
54	JPt100	−50.0	to	+100.0	°C	✓	0–1	1
63	Pt100	0.0	to	200.0	°C	✓	0–1	1
64	JPt100	0.0	to	200.0	°C	✓	0–1	1
67	Pt100	0.0	to	500.0	°C	✓	0–1	0
68	JPt100	0.0	to	500.0	°C	✓	0–1	0

*1. If the display range is exceeded, this device continues displaying the maximum or minimum value that can be displayed.

*2. C04 is the setting of the decimal point position of the PV.

*3. C04 is reset to the initial value when C01 is changed.

C01 setting	Sensor type	Range (Fahrenheit)*1				C04 display*2	C04 setting range	C04 initial value*3
41	Pt100	−300	to	+900	°F	-	(Fixed)	0
42	JPt100	−300	to	+900	°F	-	(Fixed)	0
43	Pt100	−300	to	+400	°F	-	(Fixed)	0
44	JPt100	−300	to	+400	°F	-	(Fixed)	0
45	Pt100	−150	to	+500	°F	-	(Fixed)	0
46	JPt100	−150	to	+500	°F	-	(Fixed)	0
51	Pt100	−50.0	to	+400.0	°F	✓	0–1	0
52	JPt100	−50.0	to	+400.0	°F	✓	0–1	0
53	Pt100	−50.0	to	+200.0	°F	✓	0–1	0
54	JPt100	−50.0	to	+200.0	°F	✓	0–1	0
63	Pt100	0.0	to	400.0	°F	✓	0–1	0
64	JPt100	0.0	to	400.0	°F	✓	0–1	0
67	Pt100	0.0	to	900.0	°F	✓	0–1	0
68	JPt100	0.0	to	900.0	°F	✓	0–1	0

*1. If the display range is exceeded, this device continues displaying the maximum or minimum value that can be displayed.

*2. C04 is the setting of the decimal point position of the PV.

*3. C04 is reset to the initial value when C01 is changed.

● PV input range table (DC voltage/current)

C01 setting	Sensor type	Range*1	C04 display*2	C04 setting range	C04 initial value*2
84	0–1 V	The scaling range is –1999 to +9999.	✓	0–3	0
86	1–5 V		✓	0–3	0
87	0–5 V		✓	0–3	0
88	0–10 V		✓	0–3	0
89	0–20 mA		✓	0–3	0
90	4–20 mA		✓	0–3	0

*1. If the display range is exceeded, this device continues displaying the maximum or minimum value that can be displayed.

*2. C04 is the setting of the decimal point position of the PV.

*3. C04 is not reset to the initial value when C01 is changed.

! Handling Precautions

- When the range No. is set, the initial setting for the PV decimal point position and the range that are shown in the tables above apply. ☞ PV decimal point position (p. 5-7) (for details on PV decimal point position)
- Be sure to specify the correct setting for C01 according to the sensor type and range. Otherwise, abnormal output may occur due to a large error in temperature.
- ☞ Chapter 14. Specifications (for the accuracy of each PV input range type)

■ Temperature unit

When the PV input range type is thermocouple or RTD, the temperature unit can be selected.

Item (bank)	Display	Description	Initial value	User level
Temperature unit (Setup bank)	C 02	0: Celsius (˚C) 1: Fahrenheit (˚F)	0	Simple, standard, advanced

- When the PV input range type is thermocouple or RTD, the display and setting can be configured.

■ Reference junction compensation (cold junction compensation)

If the PV input type is thermocouple, either one of the options below can be selected:

- This device does reference junction compensation (cold junction compensation).
- This device does not do reference junction compensation (cold junction compensation) because an external cold junction compensation device (ice bath, etc.) is used.

Item (bank)	Display	Description	Initial value	User level
Reference junction compensation (cold junction compensation) (setup bank)	C 03	0: Internal compensation (by this device) 1: External compensation (by another device)	0	Advanced

■ PV square root extraction dropout

If the PV input type is DC voltage/current, a dropout value can be set so that the result of the PV square root extraction used to convert the pressure (differential pressure) into the flow becomes "0."

Item (bank)	Display	Description	Initial value	User level
PV square root extraction dropout (setup bank)	C 09	0.0 %: PV square root extraction is not performed. 0.1 to 100.0 %	0.0 %	Advanced

- If the PV input type is DC voltage/current, this item is displayed and the setting can be changed.
- Details of PV square root extraction

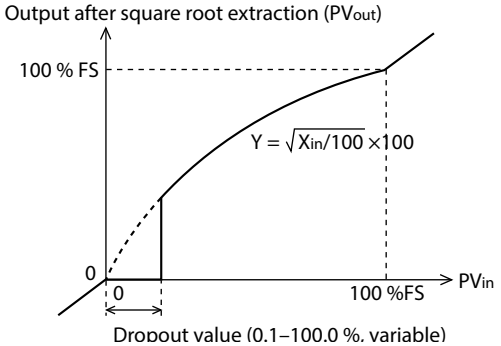
  The calculation input in % and the calculation result in % are expressed as PV_{in} and PV_{out}, respectively.

  If the PV input is greater than or equal to the PV square root extraction dropout value and is less than 100.0 %, the calculation formula will be:

  $$PV_{out} = \sqrt{PV_{in} / 100} \times 100$$

  If the PV input is more than 0.0 % and is smaller than the PV square root extraction dropout value, PV_{out} = 0.0 %.

  If the PV input is 0.0 % or less, or 100.0 % or more, the PV square root is not extracted, so $PV_{out} = PV_{in}$.



■ PV decimal point position

If the PV input type is DC voltage/current, or if some thermocouple or RTD range types are selected, the decimal point position of the PV input can be specified.

Item (bank)	Display	Description	Initial value	User level
PV decimal point position (setup bank)	C 04	0: No decimal point 1: 1 digit after the decimal point 2: 2 digits after the decimal point 3: 3 digits after the decimal point	0	Simple, standard, advanced

Handling Precautions

- This setting also applies to other parameters, including those listed below.
  - SP
  - SP low limit / high limit
  - SP up ramp / down ramp
  - PV range low limit / high limit
  - Event setting and continuous output setting related to PV
  - Event setting and continuous output setting related to SP
  - Event settings and continuous output settings related to deviation (absolute deviation)
  - ON/OFF control differential
  - ON/OFF control operating point offset
  - MV switching point PV in AT

Note

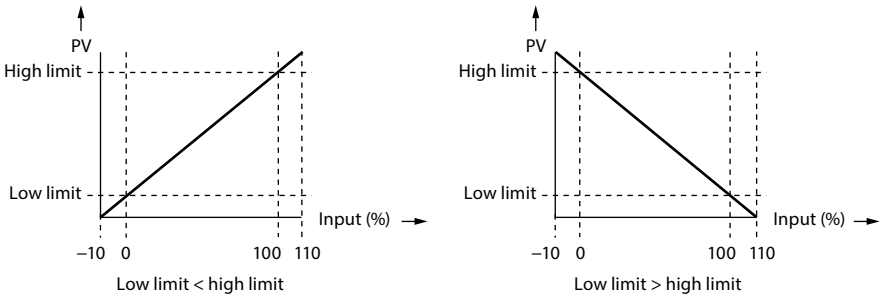
- ☞ PV input range type (p. 5-2) (for whether this item is displayed for a certain C01 setting. The setting range and initial value also vary depending on the setting.)

■ PV range low/high limit

If the PV input type is DC voltage/current, scaling of the PV input can be specified.

Item (bank)	Display	Description	Initial value	User level
PV range low limit (setup bank)	C 05	If the PV input type is DC voltage/current: −1999 to +9999 (no decimal point) −199.9 to +999.9 (1 digit after the decimal point) −19.99 to +99.99 (2 digits after the decimal point) −1.999 to +9.999 (3 digits after the decimal point) If the PV input type is thermocouple or RTD: the low and high limits of the specified PV input range	0	Simple, standard, advanced
PV range high limit (setup bank)	C 06		1000	

- If the PV input type is thermocouple or RTD, this item is displayed but the setting cannot be changed.
- If the PV input type is DC voltage/current, this item is displayed and the setting can be changed. The following figures show the relationship between the PV input and the PV according to the range low and high limit settings.



■ PV ratio and PV bias

The PV ratio and PV bias can be set to compensate the PV.

Item (bank)	Display	Description	Initial value	User level
PV ratio (parameter bank)	rA	0.001 to 9.999	1.000	Standard, advanced
PV bias (parameter bank)	bI	−1999 to +9999U	0	Simple, standard, advanced

- Details of PV ratio/bias calculation

  When the input is PV_{in}, the result is PV_{out}, the PV ratio is RA, and the PV bias BI, the formula will be:

  $$PV_{out} = (PV_{in} \times RA) + BI$$

■ PV low limit alarm threshold

Item (bank)	Display	Description	Initial value	User level
PV input failure (under range) type (setup bank)	C 97	0: –10 % FS 1: –5 mV (valid only when C01 (PV input range type) is set to 17 or 23.)	0	Simple, standard, advanced

This setting is valid when C01 (PV input range type) is set to 17 (sensor type: B) or 23 (sensor type: PR40-20). If 1 (–5 mV) is set, the PV low limit alarm is not triggered when the sensor is connected normally.

The PV low limit alarm is triggered if the sensor is connected in the wrong direction. ☞ ■ PV limiting and PV low/high limit alarm (p. 5-10) (for the lowest PV that can be displayed)

■ Sampling cycle

The update cycle for PV input and control calculation can be specified.

Item (bank)	Display	Description	Initial value	User level
Sampling cycle	C 98	1: 50 ms 2: 100 ms 3: 300 ms 4: 500 ms	1	Advanced

■ PV filter

The PV filter is a first-order lag filter used if the PV fluctuates sharply and repeatedly out of control or if it flutters due to noise, etc. The larger the setting is, the less frequently the PV changes.

Under normal circumstances, keep the filter at its initial value of 0.0.

Item (bank)	Display	Description	Initial value	User level
PV filter (parameter bank)	FL	0.0: No filter 0.1 to 120.0 s	0.0 s	Simple, standard, advanced

$$OUT = OUT_{LAST} + (IN - OUT_{LAST}) / (T/T_s + 1)$$

IN: Input to the filter
OUT: Current filter calculation output
OUT_{LAST}: Previous filter calculation output
T: Filter setting (s)
Ts: Sampling cycle (select from 0.05, 01, 0.3, 0.5 s)

■ PV hold

If the PV display is fluctuating, the display can be held steady in one of three ways by assigning "PV hold," "PV max. hold," or "PV min. hold" to a digital input (DI).

PV hold:
The PV at a certain time is displayed and not updated.

PV max. hold:
The maximum PV is displayed.
The maximum PV is updated only if a new PV is greater than the displayed value.

PV min. hold:
The minimum PV is displayed.
The minimum PV is updated only if a new PV is smaller than the displayed value.

When the PV from a certain time, the maximum PV, or the minimum PV is being displayed, the PV on the upper display flashes (blinks).

■ PV limiting and PV low/high limit alarm

The PV low and high limits are specified for each PV input range No. In principle, −10 % FS is the low limit and +110 % FS is the high limit of the PV.

☞ ■ Operation when a PV input error occurs (p. 11-4)

The PV is limited to falling within the range.

If the PV before the PV ratio, PV bias, and PV filter are applied is greater than the PV high limit, a PV high limit alarm (AL01) is generated. If it is less than the PV low limit, a PV low limit alarm (AL02) is generated.

! Handling Precautions

- If the temperature unit is Fahrenheit, the PV low limit for ranges 41–44 is −235 °F.
  A PV low limit alarm (AL02) is generated between −300 and −235 °F, which is within the PV range.
  To control a process below −235 °F, set the output operation at PV alarm (C15) to "0" (continue the control calculation) or set the temperature unit (C02) to "0" (Celsius (°C)).
  Note that if the output operation at PV alarm (C15) is set to "0" (continue the control calculation), control will continue also when an abnormality such as a PV high limit alarm (AL01) occurs.

PV range No.	Range	PV low limit	PV high limit
41, 42	−300 to +900 °F	−235 °F	+1020 °F
43, 44	−300 to +400 °F	−235 °F	+470 °F

5-2 Mode

The user can switch AUTO/MANUAL modes and RUN/READY modes, stop or start the AT (auto tuning), release all DO (digital output) latches, and turn on or off user-defined bit 1.

■ AUTO/MANUAL mode

AUTO and MANUAL modes can be switched.

Item (bank)	Display	Description	Initial value	User level
AUTO/MANUAL (mode bank)	A--M	AUto(0): AUTO mode MAn(1): MANUAL mode	AUto	Simple, standard, advanced

- After a switch between AUTO and MANUAL modes, the display returns to the operation display.
- If the operation type of any of internal contacts 1 to 5 is set to AUTO/MANUAL, A--M (AUTO/MANUAL) is displayed but the setting cannot be changed with the keys.
- If CtrL (control method) is set to 0 (ON/OFF control), AUTO mode will apply. A--M (AUTO/MANUAL) is not displayed and the setting cannot be changed with the keys.
- If "Bit 0: AUTO/MANUAL display" of C73 (mode display setup) is set to 0 (disabled), A--M (AUTO/MANUAL) is not displayed and the setting cannot be changed with the keys.

■ RUN/READY mode

RUN and READY modes can be switched.

Item (bank)	Display	Description	Initial value	User level
RUN/READY (mode bank)	r--r	rUn(0): RUN mode rdY(1): READY mode	rUn	Simple, standard, advanced

- If the operation type of any of internal contacts 1 to 5 is set to RUN/READY, r--r (RUN/READY) is displayed but the setting cannot be changed with the keys.
- If "Bit 1: RUN/READY display" of C73 (mode display setup) is set to 0 (disabled), r--r (RUN/READY) is not displayed and the setting cannot be changed with the keys.

■ AT (automatic tuning) stop/start

AT can be started or stopped.

Item (bank)	Display	Description	Initial value	User level
AT (Auto-Tuning) stop/start (mode bank)	AT	AT_oF(0): AT stop AT_on(1): AT start	AT_oF	Simple, standard, advanced

- AT stops in MANUAL or READY mode.
- If a PV high limit error (AL01) or PV low limit error (AL02) occurs, AT stops.
- If the operation type of any of internal contacts 1 to 5 is set to AT stop/start, AT (AT stop/start) is displayed but the setting cannot be changed with the keys.
- If CtrL (control method) is set to 0 (ON/OFF control), At (AT stop/start) is not displayed and the setting cannot be changed with the keys. If CtrL (Control method) is changed to 0 (ON/OFF control) while AT is running, AT stops.
- If "Bit 3: AT stop/start display" of C73 (mode display setup) is set to 0 (disabled), AT (AT stop/start) is not displayed and the setting cannot be changed with the keys.
☞ ■ AT (automatic tuning) (p. 5-27), 5 - 4 AT (Automatic Tuning) Function (p. 5-31) (for details on AT)

■ AT error

AT status can be monitored, and if it ends abnormally, the error can be cleared by this setting.

Item (bank)	Display	Description	Initial value	User level
Auto tuning error (mode bank)	AT.Er	Er_oF(0): Normal Er_on(1): Abnormal	Er_oF	Simple, standard, advanced

- After executing the AT start operation, if AT does not start, or if it stops without changing the PID constants, ATEr (auto tuning error) will be set to Er_on (abnormal).
- The error can be reset to Er_oF (normal) by any of the following operations.
  - Change the setting of ATEr (auto tuning error) to Er_oF (normal).
  - Try executing AT again until it ends normally.
  - Turn the power off and then back on.
- ☞ ■ AT (automatic tuning) (p. 5-27), 5 - 4 AT (Automatic Tuning) Function (p. 5-31) (for details on AT)

■ Release all DO (digital output) latches

Whether to release all DO (digital output) latches can be set.

Item (bank)	Display	Description	Initial value	User level
Release all DO (digital output) latches (mode bank)	doLt	LtOn(0): Latch continue LtoF(1): Latch release	LtOn	Simple, standard, advanced

- If the operation type of any of internal contacts 1 to 5 is set to 18 (release/continue all DO latches), doLt (release all DO latches) is displayed but the setting cannot be changed with the keys.
- If "Bit 4: release all DO latches display" of C73 (mode display setup) is set to 0 (disabled), doLt (release all DO latches) is not displayed and the setting cannot be changed with the keys.

■ User-defined bit 1

User-defined bit 1 can be turned on or off.

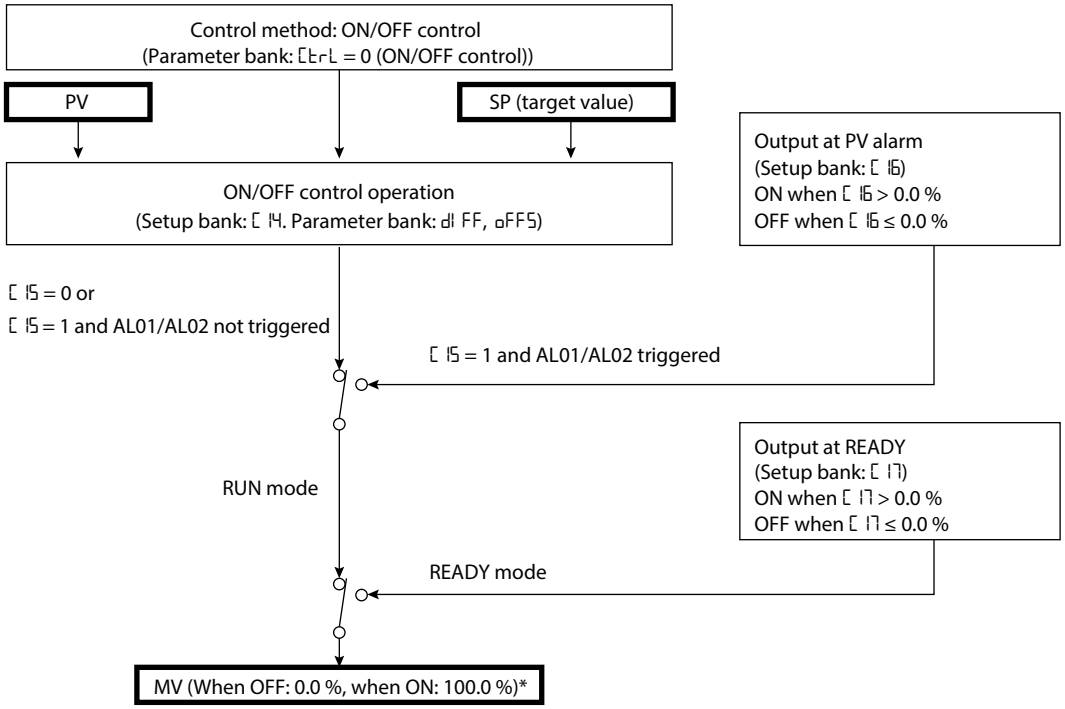
Item (bank)	Display	Description	Initial value	User level
User-defined bit 1 (mode bank)	Udb.1	dboF(0): User defined bit 1 is OFF. dbOn(1): User defined bit 1 is ON.	dboF	Simple, standard, advanced

- There are four user-defined bits, 1 to 4, but only user-defined bit 1 can be turned on or off using the keys.
- A function (operation) can be set for user-defined bit 1 in the DI assignment bank.
- If "Bit 5: user-defined bit 1 ON/OFF display" of C73 (mode display setup) is set to 0 (disabled), Udb.1 (user-defined bit 1) is not displayed and the setting cannot be changed.

5 - 3 Control

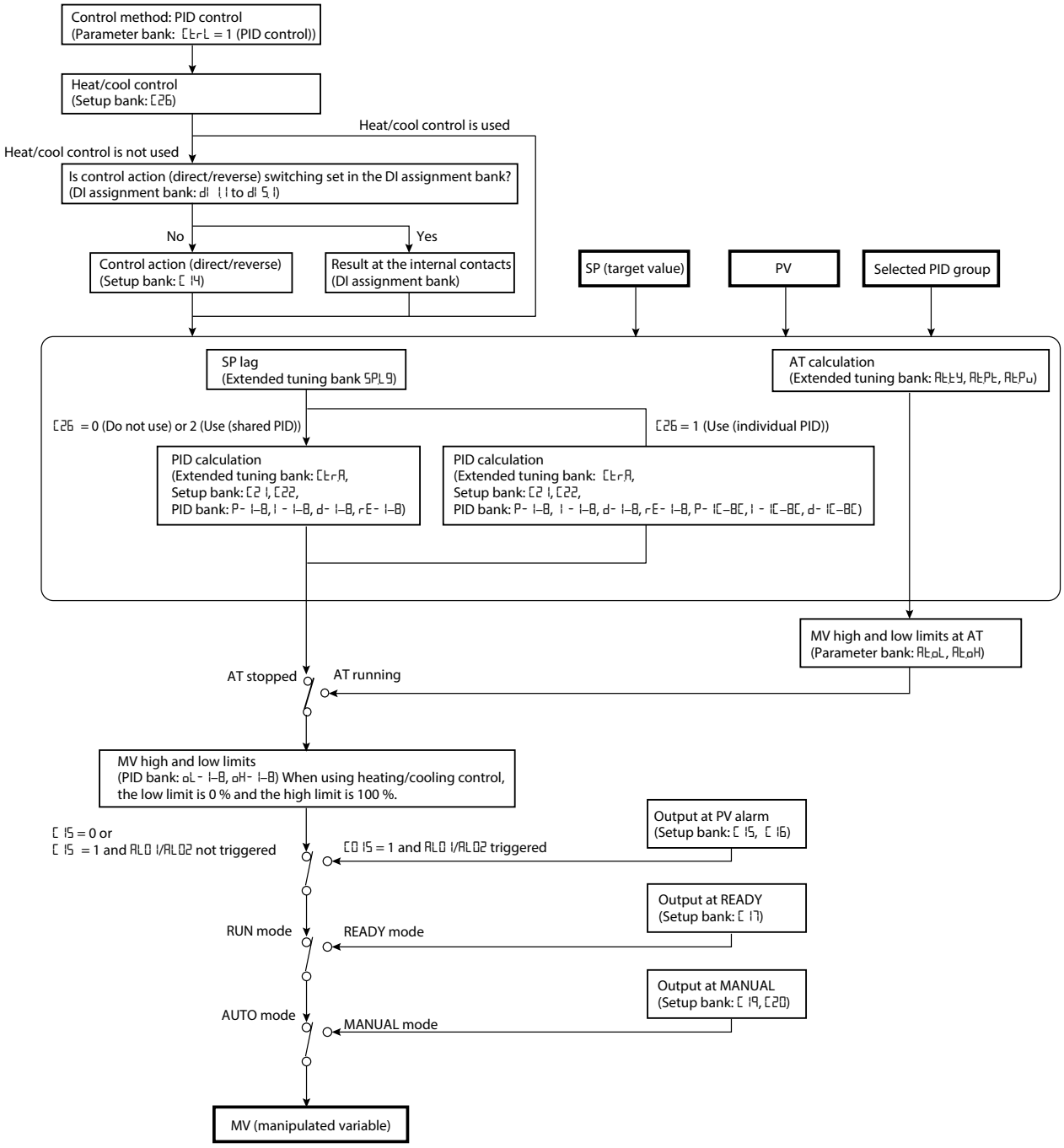
Functional block diagrams for control (ON/OFF control, PID control, Ra-PID control, heating/cooling control, etc.) are shown below.

■ ON/OFF control

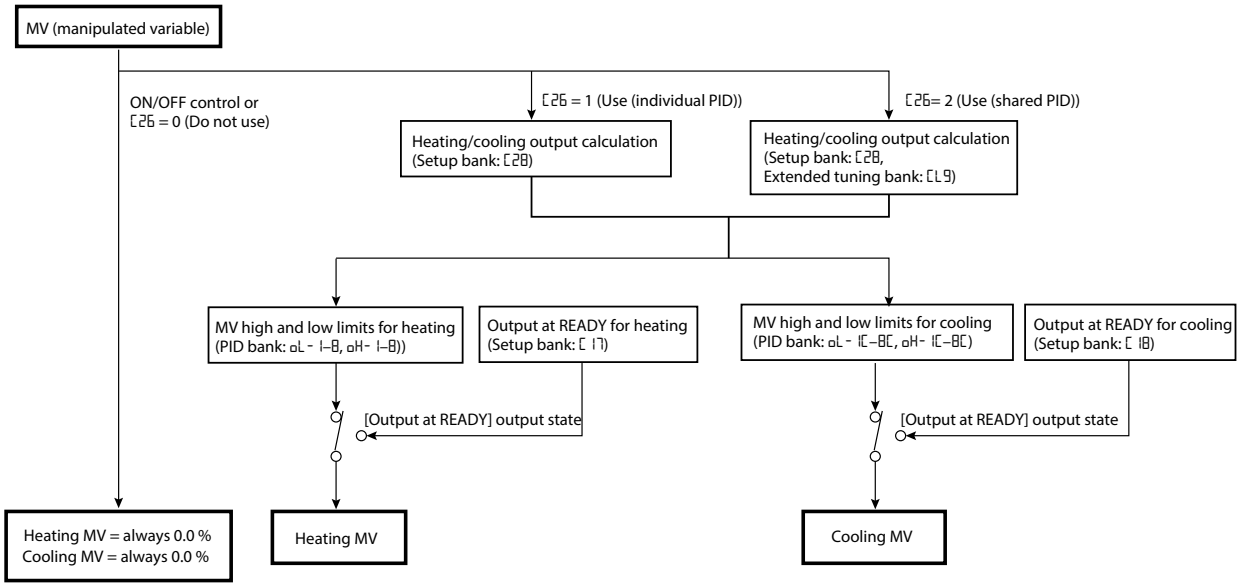


* If you have set the operation type setting in the DO assignment bank to 3–6 (functions 1–4) and use the result of ON/OFF control in a logical operation, set "MV ON/OFF status 1" for output assignments A–D.

■ PID control, Ra-PID control, heating/cooling control



■ Heating MV and cooling MV

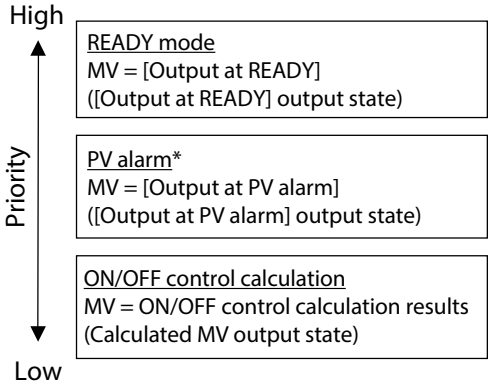


■ Control method

There are two control methods.

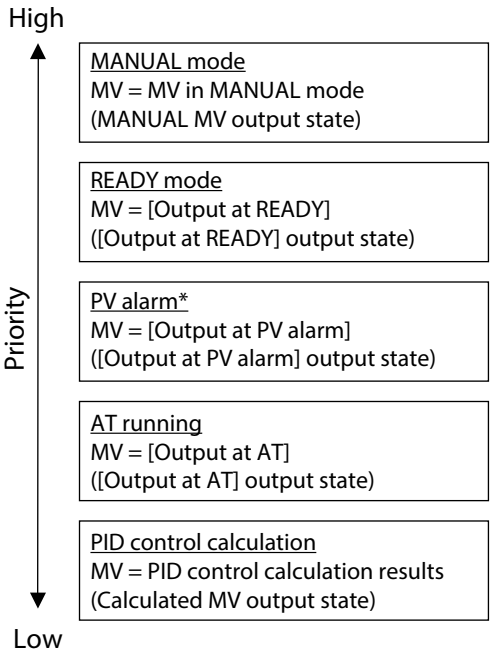
Item (bank)	Display	Description	Initial value	User level
Control method (parameter bank)	CtrL	0: ON/OFF control 1: PID control	0 or 1	Simple, standard, advanced

- If relay (R0) is selected for control output by the model No., the initial value is 0 (ON/OFF control). For other models, the initial value is 1 (PID control).
- The MV that is output in ON/OFF control is shown below.



* Valid only when [Output operation at PV alarm] is set to 1 (output the value set for [Output at PV alarm]).

- The MV that is output in PID control is shown below.



* Valid only when [Output operation at PV alarm] is set to 1 (output the value set for [Output at PV alarm]).

■ Control action and heating/cooling control

Direct/reverse of the control action and whether to use the heating/cooling control can be selected.

Item (bank)	Display	Description	Initial value	User level
Control action (direct/reverse) (setup bank)	C 14	0: Heating control (reverse action) 1: Cooling control (direct action)	0	Simple, standard, advanced
Heat/cool control (setup bank)	C 26	0: Not used 1: Use (individual PID) 2: Use (shared PID)	0	Simple, standard, advanced

- If CTRL (Control method) is set to 1 (PID control) and the total number of control outputs and event outputs is 2 or more, C 26 (Heat/cool control) is displayed and the setting can be changed.
- If C26 (heat/cool control) is set to 0 (not used), C 14 (control action) is displayed and the setting can be changed.
- If C26 (heat/cool control) is set to 0 (not used), C20 (preset MANUAL value) and C22 (initial output of PID control) will change to 0.0.
- If the setting of C26 (heat/cool control) is changed from 0 (not used) to another setting, C20 (preset MANUAL value) will change to 50.0 and C22 (initial output of PID control) will change to 50.0.
- If C26 (heat/cool control) is set to 2 (use (shared PID)), AT□L (MV low limit at AT) will change to 50.0 and AT□H (MV high limit at AT) will be 100.0.
- If C26 (heat/cool control) is changed from 2 (use (shared PID)) to another setting, AT□L (MV low limit at AT) will change to 0.0 and AT□H (MV high limit at AT) will be 100.0.
- Reverse action (heating control) is a control that reduces (or turns off) the MV when the PV increases.
  Direct action (cooling control) is a control that increases (or turns on) the MV when the PV increases.

■ Special control output

The MV (manipulated variable) in the [Output at PV alarm] output state and the [Output at READY] output state can be specified.

Item (bank)	Display	Description	Initial value	User level
Output operation at PV alarm (setup bank)	C 15	0: Continue the control calculation 1: Output the value set for "Output at PV alarm"	0	Advanced
Output at PV alarm (setup bank)	C 16	−10.0 to +110.0 %	0.0 %	Advanced
Output at READY (Heat) (setup bank)	C 17	−10.0 to +110.0 %	0.0 %	Standard, advanced
Output at READY (Cool) (setup bank)	C 18	−10.0 to +110.0 %	0.0 %	Standard, advanced

- If CtrL (control method) is set to 1 (PID control) and C26 (heat/cool control) is set to 1 or 2, C 18 (output at READY (Cool)) is displayed and the setting can be changed.
- When the PV is abnormal, AL01 or AL02 occurs.

■ Operation when switched to MANUAL mode

The MV in the MANUAL MV output state can be set.

Item (bank)	Display	Description	Initial value	User level
Output operation at changing AUTO/MANUAL (setup bank)	C 19	0: Bumpless transfer 1: Preset	0	Standard, advanced
Preset MANUAL value (setup bank)	C 20	−10.0 to +110.0 %	0.0 or 50.0 %	Standard, advanced

- If C 19 (output operation at changing AUTO/MANUAL) is set to 0 (bumpless transfer), the MV when switched from AUTO to MANUAL is retained.
  If 1 (preset) is set, the MV is changed to the value set by C20 (preset MANUAL value) when the mode is switched from AUTO to MANUAL.
- If CtrL (control method) is set to 1 (PID control), C 19 (output operation at changing AUTO/MANUAL) and C20 (preset MANUAL value) are displayed and the settings can be changed.
- The initial value of C20 (preset MANUAL value) is 0.0 when C26 (heat/cool control) is set to 0 (not used), and 50.0 when the setting is 1 or 2 (use).

[!] Handling Precautions

- If the mode is MANUAL at power ON, the MV will be the value set by C20 (preset MANUAL value).

■ Initial output type (mode) of PID control

Item (bank)	Display	Description	Initial value	User level
Initial output type (mode) of PID control (setup bank)	C 21	0: Automatic 1: Not initialized 2: Initialize (if a new SP is set)	0	Advanced

- If CtrL (control method) is set to 1 (PID control), this item is displayed and the setting can be changed.
- When PID groups are switched according to a change in the SP or the SP group, the MV may be stuck at the low or high limit, and the PV may not change or may overshoot. PID control initialization is useful in preventing these problems.
- If 0 (automatic) is set:
  When the SP value is changed or SP groups are switched, whether the PID control must be initialized or not is determined automatically, and it is initialized only when necessary.
- If 1 (not initialized) is set:
  PID control is not initialized when the SP is changed or SP groups are switched. This setting is useful if the continuity of the MV is important when the SP is changed or SP groups are switched.
- If 2 (initialize) is set:
  PID control is always initialized when the SP is changed or SP groups are switched. This setting is useful if it is important that, when the SP is changed or SP groups are switched, the MV increases or decreases quickly according to the relationship between the PV and SP.

■ Initial output of PID control

Item (bank)	Display	Description	Initial value	User level
Initial output of PID control (setup bank)	C 22	−10.0 to +110.0 %	0.0 or 50.0 %	Advanced

- If C tRL (control method) is set to "1" (PID control), this item is displayed and the setting can be changed.
- This value is used for PID control immediately after the operation mode is changed from READY to RUN, or after RUN mode is activated when the power is turned on. This value greatly affects the MV when the mode is switched.
- If the setting for C 26 (heat/cool control) is changed, the value will be reset automatically. If it is changed to 1 or 2 (use), 50.0 % will apply. If it is changed to 0 (not used), 0.0 % will apply.

■ Integral time and derivative time decimal point position

Item (bank)	Display	Description	Initial value	User level
Integral time and derivative time decimal point position (setup bank)	C 23	0: No decimal point 1: 1 digit after the decimal point 2: 2 digits after the decimal point 3: 3 digits after the decimal point	0	Advanced

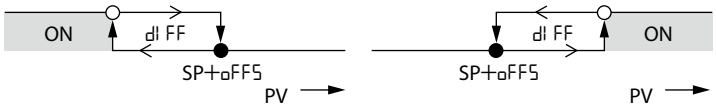
- If C tRL (control method) is set to 1 (PID control), this item is displayed and the setting can be changed.
- If 0 is set, the integral time and derivative time settings will be from 0 to 9999 s.
- If 1 is set, the integral time and derivative time settings will be from 0.0 to 999.9 s.

■ ON/OFF control

The settings related to ON/OFF control can be specified.

Item (bank)	Display	Description	Initial value	User level
ON/OFF control differential (parameter bank)	dI FF	0 to 9999U	5	Simple, standard, advanced
ON/OFF control operating point offset (parameter bank)	oFFS	–1999 to +9999U	0	Advanced

- If CtrL (control method) is set to 0 (ON/OFF control), dI FF (ON/OFF control differential) and oFFS (ON/OFF control operating point offset) are displayed and the settings can be changed.
- The operation of ON/OFF control is shown below.



Heating control (reverse action) Cooling control (direct action)

The meaning of the symbols in the diagram:

●: ON/OFF changes at the value

○: ON/OFF changes when the value is exceeded

- Example of how to use the ON/OFF control differential and the ON/OFF control operating point offset:
  In heating control with SP = 200 °C, if you want to turn off the output when the temperature is 205 °C or higher and turn on the output when the temperature falls below 190 °C, set the differential to 15 °C and the offset to 5 °C.
  In cooling control with SP = 10 °C, if you want to turn off the output when the temperature is 5 °C or lower and turn on the output when the temperature is above 10 °C, set the differential to 5 °C and the offset to −5 ° C.

[!] Handling Precautions

- dI FF (ON/OFF control differential) and oFFS (ON/OFF control operating point offset) should be set so that the output is turned on or off within the PV range. ☞ ■ PV input range type (p. 5-2) (for details on the PV range)

■ PID control

The settings related to PID control can be specified.

Item (bank)	Display	Description	Initial value	User level
Proportional band (PID bank)	P-1 to 8	0.1 to 999.9 %	5.0 %	Simple, standard, advanced
Integration time (PID bank)	I-1 to 8	0 to 9999U (0 = no integral operation)	120 s	
Derivative time (PID bank)	d-1 to 8	0 to 9999U (0 = no derivative operation)	30 s	
Manual reset (PID bank)	rE-1 to 8	−10.0 to +110.0 %	50.0 %	
MV low limit (PID bank)	oL-1 to 8	−10.0 to +110.0 %	0.0 %	Standard, advanced
MV high limit (PID bank)	oH-1 to 8	−10.0 to +110.0 %	100.0 %	
Cool-side proportional band (PID bank)	P-1C to 8C	0.1 to 999.9 %	5.0 %	Simple, standard, advanced
Cool-side integration time (PID bank)	I-1C to 8C	0 to 9999U (0 = no integral operation)	120 s	
Cool-side derivative time (PID bank)	d-1C to 8C	0 to 9999U (0 = no derivative operation)	30 s	
Cool-side MV low limit (PID bank)	oL 1C to 8C	−10.0 to +110.0 %	0.0 %	Standard, advanced
Cool-side MV high limit (PID bank)	oH 1C to 8C	−10.0 to +110.0 %	100.0 %	

- If CtrL (control method) is set to “1” (PID control), this item is displayed and the setting can be changed.
- The abbreviations for “Cool-side proportional band,” “Cool-side integration time,” and “Cool-side derivative time” are displayed and the settings can be changed if C26 (heat/cool control) is set to 1 (use (individual PID)).
- The abbreviations for “Cool-side MV low limit” and “Cool-side MV high limit” are displayed and the settings can be changed if C26 (heat/cool control) is set to 1 or 2 (use).
- In heating/cooling control, if “integration time” (I-1) or “cool-side integration time” (I-1C) is 0 seconds, no integration is performed. Manual reset (rE-1) is used for both heating and cooling.
- rE-1 (manual reset) is displayed if the integration time setting for either heating or cooling is “0.”
- If the integration time for either heating or cooling is 0 seconds, both integration times are processed as 0 seconds.
- If the MV low limit is greater than the MV high limit, the low limit and the high limit are automatically interchanged.

● PID control operation initialization

PID calculation results are initialized when:

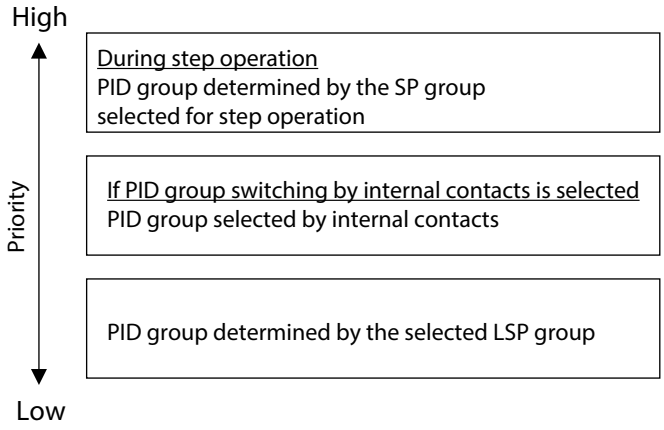
- PID control starts after the MANUAL MV output state changes to the calculated MV output state
- PID control starts after the [Output at READY] output state changes to the calculated MV output state
- PID control starts after the [Output at PV alarm] output state changes to the calculated MV output state
- PID control starts after the [Output at AT] output state changes to the calculated MV output state after AT ends normally
- PID control starts after the [Output at AT] output state changes to the calculated MV output state after AT ends abnormally
- The settings below are changed in the calculated MV output state:

  Control method
  Heat/cool control
  Control operation
  Sampling cycle
  Control algorithm

- PID calculation results are initialized according to the setting for [Initial output type (mode) of PID control] (C2 I) in the calculated MV output state

● Priority in PID group switching

The priority for PID group switching is shown below.



■ Heating/cooling control

The dead zone and cooling gain can be set for heating/cooling control.

Item (bank)	Display	Description	Initial value	User level
Heat/Cool control dead zone (setup bank)	C 28	−100.0 to +100.0 %	0.0 %	Simple, standard, advanced
Cooling gain	CL9	−10.0 to +110.0 %	30.0 %	Advanced

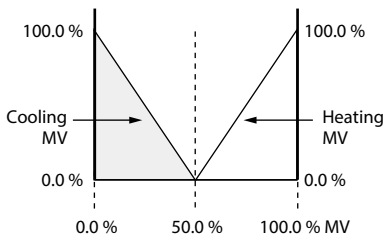
Heating/cooling control operations are as follows.

- C28 (heat/cool control dead zone) is displayed and the setting can be changed if C26 (heat/cool control) is set to 1 or 2 (use).
- If C 26 (Heat/cool control) is set to 1 (Use (individual PID)), the settings for heating in the selected PID group apply when the MV is 50 % or more, and the settings for cooling in the selected PID group apply when the MV is less than 50 %.
- CL9 (cooling gain) is displayed and the setting can be changed if C26 (heat/cool control) is set to 2 (use (shared PID)).
- Set CL9 (cooling gain) to a higher value to boost the cooling capability, and set it to a lower value to decrease the cooling capability.

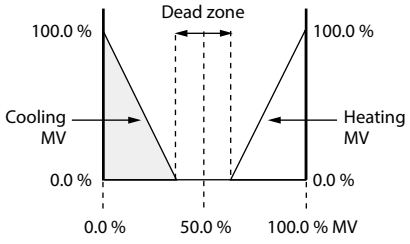
Note

● Heating/cooling output

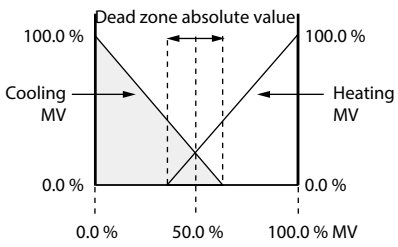
If C26 (heat/cool control) is set to 1 (use (individual PID)), the heating and cooling MVs shown in the figures below are output in accordance with the setting for "Heat/cool control dead zone."



When the dead zone is 0.0 %



When the dead zone is more than 0.0 %



When the dead zone is less than 0.0 %

The figure below shows the relationship between the MV low limit, MV high limit, cooling MV low limit, and cooling MV high limit.

MV low limit ≤ heating MV ≤ MV high limit

Cooling MV low limit ≤ cooling MV ≤ cooling MV high limit

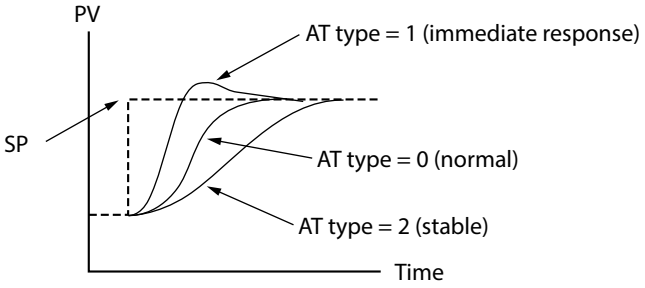
■ AT (automatic tuning)

The following settings can be specified for AT.

Item (bank)	Display	Description	Initial value	User level
MV low limit at AT (parameter bank)	AT.oL	−10.0 to +110.0 %	0.0 %	Simple, standard, advanced
MV high limit at AT (parameter bank)	AT.oH	−10.0 to +110.0 %	100.0 %	
AT type (extended tuning bank)	AT.tY	0: Normal (regular control characteristics) 1: Immediate response (to disturbance) 2: Stable (minimal PV fluctuation)	1	
AT proportional band adjust (extended tuning bank)	AT-P	0.00 to 99.99	1.00	Advanced
AT integral time adjust (extended tuning bank)	AT-I	0.00 to 99.99	1.00	
AT derivative time adjust (extended tuning bank)	AT-d	0.00 to 99.99	1.00	
Type of MV switching point at AT (extended tuning bank)	AT.Pt	0: Default (2/3 of the deviation of the initial PV from the initial SP) 1: SP 2: PV	0	
MV switching point PV in AT	AT.Pu	−1999 to +9999U	0	

- If CtrL (control method) is set to "1" (PID control), this item is displayed and the setting can be changed.
- The MV when AT is executed can be limited by "MV low limit at AT" (AToL) / "MV high limit at AT" (AToH).
  - If C26 (heat/cool control) is set to 0 (not used), the MV is limited by both "MV low limit at AT" (AToL) / "MV high limit at AT" (AToH) and by "MV low limit" (oL-1) / "MV high limit" (oH-1) for the PID constants.
  - If C26 (heat/cool control) is set to 1 or 2 (use),
    - The MV is limited by "MV low limit at AT" (AToL) / "MV high limit at AT" (AToH).
    - The heating MV is limited by "MV low limit" (oL-1 to 8) / "MV high limit" (oH-1 to 8).
    - The cooling MV is limited by "cool-side MV low limit" (oL.1C to 8C) / "cool-side MV high limit" (oH.1C to 8C).
- "AT type" (AtY) is used to calculate the PID constants that are appropriate for the control characteristics of the equipment by AT.
  1 (immediate response): adjustment for speed-oriented applications, such as a process where the PV directly reflects heating by a heater.
  2 (stable): adjustment for stability-oriented applications, such as a process where the PV indirectly reflects heating by a heater.

The following graph illustrates the differences in control results using PID constants calculated with each AT type.



Difference in PV change when SP is changed

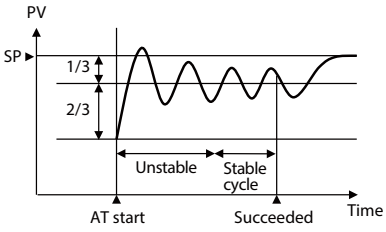
- "AT proportional band adjust" (Ⱥt-P), "AT integral time adjust" (Ⱥt-I), "AT derivative time adjust" (Ⱥt-d):
  The PID constants calculated with AT are multiplied by these factors before being written to the PID constant settings. Note that values within the setting range of the PID constants will be written.

- "Type of MV switching point at AT" is a setting for changing the MV switching point during AT.

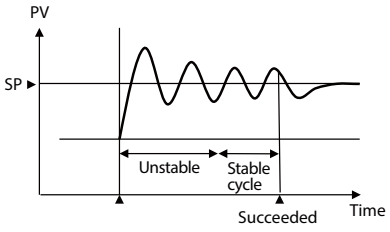
  0 (default): A new MV applies when the PV passes the two-thirds point in the amount of PV deviation from the SP at the start of AT.

  1 (SP): A new MV applies when the PV passes the SP at the start of AT.

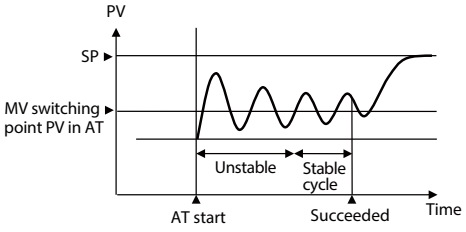
  2 (PV): A new MV applies when the PV passes the setting for "MV switching point PV in AT."



Type of MV switching point at AT = 0 (default)



Type of MV switching point at AT = 1 (SP)



Type of MV switching point at AT = 2 (PV)

Note

- If you want to execute AT only for heating PID constants when C26 (heat/cool control) is set to 1 (use (individual PID)), the settings should satisfy:
  50.0 % < MV low limit at AT (AtoL) < MV high limit at AT (AtoH)

  If you want to execute AT only for cooling PID constants, the settings should satisfy:
  MV low limit at AT (AtoL) < MV high limit at AT (AtoH) < 50.0 %

☞ ■ AT (automatic tuning) stop/start (p. 5-12)
5 - 4 AT (Automatic Tuning) Function (p. 5-31) (for details on AT)

Handling Precautions

- If C26 (heat/cool control) is set to 2 (use (shared PID), execute AT with settings that satisfy:
  50.0 % < MV low limit at AT (AtoL) < MV high limit at AT (AtoH)
- If you change a setting such as PV input range type or linear scaling low/high limit while AT is running, AT may not end. Do not change any settings other than At (AT stop/start selection) while AT is running.
- If you want to execute AT only for heating PID constants when C26 (heat/cool control) is set to 1 (use (individual PID), the settings should satisfy:
  50.0 % < MV low limit at AT (AtoL) < MV high limit at AT (AtoH)
- If you want to execute AT only for cooling PID constants when C26 (heat/cool control) is set to 1 (use (individual PID), the settings should satisfy:
  MV low limit at AT (AtoL) < MV high limit at AT (AtoH) < 50.0 %

■ Control algorithm

Item (bank)	Display	Description	Initial value	User level
Control algorithm (extended tuning bank)	CtrA	0: PID (conventional PID) 1: Ra-PID (high-performance PID)	0	Standard, advanced

- If CtrL (control method) is set to "1" (PID control), this item is displayed and the setting can be changed.
- PID-A (deviation-derivative type) is a PID control algorithm that causes derivative operations in response to changes in the loop SP as well.
- Ra-PID (high-performance PID) is a deviation-derivative type PID control algorithm that reduces instability when response to disturbance is enhanced.

■ SP lag

The SP lag is a filter function to prevent sudden changes in the SP used in control operations when the SP changes. Use the setting below for SP lag.

Item (bank)	Display	Description	Initial value	User level
SP lag constant (extended tuning bank)	SPL9	0.0 to 999.9 (0.0 = no effect)	0.0	Advanced

- If CtrL (control method) is set to "1" (PID control), this item is displayed and the setting can be changed.
- The function of SPL9 (SP lag constant):
  If 0.0 is set: The SP lag function has no effect.
  If 0.1 or more is set: The larger the constant, the smaller the amount of MV change when the SP is changed, and the more strongly overshoot is suppressed.
- The output value of the SP lag that is input to a PID calculation is reset as follows.
  - Reset to the SP (target value) when PID control starts after the MANUAL MV output state changes to the calculated MV output state
  - Reset to the PV when PID control starts after the [Output at READY] output state changes to the calculated MV output state
  - Reset to the PV when PID control starts after the [Output at PV alarm] output state changes to the calculated MV output state
  - Reset to the SP (target value) when PID control starts after the [Output at AT] output state changes to the calculated MV output state after AT ends normally
  - Reset to the PV when PID control starts after the [Output at AT] output state changes to the calculated MV output state after AT ends abnormally
  - Reset to the PV if the settings below are changed in the calculated MV output state:

    Control method
    Heat/cool control
    Control operation
    Sampling cycle
    Control algorithm

  - Reset to the PV if PID calculation results are reset according to the setting for [Initial output type (mode) of PID control (o2 1) in the calculated MV output state

5 - 4 AT (Automatic Tuning) Function

Use the AT function if:

- You want to set CtrL (control method) to 1 (PID control) and set PID constants automatically.
- The rise of PV is slow or the overshoot is large.

AT function is available if CtrL (control method) is set to 1 (PID control).

■ How to start AT

(1) Check that the PV input and the actuators (heater power, etc.) are ready for control.

(2) Check that the RDY mode indicator is off, which indicates that the device is in RUN mode. If the RDY mode indicator is on and the device is in READY mode, change the mode to RUN.

(3) Check that the MAN mode indicator is off, which indicates that the device is in AUTO mode. If the MAN mode indicator is on and the device is in MANUAL mode, change the mode to AUTO.

(4) Set At (AT stop/start) in the mode bank to AtOn (AT start).

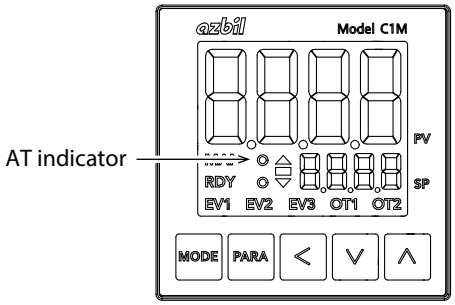
■ How to stop AT

AT ends automatically. To stop AT while it is running, set At (AT stop/start) in the mode bank to AtOF (AT stop).

AT can also be stopped by changing the mode to READY or MANUAL.

● Display while AT is running

During AT, the AT indicator flashes. When AT and the calculation of PID constants are done, the AT indicator turns off.



! Handling Precautions

- For ROM version 1.01 or earlier, the setting for [AT stop/start] cannot be changed when AL03 or AL 11 occurs.

● Operation while AT is running

During AT, PID constants are calculated using limit cycles.

(1) A limit cycle operation is performed using the MV switching point specified by "Type of MV switching point at AT"
During AT, two values are output repeatedly. One of the values is "MV low limit" (oL-1 to 8) or "MV low limit at AT"(AToL), whichever is greater, and the other is "MV high limit" (oH-1 to 8) or "MV high limit at AT" (AToH), whichever is smaller.

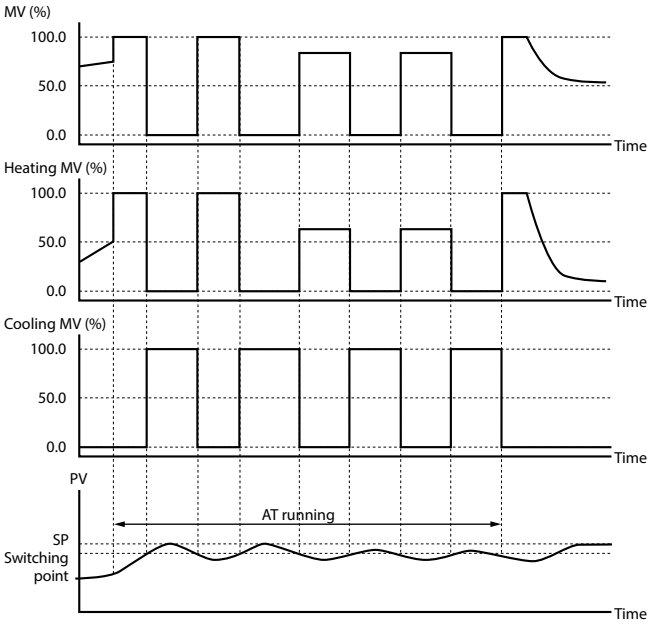
(2) When the limit cycle has stabilized, the PID constants are changed, and AT ends.

If C26 (heat/cool control) is set to 1 (use (individual PID)), AT is executed using both heating and cooling MVs.

In the first half, the MV changes to its low and high limits. In the second half, it changes within a relatively narrow range.

If C26 (heat/cool control) is set to 2 (use (shared PID)), AT is executed using only heating MV.

The figures below illustrates AT with the following settings:
C26 (heat/cool control) = 1 (use (individual PID), heating/cooling control dead zone = 0.0 %, MV low limit = 0.0 %, MV high limit = 100.0 %



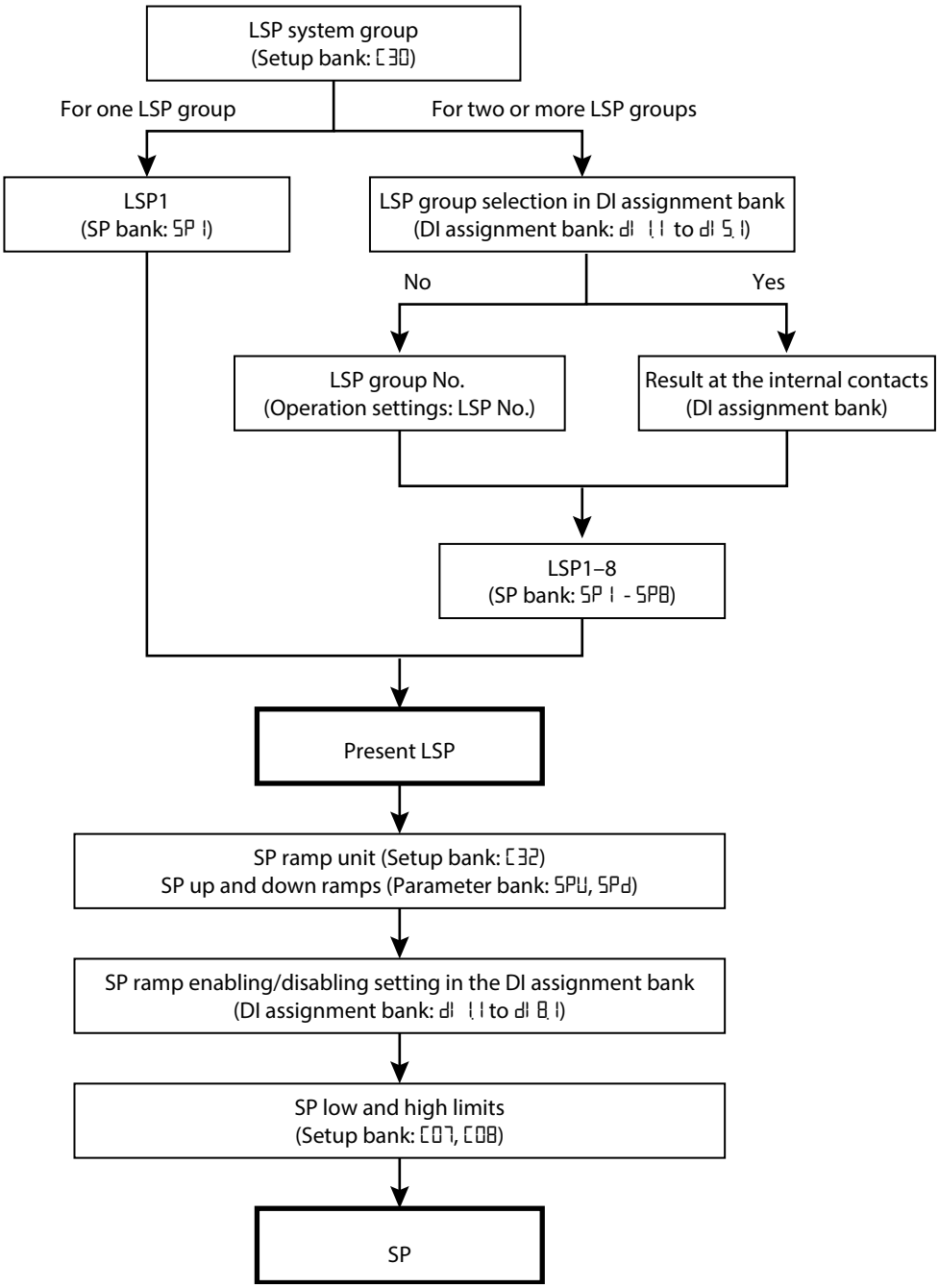
Handling Precautions

- Before starting AT, check that the PV input and the actuators (heater power, etc.) are ready for control.
- If CtrL (control method) is set to 0 (ON/OFF control), AT cannot start. Change the control method setting to 1 (PID control).
- To start AT, this device should be in the calculated MV output state and the setting for [MV switching point PV in AT] should be within the PV input range.
  ☞ ■ AT (automatic tuning) (p. 5-27) (for "Type of MV switching point at AT")
  ☞ ■ PV input range type (p. 5-2) (for the PV input range)
- If any of the following is detected during AT, AT will stop without changing the PID constants:
  - Switch to READY mode
  - Switch to MANUAL mode
  - PV error
  - Change in the setting of "control method," "heat/cool control," "control operation" (only when "heat/cool control" is set to 0 (not used)), "sampling cycle," and "control algorithm"
  - Change in the setting of "MV low limit" (oL-1 to 8), "MV low limit at AT" (AtoL), "MV high limit" (oH-1 to 8), or "MV high limit at AT" (AtoH) that would prevent change in the two-value output during AT
  - For forcible termination of AT by At (AT stop/start selection) in the mode bank or by the internal contacts to which the function to stop/start AT is assigned, see the section below:
    ☞ 5-7 Digital Input (DI) / Internal Contacts (p. 5-50)
    If AT is forced to stop, AtEr (auto tuning error) is set to Er.on (abnormal).
- AtEr (auto tuning error) can be reset to Er.oF (normal)) by any of the following operations.
  - Change the setting of AtEr (auto tuning error) to Er.oF (normal).
  - Try executing AT again until it ends normally.
  - Turn the power off and then back on.
- If C26 (Heat/cool control) is set to 2 (Use (shared PID)), specify "MV low limit at AT" (AtoL) / "MV high limit at AT" (AtoH) and "MV low limit" (oL-1 to 8) / "MV high limit" (oH-1 to 8) so that both values that are output to the MV are 50 % or more.
- If C26 (heat/cool control) is set to 1 (use (individual PID)),
  - The MV is limited by "MV low limit at AT" (AtoL) / "MV high limit at AT" (AtoH).
  - The heating MV is limited by "MV low limit" (oL-1 to 8) / "MV high limit" (oH-1 to 8) for the PID constants.
  - The cooling MV is limited by "cool-side MV low limit" (oL.1C to 8C) / "cool-side MV high limit" (oH.1C to 8C).
- If the two MVs that are output during AT are close, the PV may not change even if the MVs have changed.
  In this case, AT may not end. If this happens, stop AT manually, reset the MV low and high limits, and then start AT again.

- The number of limit cycles from the start to the end of AT and how long the AT takes differ depending on the process being controlled.
- If AT always fails, instead of using it, set the PID constants manually.
- The progress of AT can be checked on the operation display.
  ☞ ■Operation settings (p. 6-1)
- If C26 (heat/cool control) is set to 0 (not used) or 2 (use (shared PID)), a value indicating the progress of AT is displayed. It starts with 4 and is decremented to 0, which means that AT is complete.
  If C26 (heat/cool control) is set to 1 (use (individual PID)), AT starts at 7, decreases by increments of 1, and finishes at 0.
  The AT progress value indicates the number of steps remaining until AT ends. It does not indicate the time until AT ends.
- Depending on the process being controlled, it may not be possible to obtain suitable PID constants. In such a case, set the PID constants manually.
- Do not change any settings other than AT (AT stop/start selection) while AT is running.
  ☞ ■ AT (automatic tuning) stop/start (p. 5-12), ■ AT (automatic tuning) (p. 5-27) (for details on AT)

5-5 SP

The following is a functional block diagram for the SP. ☞ 5-6 Step operation (p. 5-41) (for step operation)



Note

- A local set point (LSP) is a set point stored in this device.
  A set point given by an external analog input is called a remote set point (RSP) .
  This device does not provide an RSP function.

■ Specifying the SP using operation settings

The SP for the LSP group (LSP1 to 8) that is being used can be specified.

During an SP ramp, the SP that is displayed will be different from the LSP group SP, but when the setting is being changed using the keys, the value specified for the LSP group will be displayed.

Item (bank)	Display	Description	Initial value	User level
SP (operation settings)	PV is shown on the upper display.	SP low limit to high limit	0	Simple, standard, advanced

- If "Bit 1: SP display" of C74 (PV/SP display setup) is set to 1 (enabled), this item is displayed and the setting can be changed.

■ Number of LSP groups

The number of LSP groups to be used can be specified.

Item (bank)	Display	Description	Initial value	User level
LSP system group (setup bank)	C 30	1 to 8	1	Simple, standard, advanced

■ LSP1 to 8

The SP for up to eight LSP groups can be specified individually.

Item (bank)	Display	Description	Initial value	User level
SP (SP bank)	SP-1	SP low limit to high limit	0	Simple, standard, advanced
	SP-2			
	SP-3			
	SP-4			
	SP-5			
	SP-6			
	SP-7			
	SP-8			

- SPs for as many LSP groups as are specified by C30 (LSP system group) are displayed for setting.

■ LSP group No.

The LSP group to display can be selected.

Item (bank)	Display	Description	Initial value	User level
LSP No. (operation settings)	LSP	The rightmost digit shows the number. From 1 to the number set for "LSP system group"	1	Simple, standard, advanced

- This item is displayed if C30 (LSP system group) is set to 2 or more and "Bit 2: LSP group No. display" of C74 (PV/SP display setup) is set to 1 (enabled).
- If this item is displayed and if LSP group selection is not specified in DI assignment, the setting can be changed.

■ Specifying LSP group selection by DI assignment

In the DI assignment bank, LSP group selection can be set for internal contacts 1 to 5.

Item (bank)	Display	Description	Initial value	User level
DI assignment Internal contact 1 to 5 Operation type (DI assignment bank)	di 1.1	0: No function 1: LSP group selection (0/+1) 2: LSP group selection (0/+2) 3: LSP group selection (0/+4) 4–20: other functions	0	Advanced Standard, advanced
	di 2.1		0	
	di 3.1		0	
	di 4.1		0	
	di 5.1		0	

- Details of LSP group selection by internal contact

  The LSP group No. set by ON/OFF of internal contacts is shown below.

  LSP group selection (0/+1) OFF: 0 ON: 1
  LSP group selection (0/+2) OFF: 0 ON: 2
  LSP group selection (0/+4) OFF: 0 ON: 4

  The LSP group No. is determined by adding 1 to the sum of the LSP group selection values set by ON/OFF of internal contacts.
  For example, if the sum of the values set by internal contacts 1 to 3 is 1, the LSP group No. will be 2.

- If the number of LSP groups is 1, this item can be displayed and the setting can be changed, but LSP group selection by DI assignment is invalid.

■ SP ramp unit

The time unit of the SP ramp can be specified.

Item (bank)	Display	Description	Initial value	User level
SP ramp unit (setup bank)		0: 0.1 U/s 1: 0.1 U/min 2: 0.1 U/h	1	Advanced

- 0.1 U means that the setting displayed has one more decimal place than the number of decimal places set by "PV decimal point position."

  Examples
  For a thermocouple input with a range of −200 to + 200 °C: 0.1 U = 0.1 °C

  For a DC voltage input with a range of 0.0 to 100.0: 0.1 U = 0.01

  ☞ ■ SP up ramp / down ramp (p. 5-39) (for the relationship between PV input ranges with a decimal point and the setting for "PV decimal point position")

Handling Precautions

- For a DC voltage input or DC current input with the 3-decimal place setting, 0.1 U = 0.0001.
  However, regarding the SP up ramp and SP down ramp settings, all four values displayed on this device indicate values after the decimal point, because this device can display only four digits.

■ SP up ramp / down ramp

SP up ramp and down ramp can be specified.

Item (bank)	Display	Description	Initial value	User level
SP up ramp (parameter bank)	SPU	0U : No ramp 1 to 9999U (Select the time unit of ramp by "SP ramp unit.")	0.0	Advanced
SP down ramp (parameter bank)	SPd		0.0	

- If the 0U is set, the SP ramp function does not operate. Therefore, if the up ramp is set to 1U or more and the down ramp is set to 0U, the SP ramp function operates when the SP is increasing but does not operate when the SP is decreasing. It is also possible to set the SP ramp function to operate only when the SP is decreasing.
- The setting for these items has one more decimal place than that of the displayed PV. For a linear input with the 3-decimal place setting, all four digits that are displayed are after the decimal point. The time unit of the ramp can be selected from per second, per minute, and per hour by C32 (SP ramp unit).

  Example of the relationship between PV input ranges with a decimal point and the setting for "PV decimal point position":

C01 (PV input range type)	C04 (PV decimal point position)	SPU (SP up ramp)	SPd (SP down ramp)
2 (0 to 1200 °C)	(Fixed)	0.0 to 999.9	0.0 to 999.9
3 (0.0 to 800.0 °C)	0 (no decimal point)	0.0 to 999.9	0.0 to 999.9
	1 (1 digit after the decimal point)	0.00 to 99.99	0.00 to 99.99
88 (0 to 10 V)	0 (no decimal point)	0.0 to 999.9	0.0 to 999.9
	1 (1 digit after the decimal point)	0.00 to 99.99	0.00 to 99.99
	2 (2 digits after the decimal point)	0.000 to 9.999	0.000 to 9.999
	3 (3 digit after the decimal point)	0.0000 to 0.9999	0.0000 to 0.9999

- The ramp starts with the present PV when:
  - The power is turned on.
  - The MANUAL MV output state changes to the calculated MV output state
  - The [Output at READY] output state changes to the calculated MV output state

■ SP low/high limit

The SP low/high limit can be set in order to limit the range of the SP.

Item (bank)	Display	Description	Initial value	User level
SP low limit (setup bank)	C 07	(PV range low limit to PV range high limit)	PV range low limit	Standard, advanced
SP high limit (setup bank)	C 08	(PV range low limit to PV range high limit)	PV range high limit	Standard, advanced

Handling Precautions

- If the setting for C01 (PV input range type) is changed, the SP low/high limit will be reset (excluding linear ranges)

■ Enabling/disabling SP ramp by DI assignment

In the DI assignment bank, the function to enable or disable the SP ramp can be set for internal contacts 1 to 5.

Item (bank)	Display	Description	Initial value	User level
DI assignment Internal contact 1 to 5 Operation type (DI assignment bank)	di 1.1	0: No function 13: Enabling/disabling SP ramp 1–12, 14–20: other functions	0	Simple, standard, advanced
	di 2.1		0	
	di 3.1		0	
	di 4.1		0	
	di 5.1		0	

- Details of SP ramp enabling/disabling by internal contacts
  SP ramp is enabled or disabled by ON/OFF of internal contacts as shown below.

  OFF: SP ramp enabled, ON: SP ramp disabled

  Assign SP ramp enabling/disabling to only one internal contact.

- If the SP ramp is disabled while it is running, SP ramping stops and the SP at that time will be the final SP.

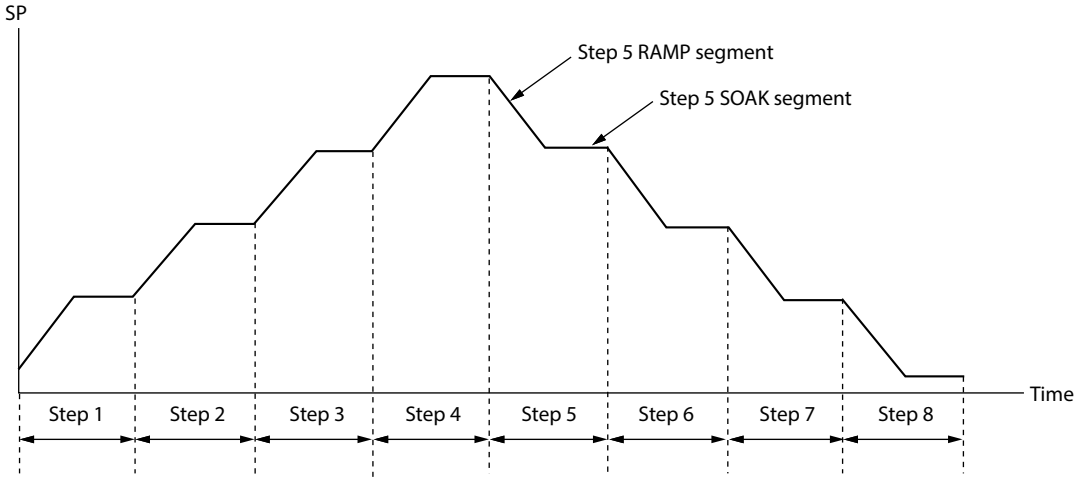
5 - 6 Step operation

Using up to eight SP groups, a step operation where the SP changes as shown in the figure below can be executed.

Configure a step operation by specifying the LSP, ramp, and time of each step. The PID group No. to use in each step can also be set.

In each step, the segment where the SP is changing is called the RAMP, and the segment where the SP does not change is the SOAK.

The RAMP and SOAK segments in step 5 are indicated in the figure below.



[!] Handling Precautions

- A step operation can run in RUN mode. If the mode is changed to READY, step operation stops at the beginning of step 1.

■ Number of LSP groups

The number of steps in one step operation can be specified by this setting.

Item (bank)	Display	Description	Initial value	User level
LSP system group (setup bank)	C 30	1 to 8	1	Simple, standard, advanced

■ SP ramp type

Whether to execute a step operation can be set.

What happens when the power is turned off and back on during a step operation can also be specified with this item. ☞ 5-6 Step operation (p. 5-41) (for step operation)

Item (bank)	Display	Description	Initial value	User level
SP ramp type (setup bank)	C 31	0: Standard 1: Multi-ramp 2: Step operation enabled: Step operation does not resume when the power is turned back on (shifts to READY) 3: Step operation enabled: Step operation resumes when the power is turned back on	0	Advanced

- Set 2 or 3 to enable step operations.
- 2: If a power failure occurs during a step operation (in RUN mode), when the power is turned back on, the step operation does not resume (this device enters READY mode) and the SP returns to its value at the beginning of the step operation.
- 3: If a power failure occurs during a step operation (in RUN mode), when the power is turned back on, the step operation resumes from the step that was being processed when the power failure occurred. However, operation cannot restart at exactly the same point of time and SP as when the power failure occurred. The step operation resumes as follows.
  If a power failure occurs during a SOAK, the operation will resume from the beginning of the SOAK. If a power failure occurs during a RAMP and there was no PV alarm (AL01/AL02), the operation will resume with an SP that is the same as the PV in that RAMP. If a power failure occurs during a RAMP and there was a PV alarm (AL01/AL02), the operation will resume with the SOAK that follows that RAMP.

! Handling Precautions

- Operation of the C1M with setting 3 (step operation enabled: the operation resumes when the power is turned back on) differs from the setting 3 operation of Azil's DCP digital program controllers (DCP31/32, DCP551/552). With the DCP, operation restarts at the point of time in the RAMP or SOAK that was in progress when the power failure occurred, and with the SP at that time. With the C1M, operation restarts from the beginning of the RAMP or SOAK that was in progress.
- If setting 3 is used, pay attention to the number of times data is written to EEPROM (nonvolatile memory). During a step operation in RUN mode, every time a RAMP or SOAK segment starts, data is written to EEPROM. If step operations are repeated with 10-minute or shorter RAMP/SOAK time, the service life of writing to EEPROM (about 100,000 times) will be exceeded within 2 years.
- If C31 (SP ramp type) is set to 0 (standard) or 1 (multi-ramp) and if this device is in RUN mode, when the setting is changed to 2 or 3 (step operation enabled), this device automatically enters READY mode.

■ SP ramp unit

The unit of the ramp's slope in a step operation can be specified.

Item (bank)	Display	Description	Initial value	User level
SP ramp unit (setup bank)	C 32	0: 0.1 U/s 1: 0.1 U/min 2: 0.1 U/h	1	Advanced

- 0.1 U means that the setting displayed has one more decimal place than the number of decimal places set by "PV decimal point position."

  Examples
  For a thermocouple input with a range of −200 to + 200 °C: 0.1 U = 0.1 °C

  For DC voltage input with a range of 0.0 to 100.0: 0.1 U = 0.01

! Handling Precautions

- For DC voltage input or DC current input with the 3-decimal place setting, 0.1 U = 0.0001.
  However, regarding the SP up and down settings, all four digits that are displayed are after the decimal point because this device can display only four digits.

■ STEP time unit

The time unit of a SOAK segment in a step operation can be specified.

Item (bank)	Display	Description	Initial value	User level
STEP time unit (setup bank)	C 33	0: 0.1 s 1: 1 s (the operation display shows min.s) 2: 1 min (the operation display shows h.min)	2	Advanced

- 0: The unit of the soak time setting in the SP bank will be 0.1 s.
- 1: The unit of the soak time setting in the SP bank will be seconds. The time remaining in the step is displayed in the format MM.SS (minutes.seconds).
- 2: The unit of the soak time setting in the SP bank will be minutes. The time remaining in the step is displayed in the format HH.MM (hours.minutes).

[!] Handling Precautions

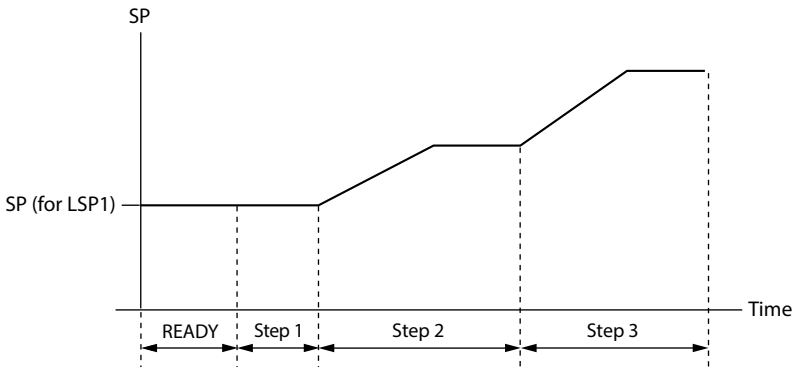
- The time remaining in the step is displayed in the unit set by "STEP time unit," regardless of whether the process is in RAMP or SOAK.
- If 1 is set, and the time remaining in the step is more than 99 minutes 59 seconds, 99.99 will be displayed.
- If 2 is set, and the time remaining in the step is more than 99 hours 59 minutes, 99.99 will be displayed.

■ STEP PV start

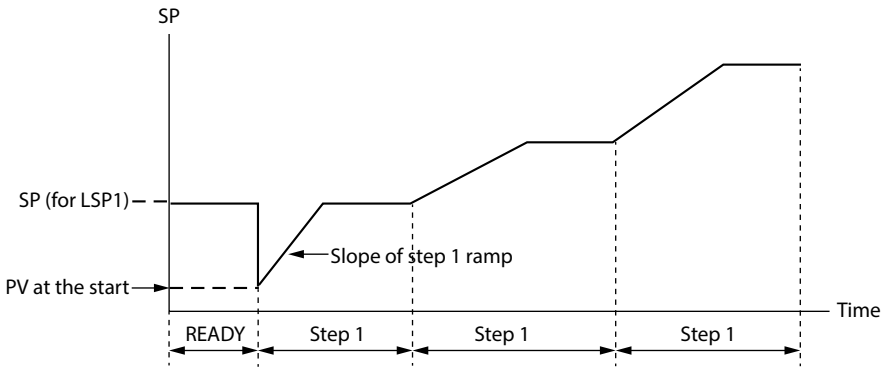
Whether to start a step operation with the PV and the type of PV start when it is used can be specified.

Item (bank)	Display	Description	Initial value	User level
STEP PV start (setup bank)	C 34	0: No 1: Up start 2: Down start	0	Advanced

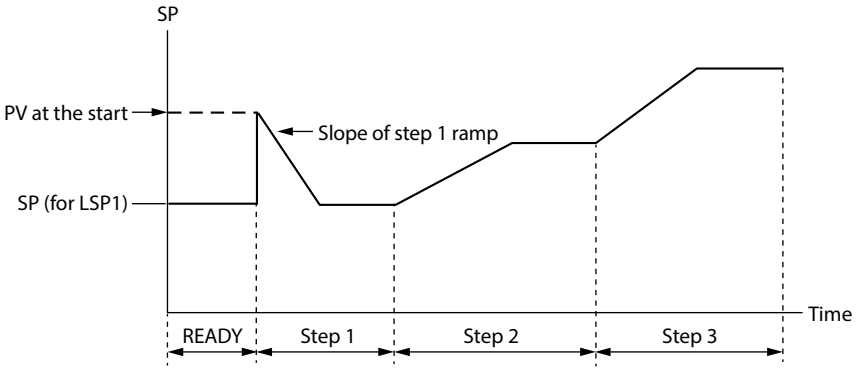
- 0: The step operation starts with SOAK in step 1.
- 1: If the PV is smaller than the SP for LSP 1, the step operation starts with the up-ramp of step 1 using an SP that is the same as the PV. If the PV is equal to or greater than the SP for LSP 1, the step operation starts with the SOAK of step 1.
- 2: If the PV is greater than the SP for LSP 1, the step operation starts with the down-ramp of step 1 using an SP that is the same as the PV. If the PV is equal to or smaller than the SP for LSP 1, the step operation starts with the SOAK of step 1.



Operation starts with SOAK in step 1



Operation starts with the up-ramp in step 1



Operation starts with the down-ramp in step 1

■ STEP loop

The operation when a step operation ends (loop back, etc.) can be specified.

Item (bank)	Display	Description	Initial value	User level
STEP loop (setup bank)	[35	0: Operation stops (no loop-back) 1: Loops back 2: Continues SOAK with the final step's SP (no loop-back)	0	Advanced

- 0: This device enters READY mode when the SOAK of the final step ends.
- 1: When the SOAK of the final step ends, step operation is repeated starting with the RAMP in step 1. In this RAMP, regardless of the setting of [34 (STEP PV start), the SP of the final step ramps up to the SP for LSP 1. There is no limit on the number of loops. Therefore, looping will continue until the operation mode is switched to READY.
- 2: When the SOAK of the final step ends, SOAK continues at the SP of the final step until the operation mode is switched to READY.

■ Step operation: LSP, PID group No., ramp, soak time

How to change the SP during a step operation and PID group No. can be specified.

Item (bank)	Display	Description	Initial value	User level
LSP (step 1) (SP bank)	SP-1	SP low limit (C07) to SP high limit (C08)	0	Simple, standard, advanced
PID group No. (step 1) (SP bank)	Pid.1	1 to 8	1	Standard, advanced
Ramp (step 1) (SP bank)	rAP.1	0U : No ramp 1 to 9999U (Select the time unit of the ramp by "SP ramp unit.")	0.0	
Soak time (step 1) (SP bank)	tIM.1	0.0 to 999.9 s (when "STEP time unit" = 0.1 s) 0 to 9999 s (when "STEP time unit" = 1 s) 0 to 9999 min (when "STEP time unit" = 1 min)	0.0	
LSP (step 2) (SP bank)	SP-2	Same as step 1	0	Simple, standard, advanced
PID group No. (step 2) (SP bank)	Pid2		1	Standard, advanced
Ramp (step 2) (SP bank)	rAP2		0.0	
Soak time (step 2) (SP bank)	tIM.2		0.0	
LSP (step 3) (SP bank)	SP-3	Same as step 1	0	Simple, standard, advanced
PID group No. (step 3) (SP bank)	Pid3		1	Standard, advanced
Ramp (step 3) (SP bank)	rAP3		0.0	
Soak time (step 3) (SP bank)	tIM.3		0.0	
LSP (step 4) (SP bank)	SP-4	Same as step 1	0	Simple, standard, advanced
PID group No. (step 4) (SP bank)	Pid4		1	Standard, advanced
Ramp (step 4) (SP bank)	rAP4		0.0	
Soak time (step 4) (SP bank)	tIM.4		0.0	

Item (bank)	Display	Description	Initial value	User level
LSP (step 5) (SP bank)	SP-5	Same as step 1	0	Simple, standard, advanced
PID group No. (step 5) (SP bank)	Pid5		1	Standard, advanced
Ramp (step 5) (SP bank)	rmP5		0.0	
Soak time (step 5) (SP bank)	tim5		0.0	
LSP (step 6) (SP bank)	SP-6	Same as step 1	0	Simple, standard, advanced
PID group No. (step 6) (SP bank)	Pid6		1	Standard, advanced
Ramp (step 6) (SP bank)	rmP6		0.0	
Soak time (step 6) (SP bank)	tim6		0.0	
LSP (step 7) (SP bank)	SP-7	Same as step 1	0	Simple, standard, advanced
PID group No. (step 7) (SP bank)	Pid7		1	Standard, advanced
Ramp (step 7) (SP bank)	rmP7		0.0	
Soak time (step 7) (SP bank)	tim7		0.0	
LSP (step 8) (SP bank)	SP-8	Same as step 1	0	Simple, standard, advanced
PID group No. (step 8) (SP bank)	Pid8		1	Standard, advanced
Ramp (step 8) (SP bank)	rmP8		0.0	
Soak time (step 8) (SP bank)	tim8		0.0	

- Steps for as many LSP groups as are specified by [3 0 (LSP system group) are displayed for setting.
- "PID group No." is not displayed and the setting cannot be changed if ON/OFF control is enabled or if "PID group selection" is set as the "Operation type" of any of internal contacts 1 to 5.
- The ramp setting is displayed with one more decimal place than the PV.
- If set to 0U, the RAMP is skipped and the next SOAK begins. If the LSP of two consecutive steps is the same, the RAMP is skipped and the next SOAK begins.
- If "soak time" is set to 0.0 or 0, the SOAK is skipped and the next RAMP begins.

■ Internal contacts: operation type

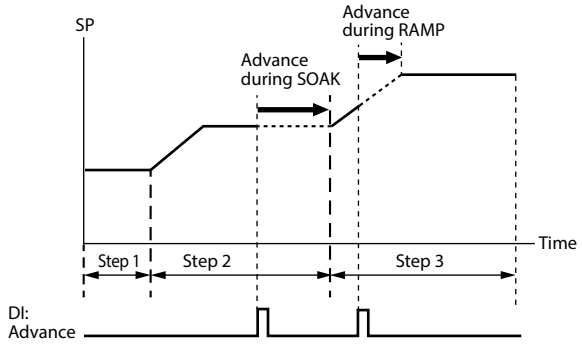
Among the internal contact operation types, the following are related to step operation.

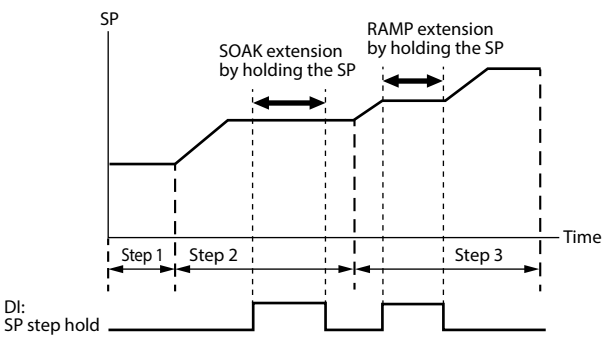
Note

- ☞ 5 - 7 Digital Input (DI) / Internal Contacts (p. 5-50) (for functions of internal contacts)

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 operation type (DI assignment bank)	dI 1.1	0 to 20 0: No function 7: RUN/READY 19: Advance 20: SP step hold (1–6 and 8–18 are not directly related to step operation.)	0	Simple, standard, advanced
Internal contact 2 operation type (DI assignment bank)	dI 2.1		0	
Internal contact 3 operation type (DI assignment bank)	dI 3.1		0	
Internal contact 4 operation type (DI assignment bank)	dI 4.1		0	
Internal contact 5 operation type (DI assignment bank)	dI 5.1		0	

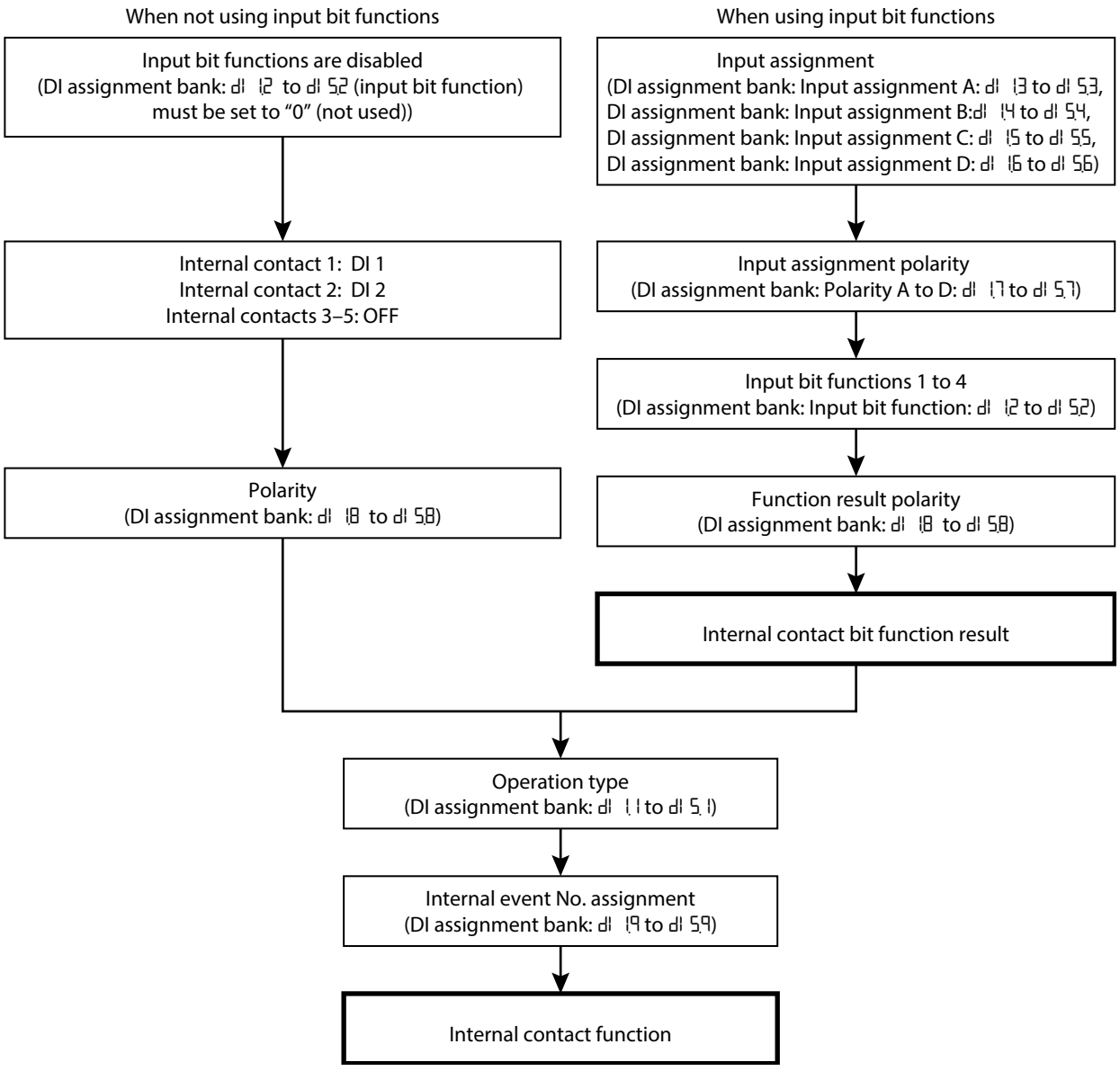
- 7: The operation mode changes to READY when the internal contact turns ON. The mode changes to RUN when the internal contact turns OFF.
- 19: If the internal contact turns ON in RUN mode during the SOAK, the next RAMP starts from the beginning. If it turns ON during the RAMP, the next SOAK starts from the beginning. This is called advance operation.
  If an advance operation is executed during the SOAK of the last step, the operation specified by [35] (STEP loop) applies: switching to READY mode, looping back to the beginning of the RAMP in step 1, or continuing to SOAK.
- 20: If the internal contact turns ON in RUN mode, the progress of the step stops (the SP of the step is held steady). If an advance operation is executed in this state, the process will jump to the beginning of the next RAMP or SOAK and its SP is also held.





5 - 7 Digital Input (DI) / Internal Contacts

The following is a functional block diagram for digital input (DI) and internal contacts.



! Handling Precautions

- There are 5 internal contacts, 1 to 5. The number of digital inputs (0, 1, or 2) can be selected by specifying the appropriate model No. For models with 2 digital inputs, the operation of these inputs is assigned to internal contacts 1 and 2 when the product is shipped.

■ Operation type

The operation by internal contacts can be specified.

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 operation type (DI assignment bank)	di 1.1	0 to 20 See the table on the next page for the functions available for these settings.	0	Simple, standard, advanced
Internal contact 2 operation type (DI assignment bank)	di 2.1		0	
Internal contact 3 operation type (DI assignment bank)	di 3.1		0	
Internal contact 4 operation type (DI assignment bank)	di 4.1		0	
Internal contact 5 operation type (DI assignment bank)	di 5.1		0	

! Handling Precautions

- For operation types 1 to 3 (LSP group selection), the LSP group number is determined by adding 1 to the sum of the weights (+1, +2, +4) of the internal contacts that are ON. However, if the number exceeds the setting for C30 (LSP system group), the value set for C30 will be set as the LSP group selection.
- For operation types 4 to 6 (PID group selection), the PID group number is determined by adding 1 to the sum of the weights (+1, 2, 4) of the internal contacts that are ON. However, if the number exceeds 8, PID group 8 is selected.
- Do not set 14 (PV hold), 15 (PV max. hold), and 16 (PV min. hold) at the same time.
- For operation types other than 0 (no function) and 1 to 3 (LSP group selection), do not set the same operation for multiple internal contacts.
- When using heating/cooling control, do not set 12 (control action (direct/reverse)).
- If 17 (timer stop/start) is set, specify an internal event No. by "Internal event No. assignment."

The functions that can be assigned by dI settings and the operations are shown below.

Settings	Functions	Operation when OFF	Operation when ON
0	No function	None	None
1	LSP group selection (0/+1)	LSP number: +0	LSP number: +1
2	LSP group selection (0/+2)	LSP number: +0	LSP number: +2
3	LSP group selection (0/+4)	LSP number: +0	LSP number: +4
4	PID group selection (0/+1)	PID number: +0	PID number: +1
5	PID group selection (0/+2)	PID number: +0	PID number: +2
6	PID group selection (0/+4)	PID number: +0	PID number: +4
7	RUN/READY*1	RUN	READY
8	AUTO/MANUAL	AUTO	MANUAL
9	No function	None	None
10	AT (automatic tuning) stop/start*2	Stops AT.	Starts AT.
11	No function	None	None
12	Control action (direct/reverse)	Operates as configured.	Reversed operation
13	SP ramp enabling/disabling	Enables SP ramp.	Disables SP ramp.
14	PV hold	Do not hold the value.	Holds the value.
15	PV max. hold	Do not hold the value.	Holds the value.
16	PV min. hold	Do not hold the value.	Holds the value.
17	Timer stop/start	Stops the timer.	Starts the timer.
18	Release all DO latches	Continues latches if any.	Release latches.
19	Advance*3	Continues step operation.	Proceeds to the next soak or ramp.
20	SP step hold	Continues step operation.	SP step hold

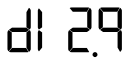
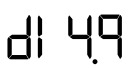
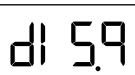
*1. During a step operation, the OFF to ON edge and the ON to OFF edge are used.

*2. The OFF to ON edge and the ON to OFF edge are used.

*3. The OFF to ON edge is used.

■ Internal event No. assignment

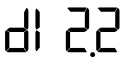
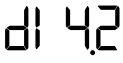
If the operation type is set to "timer stop/start," specify an internal event No. by this item.

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 Internal event No. assignment (DI assignment bank)		0: All internal events 1 to 5: Internal event No.	0	Advanced
Internal contact 2 Internal event No. assignment (DI assignment bank)			0	
Internal contact 3 Internal event No. assignment (DI assignment bank)			0	
Internal contact 4 Internal event No. assignment (DI assignment bank)			0	
Internal contact 5 Internal event No. assignment (DI assignment bank)			0	

- This item is displayed and the setting can be changed if the internal contact's operation type is set to timer stop/start.

■ Input bit functions

There are four types of input bit functions. With this item, the function to use can be selected or all functions can be disabled.

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 input bit function (DI assignment bank)		0: Not used (use the default input) 1: Function 1, (A and B) or (C and D) 2: Function 2, (A or B) and (C or D) 3: Function 3, (A or B or C or D) 4: Function 4, (A and B and C and D)	0	Advanced
Internal contact 2 input bit function (DI assignment bank)			0	
Internal contact 3 input bit function (DI assignment bank)			0	
Internal contact 4 input bit function (DI assignment bank)			0	
Internal contact 5 input bit function (DI assignment bank)			0	

- If 0 is set, input bit functions are not used and the default input is used. The default input for each internal contact:

  Internal contact 1: Digital input (DI) 1
  Internal contact 2: Digital input (DI) 2
  Internal contact 3: OFF state
  Internal contact 4: OFF state
  Internal contact 5: OFF state

- An input bit function is a combination of logical functions (AND, OR) for each of the internal contacts 1 to 5. Functions 1 to 4 have different combinations of logical functions. The following explains each logical function:

AND function	OR function
OFF and OFF = OFF	OFF or OFF = OFF
ON and OFF = OFF	ON or OFF = ON
ON and ON = ON	ON or ON = ON

- OFF may be expressed by contact open (OPEN) or the number 0.
- ON may be expressed by contact closed (CLOSE) or the number 1.

■ Input assignment

The four inputs (A, B, C, D) used for input bit functions can be selected.

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 input assignment A (DI assignment bank)	di 1.3	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1) 2: DI1 3: DI2 4 to 9: Undefined 10: Internal event 1 11: Internal event 2 12: Internal event 3 13: Internal event 4 14: Internal event 5 15 to 17: Undefined 18: User-defined bit 1 19: User-defined bit 2 20: User-defined bit 3 21: User-defined bit 4 22: MANUAL mode 23: READY mode 24: Undefined 25: AT running 26: During SP ramp 27: Undefined 28: All alarm 29: PV alarm 30: Undefined 31: [MODE] key status 32: Event output 1 terminal status 33: Control output 1 terminal status	2	Advanced
Internal contact 1 input assignment B (DI assignment bank)	di 1.4		0	
Internal contact 1 input assignment C (DI assignment bank)	di 1.5		0	
Internal contact 1 input assignment D (DI assignment bank)	di 1.6		0	
Internal contact 2 input assignment A (DI assignment bank)	di 2.3		3	
Internal contact 2 input assignment B (DI assignment bank)	di 2.4		0	
Internal contact 2 input assignment C (DI assignment bank)	di 2.5		0	
Internal contact 2 input assignment D (DI assignment bank)	di 2.6		0	
Internal contact 3 input assignment A (DI assignment bank)	di 3.3		4	
Internal contact 3 input assignment B (DI assignment bank)	di 3.4		0	
Internal contact 3 input assignment C (DI assignment bank)	di 3.5		0	
Internal contact 3 input assignment D (DI assignment bank)	di 3.6		0	
Internal contact 4 input assignment A (DI assignment bank)	di 4.3		5	
Internal contact 4 input assignment B (DI assignment bank)	di 4.4		0	
Internal contact 4 input assignment C (DI assignment bank)	di 4.5		0	
Internal contact 4 input assignment D (DI assignment bank)	di 4.6		0	
Internal contact 5 input assignment A (DI assignment bank)	di 5.3		0	
Internal contact 5 input assignment B (DI assignment bank)	di 5.4		0	
Internal contact 5 input assignment C (DI assignment bank)	di 5.5		0	
Internal contact 5 input assignment D (DI assignment bank)	di 5.6		0	

This item is displayed and the setting can be changed if input bit functions 1 to 4 is set for the internal contact.

■ Input assignment polarity

Whether to reverse the data assigned to the four inputs (A, B, C, D) used for input bit functions can be specified.

Item (bank)	Display	Description	Initial value	User level
Internal contact 1 polarity (DI assignment bank)	dI 1.7	"1st digit" (2nd, etc.) means the first digit (etc.) from the right. 1st digit: Polarity of input assignment A 2nd digit: Polarity of input assignment B 3rd digit: Polarity of input assignment C 4th digit: Polarity of input assignment D 0: Direct 1: Reverse	0000	Advanced
Internal contact 2 polarity A to D (DI assignment bank)	dI 2.7		0000	
Internal contact 3 polarity A to D (DI assignment bank)	dI 3.7		0000	
Internal contact 4 polarity A to D (DI assignment bank)	dI 4.7		0000	
Internal contact 5 polarity A to D (DI assignment bank)	dI 5.7		0000	

- This item is displayed and the setting can be changed if input bit functions 1 to 4 is set for the internal contact.

■ Function result polarity

Whether to reverse the results of input bit functions 1 to 4 can be specified.

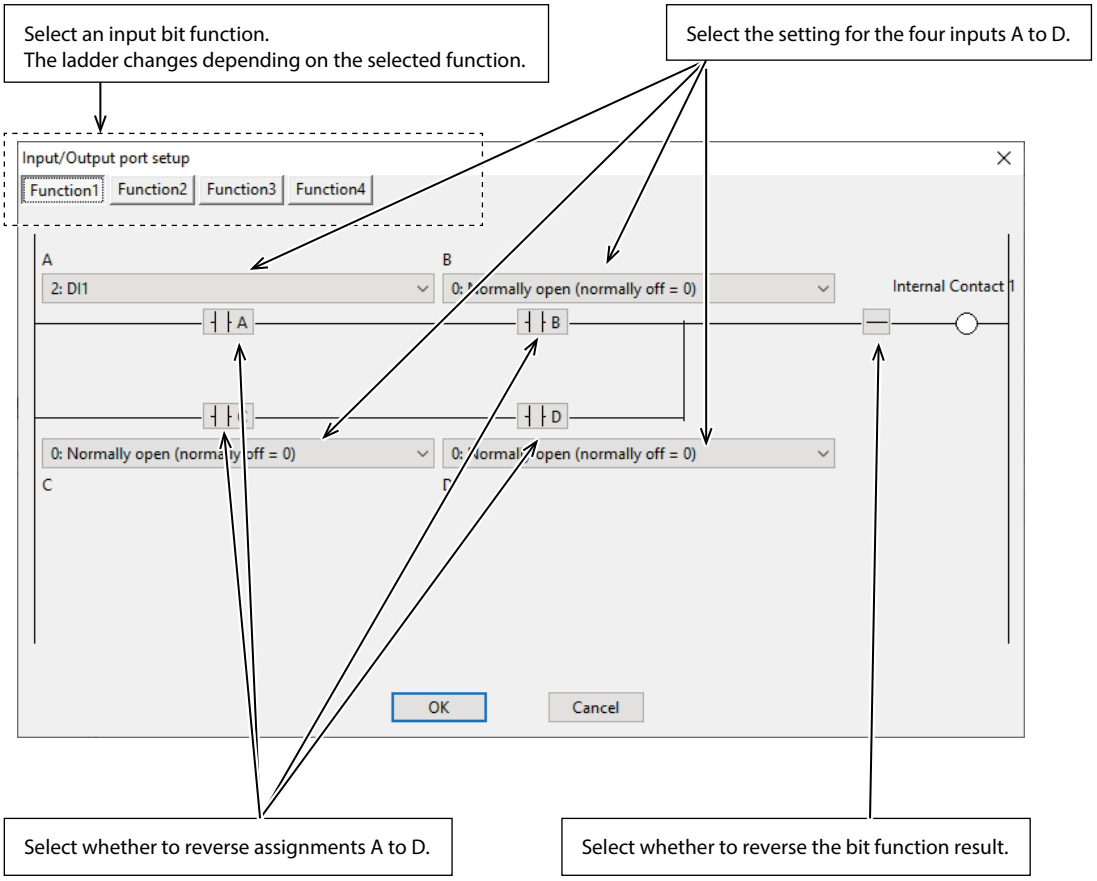
Item (bank)	Display	Description	Initial value	User level
Internal contact 1 polarity (DI assignment bank)	dI 1.8	0: Direct 1: Reverse	0	Advanced
Internal contact 2 polarity (DI assignment bank)	dI 2.8		0	
Internal contact 3 polarity (DI assignment bank)	dI 3.8		0	
Internal contact 4 polarity (DI assignment bank)	dI 4.8		0	
Internal contact 5 polarity (DI assignment bank)	dI 5.8		0	

[!] Handling Precautions

- For ROM version 1.01 or earlier, if [Input bit function] in the DI assignment bank is set to 0 (Not used), the [Polarity] setting cannot be specified.

■ DI assignment by Smart Loader Package model SLP-C1F

When specifying the settings in the DI assignment bank using Smart Loader Package model SLP-C1F, select [Edit] → [Input/Output port setup] from the input menu. This will display a screen for easy setup of the input bit function type, input assignment, input assignment polarity, and function result polarity.



Handling Precautions

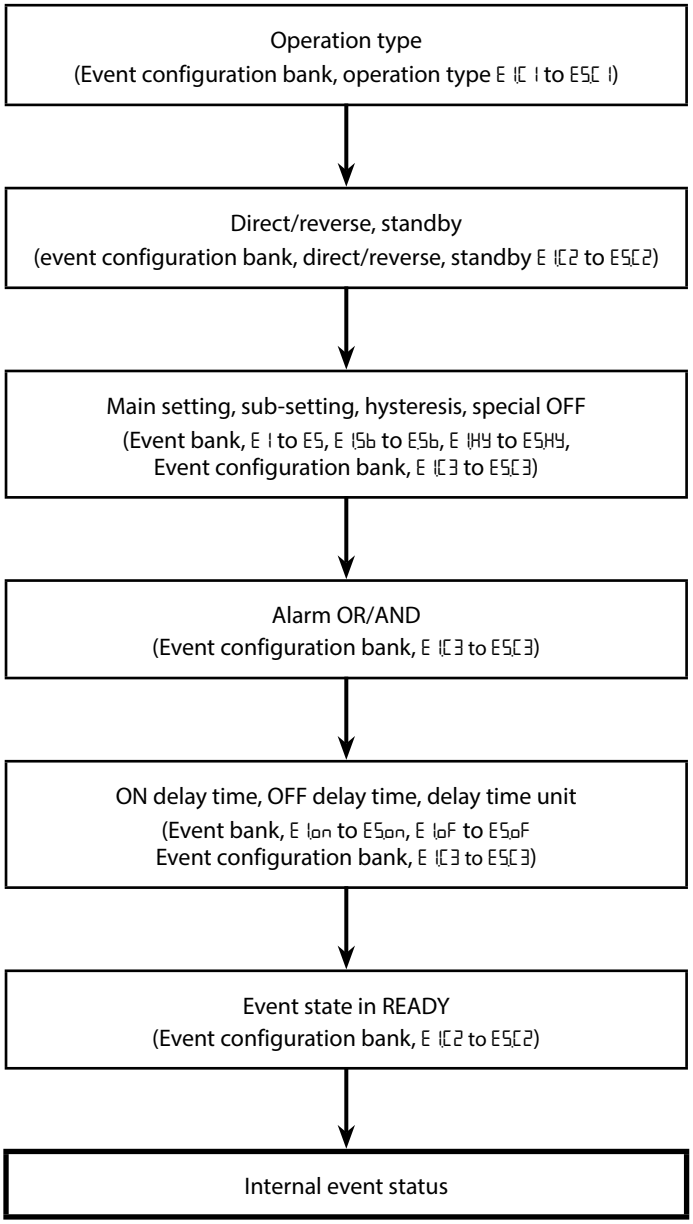
- In addition to selecting from the menu, you can also open the [Input/Output port setup] screen by the following operations.
  - Click the I/O port setting icon
  - Right-click an input bit function setting
  - Press Ctrl + P

5 - 8 Internal Events

The result of internal event processing can be output as control outputs or event outputs via the digital output (DO) processing circuit.

☞ Chapter 2. Outline of Functions (p. 2-1) (for details)

The following is a functional block diagram for internal events.



! Handling Precautions

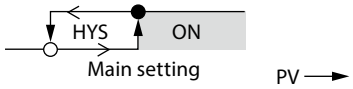
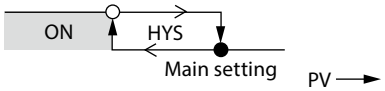
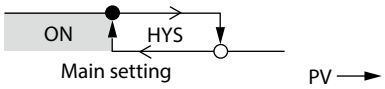
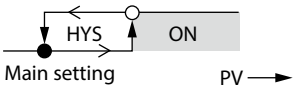
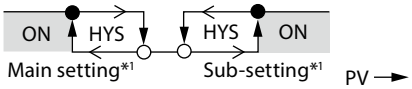
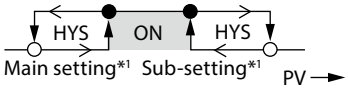
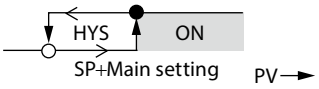
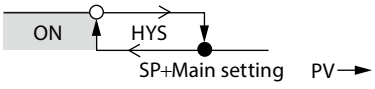
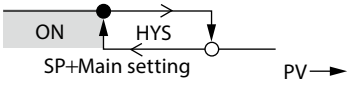
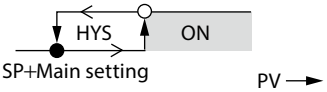
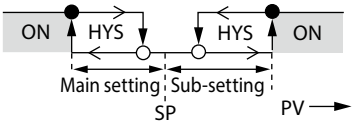
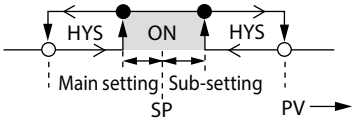
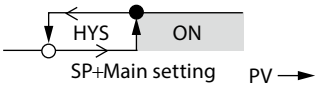
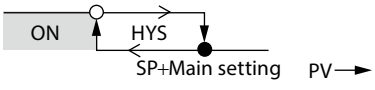
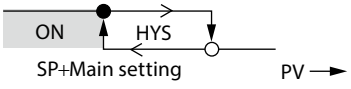
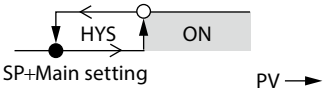
- There are 5 internal events numbered 1 to 5. The number of event outputs (0–3) can be selected by specifying the appropriate model No. When the product is shipped, the operation results of internal events 1 to 3 are set to be output from event output terminals 1 to 3. To use the operation results of internal events 4 to 5, specify the settings in the DO assignment bank.

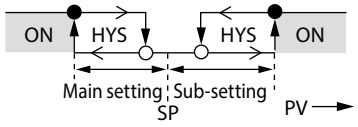
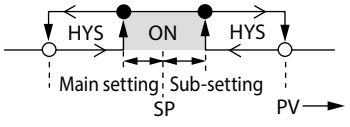
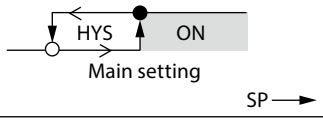
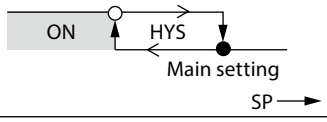
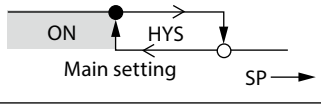
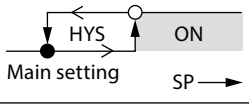
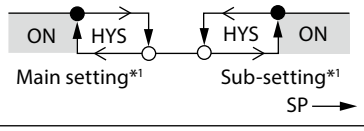
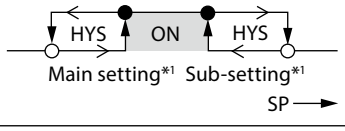
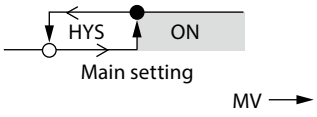
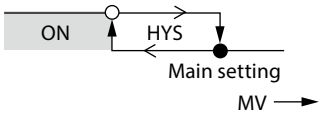
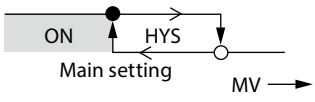
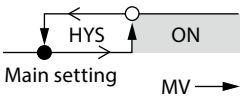
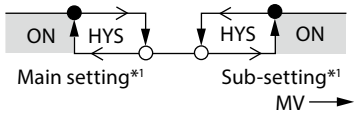
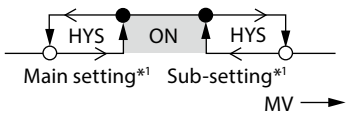
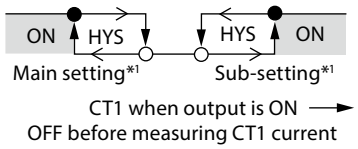
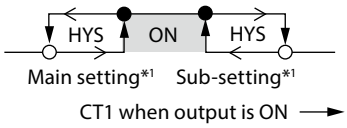
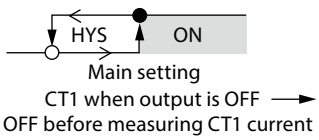
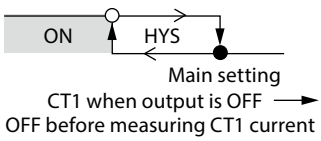
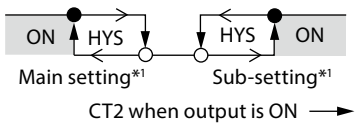
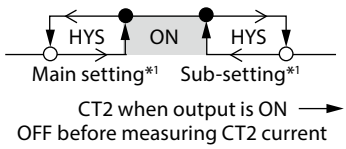
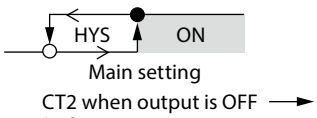
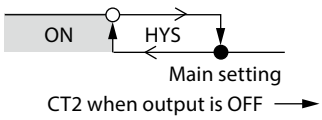
■ Operation

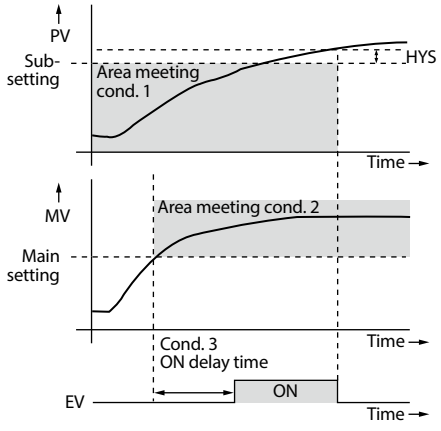
The operation of internal events is shown below. Operation differs depending on the type of operation, direct/reverse setting, event main setting, event sub-setting, hysteresis settings, etc.

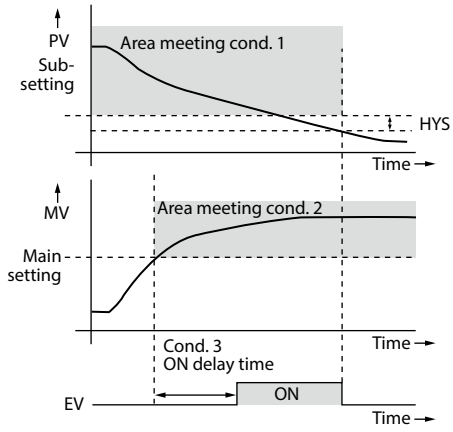
Note

- For the meaning of U (unit), see the terminology list in the Appendix.

Operation type	Setting	Direct action ●: ON/OFF changes at the value*3 ○: ON/OFF changes when the value is exceeded	Reverse action ●: ON/OFF changes at the value*3 ○: ON/OFF changes when the value is exceeded
No event	0	Always OFF	Always OFF
PV high limit	1		
PV low limit	2		
PV high and low limits	3		
Deviation high limit	4		
Deviation low limit	5		
Deviation high and low limits	6		
Deviation high limit (final SP reference)	7	 When not during an SP ramp: same as the direct action of the deviation high limit. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.	 When not during an SP ramp: same as the reverse action of the deviation high limit. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.
Deviation low limit (Final SP reference)	8	 When not during an SP ramp: same as the direct action of the deviation low limit. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.	 When not during an SP ramp: same as the reverse action of the deviation low limit. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.

Operation type	Setting	Direct action ●: ON/OFF changes at the value*3 ○: ON/OFF changes when the value is exceeded	Reverse action ●: ON/OFF changes at the value*3 ○: ON/OFF changes when the value is exceeded
Deviation high and low limits (Final SP reference)	9	 When not during an SP ramp: same as the direct action of the deviation high and low limits. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.	 When not during an SP ramp: same as the reverse action of the deviation high and low limits. During an SP ramp: the operation is different in that the final SP is used instead of the present SP.
SP high limit	10		
SP low limit	11		
SP high and low limits	12		
MV high limit	13		
MV low limit	14		
MV high and low limits	15		
Heater 1 burnout/ overcurrent*2	16	 CT1 when output is ON OFF before measuring CT1 current	 CT1 when output is ON OFF before measuring CT1 current
Heater 1 short circuit*2	17	 CT1 when output is OFF OFF before measuring CT1 current	 CT1 when output is OFF OFF before measuring CT1 current
Heater 2 burnout/ overcurrent*2	18	 CT2 when output is ON OFF before measuring CT2 current	 CT2 when output is ON OFF before measuring CT2 current
Heater 2 short circuit*2	19	 CT2 when output is OFF OFF before measuring CT2 current	 CT2 when output is OFF OFF before measuring CT2 current

<table>
<tr><th>Operation type</th><th>Setting</th><th>Direct action</th><th>Reverse action</th></tr>
<tr><td>Loop diagnosis 1</td><td>20</td><td colspan="2">Turns on if the PV does not change according to the increase or decrease of the MV.
Use this setting to detect a failure of the actuator, etc.
● Settings
• Main setting: MV
• Sub-setting: PV
• ON delay time: diagnosis time
● Operation specifications
Turns ON if the PV set for the sub-setting (condition 1) is not reached within the diagnosis time (ON delay time)(condition 3) even though the MV greater than the main setting is retained (condition 2).
● Note
To set the ON delay time, the user level (L79) should be set to “Advanced configuration.”
The ON delay time is set to 0.0 s when the product is shipped.</td></tr>
<tr><td></td><td></td><td>For heating control
 

If cond. 1 & 2 are met, ON delay starts</td><td>For cooling control
 

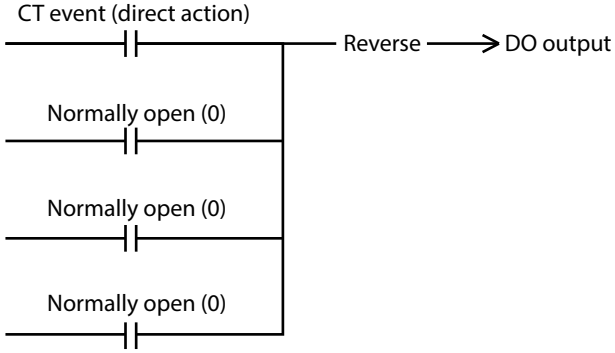
If cond. 1 & 2 are met, ON delay starts</td></tr>
</table>

*1. If the main setting is greater than the sub-setting, operations are performed with the settings automatically swapped.

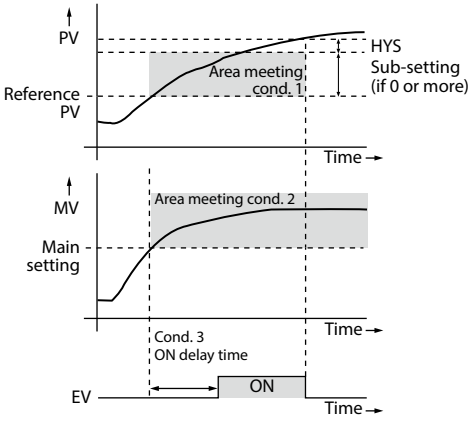
*2. If the event type is burnout/overcurrent or short circuit of heater 1 or 2, there is no event detection from the time the power is turned on until the CT input current is measured for the first time. During this period, the internal event output is OFF regardless of the direct/reverse setting for the event. To prevent a reverse-acting event’s output from turning OFF at power-on, set as follows.

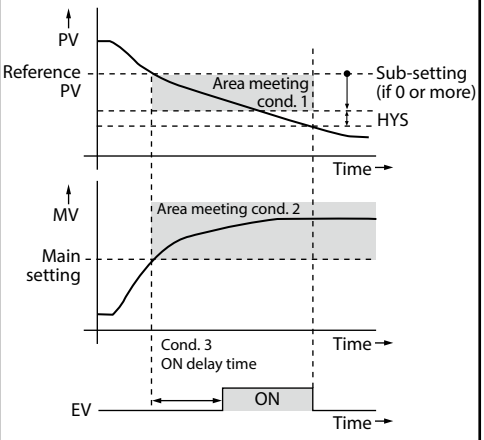
Example of settings

Select the direct action for the event of burnout/overcurrent or short circuit of heater 1/2, and set the output operation polarity of the terminal (event terminal or control output terminal) that outputs the event to “reverse” in the DO assignment bank.

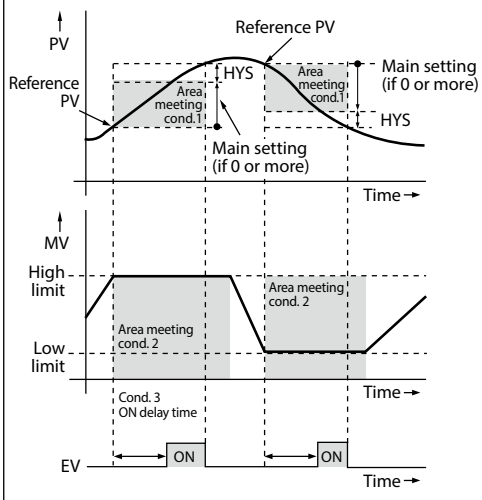


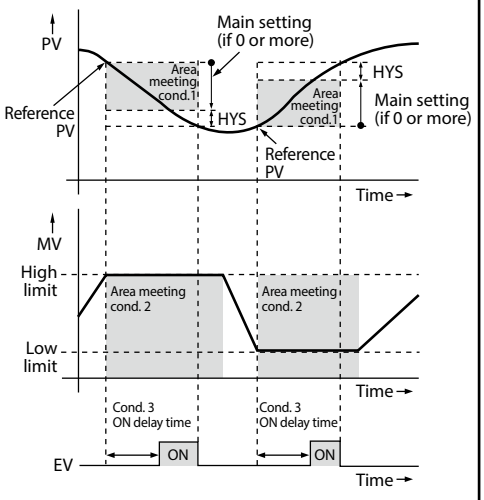
*3. If the target data is a real number (with decimal points), the displayed value may not match the main setting / sub-setting, and the event may not turn ON or OFF. In this case, set the main setting / sub-setting to a value that allows for a margin of 1U.

<table>
<tr><th>Operation type</th><th>Setting</th><th>Direct action</th><th>Reverse action</th></tr>
<tr><td>Loop diagnosis 2</td><td>21</td><td colspan="2">Turns on when the PV does not change according to the increase or decrease of the MV.
Use this setting to detect a failure of the actuator, etc.
● Settings
• Main setting: MV
• Sub-setting: the amount of the change in the PV from the time when the MV exceeds the value set for the main setting
• ON delay time: diagnosis time
● Operation specifications
Turns ON if the PV does not reach the value obtained by adding (subtracting) the sub-setting value to the PV when the MV exceeds the main setting (condition 1) within the diagnosis time (ON delay time)(condition 3) even though an MV greater than the main setting is retained (condition 2).
● Note
To set the ON delay time, the user level (L 79) should be set to “advanced configuration.”
The ON delay time is set to 0.0 s when the product is shipped.</td></tr>
<tr><td></td><td></td><td>For heating control
 

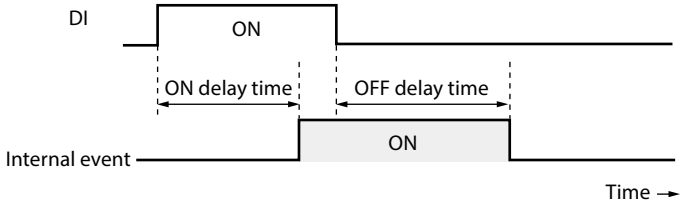
If cond. 1 & 2 are met, ON delay starts</td><td>For cooling control
 

If cond. 1 & 2 are met, ON delay starts</td></tr>
</table>

<table>
<tr><th>Operation type</th><th>Setting</th><th>Direct action</th><th>Reverse action</th></tr>
<tr><td>Loop diagnosis 3</td><td>22</td><td colspan="2">
Turns on when the PV does not change according to the increase or decrease of the MV.
Use this setting to detect a failure of the actuator, etc.
● Settings
• Main setting: the amount of a change in the PV from the time when the MV reaches the high limit (100 %) or the low limit (0 %)
• Sub-setting: the absolute value of deviation (PV−SP) that will turn off the event
• ON delay time: diagnosis time
• OFF delay time: time from power-on to event OFF
● Operation specifications
In a direct operation of heating control, the event turns ON if:
• The amount of PV increase after the diagnosis time (ON delay time) elapses after the MV reaches the high limit is smaller than the main setting.
• The amount of PV decrease after the diagnosis time (ON delay time) elapses after the MV reaches the low limit is smaller than the main setting.
In a reverse operation of cooling control, the event turns ON if:
• The amount of PV decrease after the diagnosis time (ON delay time) elapses after the MV reaches the high limit is smaller than the main setting.
• The amount of PV increase after the diagnosis time (ON delay time) elapses after the MV reaches the low limit is smaller than the main setting.
The conditions below have priority over the conditions above, and if any of these conditions is met, the event will turn OFF.
• The absolute value of deviation (PV−SP) is smaller than the sub-setting
However, after the absolute value of deviation exceeds the sub-setting, the event turns OFF if the absolute value of deviation becomes smaller than the value obtained by subtracting the hysteresis from the sub-setting.
• The time from the start of operation after power-on is less than the OFF delay time
● Note
To set the ON and OFF delay times, the user level (L79) should be set to “advanced configuration.”
The ON and OFF delay times are set to 0.0 s when the product is shipped.
</td></tr>
<tr><td></td><td></td><td>
For heating control


If cond. 1 & 2 are met, ON delay starts
</td><td>
For cooling control


If cond. 1 & 2 are met, ON delay starts
</td></tr>
</table>

<table>
<tr><th>Operation type</th><th>Setting</th><th>Direct action</th><th>Reverse action</th></tr>
<tr><td>Alarm
(status)</td><td>23</td><td>ON when an alarm (alarm code AL01 to AL96) occurs, OFF otherwise</td><td>OFF when an alarm (alarm code AL01 to AL96) occurs, ON otherwise</td></tr>
<tr><td>READY
(status)</td><td>24</td><td>ON in READY mode
OFF in RUN mode</td><td>OFF in READY mode
ON in RUN mode</td></tr>
<tr><td>MANUAL
(status)</td><td>25</td><td>ON in MANUAL mode
OFF in AUTO mode</td><td>OFF in MANUAL mode
ON in AUTO mode</td></tr>
<tr><td>Invalid</td><td>26</td><td>Always OFF</td><td>Always ON</td></tr>
<tr><td>AT running (status)</td><td>27</td><td>ON when AT is running
OFF when AT stopped</td><td>OFF when AT is running
ON when AT stopped</td></tr>
<tr><td>During SP ramp</td><td>28</td><td>ON during SP ramp
OFF when there is no SP ramp or it is completed</td><td>OFF during SP ramp
ON when there is no SP ramp or it is completed</td></tr>
<tr><td>Control direct action
(status)</td><td>29</td><td>ON during direct action (cooling)
OFF during reverse action (heating)</td><td>OFF during direct action (cooling)
ON during reverse action (heating)</td></tr>
<tr><td>Invalid</td><td>30</td><td>Always OFF</td><td>Always ON</td></tr>
<tr><td>Invalid</td><td>31</td><td>Always OFF</td><td>Always ON</td></tr>
<tr><td>Timer
(status)</td><td>32</td><td colspan="2">The direct and reverse action settings are disabled for timer events.
To use timer events, set the operation type to “timer stop/start” in the DI assignment bank. Multiple timer events can be controlled by a single internal contact (DI) by setting “internal event No. assignment” in the DI assignment bank.
● Settings
• ON delay time: Time until the event changes from OFF to ON after the DI changes from OFF to ON
• OFF delay time: Time until the event changes from ON to OFF after the DI changes from ON to OFF
● Operation specifications
• Turns ON when DI ON continues for the ON delay time or longer.
• Turns OFF when DI OFF continues for the OFF delay time or longer.
• In other cases, the current status is retained.
 
● Note
To set the ON and OFF delay times, the user level (LC79) should be set to “advanced configuration.”
The ON and OFF delay times are set to 0.0 s when the product is shipped.
“Internal event No. assignment” in the DI assignment bank is set to 0 when the product is shipped. With this setting, a timer can be started or stopped for all internal events by a single internal contact (DI).
If the setting is changed to 1 or more, a timer can be started or stopped for one specified internal event by one internal contact (DI).
To change the setting, the user level (LC79) should be set to “advanced configuration.”</td></tr>
</table>

■ Operation type

The operation type can be set for internal events.

Item (bank)	Display	Description	Initial value	User level
Internal event 1 configuration 1 Operation type (event configuration bank)	E1C1	0: No event 1: PV high limit 2: PV low limit 3: PV high and low limits 4: Deviation high limit 5: Deviation low limit 6: Deviation high and low limits 7: Deviation high limit (final SP reference) 8: Deviation low limit (final SP reference) 9: Deviation high and low limits (final SP reference) 10: SP high limit 11: SP low limit 12: SP high and low limits 13: MV high limit 14: MV low limit 15: MV high and low limits 16: Heater 1 burnout/overcurrent 17: Heater1 short circuit 18: Heater 2 burnout/overcurrent 19: Heater 2 short circuit 20: Loop diagnosis 1 21: Loop diagnosis 2 22: Loop diagnosis 3 23: Alarm (status) 24: READY (status) 25: MANUAL (status) 27: AT running (status) 28: During SP ramp (status) 29: Control direct action (status) 32: Timer (status)	0	Simple, standard, advanced
Internal event 2 configuration 1 Operation type (Event configuration bank)	E2C1		0	
Internal event 3 configuration 1 Operation type (event configuration bank)	E3C1		0	
Internal event 4 configuration 1 Operation type (event configuration bank)	E4C1		0	
Internal event 5 configuration 1 Operation type (event configuration bank)	E5C1		0	

Note

- The functions available vary depending on the operation type.
  ☞ Event operation type and available functions (p. App.-2) (for details)

Handling Precautions

- Do not set an operation type number that is not listed in the description or that is for a function not supported by the model. Unintended values may result.

■ Direct/reverse, standby, and event state in READY mode

Direct/reverse, standby, and event state in READY mode that is associated with operation type can be set.

Item (bank)	Display	Description	Initial value	User level
Internal event 1 configuration 2 (event configuration bank)	E1C2	"1st digit" (2nd, etc.) means the first digit (etc.) from the right. 1st digit: Direct/reverse setting 0: Direct 1: Reverse 2nd digit: Standby setting 0: None 1: Standby 2: Standby + standby when the SP is changed 3rd digit: Event state in READY mode 0: Continues 1: Forced OFF 4th digit: Undefined 0: Undefined	0000	Simple, standard, advanced
Internal event 2 configuration 2 (event configuration bank)	E2C2		0000	
Internal event 3 configuration 2 (event configuration bank)	E3C3		0000	
Internal event 4 configuration 2 (event configuration bank)	E4C4		0000	
Internal event 5 configuration 2 (event configuration bank)	E5C5		0000	

- If internal event configuration 1 operation type is set to 0 (no event), internal event configuration 2 (direct/reverse, standby, event state in READY mode) is not displayed.

Note

- For the operation of internal events according to the direct/reverse setting, see Operation (p.5-59 to 5-64.)
- The standby function is not available for some operation types.
  ☞ Event operation type and available functions (p. App.-2) (for details).

Handling Precautions

- The standby function makes it possible to have an event not turn ON even if the ON conditions (before reversing) are satisfied after this device's power has just been turned ON or when the mode is switched from READY to RUN. The event will turn ON after the OFF conditions are satisfied if the ON conditions are satisfied again.
- "Standby + standby when the SP is changed" is a function that reactivates the standby function when the SP or LSP group No. is changed, in addition to the regular standby function operation. However, if the same SP is written or if the SP does not change after a change of LSP group No., this device will not enter standby mode.

	READY		When changed from READY to RUN	
Event status in READY mode / Standby setting	0: Continues	1: Forced OFF	0: Continues	1: Forced OFF
0: None	Normal operation	OFF	Normal operation	Normal operation
1: Standby	OFF	OFF	OFF (standby status)	OFF (standby status)
2: Standby + standby when the SP is changed	OFF	OFF	OFF (standby status)	OFF (standby status)

■ Alarm OR, special OFF, delay time unit

Alarm OR, special OFF, and delay time unit associated with operation type can be set.

Item (bank)	Display	Description	Initial value	User level
Internal event 1 configuration 3 (event configuration bank)	E1C3	"1st digit" (2nd, etc.) means the first digit (etc.) from the right. 1st digit: Alarm OR setting 0: None 1: Alarm direct + OR operation 2: Alarm direct + AND operation 3: Alarm reverse + OR operation 4: Alarm reverse + AND operation 2nd digit: Special OFF setting 0: No special OFF 1: If the main setting for the event is 0, the event is OFF. 3rd digit: Delay time unit setting 0: 0.1 s 1: 1 s 2: 1 min 4th digit: Undefined 0: Undefined	0000	Advanced
Internal event 2 configuration 3 (event configuration bank)	E2C3		0000	
Internal event 3 configuration 3 (event configuration bank)	E3C3		0000	
Internal event 4 configuration 3 (event configuration bank)	E4C3		0000	
Internal event 5 configuration 3 (event configuration bank)	E5C3		0000	

- If internal event configuration 1 operation type is set to 0 (no event), internal event configuration 3 (alarm OR, special OFF, delay time unit) is not displayed.

Note

- The special OFF function is not available for some operation types.
  ☞ Event operation type and available functions (p. App.-2) (for details).

- The relationship between the alarm OR setting, alarm occurrence, and internal event ON/OFF is shown below.

Alarm OR setting	Alarm occurrence	Internal event status before alarm OR processing	Internal event status after alarm OR processing
None	No	OFF	OFF
	No	ON	ON
	Yes	OFF	OFF
	Yes	ON	ON
Alarm direct + OR operation	No	OFF	OFF
	No	ON	ON
	Yes	OFF	ON
	Yes	ON	ON
Alarm direct + AND operation	No	OFF	OFF
	No	ON	OFF
	Yes	OFF	OFF
	Yes	ON	ON
Alarm reverse + OR operation	No	OFF	ON
	No	ON	ON
	Yes	OFF	OFF
	Yes	ON	ON
Alarm reverse + AND operation	No	OFF	OFF
	No	ON	ON
	Yes	OFF	OFF
	Yes	ON	OFF

■ Main setting, sub-setting,hysteresis

The main setting, sub-setting, and hysteresis associated with operation type can be set.

Item (bank)	Display	Description	Initial value	User level
Internal event 1 main setting (event bank)	E 1	−1999 to +9999U The number of decimal places in the PV changes according to the operation type. For some operation types, the range is 0–9999U.	0	Simple, standard, advanced
Internal event 1 sub-setting (event bank)	E 1.Sb	−1999 to +9999U The number of decimal places in the PV changes according to the operation type. For some operation types, the range is 0–9999U.	0	
Internal event 1 hysteresis (event bank)	E 1.HY	0 to 9999U The number of decimal places in the PV changes according to the operation type.	5	
Internal event 2 main setting (event bank)	E2	Same as internal event 1 main setting	0	
Internal event 2 sub-setting (event bank)	E2.Sb	Same as internal event 1 sub-setting	0	
Internal event 2 hysteresis (event bank)	E2.HY	Same as internal event 1 hysteresis	5	
Internal event 3 main setting (event bank)	E3	Same as internal event 1 main setting	0	
Internal event 3 sub-setting (event bank)	E3.Sb	Same as internal event 1 sub-setting	0	
Internal event 3 hysteresis (event bank)	E3.HY	Same as internal event 1 hysteresis	5	
Internal event 4 main setting (event bank)	E4	Same as internal event 1 main setting	0	
Internal event 4 sub-setting (event bank)	E4.Sb	Same as internal event 1 sub-setting	0	
Internal event 4 hysteresis (event bank)	E4.HY	Same as internal event 1 hysteresis	5	
Internal event 5 main setting (event bank)	E5	Same as internal event 1 main setting	0	
Internal event 5 sub-setting (event bank)	E5.Sb	Same as internal event 1 sub-setting	0	
Internal event 5 hysteresis (event bank)	E5.HY	Same as internal event 1 hysteresis	5	

- If internal event configuration 1 operation type is set to 0 (no event), internal event main setting, sub-setting, and hysteresis are not displayed.
- ☞For the operation of internal events according to the main setting, sub-setting, and hysteresis, see Operation (p.5-59 to 5-64.)

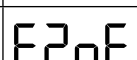
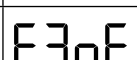
■ ON delay time, OFF delay time

ON delay is a function that delays the timing at which the internal event status is changed from OFF to ON.

OFF delay is a function that delays the timing at which the internal event status is changed from ON to OFF.

Note that, if the operation type is set to 20 (loop diagnosis 1), 21 (loop diagnosis 2), 22 (loop diagnosis 3), or 32 (timer), it operates as a different function.
☞" Operation (p.5-59 to 5-64.)

The ON delay time and OFF delay time can be specified by the parameters below.

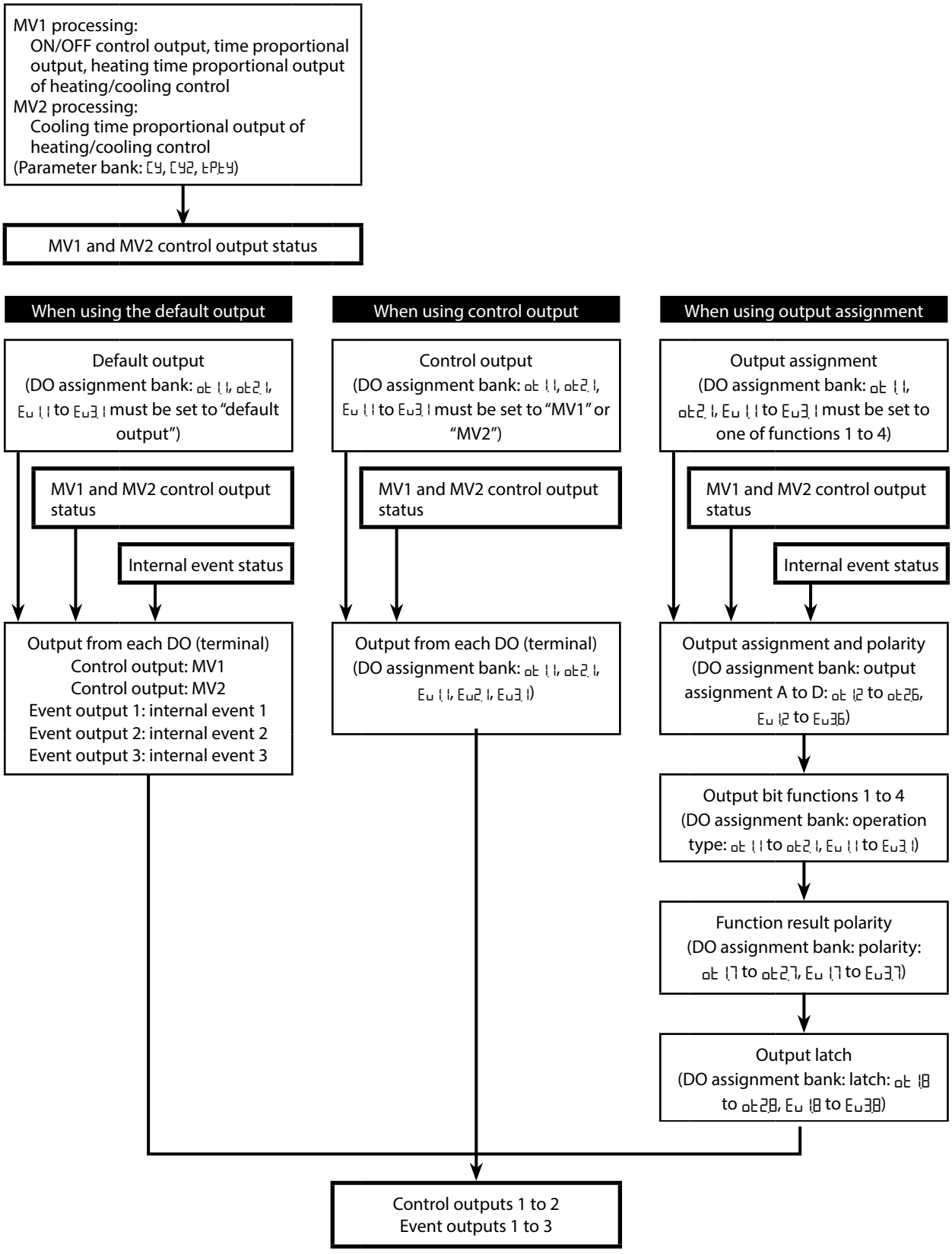
Item (bank)	Display	Description	Initial value	User level
Internal event 1 ON delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	Advanced
Internal event 1 OFF delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 2 ON delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 2 OFF delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 3 ON delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 3 OFF delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 4 ON delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	
Internal event 4 OFF delay time (event bank)		0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	

Item (bank)	Display	Description	Initial value	User level
Internal event 5 ON delay time (event bank)	E5.on	0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	Advanced
Internal event 5 OFF delay time (event bank)	E5.oF	0.0 to 999.9 s (when "delay time unit" = 0.1 s) 0 to 9999 s (when "delay time unit" = something other than 0.1 s)	0.0 s or 0 s	

- If internal event configuration 1 operation type is set to 0 (no event), internal event ON delay time and OFF delay time are not displayed.

5 - 9 Digital Output (DO)

The following is a functional block diagram for digital output (DO).



■ MV1/MV2 processing

The time proportional cycle and time proportional cycle mode for MV1 and MV2 can be specified.

Item (bank)	Display	Description	Initial value	User level
Time proportional cycle 1 (for MV1) (parameter bank)	CY	5 to 120 s (when the output includes the relay output) 1 to 120 s (when the output does not include the relay output)	10 or 2 s	Simple, standard, advanced
Time proportional cycle 2 (for MV2) (parameter bank)	CY2		10 or 2 s	
Time proportional cycle mode (parameter bank)	tPtY	0: Priority on controllability 1: Priority on actuator service life (only one ON/OFF operation in a time proportional cycle)	0 or 1	Advanced
Time proportional minimum ON/OFF time 1 (for MV1) (parameter bank)	tPo	0 to 250 ms	0	Advanced
Time proportional minimum ON/OFF time 2 (for MV2) (parameter bank)	tPo2	0 to 250 ms	0	Advanced

- MV1: ON/OFF control output, time proportional output, heating time proportional output of heating/cooling control
  MV2: Cooling time proportional output of heating/cooling control
- In the DO assignment bank, if MV1 is connected to any of relay control output, voltage pulse control output, or event output, time proportional cycle 1 (CY) is displayed and the setting can be changed.
- If heating/cooling control is used and, in the DO assignment bank, if MV2 is connected to any of relay control output, voltage pulse control output, or event output, time proportional cycle 2 (CY2) is displayed and the setting can be changed.
- The initial value of time proportional cycle 1 (CY) is 2 if the control output 1 is a voltage pulse output, and 10 otherwise.
- The initial value of time proportional cycle 2 (CY2) is 2 if the control output 2 is a voltage pulse output, and 10 otherwise.
- The time proportional cycle mode (tPtY) setting is valid for both MV1 and MV2 time proportional outputs.
- The initial value of time proportional cycle mode (tPtY) is 0 if the control output 1 is a voltage pulse output, and 1 otherwise.
- If MV1 is connected to the relay control output or event output in the DO assignment bank and if time proportional cycle 1 (CY) is set to shorter than 5 s, 5 s applies.
- If MV2 is connected to the relay control output or event output in the DO assignment bank and if time proportional cycle 2 (CY2) is set to shorter than 5 s, 5 s applies.

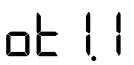
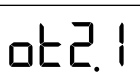
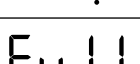
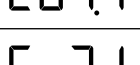
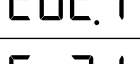
- The minimum ON/OFF time is the minimum time to maintain the output status after switching the output ON/OFF. Until this time elapses, the output status is maintained even if the time to switch ON/OFF comes.
- If time proportional minimum ON/OFF time 1 = 0: If MV1 is connected to the relay control output or event output in the DO assignment bank, or if time proportional cycle 1 is 10 s or longer, 250 ms applies. Otherwise, 1 ms applies.
- If time proportional minimum ON/OFF time 1 = 1–250: If MV1 is connected to the relay control output or event output in the DO assignment bank, and if the setting is 1–49, 50 ms applies. If the setting is 50–250, the set value applies.
- If time proportional minimum ON/OFF time 2 = 0: If MV2 is connected to the relay control output or event output in the DO assignment bank, or if time proportional cycle 2 is 10 s or longer, 250 ms applies. Otherwise, 1 ms applies.
- If time proportional minimum ON/OFF time 2 = 1–250: If MV2 is connected to the relay control output or event output in the DO assignment bank, and if the setting is 1–49, 50 ms applies. If the setting is 50–250, the set value applies.

Handling Precautions

- The shorter the time proportional cycle, the better the controllability. However, when specifying the settings, please take the electrical service life of the relay into consideration.

■ Operation type

The operation type of control outputs 1–2 and event outputs 1–3 can be specified in the DO assignment bank.

Item (bank)	Display	Description	Initial value	User level
Control output 1 operation type (DO assignment bank)		0: Default output 1: MV1 2: MV2 3: Function 1, (A and B) or (C and D) 4: Function 2, (A or B) and (C or D) 5: Function 3, (A or B or C or D) 6: Function 4, (A and B and C and D)	0	Advanced
Control output 2 operation type (DO assignment bank)			0	
Event output 1 operation type (DO assignment bank)			0	
Event output 2 operation type (DO assignment bank)			0	
Event output 3 operation type (DO assignment bank)			0	

- If relay output or voltage pulse output is set as the control output by the model No., the operation type setting of control outputs 1–2 (to) is displayed and can be changed.
- If a model with event relay outputs is used, the operation type setting of event outputs 1–3 (to) is displayed and can be changed.
- MV1: ON/OFF control output, time proportional output, heating time proportional output of heating/cooling control
  MV2: Cooling time proportional output of heating/cooling control
- When set to 0 (default output), the following will be output:

  Control output 1: MV1 control output status
  Control output 2: MV2 control output status
  Event output 1: Internal event 1 processing result
  Event output 2: Internal event 2 processing result
  Event output 3: Internal event 3 processing result

- An output bit function is a combination of logical functions (AND, OR) for each of the control outputs and event outputs. Functions 1 to 4 have different combinations of logical operations. The following explains each logical function:

AND function	OR function
OFF and OFF = OFF	OFF or OFF = OFF
OFF and ON = OFF	OFF or ON = ON
ON and OFF = OFF	ON or OFF = ON
ON and ON = ON	ON or ON = ON

■ Output assignment

The four inputs (A, B, C, D) used for output bit functions can be selected.

Item (bank)	Display	Description	Initial value	User level
Control output 1 output assignment A (DO assignment bank)	ot 12	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1)	14	Advanced
Control output 1 output assignment B (DO assignment bank)	ot 13	2: Internal event 1 3: Internal event 2	0	
Control output 1 output assignment C (DO assignment bank)	ot 14	4: Internal event 3 5: Internal event 4	0	
Control output 1 output assignment D (DO assignment bank)	ot 15	6: Internal event 5 7 to 13: Undefined	0	
Control output 2 output assignment A (DO assignment bank)	ot22	14: MV ON/OFF status 1 15: MV ON/OFF status 2	15	
Control output 2 output assignment B (DO assignment bank)	ot23	16 to 17: Undefined 18: DI1	0	
Control output 2 output assignment C (DO assignment bank)	ot24	19: DI2 20 to 25: Undefined	0	
Control output 2 output assignment D (DO assignment bank)	ot25	26: Internal contact 1 27: Internal contact 2	0	
Event output 1 output assignment A (DO assignment bank)	Eu 12	28: Internal contact 3 29: Internal contact 4	2	
Event output 1 output assignment B (DO assignment bank)	Eu 13	30: Internal contact 5 31 to 33: Undefined	0	
Event output 1 output assignment C (DO assignment bank)	Eu 14	34: User-defined bit 1 35: User-defined bit 2	0	
Event output 1 output assignment D (DO assignment bank)	Eu 15	36: User-defined bit 3 37: User-defined bit 4	0	
Event output 2 output assignment A (DO assignment bank)	Eu22	38: MANUAL mode 39: READY mode	3	
Event output 2 output assignment B (DO assignment bank)	Eu23	40: Undefined 41: AT running	0	
Event output 2 output assignment C (DO assignment bank)	Eu24	42: During SP ramp 43: Undefined	0	
Event output 2 output assignment D (DO assignment bank)	Eu25	44: Alarm (AL01 to AL96) 45: PV alarm (AL01 to AL03)	0	
Event output 3 output assignment A (DO assignment bank)	Eu32	46: Undefined 47: [MODE] key status	4	
Event output 3 output assignment B (DO assignment bank)	Eu33	48: Event output 1 terminal status 49: Control output 1 terminal status	0	
Event output 3 output assignment C (DO assignment bank)	Eu34		0	
Event output 3 output assignment D (DO assignment bank)	Eu35		0	

- If relay output or voltage pulse output is set as the control output by the model No. and if one of functions 1 to 4 is set for the operation type of control outputs 1–2 (ot 1.1 to ot2.1), the output assignment A–D setting of control outputs 1–2 (ot 1.2 to ot2.5) is displayed and can be changed.
- If a model with event relay outputs is used and if one of functions 1 to 4 is set for the operation type of event outputs 1–3 (Eu 1.1 to Eu3.1), the output assignment A–D setting of event outputs 1–3 (Eu 1.2 to Eu3.5) is displayed and can be changed.

■ Output assignment polarity

Whether to reverse the data assigned to the four inputs (A, B, C, D) used for output bit functions can be specified.

Item (bank)	Display	Description	Initial value	User level
Control output 1 polarity A to D (DO assignment bank)	ot 1.6	"1st digit" (2nd, etc.) means the first digit (etc.) from the right. 1st digit: Polarity of output assignment A 2nd digit: Polarity of output assignment B 3rd digit: Polarity of output assignment C 4th digit: Polarity of output assignment D 0: Direct 1: Reverse	0000	Advanced
Control output 2 polarity A to D (DO assignment bank)	ot2.6		0000	
Event output 1 polarity A to D (DO assignment bank)	Eu 1.6		0000	
Event output 2 polarity A to D (DO assignment bank)	Eu2.6		0000	
Event output 3 polarity A to D (DO assignment bank)	Eu3.6		0000	

- If relay output or voltage pulse output is set as the control output by the model No. and if one of functions 1 to 4 is set for the operation type of control outputs 1–2 (ot 1.1 to ot2.1), the polarity A–D setting of control outputs 1–2 (ot 1.6 to ot2.6) is displayed and can be changed.
- If a model with event relay outputs is used and if one of functions 1 to 4 is set for the operation type of event outputs 1–3 (Eu 1.1 to Eu3.1), the polarity A–D setting of event outputs 1–3 (Eu 1.6 to Eu3.6) is displayed and can be changed.

[!] Handling Precautions

- Depending on the conditions, the output relay may turn on and off quickly and repeatedly. To prevent this, observe the following:
  - If 49 (control output 1 terminal status) is set for any of control output 1 output assignments A to D (ot 1.2 to ot 1.5), do not set 1 (reverse) as the output assignment polarity for the same letter.
  - If 48 (event output 1 terminal status) is set for any of event output 1 output assignments A to D (Eu 1.2 to Eu 1.5), do not set 1 (reverse) as the output assignment polarity for the same letter.

■ Function result polarity

Whether to reverse the results of output bit functions 1 to 4 can be specified.

Item (bank)	Display	Description	Initial value	User level
Control output 1 polarity (DO assignment bank)	ot 1.7	0: Direct 1: Reverse	0	Advanced
Control output 2 polarity (DO assignment bank)	ot2.7		0	
Event output 1 polarity (DO assignment bank)	Eu 1.7		0	
Event output 2 polarity (DO assignment bank)	Eu2.7		0	
Event output 3 polarity (DO assignment bank)	Eu3.7		0	

- If relay output or voltage pulse output is set as the control output by the model No. and if one of functions 1 to 4 is set for the operation type of control outputs 1–2 (ot 1.1 to ot2.1), the polarity setting of control outputs 1–2 (ot 1.7 to ot2.7) is displayed and can be changed.
- If a model with event relay outputs is used and if one of functions 1 to 4 is set for the operation type of event outputs 1–3 (Eu 1.1 to Eu3.1), the polarity setting of event outputs 1–3 (Eu 1.7 to Eu3.7) is displayed and can be changed.

■ Latch

Whether to latch the output when it is ON or OFF can be specified.

Item (bank)	Display	Description	Initial value	User level
Control output 1 latch (DO assignment bank)	ot 1.8	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	Advanced
Control output 2 latch (DO assignment bank)	ot2.8		0	
Event output 1 latch (DO assignment bank)	Eu 1.8		0	
Event output 2 latch (DO assignment bank)	Eu2.8		0	
Event output 3 latch (DO assignment bank)	Eu3.8		0	

- If relay output or voltage pulse output is set as the control output by the model No. and if one of functions 1 to 4 is set for the operation type of control outputs 1–2 (ot 1.1 to ot2.1), the latch operation setting of control outputs 1–2 (ot 1.8 to ot2.8) is displayed and can be changed.
- If a model with event relay outputs is used and if one of functions 1 to 4 is set for the operation type of event outputs 1–3 (Eu 1.1 to Eu3.1), the latch operation setting of event outputs 1–3 (Eu 1.8 to Eu3.8) is displayed and can be changed.

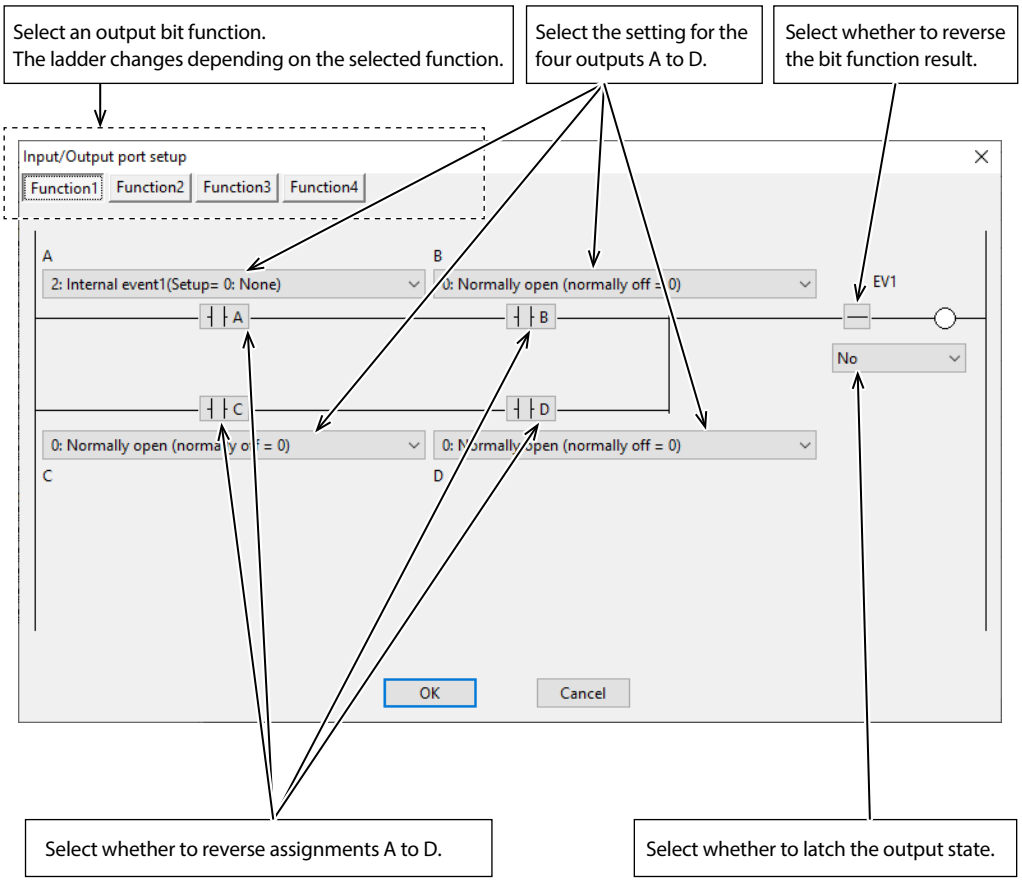
- To release the latches, do any of the following operations: turn the power off and then back on, set "release all DO latches" (doLt) to LtoF (latch release) using the keys or communication, or change the above latch setting in the DO assignment bank to 0 (do not latch).

Handling Precautions

- When output assignments A–D are set to "14" (MV ON/OFF status 1) or "15" (MV ON/OFF status 2), [Latch] can be set to "1" (latch when ON) or "2" (latch when OFF) only if the ROM version is 1.01 or later.

■ DO assignment by Smart Loader Package model SLP-C1F

When specifying the settings in the DO assignment bank using Smart Loader Package model SLP-C1F, select [Edit] → [Input/Output port setup] from the input menu. This will display a screen for easy setup of the output bit function type, output assignment, output assignment polarity, function result polarity, and whether to latch the output.



Handling Precautions

- In addition to selecting from the menu, you can also open the [Input/Output port setup] screen by the following operations.
  - Click the I/O port setting icon
  - Right-click an output bit function setting
  - Press Ctrl + P

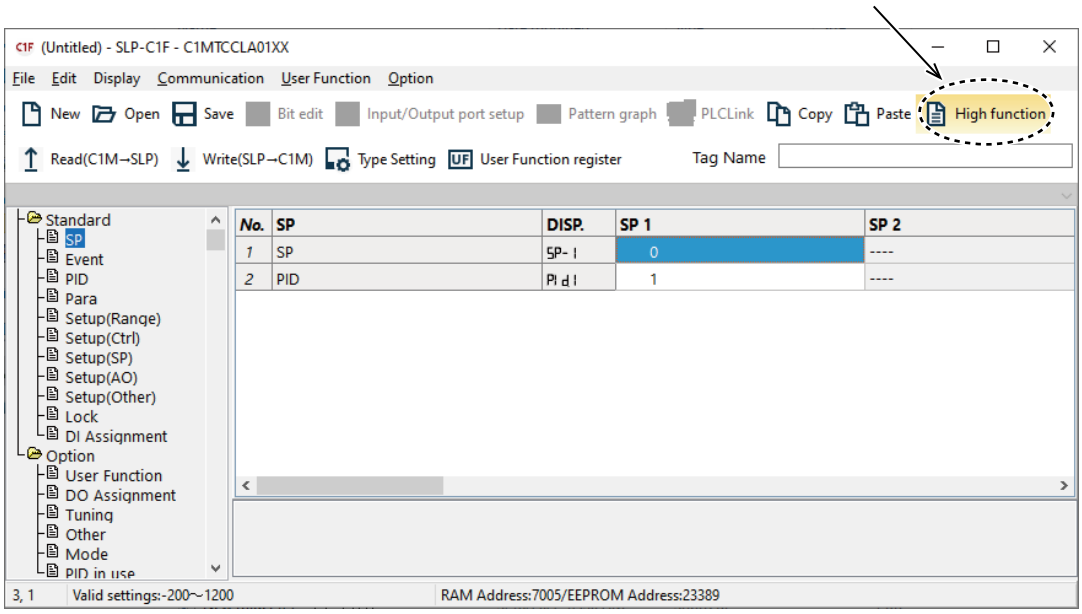
5 - 10 Application Examples

This section gives examples of applications that use the assignment function of this device.

■ Applications using the assignment function

This section gives examples of settings using Smart Loader Package model SLP-C1F.

To use the assignment function, set the user level to "Advanced (High function)" first.



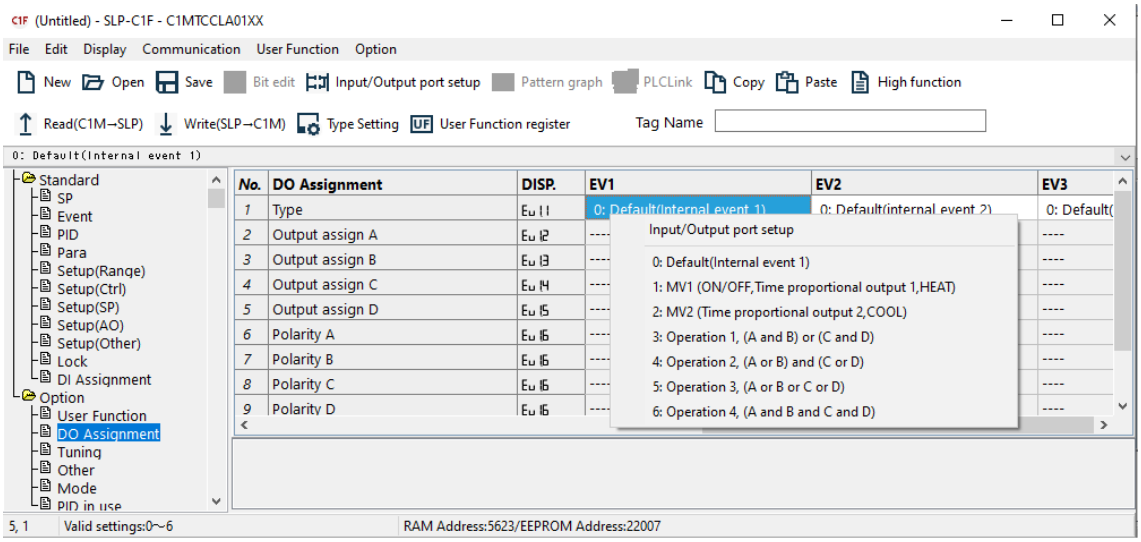
● Example 1: Output OR of heater burnout and PV high limit alarm

Overview: Set the PV high limit for internal event 1.
Set heater burnout for internal event 2.
Output the OR of the above outputs to the EV1 relay.

(1) Select [Event] under [Standard] and set [1: PV high limit] for [Internal event 1].

(2) In the same manner, set [16: Heater 1 burnout/overcurrent] for [Internal event 2].

(3) Select [DO Assignment] under [Option], right-click the operation type field of [EV1], and select [Input/Output port setup].



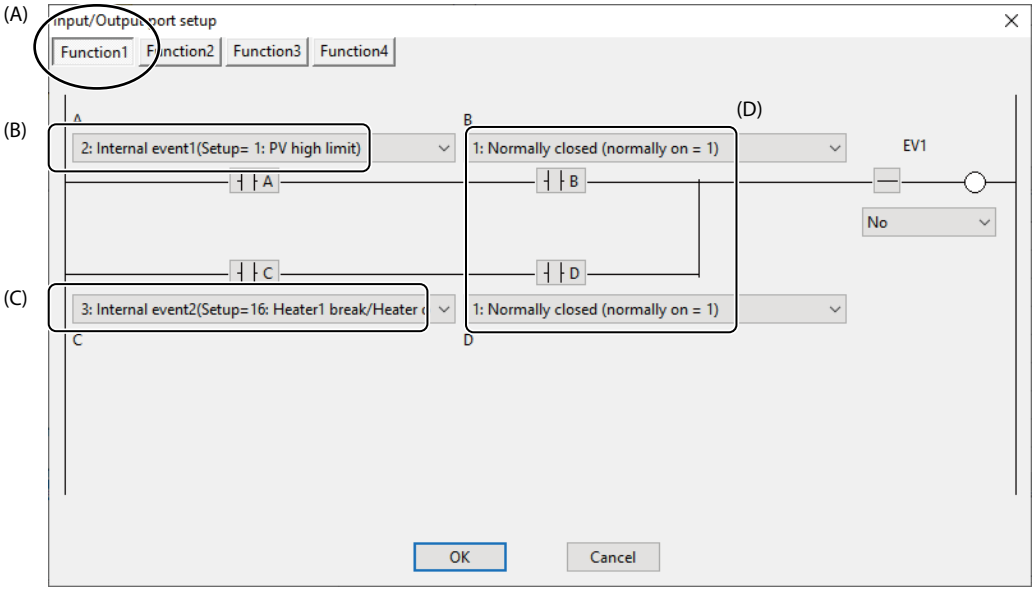
(4) On the [Input/Output port setup] screen, configure the settings as shown below.

(A) Select [Function 1] to output the OR of two operations.

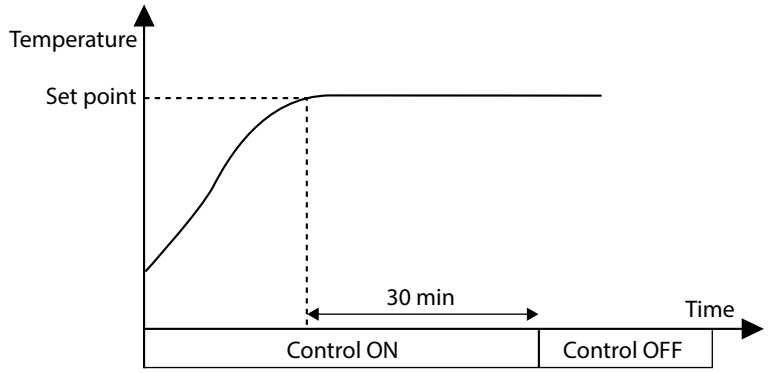
(B) Select [Internal event 1 (setting = 1: PV high limit)] for output assignment A.

(C) In the same manner, select [Internal event 2 (setting = 16: heater 1 burnout/overcurrent] for output assignment C.

(D) Select [Normally closed (normally on = 1)] for output assignments B and D.



● **Example 2: Start operation by switching to RUN mode with an external switch, and stop operation by automatically switching to READY mode 30 minutes after the set point is reached.**



● **Explanation**

Timer start condition: AND of the external switch (DI1) and the target temperature (internal event 2: deviation high limit)

Timer ON delay time: the desired amount of time between the time when the set point is reached and when operation stops automatically

The mode (RUN/READY) changes depending on the combination of the DI1 status and timer ON/OFF.

Status	Control OFF	Operation started, timer counting	Time elapsed, operation stopped
DI1	OFF	ON	ON
Timer (internal EV2)	OFF	OFF	ON
Internal contact 2 status	ON	OFF	ON
Mode	READY	RUN	READY

● Sample settings

• Event

Event	Display	Internal event 1	Internal event 2
Operation type	E_C1	32: Timer	4: Deviation high limit
Direct/reverse	E_C2	----	0: Direct
Standby	E_C2	----	0: No standby
Event state in READY	E_C2	0: Continues	0: Continues
Alarm OR	E_C3	0: None	0: None
Special OFF	E_C3	----	0: No special OFF
Delay time unit	E_C3	2: 1 min	0: 0.1 s
Event main setting (low limit)	E_	----	0
Event sub-setting (high limit)	E_Sb	----	----
Hysteresis	E_HY	----	5
ON delay time	E_on	30	0
OFF delay time	E_oF	0	0

_: Internal event No.

• DI assignment

DI assignment	Display	Internal contact 1	Internal contact 2
Operation type	di_.1	17: Timer stop/start	7: RUN/READY
Input bit function	di_.2	1: Function 1, (A and B) or (C and D)	1: Function 1, (A and B) or (C and D)
Input assignment A	di_.3	2: DI1	2: DI1
Input assignment B	di_.4	11: Internal event 2 (setting = 4: Deviation high limit)	10: Internal event 1 (setting = 32: Timer (status))
Input assignment C	di_.5	0: Normally open (normally OFF = 0)	0: Normally open (normally OFF = 0)
Input assignment D	di_.6	0: Normally open (normally OFF = 0)	0: Normally open (normally OFF = 0)
Polarity A	di_.7	0: Direct	0: Direct
Polarity B	di_.7	0: Direct	1: Reverse
Polarity C	di_.7	0: Direct	0: Direct
Polarity D	di_.7	0: Direct	0: Direct
Polarity	di_.8	0: Direct	1: Reverse
Internal event No. assignment	di_.9	1	----

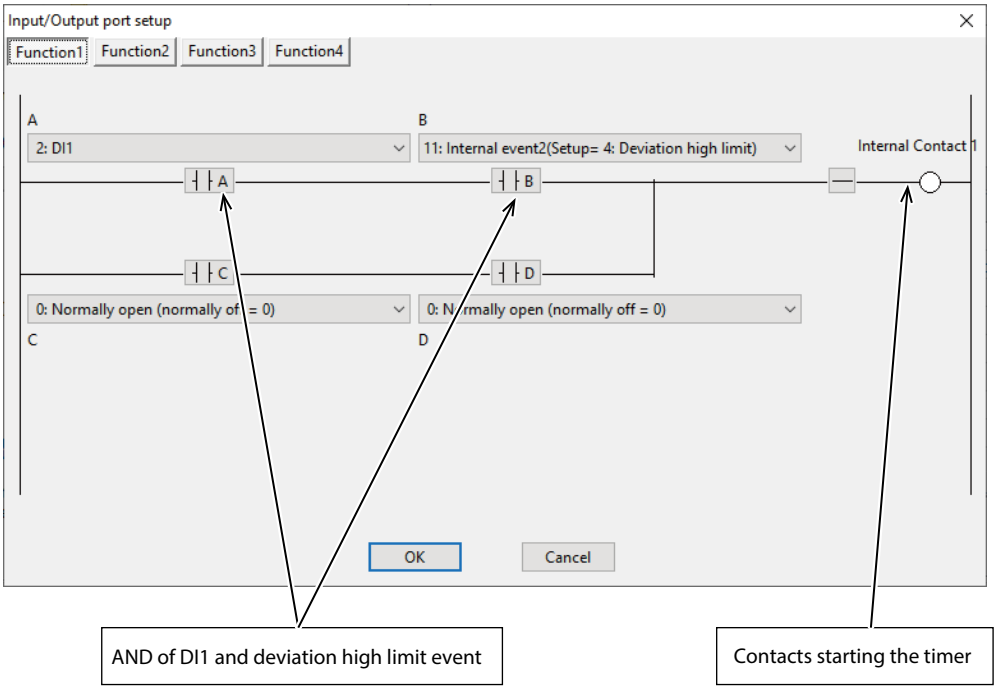
_ : Internal contact No.

- **Key points for configuration**

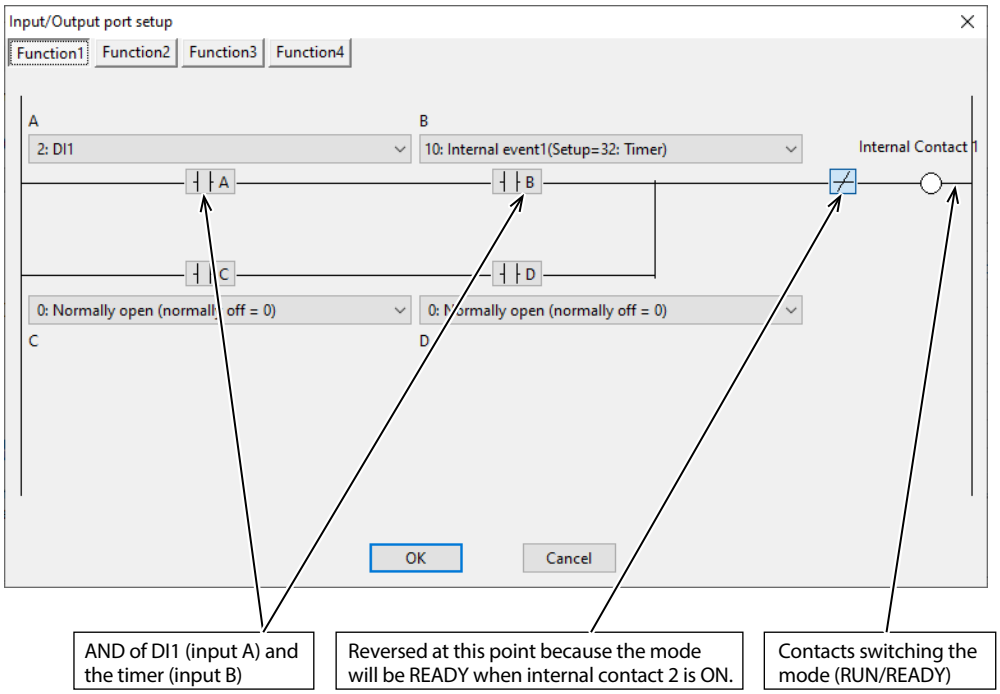
Timer start condition: AND of DI1 and the target temperature (internal event 2: deviation high limit)

Condition for RUN/ READY mode switching: AND of DI (input A) and the timer (input B). However, because the mode will be READY when the internal contacts are ON, the function result is reversed at the final stage of the internal contact 2 processing.

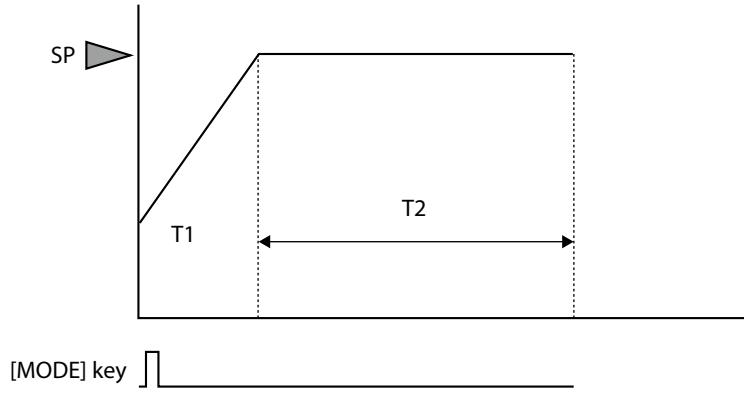
DI assignment (internal contact 1): Input/output port setup



DI assignment (internal contact 2): Input/output port setup



● Example 3: Simple operation



● Explanation

When [MODE] is pressed, this device enters RUN mode and the PV starts to change.

The SP increases (or decreases) according to the ramp setting.

When the final SP is reached and the PV is within a certain range, the timer starts counting. After T2 hours, this device enters READY mode.

● Sample settings

• Event

Event	Display	Internal event 1	Internal event 2
Operation type	E_C1	9: Deviation high and low limits (final SP reference)	32: Timer (status)
Direct/Reverse	E_C2	1: Reverse	----
Standby	E_C2	0: No standby	----
Event state in READY	E_C2	1: Forced OFF	0: Continues
Alarm OR	E_C3	0: None	0: None
Special OFF	E_C3	0: No special OFF	----
Delay time unit	E_C3	0: 0.1 s	0: 0.1 s
Event main setting (low limit)	E_	3	----
Event sub-setting (high limit)	E_.Sb	3	----
Hysteresis	E_.HY	9999	----
ON delay	E_.on	2	15
OFF delay	E_.oF	0	0

_ : Internal event No.

• DI assignment

DI assignment	Display	Internal contact 1	Internal contact 2
Operation type	di_.1	7: RUN/READY	17: Timer stop/start
Input bit function	di_.2	1: Function 1, (A and B) or (C and D)	1: Function 1, (A and B) or (C and D)
Input assignment A	di_.3	18: User-defined bit 1	10: Internal event 1 (setting = 9: Deviation high and low limits (final SP reference))
Input assignment B	di_.4	11: Internal event 2 (setting = 32: Timer (status))	26: During SP ramp
Input assignment C	di_.5	0: Normally open (normally OFF = 0)	18: User-defined bit 1
Input assignment D	di_.6	0: Normally open (normally OFF = 0)	11: Internal event 2 (setting = 32: Timer (status))
Polarity A	di_.7	0: Direct	0: Direct
Polarity B	di_.7	1: Reverse	1: Reverse
Polarity C	di_.7	0: Direct	0: Direct
Polarity D	di_.7	0: Direct	0: Direct
Polarity	di_.8	1: Reverse	0: Direct
Internal event No. assignment	di_.9	----	2

_ : Internal contact No.

- **Other**

  [72 ([MODE] key function): 7 (user-defined bit 1 switching)

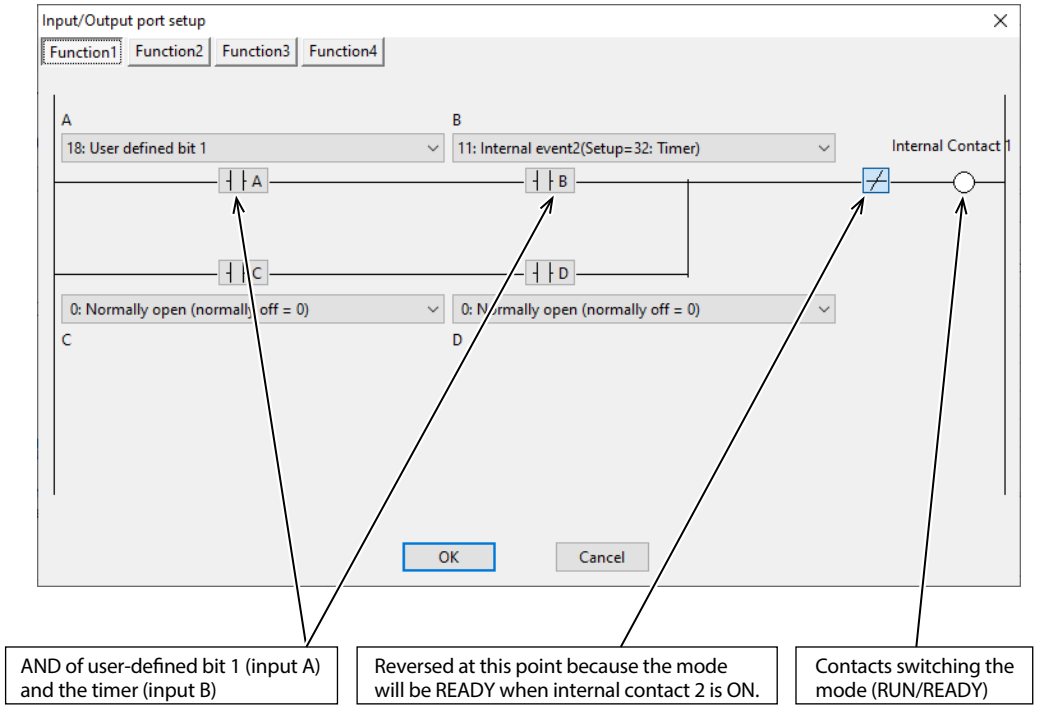
  SP up ramp and down ramp: any

- **Key points for configuration**

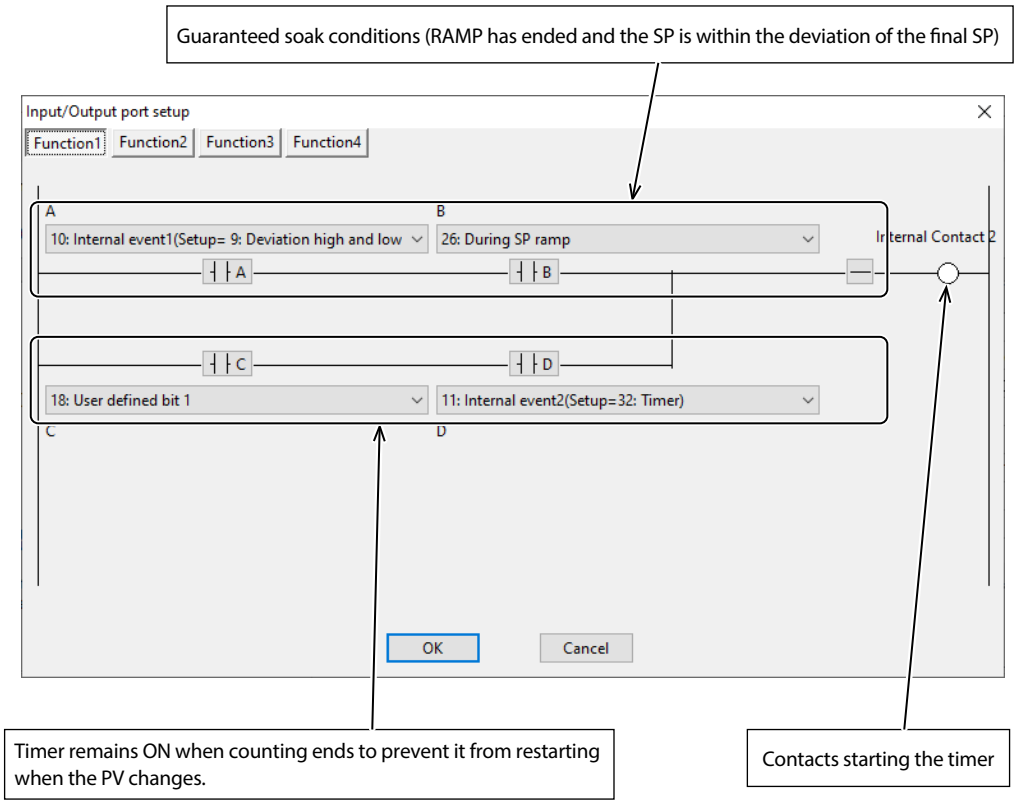
  The internal event 1 is a substitute for the guaranteed soak.

  Therefore, set the hysteresis of event 1 to “9999” so that the event will not turn OFF even if the PV fluctuates after it is turned ON.

  DI assignment (internal contact 1): Input/output port setup

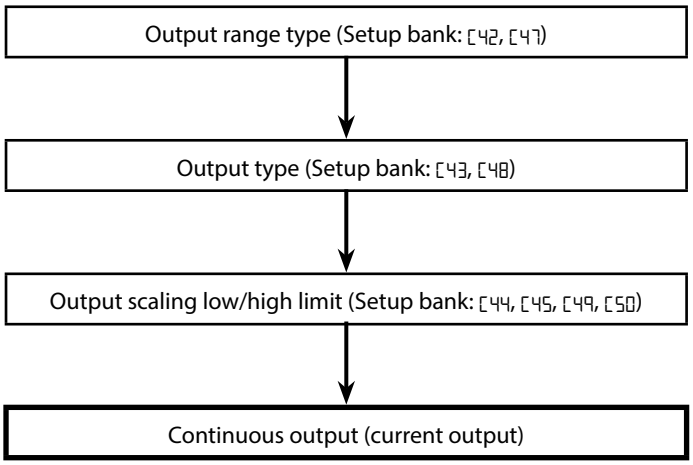


DI assignment (internal contact 2): Input/output port setup



5 - 11 Continuous output

The following is a functional block diagram for continuous output.



■ Output range

The output range can be set for the current output.

Item (bank)	Display	Description	Initial value	User level
Control output 1 range (setup bank)	C 42	1: 4 to 20 mA 2: 0 to 20 mA	1	Simple, standard, advanced
Control output 2 range (setup bank)	C 47		1	

- These items are displayed and the settings can be changed if current output is set as the control output.

■ Output type

The type of current output can be set.

Item (bank)	Display	Description	Initial value	User level
Control output 1 type (setup bank)	C 43	0: MV 1: Heating MV (for heating/cooling control) 2: Cooling MV (for heating/cooling control) 3: PV	0	Simple, standard, advanced
Control output 2 type (setup bank)	C 48	4: PV (before applying ratio, bias, filter) 5: SP 6: Deviation (PV – SP) 7: CT1 current 8: CT2 current 9: Invalid 10: SP+MV 11: PV+MV	3	

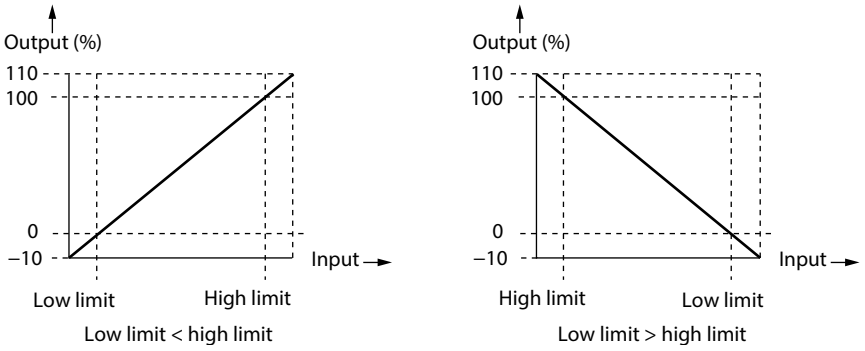
- These items are displayed and the settings can be changed if current output is set as the control output.
- The MV scaling width is used for calculation of SP + MV and PV + MV.
☞ ■ MV scaling width (p. 5-93) (for details)

■ Output scaling low/high limit

Output scaling low and high limits can be set for the current output.

Item (bank)	Display	Description	Initial value	User level
Control output 1 scaling low limit (setup bank)	C 44	−1999 to +9999U The number of decimal places changes according to the output type. Either of the following units is used depending on the output type. Output type = 0–2: % (of the MV) Output type = 3–6: same as the PV (°C, etc.) Output type = 7–8: A (current)	0.0	Simple, standard, advanced
Control output 1 scaling high limit (setup bank)	C 45		100.0	
Control output 2 scaling low limit (setup bank)	C 49		0	
Control output 2 scaling high limit (setup bank)	C 50		1000	

- These items are displayed and the settings can be changed if current output is set as the control output.
- The relationship between the output type and the output based on the output scaling low and high limit settings is shown in the figure below.



However, in the 0–20 mA range the output is 0–110 %.

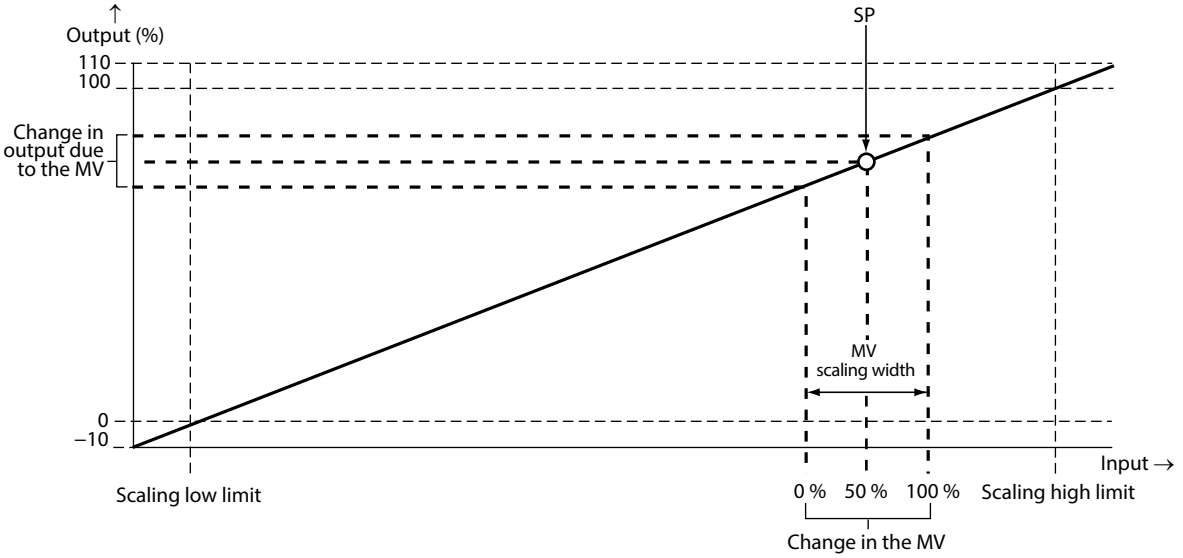
■ MV scaling width

If the output type is set to either SP + MV or PV + MV, the output can be made continuous by adding the change in the MV to the SP or PV.

Item (bank)	Display	Description	Initial value	User level
Control output 1 MV scaling width (setup bank)	C 46	0 to 9999U The number of decimal places and the unit are the same as the PV.	200	Simple, standard, advanced
Control output 2 MV scaling width (setup bank)	C 51		200	

- These items are displayed and the settings can be changed if the output type of control output 1 or 2 is set to SP + MV or PV + MV.
- The value calculated by the following expression is output according to the output scaling low and high limit settings.

SP + MV: (MV − 50.0) / 100.0 × MV scaling width + SP
PV + MV: (MV − 50.0) / 100.0 × MV scaling width + PV



When the output type is SP + MV

[!] Handling Precautions

- This function is used when the continuous output from the C1M is connected to the remote SP (RSP) input of another controller for the purpose of cascade control in which the C1M operates as the primary device and another controller operates as the secondary device. Set the width of the RSP of the secondary device that changes according to the changes of the MV (0–100 %) of the C1M as the MV scaling width.

5 - 12 Current Transformer (CT) Input

There are two types of current values input from the CT input terminals.

- Current when output ON: Used for heater burnout/overcurrent events. It can be displayed as CT current.
- Current when output OFF: Used for heater short-circuit events. It cannot be displayed.

If [36 or [39 (CT operation type) is set to 0 (heater burnout detection):

Current when output ON: The CT current measured when the output specified by “CT output” is ON

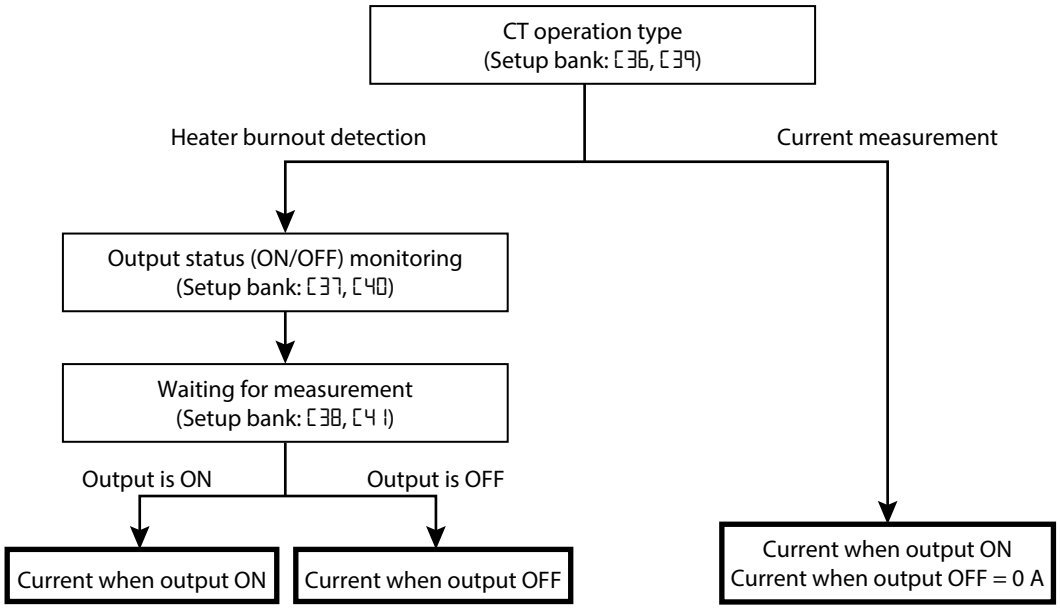
Current when output OFF: The CT current measured when the output specified by “CT output” is OFF

If [36 or [39 (CT operation type) is set to 1 (current measurement):

Current when output ON: The CT current measured regardless of whether the output is ON or OFF

Current when output OFF: Always 0.0 A

The following is a functional block diagram for CT input.



! Handling Precautions

- The current when the output is ON is used if the operation type of the internal event is set to heater burnout/overcurrent.
  The current when the output is OFF is used if the operation type of the internal event is set to heater short.

■ CT operation type

Different operations can be set for CT inputs 1 and 2.

Item (bank)	Display	Description	Initial value	User level
CT1 operation type (setup bank)	C 36	0: Heater burnout detection 1: Current measurement	0	Simple, standard, advanced
CT2 operation type (setup bank)	C 39		0	

- These items are displayed and the settings can be changed if a model with two CT inputs is used.
- If current measurement is selected, the current when the output is ON is updated regardless of the ON/OFF status of the output, and the current when the output is OFF is always 0.0 A.

■ CT output

When the CT operation type is heater burnout detection, an output whose ON/OFF is monitored can be specified.

Item (bank)	Display	Description	Initial value	User level
CT1 output (setup bank)	C 37	0: Control output 1 1: Control output 2 2: Event output 1 3: Event output 2 4: Event output 3	0	Simple, standard, advanced
CT2 output (setup bank)	C 40		0	

- These items are displayed and the settings can be changed if a model with two CT inputs is used and the CT operation type is set to heater burnout detection.

■ CT measurement wait time

When the CT operation type is heater burnout detection, the time from the change in the output ON/OFF status to the start of the current measurement can be set.

Item (bank)	Display	Description	Initial value	User level
CT1 measurement wait time (setup bank)	C 38	30 to 300 ms	30 ms	Simple, standard, advanced
CT2 measurement wait time (setup bank)	C 41		30 ms	

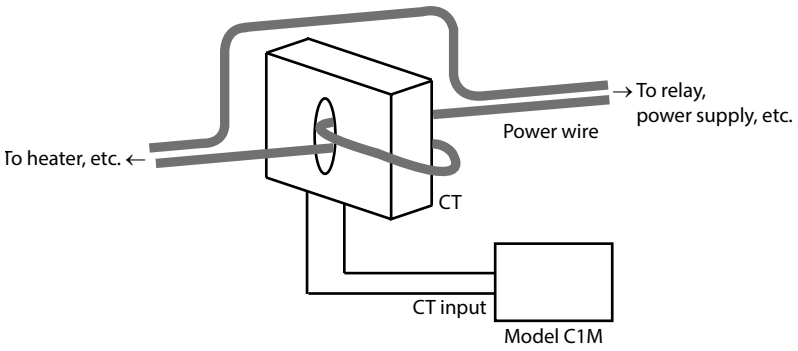
- These items are displayed and the settings can be changed if a model with two CT inputs is used and the CT operation type is set to heater burnout detection.
- Current measurement starts when the measurement waiting time elapses after the change in the ON/OFF status of the monitored output, and it ends when 100 ms elapses.

■ Number of CT turns / number of CT power wire passes

Different settings can be specified for CT inputs 1 and 2.

Item (bank)	Display	Description	Initial value	User level
Number of CT1 turns (setup bank)	C 90	0: 800 1–40: CT turns divided by 100	8	Advanced
Number of CT1 power wire passes (setup bank)	C 91	0: 1 1–6: The set value	1	
Number of CT2 turns (setup bank)	C 92	0: 800 1–40: CT turns divided by 100	8	
Number of CT2 power wire passes (setup bank)	C 93	0: 1 1–6: The set value	1	

- These items are displayed and the settings can be changed if a model with two CT inputs is used.
- For the number of turns, set the number of turns of the CT connected to this device divided by 100.
  For example, if the number of CT turns is 400, set 4.
  Note that, if 0 is set, 800 turns apply (same result as when 8 is set).
- The optional CTs, models QN206A and QN212A, have 800 turns, so set 8 for them. For the number of power wire passes, set the number of times that the power wire passes through the hole in the CT.
  For example, if the power wire passes through the hole of the CT twice as shown below, set 2.
  Note that, if 0 is set, 1 applies (same result as when 1 is set).



Handling Precautions

- Make sure that the current does not exceed the high limit of the CT input that can be displayed. Exceeding the high limit may cause malfunction.
- If this device detects a current exceeding the high limit of the CT input that can be displayed, a CT input error alarm (RL 1 1) will be generated. However, if the current is so large that a malfunction occurs, the CT input error alarm will not be generated.
- The display range and the current measurement range of the CT input vary depending on the number of turns and power wire passes of the CT.
  Make sure to specify settings that match the number of turns and power wire passes of the connected CT.
  The display range and the current measurement range are calculated using the expression below.
  (The calculation by this device has a margin of error of 0.1 A or less.)
  Display range low limit (A) = 0.0
  Display range high limit (A) = Number of turns ÷ (16 × number of power wire passes) × 1.4
  Current measurement range low limit (A) = Number of turns ÷ (2000 × number of power wire passes)
  Current measurement range high limit (A) = Number of turns ÷ (16 × number of power wire passes)

  The table below shows an example of the display range and the current measurement range determined by the number of turns and power wire passes of the CT. The current measurement range is shown in parentheses.

Number of turns / Number of power wire passes	100	400	800	1600	4000
1	0.0 to 8.7 A (0.1 to 6.2 A)	0.0 to 35.0 A (0.2 to 25.0 A)	0.0 to 70.0 A (0.4 to 50.0 A)	0.0 to 140.0 A (0.8 to 100.0 A)	0.0 to 350.0 A (2.0 to 250.0 A)
2	0.0 to 4.3 A (0.1 to 3.1 A)	0.0 to 17.5 A (0.1 to 12.5 A)	0.0 to 35.0 A (0.2 to 25.0 A)	0.0 to 70.0 A (0.4 to 50.0 A)	0.0 to 175.0 A (1.0 to 125.0 A)
6	0.0 to 1.4 A (0.1 to 1.0 A)	0.0 to 5.8 A (0.1 to 4.1 A)	0.0 to 11.6 A (0.1 to 8.3 A)	0.0 to 23.3 A (0.2 to 16.6 A)	0.0 to 58.3 A (0.4 to 41.6 A)

5 - 13 Display on the Console and Key Operation

What is displayed on the console and the use of the keys can be customized.

■ Key operation mode

There are two key operation modes, standard and special, which can be selected by the setting below.

☞ 2 - 2 Key Operation (p. 2-2) (for details about the two modes)

Item (bank)	Display	Description	Initial value	User level
Key operation mode (setup bank)	C 71	0: Standard 1: Special	0	Advanced

■ [MODE] key function

The switching operation of the [MODE] key can be selected. Switching occurs when the key is pressed for 1 second or longer while the operation display is shown.

Item (bank)	Display	Description	Initial value	User level
[MODE] key function (setup bank)	C 72	0: Invalid 1: AUTO/MANUAL selection 2: RUN/READY selection 3: AT stop/start 4: LSP group selection 5: Release all DO latches 6: Invalid 7: User-defined bit 1 8: Invalid	1	Simple, standard, advanced

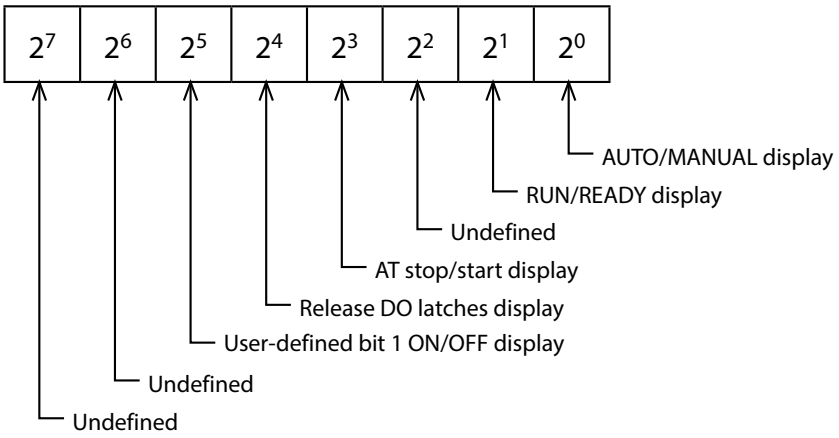
Handling Precautions

- If CtrL (control method) is set to 0 (ON/OFF control), the AUTO/MANUAL selection setting is invalid.
- If CtrL (control method) is set to 0 (ON/OFF control), or if the PV high/low limit alarm is triggered, the AT stop/start setting is invalid.
- If C30 (LSP system group) is set to 1, the LSP group selection setting is invalid.

■ Mode display setup

Whether to display the mode settings in the mode bank can be selected.

Item (bank)	Display	Description	Initial value	User level
Mode display setup (setup bank)	[73	Whether to display the settings in the mode bank is determined by the sum of the weights shown below. Bit 0: AUTO/MANUAL display No: 0, Yes: +1 Bit 1: RUN/READY display No: 0, Yes: +2 Bit 3: AT stop/start display No: 0, Yes: +8 Bit 4: DO latch release display No: 0, Yes: +16 Bit 5: User-defined bit 1 ON/OFF display No: 0, Yes: +32 Invalid settings: 0, +4, +64, +128	255	Standard, advanced



- If Smart Loader Package model SLP-C1F is used, the setting for [73 (mode display setting) can be specified not only by a numerical value but also by bit input.

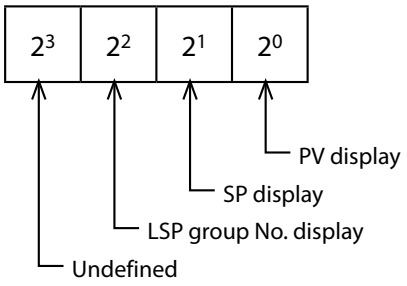
[!] Handling Precautions

- Even if AUTO/MANUAL display is enabled, if [trL (control method) is set to 0 (ON/OFF control), the AUTO/MANUAL selection setting is not displayed.
- Even if AT stop/start display is enabled, if [trL (control method) is set to 0 (ON/OFF control), the AT stop/start setting is not displayed.
- For ROM version 1.02 and earlier, if you press [∧] or [∨] after starting the configuration using the keys, it becomes impossible to change the setting to a value other than 0.
  However, if Smart Loader Package model SLP-C1F or host communication is used, other values can be set.

■ PV/SP display setup

Whether to show PV- and SP-related settings on the operation display can be selected.

Item (bank)	Display	Description	Initial value	User level
PV/SP display setup (setup bank)	C 74	Whether to show the following items on the operation display is determined by the sum of the weights shown below. Bit 0: PV No: 0. Yes: +1 Bit 1: SP No: 0. Yes: +2 Bit 2: LSP group No. No: 0. Yes: +4 Invalid settings: 0, +8	15	Standard, advanced



- If Smart Loader Package model SLP-C1F is used, the setting for C74 (PV/SP display setup) can be specified not only by a numerical value but also by bit input.

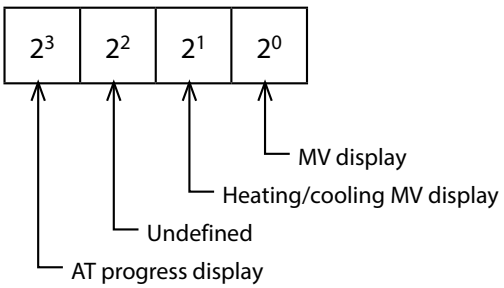
! Handling Precautions

- Even if LSP group No. display is enabled, if C30 (LSP system group) is set to 1, LSP group numbers are not displayed.

■ MV display setup

Whether to show MV-related settings on the operation display can be selected.

Item (bank)	Display	Description	Initial value	User level
MV display setup (setup bank)	C 75	Whether to show the following items on the operation display is determined by the sum of the weights shown below. Bit 0: MV No: 0. Yes: +1 Bit 1: Heating MV / cooling MV No: 0. Yes: +2 Bit 3: AT progress No: 0. Yes: +8 Invalid settings: 0, +4	15	Standard, advanced



- If Smart Loader Package model SLP-C1F is used, the setting for C75 (MV display setup) can be specified not only by a numerical value but also by bit input.

! Handling Precautions

- Even if heating/cooling MV display is enabled, if C26 (heat/cool control) is set to 0 (not used), the heating/cooling MV is not displayed.
- Even if AT progress display is enabled, the progress is not displayed when AT is not running.

■ Event display setup

Whether to show the main- and sub-settings of internal events 1–3 on the operation display can be selected.

Item (bank)	Display	Description	Initial value	User level
EV display setup (setup bank)	C 76	0: Do not show internal event settings on the operation display 1: Show internal event 1 settings on the operation display 2: Show internal event 1–2 settings on the operation display 3: Show internal event 1–3 settings on the operation display	0	Standard, advanced

Handling Precautions

- Even if internal event settings are set to be displayed, they are not displayed if an internal event operation type that does not require main- and sub-settings is specified.
- The main- and sub-settings of internal events 4–5 cannot be displayed on the operation display.

■ Event remaining time display setup

Whether to show the ON/OFF delay remaining time of internal events 1–3 on the operation display can be selected.

Item (bank)	Display	Description	Initial value	User level
Event remaining time display setup (setup bank)	C 77	0: Do not show the ON/OFF delay remaining time of internal events on the operation display 1: Show the ON/OFF delay remaining time of internal event 1 on the operation display 2: Show the ON/OFF delay remaining time of internal events 1–2 on the operation display 3: Show the ON/OFF delay remaining time of internal events 1–3 on the operation display	0	Standard, advanced

Handling Precautions

- The ON/OFF delay remaining time of an internal event whose operation type is set to "23" or higher can be shown on the operation display by specifying [Event remaining time display setup] only if the ROM version is 1.01 or later. With ROM version 1.00, do not change the initial value of [Event remaining time display setup].
- Even if the internal event remaining time is set to be displayed, it is not displayed if an internal event operation type that does not require display of the remaining time is specified.
- The remaining time of internal events 4–5 cannot be displayed on the operation display.

■ CT input current display setup

Whether to show the CT current on the operation display can be selected.

Item (bank)	Display	Description	Initial value	User level
CT input current display setup (setup bank)	C 78	0: Do not show the CT current on the operation display 1: Show the CT1 current on the operation display 2: Show the CT1 and CT2 currents on the operation display	1	Standard, advanced

- This item is displayed and the setting can be changed if a model with two CT inputs is used.

■ User level

What is displayed on the console can be restricted by specifying the user level. The higher the setting, the more displayed items.

Item (bank)	Display	Description	Initial value	User level
User level (setup bank)	C 79	0: Simple 1: Standard 2: Advanced	0	Simple, standard, advanced

■ Status indicator

The function of the status indicator can be selected.

Item (bank)	Display	Description	Initial value	User level
Status indicator (setup bank)	C 80	0: Not used (always off) 1: Blinks when sending RS-485 communication data 2: Blinks when receiving RS-485 communication data 3: OR (logical sum) of all DI states 4: Always OFF	0	Advanced

■ User-defined function

Up to eight more settings selected from various settings can be displayed as user-defined functions 1–8 on the operation display.

Item (bank)	Display	Description	Initial value	User level
User function 1 (user function bank)	UF-1	Displayed characters are defined for each item. The following are special cases. ----: Unregistered P-_: Proportional band of the PID in use I-_: Integral time of the PID in use d-_: Derivative time of the PID in use rE-_: Manual reset of the PID in use oL-_: MV low limit of the PID in use oH-_: MV high limit of the PID in use P-_C: Proportional band for cooling of the PID in use I-_C: Integral time for cooling of the PID in use d-_C: Derivative time for cooling of the PID in use oL_C: MV low limit for cooling of the PID in use oH_C: MV high limit for cooling of the PID in use	----	Standard, advanced
User function 2 (user function bank)	UF-2		----	
User function 3 (user function bank)	UF-3		----	
User function 4 (user function bank)	UF-4		----	
User function 5 (user function bank)	UF-5		----	
User function 6 (user function bank)	UF-6		----	
User function 7 (user function bank)	UF-7		----	
User function 8 (user function bank)	UF-8		----	

- Only the settings that can be displayed can be registered.
  (Example: Manual reset of the PID constants can be registered when integral time = 0)
- Items cannot be registered from the console using the parameter number displayed on the setup screen of Smart Loader Package model SLP-C1F.
- To select a parameter, use the keys as follows.

  [<]: Displays the first parameter in the next bank.

  [∨]: Displays the next parameter.

  [∧]: Displays the previous parameter.

[!] Handling Precautions

- The user level required for user-defined functions 1–8 to be shown on the operation display is "advanced."

● Specifying user-defined functions

This section gives examples of settings using Smart Loader Package model SLP-C1F.

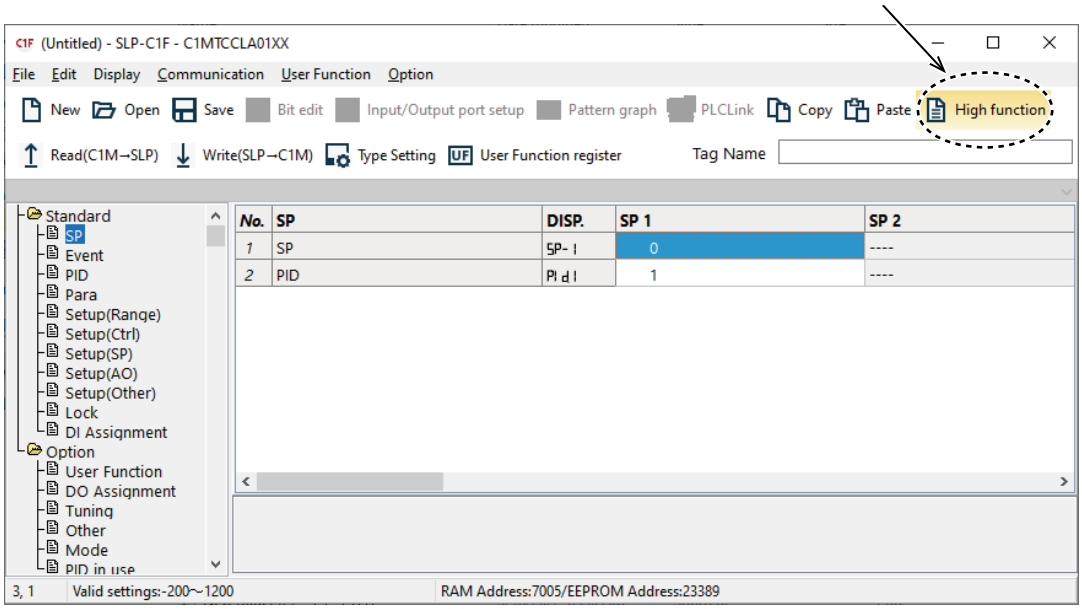
Up to eight user-defined functions (parameters) can be assigned to the [PARA] key.

Set frequently used functions to make the operation of this device easier.

In the example below, the main setting of event 1 is set for UF1.

1. Specifying from the user-defined function screen

To use this function, set the user level to “Standard” or “Advanced (High function)” first.



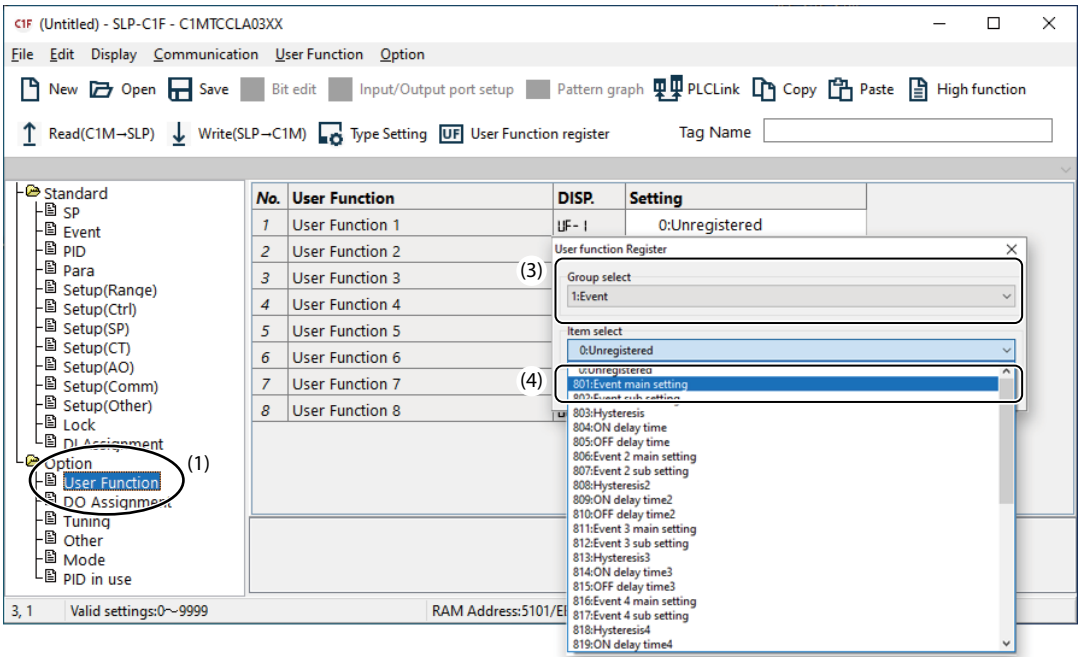
(1) Select [User Function] under [Option].

(2) Select any of user-defined functions 1–8.

≫ The [User Function register] dialog box is displayed.

(3) In [Group select], select [1: Event].

(4) In [Item select], select [801: Event main setting](low limit).



2. If you find a parameter to set for a user-defined function during configuration

In this case, use the procedure below.

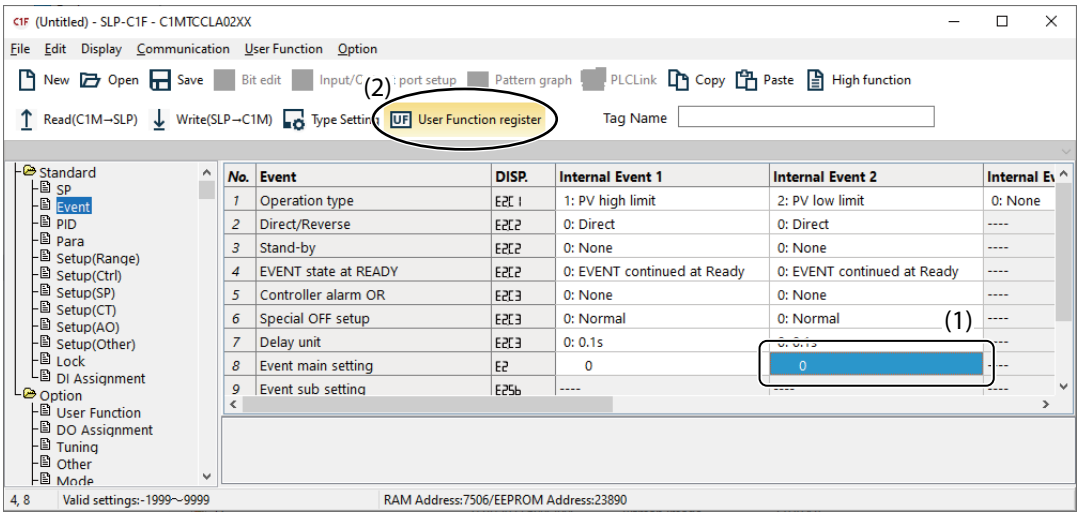
(1) Place the cursor on the parameter you want to register.

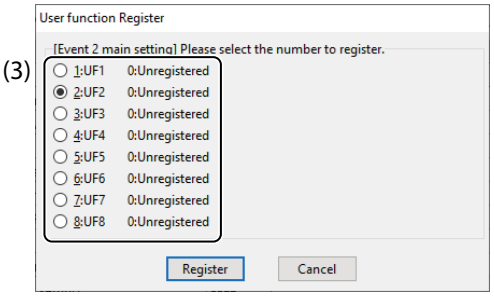
(2) Click the [User Function Register] icon.

≫ The [User Function register] dialog box is displayed.

(3) Click the radio button for the UF No. to which the parameter should be registered, and then click [Register].

≫ The parameter is now registered.





Note

- The registered parameters can be checked by selecting [User function] under [Option].

■ Key lock, communication lock, loader lock

With various lock functions, changing the settings and communication can be prohibited.

Item (bank)	Display	Description	Initial value	User level
Key lock (lock bank)	LoC	0: All settings can be specified. 1: Mode, event, operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 2: Operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 3: UF, lock, manual MV, and [MODE] key operation can be specified.	0	Simple, standard, advanced
Communication lock (lock bank)	C.LoC	0: Unlocked 1: Locked	0	Advanced
Loader lock (lock bank)	L.LoC	0: Unlocked 1: Locked	0	Advanced

- If you set a password in addition to the key lock, only the items whose settings can be changed using the keys (shown in the table above) are displayed.

The parameters shown below can be read and written even if communication lock or loader lock is enabled.

Bank	Parameter
Setup	PV decimal point position
Mode	AUTO/MANUAL mode selection
	RUN/READY mode selection
	AT stop/start selection
	Release all DO latches
Operation settings	PV
	SP (target value)
	LSP No.
	MV (Manipulated Variable)
	Heat MV (Manipulated Variable)
	Cool MV (Manipulated Variable)
	AT progress
	Current transformer (CT) input 1 current
	Current transformer (CT) input 2 current
	Timer remaining time 1
	Timer remaining time 2
	Timer remaining time 3
	Timer remaining time 4
	Timer remaining time 5
	Step No.*
	Step remaining time
	Step remaining time (second)
	LSP in use
	PV before applying ratio,bias,filter
Status	Input alarm status

* If the step operation is stopped (READY mode), the step operation No. will be 0.

■ Password

If a password is set (password lock), key-locked items whose settings cannot be changed using the keys will not be displayed.

Item (bank)	Display	Description	Initial value	User level
Password display (lock bank)	PASS	0 to 15 5: Displays passwords 1A to 2B	0 (0 is set at power-on)	Simple, standard, advanced
Password 1A (lock bank)	P5 1A	0000 to FFFF (hex)	0000	
Password 2A (lock bank)	P52A	0000 to FFFF (hex)	0000	
Password 1B (lock bank)	P5 1b	0000 to FFFF (hex)	0000	
Password 2B (lock bank)	P52b	0000 to FFFF (hex)	0000	

- P5 1A (password 1A) and P52A (password 2A) are displayed and the settings can be changed if PASS (password display) is set to 5 and the two sets of passwords (1A and 1B, 2A and 2B) match.
- P5 1b (password 1B) and P52b (password 2B) are displayed and the settings can be changed if PASS (password display) is set to 5.
- The value set for P5 1A (password 1A) is automatically set for P5 1b (password 1B).
- The value set for P52A (password 2A) is automatically set for P52b (password 2B).

[!] Handling Precautions

- The password function can be used only if the ROM version is 1.01 or later. With ROM version 1.00, do not change the initial value of [Password 1A/2A/1B/2B].
- Before setting passwords 1A to 2B, decide on two hexadecimal numbers that will be the passwords, and make a note so that you will remember them.
- PASS is provided to prevent accidental changing of passwords by restricting the display conditions of passwords 1A to 2B.
- If you set a value for passwords 1A and 2A and then set a different value for passwords 1B and 2B, passwords 1A and 2A will no longer be displayed, and the settings for key lock, communication lock, and loader lock cannot be changed. This is called a password locked state.
- Settings that cannot be changed due to key lock cannot be displayed in the password locked state.
- If the password lock cannot be reset, initialize settings from the [Calibration and checking] screen of Smart Loader Package model SLP-C1F. In this case, any settings configured by the user will also be initialized (lost).

-MEMO-

Chapter 6. Displayed Items and Settings

6 - 1 Operation Settings

Meaning of user level settings
0: Simple configuration, 1: Standard configuration, 2: Advanced configuration

■ Operation settings

Display	Item	Description	Initial value	User level	Notes
Upper display: PV Lower display: SP	SP (target value)	SP low limit (C07) to SP high limit (C08)	0	0	Whether to display can be selected by the PV/SP value display setting (C74).
LSP 1 Lower display: LSP	LSP No. (the last digit)	From 1 to the number set for LSP system group (C30, max. = 8)	1	0	Displayed if LSP system group (C30) is set to 2 or more. The lower display shows the LSP for the LSP group. Whether to display can be selected by the PV/SP value display setting (C74).
St.1- (display example) Lower display: Step remaining time	Step No., step remaining time	Setting cannot be changed The upper display indicates the step No. (1–8) to the right of St and tells whether the process is ramp-up, ramp-down, or soak. The lower display shows the remaining time for the soak or ramp.	-	0	The time remaining in the step is displayed in the unit set by STEP time unit (C33) regardless of whether the current process is ramp or soak. If the unit is 1 s: min.s If the unit is 1 min: h.min
oUt	MV (Manipulated Variable)	−10.0 to +110.0 % Setting cannot be changed in AUTO mode (the setting does not blink) Setting can be changed in MANUAL mode (the setting blinks)	-	0	In ON/OFF control (CtrL = 0), 100.0 is displayed when ON and 0.0 is displayed when OFF. Whether to display can be selected by the MV display setting (C75).
HEAt	Heat MV (Manipulated Variable)	Setting cannot be changed	-	0	Displayed if heat/cool control is used (C26 ≠ 0). Whether to display can be selected by the MV display setting (C75).
CooL	Cool MV (Manipulated Variable)	Setting cannot be changed	-	0	
Upper display: PV At 1	AT progress (the last digit*)	Setting cannot be changed x to 1: AT is running (the value decrements) 0: AT is complete	-	0	Displayed if AT is running (display continues even after AT ends). Whether to display can be selected by the MV display setting (C75).
Ct1	Current transformer (CT) input 1 current	Setting cannot be changed	-	0	Displayed if a model with two CT inputs is used. Whether to display can be selected by the CT display setting (C78).
Ct2	Current transformer (CT) input 2 current	Setting cannot be changed	-	0	
E 1	Internal event 1 main setting	The range of settings differs depending on the operation type of the internal event. 0 to 9999 U: An absolute value is set −199.9 to + 999.9 %: MV −1999 to +9999 U: Other than the above	0	0	The settings required for the internal event type are displayed. Whether to display can be selected by the event display setting (C76).
E 1.5b	Internal event 1 sub-setting		0	0	

Display	Item	Description	Initial value	User level	Notes
t1	Timer remaining time 1	Setting cannot be changed The rightmost digit shows ⌜ for ON delay and ⌞ for OFF delay.	-	0	Whether to display can be selected by the timer remaining time display setting (□77).
E2	Internal event 2 main setting	The range of settings differs depending on the operation type of the internal event. 0 to 9999 U: An absolute value is set −199.9 to + 999.9 %: MV −1999 to +9999 U: Other than the above	0	0	The settings required for the internal event type are displayed. Whether to display can be selected by the event display setting (□76).
E2.5b	Internal event 2 sub-setting		0	0	
t2	Timer remaining time 2	Setting cannot be changed The rightmost digit shows ⌜ for ON delay and ⌞ for OFF delay.	-	0	Whether to display can be selected by the timer remaining time display setting (□77).
E3	Internal event 3 main setting	The range of settings differs depending on the operation type of the internal event. 0 to 9999 U: An absolute value is set −199.9 to + 999.9 %: MV −1999 to +9999 U: Other than the above	0	0	The settings required for the internal event type are displayed. Whether to display can be selected by the event display setting (□76).
E3.5b	Internal event 3 sub-setting		0	0	
t3	Timer remaining time 3	Setting cannot be changed The rightmost digit shows ⌜ for ON delay and ⌞ for OFF delay.	-	0	Whether to display can be selected by the timer remaining time display setting (□77).

* The rightmost digit

6-2 Parameter Settings

Meaning of user level settings
0: Simple configuration, 1: Standard configuration, 2: Advanced configuration

■ Mode bank

Bank selection: mode

Display	Item	Description	Initial value	User level	Notes
A--m	AUTO/MANUAL mode selection	AUto: AUTO mode mAn: MANUAL mode	AUTO	0	Displayed if the control method is PID control (CtrL = 1). Whether to display can be selected by the mode display setting (C73).
r--r	RUN/READY mode selection	rUn: RUN mode rdY: READY mode	RUN	0	Whether to display can be selected by the mode display setting (C73).
At	AT start/stop selection	AtoF: AT stop Aton: AT start	AT stop	0	Displayed if the control method is PID control (CtrL = 1). Whether to display can be selected by the mode display setting (C73).
At.Er	Auto tuning error	EroF: Normal Eron: Abnormal	Normal	0	Displayed if the control method is PID control (CtrL = 1). Whether to display can be selected by the mode display setting (C73).
doLt	Release all DO latches	Lton: Latch continue LtoF: Latch release	Latch continue	0	All DOs for control outputs (relay, voltage pulse) and event outputs can be unlatched. Whether to display can be selected by the mode display setting (C73).
Udb.1	User-defined bit 1	dboF: OFF dbon: ON	OFF	0	Whether to display can be selected by the mode display setting (C73).

■ SP bank

Bank selection: SP

Display	Item	Description	Initial value	User level	Notes
SP-1	SP (for LSP1)	SP low limit (C07) to SP high limit (C08)	0	0	
Pid1	PID group No. (for LSP1)	1 to 8	1	1	Displayed for PID control (CtrL = 1)
rmP.1	Ramp (for LSP1)	0 to 9999U (The decimal point position is determined by the decimal point position of the PV and the SP ramp unit (C33).)	0	1	Displayed if SP ramp type (C31) is set to 1 or more.
tIm.1	Soak time (for LSP1)	0.0 to 999.9 (when STEP time unit = 0.1 s) 0 to 9999 (when STEP time unit = 1 s or 1 min)	0	1	Displayed if SP ramp type (C31) is set to 2 or more.
SP-2	SP (for LSP2)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 2 or more and the conditions for LSP1 described above are met.
Pid2	PID group No. (for LSP2)		1	1	
rmP.2	Ramp (for LSP2)		0	1	
tIm.2	Soak time (for LSP2)		0	1	
SP-3	SP (for LSP3)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 3 or more and the conditions for LSP1 described above are met.
Pid3	PID group No. (for LSP3)		1	1	
rmP.3	Ramp (for LSP3)		0	1	
tIm.3	Soak time (for LSP3)		0	1	
SP-4	SP (for LSP4)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 4 or more and the conditions for LSP1 described above are met.
Pid4	PID group No. (for LSP4)		1	1	
rmP.4	Ramp (for LSP4)		0	1	
tIm.4	Soak time (for LSP4)		0	1	

Display	Item	Description	Initial value	User level	Notes
SP-5	SP (for LSP5)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 5 or more and the conditions for LSP1 described above are met.
PId5	PID group No. (for LSP5)		1	1	
rAP5	Ramp (for LSP5)		0	1	
tIA5	Soak time (for LSP5)		0	1	
SP-6	SP (for LSP6)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 6 or more and the conditions for LSP1 described above are met.
PId6	PID group No. (for LSP6)		1	1	
rAP6	Ramp (for LSP6)		0	1	
tIA6	Soak time (for LSP6)		0	1	
SP-7	SP (for LSP7)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 7 or more and the conditions for LSP1 described above are met.
PId7	PID group No. (for LSP7)		1	1	
rAP7	Ramp (for LSP7)		0	1	
tIA7	Soak time (for LSP7)		0	1	
SP-8	SP (for LSP8)	Same as LSP group 1	0	0	Displayed if LSP system group (C30) is set to 8 or more and the conditions for LSP1 described above are met.
PId8	PID group No. (for LSP8)		1	1	
rAP8	Ramp (for LSP8)		0	1	
tIA8	Soak time (for LSP8)		0	1	

■ Event bank

Bank selection: Eu

Display	Item	Description	Initial value	User level	Notes
E 1	Internal event 1 main setting	−1999 to +9999U The number of decimal places changes according to the operation type of the internal event. For some operation types, the range is 0 to 9999U.	0	0	The settings required for the internal event 1 operation type (E1C1) are displayed.
E 1.Sb	Internal event 1 sub-setting		0	0	
E 1.HY	Internal event 1 hysteresis	0 to 9999U The number of decimal places changes according to the operation type of the internal event.	5	0	
E 1.on	Internal event 1 ON delay time	0.0 to 999.9 (when delay time unit = 0.1 s) 0 to 9999 (when delay time unit = something other than 0.1 s)	0	2	
E 1.oF	Internal event 1 OFF delay time		0	2	
E2	Internal event 2 main setting	Same as internal event 1	0	0	The settings required for the internal event 2 operation type (E2C1) are displayed.
E2.Sb	Internal event 2 sub-setting		0	0	
E2.HY	Internal event 2 hysteresis		5	0	
E2.on	Internal event 2 ON delay time		0	2	
E2.oF	Internal event 2 OFF delay time		0	2	
E3	Internal event 3 main setting	Same as internal event 1	0	0	The settings required for the internal event 3 operation type (E3C1) are displayed.
E3.Sb	Internal event 3 sub-setting		0	0	
E3.HY	Internal event 3 hysteresis		5	0	
E3.on	Internal event 3 ON delay time		0	2	
E3.oF	Internal event 3 OFF delay time		0	2	

Display	Item	Description	Initial value	User level	Notes
E4	Internal event 4 main setting	Same as internal event 1	0	0	The settings required for the internal event 4 operation type (E4C 1) are displayed.
E4.Sb	Internal event 4 sub-setting		0	0	
E4.HY	Internal event 4 hysteresis		5	0	
E4.on	Internal event 4 ON delay time		0	2	
E4.oF	Internal event 4 OFF delay time		0	2	
E5	Internal event 5 main setting	Same as internal event 1	0	0	The settings required for the internal event 5 operation type (E5C 1) are displayed.
E5.Sb	Internal event 5 sub-setting		0	0	
E5.HY	Internal event 5 hysteresis		5	0	
E5.on	Internal event 5 ON delay time		0	2	
E5.oF	Internal event 5 OFF delay time		0	2	

■ PID bank

Bank selection: PId

Display	Item	Description	Initial value	User level	Notes
P-1	Proportional band (PID group 1)	0.1 to 999.9 %	5.0	0	Displayed if the control method is PID control (CtrL = 1).
I-1	Integration time (PID group 1)	0 to 9999U (0 = no integral operation) (The decimal point position is determined by "Integral time and derivative time decimal point position" (C23)).	120	0	
d-1	Derivative time (PID group 1)	0 to 9999U (0 = no derivative operation) (The decimal point position is determined by "Integral time and derivative time decimal point position" (C23)).	30	0	
rE-1	Manual reset (PID group 1)	−10.0 % to +110.0 %	50.0	0	Displayed if the control method is PID control (CtrL = 1) and if integration time (I - 1) of the PID group = 0.
oL-1	MV low limit (PID group 1)	−10.0 % to +110.0 %	0.0	1	Displayed if either of the set of conditions below is met • The control method is PID control (CtrL = 1), individual PID heating/cooling control is not used (C26 ≠ 1), and the integration time (I - 1) of the PID group = 0 • The control method is PID control (CtrL = 1), individual PID heating/cooling control is used (C26 = 1), and the integration time (I - 1) or the integration time for cooling of the PID group (I - 1C) = 0
oH-1	MV high limit (PID group 1)	−10.0 % to +110.0 %	100.0	1	
P-1C	Cool-side proportional band (PID group 1)	0.1 to 999.9 %	5.0	0	Displayed if the control method is PID control (CtrL = 1) and individual PID heating/cooling control is used (C26 = 1)
I-1C	Cool-side integration time (PID group 1)	0 to 9999U (The decimal point position is determined by "Integral time and derivative time decimal point position" (C23)).	120	0	
d-1C	Cool-side derivative time (PID group 1)	0 to 9999U (The decimal point position is determined by "Integral time and derivative time decimal point position" (C23)).	30	0	
oL.1C	Cool-side MV low limit (PID group 1)	−10.0 % to +110.0 %	0.0	1	
oH.1C	Cool-side MV high limit (PID group 1)	−10.0 % to +110.0 %	100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-2	Proportional band (PID group 2)	Same as PID group 1	5.0	0	Same as PID group 1
I -2	Integration time (PID group 2)		120	0	
d-2	Derivative time (PID group 2)		30	0	
rE-2	Manual reset (PID group 2)		50.0	0	
oL-2	MV low limit (PID group 2)		0.0	1	
oH-2	MV high limit (PID group 2)		100.0	1	
P-2C	Cool-side proportional band (PID group 2)		5.0	0	
I -2C	Cool-side integration time (PID group 2)		120	0	
d-2C	Cool-side derivative time (PID group 2)		30	0	
oL.2C	Cool-side MV low limit (PID group 2)		0.0	1	
oH.2C	Cool-side MV high limit (PID group 2)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-3	Proportional band (PID group 3)	Same as PID group 1	5.0	0	Same as PID group 1
I-3	Integration time (PID group 3)		120	0	
d-3	Derivative time (PID group 3)		30	0	
rE-3	Manual reset (PID group 3)		50.0	0	
oL-3	MV low limit (PID group 3)		0.0	1	
oH-3	MV high limit (PID group 3)		100.0	1	
P-3C	Cool-side proportional band (PID group 3)		5.0	0	
I-3C	Cool-side integration time (PID group 3)		120	0	
d-3C	Cool-side derivative time (PID group 3)		30	0	
oL.3C	Cool-side MV low limit (PID group 3)		0.0	1	
oH.3C	Cool-side MV high limit (PID group 3)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-4	Proportional band (PID group 4)	Same as PID group 1	5.0	0	Same as PID group 1
I -4	Integration time (PID group 4)		120	0	
d-4	Derivative time (PID group 4)		30	0	
rE-4	Manual reset (PID group 4)		50.0	0	
oL-4	MV low limit (PID group 4)		0.0	1	
oH-4	MV high limit (PID group 4)		100.0	1	
P-4C	Cool-side proportional band (PID group 4)		5.0	0	
I -4C	Cool-side integration time (PID group 4)		120	0	
d-4C	Cool-side derivative time (PID group 4)		30	0	
oL.4C	Cool-side MV low limit (PID group 4)		0.0	1	
oH.4C	Cool-side MV high limit (PID group 4)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-5	Proportional band (PID group 5)	Same as PID group 1	5.0	0	Same as PID group 1
I -5	Integration time (PID group 5)		120	0	
d-5	Derivative time (PID group 5)		30	0	
rE-5	Manual reset (PID group 5)		50.0	0	
oL-5	MV low limit (PID group 5)		0.0	1	
oH-5	MV high limit (PID group 5)		100.0	1	
P-5C	Cool-side proportional band (PID group 5)		5.0	0	
I -5C	Cool-side integration time (PID group 5)		120	0	
d-5C	Cool-side derivative time (PID group 5)		30	0	
oL.5C	Cool-side MV low limit (PID group 5)		0.0	1	
oH.5C	Cool-side MV high limit (PID group 5)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-6	Proportional band (PID group 6)	Same as PID group 1	5.0	0	Same as PID group 1
I -6	Integration time (PID group 6)		120	0	
d-6	Derivative time (PID group 6)		30	0	
rE-6	Manual reset (PID group 6)		50.0	0	
oL-6	MV low limit (PID group 6)		0.0	1	
oH-6	MV high limit (PID group 6)		100.0	1	
P-6C	Cool-side proportional band (PID group 6)		5.0	0	
I -6C	Cool-side integration time (PID group 6)		120	0	
d-6C	Cool-side derivative time (PID group 6)		30	0	
oL.6C	Cool-side MV low limit (PID group 6)		0.0	1	
oH.6C	Cool-side MV high limit (PID group 6)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-7	Proportional band (PID group 7)	Same as PID group 1	5.0	0	Same as PID group 1
I-7	Integration time (PID group 7)		120	0	
d-7	Derivative time (PID group 7)		30	0	
rE-7	Manual reset (PID group 7)		50.0	0	
oL-7	MV low limit (PID group 7)		0.0	1	
oH-7	MV high limit (PID group 7)		100.0	1	
P-7C	Cool-side proportional band (PID group 7)		5.0	0	
I-7C	Cool-side integration time (PID group 7)		120	0	
d-7C	Cool-side derivative time (PID group 7)		30	0	
oL.7C	Cool-side MV low limit (PID group 7)		0.0	1	
oH.7C	Cool-side MV high limit (PID group 7)		100.0	1	

Display	Item	Description	Initial value	User level	Notes
P-8	Proportional band (PID group 8)	Same as PID group 1	5.0	0	Same as PID group 1
I -8	Integration time (PID group 8)		120	0	
d-8	Derivative time (PID group 8)		30	0	
rE-8	Manual reset (PID group 8)		50.0	0	
oL-8	MV low limit (PID group 8)		0.0	1	
oH-8	MV high limit (PID group 8)		100.0	1	
P-8C	Cool-side proportional band (PID group 8)		5.0	0	
I -8C	Cool-side integration time (PID group 8)		120	0	
d-8C	Cool-side derivative time (PID group 8)		30	0	
oL.8C	Cool-side MV low limit (PID group 8)		0.0	1	
oH.8C	Cool-side MV high limit (PID group 8)		100.0	1	

■ Parameter bank

Bank selection: PArA

Display	Item	Description	Initial value	User level	Notes
CtrL	Control method	0: ON/OFF control 1: PID control	0 or 1	0	The initial value is 0 if control output 1 is a relay output, and 1 otherwise.
At.oL	MV low limit at AT	−10.0 to +110.0 %	0.0	0	Displayed if the control method is PID control (CtrL = 1).
At.oH	MV high limit at AT	−10.0 to +110.0 %	100.0	0	
dIFF	ON/OFF control differential	0 to 9999U	5	0	Displayed if the control method is ON/OFF control (CtrL = 0).
oFFS	ON/OFF control operating point offset	−1999 to +9999U	0	2	
FL	PV filter	0.0 to 120.0 s	0.0	0	
rA	PV ratio	0.001 to 9.999	1.000	1	
bI	PV bias	−1999 to +9999U	0	0	
CyU	Time proportional cycle unit 1	0: 1 s 1: Always 0.5 s*1 2: Always 0.25 s*1 3: Always 0.1 s*1	0	2	Displayed if the conditions to display time proportional cycle 1 (Cy) are met and the output does not include a relay output.
Cy	Time proportional cycle 1	5 to 120 s (when the output includes a relay output) 1 to 120 s (when the output does not include a relay output)	10 or 2	0	Displayed if MV1 (time proportional output, or time proportional output for heating in heating/cooling control) is set for relay control output, voltage pulse control output, or event output in DO assignment. The initial value is 2 if control output 1 is a voltage pulse output, and 10 otherwise.
tPo	Time proportional minimum ON/OFF time 1	Set value: 0 If either one of the conditions below is true, 250 ms applies. Otherwise, 1 ms applies. • MV1 is set for relay control output or event output in DO assignment. • Time proportional cycle 1 is 10 s or longer. Set value: 1–250 ms If MV1 is set for relay control output or event output in DO assignment, 1–49: 50 ms applies. 50–250: The set value applies.	0	2	Same as time proportional cycle1 (Cy)
Cyu2	Time proportional cycle unit 2	0: 1 s 1: Always 0.5 s*2 2: Always 0.25 s*2 3: Always 0.1 s*2	0	2	Displayed if the conditions to display time proportional cycle 2 (Cy2) are met and the output does not include a relay output.

Display	Item	Description	Initial value	User level	Notes
C42	Time proportional cycle 2	5 to 120 s (when the output includes a relay output) 1 to 120 s (when the output does not include a relay output)	10 or 2	0	Displayed if heating/cooling control is used (C26 ≠ 0) and MV2 (time proportional output for cooling in heating/cooling control) is set for relay control output, voltage pulse control output, or event output in DO assignment. The initial value is 2 if control output 2 is a voltage pulse output, and 10 otherwise.
tPo2	Time proportional minimum ON/OFF time 2	Set value: 0 If either one of the conditions below is true, 250 ms applies. Otherwise, 1 ms applies. • MV2 is set for relay control output or event output in DO assignment. • Time proportional cycle 2 is 10 s or longer. Set value: 1–250 ms If MV2 is set for relay control output or event output in DO assignment, 1–49: 50 ms applies. 50–250: The set value applies.	0	2	Same as time proportional cycle 2 (C42)
tPtY	Time proportional cycle mode	0: Priority on controllability 1: Priority on actuator service life (only one ON/OFF operation in a time proportional cycle)	0 or 1	2	The initial value is 0 if control output 1 is a voltage pulse output, and 1 otherwise.
SPU	SP up ramp	0 to 9999U (0U: no ramp)	0.0	2	Select the time unit of the ramp by SP ramp unit (C32).
SPd	SP down ramp		0.0	2	

*1. The setting cannot be specified for time proportional cycle 1 (C4).

*2. The setting cannot be specified for time proportional cycle 2 (C42).

■ Extended tuning bank

Bank selection: Et

Display	Item	Description	Initial value	User level	Notes
AtTy	AT type	0: Normal (regular control characteristics) 1: Immediate response (to disturbance) 2: Stable (minimal PV fluctuation)	1	0	Displayed if the control method is PID control (CtrL = 1).
SPLg	SP lag constant	0.0 to 999.9	0.0	2	
At-P	AT proportional band adjust	0.00 to 99.99	1.00	2	
At-I	AT integral time adjust	0.00 to 99.99	1.00	2	
At-d	AT derivative time adjust	0.00 to 99.99	1.00	2	
AtPt	Type of MV switching point at AT	0: Default (2/3 of the deviation of the initial PV from the initial SP) 1: SP 2: PV	0	2	Displayed if the control method is PID control (CtrL = 1).
AtPu	MV switching point PV in AT	−1999 to + 9999 U	0	2	Displayed if the control method is PID control (CtrL = 1) and type of MV switching point at AT (AtPt) is set to 2 (PV).
CtrA	Control algorithm	0: PID (conventional PID) 1: Ra-PID (high-performance PID)	0	1	Displayed if the control method is PID control (CtrL = 1).
CLg	Cooling Gain	−10.0 to +110.0 %	30.0	2	Displayed if the control method is PID control (CtrL = 1) and shared PID heating/cooling control is used (C23 = 2).

6-3 Setup Bank, etc., Settings

Meaning of user level settings
0: Simple configuration, 1: Standard configuration, 2: Advanced configuration

■ Setup bank

Bank selection: STUP

Display	Item	Description	Initial value	User level	Notes
C 01	PV input range type	For thermocouple: 1–6, 9–11, 13–21, 23–25	1	0	☞ PV input range type (p. 5-2) (for details)
		For RTD: 41–46, 51–54, 63, 64, 67, 68	41		
		For DC voltage/current: 84, 86–90	88		
C 03	Reference junction compensation (cold junction compensation)	0: Internal compensation (by this device) 1: External compensation (by another device)	0	2	Displayed if a thermocouple range is set for PV input range type.
C 04	PV Decimal point position	0: No decimal point 1: 1 digit after the decimal point 2: 2 digits after the decimal point 3: 3 digits after the decimal point	0	0	If a DC voltage/current range is set for PV input range type or if a thermocouple or RTD range with a decimal point is selected.
C 05	PV range low limit	If a thermocouple or RTD range is set for PV input range type (C01),the low limit of the specified PV input range is displayed but the setting cannot be changed.	-	0	
		If the PV input type is DC voltage/current: −1999 to +9999U	0		
C 06	PV range high limit	If a thermocouple or RTD range is set for PV input range type (C01),the high limit of the specified PV input range is displayed but the setting cannot be changed.	-	0	
		If the PV input type is DC voltage/current: −1999 to +9999U	1000		
C 07	SP low limit	PV range low limit to PV range high limit	-	1	
C 08	SP high limit		-	1	
C 09	PV square root extraction dropout	0.0 to 100.0 % (0.0 = no square root extraction)	0.0	2	Displayed if the PV input type is DC voltage/current.
C 14	Control action (direct/reverse)	0: Heating control (reverse action) 1: Cooling control (direct action)	0	0	Displayed if the control method is ON/OFF control (CtrL = 0) or if heating/cooling control is not used (C26 = 0).
C 15	Output operation at PV alarm	0: Continue the control calculation 1: Output the value set for "Output at PV alarm"	0	2	
C 16	Output at PV alarm	−10.0 to +110.0 %	0.0	2	
C 17	Output at READY (Heat)	−10.0 to +110.0 %	0.0	1	

Display	Item	Description	Initial value	User level	Notes
C 18	Output at READY (Cool)	−10.0 to +110.0 %	0.0	1	Displayed if the control method is PID control (CtrL = 1) and heating/cooling control is used (C26 ≠ 0).
C 19	Output operation at changing AUTO/ MANUAL	0: Bumpless transfer 1: Preset	0	1	Displayed if the control method is PID control (CtrL = 1). If the mode is MANUAL at power-on, the MV will be the value set by preset MANUAL value (C20).
C 20	Preset MANUAL value	−10.0 to +110.0 %	0.0 or 50.0	1	
C 21	Initial output type (mode) of PID control	0: Automatic 1: Not initialized 2: Initialize (if a new SP is set)	0	2	
C 22	Initial output of PID control	−10.0 to +110.0 %	0.0 or 50.0	2	
C 23	Integral time and derivative time decimal point position	0: No decimal point 1: 1 digit after the decimal point 2: 2 digits after the decimal point 3: 3 digits after the decimal point	0	2	Displayed if the control method is PID control (CtrL = 1).
C 26	Heat/cool control	0: Not used 1: Use (individual PID) 2: Use (shared PID)	0	0	Displayed if the control method is PID control (CtrL = 1) and the sum of control outputs and event relay outputs is 2 or more. ☞ Control action and heating/ cooling control (p. 5-18) (for details)
C 28	Heat/Cool control dead zone	−100.0 to +100.0 %	0.0	0	Displayed if heat/cool control is used (C26 ≠ 0).
C 30	LSP system group	1 to 8	1	0	
C 31	SP ramp type	0: Standard 1: Multi-ramp 2: Step operation enabled: Step operation does not resume when the power is turned back on (shifts to READY) 3: Step operation enabled: Step operation resumes when the power is turned back on	0	2	
C 32	SP ramp unit	0: 0.1 U/s 1: 0.1 U/min 2: 0.1 U/h	1	2	

Display	Item	Description	Initial value	User level	Notes
C 33	STEP time unit	0: 0.1 s 1: 1 s (displayed as min.s on the console) 2: 1 min (displayed as h.min on the console)	2	2	Displayed if the SP ramp type is set to step operation (C31=2 or 3).
C 34	STEP PV start	0: No 1: Up start 2: Down start	0	2	
C 35	STEP loop	0: Operation stops (no loop-back) 1: Loops back 2: Continues SOAK with the final step's SP (no loop-back)	0	2	
C 36	CT1 operation type	0: Heater burnout detection 1: Current measurement	0	0	Displayed if a model with two CT inputs is used.
C 37	CT1 output	0: Control output 1 1: Control output 2 2: Event output 1 3: Event output 2 4: Event output 3	0	0	Displayed if a model with two CT inputs is used and CT1 operation type is set to heater burnout detection (C36 = 0).
C 38	CT1 measurement wait time	30 to 300 ms	30	0	
C 39	CT2 operation type	0: Heater burnout detection 1: Current measurement	0	0	Displayed if a model with two CT inputs is used.
C 40	CT2 output	0: Control output 1 1: Control output 2 2: Event output 1 3: Event output 2 4: Event output 3	0	0	Displayed if a model with two CT inputs is used and CT2 operation type is set to heater burnout detection (C39 = 0).
C 41	CT2 measurement wait time	30 to 300 ms	30	0	
C 42	Control output 1 range	1: 4–20 mA 2: 0–20 mA	1	0	Displayed if current output is set as control output 1 by the model No.
C 43	Control output 1 type	0: MV 1: Heating MV (for heating/cooling control) 2: Cooling MV (for heating/cooling control) 3: PV 4: PV (before applying ratio, bias, filter) 5: SP 6: Deviation 7: CT1 current 8: CT2 current 9: Invalid 10: SP+MV 11: PV+MV	0	0	<u>The decimal point position of scaling low and high limits</u> If "Control output 1 type" is set to MV or CT: 1 digit after the decimal point PV or SP: the same as the PV decimal point position <u>The unit for scaling low and high limits</u> If "Control output 1 type" is set to MV: % PV or SP: the same as the PV unit CT: A (current)
C 44	Control output 1 scaling low limit	−1999 to +9999U The decimal point position and unit vary depending on the setting for "control output 1 type" (C43).	0.0	0	
C 45	Control output 1 scaling high limit		100.0	0	

Display	Item	Description	Initial value	User level	Notes
C 46	Control output 1 MV scaling width	0 to 9999U The decimal point position and unit are the same as those of the PV.	200	0	Displayed if control output 1 is set to current output by the model No. and if control output 1 type is set to SP+MV or PV+MV.
C 47	Control output 2 range	1: 4–20 mA 2: 0–20 mA	1	0	Displayed if current output is set as control output 2 by the model No. The decimal point position and unit of scaling low and hight limits are the same as those of control output 1.
C 48	Control output 2 type	0: MV 1: Heating MV (for heating/cooling control) 2: Cooling MV (for heating/cooling control) 3: PV 4: PV (before applying ratio, bias, filter) 5: SP 6: Deviation 7: CT1 current 8: CT2 current 9: Invalid 10: SP+MV 11: PV+MV	3	0	
C 49	Control output 2U scaling low limit	−1999 to +9999U The decimal point position and unit vary depending on the setting for control output 2 type (C48).	0	0	
C 50	Control output 2 scaling high limit		1000	0	
C 51	Control output 2U MV scaling width	0 to 9999U The decimal point position and unit are the same as those of the PV.	200	0	Displayed if current output is set as control output 2 by the model No. and if "control output 2 type" is set to SP+MV or PV+MV.
C 64	Communication type	0: CPL 1: Modbus/ASCII 2: Modbus/RTU 3: PLC link	0	0	Displayed if a model with RS-485 is used.
C 65	Station address	1 to 127 (0: no communication)	0	0	
C 66	Transmission speed	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	2	0	
C 67	Data format (data length)	0: 7 bits 1: 8 bits	1	0	
C 68	Data format (parity)	0: Even parity 1: Odd parity 2: No parity	0	0	
C 69	Data format (stop bit)	0: 1 bit 1: 2 bits	0	0	
C 70	Communication minimum response time	1 to 250 ms	3	2	
C 71	Key operation mode	0: Standard 1: Special	0	2	

Display	Item	Description	Initial value	User level	Notes
C 72	[MODE] key function	0: Invalid 1: AUTO/MANUAL mode selection 2: RUN/READY mode selection 3: AT stop/start 4: LSP group selection 5: Release all DO latches 6: Invalid 7: User-defined bit 1 8: Invalid	1	0	
C 73	Mode display setup	Whether to display the settings in the mode bank is determined by the sum of the weights shown below. Bit 0: AUTO/MANUAL display No: 0. Yes: +1 Bit 1: RUN/READY display No: 0. Yes: +2 Bit 3: AT stop/start display No: 0. Yes: +8 Bit 4: DO latch release display No: 0. Yes: +16 Bit 5: User-defined bit 1 ON/OFF display No: 0. Yes: +32 Bits 6–7: Invalid	255	1	
C 74	PV/SP display setup	Whether to show the following items on the operation display is determined by the sum of the weights shown below. Bit 0: PV No: 0. Yes: +1 Bit 1: SP No: 0. Yes: +2 Bit 2: LSP group No. No: 0. Yes: +4 Bits 3–7: Invalid	15	1	
C 75	MV display setup	Whether to show the following items on the operation display is determined by the sum of the weights shown below. Bit 0: MV No: 0. Yes: +1 Bit 1: Heating MV / cooling MV No: 0. Yes: +2 Bit 2: Invalid Bit 3: AT progress No: 0. Yes: +8 Bits 4–7: Invalid	15	1	
C 76	EV display setup	0: Do not show internal event settings on the operation display 1: Show internal event 1 settings on the operation display 2: Show internal event 1–2 settings on the operation display 3: Show internal event 1–3 settings on the operation display	0	1	

Display	Item	Description	Initial value	User level	Notes
C 77	Event remaining time display setup	0: Do not show the ON/OFF delay remaining time of internal events on the operation display 1: Show the ON/OFF delay remaining time of internal event 1 on the operation display 2: Show the ON/OFF delay remaining time of internal events 1–2 on the operation display 3: Show the ON/OFF delay remaining time of internal events 1–3 on the operation display	0	1	
C 78	CT input current display setup	0: Do not show the CT current on the operation display 1: Show the CT1 current on the operation display 2: Show the CT1 and CT2 currents on the operation display	1	1	
C 79	User level	0: Simple configuration 1: Standard configuration 2: Advanced configuration	0	0	
C 80	Status indicator	0: Not used (always off) 1: Blinks when sending RS-485 communication data 2: Blinks when receiving RS-485 communication data 3: OR (logical sum) of all DI states 4: Always OFF	0	2	
C 90	Number of CT1 turns	0: 800 1–40: CT turns divided by 100	8	2	Displayed if a model with two CT inputs is used.
C 91	Number of CT1 power wire passes	0: 1 1–6: The set value	1	2	
C 92	Number of CT2 turns	0: 800 1–40: CT turns divided by 100	8	2	
C 93	Number of CT2 power wire passes	0: 1 1–6: The set value	1	2	
C 97	PV input failure (under range) type	0: –10 % FS 1: –5 mV (valid only when C0 1(PV input range type) is set to 17 or 23.)	0	0	
C 98	Sampling cycle	1: 50 ms 2: 100 ms 3: 300 ms 4: 500 ms	1	2	

■ Event configuration bank

Bank selection: EuCF

Display	Item	Description	Initial value	User level	Notes
E1C1	Internal event 1 conf. 1 operation type	0: No event 1: PV high limit 2: PV low limit 3: PV high and low limits 4: Deviation high limit 5: Deviation low limit 6: Deviation high and low limits 7: Deviation high limit (final SP reference) 8: Deviation low limit (final SP reference) 9: Deviation high and low limits (final SP reference) 10: SP high limit 11: SP low limit 12: SP high and low limits 13: MV high limit 14: MV low limit 15: MV high and low limits 16: Heater 1 burnout/overcurrent 17: Heater 1 short circuit 18: Heater 2 burnout/overcurrent 19: Heater 2 short circuit 20: Loop diagnosis 1 21: Loop diagnosis 2 22: Loop diagnosis 3 23: Alarm (status) 24: READY (status) 25: MANUAL (status) 27: AT running (status) 28: During SP ramp (status) 29: Control direct action (status) 32: Timer (status)	0	0	
E1C2	Internal event 1 conf. 2	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		0	
	1st digit: Direct/reverse	0: Direct 1: Reverse	0		
	2nd digit: Standby	0: None 1: Standby 2: Standby + standby when the SP is changed	0		
	3rd digit: Event state in READY mode	0: Continues 1: Forced OFF	0		
	4th digit: Undefined	0	0		

Display	Item	Description	Initial value	User level	Notes
E 1.C 3	Internal event 1 conf. 3	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Alarm OR	0: None 1: Alarm direct + OR operation 2: Alarm direct + AND operation 3: Alarm reverse + OR operation 4: Alarm reverse + AND operation	0		
	2nd digit: Special OFF	0: No special OFF 1: If the main setting for the event is 0, the event is OFF.	0		
	3rd digit: Delay time unit	0: 0.1 s 1: 1 s 2: 1 min	0		
	4th digit: Undefined	0	0		
E2.C 1	Internal event 2 conf. 1 operation type	Same as internal event 1 configuration 1	0	0	
E2.C2	Internal event 2 conf. 2 1st digit: Direct/reverse 2nd digit: Standby 3rd digit: Event state in READY mode 4th digit: Undefined		0000	0	
E2.C 3	Internal event 2 conf. 3 1st digit: Alarm OR 2nd digit: Special OFF 3rd digit: Delay time unit 4th digit: Undefined	Same as internal event 1 configuration 3	0000	2	
E3.C 1	Internal event 3 conf. 1 operation type	Same as internal event 1 configuration 1	0	0	
E3.C2	Internal event 3 conf. 2 1st digit: Direct/reverse 2nd digit: Standby 3rd digit: Event state in READY mode 4th digit: Undefined	Same as internal event 1 configuration 2	0000	0	
E3.C 3	Internal event 3 conf. 3 1st digit: Alarm OR 2nd digit: Special OFF 3rd digit: Delay time unit 4th digit: Undefined	Same as internal event 1 configuration 3	0000	2	

Display	Item	Description	Initial value	User level	Notes
E4C 1	Internal event 4 conf. 1 operation type	Same as internal event 1 configuration 1	0	0	
E4C2	Internal event 4 conf. 2 1st digit: Direct/reverse 2nd digit: Standby 3rd digit: Event state in READY mode 4th digit: Undefined	Same as internal event 1 configuration 2	0000	0	
E4C3	Internal event 4 conf. 3 1st digit: Alarm OR 2nd digit: Special OFF 3rd digit: Delay time unit 4th digit: Undefined	Same as internal event 1 configuration 3	0000	2	
E5C 1	Internal event 5 conf. 1 operation type	Same as internal event 1 configuration 1	0	0	
E5C2	Internal event 5 conf. 2 1st digit: Direct/reverse 2nd digit: Standby 3rd digit: Event state in READY mode 4th digit: Undefined	Same as internal event 1 configuration 2	0000	0	
E5C3	Internal event 5 conf. 3 1st digit: Alarm OR 2nd digit: Special OFF 3rd digit: Delay time unit 4th digit: Undefined	Same as internal event 1 configuration 3	0000	2	

■ DI assignment bank

Bank selection: dI

Display	Item	Description	Initial value	User level	Notes
dI 1.1	Internal contact 1 operation type	0: No function 1: LSP group selection (0/+1) 2: LSP group selection (0/+2) 3: LSP group selection (0/+4) 4: PID group selection (0/+1) 5: PID group selection (0/+2) 6: PID group selection (0/+4) 7: RUN/READY selection 8: AUTO/MANUAL selection 9: Invalid 10: AT stop/start 11: Invalid 12: Control operation (direct/reverse) (Operates as configured / reversed operation) 13: SP ramp enabling/disabling 14: PV hold (disabled/enabled) 15: PV max. hold (disabled/enabled) 16: PV min. hold (disabled/enabled) 17: Timer stop/start 18: Release/continue all DO latches 19: Advance (disabled/enabled) 20: SP step hold (disabled/enabled)	0	0	
dI 1.2	Internal contact 1 input bit function	0: Not used (use the default input) 1: Function 1, (A and B) or (C and D) 2: Function 2, (A or B) and (C or D) 3: Function 3, (A or B or C or D) 4: Function 4, (A and B and C and D)	0	2	If a model with digital inputs is used, if 0 (not used) is selected, internal contact 1 reflects the state of digital input 1.

Display	Item	Description	Initial value	User level	Notes
dI 13	Internal contact 1 input assignment A	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1) 2: DI1 3: DI2 4 to 9: Invalid 10: Internal event 1 11: Internal event 2 12: Internal event 3 13: Internal event 4 14: Internal event 5 15 to 17: Invalid 18: User-defined bit 1 19: User-defined bit 2 20: User-defined bit 3 21: User-defined bit 4 22: MANUAL 23: READY 24: Invalid 25: AT (Auto-Tuning) 26: During SP ramp 27: Invalid 28: Alarm 29: PV alarm 30: Invalid 31: [MODE] key status 32: Event output 1 terminal status 33: Control output 1 terminal status	2	2	Displayed if internal contact 1 input bit function is set to one of functions 1–4 (dI ⌊2 ≠ 0).
dI 14	Internal contact 1 input assignment B		0	2	
dI 15	Internal contact 1 input assignment C		0	2	
dI 16	Internal contact 1 input assignment D		0	2	
dI 17	Internal contact 1 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	Displayed if internal contact 1 input bit function is set to one of functions 1–4 (dI ⌊2 ≠ 0).
	1st digit: Polarity A (polarity of input assignment A)	0: Direct 1: Reverse	0		
	2nd digit: Polarity B (polarity of input assignment B)		0		
	3rd digit: Polarity C (polarity of input assignment C)		0		
	4th digit: Polarity D (polarity of input assignment D)		0		
dI 18	Internal contact 1 polarity	0: Direct 1: Reverse	0	2	
dI 19	Internal contact 1 internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	2	Displayed if internal contact 1 operation type is set to timer stop/start (dI ⌊⌊ = 17).
dI 2.1	Internal contact 2 operation type	Same as internal contact 1 operation type 0 to 20	0	0	
dI 2.2	Internal contact 2 input bit function	Same as internal contact 1 input bit function 0: Not used (use the default input) 1-4: Functions 1-4	0	2	If a model with digital inputs is used, if 0 (not used) is selected, internal contact 2 reflects the state of digital input 2.

Display	Item	Description	Initial value	User level	Notes
d1 2.3	Internal contact 2 input assignment A	Same as internal contact 1 input assignment A to D 0 to 33	3	2	Displayed if internal contact 2 input bit function is set to one of functions 1–4 (d1 22 ≠ 0).
d1 2.4	Internal contact 2 input assignment B		0	2	
d1 2.5	Internal contact 2 input assignment C		0	2	
d1 2.6	Internal contact 2 input assignment D		0	2	
d1 2.7	Internal contact 2 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A (polarity of input assignment A)	0: Direct 1: Reverse	0		
	2nd digit: Polarity B (polarity of input assignment B)		0		
	3rd digit: Polarity C (polarity of input assignment C)		0		
	4th digit: Polarity D (polarity of input assignment D)		0		
d1 2.8	Internal contact 2 polarity	0: Direct 1: Reverse	0	2	
d1 2.9	Internal contact 2 internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	2	Displayed if internal contact 2 operation type is set to timer stop/start (d1 21 = 17).
d1 3.1	Internal contact 3 operation type	Same as internal contact 1 operation type 0 to 20	0	0	
d1 3.2	Internal contact 3 input bit function	Same as internal contact 1 input bit function 0: Not used 1-4: Functions 1-4	0	2	

Display	Item	Description	Initial value	User level	Notes
di 33.	Internal contact 3 input assignment A	Same as internal contact 1 input assignment A to D 0 to 33	4	2	Displayed if internal contact 3 input bit function is set to one of functions 1–4 (di 32 ≠ 0).
di 34	Internal contact 3 input assignment B		0	2	
di 35	Internal contact 3 input assignment C		0	2	
di 36	Internal contact 3 input assignment D		0	2	
di 37	Internal contact 3 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A (polarity of input assignment A)	0: Direct 1: Reverse	0		
	2nd digit: Polarity B (polarity of input assignment B)		0		
	3rd digit: Polarity C (polarity of input assignment C)		0		
	4th digit: Polarity D (polarity of input assignment D)		0		
di 38	Internal contact 3 polarity	0: Direct 1: Reverse	0	2	
di 39	Internal contact 3 internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	2	Displayed if internal contact 3 operation type is set to timer stop/start (di 31 = 17).
di 41	Internal contact 4 operation type	Same as internal contact 1 operation type 0 to 20	0	0	
di 42	Internal contact 4 input bit function	Same as internal contact 1 input bit function 0: Not used 1-4: Functions 1-4	0	2	

Display	Item	Description	Initial value	User level	Notes
dI 4.3	Internal contact 4 input assignment A	Same as internal contact 1 input assignment A to D 0 to 33	5	2	Displayed if internal contact 4 input bit function is set to one of functions 1–4 (dI 22 ≠ 0).
dI 4.4	Internal contact 4 input assignment B		0	2	
dI 4.5	Internal contact 4 input assignment C		0	2	
dI 4.6	Internal contact 4 input assignment D		0	2	
dI 4.7	Internal contact 4 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A (polarity of input assignment A)	0: Direct 1: Reverse	0		
	2nd digit: Polarity B (polarity of input assignment B)		0		
	3rd digit: Polarity C (polarity of input assignment C)		0		
	4th digit: Polarity D (polarity of input assignment D)		0		
dI 4.8	Internal contact 4 polarity	0: Direct 1: Reverse	0	2	
dI 4.9	Internal contact 4 internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	2	Displayed if internal contact 4 operation type is set to timer stop/start (dI 21 = 17).
dI 5.1	Internal contact 5 operation type	Same as internal contact 1 operation type 0 to 20	0	0	
dI 5.2	Internal contact 5 input bit function	Same as internal contact 1 input bit function 0: Not used 1-4: Functions 1-4	0	2	

Display	Item	Description	Initial value	User level	Notes
di 5.3	Internal contact 5 input assignment A	Same as internal contact 1 input assignment A to D 0 to 33	0	2	Displayed if internal contact 5 input bit function is set to one of functions 1–4 (di 22 ≠ 0).
di 5.4	Internal contact 5 input assignment B		0	2	
di 5.5	Internal contact 5 input assignment C		0	2	
di 5.6	Internal contact 5 input assignment D		0	2	
di 5.7	Internal contact 5 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A (polarity of input assignment A)	0: Direct 1: Reverse	0		
	2nd digit: Polarity B (polarity of input assignment B)		0		
	3rd digit: Polarity C (polarity of input assignment C)		0		
	4th digit: Polarity D (polarity of input assignment D)		0		
di 5.8	Internal contact 5 polarity	0: Direct 1: Reverse	0	2	
di 5.9	Internal contact 5 internal event No. assignment	0: All internal events 1 to 5: Internal event No.	0	2	Displayed if internal contact 5 operation type is set to timer stop/start (di 21 = 17).

■ DO assignment bank

Bank selection: dO

Display	Item	Description	Initial value	User level	Notes
oT 1.1	Control output 1 operation type	0: Default output 1: MV1 (ON/OFF control output, time proportional output, heating time proportional output of heating/cooling control) 2: MV2 (cooling time proportional output of heating/cooling control 3: Function 1, (A and B) or (C and D) 4: Function 2, (A or B) and (C or D) 5: Function 3, (A or B or C or D) 6: Function 4, (A and B and C and D)	0	2	Displayed if control output 1 is set to relay output or voltage pulse output by the model No. For control output 1, the default output is MV1.
oT 1.2	Control output 1 output assignment A	0: Normally open (normally off = 0) 1: Normally closed (normally on = 1) 2: Internal event 1 3: Internal event 2 4: Internal event 3 5: Internal event 4 6: Internal event 5 7 to 13: Invalid 14: MV ON/OFF status 1 15: MV ON/OFF status 2 16 to 17: Invalid 18: DI1 19: DI2 20 to 25: Invalid 26: Internal contact 1 27: Internal contact 2 28: Internal contact 3 29: Internal contact 4 30: Internal contact 5 31 to 33: Undefined 34: User-defined bit 1 35: User-defined bit 2 36: User-defined bit 3 37: User-defined bit 4 38: MANUAL 39: READY 40: Invalid 41: AT running 42: During SP ramp 43: Invalid 44: Alarm 45: PV alarm 46: Invalid 47: [MODE] key status 48: Event output 1 terminal status 49: Control output 1 terminal status	14	2	Displayed if relay output or voltage pulse output is set as control output 1 by the model No. and control output 1 operation type is set to one of functions 1–4 (oT ! ! > 2).
oT 1.3	Control output 1 output assignment B		0	2	
oT 1.4	Control output 1 output assignment C		0	2	
oT 1.5	Control output 1 output assignment D		0	2	

Display	Item	Description	Initial value	User level	Notes
ot 16	Control output 1 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	Displayed if relay output or voltage pulse output is set as control output 1 by the model No. and control output 1 operation type is set to one of functions 1–4 (ot ! ! > 2).
	1st digit: Polarity A	0: Direct 1: Reverse	0		
	2nd digit: Polarity B		0		
	3rd digit: Polarity C		0		
	4th digit: Polarity D		0		
ot 17	Control output 1 polarity	0: Direct 1: Reverse	0	2	
ot 18	Control output 1 latch	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	2	
ot2.1	Control output 2 operation type	Same as control output 1 operation type 0: Default output 1: MV1 2: MV2 3-6: Functions 1-4	0	2	Displayed if voltage pulse output is set as control output 2 by the model No. For control output 2, the default output is MV2.
ot2.2	Control output 2 output assignment A	Same as control output 1 output assignment A to D 0 to 49	15	2	Displayed if voltage pulse output is set as control output 2 by the model No. and control output 2 operation type is set to one of functions 1–4 (ot2.! > 2).
ot2.3	Control output 2 output assignment B		0	2	
ot2.4	Control output 2 output assignment C		0	2	
ot2.5	Control output 2 output assignment D		0	2	
ot2.6	Control output 2 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A	0: Direct 1: Reverse	0		
	2nd digit: Polarity B		0		
	3rd digit: Polarity C		0		
	4th digit: Polarity D		0		
ot2.7	Control output 2 polarity	0: Direct 1: Reverse	0	2	
ot2.8	Control output 2 latch	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	2	
Eu 1.1	Event output 1 operation type	Same as control output 1 operation type 0: Default output 1: MV1 2: MV2 3-6: Functions 1-4	0	2	Displayed if a model with event output 1 is used. For event output 1, the default output is internal event 1.

Display	Item	Description	Initial value	User level	Notes
Eu 12	Event output 1 output assignment A	Same as control output 1 output assignment A to D 0 to 49	2	2	Displayed if event output 1 is selected by the model No. and event output 1 operation type is set to one of functions 1–4 (Eu 11 > 2).
Eu 13	Event output 1 output assignment B		0	2	
Eu 14	Event output 1 output assignment C		0	2	
Eu 15	Event output 1 output assignment D		0	2	
Eu 16	Event output 1 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A	0: Direct 1: Reverse	0		
	2nd digit: Polarity B		0		
	3rd digit: Polarity C		0		
	4th digit: Polarity D		0		
Eu 17	Event output 1 polarity	0: Direct 1: Reverse	0	2	
Eu 18	Event output 1 latch	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	2	
Eu2.1	Event output 2 operation type	Same as control output 1 operation type 0: Default output 1: MV1 2: MV2 3-6: Functions 1-4	0	2	Displayed if a model with event output 2 is used. For event output 2, the default output is internal event 2.
Eu22	Event output 2 output assignment A	Same as control output 1 output assignment A to D 0 to 49	3	2	Displayed if event output 2 is selected by the model No. and event output 2 operation type is set to one of functions 1–4 (Eu21 > 2).
Eu23	Event output 2 output assignment B		0	2	
Eu24	Event output 2 output assignment C		0	2	
Eu25	Event output 2 output assignment D		0	2	
Eu26	Event output 2 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A	0: Direct 1: Reverse	0		
	2nd digit: Polarity B		0		
	3rd digit: Polarity C		0		
	4th digit: Polarity D		0		
Eu27	Event output 2 polarity	0: Direct 1: Reverse	0	2	
Eu28	Event output 2 latch	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	2	

Display	Item	Description	Initial value	User level	Notes
Eu3.1	Event output 3 operation type	Same as control output 1 operation type 0: Default output 1: MV1 2: MV2 3-6: Functions 1-4	0	0	Displayed if a model with event output 3 is used. For event output 3, the default output is internal event 3.
Eu3.2	Event output 3 output assignment A	Same as control output 1 output assignment A to D 0 to 49	4	2	Displayed if event output 3 is selected by the model No. and event output 3 operation type is set to one of functions 1–4 (Eu□1 > 2).
Eu3.3	Event output 3 output assignment B		0	2	
Eu3.4	Event output 3 output assignment C		0	2	
Eu3.5	Event output 3 output assignment D		0	2	
Eu3.6	Event output 3 polarity A to D	"1st digit" (2nd, etc.) means the first digit (etc.) from the right.		2	
	1st digit: Polarity A	0: Direct 1: Reverse	0		
	2nd digit: Polarity B		0		
	3rd digit: Polarity C		0		
	4th digit: Polarity D		0		
Eu3.7	Event output 3 polarity	0: Direct 1: Reverse	0	2	
Eu3.8	Event output 3 latch	0: Do not latch 1: Latch when ON 2: Latch when OFF (except for initialization at power-on)	0	2	

■ User function bank

Bank selection: UF

Display	Item	Description	Initial value	User level	Notes
UF-1	User function 1	Displayed characters are defined for each item. The following are special cases. ----: Unregistered P-_: Proportional band of the PID in use I-_: Integral time of the PID in use d-_: Derivative time of the PID in use rE-_: Manual reset of the PID in use oL-_: MV low limit of the PID in use oH-_: MV high limit of the PID in use P-_C: Proportional band for cooling of the PID in use I-_C: Integral time for cooling of the PID in use d-_C: Derivative time for cooling of the PID in use oL_C: MV low limit for cooling of the PID in use oH_C: MV high limit for cooling of the PID in use	----	1	Only the settings that can be displayed can be registered. (For example, manual reset of the PID constants can be registered when integral time = 0) Registered settings are added to the end of the list of settings that are shown on the operation display.
UF-2	User function 2		----	1	
UF-3	User function 3		----	1	
UF-4	User function 4		----	1	
UF-5	User function 5		----	1	
UF-6	User function 6		----	1	
UF-7	User function 7		----	1	
UF-8	User function 8		----	1	

■ Lock bank

Bank selection: LoC

Display	Item	Description	Initial value	User level	Notes
LoC	Key lock	0: All settings can be specified. 1: Mode, event, operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 2: Operation display, SP, UF, lock, manual MV, and [MODE] key operation can be specified. 3: UF, lock, manual MV, and [MODE] key operation can be specified.	0	0	The setting can be specified if the two sets of passwords (1A and 1B, 2A and 2B) match. The [MODE] key operation, MV in MANUAL mode, key lock, password display, and passwords 1A to 2B can be specified when any value from 0 to 3 is set for key lock (LoC).
C.LoC	Communication lock	0: Unlocked 1: Locked	0	2	
L.LoC	Loader lock	0: Unlocked 1: Locked	0	2	
PASS	Password display	0 to 15 5: Displays passwords 1A to 2B	0	0	Reset to 0 each time the power is turned on.
PS 1A	Password 1A	0000 to FFFF (hex)	0000	0	The setting can be specified if password display (PASS) is set to 5 and the two sets of passwords (1A and 1B, 2A and 2B) match.
PS2A	Password 2A	0000 to FFFF (hex)	0000	0	
PS 1b	Password 1B	0000 to FFFF (hex)	0000	0	Displayed if password display (PASS) is set to 5.
PS2b	Password 2B	0000 to FFFF (hex)	0000	0	

■ Instrument information bank

Bank selection: Id

Display	Item	Description	Initial value	User level	Notes
Id01	ROM ID	Always 16	–	2	ROM firmware identification Setting cannot be changed
Id02	ROM version 1		–	2	
Id03	ROM version 2		–	2	
Id04	Loader information		–	2	
Id05	EST Information		–	2	
Id06	Manufacturing date code (year)	Year – 2000 Example: Year 2021 is "21"	–	2	Date of manufacture and serial No. Setting cannot be changed
Id07	Manufacturing date code (month, day)	Month + (day ÷ 100) Example: Dec. 1 is "12.01."	–	2	
Id08	Serial No.		–	2	
Id09	Model No.		–	2	Product identification code Setting cannot be changed
Id10	Model information		–	2	
Id11	Production site code		–	2	
FP01	Advanced function password 1	0000 to FFFF (hex)	0000	2	
FP02	Advanced function password 2	0000 to FFFF (hex)	0000	2	
FP03	Advanced function password 3	0000 to FFFF (hex)	0000	2	
FP04	Advanced function password 4	0000 to FFFF (hex)	0000	2	
FP05	Advanced function password 5	0000 to FFFF (hex)	0000	2	
FP06	Advanced function password 6	0000 to FFFF (hex)	0000	2	
FP07	Advanced function password 7	0000 to FFFF (hex)	0000	2	
FP08	Advanced function password 8	0000 to FFFF (hex)	0000	2	
FP09	Advanced function password 9	0000 to FFFF (hex)	0000	2	

Display	Item	Description	Initial value	User level	Notes
FP 10	Advanced function password 10	0000 to FFFF (hex)	0000	2	
FP 11	Advanced function password 11	0000 to FFFF (hex)	0000	2	
FP 12	Advanced function password 12	0000 to FFFF (hex)	0000	2	
FP 13	Advanced function password 13	0000 to FFFF (hex)	0000	2	
FP 14	Advanced function password 14	0000 to FFFF (hex)	0000	2	
FP 15	Advanced function password 15	0000 to FFFF (hex)	0000	2	
FP 16	Advanced function password 16	0000 to FFFF (hex)	0000	2	

-MEMO-

Chapter 7. CPL Communication Function

7 - 1 Overview of Communications

If a model with RS-485 communication is used, this device can communicate with a PC, PLC, or other host device using a program created by the user.

CPL (Controller Peripheral Link: Azbil Corporation's host communication protocol) or MODBUS can be selected as the communication protocol. This chapter describes CPL communications.

■ Features

The features of the C1M's communication functions are as follows:

- Up to 31 C1M units can be connected to a single master station (host device).
- Almost all of the parameter data of this device can be communicated.
  ☞ Chapter 10. List of Communication Data
- Random access commands are available.
  Two or more parameters at separated addresses can be read or written by a single command.

■ Configuration

The settings shown below must be specified for CPL communication.

They can be displayed and configured if a model with RS-485 communication is used.

Item	Display	Description	Initial value	User level
Communication type	C 64	0: CPL 1: Modbus/ASCII 2: Modbus/RTU 3: PLC link	0	Simple, standard, advanced
Station address	C 65	0: No communication 1 to 127	0	
Transmission speed	C 66	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	2	
Data format (data length)	C 67	0: 7 bits 1: 8 bits	1	
Data format (parity)	C 68	0: Even parity 1: Odd parity 2: No parity	0	
Data format (stop bit)	C 69	0: 1 bits 1: 2 bits	0	
Communication minimum response time	C 70	1 to 250 ms	3	Advanced

[!] Handling Precautions:

- The settings can be configured using the keys on this device or Smart Loader Package model SLP-C1F. RS-485 communications cannot be used for configuration.

■ Communication procedure

The communication procedure is as follows.

(1) The host device (master station) sends an instruction message to one C1M unit (slave station).

(2) The slave station receives the instruction message and performs read or write processing according to the content of the message.

(3) The slave station sends a response message appropriate for the type of processing.

(4) The master station receives the response message.

Handling Precautions:

- Sending data using several protocols intermixed (CPL, Modbus/ASCII, Modbus/RTU, PLC link) to the same RS-485 transmission line is not allowed.

7 - 2 Message Structure

■ Message structure

The following shows the message structure.

Messages are broadly classified into two layers: the data link layer and the application layer.

- Data link layer

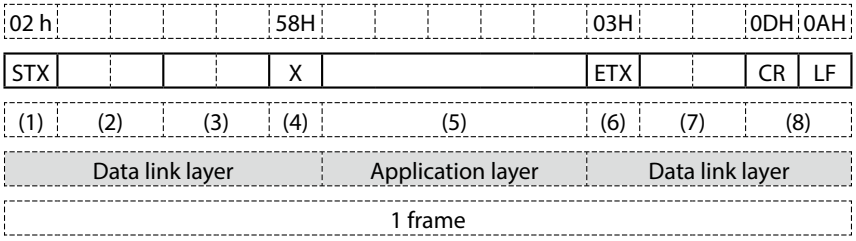
  This layer contains the basic information required for communications such as the destination of the communication message and the check information of the message.

- Application layer

  Data is read and written in this layer. The content of the layer varies according to the purpose of the message.

A message consists of (1) to (8) below.

The command (details sent from the master station) and the response (details returned from the slave station) are stored in the application layer.



(1) STX (start of message)

(2) Station address

(3) Sub-address

(4) Device ID code

(5) Instruction message = command, response message = response

(6) ETX (end of command/response)

(7) Checksum

(8) Delimiter (end of message)

■ Data link layer

● Overview

The data link layer is of a fixed length. The position of each data item and the number of its characters are already decided. Note, however, that the data positions of the data link layer from ETX onwards shift according to the number of characters in the application layer.

● Response start conditions

- This device sends a response message only when all the message components in the data link layer of the instruction message are correct. If even one of these is incorrect, no response message is sent, and the device stands by for reception of STX.

- The maximum number of word addresses that can be accessed by one frame is 32.

● List of data link layer data definitions

The following list shows the definitions for data in the data link layer.

Data name	Character code	Number of characters	Meaning of data
STX	02 h	1	Start of message
Station address	0 to 7FH are expressed as hexadecimal character codes.	2	Identification of device to communicate with
Sub-address	00 (30H, 30H)	2	No function
Device ID code	X (58H) or x (78H)	1	Device type
ETX	03H	1	End position of the application layer
Checksum	00H to FFH are expressed as 2-digit hexadecimal character codes.	2	Checksum of message
Delimiter	CR (0DH), LF (0AH)	2	End of message

● Description of data items

- STX (02H)

  When STX is received, this device interprets it as the start of a command message. No matter what has been received previously, upon receiving STX, this device begins processing a new message. In this way, if an instruction message contains an error due to electromagnetic noise, etc., this device can respond to the next proper message (a resent message, etc.) from the master station.

- Station address

  This device creates a response message only to instruction messages that mention its station address. A station address is expressed as a 2-digit hexadecimal character code in a message.

  This device returns a response message that includes its own station address. The station address can be specified by C65 (station address). Note that, if the station address is set to 0 (30H 30H), this device does not respond even if the station addresses match.

- Sub-address

  Set the sub-address to 00 (30H 30H), because this device does not use sub-addresses.
  However, this device will return a response message that includes a received sub-address.

- Device ID code

  X (58H) or x (78H) can be used. This code is determined for each product series, and other codes cannot be selected. This device returns a response message that includes the received device ID code. X (58H) is used as the default, and x (78H) is used to distinguish the message from the resend message.

- ETX

  ETX indicates the end of the application layer.

- Checksum

  This value is for checking whether something abnormal (e.g., electromagnetic noise) has caused the message content to change during transmission.

  The checksum is expressed as a 2-digit hexadecimal character code.

- How to calculate a checksum

  (1) Add the character codes in the message from STX through ETX in single byte units.

  (2) Take two's complement of the low-order one byte of the sum.

  (3) Convert the obtained two's complement to a two-byte ASCII code.

  The following is a sample checksum calculation:

  Sample message

  STX : 02H

  0: 30H (1st byte of the station address)

  1: 31H (2nd byte of the station address)

  0: 30H (1st byte of the sub-address)

  0: 30H (2nd byte of the sub-address)

  X: 58H (device ID code)

  R: 52H (1st byte of the command)

  S: 53H (2nd byte of the command)

  (omitted)

  ETX : 03H

  (1) Add the character codes in the message from STX through ETX in single byte units. The addition calculation in single byte units is as follows:
  02H + 30H + 31H + 30H + 30H + 58H + 52H + 53H + ... + 03H
  The result of this calculation is 376H.

  (2) The low-order byte of the sum, 376H, is 76H. The two's complement of 76H is 8AH.

  (3) Convert the obtained 8AH to a two-byte ASCII code.

  The result is:

  8: 38H

  A: 41H

  The two bytes, 8 (38H) and A (41H), are the checksum.

- Delimiter (CR/LF)

  This indicates the end of the message. Immediately after LF is received, the device enters a state allowed to process the received message.

■ Application layer

The table below shows the configuration of the application layer.

Item	Description
Command	RS (read decimal format data from consecutive addresses)
	WS (write decimal format data to consecutive addresses)
	RD (read hexadecimal format data from consecutive addresses)
	WD (write hexadecimal format data to consecutive addresses)
	RU (read hexadecimal format data from random addresses)
	WU (write hexadecimal format data to random addresses)
Data delimiter	RS and WS commands: "," (comma) Other commands: None
Word address	RS and WS commands: decimal value and "W" (e.g., 501W) Other commands: hexadecimal value (e.g., 01F5)
Number of data records to read	RS and WS commands: decimal value (e.g., 1) Other commands: hexadecimal value (e.g., 0001)
Data	RS and WS commands: decimal value (ex.: 100) Other commands: hexadecimal value (e.g., 0064)

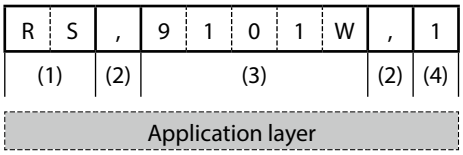
7 - 3 Description of Commands

■ Continuous data read command (RS command)

This command reads data from consecutive addresses in one message.

● Instruction message

This is a command—in one message—to read data from consecutive word addresses starting from the specified address. The figure below shows the structure of the application layer of a "read" instruction message.



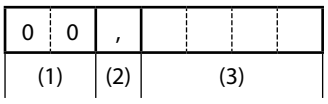
(1) Continuous data read command
(2) Data delimiter
(3) Starting word address
(4) Read data count

● Response message

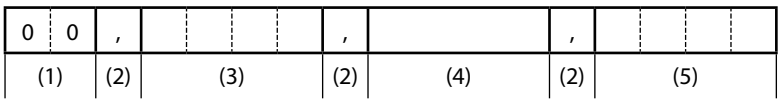
If an instruction message is received successfully, a response message appropriate for the command is returned.

The figure below shows the structure of the application layer of a response message for a read command.

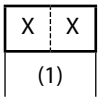
- Normal termination (reading of single data record)



- Normal termination (reading of multiple data records)



- Abnormal termination



A termination code indicating an error is entered in place of XX.
☞ 7 - 6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code
(2) Data delimiter
(3) Read data 1
(4) Read data 2 to (n−1)
(5) Read data n

● Maximum read data count per message

64 words

■ Continuous data write command (WS command)

This command writes data to consecutive addresses.

● Instruction message

The figure below shows the structure of the application layer of a “write” instruction message.

W	S	,	1	5	0	1	W	,	1	,	6	5
(1)		(2)	(3)					(2)	(4)	(2)	(5)	

(1) Write command
(2) Data delimiter
(3) Starting word address
(4) Write data (1st word)
(5) Write data (2nd word)

● Response message

The figure below shows the structure of the application layer of a response message for a write command.

- Normal termination

0	0
(1)	

- Abnormal termination or warning

X	X
(1)	

A termination code indicating an error is entered in place of XX.
☞ 7-6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code

● Maximum write data count per message

64 words

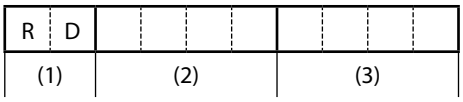
■ Fixed-length continuous data read command (RD command)

This command reads continuous data in two-byte units. This command is suitable for handling data in ladder programs sent by PLC communications as the data is of a fixed length.

The starting word address is expressed as four hexadecimal digits. The data count is expressed as four digits, and data is expressed as four × n (n is a positive integer) hexadecimal digits.

● Instruction message

The read starting word address (four hexadecimal digits) and the read data count (four hexadecimal digits) are sent.



(1) Fixed-length continuous data read command

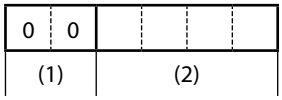
(2) Starting word address

(3) Read data count

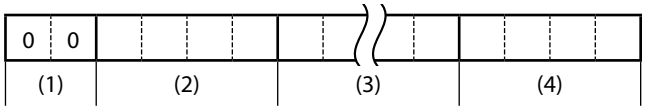
● Response message

If the command is processed successfully, a termination code indicating success (two decimal digits) is returned with the specified number of read data records (four hexadecimal digits × read data count). If there was an error, a termination code indicating error (two decimal digits) is returned without appending the data that was read.

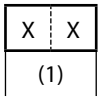
- Normal termination (reading of single data record)



- Normal termination (reading of multiple data records)



- Abnormal termination



A termination code indicating an error is entered in place of XX.

☞ 7 - 6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code

(2) Read data 1

(3) Read data 2 to (n−1)

(4) Read data n

● Maximum read data count per message

64 words

■ Fixed-length continuous data write command (WD command)

This command writes continuous data in two-byte units. This command is suitable for handling data in ladder programs sent by PLC communications as the data is of a fixed length.

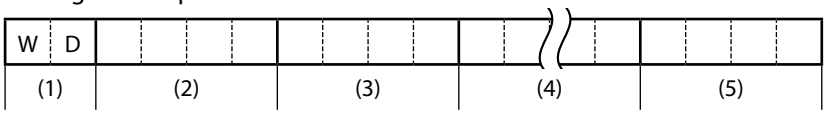
The starting word address is expressed as four hexadecimal digits. Data is expressed as four × n (n is a positive integer) hexadecimal digits.

● Instruction message

The write starting word address (four hexadecimal digits) and data to be written (four × n hexadecimal digits) is sent.

- Writing of one data record

- Writing of multiple data records

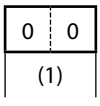


(1) Fixed-length continuous data write command
(2) Starting word address
(3) Write data 1
(4) Write data 2 to (n-1)
(5) Write data n

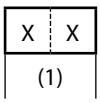
● Response message

If data is written, a termination code indicating success (two decimal digits) is returned. If only part of the data is written, a termination code indicating warning (two decimal digits) is returned. If none of the data is written, a termination code indicating error (two decimal digits) is returned.

- Normal termination



- Abnormal termination or warning



A termination code indicating an error is entered in place of XX.
☞ 7 - 6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code

● Maximum write data count per message

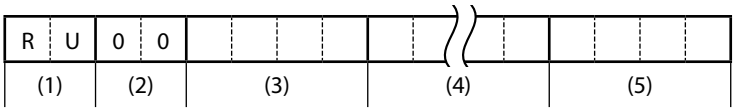
64 words

■ Fixed-length random data read command (RU command)

This command reads random (non-consecutive) data in two-byte units.

● Instruction message

The word address (four hexadecimal digits) of the data to be read is sent in the specified order.

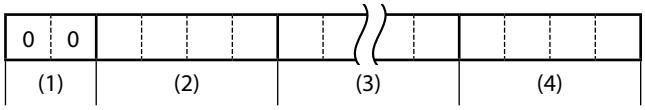


(1) Fixed-length random data read command
(2) Sub-command: fixed to "00"
(3) Word address 1
(4) Word address 2 to (n–1)
(5) Word address n

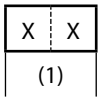
● Response message

If the command is processed successfully, a termination code indicating success (two decimal digits) is returned with the specified number of read data records (four hexadecimal digits × read data count). If there was an error, a termination code indicating error (two decimal digits) is returned without appending the data that was read.

- Normal termination



- Abnormal termination



A termination code indicating an error is entered in place of XX.
☞ 7 - 6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code
(2) Read data 1
(3) Read data 2 to (n–1)
(4) Read data n

● Maximum read data count per message

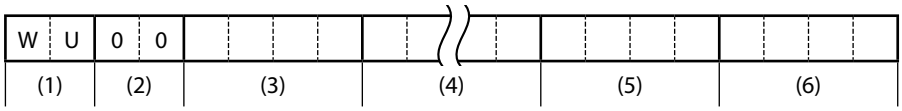
64 words

■ Fixed-length random data write command (WU command)

This command writes data to random (non-consecutive) addresses in two-byte units. Data is expressed in four hexadecimal digits.

● Instruction message

Data is sent for the specified write data count with the data address (four hexadecimal digits) of the data to be written and the data (four hexadecimal digits) as a pair.

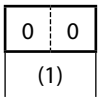


(1) Fixed-length random data write command
(2) Sub-command: fixed to "00"
(3) Word address 1
(4) Write data 1
(5) Word address n
(6) Write data n

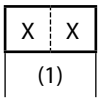
● Response message

If data is written, a termination code indicating success (two decimal digits) is returned. If only part of the data is written, a termination code indicating warning (two decimal digits) is returned. If none of the data is written, a termination code indicating error (two decimal digits) is returned.

- Normal termination



- Abnormal termination or warning



A termination code indicating an error is entered in place of XX.
☞ 7-6 List of Termination Codes (p. 7-15) (for details about termination codes)

(1) Termination code

● Maximum write data count per message

64 words

7 - 4 Definition of Word Addresses

■ RAM and EEPROM areas of data addresses

Word addresses are categorized as follows:

Word address (Hexadecimal)	Name	Notes
273W to 15935W (0111 to 3E3F)	RAM access word address	Reading and writing of these addresses are both performed on RAM. Since writing is not performed to EEPROM, the value returns to that stored in EEPROM when the power is turned off and back on.
16657W to 32319W (4111 to 7E3F)	EEPROM access word address	Writing is performed to both RAM and EEPROM, but reading is performed only on RAM. Since writing is also performed to EEPROM, the value does not change even when the power is turned off and back on.

[!] Handling Precautions:

- The number of EEPROM erase/write cycles is limited (about 100,000 cycles). Accordingly, it is recommended that very frequently written parameters be written to RAM, which does not have a limitation on cycles. Note, however, that the data written to the RAM area is overwritten with the EEPROM area data when the power is turned on.

■ Write data range

If the value to be written is outside the range specified for the parameter, the value is not written and a termination code indicating error is returned.

■ Write conditions

A termination code indicating an error is also returned if the conditions for writing are not satisfied.

7 - 5 Numerical Representation in the Application Layer

The specifications of numerical representation are decimal variable-length (zero suppress) for RS and WS commands and hexadecimal fixed-length for RD, WD, RU and WU commands. Details are as follows:

■ RS and WS commands

Item	Specifications	Error handling
Unnecessary space	Cannot be appended.	The message processing is aborted and a termination code indicating error is returned in a response message.
Unnecessary zero	Cannot be appended.	
Numerical value = zero	Cannot be omitted. Be sure to use "0."	
Other unnecessary characters	Numerical values may be prefixed with a "–" expressing a negative number. Any other characters cannot be appended. The "+" sign must not be appended to indicate positive numerical values.	
Range of available numerical values	–32768 to +32767 Values outside this range are not allowed.	

■ RD, WD, RU, and WU commands

Item	Specifications	Error handling
Unnecessary space	Cannot be appended.	The message processing is aborted and a termination code indicating error is returned in a response message.
Unnecessary zero	Cannot be appended.	
Numerical value = zero	Cannot be omitted. Be sure to use "0000."	
Other unnecessary characters	Cannot be appended.	
Range of available numerical values	0000H to FFFFH	

7 - 6 List of Termination Codes

If an error occurred in the application layer, a termination code indicating error is returned in a response message.

Termination code	Description	Process	Example
00	Normal termination	All the processing has completed successfully.	
99	Undefined command Other errors	Only the termination code is returned. The message is not processed.	AA,1001W,1 RX03E80001
10	Numerical value conversion error • A numerical value of 7 digits or more • A figure other than 0 of which the leading digit is 0 • The conversion result is 65535 or greater, or -65536 or smaller. • Other obvious illegal representation of an integer	Processing is aborted when a conversion error or a range error has occurred. (Processing is performed until just before the abnormality occurs)	RS,1001W,100000 RS,01001W,1 RS,+1001W,1 WS,10?1W,1 RD03E9000> RU0103E9
22	The value of read data is outside the specified range. • The decimal point position is changed and the value becomes −32769 or smaller, or 32768 or larger.	The high limit or low limit value is read from the corresponding word address, and the subsequent processing continues.	
	The value of written data is outside the specified range.	Processing is continued excluding the relevant word address.	(Example: Specified range for 5001W is 0 to 1) (Processing aborted) WS,5001W,3000 WD13890BB8 WU0013890BB8
23	Writing disabled due to instrument set value conditions, instrument external conditions, etc.	Processing is continued excluding the relevant word address.	
	Writing/reading disabled because communications/loader locked	Only the termination code is returned. The message is not processed.	
40	Read/write word count error	Only the termination code is returned. The message is not processed.	RS,1001W,100 RD03E90064
41	Word address out of the range • Out of the range between 256 and 65534	Only the termination code is returned. The message is not processed.	RS,100000W,1 RD03G90001 RU00$3E903EA WS,03E9W,1 WD0XXX0001 WU00o3E90001
42	The value of written data is outside the specified range. • −32769 or smaller, or 32768 or greater	Processing is performed up to the relevant word address. The succeeding processing is not performed.	WS,2101W,100,XXX WS,2101W,100000 WD03E900010XXX

Termination code	Description	Process	Example
83	Any of the following alarms has occurred: • AL74: Nonvolatile memory error • AL80: Nonvolatile memory not initialized • AL81: Setting value area error • AL82: Adjustment value area error • AL83: Internal system error • AL84: Setting value initialization error • AL95: Setting value error • AL96: Adjustment value error	Only the termination code is returned. The message is not processed.	

7 - 7 Reception and Transmission Timing

■ Time specifications for instruction and response messages

The cautions below are required with regard to the timing of command message transmission from the master station and response message transmission from the slave station (this device).

● Response monitoring time

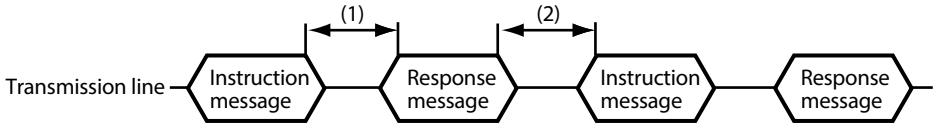
The maximum response time from the end of the instruction message transmission by the master station until when the master station receives a response message from this device is two seconds ((1) in the figure below).

So, the response monitoring time should be set to two seconds.

Generally, when a response time-out occurs, the instruction message is resent.

● Transmission start time

A wait time of 10ms is required before the master station starts to transmit the next instruction message (to the same slave station or a different slave station) after the end of receiving response message ((2) in the figure below).

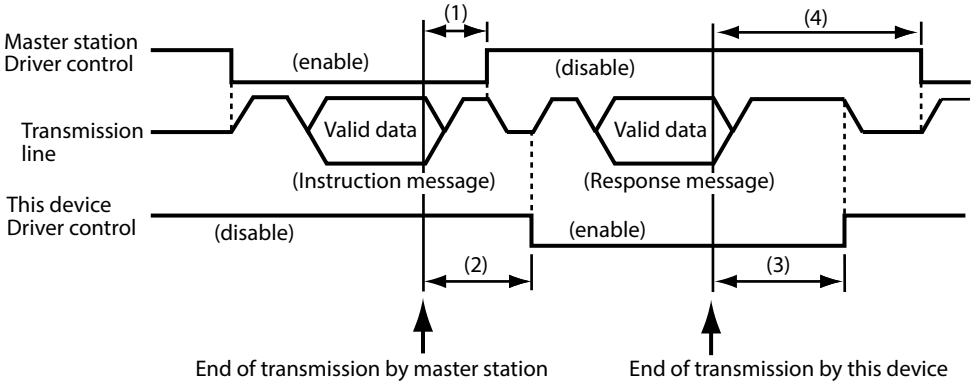


(1) End of transmission by master station – Transmission start time of this device = 2000 ms max.

(2) End of transmission by this device – Transmission start time of master station = 10 ms min.

■ RS-485 driver control timing specifications

When the transmission/reception on the RS-485 3-wire system is directly controlled by the master station, care should be paid to the following timing:



(1) End of transmission by master station – Driver disable time = 500 µs max.

(2) End of reception by this device – Driver enable time = Response time-out setting (C70) or longer

(3) End of transmission by this device – Driver disable time = 10 ms max.

(4) End of reception by master station – Driver enable time = 10 ms min.

7 - 8 Precautions for Creating Communication Programs for the Master Station

Keep the following points in mind when creating a communication program.

- This device takes a maximum of two seconds before it sends a response. Therefore, specify the response monitoring time to two seconds.
- Resend the message if there is no response within two seconds. Set a communications error to occur if there is no response even after two retries.
- Be sure to resend as described above, because sometimes a message is not transmitted correctly for some reason such as electrical noise during communication.

Note

- If "X" and "x" device ID codes are alternated when a message is resent by the master station, it will be easy to identify whether the received message is a response to the previous instruction or to the current one.

■ Communication program example

A sample program is installed in the folder in which Smart Loader Package SLP-C1F has been installed.

In the default setting, the directory is C:\Program Files(x86)\SLP\SLPC1\Samples\cpl.cpp.

This program is written in C++.

The sample program is for your reference only, and there is no guarantee that all functions will work properly.

Handling Precautions:

- Azbil Corporation will not be liable for any loss or damage caused by applying this sample program.

● Before executing the sample program

Check the settings for communication type, station address, transmission speed and data format of the instrument.

● Compiling

The following is an example of compiling with Visual Studio 2019.

After launching x86 Native Tools Command Prompt for VS 2019 from the start menu, compile using the cl command.

Example of execution results

```
C:\Sample>cl cpl.cpp
Microsoft(R) C/C++ Optimizing Compiler Version 19.29.30133 for x86
Copyright (C) Microsoft Corporation.  All rights reserved.

cpl.cpp
Microsoft (R) Incremental Linker Version 14.29.30133.0
Copyright (C) Microsoft Corporation.  All rights reserved.

/out:cpl.exe
cpl.obj
```

● Running the sample program

This program reads and writes data using COM port 1. When executed, the application layers of the instruction and response messages communicated are displayed.

```
command:RS,14356W,2
result:00,0,0
command:WS,14357W,2
result:00
```

Example of execution results

● Processing of the sample program

- Setup for communication
  Call open () and initialize the RS-232C port.
- Executing commands
  Set a desired character string in “command” and call AppCPL().

-MEMO-

Chapter 8. Modbus Communication Function

8 - 1 Overview of Communications

If a model with RS-485 communication is used, this device can communicate with a PC, PLC or other host device using a program created by the user.

CPL (Controller Peripheral Link: Azbil Corporation's host communication protocol) or MODBUS can be selected as the communication protocol. This chapter describes MODBUS communications.

■ Features

Key features of the C1M's communication functions are as follows:

- Up to 31 C1M units can be connected to a single master station (host device).
- Almost all of the parameter data of this device can be communicated.
  ☞ Chapter 10. List of Communication Data

[!] Handling Precautions:

- In MODBUS communications, the data address of this device that is set in the host device may be reduced by 1 in a communication message during transmission. Be sure to understand the specifications of the host device before using this device.
  Example: If the data address is set to 1001 in the host device, it will be 1000 in a communication message during transmission.

■ Configuration

The settings shown below must be specified for Modbus communication.

Item	Display	Description	Initial value	User level
Communication type	C 64	0: CPL 1: Modbus/ASCII 2: Modbus/RTU 3: PLC link	0	Simple, standard, advanced
Station address	C 65	0: No communication 1 to 127	0	
Transmission speed	C 66	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	2	
Data format (data length)	C 67	0: 7 bits 1: 8 bits	1	
Data format (parity)	C 68	0: Even parity 1: Odd parity 2: No parity	0	
Data format (stop bit)	C 69	0: 1 bit 1: 2 bits	0	
Communication minimum response time	C 70	1 to 250 ms	3	Advanced

- These items can be displayed and configured if a model with RS-485 communication is used.
- When the communication type is set to MODBUS/RTU, the operation is fixed to 8-bit data regardless of the data format (data length) setting.

Handling Precautions:

- The settings can be configured using the keys on this device or using Smart Loader Package model SLP-C1F. RS-485 communications cannot be used for configuration.

■ Communication procedure

The communication procedure is as follows.

(1) The host device (master station) sends an instruction message to one C1M unit (slave station).

(2) The slave station receives the instruction message and performs read or write processing according to the content of the message.

(3) The slave station sends a response message appropriate for the type of processing.

(4) The master station receives the response message.

Handling Precautions:

- Sending data using several protocols intermixed (CPL, Modbus/ASCII, Modbus/RTU, PLC link) to the same RS-485 transmission line is not allowed.

8 - 2 Message Structure

■ Message Structure

The following shows the message structure.

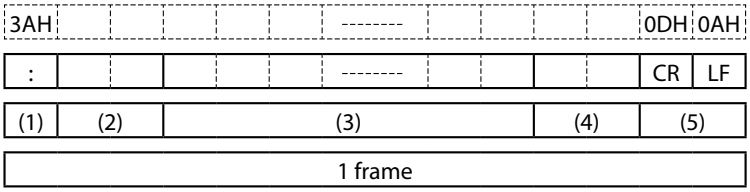
All messages are expressed in hexadecimal.

● Modbus/ASCII

All messages are written in hexadecimal ASCII codes (each slot below represents one character).

A MODBUS/ASCII message consists of (1) to (5) below.

The command (details sent from the master station) and the response (details returned from the slave station) are stored in (3).



(1) Start of message (colon, expressed with ASCII code 3AH)

(2) Station address (2 bytes)

(3) Instruction message, response message

(4) Checksum (LRC) (2 bytes)

(5) Delimiter (end of message)

- Colon (3AH)

  When a colon (3AH) is received, this device interprets it as the start of a command message.

  No matter what has been received previously, upon receiving a colon, this device begins processing a new message.

  In this way, if an instruction message contains an error due to electromagnetic noise, etc., this device can respond to the next proper message (a resent message, etc.) from the master station.

- Station address

  This device creates a response message only to instruction messages that mention its station address. A station address is expressed as a 2-digit hexadecimal character code in a message.

  This device returns a response message that includes its own station address.

  The station address can be specified by C65 (station address). Note that, if the station address is set to 0 (30H 30H), this device does not respond even if the station addresses match.

- Checksum (LRC)

  This value is for checking whether something abnormal (e.g., electromagnetic noise) has caused the message content to change during transmission. The checksum is expressed as a 2-digit hexadecimal character code. The procedure for calculating the checksum is as follows.

  (1) Add from the start of the station address to immediately before the checksum. Note that the values to be added are not the ASCII character values in the instruction message but the one-byte binary data converted from two ASCII characters.

  (2) Take the two's complement of the sum.

  (3) Convert the low-order one byte of the sum to a 2-digit hexadecimal character code.

  The following is a sample checksum calculation:

  Sample message

  : : 3AH (start of the message)
  0: 30H (1st byte of the station address)
  A: 41H (2nd byte of the station address)
  0: 30H (1st byte of the read command)
  3: 33H (2nd byte of the read command)
  0: 30H (1st byte of the starting word address)
  3: 33H (2nd byte of the starting word address)
  E: 45H (3rd byte of the starting word address)
  9: 39H (4th byte of the starting word address)
  0: 30H (1st byte of the read count)
  0: 30H (2nd byte of the read count)
  0: 30H (3rd byte of the read count)
  2: 32H (4th byte of the read count)

  (1) Add from the start of the station address to immediately before the checksum. The addition calculation is as follows:
  0AH + 03H + 03H + E9H + 00H + 02H
  The result is FBH.

  (2) The low-order byte of FBH is FBH. It remains unchanged. The two's complement of FBH is 05H.

  (3) Convert the obtained 05H to a two-byte ASCII code.
  The result is:

  0 : 30H
  5 : 35H

  The two bytes, 0 (30H) and 5 (35H), are the checksum.

- Delimiter (CR/LF)

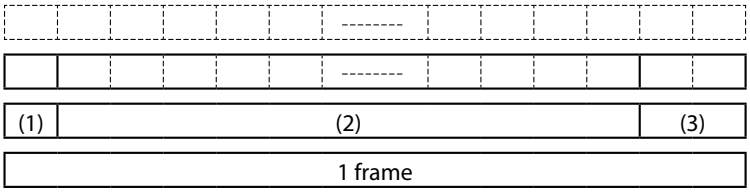
  This indicates the end of the message. Immediately after LF is received, the device enters a state allowed to process the received message.

● Modbus/RTU

All messages use binary data (each slot below represents one byte).

A Modbus RTU message consists of (1) to (3) below.

The command (details sent from the master station) and the response (details returned from the slave station) are stored in (2).



(1) Station address (1 byte)

(2) Instruction message, response message

(3) Checksum (2 bytes)

- Station address

  This device creates a response message only to instruction messages that mention its station address. A station address is expressed in one byte in a message.

  This device returns a response message that includes its own station address.

  The station address can be specified by C65 (station address). Note that, if the station address is set to 0, this device does not respond even if the station addresses match.

- Checksum (CRC)

  This value is for checking whether something abnormal (e.g., electromagnetic noise) has caused the message content to change during transmission. The check sum is expressed in two bytes.

The procedure for calculating the checksum (CRC) is as follows.

```
/* CRC calculation */
/* Input   unsigned char length:        Number of bytes sent */
/*         unsigned char * top:         Sent data start pointer */
/* Output unsigned short CRC:           CRC calculation result */
unsigned short crc16 (unsigned char length, unsigned char *top)
{
        unsigned short CRC= 0xffff;
        unsigned short next;
        unsigned short carry;
        unsigned short n;
        unsigned char  crcl;

        while ( length-- ) {
                next = (unsigned short)*top;
                CRC ^= next;
                for (n = 0; n < 8; n++) {
                        carry = CRC & 1;
                        CRC >>= 1;
                        if (carry) {
                                CRC ^= 0xA001;
                        }
                }
                top++;
        }

        crcl = (CRC & 0xff00)>>8;
        CRC <<= 8;
        CRC |= crcl;

        return CRC;
}
```

- Determining the end of one frame

  The message end (end of 1 frame) is determined when the period of time during which no character is received exceeds the time specified for the transmission speed. If the next character is not received by the timeout time shown below, the frame is determined to have ended.

  Note that the timeout time has a fluctuation of ±1 ms.

Set transmission speed (bps)	Timeout time
4800	9 ms or more
9600	5 ms or more
19200	3 ms or more
38400	2 ms or more

■ Command types

Command (send message) types supported by this device are as follows.

Command type	Description		Conformance class
	ASCII	RTU	
Read multiple data records	03 (2 bytes)	03H (1 byte)	0
Write multiple data records	10 (2 bytes)	10H (1 byte)	0
Write 1 data record	06 (2 bytes)	06H (1 byte)	1*

* This device does not support class 1 commands other than the writing of one data record.

■ Number of data records

The number of data records that can be read or written using a one-frame message is shown below.

Command type (function code)	Description	
	ASCII	RTU
Read command	1 to 64	1 to 64
Write command	1 to 64	1 to 64
1 data record write command	1	1

■ Other specifications

If there is an error in a response message, one of the exception codes shown below is added after the function code.

Error type	Exception code		Description
	ASCII	RTU	
Illegal function code	01 (2 bytes)	01H (1 byte)	Function code not supported by this device The value is outside the specified range from −32767 to +32768.
Illegal data address	02 (2 bytes)	02H (1 byte)	An included data address cannot be read or written.
Device failure	04 (2 bytes)	04H (1 byte)	Any of the following alarms has occurred: · AL74: Nonvolatile memory error · AL80: Nonvolatile memory not initialized · AL81: Setting value area error · AL82: Adjustment value area error · AL83: Internal system error · AL84: Setting value initialization error · AL95: Setting value error · AL96: Adjustment value error
Illegal data	03 (2 bytes)	03H (1 byte)	Error other than the above

8 - 3 Description of Commands

■ Read command (03H)

● Instruction message

This is a command—in one message—to read data from consecutive word addresses starting from the specified address. The following is a sample "read" instruction message.

Modbus/ASCII

3AH	30H	41H	30H	33H	30H	33H	45H	39H	30H	30H	30H	32H	30H	35H	0DH	0AH
:	0	A	0	3	0	3	E	9	0	0	0	2	0	5	CR	LF
(1)	(2)		(3)		(4)				(5)				(6)		(7)	

(1) Start of the message
(2) Station address
(3) Read command (03H)
(4) Starting word address
(5) Read data count
(6) Checksum (LRC)
(7) Delimiter

Modbus/RTU

0AH	03H	03H	E9H	00H	02 h	14H	C0H
(1)	(2)	(3)		(4)		(5)	

(1) Station address
(2) Read command (03H)
(3) Starting word address
(4) Read data count
(5) Checksum (CRC)

● Response message

If an instruction message is received successfully, a response message appropriate for the command is returned.

The following is a sample response message for a read command.

Modbus/ASCII

- Normal termination

3AH	30H	41H	30H	33H	30H	34H	30H	33H	30H	31H	30H	30H	30H	33H	45H	38H	0DH	0AH
:	0	A	0	3	0	4	0	3	0	1	0	0	0	3	E	8	CR	LF
(1)	(2)		(3)		(4)		(5)				(6)				(7)		(8)	

(1) Start of the message
(2) Station address
(3) Read command (03H)
(4) Read data count × 2
(5) Read data 1
(6) Read data 2
(7) Checksum (LRC)
(8) Delimiter

- Abnormal termination

3AH	30H	41H	38H	34H	30H	31H	37H	31H	0DH	0AH
:	0	A	8	4	0	1	7	1	CR	LF
(1)	(2)		(3)		(4)		(5)		(6)	

(1) Start of the message
(2) Station address
(3) Error flag (Since undefined "04" was sent as a command with an instruction message, the most significant bit was turned ON and "84" was returned.)
(4) Termination code indicating error (☞ Page 8-8)
(5) Checksum (LRC)
(6) Delimiter

Modbus/RTU

- Normal example

0AH	03H	04H	03H	01H	00H	03H	51H	76H
(1)	(2)	(3)	(4)		(5)		(6)	

(1) Station address
(2) Read command (03H)
(3) Read data count × 2 (bytes)
(4) Read data 1
(5) Read data 2
(6) Checksum (CRC)

- Abnormal termination

0AH	84H	01H	F3H	02 h
(1)	(2)	(3)	(4)	

(1) Station address
(2) Error flag (Since undefined "04H" was sent as a command with an instruction message, the most significant bit was turned ON and "84H" was returned.)
(3) Termination code indicating error (☞ Page 8-8)
(4) Checksum (CRC)

■ Write command (10H)

● Instruction message

This is a command—in one message—to write data to consecutive word addresses starting from the specified address. The following is a sample "write" instruction message.

Example: 01A0H and 0E53H are written to two consecutive word addresses starting from 1501W (05DDH).

Modbus/ASCII

3AH	30H	31H	31H	30H	30H	35H	44H	44H	30H	30H	30H	32H	30H	34H	30H	31H	41H	30H	30H	45H	35H	33H	30H	35H	0DH	0AH
:	0	1	1	0	0	5	D	D	0	0	0	2	0	4	0	1	A	0	0	E	5	3	0	5	CR	LF
(1)	(2)		(3)		(4)				(5)				(6)		(7)				(8)				(9)		(10)	

(1) Start of the message
(2) Station address
(3) Write command (10H)
(4) Starting word address
(5) Write data count
(6) Write data count ×2
(7) Write data 1
(8) Write data 2
(9) Checksum (LRC)
(10) Delimiter

Modbus/RTU

01H	10H	05H	DDH	00H	02 h	04H	01H	A0H	0EH	53H	45H	B9H
(1)	(2)	(3)		(4)		(5)	(6)		7		(8)	

(1) Station address
(2) Write command (10H)
(3) Starting word address
(4) Write data count
(5) Write data count ×2
(6) Write data 1
(7) Write data 2
(8) Checksum (CRC)

● Response message

If an instruction message is received successfully, a response message appropriate for the command is returned.

The following is a sample response message for a write command.

Modbus/ASCII

3AH	30H	31H	31H	30H	30H	35H	44H	44H	30H	30H	30H	32H	30H	42H	0DH	0AH
:	0	1	1	0	0	5	D	D	0	0	0	2	0	B	CR	LF
(1)	(2)		(3)		(4)				(5)				(6)		(7)	

(1) Start of the message
(2) Station address
(3) Write command (10H)
(4) Starting word address
(5) Write data count
(6) Checksum (LRC)
(7) Delimiter

Modbus/RTU

01H	10H	05H	DDH	00H	02 h	D1H	3EH
(1)	(2)	(3)		(4)		(5)	

(1) Station address
(2) Write command (10H)
(3) Write starting word address
(4) Write data count
(5) Checksum (CRC)

Note

- The format of a response message for abnormal termination is the same as that of the read command.

■ One data record write command (06H)

● Instruction message

This is a command to write one data record to the specified address. The following is a sample write instruction message.

Example: 01A0H is written to word address 1501W (05DDH).

Modbus/ASCII

3AH	30H	31H	30H	36H	30H	35H	44H	44H	30H	31H	41H	30H	37H	36H	0DH	0AH
:	0	1	0	6	0	5	D	D	0	1	A	0	7	6	CR	LF
(1)	(2)		(3)		(4)				(5)				(6)		(7)	

(1) Start of the message
(2) Station address
(3) Write command (06H)
(4) Word address
(5) Write data
(6) Checksum (LRC)
(7) Delimiter

Modbus/RTU

01H	06H	05H	DDH	01H	A0H	18H	D4H
(1)	(2)	(3)		(4)		(5)	

(1) Station address
(2) Write command (06H)
(3) Word address
(4) Write data
(5) Checksum (CRC)

● Response message

The format of a response message for normal termination is the same as that of the instruction message.

Note

- The format of a response message for abnormal termination is the same as that of the read command.

8-4 Specifications Common with CPL Communication Function

■ Definition of word addresses

☞ 7-4 Definition of Word Addresses (p. 7-13)

■ Numerical representation

The specifications of numerical representation are the same as the following:

☞ 7-5 Numerical Representation in the Application Layer
RD, WD, RU, and WU commands (p. 7-14)

■ Specifications of RS-485 driver control timing

☞ 7-7 Reception and Transmission Timing (p. 7-17)

Chapter 9. PLC Link Communication Function

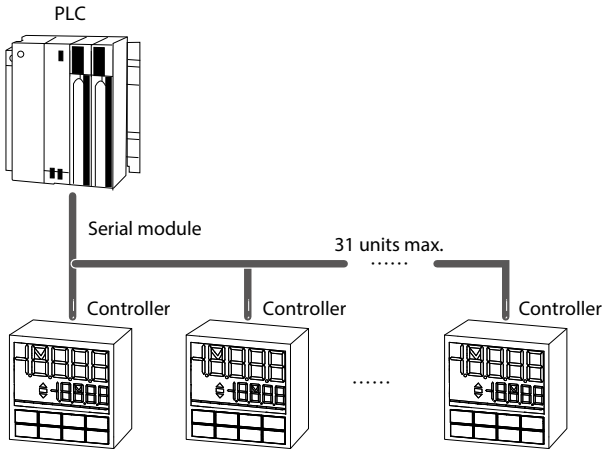
9 - 1 Overview

If a model with RS-485 communication is selected, this controller can directly communicate with a PLC using the PLC link communication function.

With this function, data retained by a PLC can be written to this controller and vice versa.

If conditions such as the communication protocol and communication speed are the same, the C1M, C1A, C2 and C3 can use the PLC link communication function at the same time.

■ Sample connection



■ Supported PLC protocol

- Mitsubishi Electric QnA-compatible 3C frame format 4
- Omron FINS
- Keyence Modbus/RTU
- Siemens Modbus/RTU
- General-purpose Modbus/RTU

■ Supported PLCs (typical models)

- Mitsubishi Electric

  MELSEC iQ-R/L series (Mitsubishi Electric QnA-compatible 3C format 4 protocol)
  MELSEC iQ-F series (Mitsubishi Electric QnA-compatible 3C format 4 protocol)
  MELSEC Q series (Mitsubishi Electric QnA-compatible 3C format 4 protocol)
- Omron

  CS/CJ/CP series (FINS protocol)

  NJ/NX series (FINS protocol)
- Keyence

  KV Nano series (Modbus/RTU protocol)
- Siemens

  S7-1200 series (Modbus/RTU protocol)
- Modbus/RTU device

  General-purpose Modbus/RTU device (Modbus/RTU protocol)

■ Specifications

- Number of connected PLCs = 1
- Number of connected single loop controllers = 31 max.
- Communication data count: 64 (PLC →), 64 (→ PLC)

■ Precautions for the PLC link communication function

- When the PLC link communication function is used, RS-485 communication with the host device cannot be used.
- When using the PLC link communication function, set [Data format (data length)] to 1 (8 bits).
- Do not connect anything other than single loop controllers and one PLC to the RS-485 communication line.
- Specify the station address of single loop controllers in a range of 1 to the maximum number of connected controllers. The maximum number of connected controllers can be selected from 8 (default), 16, 24, and 31. Use the same settings for all stations in the same network.
- The PLC and single loop controllers must have unique station addresses.
- Do not use 255 or 254 as the station address of the PLC.
- New settings will apply after the power is turned off and back on. If you have changed the settings, turn the power off and back on.
- Use the required number of consecutive registers on the PLC.
- Different protocols cannot be used at the same time.
- If the single loop controllers on the RS-485 communication line are powered by different power supplies, turn on the power supply connected to the controller with the lowest station address first.
- When connecting to the MELSEC iQ-F series, set the MELSEC to format 4 (X,Y octal).

9 - 2 Data Transmission

PLC link communication is a function for transferring data between the PLC and this controller. There are two transfer types: “Cyclic data transfer” and “Triggered data transfer.”

The type of transfer can be set in the PLC link settings of the SLP-C1F Smart Loader Package.

The upper limits for the number of transfer processes and number of sheets are shown below.

Function	Maximum No. of sheets	Maximum No. of processes in 1 sheet	Total maximum No. of sheets for the function	Total maximum No. of processes for the function
Cyclic data transfer	4 sheets	64 lines	4 sheets	64 lines
Triggered data transfer	4 sheets	64 lines		

! Handling Precautions

- Triggered data transfer is available for ROM version 1.02 or later.

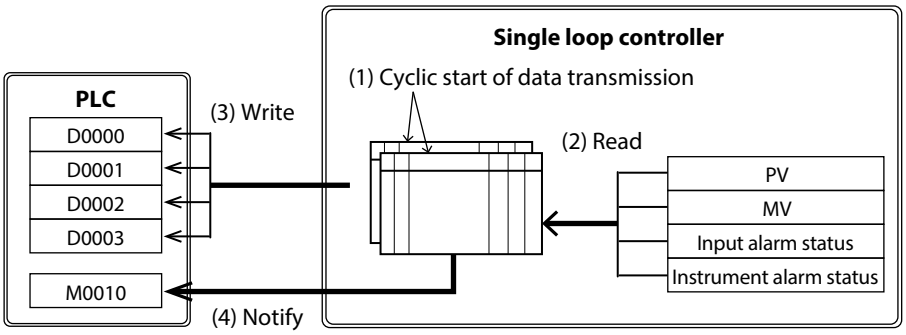
● Cyclic data transfer

Data from the controller can be transferred to the PLC periodically. Data can also be transferred from the host device to the controller.

Major applications:

- Saving controller data to the PLC
- Monitoring controller data by the PLC for device management

The controller transfers data periodically as follows.



(1) The controller starts cyclic data transfer according to the configuration sheets.

(2) Data is read from the controller.

(3) The read data is written to the PLC.

(4) When transfer of the data specified for the sheet is complete, a completion notification is written.

! Handling Precautions

- RAM addresses and nonvolatile memory addresses are available for the data written from the PLC to this controller.
  ☞ Chapter 10. List of Communication Data (for details)

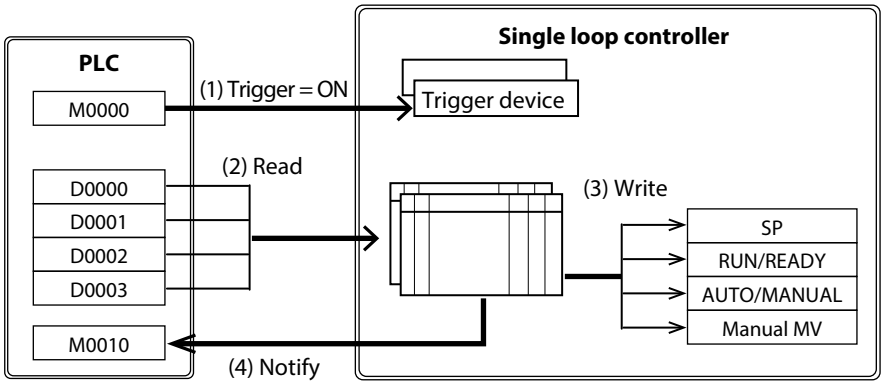
● Triggered data transfer

Data from the controller is transferred to the PLC when the trigger device is detected turning from OFF to ON. Data can also be transferred from the PLC to the controller.

Major applications:

- Changing the controller settings (SP, PID, etc.) from the PLC
- Changing the controller operations (RUN/READY mode selection, etc.) from the PLC

The controller executes triggered data transfer as follows.



(1) The controller reads the trigger device in order to monitor the trigger device turning from OFF to ON. When the trigger device is turned on, triggered data transfer starts.

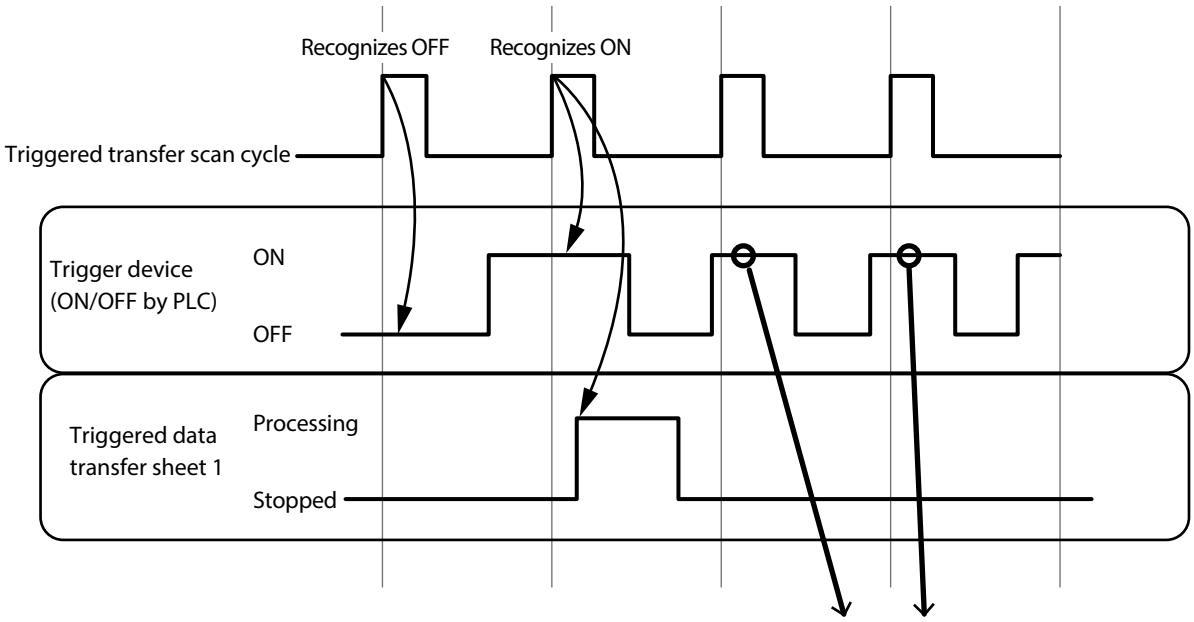
(2) Data is read from the PLC.

(3) The read data is written to the controller.

(4) When transfer of the data specified for the sheet is complete, a completion notification is written.

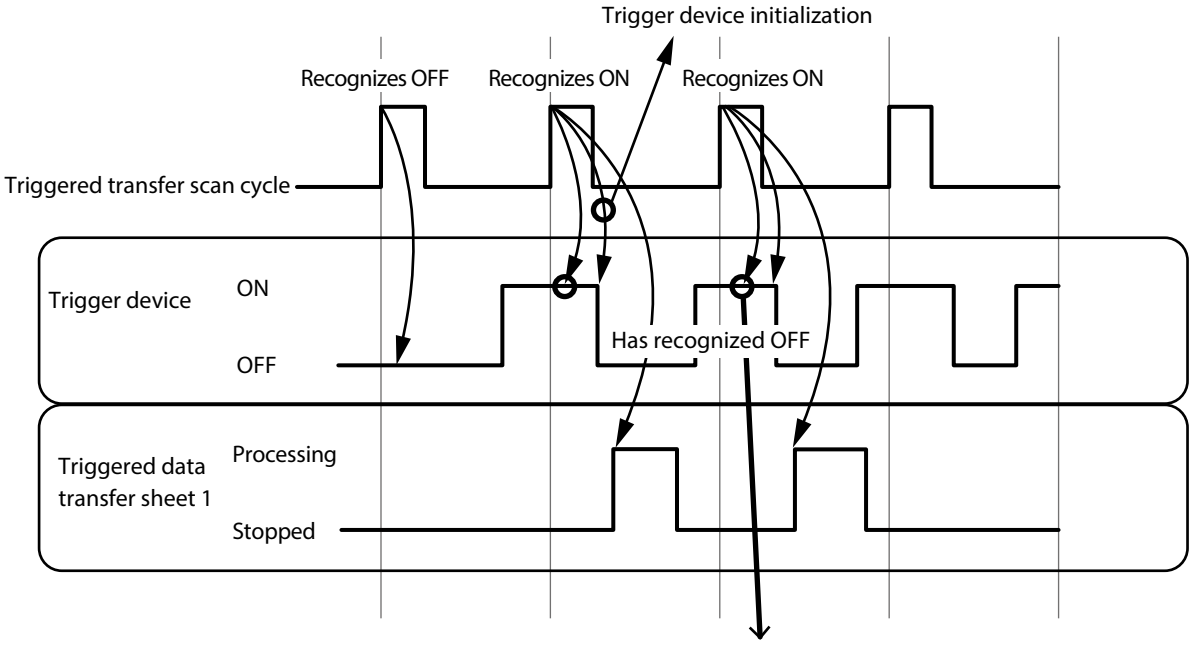
The triggered transfer scan cycle and triggered data transfer operations are as follows.

Data transfer is started for all sheets for which trigger device = ON is detected.



"Trigger ON" cannot be detected if the trigger device is turned on and off by PLC on a cycle shorter than the scan cycle.

- If a device of the PLC is set for [Trigger device/Live notification device] and if the [Trigger device initialization] setting is 1 (enabled), this controller turns off the trigger device immediately after detecting a trigger. In this case, since this controller has recognized that the trigger device is OFF, in a subsequent scan when it recognizes that the trigger device is ON, it will detect triggers.
- If a device of this controller is set for [Trigger device/Live notification device], even if the [Trigger device initialization] setting is 1 (enabled), this controller will not turn off the trigger device immediately after detecting a trigger. However, it will detect triggers continuously as long as the trigger device remains ON.



■ Usable devices

The address ranges of the devices (data) usable with each model are as follows.

● Single loop controller (this controller)

Various monitoring data and parameters can be selected in the PLC link settings in the SLP-C1F Smart Loader Package. Frequently used data and addresses can be entered directly.

See the following table for the addresses of frequently used data.

Name	R/W	Address	
		Decimal	Hex
Representative alarm	R/-	14336	3800
DO state	R/-	14337	3801
DI state	R/-	14338	3802
Loop PV	R/-	14356	3814
Loop SP	R/-	14357	3815
MV	R/-	14358	3816
CT1 current when output ON	R/-	14418	3852
CT2 current when output ON	R/-	14419	3853
Heat MV	R/-	14420	3854
Cool MV	R/-	14421	3855
LSP group selection	R/W	14592	3900
LSP in use	R/W	14593	3901
Manual MV	R/W	14594	3902
RUN/READY	R/W	14595	3903
AUTO/MANUAL	R/W	14596	3904
AT stop/start selection	R/W	14597	3905
P(Proportional Band) in use	R/W	14848	3A00
I(Integral time) in use	R/W	14849	3A01
D(Derivative time) in use	R/W	14850	3A02
Manual Reset in use	R/W	14851	3A03
Output low limit in use	R/W	14852	3A04
Output high limit in use	R/W	14853	3A05
P(Proportional Band)(Cool) in use	R/W	14854	3A06
I(Integral time)(Cool) in use	R/W	14855	3A07
D(Derivative time)(Cool) in use	R/W	14856	3A08
Output low limit(Cool) in use	R/W	14858	3A0A
Output high limit(Cool) in use	R/W	14859	3A0B

R/- The data can be read from this controller and written to the PLC.

R/W The data can be read from this controller and written to the PLC and vice versa.

● Mitsubishi Electric MELSEC iQ-R/F series (Mitsubishi Electric QnA-compatible 3C format 4 protocol)

Device type	Address range		
Input relay	X000000	to	X7FFFFF
Output relay	Y000000	to	Y7FFFFF
Internal relay	M000000	to	M999999
Special relay	SM00000	to	SM99999
Link special relay	SB00000	to	SB7FFFF
Edge relay	V000000	to	V999999
Latch relay	L000000	to	L999999
Link relay	B000000	to	B7FFFFF
Annunciator	F000000	to	F999999
Timer (contact)	TS00000	to	TS99999
Timer (coil)	TC00000	to	TC99999
Retentive timer (contact)	SS00000	to	SS99999
Retentive timer (coil)	SC00000	to	SC99999
Counter (contact)	CS00000	to	CS99999
Counter (coil)	CC00000	to	CC99999
Data register	D000000	to	D999999
Link register	W000000	to	W7FFFFF
Index register	Z000000	to	Z999999
File register (R)	R000000	to	R999999
File register (ZR)	ZR00000	to	ZR99999
Special register	SD00000	to	SD99999
Link special register	SW00000	to	SW7FFFF
Timer current value	TN00000	to	TN99999
Retentive timer current value	SN00000	to	SN99999
Counter current value	CN00000	to	CN99999

Note: The range of available addresses varies depending on the specifications and settings of the CPU unit.

● Mitsubishi Electric MELSEC iQ-F series (Mitsubishi Electric QnA-compatible 3C format 4 protocol)

Device type	Address range		
Input relay	X000000	to	X777777
Output relay	Y000000	to	Y777777
Internal relay	M000000	to	M999999
Special relay	SM00000	to	SM99999
Link special relay	SB00000	to	SB7FFFF
Latch relay	L000000	to	L999999
Link relay	B000000	to	B7FFFFF
Annunciator	F000000	to	F999999
Timer (contact)	TS00000	to	TS99999
Timer (coil)	TC00000	to	TC99999
Retentive timer (contact)	SS00000	to	SS99999
Retentive timer (coil)	SC00000	to	SC99999
Counter (contact)	CS00000	to	CS99999
Counter (coil)	CC00000	to	CC99999
Data register	D000000	to	D999999
Link register	W000000	to	W7FFFFF
Index register	Z000000	to	Z999999
File register (R)	R000000	to	R999999
Special register	SD00000	to	SD99999
Link special register	SW00000	to	SW7FFFF
Timer current value	TN00000	to	TN99999
Retentive timer current value	SN00000	to	SN99999
Counter current value	CN00000	to	CN99999

Note: The range of available addresses varies depending on the specifications and settings of the CPU unit.

● Mitsubishi Electric MELSEC Q series (Mitsubishi QnA-compatible 3C format 4 protocol)

Device type	Address range		
Input relay	X000000	to	X7FFFFF
Output relay	Y000000	to	Y7FFFFF
Internal relay	M000000	to	M999999
Special relay	SM00000	to	SM99999
Link special relay	SB00000	to	SB7FFFF
Edge relay	V000000	to	V999999
Latch relay	L000000	to	L999999
Link relay	B000000	to	B7FFFFF
Annunciator	F000000	to	F999999
Timer (contact)	TS00000	to	TS99999
Timer (coil)	TC00000	to	TC99999
Retentive timer (contact)	SS00000	to	SS99999
Retentive timer (coil)	SC00000	to	SC99999
Counter (contact)	CS00000	to	CS99999
Counter (coil)	CC00000	to	CC99999
Data register	D000000	to	D999999
Link register	W000000	to	W7FFFFF
Index register	Z000000	to	Z999999
File register (R)	R000000	to	R999999
File register (ZR)	ZR00000	to	ZR7FFFF
Special register	SD00000	to	SD99999
Link special register	SW00000	to	SW7FFFF
Timer current value	TN00000	to	TN99999
Retentive timer current value	SN00000	to	SN99999
Counter current value	CN00000	to	CN99999

Note: The range of available addresses varies depending on the specifications and settings of the CPU unit.

● **Omron CS/CJ/CP series (Omron FINS protocol)**

● **Omron NJ/NX series (Omron FINS protocol)**

Device type	Address range		
Channel I/O bit	0000.00	to	6143.15
Internal auxiliary relay bit	W0000.00	to	W0511.15
Retaining relay bit	H0000.00	to	H1535.15
Special auxiliary relay bit	A0000.00	to	A1471.15
Timer (up flag)	T00000	to	T04095
Counter (up flag)	C00000	to	C04095
Channel I/O	00000	to	06143
Timer (current value)	TN00000	to	TN04095
Counter (current value)	CN00000	to	CN04095
Data memory	D00000	to	D32767
Extended data memory bank 0	E0_00000	to	E0_32767
Extended data memory bank 1	E1_00000	to	E1_32767
Extended data memory bank 2	E2_00000	to	E2_32767
Extended data memory bank 3	E3_00000	to	E3_32767
Extended data memory bank 4	E4_00000	to	E4_32767
Extended data memory bank 5	E5_00000	to	E5_32767
Extended data memory bank 6	E6_00000	to	E6_32767
Extended data memory bank 7	E7_00000	to	E7_32767
Extended data memory bank 8	E8_00000	to	E8_32767
Extended data memory bank 9	E9_00000	to	E9_32767
Extended data memory bank A	EA_00000	to	EA_32767
Extended data memory bank B	EB_00000	to	EB_32767
Extended data memory bank C	EC_00000	to	EC_32767
Extended data memory bank D	ED_00000	to	ED_32767
Extended data memory bank E	EE_00000	to	EE_32767
Extended data memory bank F	EF_00000	to	EF_32767
Extended data memory bank 10	E10_00000	to	E10_32767
Extended data memory bank 11	E11_00000	to	E11_32767
Extended data memory bank 12	E12_00000	to	E12_32767
Extended data memory bank 13	E13_00000	to	E13_32767
Extended data memory bank 14	E14_00000	to	E14_32767
Extended data memory bank 15	E15_00000	to	E15_32767
Extended data memory bank 16	E16_00000	to	E16_32767
Extended data memory bank 17	E17_00000	to	E17_32767
Extended data memory bank 18	E18_00000	to	E18_32767
Extended data memory current	E00000	to	E32767

Note: The range of available addresses varies depending on the specifications and settings of the CPU unit.

● **Keyence KV nano series (Modbus/RTU protocol)**

● **Siemens S7-1200 series (Modbus/RTU protocol)**

● **General-purpose Modbus/RTU device (Modbus/RTU protocol)**

Device type	Address range		
Coil	000001	to	065536
Input relay	100001	to	165536
Input register	300001	to	365536
Retaining register	400001	to	465536

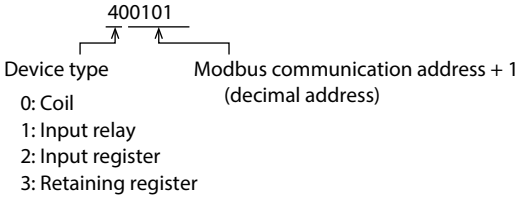
Change the Modbus address used by the SLP in accordance with the address expression used for the connected Modbus device.

The address expression in the Modbus protocol and the SLP is as follows.

Device type	Modbus communication protocol			SLP-C1F
	Function code		Address range	Address range
	For reading	For writing		
Coil	1 (0x01)	15 (0x0F)	0000	000001
			0001	000002
			to	to
			FFFF	065536
Input relay	2 (0x02)	–	0000	100001
			0001	100002
			to	to
			FFFF	165536
Input register	4 (0x04)	–	0000	300001
			0001	300002
			to	to
			FFFF	365536
Retaining register	3 (0x03)	16 (0x10)	0000	400001
			0001	400002
			–	to
			FFFF	465536

In the Modbus communication protocol, a function number is added to an address in order to indicate the device type. In the SLP, the type is expressed by the value (0, 1, 3, 4) at the beginning of an address.

Also, the address used by the loader is the Modbus protocol address + 1, as shown in the above example of “000001” to “065536."



Handling Precautions

- When connectinga Keyence KV PLC, set SendDelayTime100 ms or longer. If a time shorter than 100 ms is set, faulty communication may result.

■ Completion notification data

When transfer of data within a sheet is completed during cyclic data transfer and triggered data transfer, completion notification data is written. The contents of the completion notification data are as follows.

Type	Code	Description
Communication succeeded	0	Normal response
Timeout	1	Timeout occurred in communication between the PLC and this controller.
Controller error	2	An error occurred in this controller.
PLC error	3	An abnormal code is included in the reply data from the PLC.

- For ROM version 1.01 or earlier, even if the status of PLC link communication changes from abnormal to normal, the device set for [Completion notification data] will retain the latest error code (other than 0). To change the data to 0 (communication succeeded), write 1 to [Clear monitoring information]. Note that the number of communications will also be reset to zero.
- The device set for [Completion notification data] operates according to the [Notification device initialization] setting.

  If the setting is 0 (disabled):

  Even if the status of PLC link communication changes from abnormal to normal, the device set for [Completion notification data] will retain the latest error code (other than 0). To change the data to 0 (communication succeeded), write 1 to [Clear monitoring information]. Note that the number of communications will also be reset to zero.

  If the setting is 1 (enabled):

  When the communication status changes from abnormal to normal, 0 (communication succeeded) is automatically written to the device set for [Completion notification data].

Handling Precautions

- To write data to [Clear monitoring information], register the address of this item as a user-defined address on the [Numeric Monitor] screen of the SLP-C1F.

Note

- ☞ User's Manual for Detailed Functions of Smart Loader Package Model SLP-C1F for Single Loop Controller Model C1M/C1A/C2/C3 (Document No. CP-SP-1463E) (for user-defined addresses on the [Numeric Monitor] screen of the SLP-C1F).

9-3 PLC Link Setup

To set up PLC link communication, use the SLP-C1F Smart Loader Package.

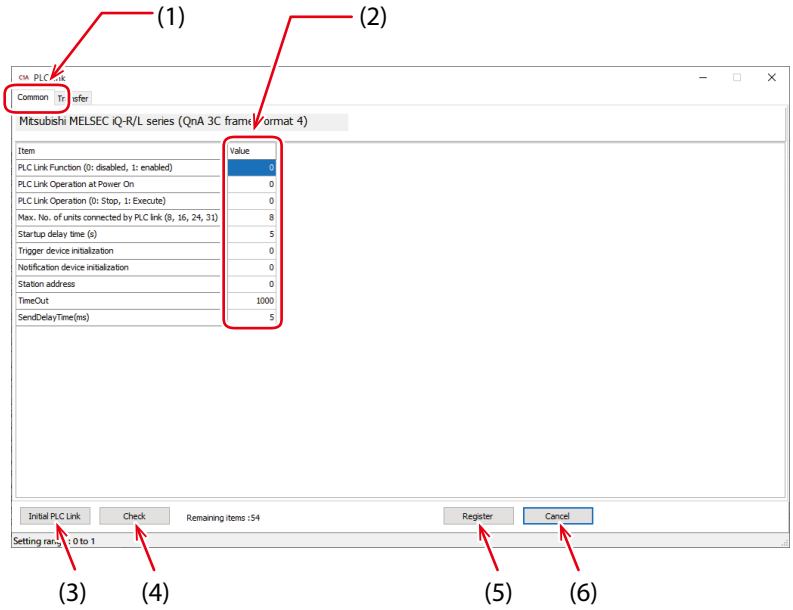
Open the setup screen of the SLP-C1F and click the [PLC Link] button to open the [PLC Link] window.

The method of setup is described below, illustrated by the SLP-C1F screen.

! Handling Precautions

- To use PLC link communication, set CPL/MODBUS to 3 (PLC link communication) in the Setup (communication) Bank.

■ Common settings



(1) Select the [Common] tab to configure the PLC connection settings common to transfer 1 to 4.

(2) Enter a value for each item.

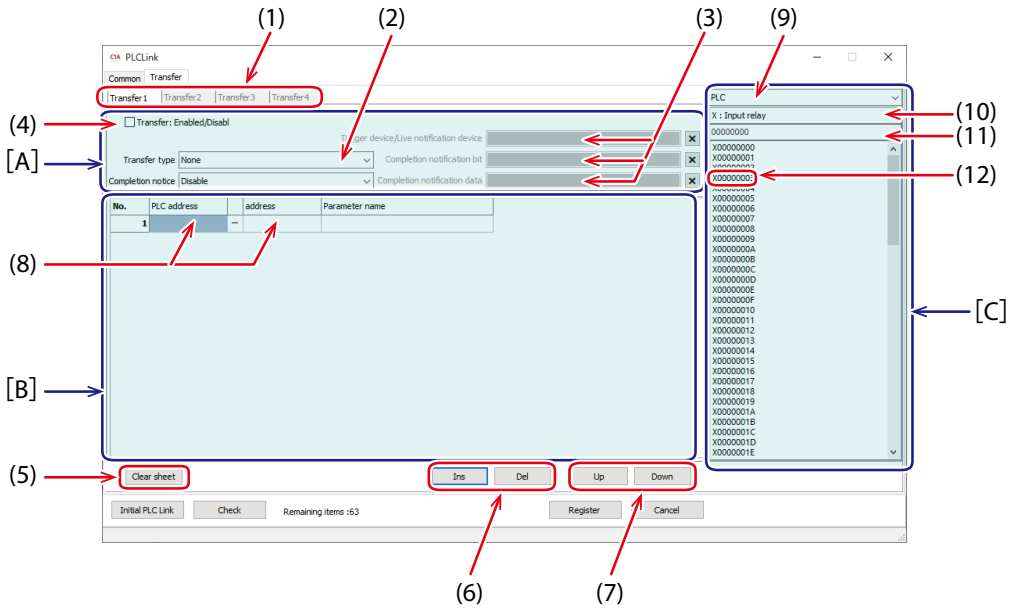
(3) Click the [Initial PLC Link] button to initialize (clear) the PLC link setup screen.

(4) Click the [Check] button to check that all the transfer setting addresses have been defined.

(5) Click the [Register] button to enable the configured PLC link settings.
Note that registration only rewrites the settings in the PC memory. After registration, the settings must be written, along with other parameters, to the controller or be saved in a PC file.

(6) Click the [Cancel] button to discard the configured PLC link settings.

■ Transfer settings



(1) Select a tab from the [Transfer 1] to [Transfer 4] tabs.

● Section [A] Transfer operation settings

(2) After selecting a tab, first select [Transfer type].

(3) Drag and drop an address in section [C] to [Trigger device/Live notification device], [Completion notification bit], and [Completion notification data].
For cyclic data transfer, specify a device of the PLC for [Trigger device/Live notification device].
Set [Completion notice] to "Enable" and then specify a device of the PLC for [Completion notification bit] and [Completion notification data].
The settings for [Trigger device/Live notification device], [Completion notification bit], and [Completion notification data] can be deleted by clicking the [×] to the right of each item.

(4) You can enable or disable the settings using the [Transfer: Enabled/Disabled] checkbox. Text on disabled tabs is grayed out.

● Section [B] Transfer data settings

(5) [Clear sheet] initializes the sheet for each transfer setting.

(6) The number of lines can be increased or decreased with [Ins] and [Del].
One line corresponds to one item. Up to 64 items can be specified in total for transfer 1 to transfer 4 combined. [Remaining items] is displayed at the bottom of the screen.

(7) Other lines can be selected by using [Up] and [Down].

(8) Set [PLC address] and [Address] by dragging and dropping an address in section [C]. Also, you can enter a decimal address into [Address] directly from the keyboard.

● **Section [C]** **Address list**

(9) Select “PLC” or this controller.

(10) Select a data type.

(11) Enter the first address in the list.

(12) An address can be selected from the list and dragged and dropped to sections [A] and [B].

■ Transfer setting examples

● Cyclic data transfer (PLC →)

Used for writing parameters from the PLC to this controller consecutively. In this example, data at D0000100 to D0000103 are transferred to this controller periodically.

● Transfer operation settings

Transfer type: Cyclic data transfer (PLC →)

Live notification device: M000100

Completion notification bit: M000010

Completion notification data: D000010

Note

- 0 and 1 are written alternately to the live notification device periodically.
- If [Notification device initialization] on the [Common] tab is set to 0 (enabled), 0 is written to the device specified by [Completion notification bit] immediately before the data transfer.
- After the data transfer, 1 is written to the completion notification bit.
- If there is an error in the data transfer, a value other than 0 is written to the device set for [Completion notification data]. If [Notification device initialization] on the [Common] tab is set to 1 (enabled), when the error has been removed, 0 (communication succeeded) is written to the device set for [Completion notification data].

- **Transfer data settings**

D000100 → SP (target value)

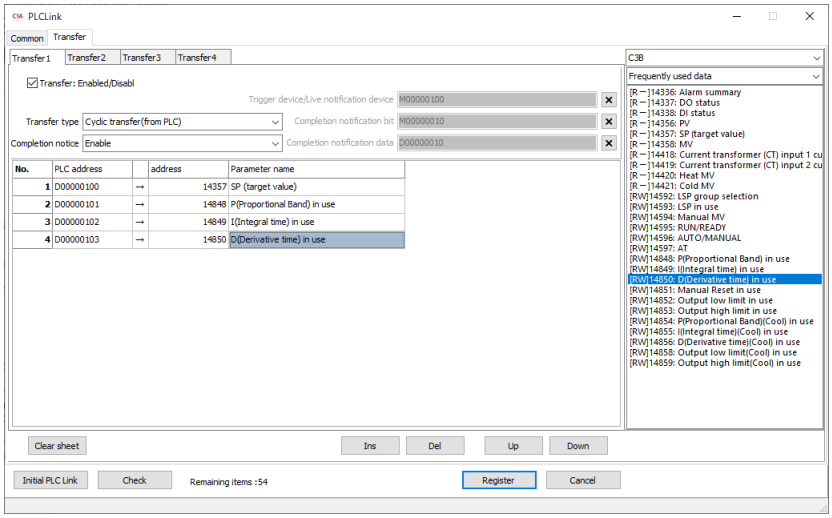
D000101 → P (Proportional Band)

D000102 → I (Integral time)

D000103 → D (Derivative time)

Handling Precautions

- Use RAM write addresses when transferring (writing) data to this controller periodically.



● Cyclic data transfer (→ PLC)

Used for monitoring the data of this controller on the PLC. In this example, the data of this controller is transferred to addresses D000200 to D000201.

● Transfer operation settings

Transfer type: Cyclic data transfer (→ PLC)

Live notification device: M000101

Completion notification bit: M000011

Completion notification data: D000011

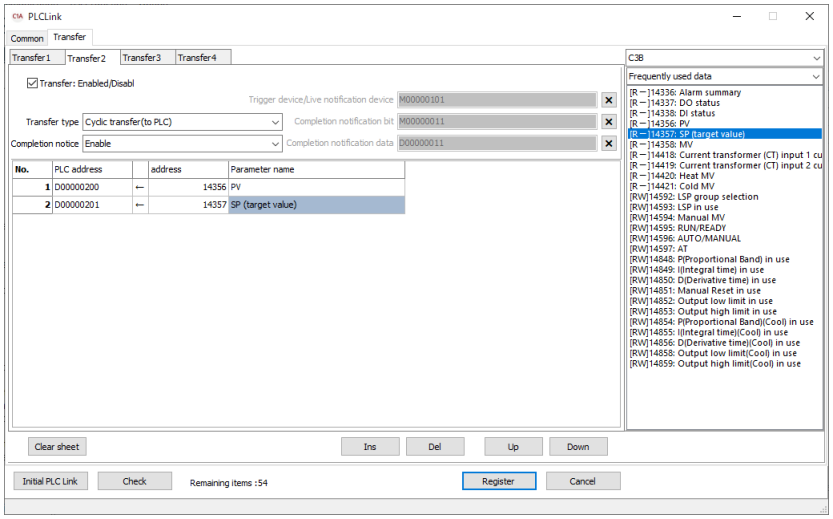
Note

- 0 and 1 are written alternately to the live notification device periodically.
- If [Notification device initialization] on the [Common] tab is set to 0 (enabled), 0 is written to the device specified by [Completion notification bit] immediately before the data transfer.
- After the data transfer, 1 is written to the completion notification bit.
- If there is an error in the data transfer, a value other than 0 is written to the device set for [Completion notification data]. If [Notification device initialization] on the [Common] tab is set to 1 (enabled), when the error has been removed, 0 (communication succeeded) is written to the device set for [Completion notification data].

● Transfer data settings

PV → D000200

SP (target value) → D000201



● Triggered data transfer (PLC →)

Used for writing parameters from the PLC to this controller at a time determined by the PLC. In this example, when M000050 turns ON, the data from M000016 and M000017 is transferred to the mode setting of this controller.

● Transfer operation settings

Transfer type: Triggered data transfer (PLC →)

Trigger device: M000050

Completion notification bit: M000060

Completion notification data: D000050

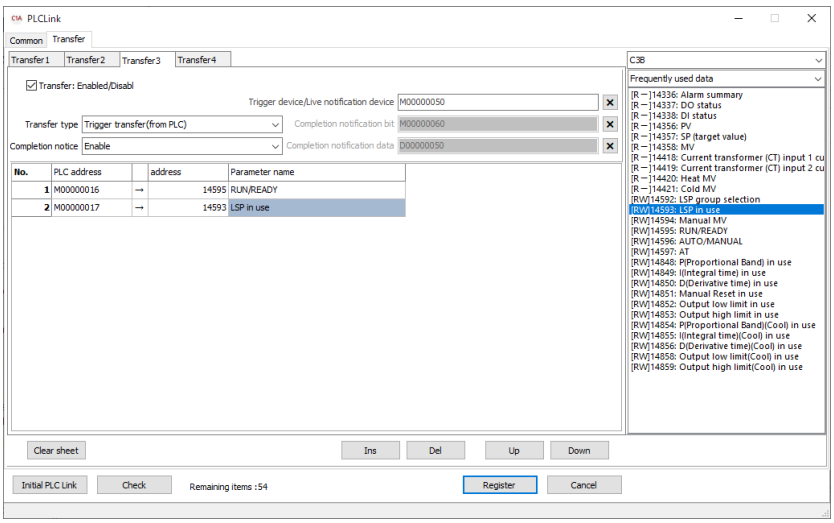
Note

- If [Trigger device initialization] on the [Common] tab is set to 0 (enabled), 0 is written to the trigger device when a trigger is detected.
- If [Notification device initialization] on the [Common] tab is set to 0 (enabled), 0 is written to the device specified by [Completion notification bit] when a trigger is detected.
- After the data transfer, 1 is written to the completion notification bit.
- If there is an error in the data transfer, a value other than 0 is written to the device set for [Completion notification data]. If [Notification device initialization] on the [Common] tab is set to 1 (enabled), when the error has been removed, 0 (communication succeeded) is written to the device set for [Completion notification data].

● Transfer data settings

M000016 → RUN/READY mode selection

M000017 → LSP in use



● Triggered data transfer (→ PLC)

Used for writing the data of this controller to the PLC when an event occurs with this controller. In this example, when the [Alarm summary] setting of this controller changes to a value other than 0, the data of this controller is transferred to D0000070 and D0000071.

● Transfer operation settings

Transfer type: Triggered data transfer (→ PLC)

Trigger device: Alarm summary

Completion notification bit: M000051

Completion notification data: D000051

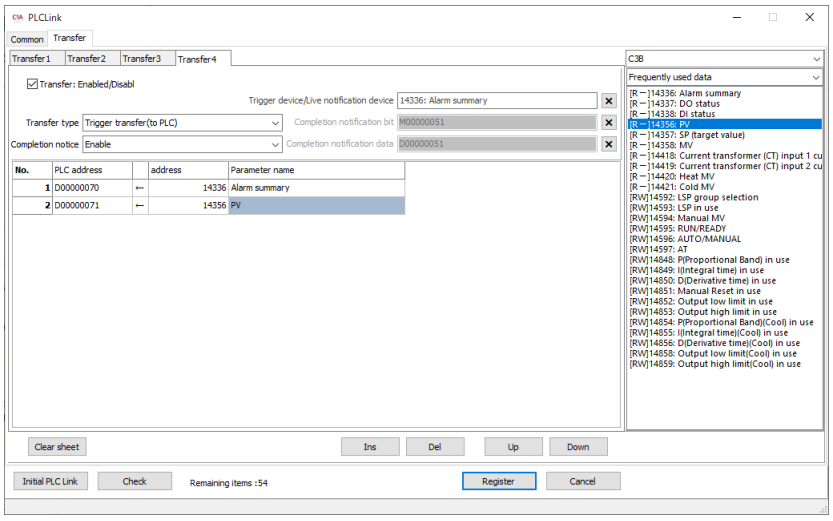
Note

- If [Notification device initialization] on the [Common] tab is set to 1 (enabled) and if a device of this controller is set for [Trigger device/Live notification device], this controller will not write 0 to the trigger device immediately after detecting a trigger. However, it will detect triggers continuously as long as the setting for the trigger device remains a value other than 0.
- If [Notification device initialization] on the [Common] tab is set to 0 (enabled), 0 is written to the device specified by [Completion notification bit] when a trigger is detected.
- After the data transfer, "1" is written to the completion notification bit.
- If there is an error in the data transfer, a value other than 0 is written to the device set for [Completion notification data]. If [Notification device initialization] on the [Common] tab is set to 1 (enabled), when the error has been removed, 0 (communication succeeded) is written to the device set for [Completion notification data].

● Transfer data settings

Representative alarm → D000070

PV → D000071



9 - 4 List of PLC Link Settings

The PLC link settings include common settings, transfer settings, and data settings.

■ Common settings

Item	Settings	Initial value	Notes
PLC Link Function	0: Disabled 1: Enabled	0	
PLC Link Operation at Power On	0: PLC link operation stops when the power is turned on. 1: PLC link operation is executed when the power is turned on.	0	The setting is valid only if [PLC Link Function] is set to 1.
PLC Link Operation	0: Stop 1: Execute	0	The setting is valid only if [PLC Link Function] is set to 1.
Max. No. of units connected by PLC link	8, 16, 24, 31	8	
Startup delay time	0–60 s	5	
Trigger device initialization	0: No 1: Yes	0	
Notification device initialization	0: No 1: Yes	0	
Station address	0–127	0	The address of the PLC to communicate with
TimeOut	0–32000 ms	1000	
Send Delay Time	0–1000 ms	5	

[!] Handling Precautions

- To use PLC link communication, set CBH (CPL/MODBUS) to "3" (PLC link communication) and configure the above settings on the PLC link screen of the SLP-C1F in advance.

■ Transfer settings

Transfer sheets 1 to 4 can be set independently.

Item	Settings	Initial value	Notes
Transfer: Enabled/Disabled	Unchecked: Disabled Checked: Enabled	Unchecked	
Transfer type	Cyclic data transfer (PLC →) Cyclic data transfer (→ PLC) Triggered data transfer (PLC →) Triggered data transfer (→ PLC)	None	
Trigger device address	For PLC: See the list of device types and address ranges for the PLC. ☞ ■Usable devices (p. 9-7) For this controller: Selectable from the monitoring data and parameters of this controller.	Not set	For triggered data transfer
Live notification device address	See the list of device types and address ranges for the PLC. ☞ ■Usable devices (p. 9-7)	Not set	For cyclic data transfer
Completion notification bit address	See the list of device types and address ranges for the PLC. ☞ ■Usable devices (p. 9-7)	Not set	
Completion notification data address	See the list of device types and address ranges for the PLC. ☞ ■Usable devices (p. 9-7)	Not set	

■ Data settings

Transfer sheets 1 to 4 can be set independently. Up to 64 data items can be specified in total for all sheets combined. The settings for each data item are shown in the table below.

Item	Settings	Initial value	Notes
PLC address	See the list of address ranges for the PLC device type.	Not set	
Address	Selectable from the monitoring data and parameters of this controller.	Not set	

Chapter 10. List of Communication Data

■ List of communication data

The symbols in the RAM/EEPROM Read/Write columns are as follows.

No symbol: Possible
☐: Possible depending on the conditions
△: Possible but data is invalid
×: Not possible
Note: Reading the EEPROM address, like reading the RAM address, reads data from RAM.

Decimal point information

–: No decimal point
1 to 3: The value indicates the decimal point position (for communication, original value is multiplied by 10, 100, or 1000)
P: Varies depending on the PV input range
C: Varies depending on the integral time and derivative time decimal point position
S: Varies depending on various conditions

RS/WS commands for CPL communication use a decimal word address followed by "W."
RD/WD/RU/WU commands for CPL communication use a hexadecimal word address.
Modbus communication commands use a hexadecimal word address.

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Instrument information	ROM ID	273	0111	16657	4111		×		×	–	"16" for model C1M
	ROM version 1	274	0112	16658	4112		×		×	2	
	ROM version 2	275	0113	16659	4113		×		×	2	
	Loader information	276	0114	16660	4114		×		×	–	
	EST Information	277	0115	16661	4115		×		×	–	
	Manufacturing date code (year)	278	0116	16662	4116		×		×	–	Year – 2000 Example: Year 2021 is "21"
	Manufacturing date code (month, day)	279	0117	16663	4117		×		×	2	Month + (day ÷ 100) Example: Dec. 1 is "12.01."
	Serial No.	280	0118	16664	4118		×		×	–	
	Advanced function password 1	5021	139D	21405	539D					–	
	Advanced function password 2	5022	139E	21406	539E					–	
	Advanced function password 3	5023	139F	21407	539F					–	
	Advanced function password 4	5024	13A0	21408	53A0					–	
	Advanced function password 5	5025	13A1	21409	53A1					–	
	Advanced function password 6	5026	13A2	21410	53A2					–	
	Advanced function password 7	5027	13A3	21411	53A3					–	
	Advanced function password 8	5028	13A4	21412	53A4					–	
	Advanced function password 9	5029	13A5	21413	53A5					–	
	Advanced function password 10	5030	13A6	21414	53A6					–	
	Advanced function password 11	5031	13A7	21415	53A7					–	
	Advanced function password 12	5032	13A8	21416	53A8					–	
	Advanced function password 13	5033	13A9	21417	53A9					–	
	Advanced function password 14	5034	13AA	21418	53AA					–	
	Advanced function password 15	5035	13AB	21419	53AB					–	
	Advanced function password 16	5036	13AC	21420	53AC					–	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Lock	Key lock	5001	1389	21385	5389					–	
	Communication lock	5002	138A	21386	538A	☐	×	☐	×	–	When communication is locked, an error response is sent.
	Loader lock	5003	138B	21387	538B		×		×	–	
	Password display	5004	138C	21388	538C				×	–	*1
	Password 1A	–	–	–	–	×	×	×	×	–	Passwords can't be read/ written by comm. or loader
	Password 2A	–	–	–	–	×	×	×	×	–	Same as above.
	Password 1B	–	–	–	–	×	×	×	×	–	Same as above.
	Password 2B	–	–	–	–	×	×	×	×	–	Same as above.
User Function	User function 1	5101	13ED	21485	53ED					–	
	User function 2	5102	13EE	21486	53EE					–	
	User function 3	5103	13EF	21487	53EF					–	
	User function 4	5104	13F0	21488	53F0					–	
	User function 5	5105	13F1	21489	53F1					–	
	User function 6	5106	13F2	21490	53F2					–	
	User function 7	5107	13F3	21491	53F3					–	
	User function 8	5108	13F4	21492	53F4					–	
Setup	PV input range type	5201	1451	21585	5451					–	
	Reference junction compensation (cold junction compensation)	5203	1453	21587	5453		☐		☐	–	
	PV Decimal point position	5204	1454	21588	5454		☐		☐	–	
	PV range low limit	5205	1455	21589	5455		☐		☐	P	
	PV range high limit	5206	1456	21590	5456		☐		☐	P	
	SP low limit	5207	1457	21591	5457					P	
	SP high limit	5208	1458	21592	5458					P	
	PV square root extraction dropout	5209	1459	21593	5459		☐		☐	1	
	(Reserved for future use.)	5210	145A	21594	545A	△	×	△	×	–	
	(Reserved for future use.)	5211	145B	21595	545B	△	×	△	×	P	
	(Reserved for future use.)	5212	145C	21596	545C	△	×	△	×	P	
	(Reserved for future use.)	5213	145D	21597	545D	△	×	△	×	–	
	Control action (direct/reverse)	5214	145E	21598	545E					–	
	Output operation at PV alarm	5215	145F	21599	545F					–	
	Output at PV alarm	5216	1460	21600	5460					1	
	Output at READY (Heat)	5217	1461	21601	5461					1	
	Output at READY (Cool)	5218	1462	21602	5462					1	
	Output operation at changing AUTO/ MANUAL	5219	1463	21603	5463					–	
	Preset MANUAL value	5220	1464	21604	5464					1	
	Initial output type (mode) of PID control	5221	1465	21605	5465					–	
	Initial output of PID control	5222	1466	21606	5466					1	
	Integral time and derivative time decimal point position	5223	1467	21607	5467					–	
	(Reserved for future use.)	5224	1468	21608	5468	△	×	△	×	–	
	(Reserved for future use.)	5225	1469	21609	5469	△	×	△	×	–	
	Heat/cool control	5226	146A	21610	546A					–	
	(Reserved for future use.)	5227	146B	21611	546B	△	×	△	×	–	
	Heat/Cool control dead zone	5228	146C	21612	546C					1	
	(Reserved for future use.)	5229	146D	21613	546D	△	×	△	×	1	
	LSP system group	5230	146E	21614	546E					–	
	SP ramp type	5231	146F	21615	546F					–	
	SP ramp unit	5232	1470	21616	5470					–	

*1. The value read is always 0.

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Setup	STEP time unit	5233	1471	21617	5471					–	
	STEP PV start	5234	1472	21618	5472					–	
	STEP loop	5235	1473	21619	5473					–	
	CT1 operation type	5236	1474	21620	5474					–	
	CT1 output	5237	1475	21621	5475					–	
	CT1 measurement wait time	5238	1476	21622	5476					–	
	CT2 operation type	5239	1477	21623	5477					–	
	CT2 output	5240	1478	21624	5478					–	
	CT2 measurement wait time	5241	1479	21625	5479					–	
	Control output 1 range	5242	147A	21626	547A					–	
	Control output 1 type	5243	147B	21627	547B					–	
	Control output 1 scaling low limit	5244	147C	21628	547C					S	
	Control output 1 scaling high limit	5245	147D	21629	547D					S	
	Control output 1 MV scaling width	5246	147E	21630	547E					P	
	Control output 2 range	5247	147F	21631	547F					–	
	Control output 2 type	5248	1480	21632	5480					–	
	Control output 2 scaling low limit	5249	1481	21633	5481					S	
	Control output 2 scaling high limit	5250	1482	21634	5482					S	
	Control output 2 MV scaling width	5251	1483	21635	5483					P	
	(Reserved for future use.)	5252	1484	21636	5484	△	×	△	×	–	
	(Reserved for future use.)	5253	1485	21637	5485	△	×	△	×	–	
	(Reserved for future use.)	5254	1486	21638	5486	△	×	△	×	S	
	(Reserved for future use.)	5255	1487	21639	5487	△	×	△	×	S	
	(Reserved for future use.)	5256	1488	21640	5488	△	×	△	×	–	
	(Reserved for future use.)	5257	1489	21641	5489	△	×	△	×	–	
	(Reserved for future use.)	5258	148A	21642	548A	△	×	△	×	1	
	(Reserved for future use.)	5259	148B	21643	548B	△	×	△	×	–	
	(Reserved for future use.)	5260	148C	21644	548C	△	×	△	×	–	
	(Reserved for future use.)	5261	148D	21645	548D	△	×	△	×	–	
	(Reserved for future use.)	5262	148E	21646	548E	△	×	△	×	–	
	(Reserved for future use.)	5263	148F	21647	548F	△	×	△	×	1	
	Communications type	5264	1490	21648	5490		×		×	–	
	Station address	5265	1491	21649	5491		×		×	–	
	Transmission speed (bps)	5266	1492	21650	5492		×		×	–	
	Data format (data length)	5267	1493	21651	5493		×		×	–	
	Data format (parity)	5268	1494	21652	5494		×		×	–	
	Data format (stop bit)	5269	1495	21653	5495		×		×	–	
	Communication minimum response time	5270	1496	21654	5496		×		×	–	
	Key operation mode	5271	1497	21655	5497					–	
	[MODE] key function	5272	1498	21656	5498					–	
	Mode display setup	5273	1499	21657	5499					–	
	PV/SP display setup	5274	149A	21658	549A					–	
	MV display setup	5275	149B	21659	549B					–	
	EV display setup	5276	149C	21660	549C					–	
	Event remaining time display setup	5277	149D	21661	549D					–	
	CT input current display setup	5278	149E	21662	549E					–	
	User level	5279	149F	21663	549F					–	
	Status indicator	5280	14A0	21664	54A0					–	
	(Reserved for future use.)	5281	14A1	21665	54A1	△	△	△	△	–	
	(Reserved for future use.)	5282	14A2	21666	54A2	△	△	△	△	–	
	(Reserved for future use.)	5283	14A3	21667	54A3	△	△	△	△	–	
	(Reserved for future use.)	5284	14A4	21668	54A4	△	△	△	△	–	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Setup	(Reserved for future use.)	5285	14A5	21669	54A5	△	△	△	△	–	
	(Reserved for future use.)	5286	14A6	21670	54A6	△	△	△	△	–	
	(Reserved for future use.)	5287	14A7	21671	54A7	△	△	△	△	–	
	(Reserved for future use.)	5288	14A8	21672	54A8	△	△	△	×	–	
	(Reserved for future use.)	5289	14A9	21673	54A9	△	×	△	×	–	
	Number of CT1 turns	5290	14AA	21674	54AA					–	
	Number of CT1 power wire passes	5291	14AB	21675	54AB					–	
	Number of CT2 turns	5292	14AC	21676	54AC					–	
	Number of CT2 power wire passes	5293	14AD	21677	54AD					–	
	PV input failure (under range) type	5297	14B1	21681	54B1					–	
	Sampling cycle	5298	14B2	21682	54B2					–	
DI assign-ment	Internal contact 1 operation type	5401	1519	21785	5519					–	
	Internal contact 1 input bit function	5402	151A	21786	551A					–	
	Internal contact 1 input assignment A	5403	151B	21787	551B					–	
	Internal contact 1 input assignment B	5404	151C	21788	551C					–	
	Internal contact 1 input assignment C	5405	151D	21789	551D					–	
	Internal contact 1 input assignment D	5406	151E	21790	551E					–	
	Internal contact 1 polarity A	5407	151F	21791	551F					–	
	Internal contact 1 polarity B	5408	1520	21792	5520					–	
	Internal contact 1 polarity C	5409	1521	21793	5521					–	
	Internal contact 1 polarity D	5410	1522	21794	5522					–	
	Internal contact 1 polarity	5411	1523	21795	5523					–	
	Internal contact 1 internal event No. assignment	5412	1524	21796	5524					–	
	Internal contact 2 operation type	5413	1525	21797	5525					–	
	Internal contact 2 input bit function	5414	1526	21798	5526					–	
	Internal contact 2 input assignment A	5415	1527	21799	5527					–	
	Internal contact 2 input assignment B	5416	1528	21800	5528					–	
	Internal contact 2 input assignment C	5417	1529	21801	5529					–	
	Internal contact 2 input assignment D	5418	152A	21802	552A					–	
	Internal contact 2 polarity A	5419	152B	21803	552B					–	
	Internal contact 2 polarity B	5420	152C	21804	552C					–	
	Internal contact 2 polarity C	5421	152D	21805	552D					–	
	Internal contact 2 polarity D	5422	152E	21806	552E					–	
	Internal contact 2 polarity	5423	152F	21807	552F					–	
	Internal contact 2 internal event No. assignment	5424	1530	21808	5530					–	
	Internal contact 3 operation type	5425	1531	21809	5531					–	
	Internal contact 3 input bit function	5426	1532	21810	5532					–	
	Internal contact 3 input assignment A	5427	1533	21811	5533					–	
	Internal contact 3 input assignment B	5428	1534	21812	5534					–	
	Internal contact 3 input assignment C	5429	1535	21813	5535					–	
	Internal contact 3 input assignment D	5430	1536	21814	5536					–	
	Internal contact 3 polarity A	5431	1537	21815	5537					–	
	Internal contact 3 polarity B	5432	1538	21816	5538					–	
	Internal contact 3 polarity C	5433	1539	21817	5539					–	
	Internal contact 3 polarity D	5434	153A	21818	553A					–	
	Internal contact 3 polarity	5435	153B	21819	553B					–	
	Internal contact 3 internal event No. assignment	5436	153C	21820	553C					–	
	Internal contact 4 operation type	5437	153D	21821	553D					–	
	Internal contact 4 input bit function	5438	153E	21822	553E					–	
	Internal contact 4 input assignment A	5439	153F	21823	553F					–	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
DI assign-ment	Internal contact 4 input assignment B	5440	1540	21824	5540					–	
	Internal contact 4 input assignment C	5441	1541	21825	5541					–	
	Internal contact 4 input assignment D	5442	1542	21826	5542					–	
	Internal contact 4 polarity A	5443	1543	21827	5543					–	
	Internal contact 4 polarity B	5444	1544	21828	5544					–	
	Internal contact 4 polarity C	5445	1545	21829	5545					–	
	Internal contact 4 polarity D	5446	1546	21830	5546					–	
	Internal contact 4 polarity	5447	1547	21831	5547					–	
	Internal contact 4 internal event No. assignment	5448	1548	21832	5548					–	
	Internal contact 5 operation type	5449	1549	21833	5549					–	
	Internal contact 5 input bit function	5450	154A	21834	554A					–	
	Internal contact 5 input assignment A	5451	154B	21835	554B					–	
	Internal contact 5 input assignment B	5452	154C	21836	554C					–	
	Internal contact 5 input assignment C	5453	154D	21837	554D					–	
	Internal contact 5 input assignment D	5454	154E	21838	554E					–	
	Internal contact 5 polarity A	5455	154F	21839	554F					–	
	Internal contact 5 polarity B	5456	1550	21840	5550					–	
	Internal contact 5 polarity C	5457	1551	21841	5551					–	
	Internal contact 5 polarity D	5458	1552	21842	5552					–	
	Internal contact 5 polarity	5459	1553	21843	5553					–	
	Internal contact 5 internal event No. assignment	5460	1554	21844	5554					–	
DO assign-ment	Control output 1 operation type	5601	15E1	21985	55E1					–	
	Control output 1 output assignment A	5602	15E2	21986	55E2					–	
	Control output 1 output assignment B	5603	15E3	21987	55E3					–	
	Control output 1 output assignment C	5604	15E4	21988	55E4					–	
	Control output 1 output assignment D	5605	15E5	21989	55E5					–	
	Control output 1 polarity A	5606	15E6	21990	55E6					–	
	Control output 1 polarity B	5607	15E7	21991	55E7					–	
	Control output 1 polarity C	5608	15E8	21992	55E8					–	
	Control output 1 polarity D	5609	15E9	21993	55E9					–	
	Control output 1 polarity	5610	15EA	21994	55EA					–	
	Control output 1 latch	5611	15EB	21995	55EB					–	
	Control output 2 operation type	5612	15EC	21996	55EC					–	
	Control output 2 output assignment A	5613	15ED	21997	55ED					–	
	Control output 2 output assignment B	5614	15EE	21998	55EE					–	
	Control output 2 output assignment C	5615	15EF	21999	55EF					–	
	Control output 2 output assignment D	5616	15F0	22000	55F0					–	
	Control output 2 polarity A	5617	15F1	22001	55F1					–	
	Control output 2 polarity B	5618	15F2	22002	55F2					–	
	Control output 2 polarity C	5619	15F3	22003	55F3					–	
	Control output 2 polarity D	5620	15F4	22004	55F4					–	
	Control output 2 polarity	5621	15F5	22005	55F5					–	
	Control output 2 latch	5622	15F6	22006	55F6					–	
	Event output 1 operation type	5623	15F7	22007	55F7					–	
	Event output 1 output assignment A	5624	15F8	22008	55F8					–	
	Event output 1 output assignment B	5625	15F9	22009	55F9					–	
	Event output 1 output assignment C	5626	15FA	22010	55FA					–	
	Event output 1 output assignment D	5627	15FB	22011	55FB					–	
	Event output 1 polarity A	5628	15FC	22012	55FC					–	
	Event output 1 polarity B	5629	15FD	22013	55FD					–	
	Event output 1 polarity C	5630	15FE	22014	55FE					–	
	Event output 1 polarity D	5631	15FF	22015	55FF					–	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
DO assign-ment	Event output 1 polarity	5632	1600	22016	5600					–	
	Event output 1 latch	5633	1601	22017	5601					–	
	Event output 2 operation type	5634	1602	22018	5602					–	
	Event output 2 output assignment A	5635	1603	22019	5603					–	
	Event output 2 output assignment B	5636	1604	22020	5604					–	
	Event output 2 output assignment C	5637	1605	22021	5605					–	
	Event output 2 output assignment D	5638	1606	22022	5606					–	
	Event output 2 polarity A	5639	1607	22023	5607					–	
	Event output 2 polarity B	5640	1608	22024	5608					–	
	Event output 2 polarity C	5641	1609	22025	5609					–	
	Event output 2 polarity D	5642	160A	22026	560A					–	
	Event output 2 polarity	5643	160B	22027	560B					–	
	Event output 2 latch	5644	160C	22028	560C					–	
	Event output 3 operation type	5645	160D	22029	560D					–	
	Event output 3 output assignment A	5646	160E	22030	560E					–	
	Event output 3 output assignment B	5647	160F	22031	560F					–	
	Event output 3 output assignment C	5648	1610	22032	5610					–	
	Event output 3 output assignment D	5649	1611	22033	5611					–	
	Event output 3 polarity A	5650	1612	22034	5612					–	
	Event output 3 polarity B	5651	1613	22035	5613					–	
	Event output 3 polarity C	5652	1614	22036	5614					–	
	Event output 3 polarity D	5653	1615	22037	5615					–	
	Event output 3 polarity	5654	1616	22038	5616					–	
	Event output 3 latch	5655	1617	22039	5617					–	
Event configura-tion	Internal event 1 operation type	5801	16A9	22185	56A9					–	
	Internal event 1 direct/reverse	5802	16AA	22186	56AA					–	
	Internal event 1 standby	5803	16AB	22187	56AB					–	
	Internal event 1 event state at READY	5804	16AC	22188	56AC					–	
	(Reserved for future use.)	5805	16AD	22189	56AD	△	△	△	△	–	
	Internal event 1 alarm OR	5806	16AE	22190	56AE					–	
	Internal event 1 special OFF setup	5807	16AF	22191	56AF					–	
	Internal event 1 delay time unit	5808	16B0	22192	56B0					–	
	(Reserved for future use.)	5809	16B1	22193	56B1	△	△	△	△	–	
	Internal event 2 operation type	5810	16B2	22194	56B2					–	
	Internal event 2 direct/reverse	5811	16B3	22195	56B3					–	
	Internal event 2 standby	5812	16B4	22196	56B4					–	
	Internal event 2 event state at READY	5813	16B5	22197	56B5					–	
	(Reserved for future use.)	5814	16B6	22198	56B6	△	△	△	△	–	
	Internal event 2 alarm OR	5815	16B7	22199	56B7					–	
	Internal event 2 special OFF setup	5816	16B8	22200	56B8					–	
	Internal event 2 delay time unit	5817	16B9	22201	56B9					–	
	(Reserved for future use.)	5818	16BA	22202	56BA	△	△	△	△	–	
	Internal event 3 operation type	5819	16BB	22203	56BB					–	
	Internal event 3 direct/reverse	5820	16BC	22204	56BC					–	
	Internal event 3 standby	5821	16BD	22205	56BD					–	
	Internal event 3 event state at READY	5822	16BE	22206	56BE					–	
	(Reserved for future use.)	5823	16BF	22207	56BF	△	△	△	△	–	
	Internal event 3 alarm OR	5824	16C0	22208	56C0					–	
	Internal event 3 special OFF setup	5825	16C1	22209	56C1					–	
	Internal event 3 delay time unit	5826	16C2	22210	56C2					–	
	(Reserved for future use.)	5827	16C3	22211	56C3	△	△	△	△	–	
	Internal event 4 operation type	5828	16C4	22212	56C4					–	
	Internal event 4 direct/reverse	5829	16C5	22213	56C5					–	
	Internal event 4 standby	5830	16C6	22214	56C6					–	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Event configuration	Internal event 4 event state at READY	5831	16C7	22215	56C7					–	
	(Reserved for future use.)	5832	16C8	22216	56C8	△	△	△	△	–	
	Internal event 4 alarm OR	5833	16C9	22217	56C9					–	
	Internal event 4 special OFF setup	5834	16CA	22218	56CA					–	
	Internal event 4 delay time unit	5835	16CB	22219	56CB					–	
	(Reserved for future use.)	5836	16CC	22220	56CC	△	△	△	△	–	
	Internal event 5 operation type	5837	16CD	22221	56CD					–	
	Internal event 5 direct/reverse	5838	16CE	22222	56CE					–	
	Internal event 5 standby	5839	16CF	22223	56CF					–	
	Internal event 5 event state at READY	5840	16D0	22224	56D0					–	
	(Reserved for future use.)	5841	16D1	22225	56D1	△	△	△	△	–	
	Internal event 5 alarm OR	5842	16D2	22226	56D2					–	
	Internal event 5 special OFF setup	5843	16D3	22227	56D3					–	
	Internal event 5 delay time unit	5844	16D4	22228	56D4					–	
	(Reserved for future use.)	5845	16D5	22229	56D5	△	△	△	△	–	
Parameter	Control method	6001	1771	22385	5771					–	
	MV low limit at AT	6002	1772	22386	5772					1	
	MV high limit at AT	6003	1773	22387	5773					1	
	ON/OFF control differential	6004	1774	22388	5774					P	
	ON/OFF control operating point offset	6005	1775	22389	5775					P	
	PV filter	6006	1776	22390	5776					1	
	PV ratio	6007	1777	22391	5777					3	
	PV bias	6008	1778	22392	5778					P	
	(Reserved for future use.)	6009	1779	22393	5779	△	△	△	△	1	
	(Reserved for future use.)	6010	177A	22394	577A	△	△	△	△	3	
	(Reserved for future use.)	6011	177B	22395	577B	△	△	△	△	P	
	Time proportional cycle unit 1	6012	177C	22396	577C					–	
	Time proportional cycle 1	6013	177D	22397	577D					–	
	Time proportional cycle unit 2	6014	177E	22398	577E					–	
	Time proportional cycle 2	6015	177F	22399	577F					–	
	TP operation type	6016	1780	22400	5780					–	
	(Reserved for future use.)	6017	1781	22401	5781	△	△	△	△	1	
	SP up ramp	6018	1782	22402	5782					S	
	SP down ramp	6019	1783	22403	5783					S	
	(Reserved for future use.)	6020	1784	22404	5784	△	△	△	△	P	
	Time Proportional Min. ON/OFF Time 1	6021	1785	22405	5785	□	□	□	□	–	
	Time Proportional Min. ON/OFF Time 2	6022	1786	22406	5786	□	□	□	□	–	
SP	(Reserved for future use.)	7001	1B59	23385	5B59	△	×	△	×	P	
	(Reserved for future use.)	7002	1B5A	23386	5B5A	△	△	△	△	–	
	(Reserved for future use.)	7003	1B5B	23387	5B5B	△	△	△	△	S	
	(Reserved for future use.)	7004	1B5C	23388	5B5C	△	△	△	△	S	
	LSP1	7005	1B5D	23389	5B5D					P	Same as RAM address 13312 (decimal).
	PID group number (for LSP1)	7006	1B5E	23390	5B5E					–	
	Ramp (for LSP1)	7007	1B5F	23391	5B5F					S	
	Soak time (for LSP1)	7008	1B60	23392	5B60					S	
	LSP2	7009	1B61	23393	5B61					P	Same as RAM address 13313 (decimal).
	PID group number (for LSP2)	7010	1B62	23394	5B62					–	
	Ramp (for LSP2)	7011	1B63	23395	5B63					S	
	Soak time (for LSP2)	7012	1B64	23396	5B64					S	
	LSP3	7013	1B65	23397	5B65					P	Same as RAM address 13314 (decimal).
	PID group number (for LSP3)	7014	1B66	23398	5B66					–	
	Ramp (for LSP3)	7015	1B67	23399	5B67					S	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
SP	Soak time (for LSP3)	7016	1B68	23400	5B68					S	
	LSP4	7017	1B69	23401	5B69					P	Same as RAM address 13315 (decimal).
	PID group number (for LSP4)	7018	1B6A	23402	5B6A					–	
	Ramp (for LSP4)	7019	1B6B	23403	5B6B					S	
	Soak time (for LSP4)	7020	1B6C	23404	5B6C					S	
	LSP5	7021	1B6D	23405	5B6D					P	Same as RAM address 13316 (decimal).
	PID group number (for LSP5)	7022	1B6E	23406	5B6E					–	
	Ramp (for LSP5)	7023	1B6F	23407	5B6F					S	
	Soak time (for LSP5)	7024	1B70	23408	5B70					S	
	LSP6	7025	1B71	23409	5B71					P	Same as RAM address 13317 (decimal).
	PID group number (for LSP6)	7026	1B72	23410	5B72					–	
	Ramp (for LSP6)	7027	1B73	23411	5B73					S	
	Soak time (for LSP6)	7028	1B74	23412	5B74					S	
	LSP7	7029	1B75	23413	5B75					P	Same as RAM address 13318 (decimal).
	PID group number (for LSP7)	7030	1B76	23414	5B76					–	
	Ramp (for LSP7)	7031	1B77	23415	5B77					S	
	Soak time (for LSP7)	7032	1B78	23416	5B78					S	
	LSP8	7033	1B79	23417	5B79					P	Same as RAM address 13319 (decimal).
	PID group number (for LSP8)	7034	1B7A	23418	5B7A					–	
	Ramp (for LSP8)	7035	1B7B	23419	5B7B					S	
	Soak time (for LSP8)	7036	1B7C	23420	5B7C					S	
Event	Internal event 1 main setting	7501	1D4D	23885	5D4D					S	Same as RAM address 13056 (decimal).
	Internal event 1 sub-setting	7502	1D4E	23886	5D4E					S	Same as RAM address 13057 (decimal).
	Internal event 1 hysteresis	7503	1D4F	23887	5D4F					S	
	Internal event 1 ON delay time	7504	1D50	23888	5D50					S	
	Internal event 1 OFF delay time	7505	1D51	23889	5D51					S	
	Internal event 2 main setting	7506	1D52	23890	5D52					S	Same as RAM address 13058 (decimal).
	Internal event 2 sub-setting	7507	1D53	23891	5D53					S	Same as RAM address 13059 (decimal).
	Internal event 2 hysteresis	7508	1D54	23892	5D54					S	
	Internal event 2 ON delay time	7509	1D55	23893	5D55					S	
	Internal event 2 OFF delay time	7510	1D56	23894	5D56					S	
	Internal event 3 main setting	7511	1D57	23895	5D57					S	Same as RAM address 13060 (decimal).
	Internal event 3 sub-setting	7512	1D58	23896	5D58					S	Same as RAM address 13061 (decimal).
	Internal event 3 hysteresis	7513	1D59	23897	5D59					S	
	Internal event 3 ON delay time	7514	1D5A	23898	5D5A					S	
	Internal event 3 OFF delay time	7515	1D5B	23899	5D5B					S	
	Internal event 4 main setting	7516	1D5C	23900	5D5C					S	Same as RAM address 13062 (decimal).
	Internal event 4 sub-setting	7517	1D5D	23901	5D5D					S	Same as RAM address 13063 (decimal).
	Internal event 4 hysteresis	7518	1D5E	23902	5D5E					S	
	Internal event 4 ON delay time	7519	1D5F	23903	5D5F					S	
	Internal event 4 OFF delay time	7520	1D60	23904	5D60					S	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Event	Internal event 5 main setting	7521	1D61	23905	5D61					S	Same as RAM address 13064 (decimal).
	Internal event 5 sub-setting	7522	1D62	23906	5D62					S	Same as RAM address 13065 (decimal).
	Internal event 5 hysteresis	7523	1D63	23907	5D63					S	
	Internal event 5 ON delay time	7524	1D64	23908	5D64					S	
	Internal event 5 OFF delay time	7525	1D65	23909	5D65					S	
Extended tuning	AT type	8501	2135	24885	6135					–	
	(Reserved for future use.)	8502	2136	24886	6136	△	×	△	×	–	
	(Reserved for future use.)	8503	2137	24887	6137	△	×	△	×	–	
	SP lag constant	8504	2138	24888	6138					1	
	(Reserved for future use.)	8505	2139	24889	6139	△	×	△	×	–	
	AT proportional band adjust	8506	213A	24890	613A					2	
	AT integral time adjust	8507	213B	24891	613B					2	
	AT derivative time adjust	8508	213C	24892	613C					2	
	MV Switching Point Type for AT	8541	215D	24925	615D					–	
	MV Switching Point PV for AT	8542	215E	24926	615E					P	
	Control algorithm	8509	213D	24893	613D					–	
	Cooling Gain	6071	17B7	22455	57B7					1	
	(Reserved for future use.)	8510	213E	24894	613E	△	×	△	×	–	
	(Reserved for future use.)	8511	213F	24895	613F	△	×	△	×	–	
	(Reserved for future use.)	8512	2140	24896	6140	△	×	△	×	–	
	(Reserved for future use.)	8513	2141	24897	6141	△	×	△	×	–	
	(Reserved for future use.)	8514	2142	24898	6142	△	×	△	×	–	
	(Reserved for future use.)	8515	2143	24899	6143	△	×	△	×	2	
	(Reserved for future use.)	8516	2144	24900	6144	△	×	△	×	2	
	(Reserved for future use.)	8517	2145	24901	6145	△	×	△	×	2	
	(Reserved for future use.)	8518	2146	24902	6146	△	×	△	×	–	
Mode	AUTO/MANUAL	9001	2329	25385	6329		☐		☐	–	Same as RAM address 14596 (decimal). Writable when not assigned to a DI, etc.
	RUN/READY	9002	232A	25386	632A		☐		☐	–	Same as RAM address 14595 (decimal). Writable when not assigned to a DI.
	(Reserved for future use.)	9003	232B	25387	632B	△	×	△	×	–	Same as RAM address 14598 (decimal).
	AT start/stop selection	9004	232C	25388	632C		☐		☐	–	Same as RAM address 14597 (decimal). Writable when not assigned to a DI, etc.
	Auto tuning error	9126	23A6	25510	63A6		☐		☐	–	
	Release all DO latches	9005	232D	25389	632D		☐		☐	–	Writable when not assigned to a DI.

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Operation settings	PV	9101	238D	25485	638D		×		×	P	Same as RAM address 14356 (decimal).
	SP (target value)	9102	238E	25486	638E					P	*2
	LSP group selection	9103	238F	25487	638F		□		□	–	Same as RAM address 14592 (decimal). Writable when not assigned to a DI.*3
	(Reserved for future use.)	9104	2390	25488	6390	△	×	△	×	–	
	MV (Manipulated Variable)	9105	2391	25489	6391		□		□	1	Same as RAM address 14594 (decimal). Writable in manual mode
	Heat MV (Manipulated Variable)	9106	2392	25490	6392		×		×	1	Same as RAM address 14420 (decimal).
	Cool MV (Manipulated Variable)	9107	2393	25491	6393		×		×	1	Same as RAM address 14421 (decimal).
	(Reserved for future use.)	9108	2394	25492	6394	△	×	△	×	1	Same as RAM address 14417 (decimal).
	AT progress	9109	2395	25493	6395		×		×	–	
	CT1 current	9110	2396	25494	6396		×		×	1	Same as RAM address 14418 (decimal).
	CT2 current	9111	2397	25495	6397		×		×	1	Same as RAM address 14419 (decimal).
	Timer remaining time 1	9112	2398	25496	6398		×		×	S	
	Timer remaining time 2	9113	2399	25497	6399		×		×	S	
	Timer remaining time 3	9114	239A	25498	639A		×		×	S	
	Timer remaining time 4	9115	239B	25499	639B		×		×	S	
	Timer remaining time 5	9116	239C	25500	639C		×		×	S	
	(Reserved for future use.)	9117	239D	25501	639D	△	×	△	×	S	
	(Reserved for future use.)	9118	239E	25502	639E	△	×	△	×	S	
	(Reserved for future use.)	9119	239F	25503	639F	△	×	△	×	S	
	Step No.	9120	23A0	25504	63A0		×		×	S	
	Step remaining time	9121	23A1	25505	63A1		×		×	S	
	Step remaining time (second)	9122	23A2	25506	63A2		×		×	S	
	LSP in use	9123	23A3	25507	63A3					P	Same as RAM address 14593 (decimal).*2
	PV (before ratio,bias,filter)	9124	23A4	25508	63A4		×		×	P	
	(Reserved for future use.)	9125	23A5	25509	63A5	△	×	△	×	P	

*2. If a value is read immediately after writing it to an SP or LSP that is in use, the value may not have changed yet. Values are updated after the sampling cycle time ends.

*3. If an SP or LSP that is in use is read immediately after writing the value to the LSP group selection, the value may not have changed yet. Values are updated after the sampling cycle time ends.

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Status	Input alarm status	9201	23F1	25585	63F1		×		×	–	Bit 0: AL01 (PV input error (over range)) Bit 1: AL02 (PV input error (under range)) Bit 2: AL03 (Reference junction compensation error (thermocouple) / PV input error (RTD)) Bits 3–9: Undefined Bit 10: AL11 (CT input error (over range)) Bits 11–15: Undefined
	Instrument alarm status	9202	23F2	25586	63F2		×		×	–	Bit 0: AL74 (Nonvolatile memory error) Bit 1: Undefined Bit 2: AL70 (A/D conversion error) Bit 3: AL95 (Setting value error) Bit 4: AL96 (Adjustment value error) Bit 5: AL81 (Setting value area error) Bit 6: AL82 (Adjustment value area error) Bit 7: Undefined Bit 8: AL83 (Internal system error) Bit 9: AL84 (Setting value initialization error) Bits 10–11: Undefined Bit 12: AL80 (Nonvolatile memory not initialized) Bits 13–15: Undefined
	Internal event / internal contact function status	9203	23F3	25587	63F3		×		×	–	Bits 0–4: Internal events 1–5 Bits 5–7: Undefined Bits 8-10: Internal contacts 1-3 Bits 11–15: Undefined

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Status	Control status	9204	23F4	25588	63F4		×		×	–	Bit 0: MANUAL mode 0: AUTO 1: MANUAL Bit 1: READY mode 0: RUN mode 1: READY mode Bit 2: Undefined Bit 3: AT is in progress Bits 4–5: Undefined Bit 6: During SP ramp Bit 7: SP ramp-up is in progress Bit 8: SP ramp-down is in progress Bits 9–12: Undefined Bit 13: Heating PID is in use* Bit 14: Cooling PID is in use* Bit 15: Undefined
	DO state	9205	23F5	25589	63F5		×		×	–	Same as RAM address 14337 (decimal). Bit 0: Control output 1 Bit 1: Control output 2 Bit 2: Event output 1 Bit 3: Event output 2 Bit 4: Event output 3 Bits 5–15: Undefined
	DI state	9206	23F6	25590	63F6		×		×	–	Same as RAM address 14338 (decimal). Bit 0: DI1 Bit 1: DI2 Bit 3: Undefined
	User-defined bit	9207	23F7	25591	63F7					–	Bit 0:User-defined bit 1 Bit 1:User-defined bit 2 Bit 2:User-defined bit 3 Bit 3:User-defined bit 4
	User-defined bit 1	9208	23F8	25592	63F8					–	
	User-defined bit 2	9209	23F9	25593	63F9					–	
	User-defined bit 3	9210	23FA	25594	63FA					–	
	User-defined bit 4	9211	23FB	25595	63FB					–	
Tag	Tag 1	9301	2455	25685	6455					–	Cannot be displayed or set on the console
	Tag 2	9302	2456	25686	6456					–	Same as above.
	Tag 3	9303	2457	25687	6457					–	Same as above.
	Tag 4	9304	2458	25688	6458					–	Same as above.
	Tag 5	9305	2459	25689	6459					–	Same as above.
	Tag 6	9306	245A	25690	645A					–	Same as above.
	Tag 7	9307	245B	25691	645B					–	Same as above.
	Tag 8	9308	245C	25692	645C					–	Same as above.
	Tag 9	9309	245D	25693	645D					–	Same as above.
	Tag 10	9310	245E	25694	645E					–	Same as above.
	Tag 11	9311	245F	25695	645F					–	Same as above.
	Tag 12	9312	2460	25696	6460					–	Same as above.
	Tag 13	9313	2461	25697	6461					–	Same as above.
	Tag 14	9314	2462	25698	6462					–	Same as above.
	Tag 15	9315	2463	25699	6463					–	Same as above.
	Tag 16	9316	2464	25700	6464					–	Same as above.

* Valid only if L26 (heat/cool control) is set to 1 (use (individual PID))

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
PID	Proportional band 1	12288	3000	28672	7000					1	
	Integration time 1	12289	3001	28673	7001					C	
	Derivative time 1	12290	3002	28674	7002					C	
	Manual reset 1	12291	3003	28675	7003					1	
	MV low limit 1	12292	3004	28676	7004					1	
	MV high limit 1	12293	3005	28677	7005					1	
	Cool-side proportional band 1	12336	3030	28720	7030					1	
	Cool-side integration time 1	12337	3031	28721	7031					C	
	Cool-side derivative time 1	12338	3032	28722	7032					C	
	(Reserved for future use.)	12339	3033	28723	7033	△	△	△	△	1	
	Cool-side MV low limit 1	12340	3034	28724	7034					1	
	Cool-side MV high limit 1	12341	3035	28725	7035					1	
	Proportional band 2	12294	3006	28678	7006					1	
	Integral time 2	12295	3007	28679	7007					C	
	Derivative time 2	12296	3008	28680	7008					C	
	Manual reset 2	12297	3009	28681	7009					1	
	MV low limit 2	12298	300A	28682	700A					1	
	MV high limit 2	12299	300B	28683	700B					1	
	Cool-side proportional band 2	12342	3036	28726	7036					1	
	Cool-side integration time 2	12343	3037	28727	7037					C	
	Cool-side derivative time 2	12344	3038	28728	7038					C	
	(Reserved for future use.)	12345	3039	28729	7039	△	△	△	△	1	
	Cool-side MV low limit 2	12346	303A	28730	703A					1	
	Cool-side MV high limit 2	12347	303B	28731	703B					1	
	Proportional band 3	12300	300C	28684	700C					1	
	Integral time 3	12301	300D	28685	700D					C	
	Derivative time 3	12302	300E	28686	700E					C	
	Manual reset 3	12303	300F	28687	700F					1	
	MV low limit 3	12304	3010	28688	7010					1	
	MV high limit 3	12305	3011	28689	7011					1	
	Cool-side proportional band 3	12348	303C	28732	703C					1	
	Cool-side integration time 3	12349	303D	28733	703D					C	
	Cool-side derivative time 3	12350	303E	28734	703E					C	
	(Reserved for future use.)	12351	303F	28735	703F	△	△	△	△	1	
	Cool-side MV low limit 3	12352	3040	28736	7040					1	
	Cool-side MV high limit 3	12353	3041	28737	7041					1	
	Proportional band 4	12306	3012	28690	7012					1	
	Integral time 4	12307	3013	28691	7013					C	
	Derivative time 4	12308	3014	28692	7014					C	
	Manual reset 4	12309	3015	28693	7015					1	
	MV low limit 4	12310	3016	28694	7016					1	
	MV high limit 4	12311	3017	28695	7017					1	
	Cool-side proportional band 4	12354	3042	28738	7042					1	
	Cool-side integration time 4	12355	3043	28739	7043					C	
	Cool-side derivative time 4	12356	3044	28740	7044					C	
	(Reserved for future use.)	12357	3045	28741	7045	△	△	△	△	1	
	Cool-side MV low limit 4	12358	3046	28742	7046					1	
	Cool-side MV high limit 4	12359	3047	28743	7047					1	
	Proportional band 5	12312	3018	28696	7018					1	
	Integral time 5	12313	3019	28697	7019					C	
	Derivative time 5	12314	301A	28698	701A					C	
	Manual reset 5	12315	301B	28699	701B					1	
	MV low limit 5	12316	301C	28700	701C					1	
	MV high limit 5	12317	301D	28701	701D					1	
	Cool-side proportional band 5	12360	3048	28744	7048					1	
	Cool-side integration time 5	12361	3049	28745	7049					C	
	Cool-side derivative time 5	12362	304A	28746	704A					C	
	(Reserved for future use.)	12363	304B	28747	704B	△	△	△	△	1	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
PID	Cool-side MV low limit 5	12364	304C	28748	704C					1	
	Cool-side MV high limit 5	12365	304D	28749	704D					1	
	Proportional band 6	12318	301E	28702	701E					1	
	Integral time 6	12319	301F	28703	701F					C	
	Derivative time 6	12320	3020	28704	7020					C	
	Manual reset 6	12321	3021	28705	7021					1	
	MV low limit 6	12322	3022	28706	7022					1	
	MV high limit 6	12323	3023	28707	7023					1	
	Cool-side proportional band 6	12366	304E	28750	704E					1	
	Cool-side integration time 6	12367	304F	28751	704F					C	
	Cool-side derivative time 6	12368	3050	28752	7050					C	
	(Reserved for future use.)	12369	3051	28753	7051	△	△	△	△	1	
	Cool-side MV low limit 6	12370	3052	28754	7052					1	
	Cool-side MV high limit 6	12371	3053	28755	7053					1	
	Proportional band 7	12324	3024	28708	7024					1	
	Integration time 7	12325	3025	28709	7025					C	
	Derivative time 7	12326	3026	28710	7026					C	
	Manual reset 7	12327	3027	28711	7027					1	
	MV low limit 7	12328	3028	28712	7028					1	
	MV high limit 7	12329	3029	28713	7029					1	
	Cool-side proportional band 7	12372	3054	28756	7054					1	
	Cool-side integration time 7	12373	3055	28757	7055					C	
	Cool-side derivative time 7	12374	3056	28758	7056					C	
	(Reserved for future use.)	12375	3057	28759	7057	△	△	△	△	1	
	Cool-side MV low limit 7	12376	3058	28760	7058					1	
	Cool-side MV high limit 7	12377	3059	28761	7059					1	
	Proportional band 8	12330	302A	28714	702A					1	
	Integration time 8	12331	302B	28715	702B					C	
	Derivative time 8	12332	302C	28716	702C					C	
	Manual reset 8	12333	302D	28717	702D					1	
	MV low limit 8	12334	302E	28718	702E					1	
	MV high limit 8	12335	302F	28719	702F					1	
	Cool-side proportional band 8	12378	305A	28762	705A					1	
	Cool-side integration time 8	12379	305B	28763	705B					C	
	Cool-side derivative time 8	12380	305C	28764	705C					C	
	(Reserved for future use.)	12381	305D	28765	705D	△	△	△	△	1	
	Cool-side MV low limit 8	12382	305E	28766	705E					1	
	Cool-side MV high limit 8	12383	305F	28767	705F					1	
Event	Internal event 1 main setting	13056	3300	29440	7300					S	
	Internal event 1 sub-setting	13057	3301	29441	7301					S	
	Internal event 2 main setting	13058	3302	29442	7302					S	
	Internal event 2 sub-setting	13059	3303	29443	7303					S	
	Internal event 3 main setting	13060	3304	29444	7304					S	
	Internal event 3 sub-setting	13061	3305	29445	7305					S	
	Internal event 4 main setting	13062	3306	29446	7306					S	
	Internal event 4 sub-setting	13063	3307	29447	7307					S	
	Internal event 5 main setting	13064	3308	29448	7308					S	
	Internal event 5 sub-setting	13065	3309	29449	7309					S	
LSP	LSP1	13312	3400	29696	7400					P	
	LSP2	13313	3401	29697	7401					P	
	LSP3	13314	3402	29698	7402					P	
	LSP4	13315	3403	29699	7403					P	
	LSP5	13316	3404	29700	7404					P	
	LSP6	13317	3405	29701	7405					P	
	LSP7	13318	3406	29702	7406					P	
	LSP8	13319	3407	29703	7407					P	

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Instrument status 1	Representative alarm	14336	3800	30720	7800		×		×	–	Bit 0: PV error Bit 1: Undefined Bit 2: CT error (AL11) Bits 3–7: Undefined Bit 8: Initialization error (AL80/83/84) Bits 9–11: Undefined Bit 12: A/D conversion error (AL70) Bit 13: Setting value error (AL81/95) Bit 14: Adjustment value error (AL82/96) Bit 15: Undefined
	DO state	14337	3801	30721	7801		×		×	–	Same as RAM address 9205 (decimal).
	DI state	14338	3802	30722	7802		×		×	–	Same as RAM address 9206 (decimal).
Instrument status 2	RUN/READY	14352	3810	30736	7810		×		×	–	
	AUTO/MANUAL	14353	3811	30737	7811		×		×	–	
	AT start/stop selection	14354	3812	30738	7812		×		×	–	
	(Reserved for future use.)	14355	3813	30739	7813	△	×	△	×	–	
	PV	14356	3814	30740	7814		×		×	P	
	SP (target value)	14357	3815	30741	7815		×		×	P	
	MV (Manipulated Variable)	14358	3816	30742	7816		×		×	1	
Instrument status 3	(Reserved for future use.)	14416	3850	30800	7850	△	×	△	×	P	Same as RAM address 7001 (decimal).
	(Reserved for future use.)	14417	3851	30801	7851	△	×	△	×	1	Same as RAM address 9108 (decimal).
	CT1 current	14418	3852	30802	7852		×		×	1	Same as RAM address 9110 (decimal).
	CT2 current	14419	3853	30803	7853		×		×	1	Same as RAM address 9111 (decimal).
	Heat MV (Manipulated Variable)	14420	3854	30804	7854		×		×	1	Same as RAM address 9106 (decimal).
	Cool MV (Manipulated Variable)	14421	3855	30805	7855		×		×	1	Same as RAM address 9107 (decimal).

Bank	Item	RAM address		EEPROM address		RAM		EEPROM		Decimal point	Notes
		Decimal	Hexa-decimal	Decimal	Hexa-decimal	Read	Write	Read	Write		
Operation	LSP group selection	14592	3900	30976	7900		☐		☐	–	Writable when not assigned to a DI. Same as RAM address 9103 (decimal).
	LSP in use	14593	3901	30977	7901					P	Same as RAM address 9123 (decimal).
	Manual MV	14594	3902	30978	7902		☐		☐	1	Writable in manual mode Same as RAM address 9105 (decimal).
	RUN/READY	14595	3903	30979	7903		☐		☐	–	Writable when not assigned to a DI. Same as RAM address 9002 (decimal).
	AUTO/MANUAL	14596	3904	30980	7904		☐		☐	–	Writable when not assigned to a DI, etc. Same as RAM address 9001 (decimal).
	AT start/stop selection	14597	3905	30981	7905		☐		☐	–	Writable when not assigned to a DI, etc. Same as RAM address 9004 (decimal).
	(Reserved for future use.)	14598	3906	30982	7906	△	×	△	×	–	Same as RAM address 9003 (decimal).
PID group in use	Proportional band	14848	3A00	31232	7A00					1	
	Integration time	14849	3A01	31233	7A01					C	
	Derivative time	14850	3A02	31234	7A02					C	
	Manual reset	14851	3A03	31235	7A03					1	
	MV low limit	14852	3A04	31236	7A04					1	
	MV high limit	14853	3A05	31237	7A05					1	
	Cool-side proportional band	14854	3A06	31238	7A06					1	
	Cool-side integration time	14855	3A07	31239	7A07					C	
	Cool-side derivative time	14856	3A08	31240	7A08					C	
	(Reserved for future use.)	14857	3A09	31241	7A09	△	△	△	△	1	
	Cool-side MV low limit	14858	3A0A	31242	7A0A					1	
	Cool-side MV high limit	14859	3A0B	31243	7A0B					1	
Commu-nication monitor	Clear monitoring information	15935	3E3F	32319	7E3F					–	

Chapter 11. Maintenance and Troubleshooting

WARNING

To remove dirt from this device, wipe it with a soft dry cloth.

Never use an organic solvent such as paint thinner or benzene, or a detergent.

Do not use this device in wet places or with wet hands.

There is a danger of electric shock.

■ Maintenance

● Cleaning

To remove dirt from this device, wipe it with a soft dry cloth.

Never use an organic solvent such as thinner or benzene.

● Parts replacement

Do not replace any parts of this unit.

● Fuse replacement

When replacing the fuse connected to the electric wiring, always use the specified standard fuse.

Standards compliance: IEC 60127

Speed: time-lag (T)

Rated voltage: 250 V AC

Rated current: 0.5 A

■ Alarm codes and countermeasures

This section describes the alarm codes that are displayed if this device has errors, and also describes countermeasures.

	Alarm code*1	Description	Cause	Corrective action
Input error	AL01	PV input error (over range)	Sensor burnout, incorrect wiring	Check the wiring.
			Incorrect settings for PV range type, etc.	Check the PV range type (C01) and other settings.
	AL02	PV input error (under range)	Sensor burnout, incorrect wiring	Check the wiring.
			Incorrect settings for PV range type, etc.	Check the PV range type (C01) and other settings.
	AL03	Reference junction compensation (cold junction compensation) error	Measurement range error in terminal temperature at reference junction compensation	Make sure that the ambient temperature is within the specifications of this product.
		RTD input error	Sensor burnout, incorrect wiring	Check the wiring.
	AL11	CT input error (over range)*2	Current input exceeding the high limit of the display range	Use a current transformer with a number of turns that matches the display range. Check the number of CT turns and the setting. Check the setting and the number of times the power wire passes through the CT.
			Incorrect wiring	Check the wiring.

	Alarm code*1	Description	Cause	Corrective action
Instrument errors	AL10	A/D conversion error	A/D conversion unit failure	Turn the power off and then on again. If the alarm is triggered when the power is turned on again, replace the device.
	AL14	Nonvolatile memory error	Temporary communication error, corruption of data written, or failure of this device	
	AL80	Nonvolatile memory not initialized		
	AL81	Setting value area error*3		The problem can be corrected with the following procedure: • Initialize the settings • Write the setting again If this procedure does not correct the problem, replace the device.
	AL82	Adjustment value area error*3		Turn the power off and then on again. If the alarm is triggered when the power is turned on again, replace the device.
	AL83	Internal system error		
	AL84	Setting value initialization error		Turn the power off and then on again. If the alarm is triggered after turning the power on again, the problem can be corrected with the following procedure: • Initialize the settings*5 • Write the setting again If this procedure does not correct the problem, replace the device.
	AL95	Setting value error		
	AL96	Adjustment value error		Turn the power off and then on again. If the alarm is triggered after turning the power on again, the problem can be corrected with the following procedure: • Restore adjustment values*4 If this procedure does not correct the problem, replace the device.

*1. Multiple alarms may occur at the same time. If the corrective action for one of the alarms says that the device should be replaced, it should be replaced.

*2. The error occurred because of CT input 1, 2, or both.

*3. This error may occur when updating the firmware.

*4. If the area in memory for restoring adjustment values has been corrupted, the values cannot be restored. ☞ ■Starting calibration and inspection (p. 12-2) (for how to restore adjustment values)

*5. ☞ ■ Initializing the settings (p. 12-6) (for how to initialize the settings)

■ Operation when a PV input error occurs

If a PV input error occurs, this device will operate as follows.

Control output: Whether to continue operation can be specified.

Other operations: Operation continues.

If the PV input is abnormal, this device displays the alarm codes and values shown in the tables below. What is displayed varies depending on the sensor type.

Input type	Error	PV range No.	Indication	Alarm code
Thermocouple	Burnout	1 to 25	Upscale (110 % FS)	AL01
	Reference junction compensation (cold junction compensation) error		Unknown	AL03
RTD	Resistor burnout Line A burnout 2- or 3-wire burnout	4 to 68	Upscale (110 % FS)	AL01 AL03
	Line B burnout		Upscale (110 % FS)*	AL01 AL03 (AL02)
	Short circuit, lines A and B	41 to 44	Downscale (–235 °C / -235°F)	AL02
		45 to 68	Downscale (–10 %FS)	AL02
DC voltage	Burnout	84	Downscale (–3 %FS)	AL02
		86	Downscale (–10 %FS)	AL02
		87	Downscale (–3 %FS)	AL02
		88	Downscale (a value around 0 % FS)	None
DC current	Burnout	89	Unknown (a value around 0 % FS)	None
		90	Downscale (–10 %FS)	AL02

* It may be upscaled after the indicated value drops for a short period of time.

! Handling Precautions

- If the temperature unit is Fahrenheit, a PV low limit alarm (AL02) is generated at –235 °F, which is within the PV range, for PV ranges 41–44.

■ If an error occurs in communication with model SLP-C1F

When this device is communicating with a PC running SLP-C1F that is connected using the loader cable, reading or writing may fail. In this case, unplug the loader cable from the PC's USB connector, wait at least 10 seconds, and then plug it in again.

■ Updating the firmware

If necessary, update the firmware using the procedure described in this section.

! Handling Precautions

- This device will stop functioning during the update. Please update the firmware when it will not affect your machines or equipment.
- Be sure to use a loader cable.

● The folder for updates

Updates are stored in the FwUpdates folder where the SLP-C1F is installed. The following is the default installation folder.

C:\Program Files (x86)\SLP\SLPC1\FwUpdates

● Update names

The names of updates vary depending on the model and ROM version as shown below. Please select an appropriate update.

FWUP_ <model ID> _ <ROM version>

Model ID

Model	Model ID
C1M	84100109001
C1A	84100110001
C2/C3	84100111001

ROM versions are expressed in four digits. If the version is 1.01, the file name ends with "_0101." If there are no updates for the versions shown in ■ ROM version history (p. App-2), please download the latest version of the Smart Loader Package Model SLP-C1F from Azbil's website.

Note

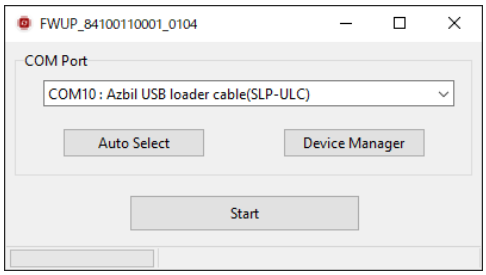
- If AL81 (Settings area error) occurs after writing is complete, initialize the settings.
  ☞ ■ Initializing the settings (p. 12-6).
- If other alarms occur:
  ☞ ■ Alarm codes and countermeasures (p. 11-2).

● Update procedure

(1) Connect the PC to the controller whose firmware should be updated with a loader cable.

(2) Select and start the update to use.

(3) Select a communication port from the options. When the program starts up, the port of the controller is set as default. If you click [Auto Select], the port of the cable connected to the PC will be set automatically.

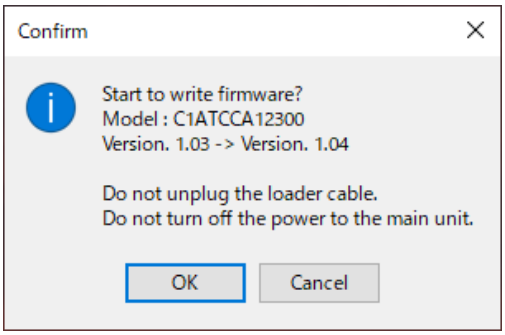


Handling Precautions

- For the update for the C1M, if the 81441177-001 USB loader cable is not connected, the name of the cable will not be displayed as a COM port option.
- For update for the C1A/C2/C3, if the SLP-ULCJA0 USB loader cable (A to micro-B) is not connected, the name of the cable will not be displayed as a COM port option.

(4) Click [Start].

≫ The dialog box for confirming whether to start writing is displayed. Check that the model of the controller, the current version, and the version after the update are correct.

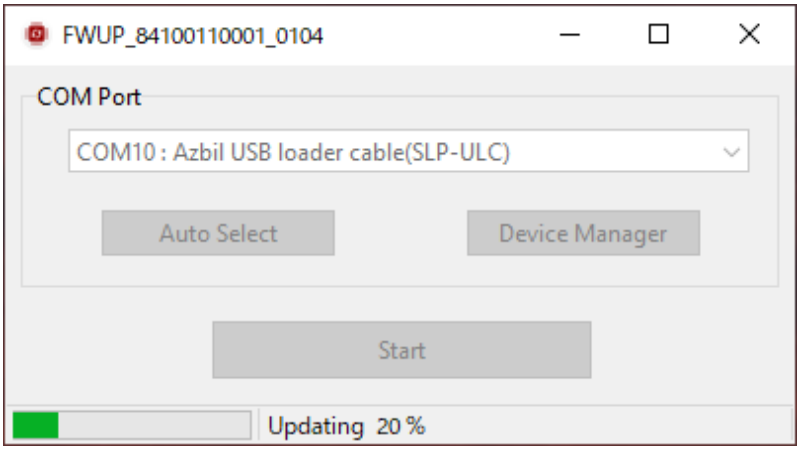


Handling Precautions

- If the previous writing has failed, the model and current version may not be displayed.

(5) Click [OK].

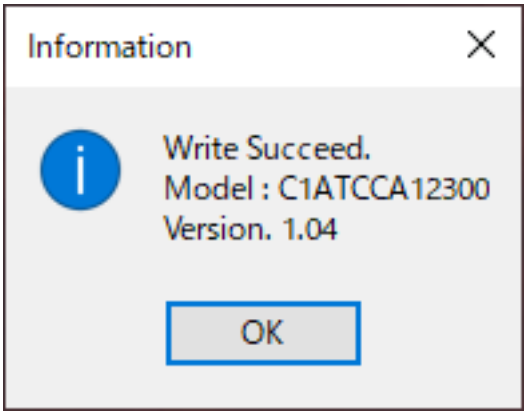
≫ Writing begins.



Handling Precautions

- Keep the loader cable connected during writing.

(6) When writing is complete, the writing result dialog box will be displayed. If [Write Succeed.] is displayed, the update was successful.



Handling Precautions

- If an error dialog box appears and writing is interrupted, close the update and start again from step 1.
- If a problem occurs during writing, the display on the controller will remain off even when the power is on. The display will turn on after the next successful writing.

Chapter 12. Calibration and Inspection

CAUTION

Do not switch to calibration/inspection mode while the object of control is in operation.

When this device is in calibration/inspection mode, the state of control outputs and event outputs is fixed and these outputs do not function. Take this into consideration when calibrating or inspecting.

Handling Precautions

- It may be necessary to disconnect or reconnect the wiring for calibration and inspection.
  In this case, follow the warnings and cautions regarding wiring given in Chapter 4. Wiring.
- Use the SLP-C1F Smart Loader Package version 2.3.0 or later for calibration and inspection.

The user can calibrate and inspect the input and output functions of this device.

The following are available:

- I/O inspection (external contact input, control output and event output, key input)
- PV input calibration
- Current output calibration
- CT input calibration

Use the SLP-C1F Smart Loader Package for calibration and inspection.

Handling Precautions

- Use the SLP-C1F Smart Loader Package version 2.3.0 or later for calibration and inspection.

Note

- ☞ *User's Manual for Detailed Functions of Smart Loader Package Model SLP-C1F for Single Loop Controller Model C1M/C1A/C2/C3* (Document No. CP-SP-1463E)(for the version of the SLP-C1F Smart Loader Package)

■ Starting calibration and inspection

Start the SLP-C1F Smart Loader Package to display the menu screen. Select [Menu] → [Calibration and checking] from the pull down menu. A dialog box saying "Calibrate" will be displayed.

When [OK] is selected, the calibration and checking screen is displayed and this device enters calibration/inspection mode.

When this device is in this mode, the lower display says tESt.

Handling Precautions

- Azbil Corporation will not be liable for problems caused by incorrect calibration or checking by the user.
- To restore the settings when the product was shipped during calibration or checking:
  If you select [Command] → [Restore adjustment values] from the pull-down menu, any current calibration settings will be discarded and the settings when the product was shipped will be restored. If you accidentally execute this command during calibration or inspection, all the current calibration data will be lost. If you accidentally execute this command during calibration or checking, all the current calibration data will be lost.

■ Ending calibration and inspection

To end calibration or inspection, do either one of the following.

- On the calibration and checking screen of the Smart Loader Package, select [File] → [Quit] from the pull-down menu.
- When you click the [×] icon in the upper right corner of the calibration and checking screen, tESt disappears and the device returns to normal mode.

! Handling Precautions

- If you disconnect the loader cable before completing calibration or inspection with the Smart Loader Package, this device will remain in calibration/inspection mode. To return this device to normal mode, turn the power off and then on.

■ Precautions for calibration

Failure to observe the following precautions will lead to poor accuracy.

- When calibrating the RTD input, use wires of the same type and length for the three wires.
- Power this device for at least 1 hour before starting calibration.
- Calibrate this device within the ambient temperature range specified by the standard conditions.
- Do not calibrate this device where it is exposed to wind or in a fluctuating ambient temperature.
- Do not calibrate with instruments or conditions that do not satisfy the specifications shown in Measuring instruments required for calibration (p. 12-3) below.

■ Measuring instruments required for calibration

Measuring instrument	Specifications
Reference current/ voltage generator	Accuracy: ±0.025 % or less, minimum resolution (voltage): 1 uV or less, minimum resolution (current): 1 µA or less
Resistor	Accuracy: ±0.025 % or less, minimum resolution: 0.1 Ω or less
Ammeter	Accuracy: ±0.05 % or less, minimum resolution: 1 µA or less
Voltmeter	Accuracy: ±0.025 % or less, minimum resolution: 1 µV or less
Thermometer	Accuracy: ±0.1 °C or less, minimum resolution: 0.1 °C or less

■ Calibration and checking procedure

● Inspection of I/Os

(1) Select the [I/O check] tab.

(2) Select the desired item to check.

(3) Press [Execute].

For inputs (external contact input, key input), the status (ON/OFF) retained by this device is loaded and displayed on the PC.

For outputs (control output, event output), the status (ON/OFF) selected by the checkbox is output from the output terminals of this device.

● PV input calibration

(1) Select the [PV Calibration] tab.

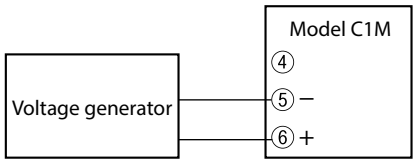
(2) Select a gain No. in ascending order.

(3) Press [Read].

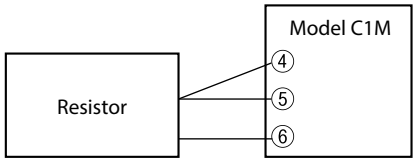
(4) Apply the voltage, current, or resistance indicated on the right of the gain No. to the PV input terminals.

Before application, connect this device to the measuring instrument as follows.

- If T (thermocouple) is selected as the PV input type by the model No. (digit ❼):

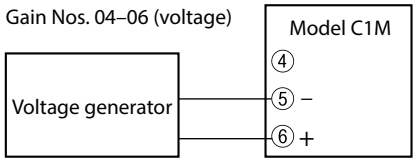


- If R (RTD) is selected as the PV input type by the model No. (digit ❼):

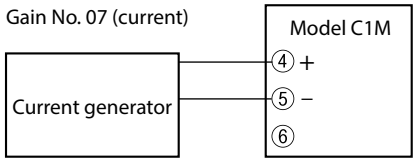


- If L (DC voltage/current) is selected as the PV input type by the model No. (digit ❼):

Gain Nos. 04–06 (voltage)



Gain No. 07 (current)



(5) Keep applying the voltage, current or resistance for 30 seconds or longer.

(6) Press [Write].

(7) Return to step 3 and repeat the procedure until the calibration of the last gain is completed.

Handling Precautions

- When calibrating the PV input, be sure to adjust all gains according to the model that is used.
- Warm up this device from power-on to the start of calibration.
- Connect external instruments for adjustment before starting warm-up to achieve the following input statuses:
  - · Thermocouple: 0 mV input
  - · RTD: 100 Ω input
  - · Voltage: 0 mV input
  - · Current: 0 mA input
- Do not leave the PV input terminals open during warm-up.

● Current transformer (CT) input calibration

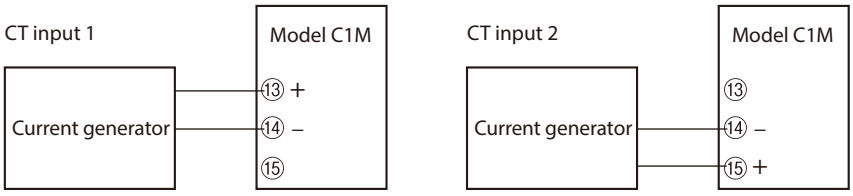
(1) Select the [CT Input Calibration] tab.

(2) Select the channel to calibrate.

(3) Select [Zero] in the [Zero/Span] field.
Both zero and span should be calibrated for one channel. Therefore, after selecting a channel, first calibrate zero and then span.

(4) Press [Read].

(5) Keep applying the zero calibration current to the CT input terminals of the selected channel for 30 seconds or longer. Before application of current, connect this device to the measuring instrument as shown.



(6) Press [Write].

(7) Select [Span] in the [Zero/Span] field.

(8) Press [Read].

(9) Keep applying the span calibration current to the CT input terminals of the selected channel for 30 seconds or longer.

(10) Press [Write].

(11) If there are other channels to calibrate, return to step 4.

Handling Precautions

- When calibrating the CT input, apply a DC current (mA) to the input terminals.

● Current output calibration

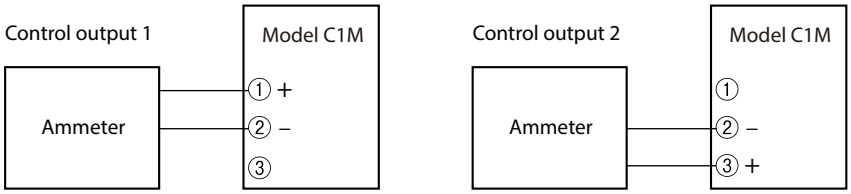
(1) Select the [Analog Output Calibration] tab.

(2) Select the channel to calibrate.
Control output 1 is indicated as "OUT1" and control output 2 is "OUT2."

(3) Select [Zero] in the [Zero/Span] field.
Both zero and span should be calibrated for one channel. Therefore, after selecting a channel, first calibrate zero and then span.

(4) Press [Read].

(5) The zero calibration current is output to the output terminal of the selected channel.
Keep this state for 30 seconds or longer. The figures below illustrate how to connect the measuring instrument.



(6) Check the current indicated by the ammeter to the 3rd digit after the decimal point, enter it in [Adjustment value], and press [Write].

(7) Select [Span] in the [Zero/Span] field.

(8) Press [Read].

(9) The span calibration current is output to the output terminal of the selected channel.
Keep this state for 30 seconds or longer.

(10) Check the current indicated by the ammeter to the 3rd digit after the decimal point, enter it in [Adjustment value], and press [Write].

(11) If there are other channels to calibrate, return to step 4.

■ Initializing the settings

From the pull-down menu, select [Command] → [Setting initialization] to restore their default settings.

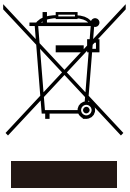
Chapter 13. Disposal

Disposal of Electrical and Electronic Equipment (for Environmental Protection)

This is an industrial product subject to the WEEE Directive.

Do not dispose of electrical and electronic equipment in the same way as household waste.

Old products contain valuable raw materials and must be returned to an authorized collection point for correct disposal or recycling.



-MEMO-

Chapter 14. Specifications

■ Specifications

● PV input (selectable by model No.)

Item		Description
Number of inputs		1
Sampling cycle		50, 100, 300, 500 ms
Thermocouple input		
	Thermocouple type	K, J, E, T, R, S, B, N (JIS C 1602: 2015) PLII, PR40-20 (ASTM E1751/E1751M-20) WRe5-26 (ASTM E988-96 (Reapproved 2002) JIS C 1602:2015 (C thermocouple)) DIN U, DIN L (DIN 43710:1985)
	Indication accuracy (under standard conditions)	±0.3 % FS ±1 digit (excluding the reference junction compensation point) (Negative range: ±0.6 % FS ±1 digit. Other exceptions: see the PV input range table)
	Reference junction compensation (cold junction compensation) accuracy	±0.5 °C (under standard conditions) (For every 1 °C outside the temperature range of the standard conditions, the accuracy decreases by ± 0.05 °C.)
	Reference junction (cold junction) compensation method	Select "0" (internal compensation (by this device)) or "1" (external compensation (by another device)).
	Allowable input*	−0.5 to +12 V
	Input bias current	+0.2 µA max. (under standard conditions)
	Thermocouple/ compensating lead wire diameter	0.3 to 0.65 mm
	Operation upon input wire burnout	☞ Operation when a PV input error occurs (p. 11-4)
RTD		
	RTD type	Pt100 (JIS C 1604:2013) JPt100 (JIS C 1604:1989)
	Indication accuracy (under standard conditions)	±0.2 % FS ±1 digit
	Allowable input*	−0.5 to +12 V
	Measuring current	1 mA (typical), from terminals 5 and 6
	Wiring resistance effect	±0.05 % FS/Ω max.
	Allowable wiring resistance	85 Ω max.
	Operation upon input wire burnout	☞ Operation when a PV input error occurs (p. 11-4)
DC voltage		
	DC voltage type	0–1 V, 1–5 V, 0–5 V, 0–10 V
	Indication accuracy (under standard conditions)	±0.2 % FS ±1 digit
	Allowable input*	−0.5 to +12 V
	Input impedance	1 MΩ min.
	Operation upon input wire burnout	☞ Operation when a PV input error occurs (p. 11-4)

Item		Description
DC current		
	DC current type	0–20 mA, 4–20 mA
	Indication accuracy (under standard conditions)	±0.2 % FS ±1 digit
	Allowable input*	30 mA or less, or 4 V or less
	Input impedance	100 Ω max. (with 20 mA input)
	Operation upon input wire burnout	☞ Operation when a PV input error occurs (p. 11-4)

* A voltage or current input greater than the allowable input may damage the circuits.

● Digital input (DI1–2) (optional)

Item	Description
Number of inputs	2
Input type	Non-voltage contacts or open collector
Allowable ON contact resistance	250 Ω max.
Allowable OFF contact resistance	100 kΩ min.
Allowable ON residual voltage	1.0 V max.
Terminal current while ON	Approx. 7.5 mA (when shorted) / approx. 5.0 mA (at a contact resistance of 250 Ω)
Minimum hold time	Sampling cycle + 10 ms
Open terminal voltage	5.5 V DC ±1 V
Parallel connection circuit voltage	24 V DC max.

● Current transformer inputs (CT1–2) (optional)

Item	Description
Number of inputs	2
Input object	Current transformer with 100–4000 turns (availability is in 100-turn units)
Measurement current	0.4–50.0 A AC, 50/60 Hz (800 turns, 1 power wire pass)
Allowable measured current	0.0–70.0 A AC and peak current 110 A (800 turns, 1 power wire pass)
Indication accuracy (under standard conditions)	±5 % FS ±1 digit (not including accuracy of current transformer in the case of sine waves)
Indication resolution	0.1 A AC
Indication update cycle	100 ms
Allowable input current	100 mA and 141.4 mA peak (AC) 3.0 V and 4.0 V peak (AC)
Transient overvoltage	Supply voltage + 250 V
Precautions when using a CT	Do not use CT input for phase control.

● Control output (selectable by model No.)

Item		Description
Relay output		
	Contact configuration	1c (SPDT)
	Contact rating	250 V AC / 30 V DC, 3 A (resistive load)
	Service life	N.O. side: 100,000 cycles or more N.C. side: 100,000 cycles or more
	Minimum switching specifications (reference value)	5 V, 100 mA
	Minimum open/close time	50 ms
Voltage pulse output (for SSR drive)		
	Voltage when open	19 V DC ±15 %
	Internal resistance	18 Ω
	Allowable current	24 mA max
	OFF-state leak current	100 μA max.
	Short-circuit protection function	Yes
	Minimum OFF/ON time	1 ms
Current output		
	Output type	0–20 mA DC or 4–20 mA DC
	Allowable load resistance	600 Ω max.
	Output accuracy (under standard conditions)	±0.3 % FS However, ±1 % FS at 0–1 mA
	Output resolution	1/12500 (at 0–20 mA DC), 1/10000 (at 4–20 mA DC)
	Output update cycle	Same as sampling cycle

● Event relay (EV1–3) (optional)

Item	Description
Number of outputs	3 (for models with 3 EV outputs) 2 (for models with 2 EV outputs with independent contacts)
Contact configuration	1a (SPST)
Contact rating	250 V AC / 30 V DC, 2 A (resistive load)
Service life	100,000 cycles or more
Minimum switching specifications (reference value)	5 V, 10 mA
Minimum open/close time	50 ms

● Loader communication

Item	Description
Cables	• USB loader cable (81441177-001) • The cable that is included with Smart Loader Package (model SLP-C1FJA0 / SLP-C1FJA3)

● RS-485 communication (optional)

Item	Description
Transmission line	3-wire system
Transmission speed	4800, 9600, 19200, 38400 bps
Data length	8 bits / 7 bits
Parity bit	Even parity, odd parity, no parity
Stop bits	1 or 2
Communication protocol	Host communication: compliant with CPL, Modbus™/RTU, Modbus/ASCII, or PLC link
Terminating resistor	External resistor (120 Ω, 1/2 W or more) recommended
Network	Multidrop (up to 31 slave stations for 1 host station)
Communications/synchronization type	Half-duplex, start-stop synchronization
Maximum cable length	500 m

● I/O Isolation

Items enclosed by solid lines are isolated from other signals. The presence or absence of input/output depends on the model. Thick solid lines indicate reinforced insulation.

<table>
<tr><td>Power</td><td rowspan="4">Internal circuits</td><td>Event outputs 1–3
* On models with independent contacts, event outputs 1 and 2 have reinforced insulation.</td></tr>
<tr><td>DIs 1–2
RS-485 communication</td></tr>
<tr><td>CT inputs 1–2
PV input
Loader communication</td><td>Control output 1 (relay)</td></tr>
<tr><td></td><td>Control outputs 1–2 (voltage pulse, current)</td></tr>
</table>

● Standard conditions

Item	Description
Ambient temperature	25 ±3 °C (provided there is a space of 2 cm below the product)
Ambient humidity	60 ±5 % RH (without condensation or freezing)
Power	105 V AC ±10 %
Power frequency	50/60 Hz ±1 Hz
Vibration	0 m/s^2
Shock	0 m/s^2
Mounting angle	Reference plane ±3°

● Operating conditions

Item	Description
Ambient temperature	−10 to +55 °C for independent mounting
Ambient humidity	10–85 % RH (without condensation or freezing)
Power	85–264 V AC, 50/60 Hz ±2 Hz (Rated power: 100–240 V AC, 50/60 Hz)
Vibration	0–5 m/s^2 (10–60 Hz for 2 h each in the X, Y, and Z directions)
Shock	0–100 m/s^2
Mounting angle	Reference plane ±10°

● Transport and storage conditions

Item	Description
Ambient temperature	−20 to +70 °C
Ambient humidity	10–85 % RH (without condensation or freezing, protected from humidity and dust)
Vibration	0–10 m/s^2 (10–60 Hz for 2 h each in the X, Y, and Z directions)
Shock	0–300 m/s^2 (vertically 3 times)
Drop test	Drop height 60 cm (free fall on 1 corner, 3 edges, 6 sides)

● Other specifications

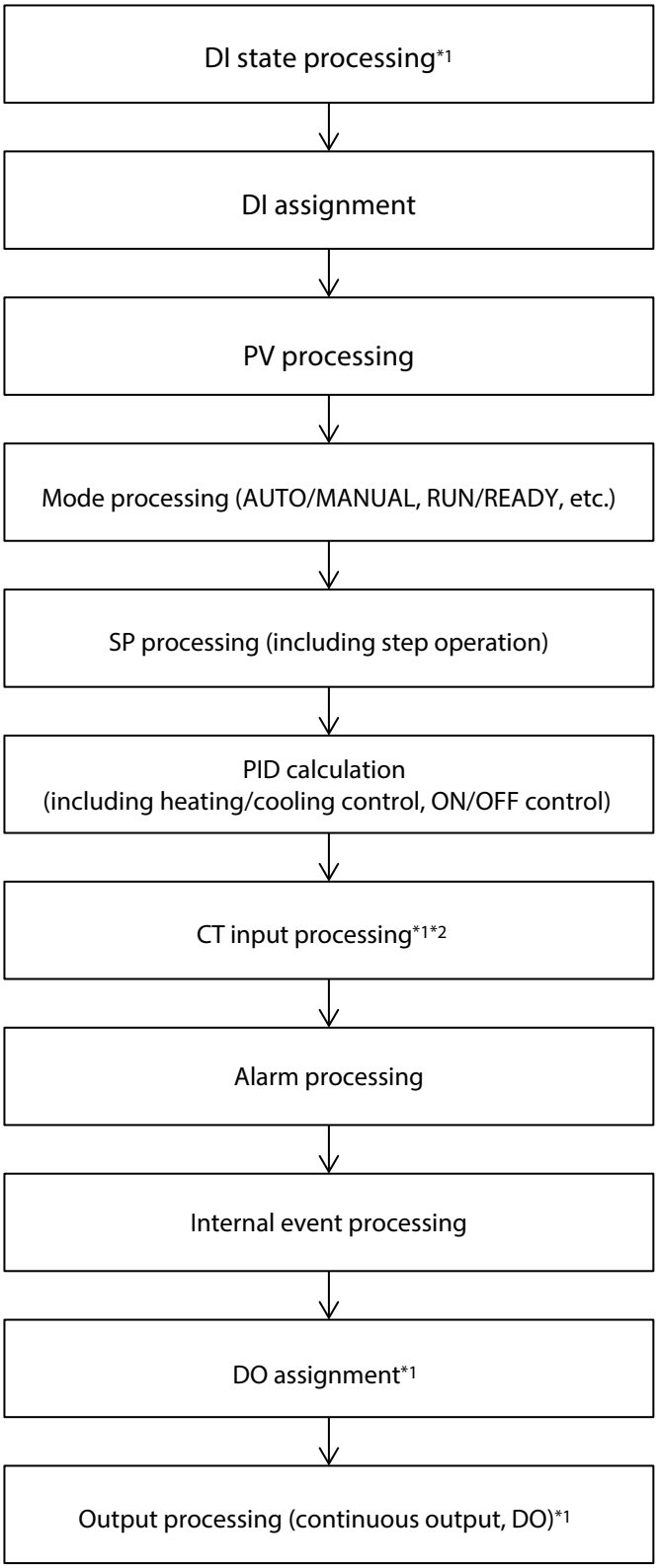
Item	Description			
Protection class	IP66 (device front side) (when individually mounted in a panel using the included gasket)			
Nonvolatile memory	EEPROM (durability: 100,000 erase/write cycles)			
Power consumption	8 VA or less (6 VA at 100 V AC, 8 VA at 264 V AC)			
Elevation	2000 m max.			
Mass	Approx. 130 g (for panel mounting: including the supplied mounting bracket, model No. 84515488-001)			
Terminal screw tightening torque	0.6 ±0.1 N·m			
Legal control/authentication		Law/ directive	Certificate/ file No., etc.	Notes
	CE	LVD		EN 61010-1
	CE	EMC*		EN 61326-1 (For use in industrial locations)
	CE	RoHS		EN IEC63000
	UKCA	LVD		EN 61010-1
	UKCA	EMC*		EN 61326-1 (For use in industrial locations)
	UKCA	RoHS		EN IEC63000
	KC	Korean Radio Act	R-R-A2B-A146	
	UL		QUYX2. E246616	UL 61010-1,UL 61010-2-030
	cUL		QUYX8. E246616	CAN/CSA-C22.2 No.61010-1-12, CSA C22.2 No.61010-2-030:18
Overvoltage category	II (IEC 60364-4-443, IEC 60664-1)			
Allowable pollution degree	2			
Insulation resistance	20 MΩ min. (Power terminals, and between power terminals and isolated I/O terminals) (with a 500 V DC insulation resistance tester)			
Dielectric strength	1500 V AC for 1 minute			
Allowable transient power loss	20 ms max.			
Power-on inrush current	18 A max. / 1.5 ms max.			
Case material/color	Modified PPE/black			
Protective sheet material/color	Polyester film/black			

* During EMC testing, the indication or output may fluctuate by the equivalent of ±10 % FS.

Appendix

■ Processing order

The order of processing that is executed for each sampling cycle is shown below.



*1. Executed only if the model has the corresponding function.

*2. Regardless of the sampling cycle setting, the update cycle is always 100 ms.

■ Event operation type and available functions

As shown in the table below, the functions available vary depending on the operation type of the internal event.

Operation type	Operation type settings	Standby*1	Event state in READY mode*2	Alarm OR*3	Special OFF*4
No event	0	×	×	×	×
PV high limit	1	✓	✓	✓	✓
PV low limit	2	✓	✓	✓	✓
PV high and low limits	3	✓	✓	✓	✓
Deviation high limit	4	✓	✓	✓	✓
Deviation low limit	5	✓	✓	✓	✓
Deviation high and low limits	6	✓	✓	✓	✓
Deviation high limit (final SP reference)	7	✓	✓	✓	✓
Deviation low limit (final SP reference)	8	✓	✓	✓	✓
Deviation high and low limits (final SP reference)	9	✓	✓	✓	✓
SP high limit	10	✓	✓	✓	✓
SP low limit	11	✓	✓	✓	✓
SP high and low limits	12	✓	✓	✓	✓
MV high limit	13	✓	✓	✓	✓
MV low limit	14	✓	✓	✓	✓
MV high and low limits	15	✓	✓	✓	✓
Heater 1 burnout/overcurrent	16	×	✓	✓	✓
Heater 1 short circuit	17	×	✓	✓	✓
Heater 2 burnout/overcurrent	18	×	✓	✓	✓
Heater 2 short circuit	19	×	✓	✓	✓
Loop diagnosis 1	20	✓	✓	✓	✓
Loop diagnosis 2	21	✓	✓	✓	✓
Loop diagnosis 3	22	✓	✓	✓	✓
Alarm (status)	23	×	✓	✓	×
READY (status)	24	×	✓	✓	×
MANUAL (status)	25	×	✓	✓	×
AT running (status)	27	×	✓	✓	×
During SP ramp (status)	28	×	✓	✓	×
Control direct action (status)	29	×	✓	✓	×
Timer (status)	32	×	✓	✓	×

*1. ✓: The operation indicated by the standby setting is available, —: No standby at any time

*2. ✓: The operation indicated by the event state in READY mode setting is available, —: Continues at any time

*3. ✓: The operation indicated by the alarm OR setting is available, —: No alarm OR at any time

*4. ✓: The operation indicated by the special OFF setting is available, —: No special OFF at any time

■ ROM version history

This section describes added functions and changes to specifications for each ROM version.

● ROM version 1.03 (available from August 2024)

● New function

(None)

● Functional improvement

(None)

● Program modification

(1) The problem that occurs when changing the [Mode display setup] setting using the keys was fixed.
☞ ■ Mode display setup (p. 5-99)

● ROM version 1.02 (available from May 2024)

● New function

(None)

● Functional improvement

(1) When the status of PLC link communication returns to normal, 0 (communication succeeded) is written to the device set for [Completion notification data].
☞ ■ Completion notification data (p. 9-13)

(2) Noise resistance for Modbus/RTU host communication and PLC link communication was enhanced.

● Program modification

(1) Problems with triggered data transfer in PLC link communication were removed.
☞ 9 - 2 Data Transmission (p. 9-3)

(2) Even if [Input bit function] in the DI assignment bank is set to 0 (Not used), the [Polarity] setting can now be specified.
☞ ■ Function result polarity (p. 5-79)

(3) The setting for [AT stop/start] can now be changed when an alarm other than AL01 (PV high limit error) and AL02 (PV low limit error) occurs.
☞ ■ How to start AT (p. 5-31)

● ROM version 1.01 (available from January 2023)

● New function

(1) Added the password function.
☞ ■Password (p. 5-109)

Added the event remaining time display function.
☞ ■ Event remaining time display setup (p. 5-102)

- **Functional improvement**

  (1) Even if PLC link communication is enabled by the SLP, if the setting for [Communication type] is anything other than "3" (PLC link), PLC link communication will not work.
  ☞ ■Common settings (p. 9-21)

  (2) Changed the conditions for displaying the [Control action (direct/reverse)] setting.
  ☞ ■ Setup bank (p. 6-19)

  (3) Changed the display transition using keys when [Bit 1: SP] of [PV/SP display setup] is set to "0" (No).
  ☞ ■ PV/SP display setup (p. 5-100)

- **Program modification**

  (1) If a timeout, C1M error, or PLC error occurs during cyclic or triggered data transfer from the PLC to the C1M in PLC link communication, C1M parameters will not be updated.
  ☞ ■Transfer settings (p. 9-22)

  (2) Improved the latch operation when output assignments A–D are set to "14" (MV ON/OFF status 1) or "15" (MV ON/OFF status 2).
  ☞ ■Latch (p. 5-79)

● ROM version 1.00 (available from January 2022)

- **New function**

  (1) New release

- **Functional improvement**

  (None)

- **Program modification**

  (None)

■ Description of used symbols, terms, and abbreviations

Abbreviations are used in the descriptions, tables, and illustrations of this manual. The main abbreviations are explained below.

Information such as detailed meanings as well as other abbreviations and words can be found on the website of Azbil Corporation.

https://aa-industrial.azbil.com/jp/en

- **Symbol**

  % FS (% of full scale)

  Full scale error

The full scale is the input range of a controller or recorder. The control or display accuracy of a device that has a specified measurement range setting for temperature, flow rate, etc., is expressed with this term. The range of error is obtained by multiplying the range specified for the device by this percentage.

● A

AT (auto-tuning)

A function to automatically calculate the optimum value of the PID control parameters (P, I, D).

● C

CJ (cold junction)

Cold junction compensation

A reference junction compensation in which the temperature of the reference junction is set to 0 °C.

CPL (Controller Peripheral Link)

CPL communication, CPL communication protocol

A type of communication, or a communication protocol, that can be used with Azbil's controllers, etc. Used to connect to a device and read and write its internal data.

CT (current transformer)

Used to detect the current applied to a heater. Heater burnout, relay short circuit, etc., can be monitored.

● D

D (derivative)

D action (derivative action)

A control action that gives a controlled variable proportional to the speed at which the process value deviates from the set point. It makes a large correction while the deviation is small. It is not used alone but works in combination with P or PI action.

DI (digital input)

External contact input

Used to switch remote/local, multiple SPs, auto/manual, etc., of controllers, etc.

DO (digital output)

External output

An ON/OFF signal is output to external devices from control output terminals, relay terminals, and event output terminals.

● **E**

EV (event)

Event output

A function of a controller or recorder that determines process (PV) abnormalities, etc., independently from the main control. A function to output abnormalities as alarms is also expressed as EV. Used with PV high/low limit alarm, deviation high/low limit alarm, etc. It is also possible to output the mode of a device (ready, manual, etc).

● **I**

I (integral)

I action (integral action)

A control action in which the amount of change in correction is proportional to the integrated value of the deviation. When an offset occurs, integral action works to eliminate the offset by changing the manipulated variable. I action is not used alone, but always with proportional action.

● **L**

LSP (local set point)

Local SP

The SP stored in the device. For the C1M, LSP has the same meaning as SP.

● **M**

Motor feedback (MFB)

Motor opening

The opening signal sent from the motor controlled by a controller. Available only on the C3 controller with the position proportional control function.

MV (manipulated variable)

A signal sent to an actuator. It is also called “control output.”

● **O**

OH (output high limit)

MV high limit

The highest MV allowed. It can be set for normal control output, control output for cooling, control output during AT, etc.

OL (output low limit)

MV low limit

The lowest MV allowed. It can be set for normal control output, control output for cooling, control output during AT, etc.

● P

P (proportional)

P action (proportional action)

Proportional control A control method in which the amount of correction is proportional to the amount of deviation. The range of the controlled variable to be corrected is called the proportional band. When only P action is used for control, an offset occurs in which the controlled variable becomes stable at a value equal to or less than the set point.

PID (proportional, integral, and derivative)

PID control

A control method that uses proportional, integral, and derivative actions.

PLC (programmable logic controller)

Programmable controller

A sequencer.

PV (process value)

Present value, measured value, detected value

● R

RJ (reference junction)

Reference junction compensation

A thermocouple has two junctions for the purpose of temperature measurement, one at the object being measured and the other connected to the measuring instrument. The junction connected to the measuring instrument is called the reference junction.

RSP (remote set point)

Remote SP

An SP sent from an external device. Available only on the C3 controller with the RSP function.

RTD (resistance temperature detector)

An RTD consists of a resistance element composed of unshielded wires made from a material such as platinum, internal lead wires, a protective tube, terminals, etc. It measures temperature by utilizing the fact that the electrical resistance of the resistance element changes with temperature. The operating temperature range is −200 to + 500 °C for platinum resistance temperature detectors.

● S

SCR (silicon controlled rectifier)

A thyristor (power regulator).

It is composed of semiconductor element transistors and is used for heater control in combination with a controller that continuously outputs a current signal for proportional control.

SLP (Smart Loader Package)

Application software that runs on a computer and facilitates configuration and monitoring of Azbil controllers.

SP (set point)

The target value

A set point specified by controllers, etc. It is also called the SV (set value).

SSR (solid-state relay)

Used for heater control in combination with a controller that outputs voltage pulses.

ST (self-tuning)

A function that automatically sets PID values when the set point is changed or a disturbance occurs. Unlike auto-tuning, the controller determines when to activate this function.

● T

T/C (thermocouple)

Used for temperature measurement. For the purpose of generating thermoelectromotive force, one end of two kinds of metal wires is electrically connected. The combinations of metals in commonly used thermocouples include platinum–platinum rhodium (R thermocouple), alumel-chromel (K thermocouple), iron-constantan (J thermocouple), and copper-constantan (T thermocouple).

● U

U (unit)

The smallest unit of an industrial quantity (°C, Pa, L/min, etc.) of a PV range. For a range of −200 to +200 °C, 1 U = 1 °C. For 0.0 to 200.0 °C, 1 U = 0.1 °C.

For DC voltage input with a scaling of 0.00 to 10.00, 1 U = 0.01. 0.1 U is one tenth of 1 U.

UF (user function)

User-defined function

A function for displaying settings and monitoring data specified by the user in the operation display of a controller. Up to 8 items can be specified.

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Revision History of CP-SP-1448E

Date	Rev.	(New) Page No.	Description
June 2022	1		
Nov. 2023	2		
Oct. 2024	3		

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

   1.1 Warranty period

   Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

   1.2 Warranty scope

   In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

   (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
   (2) Failure caused for other reasons than Azbil Corporation's product;
   (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
   (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
   (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
   (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

   Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

   You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

   (1) Regulations and standards or laws that your Equipment is to comply with.
   (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
   (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
   Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

   *1. A design that is safe even if the user makes an error.
   *2. A design that is safe even if the device fails.
   *3. Avoidance of device failure by using highly reliable components, etc.
   *4. The use of redundancy.

3. Precautions and restrictions on application

   3.1 Restrictions on application

   Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

   *5. Nuclear power quality: compliance with JEAG 4121 required
   *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
   *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

   Any Azbil Corporation's products shall not be used for/with medical equipment.

   The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

   3.2 Precautions on application

   you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

(1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
(2) For use of specific purposes, such as:
    * Nuclear energy/radiation related facilities
      [When used outside a radiation controlled area and where nuclear power quality is not required]
      [When the limit switch for nuclear power is used]
    * Machinery or equipment for space/sea bottom
    * Transportation equipment
      [Railway, aircraft, vessels, vehicle equipment, etc.]
    * Antidisaster/crime-prevention equipment
    * Burning appliances
    * Electrothermal equipment
    * Amusement facilities
    * Facilities/applications associated directly with billing
(3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
(4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
(5) Machinery or equipment that may affect human lives, human bodies or properties
(6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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