(Not for use in Japan) No. CP-SP-1402E

Multi-loop Controller with Multifunction Display

Model C7G

Installation and Configuration Manual



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

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 that could cause personal injury, follow all safety notices in this document.



This symbol warns the user of a potential shock hazard where hazardous live voltages may be accessible.

Use of this product in a manner not specified by the manufacturer will impair its built-in safety features.

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

All wiring work must comply with local regulations and be carried out by authorized and experienced personnel.

Make sure to provide a cutoff switch for the power to this device within reach of the operator.

Do not remove blocks except to replace them. Replacement of the CLOCK block (p. 11-1) and Replacing the MOTOR block (p. 11-1) (for information on replacement blocks)

For DC models, connect a Class II power supply unit.

Equipment Ratings

Ingress protection: IP67 (display unit)

AC power

Supply voltage: 100–240 V AC (operating voltage: 85–264 V AC)

Power supply frequency: 50/60 Hz

Power consumption: 25 VA max. 10 W max.

DC power

Supply voltage: 24 V DC (operating voltage: 20.4 to 28.8 V DC)

Power consumption: 12 W max.

Environmental conditions

Do not use this device near corrosive gases, flammable fluids or vapors, or in wet places. Also, do not touch it with wet hands.

Operating temperature: 0 to 50 °C (0 to 40 °C if main units are gang-mounted)

Operating humidity: 10 to 90 % RH (without condensation)

Vibration: $5 \text{ m/s}^2 (10 \text{ to } 60 \text{ Hz})$

Overvoltage: Category II (IEC 60364-4-443, IEC 60664-1)

Pollution degree: 2
Installation location: Indoors
Elevation: 2000 m max.

Ventilation space: For the main unit, leave at least 50 mm above, below, and in front of the

unit. No space is needed on the right or left.

For the display unit, no space is needed above, below, on the right, or on the left.

Equipment Installation

Excluding the supplied power, the I/O common mode voltage with respect to the ground should be 30 Vrms 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.

UL 61010-1, CAN/CSA C22.2 No. 61010-1 (UL-compliant models only)

Conventions Used in This Manual

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



Warnings are indicated when mishandling this product may result in death or serious injury.



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 wording listed below.



Indicates that caution is required in handling.



The indicated action is prohibited.



Be sure to follow the indicated instructions.

! Handling Precautions:

Precaution is required in handling.

Note: Indicates information that may be useful.

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

(1) (2) (3): Numbers inside parentheses indicate steps in a sequence or parts of an explanation.

[XXX] button: Square brackets indicate buttons at the bottom of the display unit or buttons and

messages shown on the display unit screen.

[XXX] window,

[XXX]

Square brackets indicate a window name, message, or menu, shown on the PC screen.

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

Safety Precautions





Do not use this device in an environment with conductive pollution, or with dry non-conductive pollution which can become conductive due to condensation, etc. Otherwise, problems such as tracking phenomena may damage parts, resulting in fire.



Make sure that the frame ground terminal is properly grounded (100 Ω max.) before connecting the controller to the measurement target or to external control circuits.



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 the device, be sure to turn off the power to this device and any connected devices. Otherwise, there is a danger of electric shock.



Do not touch electrically charged 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.



To prevent electrical shock, the main unit of this product must be installed in a location that is only accessible to people with appropriate knowledge about electrical safety. Install the main unit inside a control panel that cannot be opened without the use of a key or tool.

Also, before touching electrically charged components such as the input terminal block for AC power, be sure to turn off the power. After checking that the voltage has dropped, work carefully to prevent electrical shock. Always keep the cover on the power input terminal block. Otherwise, there is a danger of fire or electric shock.





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.



Wire this device correctly by using the wiring method, power, and installation method 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 cause fire or electric shock.



Do not use unused terminals as relay terminals. There is a danger of fire, electric shock, or device failure.



If the lithium battery used in this device is packaged together with it (installed) and transported by air or ship, be sure that it is transported in accordance with the IATA DGR/IMDG Code.



Do not block the ventilation holes. There is a danger of fire or device failure.





Do not operate the buttons or the touch panel with a sharp object (such as a mechanical pencil tip, etc.). Doing so can cause device failure.



The frame ground terminal of this device is a functional ground. Ground the frame ground terminal to suppress adverse effects from external noise. Otherwise, malfunction may result.



Be sure that the settings are correct for the sensor type. If the settings are incorrect, the normal PV will not be measured correctly. In that case a dangerous situation such as constant 100 % control output could occur.

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Chapter 1. Overview

1-1 Overview

The C7G multi-loop controller with multifunction display (hereafter also called simply "this device" or "C7G" or "C7") can calculate diagnostic parameters, known collectively as the health index, that help to predict failure of other equipment, in addition to calculations for PID (proportional, integral and derivative) control of process variables such as temperature, pressure, flow rate, pH, and liquid level.

This product consists of a display unit with a 3.5-inch QVGA LCD touch panel, as well as a main unit capable of controlling up to four loops with an input sampling cycle of 10 ms and an indication accuracy of \pm 0.1 % FS.

The display unit and main unit can be installed separately for installation flexibility.

A wide variety of interfaces, including Ethernet, RS-485 serial communication, microSD memory card, micro USB port, and 7 digital input/outputs are provided as standard features.

Setup, operation, and monitoring can be easily accomplished using the display unit and Smart Loader Package.

This controller is compliant with IEC directives and is CE marked.

1-2 Model No.

■ Model Selection Guide

Block name

Symbol	Block Name	Description
Al	Analog input	Full multi-range input (thermocouple, RTD, DC current, DC voltage)
V-P	Voltage pulse output	Voltage pulse output (12 V DC)
	σατρατ	2 input terminals for the current transformer (CT) for detecting heater burnout, overcurrent, and short circuits*1
AO-C	Analog current	Current output (4–20 mA DC / 0–20 mA DC)
	output	Input terminals for the current transformer (CT) for measuring current and the voltage transformer (VT) for measuring voltage (1 each)*1
HMI2	Additional display unit	Connector for the second display unit*2
CLOCK	Clock function	Clock (available for CDS and health index) with a battery
MOTOR	Motor drive	Motor drive outputs (100/200 V AC) (direct (OPEN), reverse (CLOSE))
	output	with motor feedback (MFB) inputs
DI	Digital input	4 digital inputs (external power source required)
DO	Digital output	4 digital outputs (sink output)

^{*1.} Current transformer (CT) and voltage transformer (VT) are sold separately.

Accessories

	Q	ty.	
Part name	Standard (separate) mounting model (C7G_4)	Integrated mounting model (C7G_3)	Notes
Main unit	1	1	
Display unit	1	1	
Standard gasket	1	0	Mounted on the display unit
Gasket with 92×92 mm hole	0	1	
Display unit mounting screws (6 mm)	5	5	4 screws plus 1 spare
Display unit mounting screw (10 mm)	5	0	4 screws plus 1 spare
Setscrew for temporary mounting	2	0	
Integrating bracket	0	1	
Integrating cable	0	1	
Installation Manual	1	1	Document No. CP-UM-5847JE
Instruction for safe use	1	1	Document No. CP-UM-5824EGFIS

^{*2.} Additional display unit is sold separately.

Model C7G

Main un	i+				0			0:	ther				
Iviairi uri	IL		Slots	Slots	Slots	Slots				6			
Base model No.	Comm.	Size	A3, A4	B3, B4	A1, A2	B1, B2	Option	Add'l proc.	Add'l spec.	Special support	Description		
1 2 3	4	5	6	7	8	9	10	11	12	13			
C 7 G	Α										Multi-loop controller with multifunction displa Communication (Ethernet, RS-485, USB)	у	
	A										7 digital input/outputs (sink output, source inp	out)	
'		3									Integrated mounting*1		
		4									Standard (separate) mounting		
												Slot A3	Slot A4
			1								PV1 (full-multi) × 1	(No block)	Al
			2 A								PV1 (full-multi) + RSP1 (full-multi)*2 PV1 (full-multi) + 4 digital inputs (external	AI DI	AI AI
			^								power source required)	DI DI	Ai
												Slot B3	Slot B4
				0							None	(No block)	(No block)
6 1 . 11 .6.1 .6.1		6.1		1							PV2 (full-multi) × 1	(No block)	Al
Selectable if the 6th model number (slot				2							PV2 (full-multi) + RSP2 (full-multi)*3	Al	Al
Selectable if the 6th number (slots A3, A4	digit o	f the m	odel	Α							PV2 (full-multi) + 4 digital inputs (external power source required)	DI	Al
Selectable if the 9th	n digit	of the		В							PV2 (full-multi) + clock (with battery)	CLOCK	Al
model number (slot F, W, N, G, H, 1, or 2													
												Slot A1	Slot A2
					C		-				Current output (CT and VT inputs, 1 each) × 1	(No block)	AO-C
					V F		-				Voltage pulse output (2 CT inputs) × 1	(No block)	V-P
					W						Current output (CT and VT inputs, 1 each) × 2 Voltage pulse output (2 CT inputs) × 2	AO-C V-P	AO-C V-P
					N						Current output (CT and VT inputs, 1 each) +	V-P	AO-C
					1						voltage pulse output (2 CT inputs) Current output (CT and VT inputs, 1 each) + 4	DO	AO-C
					2						digital outputs (sink output) Voltage pulse output (2 CT inputs) × 4 digital	DO	V-P
											outputs (sink output)		
C - + - - : f + - 0+	:	- 4 4 1				0	1				None	Slot B1 (No block)	Slot B2 (No block)
Selectable if the 8th $(slots A1, A2) = C, V,$						L u					none	(NO DIOCK)	(NO DIOCK)
Selectable if the 8th $(slots A1, A2) = C, F,$						С					Current output (CT and VT inputs, 1 each) × 1	(No block)	AO-C
Selectable if the 8th $(slots A1, A2) = C, V,$						٧					Voltage pulse output (2 CT inputs) × 1	(No block)	V-P
Selectable if the 8th (slots A1, A2) = F	n digit	of the	model	numb	er	F					Current output (CT and VT inputs, 1 each) × 2	AO-C	AO-C
Selectable if the 8th (slots A1, A2) = W or	n digit	of the	model	numb	er	W					Voltage pulse output (2 CT inputs) × 2	V-P	V-P
Selectable if the 8th	n digit	of the	model	numb	er	N					Current output (CT and VT inputs, 1 each) +	V-P	AO-C
(slots A1, A2) = F or Selectable if the 8th	n digit	of the	model	numb	er	G					voltage pulse output (2 CT inputs) Current output (CT and VT inputs, 1 each) +	HMI2	AO-C
(slots A1, A2) = C, F, Selectable if the 8th						Н					additional display unit Voltage pulse output (2 CT inputs) +	HMI2	V-P
(slots A1, A2) = C, V, Selectable if the 8th						L					additional display unit Current output (CT and VT inputs, 1 each) +	CLOCK	AO-C
(slots A1, A2) = C, F, Selectable if the 8th	N, or 1	l			→	P					clock (with battery) Voltage pulse output (2 CT inputs) + clock	CLOCK	V-P
(slots A1, A2) = C, V,	, W, N,	1, or 2			→						(with battery)		
Selectable if the 8th $(slots A1, A2) = F, N,$	or 1				→	1					Current output (CT and VT inputs, 1 each) × 4 digital outputs (sink output)	DO	AO-C
Selectable if the 8th $(slots A1, A2) = W, N$						2					Voltage pulse output (2 CT inputs) × 4 digital outputs (sink output)	DO	V-P
							0	_			None		
								0 D			None With inspection report		,
								Y			With traceability certificate		
									0		AC power. CE, KC, UKCA–compliant		
									D		DC power. CE, KC, UKCA–compliant		
									Α		AC power. CE, KC, UKCA, UL–compliant		
									В		DC power. CE, KC, UKCA, UL–compliant		
										0	No special support		
										F	Overseas models: switchable between Celsius/	Fahrenheit	
											Do not use these models in Japan.		

^{*1.} A rear mounting bracket and a dedicated cable for connecting the display unit are included with the product. *2. RSP1 can be switched for use as PV3.

^{*3.} RSP2 can be switched for use as PV4.

• Model C7G with MOTOR Block

	N	lain ur	nit				I/O		Other						
	e mode		Comm.	Size	Slot A4	Slot B4	Slots A2, A3, B2, B3	Slots A1, B1	Option	proc.		support	Description		
1	2	3	4	5	6	7	8	9	10	11	12	13			
С	7	G											Multi-loop controller with multifunction displa	у	
			Α										Communication (Ethernet, RS-485, USB)		
													7 digital input/outputs (sink output, source inp	ut)	
				3									Integrating kit included*1		
				4									Standard (separate) mounting		
														Slot	: A4
					1								PV1 (full-multi) × 1	P	N.
						<u> </u>			,					Slo	B4
						0							None	(No b	lock)
						1							PV2 (full-multi) × 1*2	F	N.
														Slots A2,	A3, B2, B3
							М						Motor drive output (with MFB input)	MO	TOR
														Slot A1	Slot B1
								0					None	(No block)	(No block)
								С					Current output (CT and VT inputs, 1 each) \times 1	AO-C	(No block)
								V					Voltage pulse output (2 CT inputs) × 1	V-P	(No block)
								N					Current output (CT and VT inputs, 1 each) + voltage pulse output (2 CT inputs)	AO-C	V-P
								G					Current output (CT and VT inputs, 1 each) + additional display unit	AO-C	HMI2
								L					Current output (CT and VT inputs, 1 each) + clock (with battery)	AO-C	CLOCK
								1					Current output (CT and VT inputs, 1 each) \times 4 digital outputs (sink output)	AO-C	DO
								4					4 digital outputs (sink output) + clock (with battery)	DO	CLOCK
							·		0				None		
										0			None		
										D			With inspection report		
										Υ			With traceability certificate		
									,		0		AC power. CE, KC, UKCA–compliant		
											D		DC power. CE, KC, UKCA–compliant		
											Α		AC power. CE, KC, UKCA, UL–compliant		
											В		DC power. CE, KC, UKCA, UL–compliant		
												0	No special support		
												F	Overseas models: switchable between Celsius/ Do not use these models in Japan.	Fahrenheit	

^{*1.} A rear mounting bracket and a dedicated cable for connecting the display unit are included with the product.

^{*2.} PV2 can be switched for use as RSP1.

• C7D Additional Display Unit

	Main unit Other							Othe	r		
Bas	e mod	el N	Vo.	-	Size	Option 1	Option 2	Add'l proc.	Add'l spec.	Special support	Description
1	2		3	4	5	6	7	8	9	10	
C	7		D	-							Additional display unit for multi-loop controller with multifunction display
					3						Integrated mounting*
					4						Standard (separate) mounting
						0					English, Japanese
							0				None
								0			None
								D			With inspection report
									0		CE, KC, UKCA–compliant
										0	No special support

^{*} Rear mounting bracket included.

■ Optional Parts (Sold Separately)

Part name	Model No.
SLP-C7 Smart Loader Package (free version)*1	SLP-C7FJ91
SLP-C7 Smart Loader Package (paid version)	SLP-C7-J91
Power terminal covers (10 pieces)	81447704-001
C7 (display unit) mounting method change kit *2	84503167-001
MicroSD memory card (replacement)	84502552-001
CLOCK block (replacement)*3	84501420-001
MOTOR Block (replacement)*3	84501421-001
Current transformer (5.8 mm in diameter)	QN206A
Current transformer (12 mm in diameter)	QN212A
Voltage transformer (for 200 V AC)	81406725-003

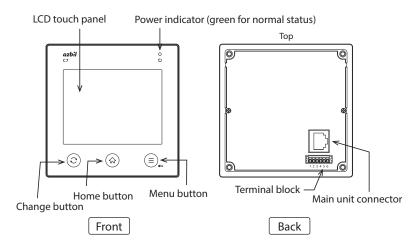
^{*1} Downloadable from our website https://www.azbil.com/products/factory/factory-product/controller-recorder/controller/index.html

^{*2} A integrated mounting bracket, a dedicated cable for connecting the display unit, standard gasket, and gasket with 92×92 mm hole are included with the product.

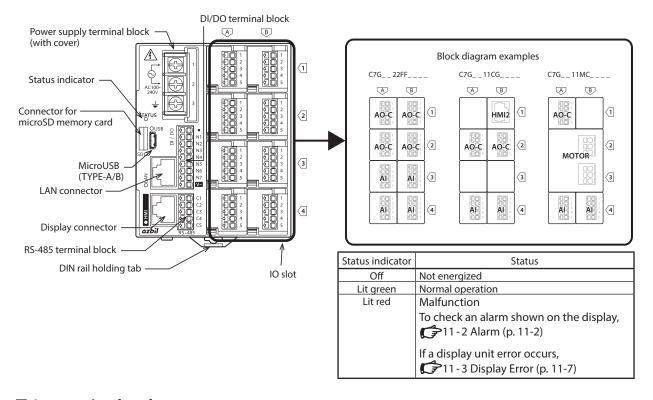
^{*3} Tool for replacement is included.

1-3 Names of Parts and Their Functions

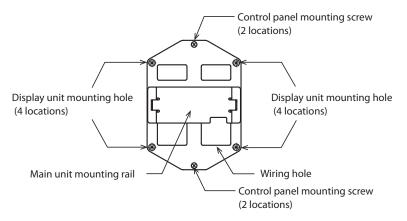
■ Display unit



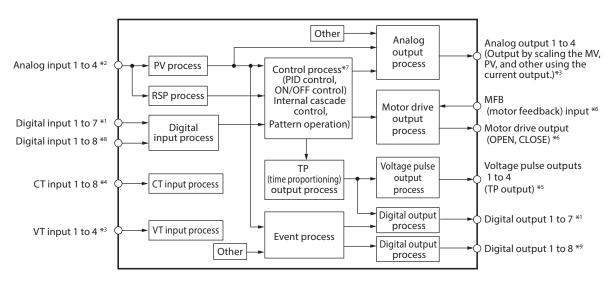
■ Main unit



■ Integrating bracket



1-4 Input/output Configuration



- *1. There are 7 digital inputs (DI) or outputs (DO) in total. Depending on the setting, they can be switched between DI and DO.
- *2. There are from 1 to 4 analog inputs, depending on the model number.
- *3. There are from 0 to 4 analog output and VT input points, a total of 4, depending on the model number.
- *4. There are from 0 to 8 CT input points, depending on the model number.
- *5. There are from 0 to 4 voltage pulse output points, depending on the model number.
- *6. There is 0 or 1 set of motor drive outputs (OPEN, CLOSE) and MFB input, depending on the model number.
- *7. There are from 1 to 4 control loops, depending on the number of analog inputs and the loop type settings.
- *8. There are from 0 to 8 digital inputs, selectable by model number, in addition to the digital inputs described in *1.
- *9. There are from 0 to 8 digital outputs, selectable by model number, in addition to the digital outputs described in *1.

Analog input (block positions: A4, B4, A3, B3)

The PV can be measured by selecting the sensor type or range. For DC voltage and DC current, PV and RSP scaling can be set. The input from a thermocouple or resistance temperature detector can be used as the RSP. Linear approximation is available.

• Analog output (AO-C) (block positions: A2, B2, A1, B1)

The scaled MV can be output as current. Additionally, when PV, SP, or deviation is selected for the output type, these values can also be scaled and output as current. Linear approximation is available.

● Voltage pulse output (V-P) (block positions: A2, B2, A1, B1)

The time proportioning output function set using the TP (time proportioning) bank can be used. Linear approximation is available.

● Motor drive output (MOTOR) (block position: B2)

The motor drive output function set using the PP (position proportioning) bank can be used. Linear approximation is available.

Digital input (DI)

Change functions set using the DI bank, such as mode change, or SP group change, can be used.

Digital output (DO)

Output functions such as event output that are set using the DO bank, or the time proportioning output function set using the TP (time proportioning) bank, can be used. Linear approximation is available for time proportioning output.

• CT (current transformer) input (block positions: A2, B2, A1, B1)

The current can be measured by the input from the CT. The control loop that displays CT input can be set in the basic action bank.

• VT (voltage transformer) input (block positions: A2, B2, A1, B1)

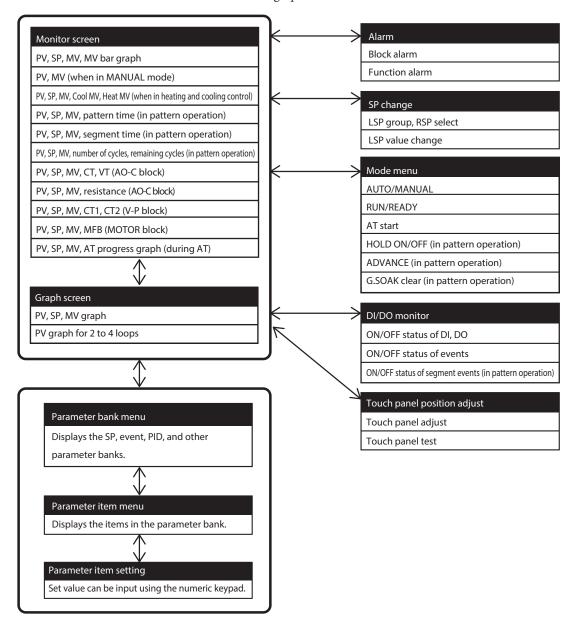
The voltage can be measured by the input from the VT. The control loop that displays VT input can be set in the basic action bank. The resistance of the actuators (heaters) calculated from the CT input and VT input can also be displayed in the same control loop as VT input.

1-5 Button Operation

Various kinds of data can be displayed or set using the buttons on the display unit screen and the buttons on the lower section of the display unit screen.

■ Screen transitions

When the power is turned on, the monitor screen is displayed. Use the buttons on the monitor screen or graph screen to switch between screens.



! Handling Precautions

- The figure above shows only the major screen transitions. Many screen transitions are not shown.
- Do not press two or more locations on the touch panel at the same time. Doing so may cause an error.
- If the firmware version of the MAIN block is earlier than 6.x.x (where x stands for any number), the screen for pattern operation and the screen showing the ON/OFF status of events and segment events cannot be displayed.

■ Parameter bank

The order of the parameter banks and parameter items is shown by the tree structure below.

Parameter bank	Parameter item
SP	
	SP values of LSP1 to LSP8, RSP for loops 1 to 4
	PID group number of LSP1 to LSP8, RSP for loops 1 to 4
EVENT	
	Main setting for event groups 1 to 16
	Sub-setting for event groups 1 to 16
	Hysteresis for event groups 1 to 16
	ON-delay time for event groups 1 to 16
	OFF-delay time for event groups 1 to 16
PID	
	P (Proportional band) of PID groups 1 to 8 for loops 1 to 4
	I (Integral time) of PID groups 1 to 8 for loops 1 to 4
	D (Derivative time) of PID groups 1 to 8 for loops 1 to 4
	RE (Manual reset) of PID groups 1 to 8 for loops 1 to 4
	OL (MV low limit) of PID groups 1 to 8 for loops 1 to 4
	OH (MV high limit) of PID groups 1 to 8 for loops 1 to 4
	Cooling-use proportional band of PID groups 1 to 8 for loops 1 to 4
	Cooling-use cumulative time of PID groups 1 to 8 for loops 1 to 4
	Cooling-use derivative time of PID groups 1 to 8 for loops 1 to 4
	Cooling-use MV low limit of PID groups 1 to 8 for loops 1 to 4
	Cooling-use MV high limit of PID groups 1 to 8 for loops 1 to 4
ANALOG INPUT	
	Range type of blocks A4, B4, A3, and B3
	Linear scaling low limit of blocks A4, B4, A3, and B3
	Linear scaling high limit of blocks A4, B4, A3, and B3
	Filter of blocks A4, B4, A3, and B3
	Ratio of blocks A4, B4, A3, and B3
	Bias of blocks A4, B4, A3, and B3
	Square root extraction dropout of blocks A4, B4, A3, and B3
	Linearization table group definition of blocks A4, B4, A3, and B3
BASIC ACTION	
	Sampling cycle
	Power supply frequency
	Time unit of patterns
	HOME screen layout
	Run/Ready at startup for loops 1 to 4
	No. of decimal places for PV 1 to 4
	Display loop for A2/B2/A1/B1 block input
	HOME screen setting for loops 1 to 4
	Display intensity
	Display language
	Keylock level
	Engineering mode

Control action for loops 1 to 4 Differential for ON/OFF control for loops 1 to 4 Heating/cooling control dead zone for loops 1 to 4 PID initial MV for loops 1 to 4 PID initialization for loops 1 to 4 PID initialization for loops 1 to 4 Type of change to MANUAL for loops 1 to 4 Preset MANUAL value for loops 1 to 4 MV increase change limit for loops 1 to 4 MV decrease change limit for loops 1 to 4 MV tracking changeover for loops 1 to 4 Reverse MV tracking signal for loops 1 to 4 MV tracking signal for loops 1 to 4 AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
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MV decrease change limit for loops 1 to 4 MV tracking changeover for loops 1 to 4 Reverse MV tracking signal for loops 1 to 4 MV tracking signal for loops 1 to 4 AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
MV tracking changeover for loops 1 to 4 Reverse MV tracking signal for loops 1 to 4 MV tracking signal for loops 1 to 4 AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
Reverse MV tracking signal for loops 1 to 4 MV tracking signal for loops 1 to 4 AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
MV tracking signal for loops 1 to 4 AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
AT type for loops 1 to 4 MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
MV low limit during AT for loops 1 to 4 MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
MV high limit during AT for loops 1 to 4 AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
AT adjustment factor, P for loops 1 to 4 AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
AT adjustment factor, I for loops 1 to 4 AT adjustment factor, D for loops 1 to 4
AT adjustment factor, D for loops 1 to 4
SP lag factor for loops 1 to 4
READY MV for loops 1 to 4
Output at READY (heat) for loops 1 to 4
Output at READY (cool) for loops 1 to 4
MV select as PV error for loops 1 to 4
MV value as PV error for loops 1 to 4
Fixed-value output 1 to 8 for loops 1 to 4
Zone action selection for loops 1 to 4
Zone 1 to 7 for loops 1 to 4
Zone hysteresis for loops 1 to 4
SP CONFIG
SP low limit for loops 1 to 4
SP high limit for loops 1 to 4
SP ramp unit for loops 1 to 4
LSP ramp up slope for loops 1 to 4
LSP ramp down slope for loops 1 to 4
RSP tracking for loops 1 to 4
Number of LSP groups for loops 1 to 4
ANALOG OUTPUT
Output range of blocks A2, B2, A1, and B1
Output type of blocks A2, B2, A1, and B1
Loop definition of blocks A2, B2, A1, and B1
Output scaling low limit of blocks A2, B2, A1, and B1
Output scaling high limit of blocks A2, B2, A1, and B1
Linearization table group definition of blocks A2, B2, A1, and B1
V change compensation of blocks A2, B2, A1, and B1

Parameter bank	Parameter item
EVENT CONFIG	
	Operation type for event groups 1 to 16
	Loop definition for event groups 1 to 16
	Direct/reverse for event groups 1 to 16
	Standby for event groups 1 to 16
	READY mode operation for event group 1 to 16
DI/DO CONFIG	
	Operation type of DI/DO 1 to 7
DO CONFIG	
	Output type of DO groups 1 to 7 of DI/DO
	Output type of DO groups 1 to 4 of blocks A1 and B1
DI	
	Operation type of DI groups 1 to 32
	Input type of DI groups 1 to 32
	Loop definition of DI groups 1 to 32
TP	
	TP output type of DO groups 4 to 7 and blocks A2, B2, A1, and B1
	TP output cycle of DO groups 4 to 7 and blocks A2, B2, A1, and B1
	TP operation type of DO groups 4 to 7 and blocks A2, B2, A1, and B1
	Linearization table group definition of DO groups 4 to 7 and blocks A2, B2, A1, and B1
	V change compensation of DO groups 4 to 7 and blocks A2, B2, A1, and B1
LOGICAL OPERATION	
	Calculation type of logical operations 1 to 32
	Input assignments A to D of logical operations 1 to 32
	Input bit attributes A to D of logical operations 1 to 32
	ON-delay time of logical operations 1 to 32
	OFF-delay time of logical operations 1 to 32
	Reversal of logical operations 1 to 32
	Latch of logical operations 1 to 32
NUMERICAL OPERATION	
	Operation type of numerical operations 1 to 32
	Input assignments 1 to 4 of numerical operations 1 to 32
	Contact input assignment of numerical operations 1 to 32
USER-DEFINED BIT	
	User-defined bits 1 to 32
USER-DEFINED VALUE	
	User-defined values 1 to 32
USER-DEFINED ALARM	
	Assignments 1 to 4 of user-defined alarms 1 to 4
	Loop specification for user-defined alarms 1 to 4

Parameter bank	Parameter item
CI	Number of turns of blocks A2, B2, A1, and B1
	Number of power wire loops of blocks A2, B2, A1, and B1
	Filter of blocks A2, B2, A1, and B1
	CT operation of blocks A2, B2, A1, and B1
	CT measurement waiting time of blocks A2, B2, A1, and B1
	Heater burnout detection current value of blocks A2, B2, A1,
	and B1
	Minimum current defined as overcurrent of blocks A2, B2, A1, and B1
	Minimum current defined as short circuit of blocks A2, B2, A1, and B1
	Hysteresis of blocks A2, B2, A1, and B1
	Delay time of blocks A2, B2, A1, and B1
	Condition for restoring status before measurement of blocks A2, B2, A1, and B1
VT	Primary voltage of blocks A2, B2, A1, and B1
	Secondary voltage of blocks A2, B2, A1, and B1
	Reference voltage of blocks A2, B2, A1, and B1
	Filter of blocks A2, B2, A1, and B1
PP (POSITION PROPORTIONAL)	THE OF BIOCKS TE, BE, TH, and B1
TT (LOSITION THOLORITONAL)	Output type
	Control method selection
	Dead zone
	Auto-tuning
	Fully closed MFB count
	Fully open MFB count
	Full opening time
LINEADIZATION TADI E	Linearization table group definition
LINEARIZATION TABLE	Operation type of linearization table groups 1 to 0
	Operation type of linearization table groups 1 to 8
CASCADE	20 break points of linearization table groups 1 to 8
CASCADE	Scaling method
	Scaling low limit
	Scaling high limit
	Filter
PATTERN CONFIG	
	Pattern start number for loops 1 to 4
	Pattern start number low limit for loops 1 to 4
	Pattern start number high limit for loops 1 to 4
	PTN SP increase change limit for loops 1 to 4
	PTN SP decrease change limit for loops 1 to 4
PATTERN	
	Number of segments of patterns 1 to 16
	G.SOAK time of patterns 1 to 16
	PV start of patterns 1 to 16
	Cycle of patterns 1 to 16
	Pattern link of patterns 1 to 16
	End of operation of patterns 1 to 16

Parameter bank	Parameter item
SEGMENT	
	SP of segments 1 to 32 of patterns 1 to 16
	Time of segments 1 to 32 of patterns 1 to 16
	PID Group of segments 1 to 32 of patterns 1 to 16
	G.SOAK type of segments 1 to 32 of patterns 1 to 16
	G.SOAK width of segments 1 to 32 of patterns 1 to 16
	Segment event in segments 1 to 32 of patterns 1 to 16
GRAPH	
	Multi-loop recording cycle for loops 1 to 4
	Graph scaling low limit for loops 1 to 4
	Graph scaling high limit for loops 1 to 4
ETHERNET	
	Modbus/TCP port number
IP ADDRESS	
	IP address
	Subnet mask
	Default gateway
RS-485	
	Station address
	Transmission speed
	Data type (parity)
	Data type (stop bits)
CDS	Minimum response time
CDS	To 11
	Recording cycle
	Operation type Data selection
	Number of data items
	Data 1 to 40
HEALTH INDEX	Data 1 to 10
TIERETTINGER	Operation type for loops 1 to 4
	R value scale for loops 1 to 4
	Ideal data for loops 1 to 4
	Deviation low limit for loops 1 to 4
	Deviation high limit for loops 1 to 4
HEALTH INDEX GRAPH	
	The 10 latest specific R value graph for loops 1 to 4
DATE TIME	
	Year, month, day, hour, minutes, and seconds
INPUT ASSIGNMENT	
	PV assignments for loops 1 to 4
	RSP assignment for loops 1 to 4
	Assignment range low limit for loops 1 to 4
	Assignment range high limit for loops 1 to 4
VIRTUAL ANALOG INPUT	
	Virtual Al assignment of virtual Al 1 to 4
	Filter of virtual Al 1 to 4
	Ratio of virtual Al 1 to 4
	Bias of virtual Al 1 to 4
	Linearization table group definition of virtual Al 1 to 4

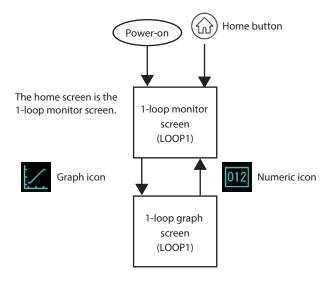
Parameter bank	Parameter item
LOCK	
	Lock level
	Verification
	Password
FF-FITTER	
	Operation type of loops 1 to 4
	T1 of loops 1 to 4
	T1 MV type of loops 1 to 4
	FF1 of loops 1 to 4
	T1a of loops 1 to 4
	FF1a of loops 1 to 4
	T2 of loops 1 to 4
	FF2 of loops 1 to 4
	T2 PID initialization type of loops 1 to 4
	T2 PID initial MV of loops 1 to 4
	FF3 of loops 1 to 4
	AT of loops 1 to 4
	T1 AT adjustment factor of loops 1 to 4
	T2 AT adjustment factor of loops 1 to 4
	AT threshold of loops 1 to 4
	AT FF3 data type of loops 1 to 4
	AT status of loops 1 to 4
	AT saved values 1 to 5 of loops 1 to 4
FIRMWARE VERSION	
	Version of MAIN block
	Version of HMI block (display unit)
	Version of DI/DO block
	Version of RS-485 block
	Version of blocks A1 to A4
	Version of blocks B1 to A4
	(Including additional display unit and CLOCK block)

■ Japanese language display

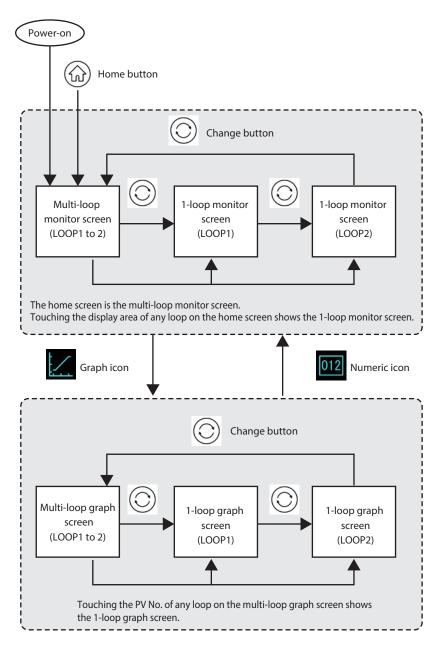
If the "Language indication" setting of the basic action bank is set to "1: Japanese," the banks, items, and descriptions displayed on the parameter setting screen and some of the content on the mode change screen will appear in Japanese. The default setting for "Language indication" is "0: English."

■ Monitor and graph screen transitions

• For 1 loop



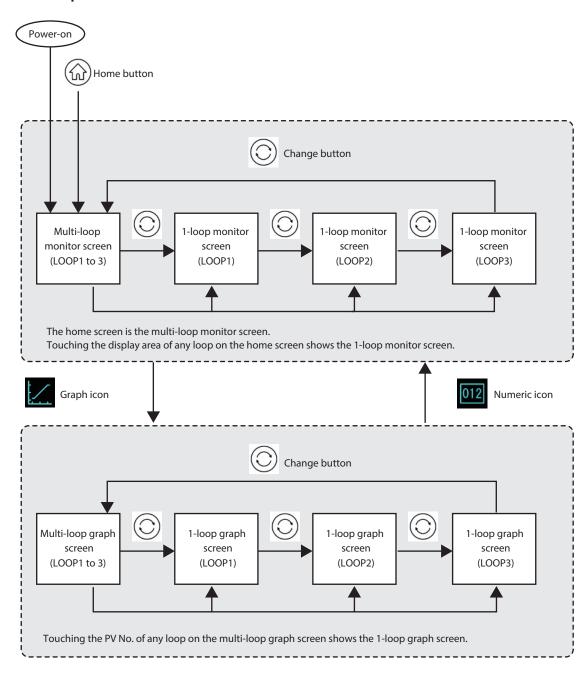
For 2 loops



! Handling Precautions

- The screen transitions when the loop type is internal cascade are identical to those for 2 loops.
- The screen set by the user can be displayed when the power is turned ON or the home button is pressed. Screen transitions of the user HOME screen (p. 1-20)

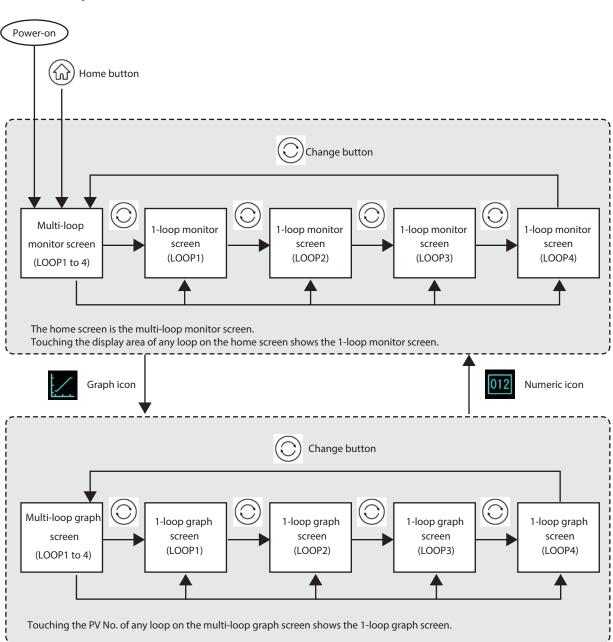
For 3 loops



! Handling Precautions

- The screen transitions when the loop type is "Internal cascade + 1 loop" are identical to those for 3 loops.
- The screen set by the user can be displayed when the power is turned ON or the home button is pressed. Screen transitions of the user HOME screen (p. 1-20)

For 4 loops



! Handling Precautions

- The screen transitions when the loop type is "Internal cascade +2 loops" or "2 internal cascades" are identical to those for 4 loops.
- The screen set by the user can be displayed when the power is turned ON or the home button is pressed. Screen transitions of the user HOME screen (p. 1-20)

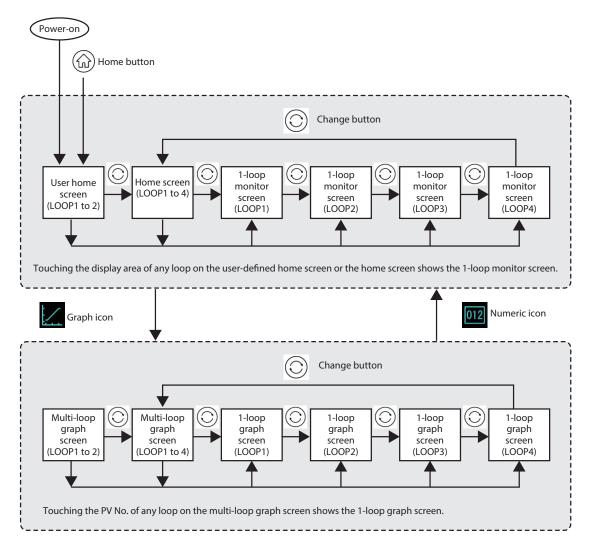
■ Screen transitions of the user HOME screen

From the loops set to be used in the loop type setting, enable the loop to be displayed on the user HOME screen with the following settings.

Item (bank)	Display	Description	Initial value
Loop1 HOME screen setting (Basic action bank)	MENU>BasicAction Loop1 HOME screen setting	0: Disabled 1: Enabled	0
Loop2 HOME screen setting (Basic action bank)	MENU>BasicAction Loop2 HOME screen setting	0: Disabled 1: Enabled	0
Loop3 HOME screen setting (Basic action bank)	MENU>BasicAction Loop3 HOME screen setting	0: Disabled 1: Enabled	0
Loop4 HOME screen setting (Basic action bank)	MENU>BasicAction Loop4 HOME screen setting	0: Disabled 1: Enabled	0

The user HOME screen is displayed only when the power is turned ON or the home button is pressed.

For example, if the loop type is set to 4 loops and Loop 1 and Loop 2 are selected for display on the user HOME screen, the transitions on the Numeric Monitor screen are as shown in the figure below.



Separate user HOME screens can be set for the standard display unit and additional display unit.

Therefore, settings such as the following are also possible.

- Show Loop 1 and Loop 2 on the user HOME screen of the standard display unit.
- Show Loop 3 and Loop 4 on the user HOME screen of the additional display unit.

The "HOME screen layout" setting (left/right split, left/right swap, vertically arranged) also applies to the 2-loop screen.

The 3-loop screen is vertically arranged regardless of the "HOME screen layout" setting.

If the graph icon on the user HOME screen is touched, the display changes to the graph screen.

- If the user HOME screen is a multi-loop screen, the destination graph screen will also be a multi-loop screen.
- If the user HOME screen is a 1-loop screen, the destination graph screen will also be a 1-loop screen.
- If the numeric icon is touched after going from the user HOME screen to the graph screen by touching the graph icon, the screen will return to the HOME screen or the 1-loop monitor screen, but not to the user HOME screen.

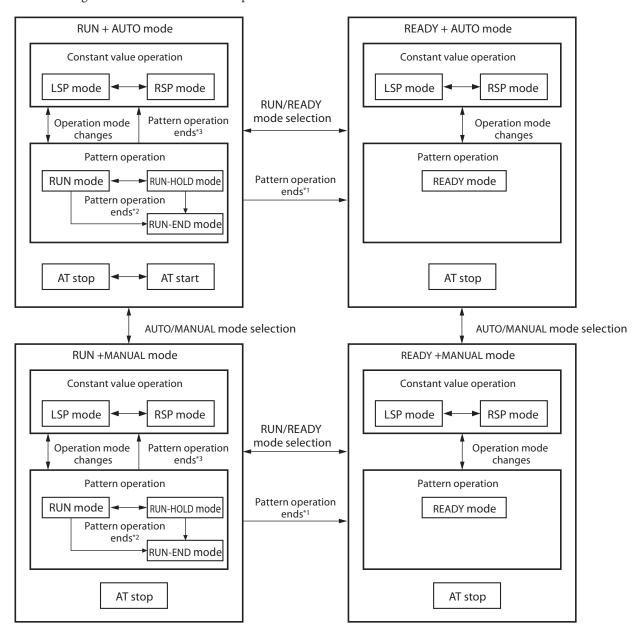
! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no user HOME screen.

1-6 Operation Modes

Up to four loops can be controlled individually. The operation modes can also be changed individually or all together.

The following shows the transition of the operation modes.



^{*1.} Transition if "End of operation" is set to READY

^{*2.} Transition if "End of operation" is set to END

^{*3.} Transition if "End of operation" is set to constant value operation

Constant value operation: Process control uses the LSP or RSP.

Pattern operation: Process control uses the pattern SP (the SP is generated from the segment setting stored

in the measuring instrument).

RUN: Control execution status (the three statuses of RUN, RUN-HOLD, and RUN-END in

the case of pattern operation)

READY: Control stop status

AUTO: Automatic operation (This controller automatically determines the MV value.)

MANUAL: Manual operation (The MV value can be operated manually.)

LSP: Local SP (The control is performed based on the SP stored into the controller.)

RSP: Remote SP (The analog input from an external device is used as the SP.)

RUN-HOLD: Control status in which pattern progression is stopped

RUN-END: Control status in which pattern progression is stopped at the final point

AT: Auto tuning (The PID constants are set automatically using the limit cycle.)

! Handling Precautions

- For a slave loop in internal cascade control, only constant value operation can be set. It is not possible to switch into pattern operation.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), only constant value operation can be set for both master and slave loops in internal cascade control. It is not possible to switch into pattern operation.
- For the function to select RUN or READY at startup, a value stored in EEPROM, RUN, or READY can be selected by setting "Loop1 Run/Ready at startup" to "Loop4 Run/Ready at startup" in the basic action bank.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no pattern operation function or Run/Ready at startup selection function.
- In internal cascade control, the modes of master and slave loops (RUN/READY and AUTO/MANUAL) are synchronized. For example, if the master loop's mode is changed to RUN, the slave loop will also be in RUN mode.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), the master loop's modes in internal cascade control are always RUN + AUTO.

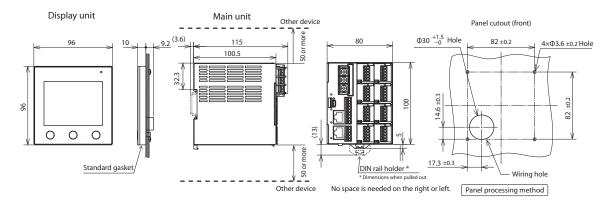
-MEMO-

Chapter 2. Mounting

2-1 External View and Mounting Dimensions

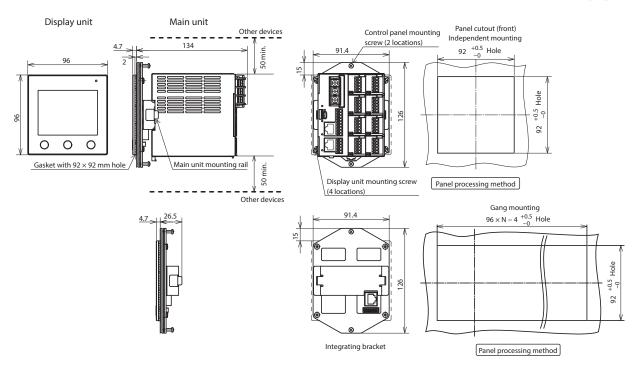
■ Standard mounting

Unit: mm



■ Integrated mounting

Unit: mm



■ Mounting locations

Do not install this product in a place with any of the following characteristics:

- Temperature or humidity outside the specified high and low limits
- Corrosive gases such as sulfide gas or silicone gas
- Dust or soot
- Direct sunlight, wind, or rain
- Mechanical vibration or shock outside the range of the specifications
- Proximity to high-voltage lines, welding machines, or other sources of electrical noise
- Within 15 m of a high-voltage ignition device for a boiler, etc.
- Strong electromagnetic fields
- Flammable liquid or gas
- Outdoor location

2-2 Mounting Method

■ Standard mounting

Main unit

Mount the main unit on a DIN rail with a width of 35 mm. Check that the DIN rail holding tab on the main unit is pushed in. Hook the catches on the upper back of the main unit onto the DIN rail and press the main unit until it clicks into place.

Display unit and additional display unit

To mount the display unit, follow the steps below.

After mounting the main unit and display unit, connect them using a Cat5E or higher straight LAN cable* of an appropriate length.

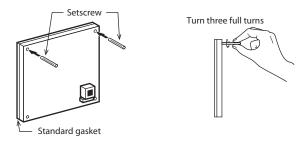
*Cable is not included with the product.



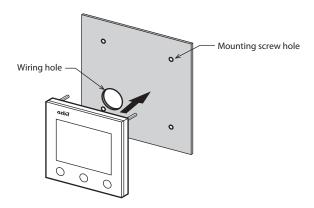
- Connecting the cable between the main unit and display unit (p. 3-22) (for details about the cable to be used)
- (1) Screw the setscrews for temporary mounting into the two screw holes in the upper part of the back of the display unit, turning them approximately three full turns by hand.

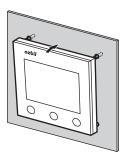
! Handling Precautions

• Excessive tightening may cause damage to the protective sheet.



(2) Mount the display unit temporarily on the front of the panel. Align the the wiring hole with the connector and insert the setscrews into the mounting screw holes.







(3) Hold the setscrews firmly from the back of the panel and screw the display unit mounting screws into the remaining mounting screw holes.

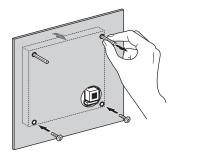
Two types of display unit mounting screws (M3 machine screws) are supplied with the product.

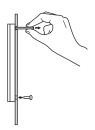
Select appropriate screws according to the thickness of the control panel.

- 6 mm screws: 1.0–4.5 mm thick control panel
- 10 mm screws: 4.5–8.5 mm thick control panel

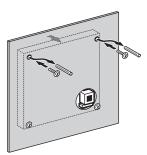
! Handling Precautions

- Hold the setscrews firmly. Otherwise the display unit may fall.
- Use the mounting screws that are suitable for the thickness of the control panel to mount the display unit firmly.



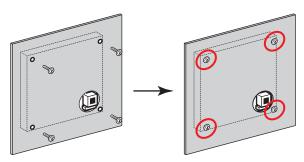


(4) Remove the setscrews and insert the display unit mounting screws.

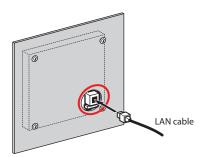




(5) Further tighten the four display unit mounting screws. (Tightening torque: $0.6~{
m N\cdot m}$)



(6) Connect the display unit and the display unit connector on the main unit using the LAN cable.



■ Integrated mounting

Main unit

After mounting the display unit on the control panel, mount the main unit on the main unit mounting rail of the integrating bracket.

Display unit

To mount the display unit on the control panel, follow the steps below.

Be sure to mount the display unit securely on the integrating bracket using the display unit mounting screws (M3 machine screws) included with the product. (Tightening torque: $0.6 \text{ N} \cdot \text{m}$)

(1) Attach the gasket with 92×92 mm hole on the display unit and connect the integrating cable.

Insert the ferrules (part of the cable for integrated mounting supplied with the product) with the specified colors into the terminal block of the display unit.

Terminal No.	1	2	3	4	5	6
Cable color	White/orange	Blue	White/blue	White/green	Green	Brown

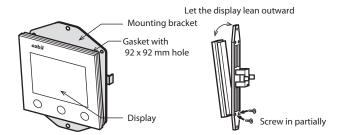
(2) Pass the integrating cable through the wiring hole and attach the display unit temporarily to the bottom part of the integrating bracket. Tighten the screws lightly so that the integrating bracket leans forward as shown in the figure below.

Note

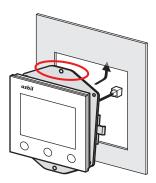
- Gennecting the cable between the main unit and display unit (p. 3-22)
- (for instructions on wiring with the integrating cable)

! Handling Precautions

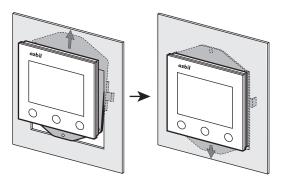
• If the screws are tightened completely, the display unit cannot be put in the control panel.



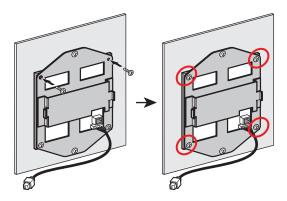
(3) Working from the front of the control panel, pass the integrating cable and the upper part of the integrating bracket through the cutout in the panel.



(4) Raise the display unit, pass the bottom part of the integrating bracket through the cutout in the panel, and hang it on the connecting part of the setscrews.



(5) Working from the back of the panel, attach the display unit to the integrating bracket with the four display unit mounting screws. (Tightening torque: $0.6~\mathrm{N\cdot m}$)



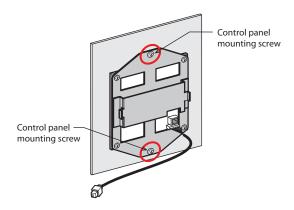
(6) Attach the integrating bracket to the control panel with the control panel mounting screws.

(Tightening torque: 0.25 N·m*)

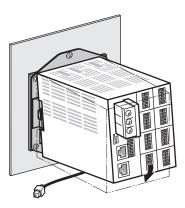
* After the display unit no longer moves freely, turn the screws on and a half more full turns.

! Handling Precautions

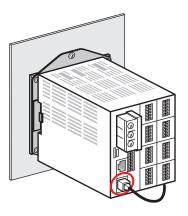
- Tightening the screws excessively may deform the display unit and control panel or prevent proper use of the touch panel and buttons.
 In addition, the display unit may not be mounted properly due to deformation of the integrating bracket or screw holes.
- When the display unit is used for a waterproof application, be sure to mount the gasket with 92×92 mm hole.



(7) Hook the catches on the back of the main unit on the main unit mounting rail of the integrating bracket. To mount the main unit, press it onto the integrating bracket, using the catches as a fulcrum, until it clicks into place.



(8) Insert the integrating cable into the display unit connector of the main unit to complete the installation.



-MEMO-

Chapter 3. Wiring

3-1 Wiring Precautions





Do not use this device in an environment with conductive pollution, or with dry non-conductive pollution 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 the device, be sure to turn off the power to this device and any connected devices. Otherwise, there is a danger of electric shock.



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.



Do not touch electrically charged 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



Wire this device correctly by using the wiring method, power, and installation method 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 this device with the provided power terminal block cover mounted. Otherwise, there is a danger of electric shock.



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.



The frame ground terminal of this device is a functional ground. Ground the frame ground terminal to suppress adverse effects from external noise. Otherwise, malfunction may result.

Wiring precautions

- Be sure to mount a switch for shutoff of the main power to this device within reach of the operator. Add this switch to the wiring on the non-grounded side.
- The following table shows the meaning of the symbols printed on the main unit.

Symbol	Description
	DC
to	AC
A	Caution: risk of electrical shock
<u> </u>	Caution
<u></u>	Functional ground terminal (not a protective ground terminal)

- Before starting the wiring work, be sure to check the model number and terminal numbers, comparing what is printed on the main unit with what is in this user's manual. After wiring, be sure to check that there are no mistakes.
- The input/output signal wires should be at least 50 cm away from power lines for motors, etc., and from other power source wiring. Also, do not put these two types of wires in the same conduit or wiring duct.
- Be careful not to allow any crimp-type terminal lugs to touch adjacent terminals.
- Connect no more than two crimp terminals to the same terminal screw.
- Make sure that devices and equipment connected to this device have reinforced insulation or double insulation suitable for the maximum operating voltage of this device's power supply, inputs, and outputs.
- To satisfy the specified accuracy, allow the device to warm up for at least 30 min.

3-2 Recommended Cables

- For the thermocouple input, after crimping the bare thermocouple lead on the
 ferrule, connect it to the terminal block.
 If the wiring distance is long or if the thermocouple uses a terminal connection,
 extend the lead wires using compensating lead wires to connect them to the
 terminals.
- Use shielded compensating lead wires.
- For inputs and outputs other than thermocouples, use JCS4364-compliant instrument cable or equivalents (commonly known as twisted shielded instrument cable).

The following cables are recommended.

Recommended cables

Company name	Number of pairs	Product name
Sumiden Hitachi	2	JKPEV-S-2P x 0.5SQ
Cable Ltd.	3	JKPEV-S-3P x 0.5SQ
	2	JKPEV-S-2P x 0.75SQ
	3	JKPEV-S-3P x 0.75SQ

- Use power cables with an appropriate wire size of 12 to 22 AWG, a rated voltage
 of 300 V or more, and a rated temperature of 60 °C or more.
 Use cables whose cross-sectional area is suitable for the crimp terminal lugs used.
- Use a Cat5E or higher straight LAN cable for Ethernet communication.
- Use a Cat5E or higher straight LAN cable to connect the main unit and display unit.
 - (Cat5E, T568A, or T568B wiring. Both ends use an RJ45 plug (8P8C modular).)
- For the motor connection of the MOTOR block, use cables with a rated voltage of 300 V or more and a rated temperature of at least 60 °C.

! Handling Precautions

 A 4-core LAN cable cannot be used to connect the main unit and display unit.

3-3 Crimp Terminals / Ferrules

!CAUTION



Firmly tighten the terminal screws to the torque listed in the specifications. Insufficient tightening may result in fire or electric shock.



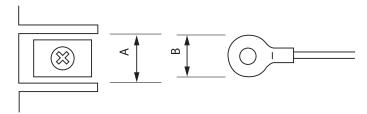
Do not use unused terminals as relay terminals. There is a danger of fire, electric shock, or device failure.



Use this device with the provided power terminal block cover mounted. Otherwise, there is a danger of electric shock.

■ Crimp terminals

When wiring the power input, use crimp terminal lugs compatible with M4 screws.



For details about the types and sizes of crimp terminals, see table below.

Manufacturer: J.S.T. Mfg. Co., Ltd.

Recommended crimp terminals

Model No.	Terminal dimensions (mm)		Cross-sectional area (mm²)	Notes
	Α	АВ		
V1.25-4	8.6	8.0	0.50 to 1.25 (AWG20 to 16)	With insulating sleeve
V2-4	8.6	8.5	1.25 to 2.00 (AWG16 to 14)	With insulating sleeve

! Handling Precautions

- Be careful not to allow any crimp-type terminal lugs to touch adjacent terminals
- The tightening torque for terminal screws is 1.4 N·m.

■ Ferrules

For details about the types and sizes of ferrules, see the table below.

Manufacturer: Phoenix Contact
Crimping tool: CRIMPFOX 6

- The use of ferrules to connect the I/O signal lines of this device is recommended.
- If you do not use ferrules, use the following types of wire.

DI/DO, RS-485, AI, AO-C, V-P, DI, DO:

Use 0.2 to 1.5 \mbox{mm}^2 solid or stranded wire and strip off 8 mm of insulation.

Display unit:

Use 0.2 to 0.5 mm² solid or stranded wire and strip off 6 mm of insulation.

• If using stranded wire, do not solder the end of the wire.

When inserting the wire into the connector hole, press a screwdriver into the adjoining release hole to open the metal clamp inside.

Recommended ferrules (for DI/DO, RS-485, AI, AO-C, V-P, DI, DO)

Model	Product number	Cross-sectional area (mm²)	Notes
AI 0,25-8 YE	3203037	0.25 (24 AWG)	With insulating sleeve
AI 0,34-8-TQ	3203066	0.34 (22 AWG)	With insulating sleeve
AI 0,5-8 WH	3200014	0.50 (20 AWG)	With insulating sleeve
AI 0,75-8 GY	3200519	0.75 (18 AWG)	With insulating sleeve
A1-8	3202517	1.00 (18 AWG)	Without insulating sleeve.
			For crimping two wires, each 0.5 mm ² (in cross-sectional area), together
A1,5-7	3200263	1.50 (16 AWG)	Without insulating sleeve.
			For crimping two wires, each 0.75 mm ² (in cross-sectional area), together
AI-TWIN 2x0,5-8 WH	3200933	0.50 (20 AWG)	With insulating sleeve.
			For crimping two wires, each 0.5 mm ² (in cross-sectional area), together
AI-TWIN 2x0,75-8 GY	3200807	0.75 (18 AWG)	With insulating sleeve.
			For crimping two wires, each 0.75 mm ² (in cross-sectional area), together

Recommended ferrules (for display unit)

Model	Product number	Cross-sectional area (mm ²)	Notes
AI 0,25-6 YE	3203024	0.25 (24 AWG)	Without insulating sleeve.
			For connecting an external power supply
			to the terminal block of the display unit

Recommended ferrules (for MOTOR)

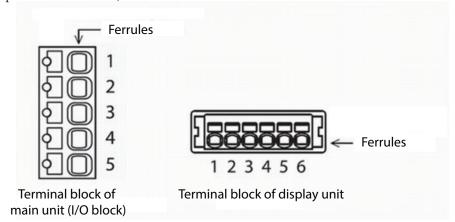
Model	Product number	Cross-sectional area (mm²)	Notes
AI0,75-8 BU	3200027	0.75 (18 AWG)	With insulation sleeve
AI1-8 RD	3200030	1.00 (18 AWG)	With insulation sleeve
AI1,5-8 RD	3201136	1.50 (16 AWG)	With insulation sleeve
AI2,5-10 BU	3202533	2.00 (14 AWG)	With insulation sleeve

! Handling Precautions

- After instrumentation wiring, check that the ferrules are inserted into the terminal block correctly.
- When using ferrules, check for improper wire insertion.
- When using the AI-TWIN 2x0,5-8WH or AI-TWIN 2x0,75-8GY, pay special attention to the terminal crimping orientation so that the insulation sleeve does not interfere with adjacent terminals when the ferrules are inserted into the terminal block.
- If a resistor with leads is used as the terminating resistor (120 Ω , ½ W) for the RS-485 block, insert the leads directly without using ferrules.
- When connecting an external power supply to the display unit, use ferrules. The integrating cable for connecting the main unit and the display unit is included in the product with ferrules crimped.

■ Inserting ferrules

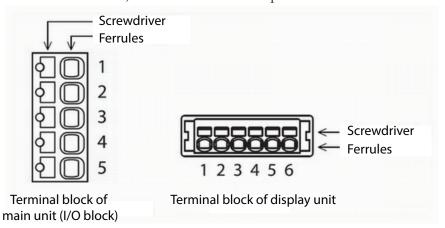
Insert ferrules into terminal holes in the terminal block (see the figure below) and push them all the way into the holes.



■ Removing ferrules

For the main unit, release buttons are located next to the terminal holes as shown in the figure on the left. Push the buttons straight down with a screwdriver (recommended blade width: 2.5 mm, blade thickness: 0.4 mm) and pull out the ferrules.

For the display unit, release holes are located above the terminal holes as shown in the figure on the right. Insert a screwdriver (recommended blade width: 2.0 mm, blade thickness: 0.4 mm) into the release holes and pull out the ferrules.



3-4 Wiring





Before wiring, installing, or removing this device, be sure to shut off the power supply. Otherwise, there is a danger of electric shock.

!CAUTION



Before handling the main unit and display unit or removing/inserting cables, touch a grounded panel to discharge any static electricity.



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.



Make sure that devices and equipment connected to this device have reinforced insulation or double insulation suitable for their operating voltage and for this device's power.



Use this device with the provided power terminal block cover mounted. Otherwise, there is a danger of electric shock.



Before touching terminals, shut off the power for the motor.



Attach ferrules with insulating sleeves to the wires for the MOTOR block. Do not use ferrules without insulating sleeves. Use ferrules with insulating sleeves even when using a single wire. Otherwise, there is a danger of electric shock.



Insert ferrules into the terminal block until the terminal part of the ferrule does not stick out.



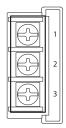
Connect potentiometer (100 to 2500 Ω) wires to the terminals for motor feedback (terminals 4 to 6). If signal wires other than wires for the potentiometer are connected, the device may be damaged. Make sure that the wiring is correct.

■ Noise suppression measures

Draw power from a single-phase instrument power supply and consider appropriate measures so that noise does not adversely affect this device. If there is too much electrical noise coming from the power supply, add an appropriate isolation transformer and use an appropriate line filter.

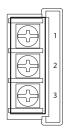
■ Power input

AC models



- 1: Live side of AC power supply
- 2: AC power neutral line
- 3: Frame ground

DC models



- 1: DC power +
- 2: DC power -
- 3: Frame ground

! Handling Precautions

- Before touching the power input terminal box, shut off the input power.
- The applicable crimp terminal for power input is a crimp terminal for M4 (8.5 mm or less wide), and the proper tightening torque is 1.4 N·m.
- Do not connect three or more crimp terminals to the same terminal screw.
- After completing the work, be sure to mount the cover on the power input terminal block.
- There is a notch in the cover of the power terminal block to prevent slippage of the cover.

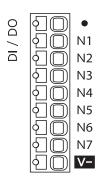


■ Grounding

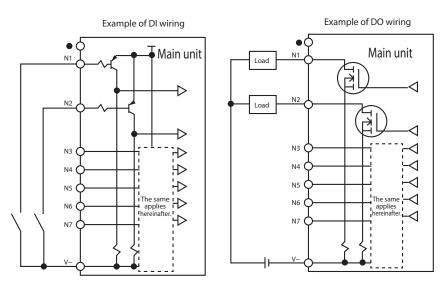
Use the frame ground terminal to ground this device only. Do not connect the ground wire from other devices.

Ground type: resistance of 100 Ω or less

■ DI/DO block (7 digital inputs or outputs, selectable)



- : N.C. (Do not connect to this terminal.)
- N1: DI/DO1 (DI/DO can be switched by changing the setting.)
- N2: DI/DO2 (DI/DO can be switched by changing the setting.)
- N3: DI/DO3 (DI/DO can be switched by changing the setting.)
- N4: DI/DO4 (DI, DO, or time proportional output can be switched by changing the setting.)
- N5: DI/DO5 (DI, DO, or time proportional output can be switched by changing the setting.)
- N6: DI/DO6 (DI, DO, or time proportional output can be switched by changing the setting.)
- N7: DI/DO7 (DI, DO, or time proportional output can be switched by changing the setting.)
- V-: COM (Common terminal)



DI specifications: Open terminal voltage 7 V or less, terminal current 1 mA.
Allowable ON residual voltage 1 V or less, allowable OFF-state leakage current 0.1 mA or less

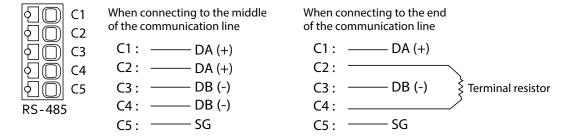
DO specifications: 4.5 to 28 V DC, max. 100 mA per output

! Handling Precautions

- The DI/DO is general input/output. Use the DI/DO with the parameters set. By default every DI/DO is set to DI.
 - To use as DI:
 - Gold contacts, etc., suitable for turning a microcurrent ON/OFF should be used for the no-voltage make contacts. To handle the terminal current during short-circuit and the open terminal voltage of this device, use contacts with surplus minimum open/close capacity.
 - When a semiconductor is used as a no-voltage make contact, use a semiconductor whose voltage at both contact ends when the contact is ON satisfies the allowable ON residual voltage. Additionally, use a semiconductor whose OFF-state leakage current is within the allowable limits.

- To use as DO or time proportional output:
 - Pay attention to the polarity of the external power supply. Reverse polarity connection may cause breakage.
 - An overcurrent protection circuit is incorporated. If an overcurrent is
 detected, the DO is forced OFF and an alarm is generated. The status of
 the loads is checked every 5 seconds after overcurrent has been detected.
 When the overcurrent status is canceled, the DO is restored automatically.

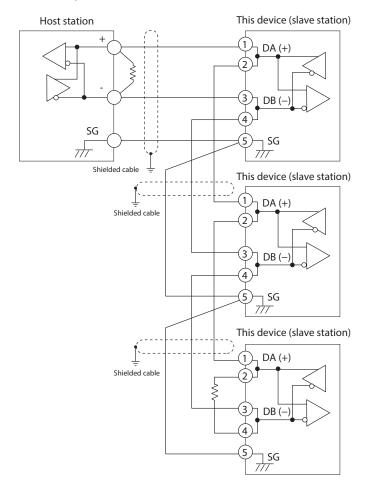
■ RS-485 (RS-485 communication port)



C1 and C2, and C3 and C4, are electrically continuous inside the port.

Use the ports for wiring in series and connect terminal resistors as shown in the sample wiring diagram below.

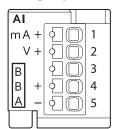
Wiring example of 3-wire system device

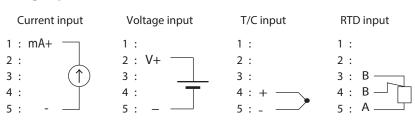


! Handling Precautions

- Connect a terminating resistor (120 Ω , 1/2 W) to both ends of the communication line. If a resistor with leads is used, insert the leads directly without using ferrules. Do not connect a terminating resistor to the middle part of the communication line.
- To connect two terminals together such as SG, use a crimp terminal without an insulation sleeve.
- Be sure to connect the SG terminals to each other. Failure to do so might cause unreliable communication.
- If equipment controller devices that do not allow connection of a terminating resistor (such as Azbil Corporation's SDC15/25/26/35/36 and DMC10) are included in the transmission line, do not connect any terminating resistor to the external or communication lines of the C7.
- The frame ground should be connected to only one end of the shielded cable, not to both ends.

■ Analog input block (analog input)





Maximum allowable input voltage

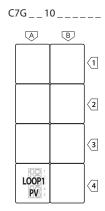
DC current input: -1.5 to +1.5 V DC voltage input: -15 to +15 V Thermocouple input: -1.5 to +1.5 V

! Handling Precautions

- Do not apply a voltage exceeding the allowable maximum input stated in the specifications to any input. Doing so will cause device failure.
- Make the connections while carefully checking the polarity of the inputs.
- Use shielded cables for input wiring.
- When a thermocouple is used for the input, take appropriate measures so that no terminals are exposed to moving air. Failure to do so may result in an error.
- Set a suitable sensor type for usage. If the setting is incorrect, it will not be possible to measure the PV correctly, and a hazardous situation could result, such as a constant 100 % control output.

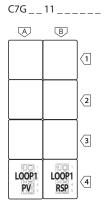
■ Analog input block layout

• 1 loop

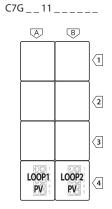


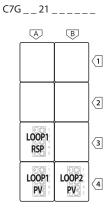
4

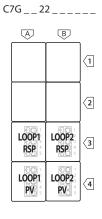
LOOP1



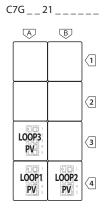
• 2 loops

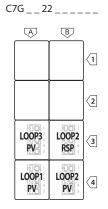




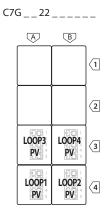


3 loops





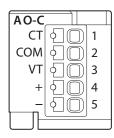
4 loops

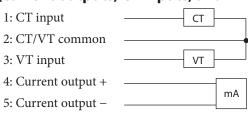


! Handling Precautions

• The AI value of an AI block that is not used for control cannot be monitored using the display or communication. When monitoring is required, set the loop type so that the relevant block is used for control.

■ Analog output block (current outputs, CT inputs, and VT inputs)





Maximum allowable input

CT: 90 mA and 130 mA peak (AC), 1 V and 1.4 V peak (AC) VT: 18 V and 26 V peak (AC)

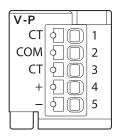
Transient overvoltage

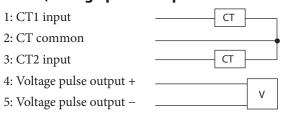
CT: Supply voltage + 250 V

! Handling Precautions

- Do not connect or disconnect any load while the power of this device is on. Failure of this device or the load may result.
- The CT, VT, and current outputs inside the same block are not isolated.
- The CT/VT common is a common terminal. Connect this terminal to an external terminal, or use a ferrule without an insulation sleeve.
- Do not apply a voltage/current exceeding the allowable maximum input stated in the specifications to the CT/VT terminal. Doing so will cause device failure.
- When the current transformer input is used for phase angle control, the input accuracy of the product may not be satisfied.
- The voltage across terminals of the current output section of this device may vary depending on the load and output value. The voltage is approx. 5 V in the open state, but this is normal operation.
- If a current transformer is used for a UL-compliant model, the transformer must be compliant with UL 2808 (categories XOBA and XOBA7). Do not use an uncertified current transformer.

■ Voltage pulse output block (voltage pulse outputs and 2 CT inputs)





Maximum allowable input

CT: 90 mA and 130 mA peak (AC), 1 V and 1.4 V peak (AC)

Transient overvoltage

CT: Supply voltage + 250 V

Load current

Voltage pulse output: 25 mA max.

! Handling Precautions

- Do not connect or disconnect any load while the power of this device is on. A failure of this device or the load may result.
- The CT1, CT2, and voltage pulse outputs inside the same block are not isolated.
- The CT1 and CT2 common are common terminals. Connect this terminal to an external terminal, or use a ferrule without an insulation sleeve.
- Do not apply a current exceeding the allowable maximum input stated in the specifications to the CT1/CT2 terminal. Doing so will cause device failure.

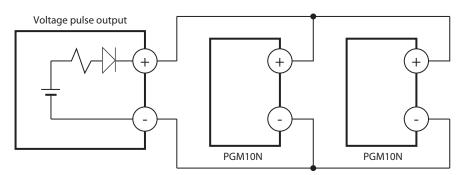
- When the current transformer input is used for phase angle control, the input accuracy of the product may not be satisfied.
- If a current transformer is used for a UL-compliant model, the transformer must be compliant with UL 2808 (categories XOBA and XOBA7). Do not use an uncertified current transformer.

Connection with a constant-current solid state relay (SSR)

When connecting constant-current SSRs to voltage pulse output, connect in parallel the number of SSRs that satisfy both of the following conditions.

- The current of the voltage pulse output is within the allowable limit.
- The voltage of the voltage pulse output is within the input voltage range of the SSR.

Example 1: Connecting two Azbil PGM10N units



Because the input current of the PGM10N is 10 mA or less, the input current is a maximum of 20 mA ($10 \text{ mA} \times 2$) when two PGM10N units are connected.

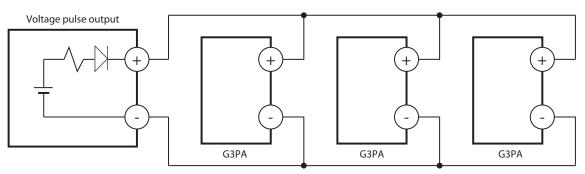
20 mA satisfies the allowable current of the C7 V-P block, which is 25 mA or less.

The output voltage of the C7 V-P block is 12 V DC +15 %/-10 % (10.8-13.8 V DC), which falls within the input voltage range of the PGM10N, which is 3.5-30 V DC.

One or two PGM10N and/or PGM10F units can be connected to one voltage pulse output.

SSR	SSR input rating	Connected SSRs	Current	Notes
PGM10N	3.5–30 V DC	1	10 mA max.	
	10 mA max.	2 in parallel	20 mA max.	
PGM10F	4.5-30 V DC	1	12 mA max.	
	12 mA max.	2 in parallel	24 mA max.	

Example 2: Connecting three Omron G3PA units



Because the input current of one G3PA is 7 mA or less, the input current is 21 mA or less $(7 \text{ mA} \times 3)$ when three G3PA units are connected.

21 mA satisfies the allowable current of the C7 V-P block, which is 25 mA or less.

The output voltage of the C7 V-P block is 12 V DC + 15 % / -10 % (10.8 - 13.8 V DC), which falls within the input voltage range of the G3PA, which is 5 - 24 V DC.

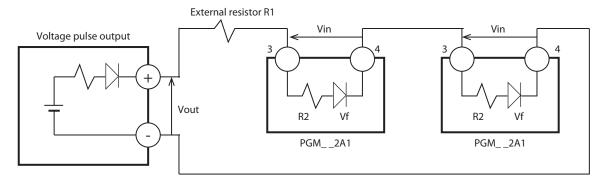
One to three G3PA and/or G3NA units can be connected to one voltage pulse output.

SSR	SSR input rating	Connected SSRs	Current	Notes
G3PA	5–24 V DC	1	7 mA max.	
	7 mA max.	2 in parallel	14 mA max.	
		3 in parallel	21 mA max.	
G3NA	5–24 V DC	1	7 mA max.	
	7 mA max.	2 in parallel	14 mA max.	
		3 in parallel	21 mA max.	

Connection with a resistance SSR

When connecting a resistance SSR to the voltage pulse output, connect an external resistor in series as needed so that the input voltage of the SSR ($V_{\rm IN}$ in the figure below) falls within the specifications.

Example: When connecting two Azbil PGM__2A1 units



If the number of SSRs is n, $V_{IN} = (R_1 \times V_F + R_2 \times V_{OUT}) \div (R_1 + R_2 \times n)$.

n: 2

 R_1 : 220 Ω

 V_{OUT} : 12 V +15 %/-10 %

V_F: 0.8-1.3 V

R₂: $260 \Omega \pm 5 \%$

When V_{OUT} , V_F , and R_2 are the minimum values, V_{IN} is the minimum value as calculated by $(220\times0.8+247\times10.8)\div(220+247\times2)\approx4.0$ V.

When V_{OUT} , V_{E} and R_{2} are the maximum values, V_{IN} is the maximum value as calculated by $(220 \times 1.3 + 273 \times 13.8) \div (220 + 273 \times 2) \approx 5.3$ V.

Because 4.0–5.3~V~DC is within the input voltage range of the PGM (3–6~V~DC), the PGM operates.

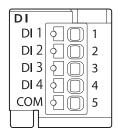
One to three PGM__2A1 units can be connected to one voltage pulse output.

SSR	SSR input rating	Connected SSRs	External resistance	SSR input voltage	Notes
PGM2A1	3–6 V DC	1	560 Ω	3.9-5.4 V DC	The external resistance
	260 Ω ± 5 %	2 in series	220 Ω	4.0-5.3 V DC	rating is ½ W or more.
	200112070	3 in series	None	3.6-4.6 V DC	

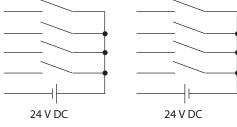
! Handling Precautions

PGMs cannot be connected in parallel because the allowable current of the C7
 V-P block would be exceeded.

■ DI block (4 digital inputs)



- 1: Digital input 1
- 2: Digital input 2
- 3: Digital input 3
- 4: Digital input 4
- 5: Common



Rated input voltage:

24 V DC +20/-15 %

Terminal current:

4 mA (with 24 V DC input)

ON voltage/current:

19 V or more / 3 mA or more

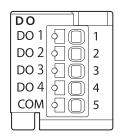
OFF voltage/current:

7 V or less / 1 mA or less

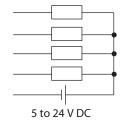
! Handling Precautions

- Gold contacts, etc., suitable for turning a microcurrent ON or OFF should be used for contacts.
- When a semiconductor is used as a contact, use a semiconductor with an OFF-state leakage current within the allowable limits.

■ DO block (4 digital outputs, sink output)



- 1: Digital output 1
- 2: Digital output 2
- 3: Digital output 3
- 4: Digital output 4
- 5: Common



Load voltage:

4.5 to 28 V DC

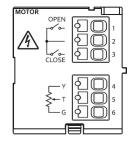
Load current:

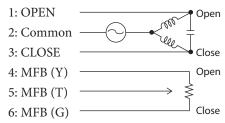
100 mA max. per digital output

! Handling Precautions

 An overcurrent protection circuit is incorporated. If an overcurrent is detected, the DO is forced OFF and an alarm is generated. The status of the loads is checked every 5 seconds after an overcurrent has been detected. When the overcurrent status is canceled, the DO is restored automatically.

■ MOTOR block (motor drive outputs and motor feedback inputs)





Contact rating

For models other than UL-compliant models 2 A, 250 V AC (inductive load) 2.5 A, 24 V DC (inductive load)

For UL-compliant models 2 A, 250 V AC (general use) FLA: 2 A, 240 V AC (100 W)

Potentiometer for motor feedback 100 to 2500 Ω

! Handling Precautions

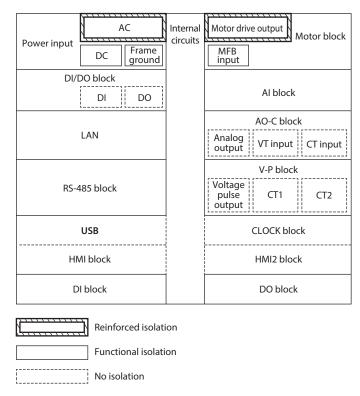
- If a motor with a 100/200 V AC motor power supply is used, pay careful attention to both the contact rating and the inrush current, and if necessary, use an external auxiliary relay.
- Do not route the wires of the MOTOR block output terminals (1, 2, and 3) through the same duct as the wires of the MOTOR block MFB input terminals (4, 5, and 6).

Also, do not put 6-core cables together. Otherwise, the device could fail due to noise at motor startup.

- If the "Control method selection" setting of the PP (position proportional) bank is 2 (estimated position control) or 3 (estimated position control + position adjustment at power-on), the wires for the MOTOR block MFB terminals 4, 5, and 6 are not needed (when controlling without motor feedback).
- Set MOTOR block output terminal 3 for motor CLOSE output.
 If output terminal 3 is set to OPEN output, the motor output may be stuck at OPEN if the relay fails.
- UL-compliant models cannot be used with the 24 V DC contact rating.

■ I/O isolation

I/O isolation



^{*1.} Blocks other than the CLOCK and HMI2 blocks are functionally isolated from one another.

■ USB connection

Connect the device to the PC using a USB-microUSB cable (type A to type B).

! Handling Precautions

 Connection and disconnection of the MicroUSB is hazardous as there is a power input terminal nearby. Be sure to turn off the power before connecting or disconnecting this cable.



• Procure a data communication cable separately.

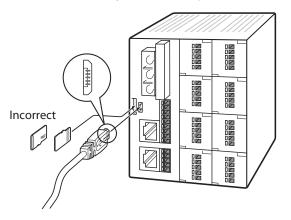
^{*2.} The AC power supply and motor drive output units have reinforced isolation from all other blocks.

■ Inserting or removing a microSD memory card

Insert the microSD memory card all the way inside. Pushing on the memory card lightly will enable you to remove the card.

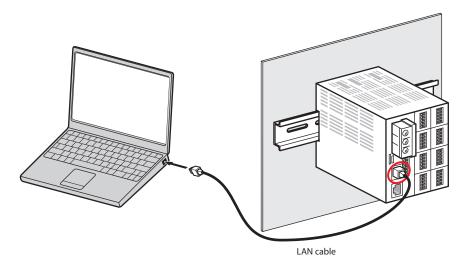
! Handling Precautions

- Do not insert or remove a memory card while the indicator next to the connector is flashing.
- Insertion and removal of a microSD memory card is hazardous as there is a power input terminal nearby. Be sure to turn off the power before inserting or removing this card.
- Insert a microSD memory card at a right angle to the main unit. If the card is tilted, it may not be possible to insert it.
- To transfer the data from a microSD memory card to the personal computer, use a commercially available adapter or reader/writer.



■ Connecting the LAN cable for Ethernet

Use a Cat5E or higher LAN cable to make the connection.



■ Connecting the cable between the main unit and display unit

! Handling Precautions

- Do not pull on the wires of the display unit excessively. Doing so may damage the connector.
- Before connecting the display unit, turn off the power to the main unit.
- Both the display unit included with the C7G and the C7D additional display unit can be connected to the C7G.

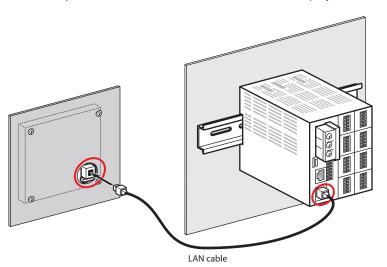
The firmware version of the display unit does not match. (p. 11-8) (for the possible firmware combinations of the main unit and the display units)

Standard mounting

Use a Cat5E or higher straight LAN cable to make the connection. (Cat5E, T568A, or T568B wiring. Both ends use an RJ45 plug (8P8C modular).)

! Handling Precautions

- A 4-core LAN cable cannot be used.
- If the length of the LAN cable for the display unit is from 30 m to 100 m, an external power source must be connected for the display unit.

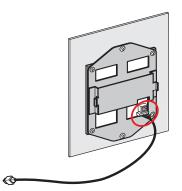


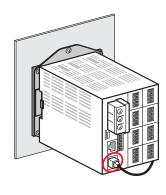
Integrated mounting

Insert the ferrules (part of the cable for integrated mounting supplied with the product) with the specified colors into the terminal block of the display unit.

Step 1 in Integrated mounting (p. 2-5)

Insert the integrating cable into the connector on the display unit.





(1) Connect the cable to the terminal of the display unit. (2) Mount the main unit on the mounting bracket,

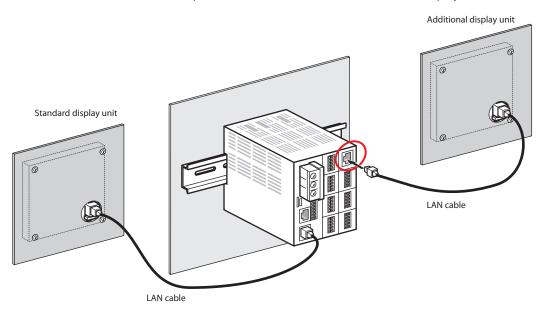
and connect the cable to the main unit.

Mounting of additional display unit

Use a Cat5E or higher straight LAN cable to make the connection. (Cat5E, T568A, or T568B wiring. Both ends use an RJ45 plug (8P8C modular).)

! Handling Precautions

- A 4-core LAN cable cannot be used.
- The additional display unit can be mounted in the 92×92 mm hole using the integrating bracket. Connect to the main unit using a LAN cable.
- If the length of the LAN cable for the display unit is from 30 m to 100 m, an external power source must be connected for the display unit.



Display unit external power supply

- If the length of the LAN cable exceeds 30 m (maximum cable length: 100 m), an
 external power supply must be connected to the display unit. Connect the LAN
 cable and external power supply to the display unit as shown in the figure on the
 next page.
- Use 0.2 to 0.5 mm² solid or stranded wire for connecting the external power supply.
- Be careful not to pull too much on the 0.2 to 0.5 mm² power wire when wiring the instruments.

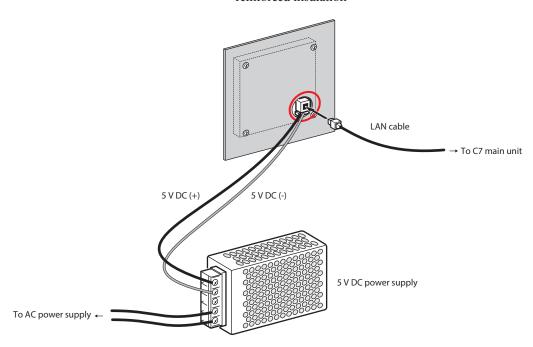
Otherwise, the wire could break.

- If using stranded wire for connecting the external power supply, do not solder the end of the wire. When inserting the wire into the connector hole, press a screwdriver into the adjoining release hole to open the metal clamp inside.
- The maximum length of the external power supply wire is 10 m.
- External power supply specifications

Output voltage: $5 \text{ V DC} \pm 10 \%$

Output current: 0.5 A min.

Insulation between commercial power supply and 5 V DC: reinforced insulation



Wiring for terminal block of display unit

Terminal No.	1	2	3	4	5	6
Cable	5 V DC (+)	Not connected		5 V DC (-)		

Chapter 4. Functions

4-1 Loop Types

This device has from 1 to 4 analog inputs (selected by model No.). For control execution, PV and RSP (remote SP) input can be assigned to any of the analog inputs in the [Loop type] settings. The loop type can be set by the SLP-C7 Smart Loader Package.

■ Model numbers and loop types

The following table shows the possible combinations of model No. and loop type with regard to analog input.

✓: Possible

-: Possible when the advanced loop type setting is enabled.

PV1: PV for loop 1 PV2: PV for loop 2 PV3: PV for loop 3 PV4: PV for loop 4 RSP1: RSP for loop 1 RSP2: RSP for loop 2 RSP3: RSP for loop 3

Unused: Although an analog input of the AI block is present, it is not assigned to the PV or RSP of the loop.

	on type	6th and 7th digits of the model No. (C7GA)					
Loop type		10	20	11	21	22	
0: 1 loop	PV1 ■	✓	✓	✓	✓	✓	
	PID WV1	A4: PV1	A4: PV1 A3: Unused	A4: PV1 B4: Unused	A4: PV1 A3: Unused B4: Unused	A4: PV1 A3: Unused B4: Unused B3: Unused	
1:1 loop, 1 RSF	PV1 RSP1 PID MV1	-	√ A4: PV1 A3: RSP1	-	A4: PV1 A3: RSP1 B4: Unused	A4: PV1 A3: RSP1 B4: Unused B3: Unused	
2: 2 loops	PV1 PV2 PID PID MV1 MV2	-	-	A4: PV1 B4: PV2	A4: PV1 A3: Unused B4: PV2	A4: PV1 A3: Unused B4: PV2 B3: Unused	
3:2 loops, 1 RS	PV1 RSP1 PV2 PID PID WV1 MV2	-	-	-	A4: PV1 A3: RSP1 B4: PV2	A4: PV1 A3: RSP1 B4: PV2 B3: Unused	
P	PS V1 RSP1 PV2 RSP2 V1 MV2	-	-	-	-	A4: PV1 A3: RSP1 B4: PV2 B3: RSP2	

	6t	h and 7th digits	of the model No.	(C7GA_ <u></u>)
Loop type	10	20	11	21	22
5: 3 loops PV1 PID PID PID PID PID WV1 MV2 MV3	-	-	-	A4: PV1 A3: PV3 B4: PV2	✓ A4: PV1 A3: PV3 B4: PV2 B3: Unused
6:3 loops, 1 RSP PV1 PV2 RSP2 PV3 PID PID PID PID MV1 MV2 MV3	-	-	-	-	A4: PV1 A3: PV3 B4: PV2 B3: RSP2
7:4 loops PV1 PV2 PV3 PV4 PID PID PID PID MV1 MV2 MV3 MV4	-	-	-	-	A4: PV1 A3: PV3 B4: PV2 B3: PV4
8:1 loop, 1 RSP PV1 RSP1 PID MV1	-	-	✓ A4: PV1 B4: RSP1	-	-
9: Internal cascade PV1 PID PID RSP2 MV2	-	-	A4: PV1 (master) B4: PV2 (slave)	A4: PV1 (master) A3: Unused B4: PV2 (slave)	A4: PV1 (master) A3: Unused B4: PV2 (slave) B3: Unused
10: Internal cascade + 1 loop PV1 PV2 PV3 PID PID PID PID RSP2 MV2 MV3	-	-	-	A4: PV1 (master) A3: PV3 B4: PV2 (slave)	A4: PV1 (master) A3: PV3 B4: PV2 (slave) B3: Unused
11: Internal cascade + 2 loops PV1 PV2 PV3 PV4 PID PID PID PID PID RSP2 MV2 MV3 MV4	-	-	-	-	A4: PV1 (master) A3: PV3 B4: PV2 (slave) B3: PV4

	6t	h and 7th digits of	the model No. (C		_)
Loop type	10	20	11	21	22
12: Internal cascade, 1 RSP	-	-	-	✓	✓
PID PID				A4: PV1 (master) A3: RSP1	A4: PV1 (master) A3: RSP1
RSP2 MV2				B4: PV2 (slave)	B4: PV2 (slave)
20: 3 loops, 3 RSPs	_	_	_	_	B3: Unused
PV1 RSP1 PV2 PV3 RSP3 PID PID PID PID PID PID PID PID PID PID					
21: 4 loops, 4 RSPs PV1 PV2 PV3 PV4 RSP1 RSP2 RSP3 RSP4 PID	-	-	-	-	-
22: Internal cascade + 2 loops, 3 RSPs PV1 PV2 PV3 PV4 RSP1 RSP3 RSP4 PID PID PID PID RSP2 MV2 MV3 MV4	_	-	_	-	-
23: 2 Internal cascades , 2 RSPs PV1 PV2 PV3 PV4 RSP1 PID PID PID RSP2 MV2 RSP4 MV4	_	_	_	_	-

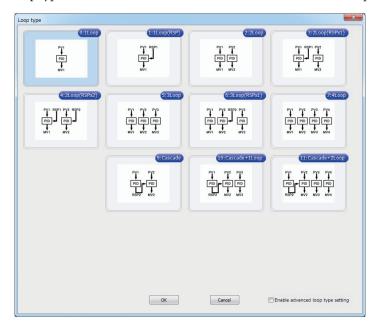
! Handling Precautions

- The value of an unused AI cannot be displayed. To display the value of the AI, even if it is not a control target, assign it to PV in the loop type. However, since the AI is actually not controlled, it is not necessary to assign the MV to the analog output or DI/DO.
- If the advanced loop type setting is enabled for [Loop type], any loop type can be selected regardless of the model number.

Setting the loop type

The loop type can be set by the SLP-C7 Smart Loader Package. The setting procedure is as follows:

- (1) Open the setup screen of the SLP-C7.
- (2) Click [Loop type] on the toolbar to open the screen shown below. Only the loop types that are suitable for the model No. of this device are displayed.



- (3) If the loop type to be selected is clicked, it is highlighted in blue. Click [OK] to close the screen.
- (4) If [Write (SLP to C7)] is clicked on the toolbar, the SLP-C7 writes the loop type setting to the C7 along with other parameter settings. If the loop type is changed, the device restarts.

! Handling Precautions

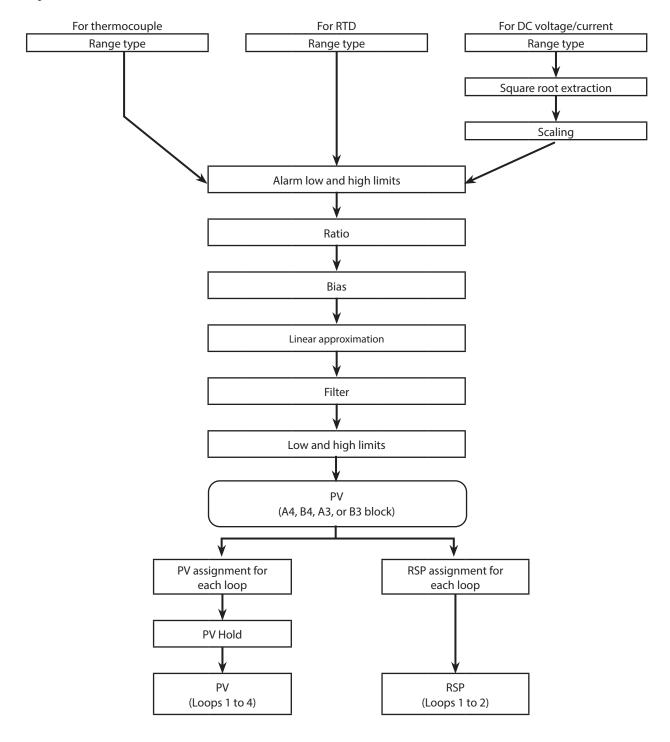
- The loop type cannot be set by the parameter setting in the display unit of this
- Select the model No. of this device in the SLP-C7 before setting the loop type.
 To select a model No., either click "Model No. Settings" or "Read (C7→SLP)" on
 the toolbar, or click "Open" in the menu and open the settings file saved on
 the PC.
- If the advanced loop type setting is enabled for [Loop type], any loop type can be selected regardless of the model number.
- If the advanced loop type setting is enabled, standard numerical codes can be assigned to PV and RSP inputs. Low limit and high limit settings are available to control the range of input assignments.



• 4-23 Advanced Loop Type Setting (p. 4-163) (for details on the advanced loop type setting and input assignments)

4-2 AI (Analog Input)

A maximum of 4 analog input points can be implemented. The following is a functional block diagram for analog input.



Range types

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot.

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
Range type	MENU > AnalogInput	Input types and ranges (p. 13-13)	88
(Analog input bank)	Range type	in chapter 13	

! Handling Precautions

• If a range type No. that is not present in the range table is selected, this device does not perform the input operation but displays 0 in the PV.

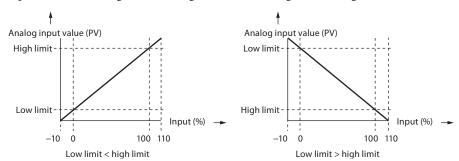
■ Linear scaling low and high limits

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot.

Input scaling can be used if the range type is set to DC voltage or DC current.

Item (bank)	Display	Description	Initial value
Linear scaling low limit Range type (Analog input bank)	MENU > AnalogInput Linear scaling low limit	If the range type is DC voltage or DC current -32000 to +32000	0.0000
Linear scaling high limit (Analog input bank)	MENU > AnalogInput Linear scaling high limit	A maximum of 5 digits, plus 4 digits after the decimal point, can be set.	1000.0

The following diagram shows the relationship between analog input and analog input value according to the settings for linear scaling low and high limits.



Setting the linear input unit character

A character string for the unit of linear input can be set by the SLP-C7 Smart Loader Package. The setting procedure is as follows:

- (1) Open the setup screen of the SLP-C7.
- (2) Click [Unit Strings] on the toolbar to open the screen as shown below.



(3) Select a type with the button on the left side.

0: None

→ No unit is displayed.

1: °C

→ °C is displayed in the same manner as the thermocouple and resistance temperature detector.

99: Character string → The character string that was input in the right-side frame is displayed.

(4) Enter a character string in the right-side frame.

A maximum of 7 alphanumeric characters in upper or lower case, and some symbols (/, etc.) can be used.

- (5) Click [OK] to close the screen.
- (6) If [Write (SLP to C7)] is clicked on the toolbar, the SLP-C7 writes the characters set for the unit of measurement to the model C7 along with other parameter settings.

■ Filter

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot.

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

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

Item (bank)	Display	Description	Initial value
Filter	MENU > AnalogInput	0.0000: No filter	0.0000
(Analog input bank)	Filter	0.0001 to 120.00 s	

 $OUT = OUT_1 + (IN - OUT_1)/(T/Ts + 1)$

IN: Input to filter

OUT: Current filter calculation output OUT_1: Previous filter calculation output

T: Filter set value (s)

Ts: Sampling cycle

■ Ratio and bias

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot.

Input can be corrected by ratio and bias.

Item (bank)	Display	Description	Initial value
Ratio (Analog input bank)	MENU > AnalogInput Ratio	0.0010 to 10.000	1.0000
Bias (Analog input bank)	MENU > AnalogInput Bias	-32000 to +32000 A maximum of 5 digits, plus 4 digits after the decimal point, can be set.	0.0000

 $AIout = (AIin \times RA) + BI$

AIin: Calculation input

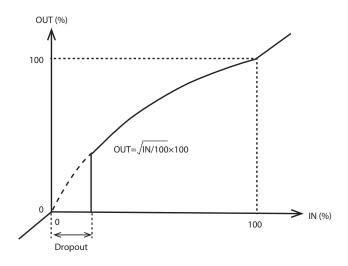
Alout: Calculation output

RA: Ratio BI: Bias

■ Square root extraction dropout

The setting is valid if the AI block is in the A4, B4, A3, or B3 slot. Whether to use square root extraction to convert pressure (differential pressure) to a flow rate and the dropout value can be specified if the range type is set to DC voltage or DC current.

Item (bank)	Display	Description	Initial value
Square root extraction dropout	MENU>AnalogInput Sqr-root extraction dropout	0.0000: Square root extraction is not used.	0.0000
(Analog input bank)		0.0001 to 10.000 %	



IN : Input that depends on the range type (%)

OUT : Output of square root extraction result (%)

When dropout = 0.0000, OUT = IN (no square root extraction).

When dropout > 0.0000, OUT is as follows.

When dropout \leq IN < 100, OUT $=\sqrt{\text{IN} \div 100} \times 100$.

When 0 < IN and IN < dropout, OUT = 0.

When IN \leq 0, OUT = IN.

When $100 \le IN$, OUT = IN.

■ Linearization table group definition

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot.

The linearization table group used for linear approximation of analog input can be set.

Item (bank)	Display	Description	Initial value
Linearization table group definition (Analog input bank)	MENU > AnalogInput Linearization table group	0: No linearization 1 to 8	0



• 4-16 Linear Approximation (p. 4-105) (for details on linearization table settings)

■ Number of decimal places for PV

The setting is valid if the AI block is in the A4, B4, A3 or B3 slot. The maximum number of digits after the decimal point can be selected for the PV display and SP display of the monitor screen.

Item (bank)	Display	Description	Initial value
No. of decimal places for PV1 (Basic action bank)	MENU > BasicAction No. of decimal places for PV1	0: No decimal point 1: 1 digit after the decimal point	1
No. of decimal places for PV2 (Basic action bank)	MENU > BasicAction No. of decimal places for PV2	2: 2 digits after the decimal point 3: 3 digits after the decimal point	
No. of decimal places for PV3 (Basic action bank)	MENU > BasicAction No. of decimal places for PV3	4: 4 digits after the decimal point	
No. of decimal places for PV4 (Basic action bank)	MENU > BasicAction No. of decimal places for PV4		

Configuration is possible for any range type of thermocouple, resistance temperature detector, DC voltage, or DC current.

Even if the number of decimal places for PV is changed, the decimal point position for the linear scaling and LSP in the AI bank does not change.

The decimal point position is set so that the entire value does not exceed 5 digits.

Ex.: If there are 2 digits after the decimal point, 999.99 is displayed as "999.99"

Ex.: If there are 2 digits after the decimal point, 1000.00 is displayed as "1000.0"

■ Sampling cycle

This setting is common to all AI blocks. The sampling cycle can be changed as necessary.

The update cycle of analog input and the execution cycle of control operation are called the sampling cycle.

Item (bank)	Display	Description	Initial value
Sampling cycle (Basic action bank)	MENU > BasicAction Sampling cycle	0: 10 ms 1: 50 ms 2: 100 ms	1

■ PV Hold

Updating of the PV value can be stopped by using PV Hold for the digital input (DI).

When a hold is applied, a blinking "PV" is displayed on the monitor screen.

When a hold is applied, the PV does not change if the analog input (AI) setting or input status changes.

Even if a hold is applied, the alarm function is still activated by a change in the analog input (AI) status.

PV Hold is disabled for RSPs.

■ Power supply frequency

Regardless of whether this product is an AC or a DC power model, be sure to set to the power supply frequency for the region where the product will be used.

This is effective for stabilizing the value of the analog input (PV, RSP, CT input, and VT input).

Item (bank)	Display	Description	Initial value
Power supply frequency	MENU > BasicAction	0: 50 Hz	0
(Basic action bank)	Power supply frequency	1: 60 Hz	

! Handling Precautions

- If the sampling cycle is 10 ms, or if CT input or VT input is used, set the power supply frequency for the region where the product will be used. If a different power supply frequency is set, the specifications for analog input indication accuracy may not be satisfied.
- It is not necessary to set the power supply frequency if the sampling cycle is not 10 ms, or if CT input and VT input are not used.

■ Alarm low and high limits

Alarms are set at -10 % FS (low limit) and 110 % FS (high limit) of the ranges shown in the table of Input types and ranges (p. 13-13). However, if the input type is thermocouple PLII, the high limit is 105 % FS.

Analog input values before processing by the ratio, bias, linear approximation, and filtering are used for alarm processing.

When an alarm is triggered, the analog input value is limited to the low or high limit.

■ Low and high limits

The analog input value is limited to the same low and high limits as with alarm low and high limit processing.

The analog input value modified by the alarm low and high limit processing, ratio, bias, linear approximation, and filtering is used for limit processing.

4-3 Mode

Up to four loops can be controlled individually by this device. The following mode selections are available for each control loop.

- AUTO/MANUAL mode selection
- Constant value operation / Pattern operation selection
- RUN/READY mode selection
- LSP/RSP mode selection
- Pattern start number selection
- READY/RUN/HOLD/END mode selection
- ADVANCE
- · G.SOAK clear
- AT (auto tuning) stop/start selection

AUTO/MANUAL mode

The AUTO and MANUAL modes can be switched for each control loop.

● AUTO → MANUAL

There are 2 methods of switching.

- Method 1:
- (1) Press the [MV] button on the 1-loop monitor screen.
 - > The confirmation screen for changing the mode to MANUAL appears.
- (2) Press the [MANUAL] button.
 - > The mode is switched to MANUAL.
- Method 2:
- (1) Press the [■] (mode) button on the 1-loop monitor screen.
 - > The mode selection screen appears.
- (2) Press the [AUTO] button on the right side of AUTO/MANUAL.
 - > The confirmation screen for changing the mode to MANUAL appears.
- (3) Press the [MANUAL] button.
 - > The mode is switched to MANUAL.

■ MANUAL → AUTO

There are 2 methods of switching.

- Method 1:
- (1) Press the [MANUAL] button on the 1-loop monitor screen.
 - > The confirmation screen for changing the mode to AUTO appears.
- (2) Press the [AUTO] button.
 - > The mode is switched to AUTO.
- Method 2:
- (1) Press the [■] (mode) button on the 1-loop monitor screen.
 - > The mode selection screen appears.

- (2) Press the [MANUAL] button on the right side of AUTO/MANUAL. > The confirmation screen for changing the mode to AUTO appears.
- (3) Press the [AUTO] button.
 > The mode is switched to AUTO.

! Handling Precautions

- AUTO/MANUAL modes are synchronized for master and slave loops in internal cascade control. For example, if the master loop's mode is changed to AUTO, the slave loop will also be in AUTO mode.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), the master loop's mode in internal cascade control is always AUTO.

■ Constant value operation / Pattern operation

Each control loop can be switched independently between constant value operation and pattern operation.

■ Constant value operation → Pattern operation

- (1) Press the [SP] button on the 1-loop monitor screen. > The SP change screen appears.
- (2) Press the Change button to the right of "PATTERN OPERATION." > The constant value operation / pattern operation selection screen appears.
- (3) Press the [PTN] button (displaying "PTN," the pattern number, and the SP). > The confirmation screen for changing the mode to pattern operation appears.
- (4) Press the [PATTERN] button.> The mode changes to the pattern operation mode.

■ Pattern operation → Constant value operation

- (1) Press the [SP] button on the 1-loop monitor screen.The SP change screen appears.
- (2) Press the Change button to the right of "PATTERN OPERATION." > The constant value operation / pattern operation selection screen appears.
- (3) Press the [LSP] button or [RSP] button (displaying "LSP" with an LSP number or "RSP," and the SP).
 - > The confirmation screen for changing the mode to constant value operation (LSP/RSP) appears.
- (4) Press the [LSP/RSP] button.
 - > The mode changes to the constant value operation mode.

! Handling Precautions

- If "Pattern" is set to "0: No pattern operation," "PATTERN OPERATION" is not displayed on the SP change screen. In this case, change the setting of "Pattern" by the SLP-C7 Smart Loader Package.
- For a slave loop in internal cascade control, only constant value operation can be set. It is not possible to switch into pattern operation.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), only constant value operation can be set for both master and slave loops in internal cascade control. It is not possible to switch into pattern operation.

■ RUN/READY mode

You can switch between the RUN and READY modes for each control loop in the constant value operation mode.

● RUN → READY

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [RUN] button in the right side of RUN/READY.> The confirmation screen for changing the mode to READY appears.
- (3) Press the [READY] button.The mode changes to READY.

● READY → RUN

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [READY] button in the right side of RUN/READY.> The confirmation screen for changing the mode to RUN appears.
- (3) Press the [RUN] button.The mode changes to RUN.

! Handling Precautions

- RUN/READY modes are synchronized for master and slave loops in internal
 cascade control. For example, if the master loop's mode is changed to RUN, the
 slave loop will also be in RUN mode.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), the master loop's mode in internal cascade control is always RUN.

■ LSP/RSP mode

You can switch between the LSP and RSP modes for each control loop.

\bullet LSP \rightarrow RSP

- (1) Press the [SP] button on the 1-loop monitor screen.The SP change screen appears.
- (2) Press the Change button on the right side of LSP/RSP.> The LSP/RSP selection screen appears.
- (3) Press the [RSP] button.
 > The mode is switched to RSP.

■ RSP → LSP

- (1) Press the [SP] button on the 1-loop monitor screen. > The SP change screen appears.
- (2) Press the Change button on the right side of LSP/RSP.> The LSP/RSP selection screen appears.
- (3) Press any of the LSP1 to 8 buttons. > The mode is switched to LSP.

! Handling Precautions

- The number of LSP buttons to be displayed is set according to the number set in the LSP setting system.
- In the pattern operation mode, switching between the LSP group and RSP is not reflected in control. However, if the operation mode is switched to constant value operation, switching between the LSP group and the RSP is reflected in control.

■ Pattern start number

The pattern start number can be switched for each control loop.

- (1) Press the [SP] button on the 1-loop monitor screen.The SP change screen appears.
- (2) Press the button with numerical values to the right of "PTN START NUMBER."
 - > It changes to an input screen (numerical keypad) for the pattern start number.
- (3) Enter the number and press the [ENTER] button.
 - > The pattern start number changes.

! Handling Precautions

- If "Pattern" is set to "0: No pattern operation," "PTN START NUMBER" is not displayed on the SP change screen. In this case, change the setting of "Pattern" by the SLP-C7 Smart Loader Package.
- The setting range for the pattern start number is from 1 to 16. However, the limits set by "Pattern start number low limit" and "Pattern start number high limit" are valid.
- In constant value operation mode, switching of the pattern start number is not reflected in control. However, if the operation mode is switched to pattern operation, switching of the pattern start number is reflected in control.

■ READY/RUN/HOLD/END mode

You can switch between the READY, RUN, HOLD, and END modes for each control loop in the pattern operation mode.

■ READY → RUN

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [READY] button to the right of "RUN/READY."> The confirmation screen for changing the mode to RUN appears.
- (3) Press the [RUN] button.The mode changes to RUN.

■ RUN → READY

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [RUN] button to the right of "RUN/READY." > The confirmation screen for changing the mode to READY appears.
- (3) Press the [READY] button. > The mode changes to READY.

● RUN → HOLD

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [PATTERN] button in the upper left corner of the screen. > The mode selection screen for pattern operation appears.
- (3) Press the [HOLD ON] button to the right of HOLD.> The confirmation screen for changing the mode to HOLD appears.
- (4) Press the [HOLD ON] button.The mode changes to HOLD.

! Handling Precautions

• The HOLD mode is sometimes called the RUN-HOLD mode because PID control is in the RUN state (control is active).

● HOLD → RUN

- (1) Press the [■] (mode) button on the 1-loop monitor screen. > The mode selection screen appears.
- (2) Press the [PATTERN] button in the upper left corner of the screen. > The mode selection screen for pattern operation appears.
- (3) Press the [HOLD OFF] button to the right of HOLD.> The confirmation screen for canceling HOLD appears.
- (4) Press the [HOLD OFF] button. > The mode changes to RUN.

● HOLD → READY

- (1) Press the [■] (mode) button on the 1-loop monitor screen. > The mode selection screen appears.
- (2) Press the [RUN] button to the right of "RUN/READY."> The confirmation screen for changing the mode to READY appears.
- (3) Press the [READY] button.The mode changes to READY.

■ END → READY

- (1) Press the [■] (mode) button on the 1-loop monitor screen. > The mode selection screen appears.
- (2) Press the [RUN] button to the right of "RUN/READY."> The confirmation screen for changing the mode to READY appears.
- (3) Press the [READY] button.> The mode changes to READY.

! Handling Precautions

- The END mode is sometimes called the RUN-END mode because PID control is in the RUN state (control is active).
- The END mode cannot be switched to the RUN mode or HOLD mode.
- Although there is no operation for switching the RUN mode or HOLD mode to the END mode, the mode switches to the END mode when the "End of operation" setting is set to END and the pattern is processed to the end by ADVANCE.

■ ADVANCE

In the pattern operation mode, the operation can progress to the next segment for each control loop.

- (1) Press the [■] (mode) button on the 1-loop monitor screen. > The mode selection screen appears.
- (2) Press the [PATTERN] button in the upper left corner of the screen. > The mode selection screen for pattern operation appears.
- (3) Press the [ADVANCE] button to the right of ADVANCE. > The ADVANCE execution confirmation screen appears.
- (4) Press the [ADVANCE] button.The operation advances to the beginning of the next segment.

! Handling Precautions

- ADVANCE is only available in the RUN and HOLD modes. It is not available in the READY and END modes.
- If ADVANCE is executed in the G.SOAK wait state, the G.SOAK wait period for the segment is canceled and the operation advances to the beginning of the next segment.
- If ADVANCE is executed in the last segment of a pattern, cycles are executed if
 there are cycles remaining, and the pattern link is executed if a pattern link is
 set. If there are no cycles or pattern links, the controller enters READY mode,
 END mode, or constant value operation, according to the setting of "End of
 operation."
- ADVANCE cannot be executed when the pattern SP increase change limit is something other than 0.0000 or the pattern SP decrease change limit is something other than 0.0000.

4-17

■ G.SOAK clear

In the pattern operation mode, the G.SOAK wait state can be canceled individually for each control loop.

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [PATTERN] button in the upper left corner of the screen. > The mode selection screen for pattern operation appears.
- (3) Press the [CLEAR] button to the right of G.SOAK CLEAR. > The G.SOAK CLEAR execution confirmation screen appears.
- (4) Press the [CLEAR] button.> The G.SOAK wait period is canceled.

! Handling Precautions

- G.SOAK CLEAR can be used only in the G.SOAK wait state.
- In the G.SOAK wait state, the SEG (segment) number display on the monitor screen blinks.

■ AT (auto-tuning) stop/start

AT stop/start can be switched for each control loop independently.

■ AT stop → AT start

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [START] button on the right side of AUTO TUNING.> The confirmation screen for changing the mode to AT start appears.
- (3) Press the [START] button. > The AT starts.

■ AT start → AT stop

- (1) Press the [■] (mode) button on the 1-loop monitor screen.> The mode selection screen appears.
- (2) Press the [STOP] button in the right side of AUTO TUNING.> The confirmation screen for changing the mode to AT stop appears.
- (3) Press the [STOP] button to stop AT.

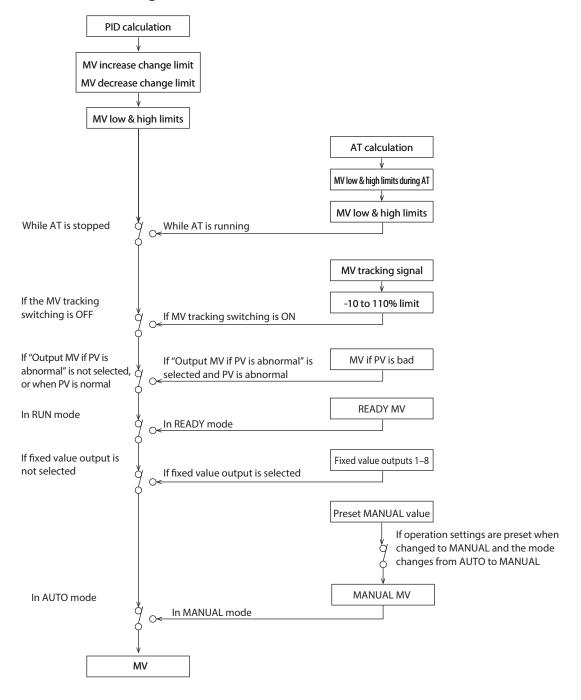
! Handling Precautions

- AT can be started by either the master side or the slave side of the internal cascade control. Master and slave cannot both start AT.
- When AT is active in the pattern operation mode, the progress of pattern operation is stopped even in the RUN mode. When AT stops or ends, the controller returns to a state in which it can progress according to the RUN, HOLD, END, or READY mode.

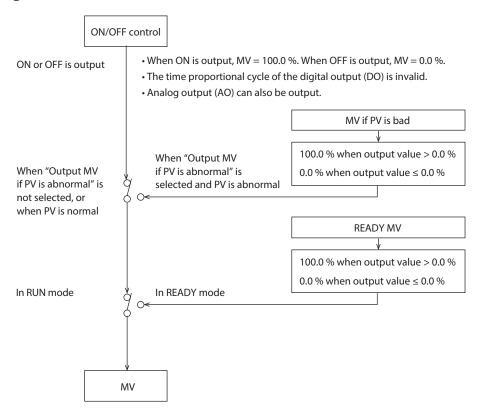
4-4 Control

PID control or ON/OFF control can be provided for a maximum of 4 loops. The following is a functional block diagram of the respective controls.

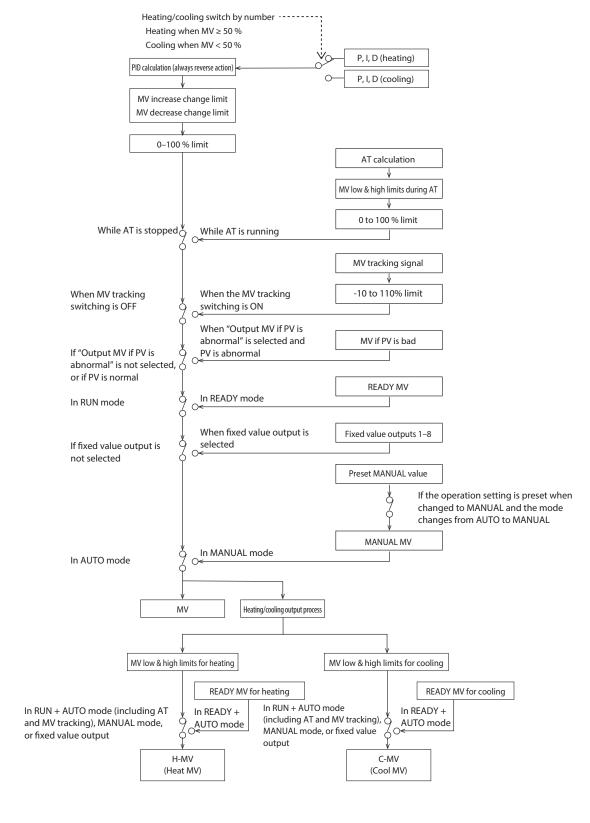
■ Functional block diagram of PID control



■ Functional block diagram of ON/OFF control



■ Functional block diagram of heating/cooling control



■ Control action

Direct or reverse control action can be selected for each control loop.

Item (bank)	Display	Description	Initial value
Control action (CONTROL bank)	MENU > Control Control action	0: PID control reverse (heating) 1: PID control direct (cooling) 2: PID control heating/cooling action 3: (Reserved) 4: ON/OFF control reverse (heating) 5: ON/OFF control direct (cooling)	0



4-11 TP (Time Proportioning) Output (p. 4-79) and 4-12 Analog Output (AO) (p. 4-85) (for the MV, Cool MV, and Heat MV output settings)

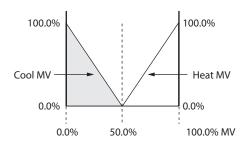
■ Heating/cooling control dead zone

The dead zone for heating and cooling control can be set for each control loop.

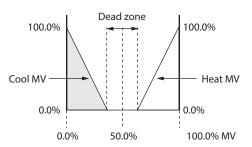
Item (bank)	Display	Description	Initial value
Heating/cooling control	MENU > Control	-100.00 to +100.00 %	0.0000
dead zone (CONTROL bank)	Heat/Cool control dead zone		

The Heat MV and Cool MV are output based on the MV that was output by the PID control calculation.

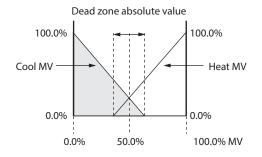
The Heat MV and Cool MV that are output behave as shown in the figures below based on the settings of the heating/cooling control dead zone.







When dead zone > 0.0%



When dead zone < 0.0%

■ Fixed value output

Fixed value output selected by DI (digital input) can be output instead of the MV from PID control. There are eight fixed value output settings for each loop, and they can be selected by the sum of the weights of the digital inputs. However, when the sum of the weights is "0," fixed value output cannot be used. If the sum of the weights exceeds 8, fixed value output 8 is selected.

Fixed value output has a higher priority than the MV of the PID control, Output at PV alarm, or Output at READY, but it is lower than the MV in MANUAL mode.

Fixed value output can be set for each control loop.

Item (bank)	Display	Description	Initial value
Fixed value output 1 (CONTROL bank)	MENU > Control Fixed value output 1	-10.000 to +110.00%	0.0000
Fixed value output 2 (CONTROL bank)	MENU > Control Fixed value output 2		
Fixed value output 3 (CONTROL bank)	MENU > Control Fixed value output 3		
Fixed value output 4 (CONTROL bank)	MENU > Control Fixed value output 4		
Fixed value output 5 (CONTROL bank)	MENU > Control Fixed value output 5		
Fixed value output 6 (CONTROL bank)	MENU > Control Fixed value output 6		
Fixed value output 7 (CONTROL bank)	MENU > Control Fixed value output 7		
Fixed value output 8 (CONTROL bank)	MENU > Control Fixed value output 8		



• \$\mathbb{G}^4 - 8 \text{ DI (Digital Input) (p. 4-60) (for information on selection or weighting by DI for fixed value output)}

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the fixed value output function is not available.

■ Special control output

The output in READY mode and the output when there is a PV alarm can be set for each control loop.

Item (bank)	Display	Description	Initial value
READY MV (CONTROL bank)	MENU > Control READY MV	-10.000 to +110.00%	0.0000
READY MV (Heat) (CONTROL bank)	MENU > Control READY MV (Heat)	-10.000 to +110.00%	0.0000
READY MV (Cool) (CONTROL bank)	MENU > Control READY MV (Cool)	-10.000 to +110.00%	0.0000
MV action if PV is bad (CONTROL bank)	MENU > Control MV action if PV is bad	Continue control operation Output MV if PV is abnormal	0
MV if PV is bad (CONTROL bank)	MENU > Control MV if PV is bad	-10.000 to +110.00%	0.0000

If the PV is abnormal, a high limit alarm or the low limit alarm was generated for the analog input used as the PV.

When switching to MANUAL mode

The control output when the mode is switched from AUTO to MANUAL can be set for each control loop.

Item (bank)	Display	Description	Initial value
Type of change to MANUAL (CONTROL bank)	MENU > Control Type of change to MANUAL	0: Bumpless*1 1: Preset* ²	0
Preset MANUAL value (CONTROL bank)	MENU > Control Preset MANUAL value	-10.000 to +110.00%	0.0000

^{*1.} If 0 (bumpless) is set, the manipulated variable (MV) is retained when switching from AUTO to MANUAL mode.

! Handling Precautions

- When the mode is MANUAL at power ON, the "Preset MANUAL value" is used as the initial MV. At this time, the "Type of change to MANUAL" setting is not affected.
- The above setting is invalid because MANUAL mode is disabled when ON/OFF control is set.
- If the "Control action" is changed from a setting other than the PID control heating/cooling action to the PID control heating/cooling action, the "Preset MANUAL value" is reset to 50.000 %.
- If the "Control action" is changed from the PID control heating/cooling action to a setting other than the PID control heating/cooling action, the "Preset MANUAL value" is reset to 0.0000 %.

^{*2.} If 1 (preset) is set, the manipulated variable (MV) is changed to the "Preset MANUAL value" when the mode is switched from AUTO to MANUAL.

■ PID control initialization

When changing the LSP or switching SP groups, the manipulated variable (MV) may be stuck at the low or high limit, the PV may be resistant to change, or the PV may overshoot. PID control initialization is effective in preventing these problems. It can be set for each control loop.

Item (bank)	Display	Description	Initial value
PID initialization	MENU > Control	0: Automatic*1	0
(CONTROL bank)	PID initialization	1: No initialization*2	
		2: Initialize (if a new SP is input)*3	

*1. If 0 (Automatic) is set

When the LSP 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.

*2. If 1 (No initialization) is set

When the LSP value is changed or SP groups are switched, the PID control is not initialized. This is a useful setting if the continuity of the manipulated variable (MV) is important when the LSP value is changed or SP groups are switched.

*3. If 2 (Initialize) is set

PID control is always initialized when the LSP value is changed or SP groups are switched. This is a useful setting if prompt response (increase or decrease) of the manipulated variable (MV) to the relationship between PV and SP is important when the LSP value is changed or SP groups are switched.

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.1.x. (where x stands for any number), and if pattern operation is used, set this item to "1" (no initialization).

■ PID initial MV

The initial output of PID control is the MV used for PID control immediately after the loop mode is changed from READY to RUN, or after RUN mode is activated when the power is turned on. It can be set for each control loop.

Item (bank)	Display	Description	Initial value
PID initial MV (CONTROL bank)	MENU > Control PID initial MV	-10.000 to +110.00%	0.0000

! Handling Precautions

- If the "Control action" is changed from a setting other than the PID control heating/cooling action to the PID control heating/cooling action, the "PID initial MV" is reset to 50.000 %.
- If the "Control action" is changed from the PID control heating/cooling action to a setting other than the PID control heating/cooling action, the "PID initial MV" is reset to 0.0000 %.

■ MV change limit

The amount of MV change can be limited for each control loop.

Item (bank)	Display	Description	Initial value
MV increase change limit (CONTROL bank)	MENU > Control MV increase change limit	0.0000: No limit 0.0001 to 10000 %/s	0.0000
MV decrease change limit (CONTROL bank)	MENU > Control MV decrease change limit	0.0000: No limit 0.0001 to 10000 %/s	0.0000

• Set the maximum amount of MV change per second using an absolute value (%). However, the MV change per sampling cycle is limited to the set value multiplied by the number of seconds of the sampling cycle.

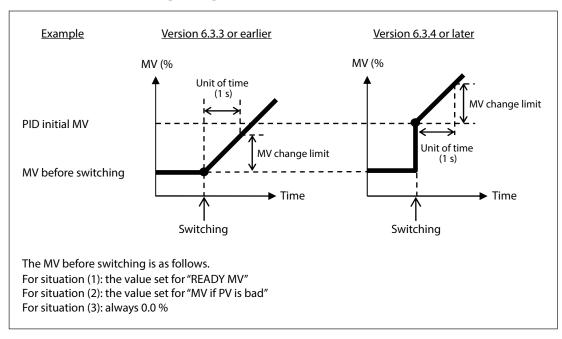
For example, if 5.0 (%/s) is set while the sampling cycle is 0.01 s, the MV change is limited to a maximum of 0.05 %.

If 0 is set, there is no limit for MV change.

• If ON/OFF control is set, the MV change limit is invalid.

Depending on the firmware version of the MAIN block, there is a difference in the base value for the MV change limit function that starts to work in one of the following three situations:

- (1) When "READY MV" output is switched to the MV obtained by PID calculation in RUN mode
- (2) When "MV if PV is bad" output is switched to the MV obtained by PID calculation after the PV error is cleared
- (3) When the MV obtained by PID calculation is output for the first time at the startup of the product



- If there is no MV change limit when the switching described above is made, the MV will change in steps towards the "PID initial MV."
- With MAIN block firmware version 6.3.4 or later, to eliminate sudden changes in the MV before and after the switching described above, set "PID initial MV" to the same value as the MV before switching.

■ PID control

The settings related to PID control can be set for each control loop.

Item (bank)	Display	Description	Initial value
P (Proportional band) (PID bank)	MENU > PID P (Proportional band)	0.1000 to 3200.0 %	5.0000
l (Integral time) (PID bank)	MENU > PID I (Integral time)	0.0000 to 32000 s	120.00
D (Derivative time) (PID bank)	MENU > PID D (Derivative time)	0.0000 to 32000 s	30.000
RE (Manual reset) (PID bank)	MENU > PID RE (Manual reset)	-10.000 to +110.00 %	50.000
OL (MV low limit) (PID bank)	MENU > PID OL (MV low limit)	-10.000 to +110.00 %	0.0000
OH (MV high limit) (PID bank)	MENU > PID OH (MV high limit)	-10.000 to +110.00 %	100.00
Proportional band for cooling (PID bank)	MENU > PID Cool P (Proportional band)	0.1000 to 3200.0 %	5.0000
Integral time for cooling (PID bank)	MENU > PID Cool I (Integral time)	0.0000 to 32000 s	120.00
Derivative time for cooling (PID bank)	MENU > PID Cool D (Derivative time)	0.0000 to 32000 s	30.000
MV low limit for cooling (PID bank)	MENU > PID Cool OL (MV low limit)	-10.000 to +110.00 %	0.0000
MV high limit for cooling (PID bank)	MENU > PID Cool OH (MV high limit)	-10.000 to +110.00 %	100.00

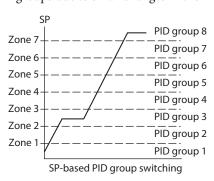
- There are 8 groups of PID settings for each control loop.
- If the MV low limit is greater than the MV high limit, the low limit and the high limit are automatically interchanged.
- When heating/cooling control is set, the settings for the proportional band for cooling, integral time for cooling, derivative time for cooling, MV low limit for cooling, and MV high limit for cooling are enabled.
- Manual reset uses parameters common to the PID control reverse action, PID control direct action, and PID control heating/cooling action. It is enabled when integral time = 0.0000 or when the derivative time for cooling = 0.0000.

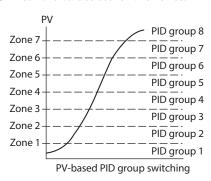
■ Zone PID

Automatic PID group switching based on the SP or PV can be selected.

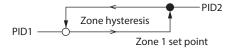
Item (bank)	Display	Description	Initial value
Zone action selection (CONTROL bank)	MENU > Control Zone action selection	0: Not used 1: SP-based selection 2: PV-based selection	0
Zone 1 (CONTROL bank)	MENU > Control Zone 1	-32000 to +32000	32000
Zone 2 (CONTROL bank)	MENU > Control Zone 2	-32000 to +32000	32000
Zone 3 (CONTROL bank)	MENU > Control Zone 3	-32000 to +32000	32000
Zone 4 (CONTROL bank)	MENU > Control Zone 4	-32000 to +32000	32000
Zone 5 (CONTROL bank)	MENU > Control Zone 5	-32000 to +32000	32000
Zone 6 (CONTROL bank)	MENU > Control Zone 6	-32000 to +32000	32000
Zone 7 (CONTROL bank)	MENU > Control Zone 7	-32000 to +32000	32000
Zone hysteresis (CONTROL bank)	MENU > Control Zone hysteresis	0.0000 to +32000	5.0000

• If "1" (SP-based selection) or "2" (PV-based selection) is set for "Zone action selection," the PID group setting in the SP bank or the segment bank becomes invalid, and PID groups are automatically switched as shown in the figures below. In addition, hysteresis can be set in order to prevent frequent switching of PID groups due to small changes in the PV or SP near the values set for the zones.





• At each zone set point, PID groups are switched as follows. This example illustrates how PID1 and PID2 switch.



PID group switches at this valueSwitches after the value passes 1U

! Handling Precautions

- In constant value operation, the priority of PID group switching setting is as follows.
 - DI function PID group selection > Zone PID PID group selection > SP bank PID group number setting
- In pattern operation, the priority of PID group switching setting is as follows. Zone PID PID group selection > Segment bank PID group number setting
- Set the values of zones 1 to 7 starting from the smallest in ascending order. If a value smaller than the value set for the previous zone is set, the settings after that zone will be invalid.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the zone PID function is not available.

■ MV tracking

In RUN-AUTO mode, if "Reverse MV tracking signal" is set to "0" (direct) and the bit specified by "MV tracking changeover" is ON, or if "Reverse MV tracking signal" is set to "1" (reverse) and the bit specified by "MV tracking changeover" is OFF, the MV tracking signal is limited to -10 to +110 % and is output from the PID calculation function block.

Item (bank)	Display	Description	Initial value
MV tracking changeover (CONTROL bank)	MENU > Control MV tracking changeover	1024 to 2047: Standard bits	1024
Reverse MV tracking signal (CONTROL bank)	MENU > Control Reverse MV tracking signal	0: Direct 1: Reverse	0
MV tracking signal (CONTROL bank)	MENU > Control MV tracking signal	2048 to 3071: Standard numerical codes	2048

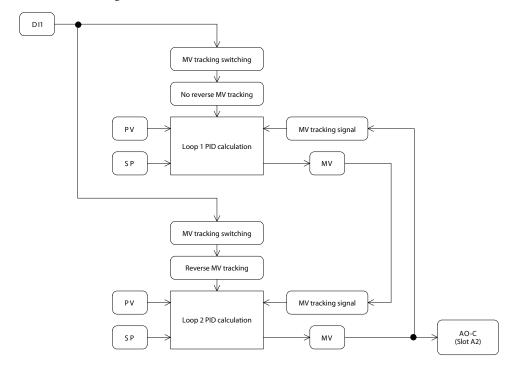
! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the MV tracking function is not available.

• Example: Switching the MV between loop 1 and loop 2 by MV tracking

This section describes the settings for bumpless output when the MV is switched by using MV tracking to output the MV in loop 1 to analog output AO-C (slot A2) when digital input DI1 is OFF and the MV in loop 2 to analog output AO-C (slot A2) when digital input DI1 is ON.

A block diagram follows.



Configure the settings as shown below.

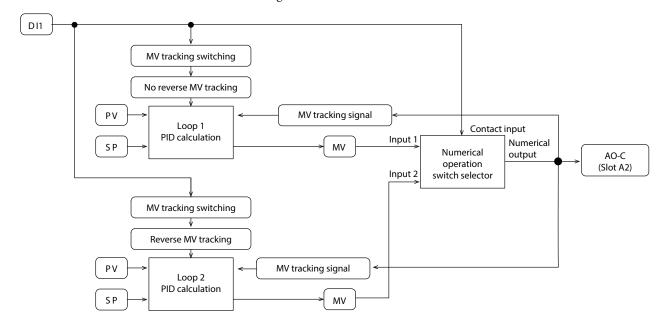
Item (bank)	Description	Notes	
Loop 1 MV tracking switching (Control bank)	1168: DI/DO1 terminal status	The PID calculation in loop 1 tracks the MV in loop 2 when DI1 = ON.	
Loop 1 reverse MV tracking (Control bank)	0 : Direct		
Loop 1 MV tracking signal (Control bank)	2417 : MV of loop 2		
Loop 2 MV tracking switching (Control bank)	1168: DI/DO1 terminal status	The PID calculation in loop 2 tracks the MV in loop 1 when DI1 = OFF.	
Loop 2 reverse MV tracking (Control bank)	1 : Reverse		
Loop 2 MV tracking signal (Control bank)	2416: MV of loop 1		

Item (bank)	Description	Notes	
Slot A2 output range (Analog output bank)	0 : 4–20 mA	0 –100 % of loop 2 MV is scaled to 4–20 mA from	
Slot A2 output type (Analog output bank)	1 : MV	AO-C output of slot A2 and output. When DI1 = OFF, loop 1 MV can be output as loop	
Slot A2 loop specification (Analog output bank)	2 :Loop 2*		
Slot A2 output scaling low limit (Analog output bank)	0.0000	2 MV with the MV tracking setting.	
Slot A2 output scaling high limit (Analog output bank)	100.00		

^{*} Although the device operates with either "1" (loop 1) or "2" (loop 2) set for the slot A2 loop specification, we recommend setting "2" because the setting affects the processing order of the PID calculation in loops 1 and 2.



 Similar MV switching is also possible by combining MV tracking and a numerical operation switch selector.
 A block diagram follows.



Configure the settings as shown below.

Item (bank)	Description	Notes	
Loop 1 MV tracking switching (Control bank)	1168: DI/DO1 terminal status	The PID calculation in loop 1 tracks the numerical output of numerical operation 17 when DI1 = ON.	
Loop 1 reverse MV tracking (Control bank)	0 : Direct		
Loop 1 MV tracking signal (Control bank)	2816: Numerical operation result 17*		
Loop 2 MV tracking switching (Control bank)	1168: DI/DO1 terminal status	The PID calculation in loop 2 tracks the numerical output of	
Loop 2 reverse MV tracking (Control bank)	1 : Reverse	numerical operation 17 when DI1 = OFF.	
Loop 2 MV tracking signal (Control bank)	2816: Numerical operation result 17*		
Operation type of numerical operation 17 (Numerical operation bank)*	3 : Switch selector	Numerical operation 17 outputs loop 1 MV when DI1 = OFF and loop 2 MV when DI1 = ON.	
Numerical operation 17 input 1 assignment	2416: MV of loop 1		
(Numerical operation bank)*			
Numerical operation 17 input 2 assignment (Numerical operation bank)*	2417: MV of loop 2		
Numerical operation 17 input 3 assignment (Numerical operation bank)*	0 (Invalid when the operation type is switch selector.)		
Numerical operation 17 input 4 assignment	0 (Invalid when the operation type is switch selector.)		
(Numerical operation bank)*		_	
Numerical operation 17 contact input assignment (Numerical operation bank)*	1168: DI/DO1 terminal status		
Slot A2 output range (Analog output bank)	0 : 4–20 mA	0–100 % of numerical operation result 17 is scaled to 4–20 mA from AO-C output of slot A2 and output.	
Slot A2 output type (Analog output bank)	2816: Numerical operation result 17*		
Slot A2 loop specification (Analog output bank)	: Loop 1 (Invalid when the output type is numerical operation result.)		
Slot 2 output scaling low limit (Analog output bank)	0.0000		
Slot A2 output scaling high limit (Analog output bank)	100.00		

^{*} Numerical operations can be performed using any of units 1 to 32. However, we recommend using units 17–32 because the setting affects the processing order of the PID calculation in loops 1 and 2 and numerical operation.

■ SP lag

SP lag suppresses the amount of MV change when the SP is changed.

This can be set for each control loop.

Item (bank)	Display	Description	Initial value
SP lag factor (CONTROL bank)	MENU > Control SP lag factor	0.0 to 1000.0	0.0000

SP lag function

- If the factor is set to 0.0, the SP lag factor has no effect.
- If the setting is 0.0001 or more, the larger the factor, the smaller the amount
 of MV change when the SP is changed, and the more strongly overshoot is
 suppressed.
- If ON/OFF control is set, the SP lag setting is invalid.

SP lag formula

 $OUT = OUT_1 + (IN - OUT_1) / (T / Ts + 1)$

IN: Input to the SP lag

OUT: SP lag filter calculation output

OUT_1: SP lag filter calculation output (previous)

T: SP lag factor (time constant (s))

Ts: Sampling cycle (based on the controller setting)

Initialization of SP lag

The SP lag filter calculation output is reset to the SP or PV under the conditions below.

- Reset to the SP when the control loop mode changes from MANUAL to AUTO.
- Reset to the PV when the control loop mode changes from READY to RUN.
- Reset to the PV when PID control is initialized according to the conditions specified for the [PID initialization] setting.

! Handling Precautions

• If the firmware version of the MAIN block is 1.x.x (where x stands for any number), the SP lag does not operate even though it can be set.

■ ON/OFF control

The settings related to ON/OFF control can be configured for each control loop.

Item (bank)	Display	Description	Initial value
Control action (CONTROL bank)	MENU > Control Control action	0: PID control reverse (heating) 1: PID control direct (cooling) 2: PID control heating/cooling action 3: (Reserved) 4: ON/OFF control reverse (heating) 5: ON/OFF control direct (cooling) Note: Select "4" for the heating process. Select "5" for the cooling process.	0
Differential for ON/OFF control (CONTROL bank)	MENU > Control Differential for ON/OFF control	0.0000 to 32000	5.0000

The action of the ON/OFF control is as shown below.



Heating operation (reverse action)

Cooling operation (direct action)

In the diagram,

• means that ON/OFF changes at that value

O means that ON/OFF changes after that value is passed

DI/DO block

DO4-DO7 of the DI/DO block can be used for ON/OFF control output.

The following is an example of the settings used to output loop 1 ON/OFF control from DO4.

Item (bank)	Display	Description	Notes
DI/DO 4 Operation type (DI/DO configuration bank)	Menu > DI/DO Config DI/DO4 Operation type	2: Time proportioning (TP) output	
DO4 Output type (DO configuration bank)	Menu > DO Config DO4 / Output type	0: OFF (any value is OK)	If the operation type is TP output, the setting is invalid.
DO4 TP output type (TP bank)	Menu > TP DO4 / TP output type	1: MV of loop 1	
DO4 TP cycle (TP bank)	Menu > TP DO4 / TP cycle	10.000 (any value is OK)	When the control action is in ON/OFF control, the setting is invalid.
DO4 TP operation type (TP bank)	Menu > TP DO4 / TP operation type	0: Priority on controllability (any value is OK)	
DO4 linearization table group definition (TP bank)	Menu > TP DO4 /Linearization table group	0: No linearization (any value is OK)	
DO4 power voltage correction selection (TP bank)	Menu > TP DO4 / V change compensation	0: Not used (any value is OK)	

- DO1-DO3 of the DI/DO block cannot be used for ON/OFF control output.
- No DO block outputs (DO1–DO4) can be used for ON/OFF control output.
- If the control action is set to ON/OFF control, the PID group number setting in the SP bank and PID group selection by DI are invalid.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the power voltage compensation selection settings shown above are not available.

V-P block

Voltage pulse output from the V-P block can be used for ON/OFF control.

The following is an example of the settings used to output loop 1 ON/OFF control from the voltage pulse output of slot A2.

Item (bank)	Display	Description	Notes
A2 TP output type (TP bank)	Menu > TP A2 / TP output type	1: MV of loop 1	
A2 TP cycle (TP bank)	Menu > TP A2 / TP cycle	10.000 (any value is OK)	When the control action is in ON/OFF
A2 TP operation type (TP bank)	Menu > TP A2 / TP operation type	0: Priority on controllability (any value is OK)	control, the setting is invalid.
A2 linearization table group definition (TP bank)	Menu > TP A2 / Linearization table group	0: No linearization (any value is OK)	
A2 power voltage correction selection (TP bank)	Menu > TP A2 / V change compensation	0: Not used (any value is OK)	

- If the control action is set to ON/OFF control, the PID group number setting in the SP bank and PID group selection by DI are invalid.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the power voltage compensation selection settings shown above are not available.

AO-C block

Current output from the AO-C block can be used for ON/OFF control. When ON, the current for MV = 100.0 % is output. When OFF, the current for MV = 0.0 % is output.

The following is an example of the settings used to output loop 1 ON/OFF control from the current output of slot A2. With these settings, 20 mA is output when ON and 0 mA when OFF.

Item (bank)	Display	Description	Notes
A2 Output range (Analog output bank)	MENU > AnalogOutput A2 / Output range	1: 0–20 mA	The range low limit output is set to 0 mA.
A2 Output type (Analog output bank)	MENU > AnalogOutput A2 / Output type	1: MV	
A2 Loop definition (Analog output bank)	Menu > AnalogOutput A2 / Loop definition	1: Loop 1	
A2 Output scaling low limit (Analog output bank)	Menu > AnalogOutput A2 / Output scaling low limit	0.0000	MV = 0.0 % is set in order to set the range low limit output (0 mA).
A2 Output scaling high limit (Analog output bank)	Menu > AnalogOutput A2 / Output scaling high limit	100.00	MV = 100.0 % is set in order to set the range high limit output (20 mA).
A2 Linearization table group definition (Analog output bank)	Menu > AnalogOutput A2 / Linearization table group	0: No linearization	When the control action is in ON/OFF control, the setting is valid.
A2 Power voltage correction selection (Analog output bank)	Menu > AnalogOutput A2 / V change compensation	0: Not used	

- If the control action is set to ON/OFF control, the PID group number setting in the SP bank and PID group selection by DI are invalid.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the power voltage compensation selection settings shown above are not available.

4-5 AT (Auto-tuning)

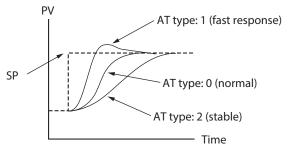
Up to four loops can be controlled individually. Use the AT function to set the PID constants automatically.

■ AT (Auto-tuning)

The settings related to AT can be set for each control loop.

Item (bank)	Display	Description	Initial value
AT type (CONTROL bank)	MENU > Control AT type	0: Normal (regular control characteristics)	0
		1: Fast response(reaction to disturbance)	
		2: Stable(minimal up/down PV fluctuation)	
MV low limit during AT (CONTROL bank)	MENU > Control MV low limit during AT	-10.000 to +110.00 %	0.0000
MV high limit during AT (CONTROL bank)	MENU > Control MV high limit during AT	-10.000 to +110.00 %	100.00
AT adjustment factor, P (CONTROL bank)	MENU > Control AT adjustment factor, P	0.0000 to 320.00	1.0000
AT adjustment factor, I (CONTROL bank)	MENU > Control AT adjustment factor, I	0.0000 to 320.00	1.0000
AT adjustment factor, D (CONTROL bank)	MENU > Control AT adjustment factor, D	0.0000 to 320.00	1.0000

- The MV (manipulated variable) can be limited during AT by means of the "MV low limit during AT" and "MV high limit during AT."
- If the MV low limit during AT is greater than the MV high limit during AT, the low limit and the high limit are automatically interchanged.
- If ON/OFF control is set, AT does not start, and the above setting is invalid.
- With the "AT type" setting, the calculation of the PID constants can be adjusted to suit the control characteristics of the equipment. "1" (fast response) is an adjustment for speed-oriented applications, such as a process where the PV directly reflects heating by a heater. "2" (stable) is an adjustment for stability-oriented applications, such as a process where the PV indirectly reflects heating by a heater. The following graph shows the pattern of differences in the control results that use PID constants calculated with each AT type.



Difference in PV change when SP is changed

• If "AT adjustment factor, P" (or "I," or "D") is set, the PID constant resulting from AT is multiplied by the specified factor and the result of calculation is written to the PID constant setting. Note that a value within the setting range of the PID constant will be written.

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the "AT type," "AT adjustment factor, P," "AT adjustment factor, I," and "AT adjustment factor, D" settings are not available.

■ How to start

- (1) Make sure that the PV (analog input) and the actuators (heater power, etc.) are ready for control.
- (2) Make sure that this device is in RUN mode on the 1-loop monitor screen. If it is in READY mode, change the mode to RUN.
- (3) Make sure that the device is in AUTO mode on the 1-loop monitor screen. If the device is in MANUAL mode, change the mode to AUTO.
- (4) On the 1-loop monitor screen, press the [■] (mode) button, and press the [START] button in "AUTO TUNING."

■ How to stop AT

AT stops automatically after the PID constants have been set.

To stop AT while it is running, press the [STOP] button next to the AT graph on the 1-loop monitor screen. Alternatively, on the 1-loop monitor screen, press the [■] (mode) button, and press the [STOP] button in "AUTO TUNING."

Also, AT can be stopped by switching the mode to READY or MANUAL.

Display while AT is running

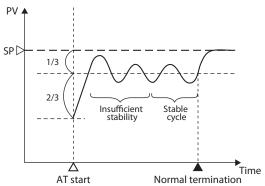
While AT is running, the AUTO TUNING progress graph is displayed on the monitor screen. After AT ends and the PID constant is obtained, the AUTO TUNING progress graph disappears.

Operation while AT is running

AT obtains the PID constants using the limit cycle.

(1) AT uses the limit cycle method to find the PID constants by making a 2:1 dividing point in the deviation between the SP and PV at the start of AT. This point becomes the ON/OFF switching point for the MV (manipulated variable).

(2) When it is determined that the limit cycle has stabilized, the PID constant is changed, and AT ends.



AT abnormal end

If AT does not start after the AT start operation, or if AT stops without changing the PID constants even though there was no AT stop operation, an AT abnormal end is generated and the data of the corresponding loop among the standard bit codes for "AT abnormal end" for loops 1 to 4 changes to 1.

Clearing an AT abnormal end

To clear an AT abnormal end, do one of the following.

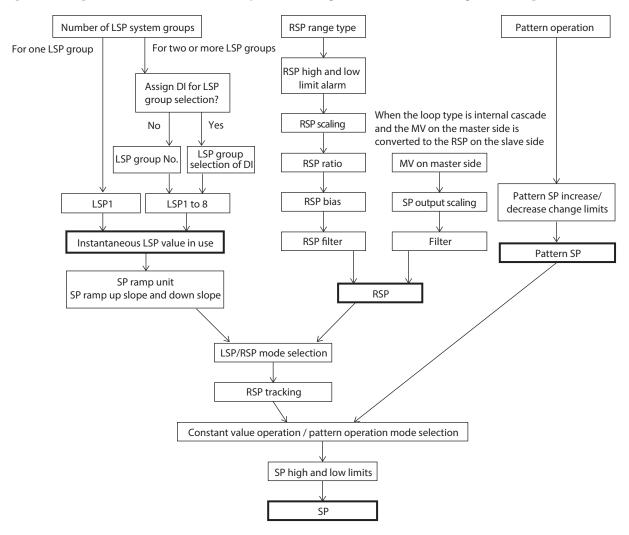
- Make sure that AT is executable and then start it.
- Press the AUTO TUNING [FAIL] button on the mode menu screen, and press the [CLEAR] button on the confirmation screen (see the figures below).
- Power the device off and back on.



- Before starting AT, make the PV (analog input) and the actuators (heater power, etc.) ready for control.
- If the control action is set to ON/OFF, AT cannot be started. Set the control action to PID.
- To start AT, all of the following conditions must be met. In RUN-AUTO mode Fixed value output is not selected. MV tracking signal output is not selected. There is no PV (analog input) error. MFB is not being adjusted.
- While AT is running, if the mode is switched to READY or MANUAL, if fixed
 value output or MV tracking signal output is selected, or if a PV (analog input)
 error, MFB adjustment, or a power failure occurs, AT stops without changing
 the PID constants.
- If heating/cooling control is not used, the MV low/high limit during AT and the PID constant MV low/high output will be assigned to the MV. Set so that the largest possible common area for these two ranges is left.
- While AT is running, the MV turns on and off several times to execute the limit cycle. ("Off" here refers to the fact that the MV is limited by the MV low limit during AT and by the MV low limit, and the factory setting is 0 %. Also, "on" refers to the fact that the MV is limited by the MV high limit during AT and by the MV high limit, and the factory setting is 100 %.) If there is a problem with this operation, do either of the following.
 - Set the MV low limit during AT and the MV high limit during AT to appropriate values, and start AT.
 - Do not use AT but set the PID constants manually.
- When heating/cooling control is used, execute AT with both Heat MV and Cool MV running. In the first half, the MV changes with the output low/high limit during AT. In the second half, it changes in a somewhat narrow range.
- AT progress is displayed in a graph on the monitor screen.
- It may not be possible to obtain appropriate PID constants, depending on the control target. In that case, set the PID constants manually.
- The MV ON/OFF switching point determined at the start of AT does not change even if the SP is changed while AT is running.
- AT can only be started by either the master side or the slave side of the internal cascade control. Master and slave cannot both start AT.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there are no standard bit codes for AT abnormal end (Loops 1 to 4).

4-6 SP

Up to four loops can be controlled individually. The following is a functional block diagram for set points.



🕮 Note

- Local set point (LSP) means a set point stored in the module.
 RSP (remote set point) means a set point given by an external analog input.
 In the internal cascade, the master-side MV is converted to RSP. 4-17
 Internal Cascade (p. 4-110)
- For constant value operation, there are the LSP and RSP modes, and for pattern operation, there is the Pattern SP mode. Operation can be switched to any of these modes.
 - 4-7 Pattern Operation (p. 4-48)

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ Setting the LSP from the 1-loop monitor screen

- (1) Press the [SP] button on the 1-loop monitor screen. > The SP change screen appears.
- (2) Press the Change button on the right side of "LSP_VALUE." > The LSP value setting screen appears.
- (3) Enter a value using the numeric keypad, and press the [ENTER] button to set the LSP that is being used (from among LSP1 to 8) to that value.

! Handling Precautions

- Input values within the SP low–high limit range and the PV range are valid. If the input value is invalid, the LSP does not change.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the input value setting range is fixed to "-32000 to +32000."
- Parameter setting: The setting range of the SP for LSP groups 1 to 8 in the SP bank is fixed to "-32000 to +32000."

■ Selecting LSP group and RSP from the 1-loop monitor screen

- (1) Press the [SP] button on the 1-loop monitor screen. > The SP change screen appears.
- (2) Press the Change button on the right side of "LSP/RSP." > The LSP/RSP selection screen appears.
- (3) Press the [LSP] button of the LSP group to be used.
 - > The mode is switched to LSP, and the selection of the LSP group is complete. Also, press the [RSP] button to switch the mode to RSP.

Number of LSP system groups

The number of LSP groups to be used can be selected for each control loop.

Item (bank)	Display	Description	Initial value
Number of LSP system groups	MENU > SP Config	1 to 8	1
(SP configuration bank)	Number of SP system groups		

■ RSP setting

RSP can be set with the AI bank assigned to RSP.

- Range type
- · Linear scaling low and high limits
- Ratio
- Bias
- Filter

■ LSP1 to 8 and RSP

It is possible to set 8 LSP groups for control loops. The RSP value can be displayed.

Item (bank)	Display	Description	Initial value
LSP1 SP	MENU > SP	-32000 to +32000	0.0000
(SP bank)	LSP1 / SP		
LSP2 SP	MENU > SP		
(SP bank)	LSP2 / SP		
LSP3 SP	MENU > SP		
(SP bank)	LSP3 / SP		
LSP4 SP	MENU > SP		
(SP bank)	LSP4 / SP		
LSP5 SP	MENU > SP		
(SP bank)	LSP5 / SP		
LSP6 SP	MENU > SP		
(SP bank)	LSP6 / SP		
LSP7 SP	MENU > SP		
(SP bank)	LSP7 / SP		
LSP8 SP	MENU > SP		
(SP bank)	LSP8 / SP		
RSP group SP	MENU > SP	Setting is disabled.	-
(SP bank)	RSP SP		

- LSP can be displayed and set only for the set number of LSP system groups.
- RSP can be displayed for models with RSP.

■ PID group number

For each control loop, the value set for the PID group number can be set for each of the 8 LSP groups and for the RSP.

Item (bank)	Display	Description	Initial value
LSP1 PID group number	MENU > SP	1 to 8	1
(SP bank)	LSP1 / PID group		
LSP2 PID group number	MENU > SP		
(SP bank)	LSP2 / PID group		
LSP3 PID group number	MENU > SP		
(SP bank)	LSP3 / PID group		
LSP4 PID group number	MENU > SP		
(SP bank)	LSP4 / PID group		
LSP5 PID group number	MENU > SP		
(SP bank)	LSP5 / PID group		
LSP6 PID group number	MENU > SP		
(SP bank)	LSP6 / PID group		
LSP7 PID group number	MENU > SP		
(SP bank)	LSP7 / PID group		
LSP8 PID group number	MENU > SP		
(SP bank)	LSP8 / PID group		
RSP group PID group number	MENU > SP		
(SP bank)	RSP / PID group		

- The PID group number for the LSP group can be displayed and set only for the number of groups set for "Number of LSP system groups."
- The PID group number for the RSP group can be displayed and set only on models with RSP.

■ LSP group No.

The LSP group number can be set for each control loop.

- (1) Press the [SP] button on the 1-loop monitor screen. > The SP change screen appears.
- (2) Press the Change button on the right side of "LSP/RSP." > The LSP/RSP selection screen appears.
- (3) Press the [LSP] button of the LSP group to be used to select the LSP group.

■ DI assignment for LSP group selection

LSP group selection can be set for DI groups 1 to 32. If LSP group selection is set for multiple DI groups, the LSP group is determined by the sum of the values of the LSP group selected for each DI group.

Item (bank)	Display	Description	Initial value
Operation type (DI bank)	MENU > DI Operation type	0: Disabled 1: LSP group selection (0/+1) 2: LSP group selection (0/2) 3: LSP group selection (0/+4) 4 to 74: Functions other than LSP group selection	0
Input type (DI bank)	MENU > DI Input type	0: Always OFF 1: Always ON 2 to 10: Undefined 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5 16: DI6 17: DI7 18 to 1023: Reserved 1024 to 2047: Standard bits 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	0
Loop definition (DI bank)	MENU > DI Loop definition	When the operation type is other than timer stop/start selection, 0: All loops collectively 1: Loop 1 2: Loop 2 3: Loop 3 4: Loop 4 When the operation type is timer stop/start selection, 0: All timer events 1 to 16: Event number for timer event	0

Details of the LSP group selection by DI assignment
 The values of LSP group selection according to the ON/OFF status of each DI are 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 number is determined by adding 1 to the sum of the values of the LSP group selection by ON/OFF of each DI.

For example, if the sum of the value of LSP group selection is 1, the LSP group number is 2. However, if the number of LSP system groups is exceeded, the LSP group number is the same as the number of LSP system groups.

• If the number of LSP system groups is 1, although the value can be displayed and set, the LSP group selection by DI assignment is invalid.

■ SP ramp unit

The time unit of the SP ramp can be set to every second, every minute, or every hour for each control loop.

Item (bank)	Display	Description	Initial value
SP ramp unit (SP configuration bank)	MENU > SP Config SP ramp unit	0: s 1: min 2: h	0

■ SP ramp up and down slopes

The up and down slopes of SP ramp can be set for each control loop.

Item (bank)	Display	Description	Initial value
LSP ramp up slope (SP configuration bank)	MENU > SP Config LSP ramp up slope	0.0000: No slope 0.0001 to 32000 (Select the time unit of slope in the SP ramp unit.)	0.0000
LSP ramp down slope (SP configuration bank)	MENU > SP Config LSP ramp down slope	0.0000: No slope 0.0001 to 32000 (Select the time unit of slope in the SP ramp unit.)	0.0000

- If the initial value is 0.0000, the SP ramp does not operate. Therefore, by setting the up slope to greater than 0.0000 and setting the down slope to 0.0000, the SP ramp can be set to function only when the SP is increasing, not when the SP is decreasing. This setting can be reversed so that the SP ramp functions when the SP is decreasing but not when the SP is increasing.
- Under the following conditions, if the SP ramp is set to enable both up and down slopes, the ramp starts with the current SP as the starting point.
 - When the LSP value changed
 - When the SP group changed
 - When the mode changes from RSP to LSP
- Under the following conditions, if the SP ramp is set to enable both up and down slopes, the ramp starts with the current PV as the starting point.
 - At power on
 - When the mode switches from READY + AUTO mode to RUN + AUTO mode
 - When the mode switches from RUN + MANUAL mode to RUN + AUTO mode
 - When fixed value output is cleared
 - When the mode switches from pattern operation mode to constant value operation mode
- The SP ramp does not operate under the following conditions.
 - In MANUAL mode
 - In READY mode
 - In RSP mode
- When the loop type is internal cascade and under the following conditions, if the SP ramp is set to enable both up and down slopes on the master side, then the ramp starts with the current master-side PV as the starting point.
 - When the slave switches from READY + AUTO mode to RUN + AUTO mode
 - When the slave switches from RUN + MANUAL mode to RUN + AUTO mode

■ SP low and high limits

The SP low and high limits can be set for each control loop in order to specify the SP range.

Item (bank)	Display	Description	Initial value
SP low limit (SP configuration bank)	MENU > SP Config SP low limit	-32000 to +32000	-32000
SP high limit (SP configuration bank)	MENU > SP Config SP high limit	-32000 to +32000	32000

- The SP limit applies to the LSP and RSP of constant value operation and the SP for pattern operation. It also applies to the SP ramp.
- If the SP low limit is greater than the SP high limit, the low limit and the high limit are automatically interchanged.

! Handling Precautions

- The SP is limited within the range of overlap between the SP low and high limits and the PV range 0 to 100 %. If the ranges do not overlap, the value is limited to the PV range.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the SP limit does not apply to a change of the LSP setting.
- If the advanced loop type setting is enabled, the low and high limits on the assignment range in the input assignment bank are used instead of the PV range.

■ RSP tracking

RSP tracking can be set up for each control loop. When the mode is switched from RSP to LSP, the value of the RSP is written to the LSP. If there are multiple SP system groups, the value is written to the LSP that is selected when the mode is switched.

However, RSP tracking is not done under the following conditions.

- In READY mode
- In MANUAL mode
- In pattern operation
- · While fixed value output is being output

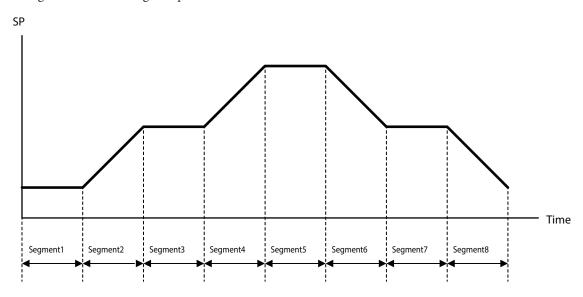
Item (bank)	Display	Description	Initial value
RSP tracking	MENU > SP Config	0: Tracking OFF	0
(SP configuration bank)	RSP tracking	1: Tracking ON	

4-7 Pattern Operation

Pattern operations in which the SP changes over time, as shown in the figure, are available.

A pattern consists of multiple segments, and each segment is determined by the specified SP and time. For each segment, a PID group number, G.SOAK (Guarantee Soak), and a segment event can also be set.

The same pattern can be shared among all loops (up to four loops). The pattern numbers selected for each loop can be the same or different. Although each loop can be operated independently, it is also possible to synchronize their operation using DI functions or logical operations.



Pattern operation has the following settings.

Range	Bank name	Item name
Common to all patterns and loops	None	Number of patterns
	(Set with SLP-C7)	
Common to all patterns and loops	Basic action	Time unit for patterns
Each loop	PatternConfig	Pattern start number, pattern start number low limit,
		pattern start number high limit, pattern SP increase
		change limit, pattern SP decrease change limit
Each pattern	Pattern	Number of segments, G.SOAK time, PV start, Cycle,
		Pattern link, End of operation
Each segment	Segment	SP, Time, PID Group, G.SOAK type, G.SOAK width,
_	_	Segment event

- 🗗 1 6 Operation Modes (p. 1-22)
- \$\infty 4-8 DI (Digital Input) (p. 4-60)
- Pattern start number (p. 4-57)
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.
- States such as the RUN-HOLD mode, RUN-END mode, cycle, and pattern link are not maintained if a power failure occurs. When the power is restored, the device starts operation in the RUN mode from segment 1 of the pattern start number. If PV start is set to enabled, PV start is executed at this point. The READY mode is maintained even when a power failure occurs.
- For a slave loop in internal cascade control, only constant value operation can be set. It is not possible to switch into pattern operation.

• If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), only constant value operation can be set for both master and slave loops in internal cascade control. It is not possible to switch into pattern operation.

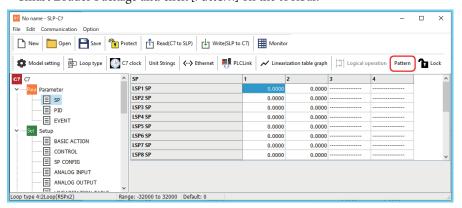
■ Pattern

Whether to allow or prohibit pattern operation can be set for all patterns and loops.

Item	Description	Initial value
Pattern	0: No pattern 1: 16 patterns × 32 segments	0

Note

• To open the screen for setting "Pattern," open the setup screen of the SLP-C7 Smart Loader Package and click [Pattern] on the toolbar.



! Handling Precautions

- "Pattern" can be set using the SLP-C7 Smart Loader Package. It cannot be set by the parameter setting in the display unit of this device.
- If the MAIN block firmware is version 6.0.x to 6.1.x (where x stands for any number), the "1" setting for "Pattern" indicates 16 patterns × 16 segments.

■ Time unit for patterns

The unit for the segment time can be set for all patterns and loops.

ltem	Display	Description	Initial value
Time unit for patterns (Basic action bank)	MENU > BasicAction Time unit of patterns	0: 0.01 s 1: 0.1 s 2: s 3: min	2

■ Number of segments

For each pattern, the number of operating segments can be set.

Item	Display	Description	Initial value
Number of segments (Pattern bank)	MENU > Pattern Number of segments	1 to 32	32

! Handling Precautions

• If the MAIN block firmware is version 6.0.x to 6.1.x (where x stands for any number), the high limit and the initial value for "Number of segments" is 16.

■ SP/Time

The SP and time can be set for each segment.

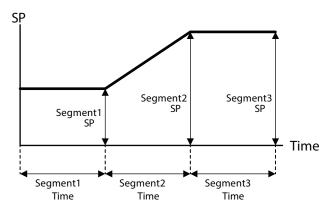
The SP is the SP at the end point of the segment.

Time is the duration from the start point to the end point of the segment.

Item	Display	Description	Initial value
SP (Segment bank)	MENU > Segment SP	-32000 to +32000	0
Time (Segment bank)	MENU > Segment Time	0 to 30000	0

The following figure shows an example of the SP and time settings and the change of the SP.

A change in the SP results in a straight line connecting the SP set for the previous segment and the SP for the relevant segment.



The unit for time settings is determined by the time unit for patterns.
 Therefore, even when the set time value is the same, the duration of segments may differ, depending on the setting of the time unit for the patterns.
 Example: Time setting = 700

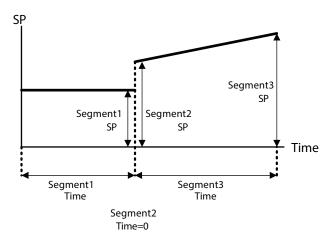
When the setting of the time unit for the pattern = 0 (0.01 s), the duration of the segment = 7.00 s

If the time unit setting for the pattern = 1 (0.1 s), the duration of the segment = 70.0 s = 1 min 10 s

If the time unit setting for the pattern = 2 (s), the duration of the segment = 700 s = 11 min 40 s

If the setting of the time unit for the pattern = 3 (min), the duratino of the segment = 700 min = 11 h 40 min

- The larger of the sampling cycle and the time unit of the pattern is used as the resolution of the pattern's operating time.
- It takes an amount of time equivalent to one sampling cycle to move from the segment end point to the start point of the next segment.
- The SP of Segment 1 is the same at the start time and end time.
- If the time for a segment is set to 0, the segments before and after it become connected, as shown in the figure below, and the SP changes to a step shape.



■ PID group number

PID group number can be set for each segment.

For Segment 1, groups 1 to 8 can be set.

For the group setting of Segment 2 and later segments, "0" to "8" can be set. If 0 is set, the PID group for the segment is the same as that of the previous segment.

Item	Display	Description	Initial value
PID group (Segment bank)	MENU > Segment PID Group	For Segment 1 Groups 1 to 8	1
		Segment 2 or later 0: Same group as previous segment Groups 1 to 8	0

• For loops in pattern operation, PID group selection by DI will be ignored.

■ G.SOAK (Guarantee Soak)

G.SOAK is a function that stops the progression of pattern operation until the PV approaches the SP.

The G.SOAK type and G.SOAK width can be set for each segment.

Item	Display	Description	Initial value
G.SOAK type (Segment bank)	MENU > Segment G.SOAK type	0: No G.SOAK 1: G.SOAK at the segment end point 2: G.SOAK at the segment start point	0
G.SOAK width (Segment bank)	MENU > Segment G.SOAK width	0.0001 to 32000.0	1.0000

The G.SOAK time can be set for each pattern.

Item	Display	Description	Initial value
G.SOAK time	MENU > Pattern	0.0000 to 300.00 s	2.0000
(Pattern bank)	G.SOAK time		

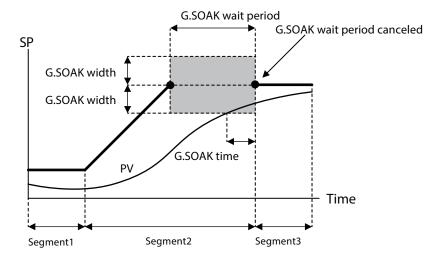
G.SOAK at the segment end point

The G.SOAK wait period starts at the end of the segment, and pattern operation progression stops.

In the G.SOAK wait state, the SEG (segment) number display on the monitor screen blinks.

If the deviation (the absolute value) between the PV and SP is the same as or smaller than the G.SOAK width for a period equaling or exceeding the G.SOAK time, the G.SOAK wait period is canceled, operation progresses to the start of the next segment, and pattern operation resumes.

The figure below shows an example of G.SOAK at the end of Segment 2.



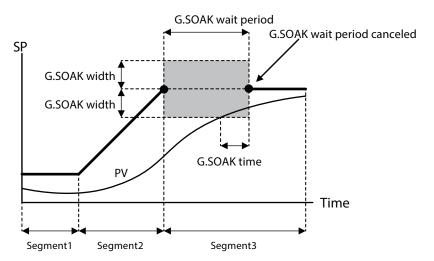
G.SOAK at the start of a segment

The G.SOAK wait period starts at the beginning of the segment and the pattern stops progressing.

While G.SOAK is waiting, the SEG (segment) number display on the monitor screen blinks.

If the deviation (the absolute value) between the PV and SP is the same as or smaller than the G.SOAK width for a period equaling or exceeding the G.SOAK time, the G.SOAK wait period is canceled, and pattern operation resumes.

The figure below shows an example of G.SOAK at the start of Segment 3.



! Handling Precautions

 The minimum resolution of the G.SOAK time for operation is the control cycle. In addition, when the G.SOAK time is 0.0000, if the deviation (the absolute value) between the PV and SP becomes equal to or smaller than the G.SOAK width for only one control cycle, the G.SOAK wait period is canceled.

■ Segment event

Aside from events that can be used in both the constant value operation and the pattern operation, 32 segment events are available for pattern operation.

Only one segment event can be set to be ON for each segment. Segment events that are not set are OFF by default.

ltem	Display	Description	Initial value
Segment event	MENU > Segment	0: No segment event	0
(Segment bank)	Segment event	1 to 32: Segment event 1 to 32	

- Segment events can be shared by multiple loops. Since one event can be set ON for each loop, ON can occur simultaneously in up to four loops. It is also possible for the same segment event to be ON in multiple loops.
- If the MAIN block firmware is version 6.0.x to 6.1.x (where x stands for any number), there are 16 segment events.

■ PV start

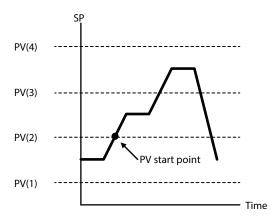
The PV start function starts pattern operation from the SP of Segment 2, if it matches the PV.

Whether to enable PV start can be set for each pattern.

If there is a point that matches the PV, operation starts from that point. If there is no point that matches the PV, operation starts at the start point of Segment 1.

ltem	Display	Description	Initial value
PV start	MENU > Pattern	0: Disable PV start	0
(Pattern bank)	PV start	1: Enable PV start	

The following figure shows whether PV start is possible or not for four PVs.



For PV(2), PV start begins from the point where the PV and SP of Segment 2 match.

For PV(1) and PV(4), PV start is not executed because there is no SP that matches the PV.

For PV(3), PV start is not executed because the match of the SP with the PV does not occur in Segment 2.

! Handling Precautions

- When operation is brought back to the start of a pattern by the cycle function,
 PV start is not executed.
- When PV start is enabled in the next pattern linked by the pattern link function, PV start is executed.

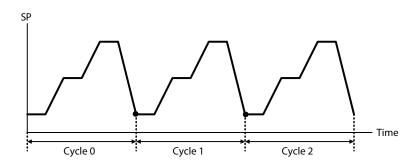
■ Cycle

Cycle is a function that repeats the operation of an entire pattern.

The number of times the cycle repeats can be set for each pattern.

The number of times set + 1 is the total pattern operation count.

ltem	Display	Description	Initial value
Cycle (Pattern bank)	MENU > Pattern Cvcle	0 to 32000	0



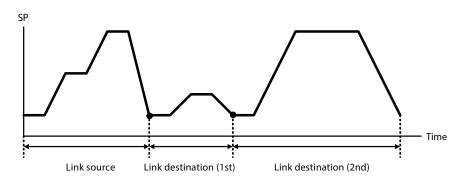
■ Pattern link

Pattern link is a function that links multiple patterns.

The pattern number of the link destination pattern can be set for each pattern.

The pattern number of another pattern to be linked can be set for the link destination pattern.

ltem	Display	Description	Initial value
Pattern link	MENU > Pattern	0: No link	0
(Pattern bank)	Pattern link	1 to 16	



- If cycle operation is set for the source of a link, the pattern link operates after the cycle operation is completed.
- If the pattern number of the link source is set for the pattern link, the pattern will be repeated endlessly.

■ End of operation

The state after the end of pattern operation can be set for each pattern.

If "0: READY" is set, operation will end in READY mode.

If "1: END" is set, operation will end in RUN-END mode.

If "2: Constant value operation" is set, operation will transition to constant value operation in RUN mode.

Item	Display	Description	Initial value
End of operation	MENU > Pattern	0: READY	0
(Pattern bank)	End of operation	1: END	
		2: Constant value operation	

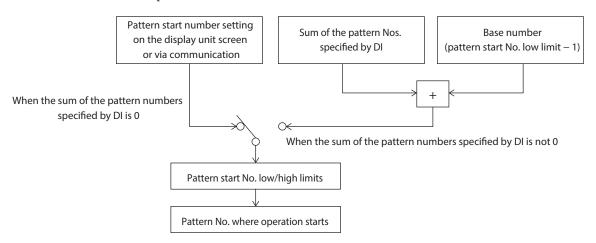
- If one time (1 repetition) or more is set in the cycle count, the device enters the end of operation state after the cycle(s) are completed.
- If a link destination is set in pattern link, instead of entering the end of operation state, the device will execute the pattern operation of the link destination
- 🎜 1-6 Operation Modes (p. 1-22) (diagram of mode transitions)
- If the device enters the RUN-END mode at the end of operation, the mode will not be retained if a power failure occurs. When the power is restored, the device starts operation in the RUN mode from segment 1 of the pattern start number.
- If the device enters the READY mode or the constant value operation mode at the end of operation, the mode will be retained even if a power failure occurs.

■ Pattern start number

The pattern start number can be set for each loop.

There are two ways to select the pattern number when the mode switches from READY to RUN, i.e., when pattern operation starts.

- The pattern start number can be set on the display unit screen or via communication.
- Add the base number to the pattern number specified by the DI and set it as the pattern start number.



The pattern start number, pattern start number low limit, and pattern start number high limit can be set for each loop.

Item	Display	Description	Initial value
Pattern start number (Pattern configuration bank)	MENU > PatternConfig PTN start number	1 to 16	1
Pattern start number low limit (Pattern configuration bank)	MENU > PatternConfig PTN start number low limit	1 to 16	1
Pattern start number high limit (Pattern configuration bank)	MENU > PatternConfig PTN start number high limit	1 to 16	16

The base number for the pattern selection by DI is the value obtained by subtracting 1 from the pattern start number low limit.

The value obtained by adding the base number to the sum of the pattern numbers specified by DI is the pattern number at which operation is started.

• Example: Selecting patterns 1 to 3 for Loop 1 and patterns 11 and 12 for Loop 2 using DI1 and DI2

Set as in the following table.

Setting	Setting details	(Operation performed by the setting)
DI1	"Pattern selection (0/+1)" is set for DI1, specifying "All loops."	The sum of the pattern numbers specified by the DI changes within the
DI2	"Pattern selection (0/+2)" is set for DI2, specifying "All loops."	range from 0 to 3.
Pattern start number low limit for Loop 1	1	The pattern number range is from 1 to 3.
Pattern start number high limit for Loop 1	3	The base number is $1 - 1 = 0$.
Pattern start number low limit for Loop 2	11	The pattern number range is from 11
Pattern start number high limit for Loop 2	12	to 12. The base number is $11 - 1 = 10$.

Operation takes place as described in the following table.

DI status	DI processing	Pattern number selection
DI1: OFF DI2: OFF	The sum of the pattern numbers specified by DI: 0	For Loop 1, pattern numbers 1 to 3 can be selected on the display unit screen or via communication.
		For Loop 2, pattern numbers 11 to 12 can be selected on the display unit screen or via communication.
DI1: ON	The sum of the pattern numbers specified by DI: 1	For Loop 1, pattern number 1 is selected by DI.
DI2: OFF	The value obtained by adding the base number 0: 1	For Loop 2, pattern number 11 is selected by DI.
	The value obtained by adding the base number 10: 11	
DI1: OFF	The sum of the pattern numbers specified by DI: 2	For Loop 1, pattern number 2 is selected by DI.
DI2: ON	The value obtained by adding the base number 0: 2	For Loop 2, pattern number 12 is selected by DI.
	The value obtained by adding the base number 10: 12	
DI1: ON	The sum of the pattern numbers specified by DI: 3	For Loop 1, pattern number 3 is selected by DI.
DI2: ON	The value obtained by adding the base number 0: 3	For Loop 2, pattern number 12 is selected by DI.
	The value obtained by adding the base number 10: 13	(Limited by pattern start number high limit 12)

■ Pattern SP increase/decrease change limit

The limit for change per unit of time specified by "Time unit for patterns" can be set for the pattern SP for each loop.

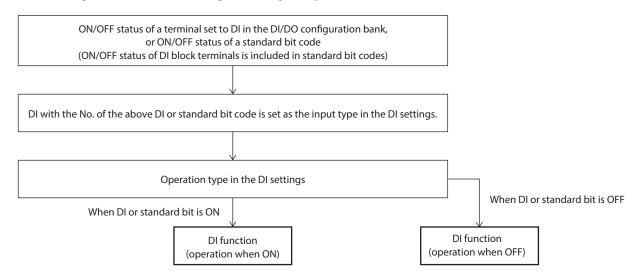
This function prevents sudden changes in the SP caused by an incorrect change of the settings or erroneous operation. Putting a limit on SP change protects what is processed by the equipment and the equipment itself. When the pattern SP change limit is active, the pattern numbers and segment numbers on the monitor screen are displayed in yellow.

Item	Display	Description	Initial value
Pattern SP increase change limit	MENU > PatternConfig	0.0000: No limit	0.0000
(Pattern configuration bank)	PTN SP increase change limit	0.0001 to 32000 /s	
Pattern SP decrease change limit	MENU > PatternConfig	0.0000: No limit	0.0000
(Pattern configuration bank)	PTN SP decrease change limit	0.0001 to 32000 /s	

- ADVANCE cannot be executed when the pattern SP increase change limit is something other than 0.0000 or the pattern SP decrease change limit is something other than 0.0000.
- SP change continues even in the RUN-HOLD or RUN-END mode or during a G.SOAK wait period if the pattern SP change limit is active.
- If the mode transition is READY → RUN, RUN → READY, RUN-HOLD → READY, or RUN-END → READY, the pattern SP change limit is invalid.
- G.SOAK operates at the SP before the pattern SP change limit is activated.

4-8 DI (Digital Input)

The following is a functional block diagram for digital input.



! Handling Precautions

- There are 7 DI/DOs (digital inputs and outputs). To use as DI, set to DI in the DI/DO configuration bank.
- If Block A3 or B3 is a DI block, it is not necessary to set the configuration bank, and there are four DIs in each block.

■ DI/DO configuration

To use as DI, set the operation of the desired DI/DO number to DI.

Item (bank)	Display	Description	Initial value
Operation type of DI/DO 1 to 7	MENU > DI/DO Config	0: DI ← Select this	0
(DI/DO configuration bank)	DI/DO1 Operation type MENU > DI/DO Config DI/DO2 Operation type MENU > DI/DO Config DI/DO3 Operation type MENU > DI/DO Config DI/DO4 Operation type MENU > DI/DO Config DI/DO5 Operation type MENU > DI/DO Config DI/DO5 Operation type MENU > DI/DO Config DI/DO6 Operation type MENU > DI/DO Config	2: TP (time proportioning) output	
	DI/DO7 Operation type		

■ DI assignment

Items related to DI groups 1 to 32 can be set using DI assignment in the DI settings.

Item (bank)	Display	Description	Initial value
Operation type of DI groups	MENU > DI	0: No function	0
1 to 32	Operation type	1: LSP group selection (0/+1)	
(DI bank)	7	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: Reserved	
		8: PV Hold	
		9 to 10: Reserved	
		11: Fixed value output selection (0/+1)	
		12: Fixed value output selection (0/+2)	
		13: Fixed value output selection (0/+4)	
		14: Reserved	
		15: Output linearization table group	
		selection (0/+1)	
		16: Output linearization table group	
		selection (0/+2)	
		17: Output linearization table group	
		selection (0/+4)	
		18 to 20: Reserved	
		21: RUN/READY mode selection	
		22: AUTO/MANUAL mode selection	
		23: LSP/RSP mode selection	
		24: AT stop/start selection	
		25 to 40: Reserved	
		41: Control operation direct/reverse selection	
		42 to 45: Reserved	
		46: Timer stop/start selection 47: Release all latches	
		48 to 50: Reserved	
		51: RUN/READY mode selection (edge)	
		52: AUTO/MANUAL mode selection (edge)	
		53: LSP/RSP mode selection (edge)	
		54: RUN selection (edge)	
		55: READY selection (edge)	
		56: AUTO selection (edge)	
		57: MANUAL selection (edge)	
		58 to 59: Reserved	
		60: Constant value operation / Pattern	
		operation mode selection	
		61: ADVANCE (edge)	
		62: HOLD	
		63: G.SOAK clear	
		64 and 65: Reserved	
		66: Constant value operation / Pattern operation	
		mode selection (edge)	
		67: HOLD (edge)	
		68 and 69: Reserved	
		70: Pattern selection (0/+1)	
		71: Pattern selection (0/+2)	
		72: Pattern selection (0/+4)	
		73: Pattern selection (0/+8)	
		74: Pattern selection (0/+16)	

Item (bank)	Display	Description	Initial value
Input type of DI groups 1 to 32 (DI bank)	MENU > DI Input type	0: Always OFF 1: Always ON 2 to 10: Reserved 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5 16: DI6 17: DI7 18 to 1023: Reserved 1024 to 2047: Standard bits 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	0
Loop definition of DI groups 1 to 32 (DI bank)	MENU > DI Loop definition	When the operation type is timer stop/start selection, 0: All timer events 1 to 16: Event number for timer event When the operation type is Linearization table group selection, 1: Block A2 2: Block B2 3: Block A1 4: Block B1 (effective only when the block type is AO-C or V-P) When the operation type is Release all latches, 0 to 16: Setting invalid (any set value will be ignored) For other operation types: 0: All loops collectively 1: Loop 1 2: Loop 2 3: Loop 3	0

- 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 DIs that are set to ON. However, if the number of LSP system groups is exceeded, the LSP group number that can be selected is the same as the number of LSP groups.
- 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 DIs that are set to ON. However, if the number exceeds 8, then PID group 8 is selected.
- For operation types 4 to 6 (PID group selection), the setting is valid for loops in constant value operation but is invalid in pattern operation.
- For the "Fixed value output selection" operation type, the fixed value output number is the sum of the weights (+1, +2, +4) of the DIs that are set to ON. However, when the number is "0," the fixed value output is not executed. If the number exceeds 8, the fixed value output 8 is selected.
- For the "Output linearization table group selection" operation type, the group number is the value obtained by adding the sum of the weights (+1, +2, +4) of the DIs that are set to ON to the setting value of the linearization table group definition. However, if the number exceeds 8, then Group 8 is selected. The target blocks are the AO-C block and V-P block.
- For the operation type "41: Control operation direct/reverse selection," direct/ reverse is not selected if the control operation of the control bank is set to "PID control heating/cooling action."
- For the DI to be set as the input type, set it to DI in the DI/DO configuration bank.

4-10 DO (Digital Output) (p. 4-76)

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the number of DI groups is 1 to 8, and operation is not performed when operation type setting is 11–13, 15–17, 51–53, 61–63, 66–67, or 70–74.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), functions assigned by selecting 47, 54, or 55 for "Operation type" will not work.
- If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), functions assigned by selecting 56 or 57 for "Operation type" will not work.

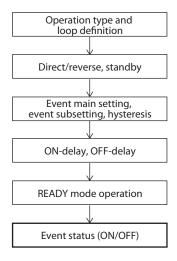
The table below shows the operations for each operation type.

	T	T	T
Set value	Operation type	Operation at OFF	Operation at ON
0	No function	Not available	Not available
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 group number: +0	PID group number: +1
5	PID group selection (0/+2)	PID group number: +0	PID group number: +2
6	PID group selection (0/+4)	PID group number: +0	PID group number: +4
7	Reserved	Not available	Not available
8	PV Hold	Without hold	With hold
9 and 10	Reserved	Not available	Not available
11	Fixed value output selection (0/+1)	Fixed value output group number: +0	Fixed value output group number: +1
12	Fixed value output selection (0/+2)	Fixed value output group number: +0	Fixed value output group number: +2
13	Fixed value output selection (0/+4)	Fixed value output group number: +0	Fixed value output group number: +4
14	Reserved	Not available	Not available
15	Output linearization table group number selection: (0/+1)	Output linearization table group number: +0	Output linearization table group number: +1
16	Output linearization table group number selection: (0/+2)	Output linearization table group number: +0	Output linearization table group number: +2
17	Output linearization table group number selection: (0/+4)	Output linearization table group number: +0	Output linearization table group number: +4
18 to 20	Reserved	Not available	Not available
21	RUN/READY mode selection	RUN	READY
22	AUTO/MANUAL mode selection	AUTO	MANUAL
23	LSP/RSP mode selection	LSP	RSP
24	AT stop/start selection	AT stop	AT start
			(The rising edge from OFF to ON is valid.)
25 to 40	Reserved	Not available	Not available
41	Control operation direct/reverse selection	Direct/reverse operation set by the control operation of the control bank	Reverse operation of the direct/ reverse operation set by the control operation of the control bank
42 to 45	Reserved	Not available	Not available
46	Timer stop/start selection	Timer stop	Timer start
47	Release all latches	Continue if latch exists	Latch release
48 to 50	Reserved	Not available	Not available
51	RUN/READY mode selection (edge)	RUN (the falling edge from ON to OFF is valid)	READY (the rising edge from OFF to ON is valid)
52	AUTO/MANUAL mode selection (edge)	AUTO (the falling edge from ON to OFF is valid)	MANUAL (the rising edge from OFF to ON is valid)
53	LSP/RSP mode selection (edge)	LSP (the falling edge from ON to OFF is valid)	RSP (the rising edge from OFF to ON is valid)
54	RUN selection (edge)	None	RUN (the rising edge from OFF to ON is valid)
55	READY selection (edge)	None	READY (the rising edge from OFF to ON is valid)

Set value	Operation type	Operation at OFF	Operation at ON
56	AUTO selection (edge)	None	AUTO (the rising edge from OFF to ON is valid)
57	MANUAL selection (edge)	None	MANUAL (the rising edge from OFF to ON is valid)
58 to 59	Reserved	Not available	Not available
60	Constant value operation / pattern operation mode selection	Constant value operation	Pattern operation
61	ADVANCE (edge)	None	ADVANCE (the rising edge from OFF to ON is valid)
62	HOLD	HOLD clear	HOLD
63	G.SOAK clear	None	G.SOAK clear
64 and 65	Reserved	Not available	Not available
66	Constant value operation / pattern operation mode selection (edge)	Constant value operation (the falling edge from ON to OFF is valid)	Pattern operation (the rising edge from OFF to ON is valid)
67	HOLD (edge)	HOLD clear (the falling edge from ON to OFF is valid)	HOLD (the rising edge from OFF to ON is valid)
68 and 69	Reserved	Not available	Not available
70	Pattern selection (0/+1)	Pattern number: +0	Pattern number: +1
71	Pattern selection (0/+2)	Pattern number: +0	Pattern number: +2
72	Pattern selection (0/+4)	Pattern number: +0	Pattern number: +4
73	Pattern selection (0/+8)	Pattern number: +0	Pattern number: +8
74	Pattern selection (0/+16)	Pattern number: +0	Pattern number: +16

4-9 Events

The following is a functional block diagram for events.



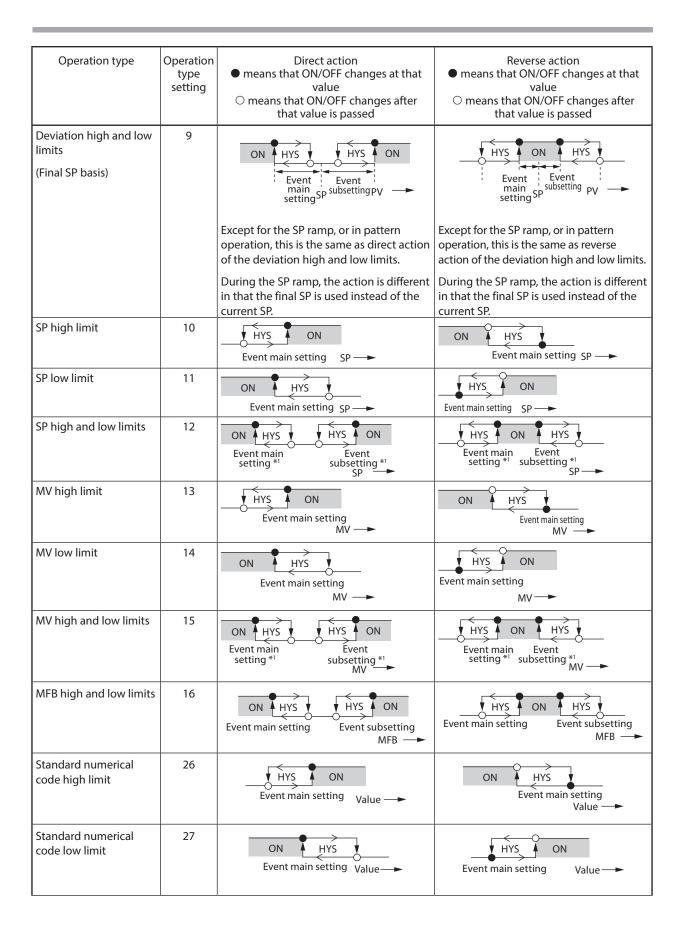
- There are 16 events numbered 1 to 16. To output an event status using DO, it is necessary to assign the event to the output type in the DO configuration bank.
- The number of events is 8 if the version of the MAIN block firmware is 3.x.x or earlier (where x stands for any number).
- Events 1 to 16 and segment events 1 to 16 for pattern operation are different functions. Events 1 to 16 can be used with both the constant value operation mode and pattern operation mode. 4-7 Pattern Operation (p. 4-48) (for information on segment events)

■ Operation

The operation of events is shown below. It differs depending on the operation type, direct/reverse setting, event main setting, event subsetting, hysteresis settings, etc.

Event operation list

	1		
Operation type	Operation type setting	Direct action ■ means that ON/OFF changes at that value ○ means that ON/OFF changes after that value is passed	Reverse action means that ON/OFF changes at that value means that ON/OFF changes after that value is passed
No event	0	Always OFF	Always OFF
PV high limit	1	HYS ON Event main setting PV	ON HYS Event main setting PV
PV low limit	2	ON HYS Event main setting PV —	HYS ON Event main setting PV
PV high and low limits	3	ON HYS HYS ON Event main setting *1 Event subsetting *1 PV	HYS ON HYS Event main setting *1 Event subsetting *1 py
Deviation high limit	4	HYS ON SP + Event main setting PV	ON HYS SP + Event main setting PV
Deviation low limit	5	ON HYS SP + Event main setting PV	SP + Event main setting PV
Deviation high and low limits	6	ON HYS HYS ON Event Event subsetting PV	Event main Event setting subsetting PV
Deviation high limit (Final SP basis)	7	SP + Event main setting PV Except for the SP ramp, or in pattern operation, this is the same as direct action of the deviation high limit. During the SP ramp, the action is different in that the final SP is used instead of the current SP.	SP + Event main setting PV Except for the SP ramp, or in pattern operation, this is the same as reverse action of the deviation high limit. During the SP ramp, the action is different in that the final SP is used instead of the current SP.
Deviation low limit (Final SP basis)	8	ON HYS SP + Event main setting PV	SP + Event main setting PV
		Except for the SP ramp, or in pattern operation, this is the same as direct action of the deviation low limit. During the SP ramp, the action is different	Except for the SP ramp, or in pattern operation, this is the same as reverse action of the deviation low limit.
		in that the final SP is used instead of the current SP.	During the SP ramp, the action is different in that the final SP is used instead of the current SP.



Operation type	Operation type setting	Direct action ■ means that ON/OFF changes at that value ○ means that ON/OFF changes after that value is passed	Reverse action means that ON/OFF changes at that value means that ON/OFF changes after that value is passed
Standard numerical code high and low limits	28	ON HYS HYS ON Event main setting Event subsetting Value	Event main setting Event subsetting Value
PV change rate	29	Operates according to the magnitude of the PV change. Value change = current value – previous value ON Event main setting ON ON ON ON ON ON ON ON ON O	Operates according to the magnitude of the PV change. Value change = current value – previous value ON Event main setting Event subsetting PV change or
		Event subsetting Event main setting PV change Always ON if event main setting = event subsetting.	Event subsetting Event main setting PV change Always OFF if event main setting = event subsetting

^{*1.} If the main setting is greater than the subsetting, the main setting and subsetting are automatically interchanged.

Operation type	Operation type setting	Direct action	Reverse action
PV change rate high limit	55	Sets the change rate high or low limit for the event main setting. Measures the PV for each sampling cycle (in seconds) set in the event subsetting, and compares the change in the PV with the change rate high limit or low limit to determine whether to turn the event on or off.	
PV change rate low limit	56	Event is turned ON and OFF on a sampling cycle basis. Change in the PV between sampling cycles is ignored. The event hysteresis and event direct/reverse settings are disabled. The event ON delay and event OFF delay can be combined. When event setting value > 0 (normally, high limit event is used)	
		PV change rate high limit event operation PV change rate low limit event operation PV change rate low limit event operation Sampling (1) (2) When event setting value < 0 (normally, low limit event is	Event main setting Event main setting Time ON (increase alarm) OFF ON (3) (4)
		PV change rate high limit event operation PV change rate low limit event operation sampling (1) (2)	Event main setting Event main setting OFF ON ON (decrease alarm) OFF (3) (4)

Operation type	Operation type setting	Direct action	Reverse action			
Standard numerical code change rate high limit	57	Sets the change rate high or low limit for the event main setting, and sets the sampling cycle for the event subsetting. Sets the standard numerical code for the Loop definition. Measures the value represented by the standard numerical code for the specified sampling cycle time, and compares the change in value with the change in the ch				
Standard numerical code change rate low limit	58	rate high limit or low limit to determine whether to turn on or off the event. This is same operation as the PV change rate high limit and PV change rate low limit.				
AT running (status)	65	ON when AT is running OFF when AT is stopped	OFF when AT is running ON when AT is stopped			
During SP ramp (status)	66	ON during SP ramp OFF when there is no SP ramp or when it has completed	OFF during SP ramp ON when there is no SP ramp or when it has completed			
Control direct action (status)	67	ON during direct action (cooling) OFF during reverse action (heating)	OFF during direct action (cooling) ON during reverse action (heating)			
Estimating MFB (status)	68	ON while estimating valve opening OFF while measuring valve opening	ON while measuring valve opening OFF while estimating valve opening			
Timer (status)	70	The direct and reverse action settings are disabled for the timer event. To use the timer event, it is necessary to set the operation type of the DI (digital input) to "Timer stop/start selection." Also, setting the event number of the loop definition of the DI (digital input) enables control of multiple timer events from different DIs. Setting items ON delay time: Time until the event changes from OFF to ON after the DI is changed from OFF to ON OFF delay time: Time until the event changes from ON to OFF after the DI is changed 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.				
		ON-delay Event	OFF-delay ON			
		 Caution The factory setting for the ON delay and 	n of DI is 0, and in this case, all timer events			

■ Operation type and Loop definition

The operation type can be set for an event.

A total of 16 events is available from loops 1 to 4.

Item (bank)	Display	Description	Initial value
Operation type (Event configuration bank)	MENUL > EventConfig 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 high and low limits 7: Deviation high and low limits 7: Deviation high limit (final SP basis) 8: Deviation low limit (final SP basis) 9: Deviation high and low limits (final SP basis) 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: MFB high and low limits 17 to 25: Reserved 26: Standard numerical code high limit 27: Standard numerical code high and low limits 29: PV change rate 30 to 54: Reserved 55: PV change rate high limit 56: PV change rate low limit 57: Standard numerical code change rate high limit 58: Standard numerical code change rate high limit 59: to 60: Reserved 61: Alarm (status) 62: READY (status) 63: MANUAL (status) 64: RSP (status) 65: AT running (status) 66: During SP ramp (status) 67: Control direct action (status) 68: Estimating MFB (status) 69: Reserved 70: Timer	
Loop definition (Event configuration bank)	MENU > EventConfig Loop definition	1: Loop 1 2: Loop 2 3: Loop 3 4: Loop 4 5 to 2047: Reserved 2048 to 3071: Standard numerical codes 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	1

! Handling Precautions

- If the operation type is set to Alarm (status), the loop definition setting is disabled, and regardless of the loop, the event is turned on when an alarm occurs, and the event is turned off when there is no alarm.
- If the operation type is set to the standard numerical code high limit, standard numerical code low limit, standard numerical code high and low limits, standard numerical code change rate high limit, or standard numerical code change rate low limit, the loop definition is set to the target standard numerical code.
- If the operation type is set to a setting other than the above, the loop definition is set to the target value and status loop.

■ Direct/reverse, Standby, and READY mode operation

Direct/reverse, Standby, and READY mode operation associated with the operation type can be set.

A total of 16 events is available for loops 1 to 4.

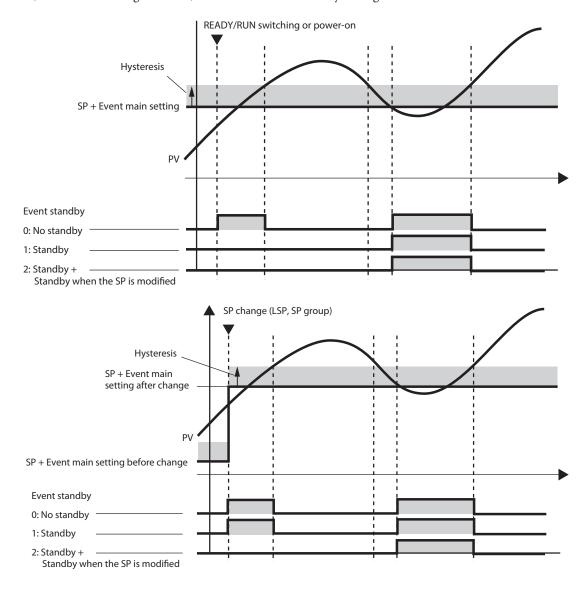
Item (bank)	Display	Description	Initial value
Direct/reverse (Event configuration bank)	MENU > EventConfig Direct/reverse	0: Direct 1: Reverse	0
Standby (Event configuration bank)	MENU > EventConfig Standby	0: No 1: Standby 2: Standby + standby when the SP is modified	0
READY mode operation	MENU > EventConfig READY mode operation	0: Continue 1: Force OFF	0

! Handling Precautions

- Standby is a function that prevents an event from turning ON even though the event satisfies the ON conditions when the controller power is turned ON or when the mode is switched from READY to RUN. The event turns ON after the OFF conditions are satisfied and then the ON conditions are satisfied again.
- "Standby + standby when the SP is modified" is a function that reactivates the standby function when the SP is modified (SP value, LSP group number) in addition to the regular standby function operation. However, the standby function is not reactivated when the new SP is the same as the old one, or when the SP does not change after the LSP group number is changed.
- If "READY mode operation" is set to "1" (forced OFF), the event turns OFF when READY is set.
- If the MAIN block firmware is earlier than version 6.1.x. (where x stands for any number), and if "Direct/reverse" is set to "1" (reverse) and "READY mode operation" is set to "1" (forced OFF), the event turns ON when READY is set.

	REAI	DY	When changing fro	m READY to RUN	When SP	changes
Event status when READY is set Standby setting	0: Continue	1: Force OFF	0: Continue	1: Force OFF	0: Continue	1: Force OFF
0: None	Normal operation	OFF	Normal operation	Normal operation	Normal operation	Normal operation
1: Standby	OFF	OFF	OFF (Standby status)	OFF (Standby status)	Normal operation	Normal operation
2: Standby + standby when the SP changes	OFF	OFF	OFF (Standby status)	OFF (Standby status)	OFF (Standby status)	OFF (Standby status)

This is an operation example for when the event type is set to "5: Deviation low limit event." The actual event is turned on or off, as shown in the figure below, based on the event standby settings.



! Handling Precautions

• If used in RSP mode, the "2: Standby + standby when the SP changes" setting is identical to "1: Standby." For this reason, if the RSP changes when "Standby + standby when the SP changes" is set, the event may turn on in certain cases.

■ Event main setting, event subsetting, hysteresis, delay

The event main setting, event subsetting, hysteresis, and ON and OFF delays associated with the event operation type can be set.

A total of 16 events is available for loops 1 to 4.

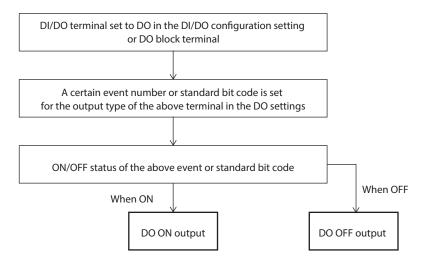
Item (bank)	Display	Description	Initial value
Event main setting	MENU > Event	-32000 to +32000	0.0000
(Event bank)	Event main setting		
Event subsetting	MENU > Event	-32000 to +32000	0.0000
(Event bank)	Event subsetting		
Hysteresis	MENU > Event	0.0000 to 32000	5.0000
(Event bank)	Hysteresis		
ON delay time	MENU > Event	0.0000 to 3200.0 s	0.0000
(Event bank)	ON delay		
OFF delay time	MENU > Event	0.0000 to 3200.0 s	0.0000
(Event bank)	OFF delay		

! Handling Precautions

• If the status of an event is ON at power-on, the specified ON delay time will be applied.

4-10 DO (Digital Output)

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



! Handling Precautions

- There are 7 DI/DOs (digital inputs and outputs). To use a DI/DO for DO, set to DO in the DI/DO configuration bank.
- If Block A1 or B1 is a DO block, it is not necessary to set the configuration bank, and there are four DOs in each block.

■ DI/DO configuration

To use as a DO, set the operation type of the desired DI/DO number to DO.

Item (bank)	Display	Description	Initial value
Operation type of DI/DO 1 to 7 (DI/DO configuration bank)	MENU > DI/DO Config DI/DO1 Operation type MENU > DI/DO Config DI/DO2 Operation type MENU > DI/DO Config DI/DO3 Operation type MENU > DI/DO Config DI/DO4 Operation type MENU > DI/DO Config DI/DO5 Operation type MENU > DI/DO Config DI/DO6 Operation type MENU > DI/DO Config DI/DO6 Operation type MENU > DI/DO Config DI/DO6 Operation type	0: DI 1: DO ← Select this 2: TP (time proportioning) output	0

■ DO assignment

For the DI/DO terminals whose operation type is set to DO in the DI/DO configuration bank and the terminals in the DO block, the output type can be set in the DO configuration bank.

DI/DO

Item (bank)	Display	Description	Initial value
Item (bank) Output type of DI/DO 1 to 7 (DO configuration bank)	MENU > DO Config DO 1/ Output type MENU > DO Config DO2 / Output type MENU > DO Config DO3 / Output type MENU > DO Config DO4 / Output type MENU > DO Config DO4 / Output type MENU > DO Config DO5 / Output type	0: OFF 1 to 10: Reserved 11: Event 1 12: Event 2 13: Event 3 14: Event 4 15: Event 5 16: Event 6 17: Event 7	Initial value
		17: Event 7 18: Event 8 19: Event 9 20: Event 10 21: Event 11 22: Event 12 23: Event 13 24: Event 14 25: Event 15 26: Event 16 27 to 1023: Reserved	
		1024 to 2047: Standard bits 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	

! Handling Precautions

- The output type setting is valid only for a DI/DO number that is set for DO in the DI/DO configuration bank. If the DO output type is set for a number set to DI in the DI/DO configuration bank, the number cannot be used for output.
- This product forces DO output OFF and displays an alarm when an overcurrent is detected in the DO terminal in order to protect the output circuits. Check the loads and wiring to prevent overcurrent from occurring.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), "DO Config" is displayed as "DO," and "DO1" to "DO7" are displayed as "GROUP1" to "GROUP7."

● Block A1, B1

Item (bank)	Display	Description	Initial value
Block A1	MENU > DO Config	0: OFF	0
DO1 to 4 output type	BLOCK A1 / DO1 / Output	1 to 10: Reserved	
(DO bank)	type	11: Event 1	
	MENU > DO Config	12: Event 2	
	BLOCK A1 / DO2 / Output	13: Event 3	
	type MENUL > DO Config	14: Event 4	
	MENU > DO Config	15: Event 5	
	BLOCK A1 / DO3 / Output type	16: Event 6	
	MENU > DO Config	17: Event 7	
	BLOCK A1 / DO4 / Output	18: Event 8	
	type	19: Event 9	
Block B1	MENU > DO Config	20: Event 10	
DO1 to 4 output type	BLOCK B1 / DO1 / Output	21: Event 11	
(DO bank)	type	22: Event 12	
	MENU > DO Config	23: Event 13	
	BLOCK B1 / DO2 / Output	24: Event 14	
	type MENU > DO Config	25: Event 15	
	BLOCK B1 / DO3 / Output	26: Event 16	
	type	27 to 1023: Reserved	
	MENU > DO Config	1024 to 2047: Standard bit codes	
	BLOCK B1 / DO4 / Output type	14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	

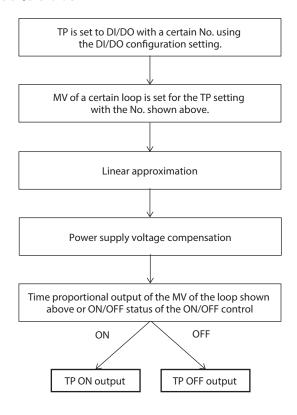
! Handling Precautions

• This product forces DO output OFF and displays an alarm when an overcurrent is detected in the DO terminal in order to protect the output circuits. Check the loads and wiring to prevent overcurrent from occurring.

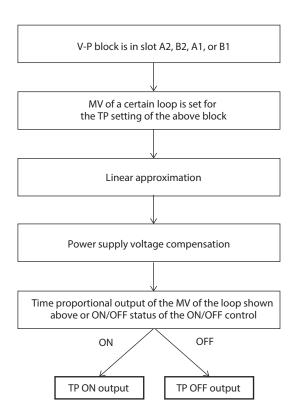
4-11 TP (Time Proportioning) Output

The following is a functional block diagram for TP (time proportioning) output and ON/OFF control output.

• For DO4 to DO7 in the DI/DO block



• For the V-P block



! Handling Precautions

- There are 7 DI/DOs (digital inputs and outputs), but only 4 of these can be used for TP output and ON/OFF control output. To use for TP (time proportioning) output or ON/OFF control output, set to TP in the DI/DO configuration bank.
- For V-P (voltage pulse) output, any blocks inserted into slots A2, B2, A1, or B1 can be used for TP output and ON/OFF control.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the power supply voltage compensation function is not available.

■ DI/DO configuration

Set the operation of the desired DI/DO number to TP.

Four settings are available for DI/DO groups 4 to 7.

Item (bank)	Display	Description	Initial value
Operation	MENU > DI/DO Config	0: DI	0
(DI/DO configuration bank)	Operation type	1: DO	
		2: TP (time proportioning) output ←Select this	

! Handling Precautions

- Set "2: TP" also to use for ON/OFF control output.
- Because V-P output is constantly TP, no operation (DI, DO, TP) settings are required.

■ TP output type

The loop MV assignments can be set to the DI/DO number and V-P output used for TP (timing proportioning) output.

Four settings are available for DI/DO groups 4 to 7, and four settings are available for blocks A2, B2, A1, and B1.

Item (bank)	Display	Description	Initial value
TP output type	MENU > TP	0: OFF	0
(TP bank)	TP output type	1: MV for loop 1	
		2: MV for loop 2	
		3: MV for loop 3	
		4: MV for loop 4	
		11: Heat MV for loop 1 (for heating/cooling control)	
		12: Cool MV for loop 1 (for heating/cooling control)	
		13: Heat MV for loop 2 (for heating/cooling control)	
		14: Cool MV for loop 2 (for heating/cooling control)	
		15: Heat MV for loop 3 (for heating/cooling control)	
		16: Cool MV for loop 3 (for heating/cooling control)	
		17: Heat MV for loop 4 (for heating/cooling control)	
		18: Cool MV for loop 4 (for heating/cooling control)	
		19 to 2047: Reserved	
		2048 to 3071: Standard numerical codes	
		14-2 Standard Bit Codes and Standard	
		Numerical Codes (p. 14-8)	

! Handling Precautions

• Set the loop MV also to use for ON/OFF control output.

■ TP cycle

The TP (time proportioning) cycle can be set to the DI/DO number and V-P output used for TP (time proportioning) output.

Four settings are available for DI/DO groups 4 to 7, and four settings are available for blocks A2, B2, A1, and B1.

Item (bank)	Display	Description	Initial value
Block DI/DO	MENU > TP	0.1000 to 120.00 s	10.000
Time proportional cycle	DI/DO		
(TP bank)	TP cycle		
Blocks A2, B2, A1, and B2	MENU > TP	0.1000 to 120.00 s	2.0000
TP output cycle	A2, B2, A1, B2		
(TP bank)	TP cycle		

■ TP operation type

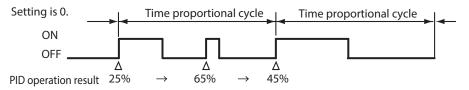
The TP (time proportioning) operation type can be set to the DI/DO number and V-P output used for TP (time proportioning) output.

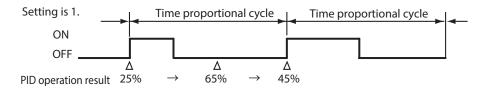
Four settings are available for DI/DO groups 4 to 7, and four settings are available for blocks A2, B2, A1, and B1.

Item (bank)	Display	Description	Initial value
TP operation type	MENU > TP	0: Priority on controllability	0
(TP bank)	TP operation type	1: Priority on device life (only one ON/OFF operation within the time proportional cycle)	

If 0 (priority on controllability) is set, DO may be turned ON twice or more in the time proportional cycle.

If 1 (priority on device life) is set, DO may remain OFF or may be turned ON only 1 time in the time proportional cycle.





■ Linearization table group definition

The linearization table group used for TP (time proportioning) output linear approximation can be set.

Four settings are available for DI/DO groups 4 to 7, and four settings are available for blocks A2, B2, A1, and B1.

The linearization table group selections made by DI (digital input) can be combined in the case of blocks A2, B2, A1, and B1.

Item (bank) Display		Description	Initial value
Linearization table group definition	MENU > TP	0: No linearization	0
(TP bank)	Linearization table group	1 to 8	

! Handling Precautions

- If a linearization table group is specified for the ON/OFF control output, the output when linear approximation input = 0 is used when OFF, and the output when linear approximation input = 100 is used when ON.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), linearization table group definition by DI (digital input) cannot be used.



• 4-16 Linear Approximation (p. 4-105) (for details on linearization table settings)

■ Power supply voltage compansation (slot selection)

For power voltage compensation for TP (time proportioning) output, the user can disable the compensation function or select a slot whose voltage transformer (VT) input terminal will be used for measuring the voltage for compensation. DI/DO 4 to 7 provide four settings, and blocks A2, B2, A1, and B1 provide four settings.

Item (bank)	Display	Description	Initial value
V change compensation (TP bank)	MENU > TP DO4 / V change compensation MENU > TP DO5 / V change compensation MENU > TP DO6 / V change compensation MENU > TP DO7 / V change compensation MENU > TP BLOCK A2 / V change compensation MENU > TP BLOCK B2 / V change compensation MENU > TP BLOCK A1 / V change compensation MENU > TP BLOCK A1 / V change compensation MENU > TP BLOCK A1 / V change compensation MENU > TP BLOCK B1 / V change compensation MENU > TP BLOCK B1 / V change compensation	0: Disabled 1: correction using voltage of slot A2 2: correction using voltage of slot B2 3: correction using voltage of slot A1 4: correction using voltage of slot B1	0

! Handling Precautions

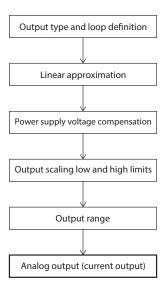
• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the "V change compensation" setting is not available.



• \$\mathbb{G}\) 4-15 VT (Voltage Transformer) Input (p. 4-103) (for details on power voltage compensation)

4-12 Analog Output (AO)

A maximum of 4 analog output points can be implemented on this device. The following is a functional block diagram for analog output (AO).



! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the power supply voltage compensation function is not available.

■ Output range

The setting is valid if the AO-C block is in slot A2, B2, A1, or B1. The output range can be set for analog output.

Item (bank)	Display	Description	Initial value
Output range	MENU > AnalogOutput	0: 4 to 20 mA	0
(ANALOG OUTPUT bank)	Output range	1: 0 to 20 mA	

■ Output type

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. The output type can be set for analog output.

Item (bank)	Display	Description	Initial value
Output type	MENU > AnalogOutput	0: Fixed at 0 %	1
(ANALOG OUTPUT bank)	Output type	1: MV	
		2: Heat MV (for heating/cooling control)	
		3: Cool MV (for heating/cooling control)	
		4: PV	
		5: SP	
		6: Deviation (PV - SP)	
		7 to 2047: Reserved	
		2048 to 3071: Standard numerical	
		codes	
		14-2 Standard Bit Codes and	
		Standard Numerical Codes (p. 14-8)	

■ Loop definition

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. The loop definition can be set for analog output.

Item (bank)	Display	Description	Initial value
Loop definition	MENU > AnalogOutput	1: Loop 1	"1" for slot A2
(ANALOG OUTPUT bank)	Loop definition	2: Loop 2	"2" for slot B2
		3: Loop 3	"3" for slot A1
		4: Loop 4	"4" for slot B1

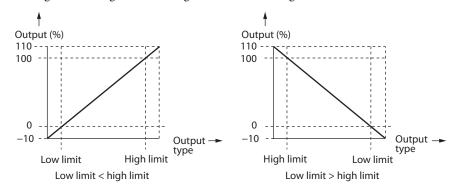
This setting is valid when output type 1 to 6 is selected.

■ Output scaling low and high limits

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. The output scaling low and high limits can be set for analog output.

Item (bank)	Display	Description	Initial value
Output scaling low limit	MENU > AnalogOutput	-32000 to +32000	0.0000
(ANALOG OUTPUT bank)	Output scaling low limit	Either of the following units is used	
Output scaling high limit	MENU > AnalogOutput	depending on the output type.	100.00
(ANALOG OUTPUT bank)	Output scaling high limit	% when the output type is MV	
		Same as AI (PV) (°C, etc.) if the output	
		type is PV, SP or deviation	

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 range from 0 to 20 mA, the output is 0 to 110 %.

■ Linearization table group definition

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot.

The linearization table group used for linear approximation of analog output can be set. It is also possible to combine the linearization table group selection by DI (digital input).

Item (bank)	Display	Description	Initial value
Linearization table group definition (ANALOG OUTPUT bank)	MENU > AnalogOutput Linearization table group	0: No linearization 1 to 8	0

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), linearization table group definition by DI (digital input) cannot be used.



• 4-16 Linear Approximation (p. 4-105) (for details on linearization table settings)

■ Power supply voltage compansation (slot selection)

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. For power voltage compensation for analog output, the user can disable the compensation function or select a slot whose VT input terminal will be used for measuring the voltage for compensation.

Item (bank)	Display	Description	Initial value
V change compensation (ANALOG OUTPUT bank)	MENU > AnalogOutput V change compensation	0: Disabled 1: Correction using voltage of slot A2 2: Correction using voltage of slot B2	0
		3: Correction using voltage of slot A1 4: Correction using voltage of slot B1	

! Handling Precautions

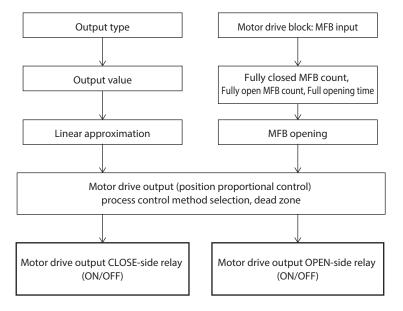
• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the "V change compensation" setting is not available.



• \$\mathbb{G}\$ 4-15 VT (Voltage Transformer) Input (p. 4-103) (for details on power voltage compensation)

4-13 Motor Drive Output (Position Proportional Control)

In this device, implementation of a maximum of one motor drive output is possible. The function block diagram of the motor drive output (position proportional control) is shown below.



Output type

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. The standard numerical code and output type that is output to the motor drive output can be set.

Item (bank)	Display	Description	Initial value
Output type	MENU > PP	0: Output OFF	1
PP (position proportional) bank	Output type	1: MV for loop 1	
		2: MV for loop 2	
		3 and 10: Reserved	
		11: Heat MV for loop 1 (for heating/cooling control)	
		12: Cool MV for loop 1 (for heating/cooling control)	
		13: Heat MV for loop 2 (for heating/cooling control)	
		14: Cool MV for loop 2 (for heating/cooling control)	
		15 to 2047: Reserved	
		2048 to 3071: Standard numerical codes	
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	

! Handling Precautions

• Do not set standard numerical codes 2464, "MFB amount of opening (estimated)," 2472, "MFB amount of opening (actual figure)," or 2479, "MFB count value."

■ Control method

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. The control method of the motor drive output can be set.

Item (bank)	Display	Description	Initial value
Control method selection	MENU > PP	0: MFB control + estimated position control	0
PP (position proportional) bank	Selection of control	1: MFB control + close upon line break	
	method	2: Estimated position control	
		3: Estimated position control + position adjustment at power-on	

Setting 0 (MFB control + estimated position control)

When the MFB (motor feedback) input is normal, motor drive output is controlled at the actual-measured MFB opening. If the MFB input is abnormal, motor drive output is controlled at the estimated MFB opening. The latter status is called "Estimating MFB."

- If the motor rotates to a position where the feedback potentiometer has deteriorated, the MFB input changes suddenly. This sudden change is detected as an abnormality, and the status changes to Estimating MFB. Estimating MFB also occurs when an MFB input wiring disconnection is detected.
- While the MFB is being estimated, standard bit code 1888 ("Estimating MFB") changes to 1. It is 0 at all other times.

Setting 1 (MFB control + close upon line break)

Motor drive output is controlled at the actually measured MFB opening. When an MFB input wiring disconnection is detected, the CLOSE-side relay remains always ON.

• The status does not change to Estimating MFB. Standard bit code 1888 ("Estimating MFB") is 0.

• Setting 2 (Estimated position control)

The motor drive output is controlled at the estimated MFB opening regardless of the wiring connection for MFB input.

- The status is always Estimating MFB. Standard bit code 1888 ("Estimating MFB") is 1.
- The status does not change to MFB input wiring disconnection.
- The error between the actual MFB opening and estimated MFB opening is corrected by turning on the CLOSE-side relay when output (MV) \leq 0.0 % and turning on the OPEN-side relay when output (MV) \geq 100.0 %.

• Setting 3 (Estimated position control + position adjustment at power-on)

The error between the actual MFB opening and estimated MFB opening is corrected by turning on the CLOSE-side relay for the duration of the "Full opening time" only when the power is turned on. Subsequent operation is identical to the case for Setting 2.

! Handling Precautions

- Execute MFB AT (MFB auto-tuning) when using settings 0 and 1.
- Accurately set "Full opening time" when using settings 2 and 3.
- Factors that tend to result in the Estimating MFB status when using setting

 include improper MFB adjustment, deterioration of the motor feedback
 potentiometer, poor resolution, and improper MFB input wiring connections.
- While the status is Estimating MFB, the error between the actual MFB degree of opening and the estimated MFB opening is corrected by turning ON the CLOSE-side relay when output (MV) ≤ 0.0 % and turning ON the OPEN-side relay when output (MV) ≥ 100.0 %. The relay turns ON under these circumstances regardless of the dead zone. For this reason, if the output changes near 0.0 % or 100.0 % in an oscillating manner, relay ON/ OFF chattering can occur. Some effective methods of preventing chattering include setting the parameter output low limit (OL) of the PID bank to −1.0 % or lower, setting the output low limit (OH) to 101.0 % or higher, or setting the derivative time (D) to 0.0 seconds.

■ MFB AT (MFB auto-tuning)

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. MFB AT start and stop can be operated for "Fully closed MFB count," "Fully open MFB count," or "Full opening time." The settings cannot be configured using the SLP-C7 Smart Loader Package.

Item (bank)	Display	Description	Initial value
Auto-tuning	MENU > PP	0: Auto-tuning stop	2
PP (position proportional) bank	Auto-tuning	1: Auto-tuning start	
		2: Auto-tuning not implemented	
		3: Auto-tuning completed	
		4: Auto-tuning failed	

MFB AT conditions

MFB AT can be executed when all of the following conditions are satisfied.

- A valid output is set for "Output type."
- "Control method selection" is set to 0 (MFB control + estimated position control) or 1 (MFB control + close upon line break).
- MOTOR block MFB input and motor drive output are wired correctly.
- Motor power is turned on, and the motor can be rotated.

MFB AT method

(1) Setting "Auto-tuning" to 1 (auto-tuning start) starts MFB AT. First, the CLOSE-side relay turns on, and once the motor rotates and stops in the fully-closed position, the OPEN-side relay turns on. MFB AT ends when the motor rotates up to the fully open position.

- (2) The MFB AT status can be viewed on the 1-loop monitor screen.
- (3) Setting "Auto-tuning" to 0 (auto-tuning stop) stops MFB AT. MFB AT can also be stopped by pressing the [MFB AT STOP] button on the 1-loop monitor screen.

• MFB AT results

- When MFB AT ends, the results are saved to "Auto-tuning."
 - 3: Auto-tuning has been completed
 - 4: Auto-tuning failed

The conditions for failed auto-tuning are shown below.

- \bullet Difference between fully closed MFB count and fully open MFB count is less than 300
- Full opening time is less than 5 seconds
- Full close or full open process took 5 minutes or longer
- If MFB AT is stopped, it returns to the set value (2 to 4) before MFB AT started.
- "Auto-tuning" can also be set manually to a value from 2 to 4.

! Handling Precautions

- If "Control method selection" is set to 0 (MFB control + estimated position control) or 1 (MFB control + close upon line break), be sure to execute MFB AT.
- If the device power is shut off during execution of MFB AT, MFB AT is stopped after the power is turned back on.
- Execution of MFB AT continues even during switching between AUTO/ MANUAL, RUN/READY, or LSP/RSP modes during execution of MFB AT.
- During execution of MFB AT, check that the motor rotated correctly to the fully closed position or fully open position.
- Once MFB ends, check that the motor rotated correctly to the fully closed position or fully open position.

■ MFB adjustment value

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. The settings can be configured using MFB AT (MFB auto-tuning). Also, although the settings can be configured on the parameter screen of the display unit in the same way as regular parameters, they cannot be configured using the SLP-C7 Smart Loader Package.

Item (bank)	Display	Description	Initial value
Fully closed MFB count	MENU > PP	0 to 8000	2000
PP (position proportional) bank	Fully closed MFB count		
Fully open MFB count	MENU > PP	0 to 8000	6000
PP (position proportional) bank	Full opening MFB count		
Full opening time	MENU > PP	5.0000 to 240.00 s	40.000
PP (position proportional) bank	Full opening time		

If MFB AT ends and the "Auto-tuning" setting changes to 3 (Auto-tuning has been completed), the settings for "Fully closed MFB count," "Fully open MFB count," and "Full opening time" are completed.

! Handling Precautions

- If "Control method selection" is set to 0 or 1, the settings for "Fully closed MFB count," "Fully open MFB count," and "Full opening time" are used.
- If "Control method selection" is set to 2 or 3, the setting for "Full opening time" is used. Because MFB AT cannot be executed, manually set "Full opening time" from the display unit.

■ Dead zone

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. The dead zone of the motor drive output can be set.

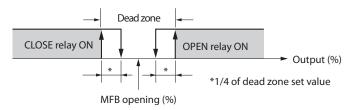
Item (bank)	Display	Description	Initial value
Dead zone	MENU > PP	0.5000 to 25.000 %	10.000
PP (position proportional) bank	Dead zone		

This sets the dead zone for the MFB opening where the motor drive output CLOSE-side relay turns on and the MFB opening where the motor drive output OPEN-side relay turn on.

Set the initial value by taking into consideration the controllability and lifespan, using 10 % as a general guide.

If the dead zone is small, MFB opening follow-up control with respect to the output value (such as MV) is improved, but the motor drive output ON/OFF frequency is increased, which can shorten the lifespans of the motor and motor drive output relay. On the other hand, if the dead zone is large, the lifespan is extended, but controllability is reduced.

The minimum value of the dead zone is the value where the motor open/close operation stops hunting while the dead zone settings are being changed at a constant output value in MANUAL mode or similar. If set at the minimum value, the lifespans of the motor and motor drive output relay will be extremely shortened, so set to a value larger than the minimum value by adding a safety margin.



! Handling Precautions

- If "Control method selection" is set to 0 or 1, set "Dead zone" after executing MFB AT (MFB auto-tuning).
- If "Control method selection" is set to 2 or 3, set "Dead zone" after setting "Full opening time."

■ Linearization table group definition

The setting is valid if a MOTOR block is inserted (using four slots) into the I/O slot. The linearization table used for linear approximation of motor drive output can be set.

The linearization table group selections made by DI (digital input) cannot be combined.

Item (bank)	Display	Description	Initial value
Linearization table group definition	MENU > PP	0: No linearization	0
PP (position proportional) bank	Linearization table group	1 to 8	



• \$\mathcal{C}\$ 4-16 Linear Approximation (p. 4-105) (for details on linearization table settings)

4-14 CT (Current Transformer) Input

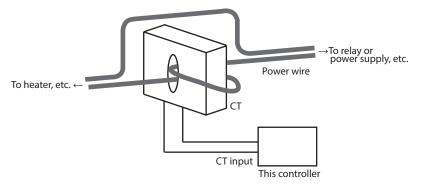
For models with CT (current transformer) input, current can be measured by the CT input.

■ Number of turns and number of power wire loops

The setting is valid if the AO-C block or V-P block is in slot A2, B2, A1, or B1. Settings can be adjusted to match the CT input transformer.

Item (bank)	Display	Description	Initial value
Number of turns	MENU > CT	100 to 4000	800
(CT input bank)	Number of turns		
Number of power wire loops	MENU > CT	1 to 6	1
(CT input bank)	Number of wire loops		

- For the number of turns, set the number of turns of the CT connected to the model C7.
- For the number of power wire loops, set the number of times that the electric wire passes through the hole in the CT. For example, if the electric wire passes through the hole of the CT twice as shown below, set "2."



• The CT input can be displayed on the monitor screen of the loop number that was set to "Input value display loop definition (CT/VT input display loop definition)" in the basic action bank.

! Handling Precautions

- If the AO-C block is used, heater burnout, overcurrent, and short circuit cannot be detected.
- Make sure that the current does not exceed the upper limit of the displayed range of the CT input. Exceeding the upper limit could cause malfunction.
- If the unit detects an overcurrent exceeding the upper limit of the displayed range of the CT input, a CT input error alarm will be generated. However, if the current is too large and the malfunction occurs, the CT input error alarm will not be generated.
- The CT input can be displayed on the monitor screen of the loop number that was set for "Input value display loop definition (CT/VT input display loop definition)" in the basic action bank.

■ CT input display range and current measurement range

The display range and the current measurement range of the CT input vary according to the number of turns inside the CT and the number of power wire loops through the CT.

Set numbers that match the number of turns and the number of power wire loops of the connected CT.

The display range and the current measurement range are calculated using the formula below.

(The internal calculation of 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 \div (16 × number of power wire loops) × 1.4

Current measurement range low limit (A) = Number of turns \div (2000 × number of power wire loops)

Current measurement range high limit (A) = Number of turns \div (16 × number of power wire loops)

The following table shows an example of the display range and the current measurement range with the number of turns and the number of power wire loops of the CT. The current measurement range is shown in parentheses.

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

■ CT input filter

The setting is valid if the AO-C block or V-P block is in slot A2, B2, A1, or B1. The filter is a first-order lag filter used if the CT input fluctuates sharply and repeatedly, interfering with proper measurement, or if the input flutters due to noise, etc. The larger the setting is, the less frequently the CT input changes.

Under normal circumstances, keep the filter at its initial value of 0.0000.

Item (bank)	Display	Description	Initial value
Filter	MENU>CT	0.0000: No filter	0.0000
(CT input bank)	Filter	0.0001 to 120.00 s	

! Handling Precautions

• If the input exceeds the high limit of the display range, the filter will be disabled and the CT input high limit will be displayed.

- For the CT input of the V-P block, if CT operation is set to "1: Detection of heater burnout for terminal OUT," the filter will not be applied.
- If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), "Filter" is not available.

■ Current measurement and error detection

The V-P (voltage pulse) blocks each have two CT inputs, and can be used for continuous current measurement or heater and actuator burnout detection, overcurrent detection, and short circuit detection.

Settings for both CT1 input and CT2 input groups must be made for each block: A2, B2, A1, and B1.

Item (bank)	Display	Description	Initial value
CT operation	MENU > CT	0: Continuous current measurement	0
(CT input bank)	CT operation	1: Detection of heater burnout for terminal OUT	
CT measurement wait time	MENU > CT	30 to 300 ms	30
(CT input bank)	CT measurement wait time		
Heater burnout detection	MENU > CT	0.0000 to 350.00 A	0.0000
current value	Burnout detection value		
(CT input bank)			
Overcurrent detection	MENU > CT	0.0000 to 350.00 A	0.0000
current value	Over-current detection value		
(CT input bank)			
Short-circuit detection	MENU > CT	0.0000 to 350.00 A	0.0000
current value	Short-circuit detection value		
(CT input bank)			
Hysteresis	MENU > CT	0.0000 to 350.00 A	0.5000
(CT input bank)	Hysteresis		
Delay time	MENU > CT	0.0000 to 3200.0 s	2.0000
(CT input bank)	Delay time		
Condition for restoring	MENU > CT	1024 to 2047 (standard bit codes)	1024
status before measurement	Unmeasured value condition		
(CT input bank)	S		

CT operation

When set to "0: Continuous current measurement," the current is measured regardless of whether V-P block output is ON or OFF. When set to "1: Detection of heater burnout for terminal OUT," different types of current value are measured depending on whether V-P block output is ON or OFF.

The measurable current values and detectable errors based on the "CT operation" settings are shown in the table below.

CT operation	Current value type	Current measurement possible / not possible	Error detection setting value	Error detection
Continuous current measurement	Current when output ON	Measurable	Heater burnout detection current value	Current low limit error (Current value < Set value)
			Overcurrent detection current value	Current high limit error (Current value > Set value)
	Current when output OFF	Not measurable (Current value = 0.0 A)	None	None
	Time proportioning current value	Not measurable (Current value = 0.0 A)	None	None
Detection of heater burnout for	Current when output ON	Measurable	Heater burnout detection current value	Heater burnout (Current value < Set value)
terminal OUT			Overcurrent detection current value	Overcurrent (Current value > Set value)
	Current when output OFF	Measurable	Short-circuit detection current value	Short-circuit (Current value > Set value)
	Time proportioning current value	Measurable	None	None

! Handling Precautions

- The time proportioning current value can be calculated using the following formula.
 - Time proportioning current value = Measured current when output ON $\times \sqrt{}$ (Time proportional output ON time \div Time proportional cycle)
- The time proportioning current value cannot be measured correctly if "Time proportioning operation type" is set to "0: Priority on controllability." If using the time proportioning current value, set "Time proportioning operation type" to "1: Priority on device life." If the version of the MAIN block firmware is 5.x.x or later (where x stands for any number), the time proportioning current value = 0.0 A when set to "Priority on controllability."
- The detection status for heater burnout, overcurrent, and short-circuit is reflected in the value of the standard bit.
- The current low limit error status for continuous current measurement is
 reflected in the value of the standard bit for heater burnout detection, and the
 current high limit error status is reflected in the standard bit for overcurrent
 detection.
 - 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)

CT measurement wait time

If "CT operation" is set to "1: Detection of heater burnout for terminal OUT," the time from the change in the output ON/OFF status to the start of the current value measurement can be set. After the ON/OFF of the monitored OUT terminal changes, measurement of the current value is started once the measurement wait time has elapsed.

• Heater burnout detection current value

If the current value when output is ON is the set value or less, heater burnout is detected.

If the setting is 0.0, the detection function is stopped.



 As a general guide, the setting should be midway between the normal current value and the burnout current value. Also, set so that the difference between the normal current value and burnout current value is 5 % FS or more of the measurement current range.

CT input display range and current measurement range (p. 4-96)

• If the CT operation is set to "0: Continuous current measurement," current value low limit errors can be detected using the heater burnout detection current value setting as the current low limit.

Overcurrent detection current value

If the measured current when output is ON exceeds the setting, overcurrent is detected.

If the setting is 0.0, the detection function is stopped.



 As a general guide, the setting should be midway between the normal current value and the overcurrent value. Also, set so that the difference between the normal current value and overcurrent value is 5 % FS or more of the measurement current range.

CT input display range and current measurement range (p. 4-96)

Set value =
$$\frac{\text{Overcurrent} + \text{Normal current}}{2}$$

• If the CT operation is set to "0: Continuous current measurement," current high limit errors can be detected using this setting.

Short-circuit detection current value

If the measured current when output is OFF exceeds the setting, a short-circuit is detected.

If the setting is 0.0, the detection function is stopped.



 As a general guide, the set value should be midway between the normal current value and the short-circuit current value. Also, set so that the difference between the normal current value and short-circuit current value is 5 % FS or more of the measurement current range.

CT input display range and current measurement range (p. 4-96)

Set value =
$$\frac{\text{Short-circuit current} + \text{Normal current}}{2}$$

Hysteresis

Set the hysteresis common to heater burnout detection, overcurrent detection, and short-circuit detection.

Delay time

Set the ON delay time common to heater burnout detection, overcurrent detection, and short-circuit detection.

This delay timer is started and reset based on the conditions in the table below.

Detection type	Start condition	Reset condition
Heater burnout	Current at output ON ≤ Heater burnout detection	Current at output ON > Heater burnout detection current value +
detection	current value	Hysteresis
Overcurrent	Current at output ON ≥ Overcurrent detection current	Current at output ON < Overcurrent detection current value –
detection	value	Hysteresis
Short-circuit	Current at output OFF ≥ Short-circuit detection	Current at output OFF < Short-circuit detection current value —
detection	current value	Hysteresis

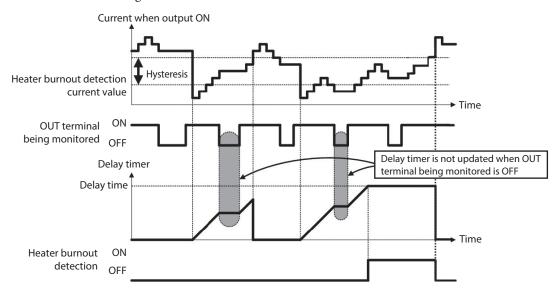


- If "heater burnout detection," "Overcurrent detection," and "Short-circuit detection" are set to ON (detection status), ON (detection status) is retained even if the delay timer reset conditions are satisfied.
 To set to OFF (disabled), set to the "no current measurement" status.
- If CT operation is set to "0: Continuous current measurement," the delay timer is updated constantly every 1 ms.
- If CT operation is set to "1: Detection of heater burnout for terminal OUT," the delay timer is updated every 1 ms based on the ON/OFF status of the OUT terminal that is being monitored.

For "heater burnout detection" and "overcurrent detection," the current at output ON is monitored, so the delay timer is updated only for the period when the output of the OUT terminal being monitored is ON.

For "short-circuit detection," the current at output OFF is monitored, so the delay timer is updated only for the period when the output of the OUT terminal being monitored is OFF.

As an example, heater burnout detection uses the operation shown in the diagram below.



Condition for restoring status before measurement

Set the standard bit code as the determining condition for restoring the CT value to the "no current measurement" status.

This function is used to cancel burnout detection that continues while control has stopped after burnout is detected.

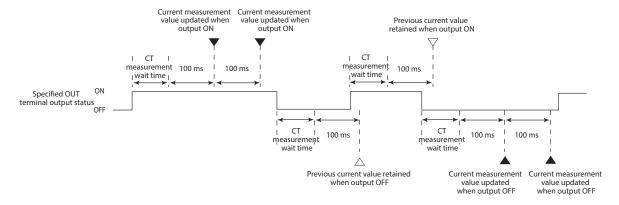


- The condition for restoring the status before measurement is used to disable
 detection determination until a new CT current is measured so that the heater
 burnout detection, overcurrent detection, and short-circuit detection are OFF
 (disabled).
- If the standard bit code specified for "Condition for restoring status before measurement" is set to ON, there is no CT current measurement.
- The ON status (detected status) of heater burnout detection, overcurrent detection, and short-circuit detection is retained until it changes to the "no current measurement" status. The "detected" status does not turn OFF (is not canceled) even after the equipment error status is cleared.

 To set "heater burnout detection," "overcurrent detection," and "short-circuit detection" status to OFF (canceled), set the standard bit that is assigned to "Condition for restoring status before measurement" to ON if no heater burnout, overcurrent, or short-circuit is detected.

■ Timing for updating CT current measurement

If "CT operation" is set to "1: Detection of heater burnout for terminal OUT," the current when the output turns ON and OFF is updated as shown below.



When the ON or OFF status of the OUT terminal output has continued for the wait time for CT measurement plus 100 ms or longer, the measured current when the output turns ON/OFF is updated. If the ON or OFF output status of the OUT terminal continues for less than the wait time for CT measurement plus 100 ms, the previously measured current is kept without updating the current when the output turns ON/OFF.

If the output becomes 0 % in READY mode or due to a temperature drop under reverse action, the previous value is kept without updating the current value at output ON.

4-15 VT (Voltage Transformer) Input

For models with VT (voltage transformer) input, voltage can be measured by the VT input. Also, the resistance of the actuator (heater) connected to the output of the AO-C block can be calculated from the voltage measured using VT input and the current measured using CT input. In addition, the TP (time proportioning) output and analog output can be compensated using the voltage measured at the VT input terminal.

■ Primary voltage and secondary voltage

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. Settings can be adjusted to match the VT input transformer.

Item (bank)	Display	Description	Initial value
Primary voltage	MENU > VT	1.0000 to 500.00	200.00
(VT input bank)	Primary voltage		
Secondary voltage	MENU > VT	1.0000 to 11.000	10.000
(VT input bank)	Secondary voltage		

! Handling Precautions

SSR.

- Make sure that the voltage does not exceed the allowable input voltage (AC 0 to 18 VRMS and 26 V peak max.) of the VT input. Exceeding the upper limit could cause malfunction.
- If the voltage exceeds the rated input high limit of the VT input, a VT input error alarm will be generated. However, if the voltage is too large and the malfunction occurs, the VT input error alarm will not be generated.
- The VT input and resistance can be displayed on the monitor screen of the loop number that was set to "Input value display loop definition (CT/VT input display loop definition)" in the basic action bank.
- The actuator resistance can be calculated using the following formula.
 Resistance (Ω) = VT input value (V) ÷ CT input value (A)
- The actuator resistance cannot be calculated if the voltage of the VT input is less than 0.1 V or if the current of the CT input is less than 0.1 A. In this case, the resistance is $0.00~\Omega$.
- The actuator resistance can be calculated only when using a thyristor and phase angle control.
 The resistance cannot be calculated when using thyristor + cycle control or

Power supply voltage compansation

The setting is valid if the AO-C block is in the A2, B2, A1, or B1 slot. Power voltage compensation is a function to improve the controllability of equipment by adjusting the MV output from this device according to changes in the power to the heater, which is the actuator for controlling the temperature. In the TP (time proportional) output or analog output (AO) settings, select a slot whose VT input (the power to the heater that is measured) will be used for compensation.

Item (bank)	Display	Description	Initial value
Reference voltage (VT input bank)	MENU > VT Reference voltage	1.0000 to 500.00	200.00
Filter (VT input bank)	MENU > VT Filter	0.0000 : No filter 0.0001 to 120.00 s	0.0000

Reference voltage

This setting is used to set the present AC voltage to the heater as the reference voltage. This device calculates the amount of compensation from the ratio between the voltage measured at the VT input terminal and the specified reference voltage.

Filter

A preliminary delay filter can be applied to the voltage measured at the VT input terminal. If small fluctuations in the power to the heater have an adverse effect on the output (MV) compensation, applying a filter can reduce the effect.

! Handling Precautions

- If the voltage measured at the VT input terminal is less than 40 % of the specified reference voltage, the output (MV) is not adjusted.
- If the voltage measured at the VT input terminal is 40 to 80 % of the specified reference voltage, the output (MV) is adjusted by around 80 %.
- If the voltage measured at the VT input terminal is more than 120 % of the specified reference voltage, the output (MV) is adjusted by around 120 %.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "Reference voltage" and "Filter" are not available.



• 4-11 TP (Time Proportioning) Output (p. 4-79) 4-12 Analog Output (AO) (p. 4-85) (for details on slot selection for power voltage compensation)

4-16 Linear Approximation

Linear approximation can be used for analog input, analog output, time proportioning output, and position proportioning output. There are eight linearization groups. Each linearization group has 20 setting points.

Two types of linear approximation are available, one by specifying breakpoints and another by specifying the bias, and the type is selected using the "Operation type" setting of the linearization table bank.

! Handling Precautions

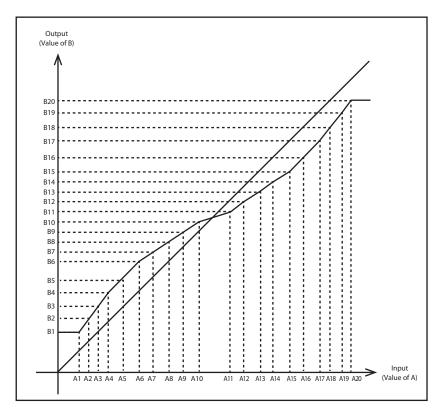
- If the version of the MAIN block firmware precedes 5.x.x (where x stands for any number), no "Operation type" setting is available, and linearization is performed by specifying breakpoints only.
- If the version of the MAIN block firmware is 6.x.x or later (where x stands for any number), linearization table group definition by DI (digital input) is available in linear approximation for the AO-C and V-P blocks.
- If the MAIN block firmware is version 3.0.x to 6.2.x (where x stands for any number), the breakpoint 1–10 settings are available to one linearization group.

■ Linearization by specifying breakpoints

The input values for linear approximation are the breakpoint settings A1 to A20, and the output values for linear approximation are breakpoint settings B1 to B20, and these appear as shown in the graph below.

Input at A1 or before results in output of B1.

Input at A20 or after results in output of B20.

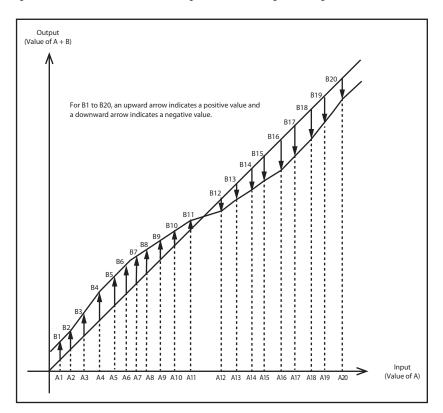


■ Linearization by specifying bias

The input values for linear approximation are the breakpoint settings A1 to A20, the bias values for linear approximation are the breakpoint settings B1 to B20, and the output values are A1 + B1 to A20 + B20, and these appear as shown in the graph below.

Input at A1 or before results in output of a value equal to Input value + B1.

Input at A20 or after results in output of a value equal to Input value + B20.



■ Example using linear approximation by analog input

This is an example of using linear approximation of one linearization table for analog input of slot A4.

The input for 0.0 to 100.0 is converted to 0.0 to 100.0 for a separate characteristic.

(1) Specify the groups of the linearization table in the analog input bank.

Item (bank)	Display	Description	Initial value
Linearization table group definition	MENU > AnalogInput	0: No linearization	0
(Analog input bank)	Linearization table group	1: 1 group ← Select this	
		2 to 8: Groups 2 to 8	

(2) Set the linearization table.

Item (bank)	Display	Description	Initial value
Operation type	MENU > Linearization Table	0: Breakpoint	0
(Linearization table bank)	Operation type		
Breakpoint A1	MENU > LinearizationTable	0	-32000
(Linearization table bank)	Breakpoint A1		
Breakpoint A2	MENU > LinearizationTable	17.4	32000
(Linearization table bank)	Breakpoint A2		
Breakpoint A3	MENU > LinearizationTable	25	-32000
(Linearization table bank)	Breakpoint A3		
Breakpoint A18	MENU > LinearizationTable	75	-32000
(Linearization table bank)	Breakpoint A18		
Breakpoint A19	MENU > LinearizationTable	82.6	-32000
(Linearization table bank)	Breakpoint A19		
Breakpoint A20	MENU > LinearizationTable	100	-32000
(Linearization table bank)	Breakpoint A20		
Breakpoint B1	MENU > LinearizationTable	0	-32000
(Linearization table bank)	Breakpoint B1		
Breakpoint B2	MENU > LinearizationTable	10	32000
(Linearization table bank)	Breakpoint B2		
Breakpoint B3	MENU > LinearizationTable	15	0.0000
(Linearization table bank)	Breakpoint B3		
Breakpoint B18	MENU > LinearizationTable	85	0.0000
(Linearization table bank)	Breakpoint B18		
Breakpoint B19	MENU > LinearizationTable	90	0.0000
(Linearization table bank)	Breakpoint B19		
Breakpoint B20	MENU > LinearizationTable	100	0.0000
(Linearization table bank)	Breakpoint B20		

■ Example using linear approximation for analog output

This is an example of using linearization table groups 3 and 4 for analog output of the A2 slot by specifying them by DI (digital input).

An output of 0.0 to 100.0 % is converted to other characteristics of 0.0 to 100.0 %.

The linearization table group having the value obtained by adding the linearization table group number specified in the analog output bank setting to the linearization table group number selected by the DI setting is selected.

When group 3 is specified in the analog output bank setting and group 0 or group 1 is set to be selected by DI, group 3 will be selected when DI is OFF, since 3 + 0 = 3, and group 4 will be selected when DI is ON, since 3 + 1 = 4.

(1) Specify the groups of the linearization table in the analog output bank.

• BLOCK A2

Item (bank)	Display	Description Initial value
Linearization table group definition	MENU > AnalogOutput	0: No linearization 0
(ANALOG OUTPUT bank)	Linearization table group	1 to 2: Groups 1 to 2
		3: Group 3 ← Select this
		4 to 8: Groups 4 to 8

(2) In the DI/DO configuration bank, set the operation type of the DI/DO to be used as digital input to "DI."

• DI/DO1

Item (bank)	Display	Description	Initial value
DI/DO 1 operation	MENU > DI/DO Config	0: DI ← Select this	0
(DI/DO configuration bank)	DI/DO1 Operation type	1: DO	

(3) Set the items related to the DI function in the DI bank.

• DI 1

Item (bank)	Display	Description	Initial value
DI group 1 operation type (DI bank)	MENU > DI GROUP1 / Operation type	0: No function (Explanation of the settings for 1 to 14 is omitted.) 15: Output linearization table group selection (0/+1) ← Select this 16: Output linearization table group selection (0/+2) 17: Output linearization table group selection (0/+4) (Explanations on the settings for 18 and later are omitted.)	0
DI group 1 input type (DI bank)	MENU > DI GROUP1 / Input type	0: Always OFF 1: Always ON 2 to 10: undefined 11: DI1 ← Select this 12: DI2 13: DI3 14: DI4 15: DI5 16: DI6 17: DI7 1024 to 2047: Standard bits	0
DI group 1 loop definition (DI bank)	MENU > DI GROUP1 / Loop definition	When the operation type is output linearization table group selection: 0: No block specification (invalid) 1: Block A2 ← Select this 2: Block B2 (including the motor drive outputs) 3: Block A1 4: Block B1	0

(4) Set the linearization table.

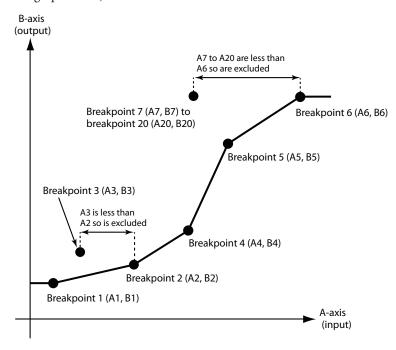
Linearization by specifying breakpoints (p. 4-105)(2) Linearization tables (for a linearization table setting example)

■ When the increase in magnitude of the breakpoints on the A-axis is not in numerical order

Linearization is done by excluding the deviating points.

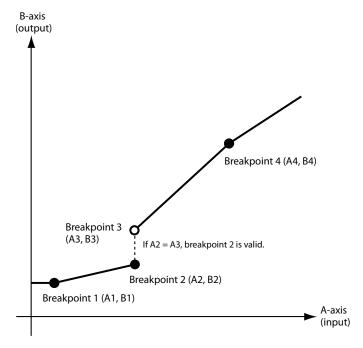
This can be done so that breakpoints in the middle are not used. (Breakpoint 3 in the graph below)

This can be done so that excess breakpoints are not used. (Breakpoints 7 to 20 in the graph below)



■ When two adjacent breakpoints have the same value on the A-axis

The breakpoint with the smaller number is valid. Also, the two points cannot be connected by a straight line.



4-17 Internal Cascade

For model numbers where the 6th and 7th digits are 11, 21, or 22, internal cascade can be selected in the loop type settings.

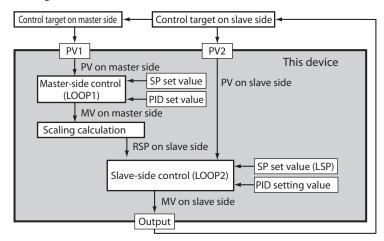
In the internal processing of the controller, the master-side MV can be converted to slave-side RSP. No output of the master-side MV to a device outside the controller by analog output is necessary, and no input of the slave-side RSP from a device outside the controller by analog input is necessary.

■ Master/Slave

The control on the master side operates as loop 1 control. PV1 becomes PV on the master side.

The control on the slave side operates as loop 2 control. PV2 becomes PV on the slave side.

The MV on the master side is converted into the RSP on the slave side through scaling calculation.



! Handling Precautions

- PV of block A4 (analog input) becomes PV on the master side.
- PV of block B4 (analog input) becomes PV on the slave side.

■ Loop Types

To use internal cascade for control, set the loop type to "9: Internal cascade," "10: Internal cascade + 1 loop," "11: Internal cascade + 2 loops," "12: Internal cascade, 1 RSP," "22: Internal cascade + 2 loops, 3 RSPs" or "23: 2 Internal cascades, 2 RSPs."

! Handling Precautions

The selectable loop type differs depending on the model number.
 4-1, "Loop Types," Model numbers and loop types (p. 4-1).
 The loop type can be set by the SLP-C7 Smart Loader Package.
 4-1, "Loop Types," Setting the loop type (p. 4-4).

■ Example: Internal cascade settings

In this example, the MV on the master side is converted to a 0 to 200 $^{\circ}$ C RSP, control is done on the slave side, and the MV on the slave side is output from the AO-C (current output) block of slot A2.

- (1) Set so that the internal cascade can be used. Use the SLP-C7 Smart Loader Package to set the loop type to "9: Internal cascade."
- (2) Set to convert the MV on the master side to the RSP on the slave side. Use "Cascade bank" for the following settings.

Item (bank)	Display	Description	Setting value
Scaling method	MENU > Cascade	0: Fixed	0
(Cascade bank)	Scaling method	1: SP basis	
		2: PV basis	
Scaling low limit	MENU > Cascade	-32000 to +32000	0.0000
(Cascade bank)	Scaling low limit		
Scaling high limit	MENU > Cascade	-32000 to +32000	200.00
(Cascade bank)	Scaling high limit		
Filter	MENU > Cascade	0.0000: No filter	0.0000
(Cascade bank)	Filter	0.0001 to 120.00 s	

The RSP conversion calculation formula may vary depending on the scaling method.

- When set to "0: Fixed," RSPs = $(MVm \div 100) \times (SH SL) + SL$
- When set to "1: SP basis," RSPs = $(MVm \div 100) \times (SH SL) + SL + SPm$
- When set to "2: PV basis," RSPs = $(MVm \div 100) \times (SH SL) + SL + PVm$

The variables used in the calculation formulas have the following meanings.

SL: Scaling low limitSH: Scaling high limitMVm: MV on master side

SPm: SP on master side PVm: PV on master side RSPs: RSP on slave side

The filter reduces the effect that the vibrations of the MV on the master side have on the RSP on the slave side.

(3) Output the MV on the slave side from the AO-C (current output) block of slot

Use "Analog output bank" for the following settings.

In this example, the 0 to 100 % range of the MV on the slave side (loop 2) is output in the range from 4 to 20 mA.

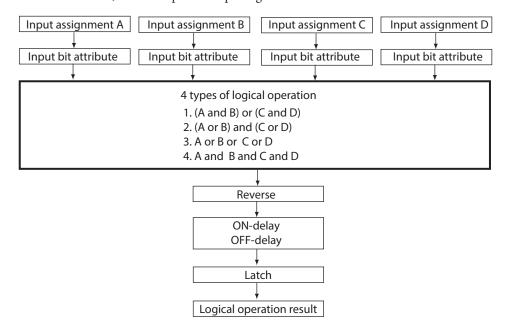
Item (bank)	Display	Description	Setting value
Output range of block A2	MENU > AnalogOutput	0: 4 to 20 mA	0
(ANALOG OUTPUT bank)	Block A2 / Output range	1: 0 to 20 mA	
Output type of block A2	MENU > AnalogOutput	0: Fixed at 0 %	1
(ANALOG OUTPUT bank)	Block A2 / Output type	1: MV	
		2 to 3: Reserved	
		4: PV	
		5: SP	
		6: Deviation (PV - SP)	
		2048 to 3071: Standard	
		numerical codes	
		14-2 Standard Bit	
		Codes and Standard Numerical Codes (p. 14-8)	
Loop definition of block A2	MENU > AnalogOutput	1: Loop 1	2
(ANALOG OUTPUT bank)	Block A2 / Loop Definition	2: Loop 2	
		3: Loop 3	
		4: Loop 4	
Output scaling low limit of	MENU > AnalogOutput	-32000 to +32000	0.0000
block A2	Block A2 / Output scaling		
(ANALOG OUTPUT bank)	low limit		
Output scaling high limit of	MENU > AnalogOutput	-32000 to +32000	100.00
block A2	Block A2 / Output scaling		
(ANALOG OUTPUT bank)	high limit		

4-18 Logical Operations

The device is capable of logical operations (Boolean operations using 0 and 1) for a wide range of device states, and the logical operation results can be used as ON/OFF outputs or internal contact inputs.

32 groups of logical operations are provided, each with four inputs and one output.

Four types of logical operations are available, and the input or output logic can be inverted.



■ Processing order for logical operations

Logical operation results can be used as inputs for logical operations. Logical operation results and the inputs in which the results are used can be in the same group or a different group.

Logical operations are executed in the order of group numbers for each cycle.

Therefore, the logical operation results of a group with a smaller number than the group number of the logical operation can be used in the same cycle. Logical operation results in the same group or a group with a larger number are used in the next cycle.



• Logical operation groups 1 to 16 are executed before PID calculation, and logical operation groups 17 to 32 are executed after PID calculation.

! Handling Precautions

 If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), 16 logical operation groups are available, and logical operation groups 1 to 4 are executed before PID calculation, and logical operation groups 5 to 16 are executed after PID calculation.

■ Calculation type

The type of logical operation can be selected from one of four patterns.

Item (bank)	Display	Description	Initial value
Calculation type	MENU > Logical Operation	1: Calculation 1 (A and B) or (C and D)	1
(Logical operation bank)	Operation type	2: Calculation 2 (A or B) and (C or D)	
		3: Calculation 3 (A or B or C or D)	
		4: Calculation 4 (A and B and C and D)	

■ Input assignments A, B, C, and D

Data assigned to the four inputs A to D are selected from the standard bit data.

Standard bit data is updated in each sampling cycle.

Item (bank)	Display	Description	Initial value
Input assignment A	MENU > LogicalOperation	1024 to 2047	1024
(Logical operation bank)	Input assignment A	Select from the standard bit codes	
Input assignment B	MENU > LogicalOperation	14-2 Standard Bit Codes and	1024
(Logical operation bank)	Input assignment B	Standard Numerical Codes (p. 14-8)	
Input assignment C	MENU > LogicalOperation		1024
(Logical operation bank)	Input assignment C		
Input assignment D	MENU > LogicalOperation		1024
(Logical operation bank)	Input assignment D		

■ Input bit polarities A, B, C, and D

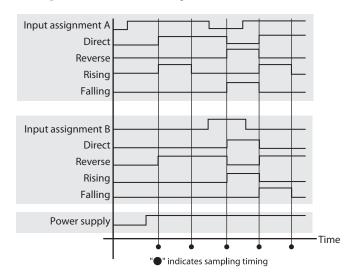
For the data assigned to the four inputs A to D, a selection is made as to whether to use the reversed result for calculation, or whether to use the results detected at rising and falling for calculation.

Item (bank)	Display	Description	Initial value
Input bit polarity A	MENU > LogicalOperation	0: Direct	0
(Logical operation bank)	Input bit polarity A	1: Reverse	
Input bit polarity B	MENU > LogicalOperation	2: Rising	0
(Logical operation bank)	Input bit polarity B	3: Falling	
Input bit polarity C	MENU > LogicalOperation		0
(Logical operation bank)	Input bit polarity C		
Input bit polarity D	MENU > LogicalOperation		0
(Logical operation bank)	Input bit polarity D		

! Handling Precautions

- Rising is detected if the target data is set to ON at power-on under the "2: Rising" setting.
- Falling is not detected if the target data is set to OFF at power-on under the "3: Falling" setting.

The ON/OFF states for "Direct," "Reverse," "Rising," and "Falling" for the input ON/OFF operate as shown in the figure below.



■ Reverse

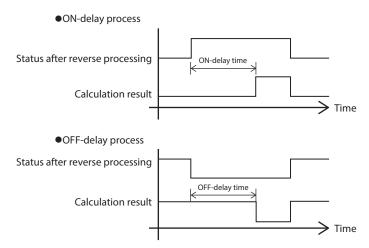
This selects whether the results of the logical operation are reversed.

Item (bank)	Display	Description	Initial value
Reverse	MENU > Logical Operation	0: Direct	0
(Logical operation bank)	Reverse	1: Reverse	

■ ON/OFF delay

This sets the ON-delay time and OFF-delay time.

Item (bank)	Display	Description	Initial value
ON delay time	MENU > LogicalOperation	0.0000 to 3200.0 s	0.0000
(Logical operation bank)	ON delay		
OFF delay time	MENU > LogicalOperation	0.0000 to 3200.0 s	0.0000
(Logical operation bank)	OFF delay		



The ON-delay and OFF-delay operation are shown in the figure below.

! Handling Precautions

- The time resolution of the operation is the sampling cycle.
- If a logical operation result is ON at power-on, the specified ON delay time will not be applied.

■ Latch

Specify whether to latch the logical operation result at ON or OFF.

Item (bank)	Display	Description	Initial value
Latch (Logical operation bank)	MENU > LOGICAL OPERATION Latch	0: Not latched 1: Latched when turned ON 2: Latched when turned OFF (Except for OFF when power is turned ON)	0

Latch release

Latches will be released if any of the following conditions are met.

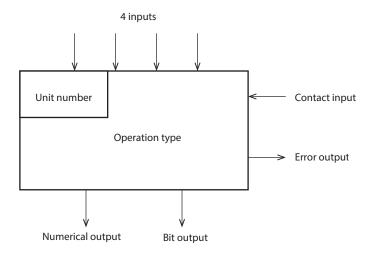
- "Latch" in the logical operation bank is set to "0" (Not latched).
- All latches are released using a DI function
- The power of this controller is turned off and then turned back on.

! Handling Precautions

- With "Latched when turned ON" selected, if the power is turned on when the logical operation result is ON, the ON state is latched.
- With "Latched when turned OFF" selected, if the power is turned on when the logical operation result is OFF, the OFF state is not latched.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the latch setting for logical operations is not available.

4-19 Numerical Operations

This device is capable of numerical operations (calculation and selection of real numbers) for a wide range of device states, and the results of calculation can be used for input and output. There are 32 numerical operation units. Each unit has 4 inputs, 1 contact input, 1 numerical output for the result of calculation, 1 bit output, and 1 error output.

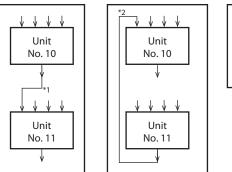


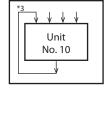
! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the numerical operation function is not available.

■ Processing order for numerical operations

Numerical operations are executed in each cycle in unit number order. The output of a numerical operation can be used as the input for a numerical operation. The cycle of input data used for a numerical operation is shown in the following example according to the processing order based on the unit Nos.





- *1 Data in this cycle when the output unit is processed before the input unit
- *2 Data in the previous cycle when the output unit is processed after the input unit
- *3 Data in the previous cycle when the output from the same unit is used as input



- Operations on units 1 to 16 are executed before PID calculation, and operations on units 17 to 32 are executed after PID calculation.
 - Processing procedure (p. 14-1) in Chapter 14 (for details)

■ Operation type

The operation types are shown in the table below.

No.	Name	Function	Buffer use	Firmware version
0	No operation	Outputs value = 0 (does not perform operation)	No	Version 6.2.x or later
1	aX+bY	Outputs the result of addition, subtraction, or multiplication.		
		(This operation can be used for calculations such as ratio or average. For subtraction, multiply the value by –1 and add.)		
2	Division	Outputs the result of division.		
3	Switch selector	Outputs the result of switching two inputs.		
4	High selector	Outputs the larger of two inputs.		
5	Low selector	Outputs the smaller of two inputs.		
6	Soft switch selector	Limits the result of switching two inputs with a ramp gradient and outputs the result.		
7	High/low limiter	Limits the value with high and low limits and outputs the result.		
8	Change rate limiter	Limits the value with increase and decrease change rates and outputs the result.		
9	Lead/lag	Outputs the result of lead/lag operation.		
10	Absolute value	Outputs the absolute value.		
11	Linearization table	Outputs the value converted with the linearization table.		
12	Hold	Outputs the held input.		
13	One-shot timer	Outputs a pulse of any width at the rising edge of the contact input.		
14	Timer	Outputs a pulse of any cycle and width.	No	Version 6.3.x or
15	Deviation monitor	Outputs the result of comparing a threshold value and the absolute value of the deviation between two inputs.		later
16	Square root	Outputs the result of square root extraction. (with input and output scaling)		
17	Integration pulse output I	Converts a value into the number of pulses per hour with high and low limit scaling, and outputs the result.		
18	Integration pulse output II	Converts % input into the number of pulses per hour with the range for integration and weight, and outputs the result.		
19	Logarithm	Converts the value into a logarithm and outputs the result.		
20	Exponent	Converts the value into an exponent and outputs the result.		
21	Derivation	Outputs the result of derivative operation.		
22	Integral	Outputs the result of integral operation.		
101	Dead time	Outputs the value after any set amount of time elapses.	Yes	
102	Moving average	Outputs the moving average for any amount of time.		

! Handling Precautions

- Numerical operations that use a buffer can be set for up to eight operation units.
- Although the number of buffers used is set for the input of operations that
 use buffers, the actual number of buffers used is determined at power-on or
 restart by the SLP-C7. Ensure that the number of buffers used does not exceed
 the number of buffers, which is 800.
- To change the operation type setting, use the SLP-C7. The setting displayed on this device cannot be changed from the display unit. The setting cannot be read or written by communication.

■ Details of numerical operations

Operation types are detailed in the tables for each numerical operation type.

The attributes (numerical value, constant with a value of 0 or more, or bit) of inputs 1–4 and the contact input are shown in the table.



• ☐ Input type (p. 4-143) (for the relationship between the attribute, input type, and data No.)

No operation

Operation type No.	0
Input 1	Not used.
Input 2	Not used.
Input 3	Not used.
Input 4	Not used.
Contact input	Not used.
Numerical output	0
Bit output	Always OFF
Error output	Always OFF

aX+bY

Operation type No.	1
Input 1	(Numerical value) a
Input 2	(Numerical value) X
Input 3	(Numerical value) b
Input 4	(Numerical value) Y
Contact input	Not used.
Numerical output	aX + bY calculation result
Bit output	Always OFF
Error output	Condition for ON
	Settings for inputs 1 to 4 are invalid
	Condition for OFF
	When conditions for ON are not met

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.3.3, the error output turns ON when the result of an operation is a subnormal number.

Division

Operation type No.	2
Input 1	(Numerical value) X
Input 2	(Numerical value) Y
Input 3	Not used.
Input 4	Not used.
Contact input	Not used.
Numerical output	Result of X ÷ Y
Bit output	Always OFF
Error output	Condition for ON
	Settings for inputs 1 to 2 are invalid
	• Y = 0
	Condition for OFF
	When conditions for ON are not met

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.3.3, the error output turns ON when the operation result is a subnormal number.

Switch selector

Operation type No.	3
Input 1	(Numerical value) X
Input 2	(Numerical value) Y
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	X when contact input = OFF
	Y when contact input = ON
Bit output	OFF when contact input = OFF
	ON when contact input = ON
Error output	Condition for ON
	Settings for inputs 1 to 2 are invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

High selector

Operation type No	4
Operation type No.	·
Input 1	(Numerical value) X
Input 2	(Numerical value) Y
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	• X when contact input = OFF and X ≥ Y
	• Y when contact input = OFF and X < Y
	X when contact input = ON
Bit output	• OFF when contact input = OFF and X ≥ Y
	• ON when contact input = OFF and X < Y
	OFF when contact input = ON
Error output	Condition for ON
	Settings for inputs 1 to 2 are invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

Low selector

Operation type No.	5
Input 1	(Numerical value) X
Input 2	(Numerical value) Y
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	• X when contact input = OFF and $X \le Y$
	• Y when contact input = OFF and X > Y
	• X when contact input = ON
Bit output	• OFF when contact input = OFF and X ≤ Y
	ON when contact input = OFF and X > Y
	OFF when contact input = ON
Error output	Condition for ON
	Settings for inputs 1 to 2 are invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

Soft switching selector

Operation type No.	6	
Input 1	(Numerical value) X	
Input 2	(Numerical value) Y	
Input 3	(Numerical value) Ramp gradient 0 to 32000 (no ramp when 0)	
Input 4	Ramp unit 0: s 1: min 2: h	
Contact input	(Bit) Switching between operations	
Numerical output	• X when contact input = OFF and ramping is complete	
	Y when contact input = ON and ramping is complete	
	The intermediate value resulting from ramping when ramping is in progress after switching by contact input	
	Output Input 2 Contact input Switch to input 2 Switching Switching Switching Input 1 Switch to input 2 Switch to input 1	
Bit output	OFF when contact input = OFF and ramping is complete	
	ON when contact input = ON and ramping is complete	
Error output	OFF when ramping is in progress after switching of contact input Condition for ON	
	• Settings for inputs 1 to 3 are invalid	
	• The actual value of the numerical value set for input 3 is outside the 0–32000 range	
	• The actual value of the numerical value set for input 4 is outside the 0–2 range	
	The contact input setting is invalid	
	Condition for OFF	
	When conditions for ON are not met	

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), the attribute of input 3 is limited to "Constant with a value of 0 or more."



• High/low limiter

Operation type No.	7
Input 1	(Numerical value) X (input)
Input 2	(Numerical value) Y (low limit or high limit: the smaller of Y and Z is the low limit)
Input 3	(Numerical value) Z (high limit or low limit: the larger of Y and Z is the high limit)
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	• X when contact input = OFF and low limit < X < high limit
	• Low limit when contact input = OFF and X ≤ low limit
	• High limit when contact input = OFF and high limit ≤ X
	• X when contact input = ON
Bit output	OFF when contact input = OFF and low limit < X < high limit
	• ON when contact input = OFF and X ≤ low limit
	• ON when contact input = OFF and high limit ≤ X
	OFF when contact input = ON
Error output	Condition for ON
	Settings for inputs 1 to 3 are invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

Change rate limiter

O 11 1 N		
Operation type No.	8	
Input 1	(Numerical value) X	
Input 2	(Numerical value) Increase change rate 0 to 32000 (no increase change rate limit when 0)	
Input 3	(Numerical value) Decrease change rate 0 to 32000 (no decrease change rate limit when 0)	
Input 4	Change rate unit	
	0: s 1: min	
	2: h	
Contact input	(Bit) Switching between operations	
Numerical output	X multiplied by the change rate limit when contact input = OFF	
· ·	• X when contact input = ON	
	Output (change rate limit) Output = input	
Bit output	OFF when the contact input = OFF and the change rate is not limited	
	ON when the contact input = OFF and the change rate is limited	
	OFF when contact input = ON	
Error output	Condition for ON	
	Settings for inputs 1 to 3 are invalid	
	• The actual value of the numerical value set for inputs 2 to 3 is outside the 0–32000 range	
	• The actual value of the numerical value set for input 4 is outside the 0–2 range	
	The contact input setting is invalid	
	Condition for OFF	
	When conditions for ON are not met	

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), the attributes of inputs 2 and 3 are limited to "Constant with a value of 0 or more."



• ▶ Input type (p. 4-143) (for details on the attributes)

Lead/lag

Operation type No.	9	
Input 1	(Numerical value) X (input)	
Input 2	(Numerical value) Lead time 0 to 3600 (s)	
Input 3	(Numerical value) Lag time 0 to 3600 (s)	
Input 4	Not used	
Contact input	(Bit) Switching between operations	
Numerical output	• The result of lead/lag calculation of X (input) when the contact input = OFF	
	• X when contact input = ON	
	Output = $\frac{1+T_1\cdot S}{1+T_2\cdot S}$ × Input	
	(T ₁ : lead time, T ₂ : lag time)	
	$T_1/T_2 \end{tabular} \begin{tabular}{ c c c c c } \hline Output when $T_1 \ge T_2$ \\ \hline Output when $T_1 < T_2$ \\ \hline Input \end{tabular}$	
Bit output	Always OFF	
Error output	Condition for ON	
	Settings for inputs 1 to 3 are invalid	
	The contact input setting is invalid	
	• The actual value of the numerical value set for inputs 2 to 3 is outside the 0–3600 range	
	Condition for OFF	
	When conditions for ON are not met	

! Handling Precautions

- If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), the attributes of inputs 2 and 3 are limited to "Constant with a value of 0 or more."
- If the MAIN block firmware is earlier than version 6.3.3, the error output turns ON when the result of an operation is a subnormal number.



• ▶ Input type (p. 4-143) (for details on the attributes)

Absolute value

Operation type No.	10
Input 1	(Numerical value) X
Input 2	Not used.
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	Absolute value of X (input) when contact input = OFF
	• X when contact input = ON
Bit output	Always OFF
Error output	Condition for ON
	The setting of input 1 is invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

Linearization table

Operation type No.	11
Input 1	(Numerical value) X
Input 2	0–8 (linearization table No.)
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	The result from the linearization table for X (input) when contact input = OFF
	• X when contact input = ON
Bit output	Always OFF
Error output	Condition for ON
	The setting of input 1 is invalid
	The contact input setting is invalid
	• The actual value of the numerical value set for input 2 is outside the 0–8 range
	Condition for OFF
	When conditions for ON are not met

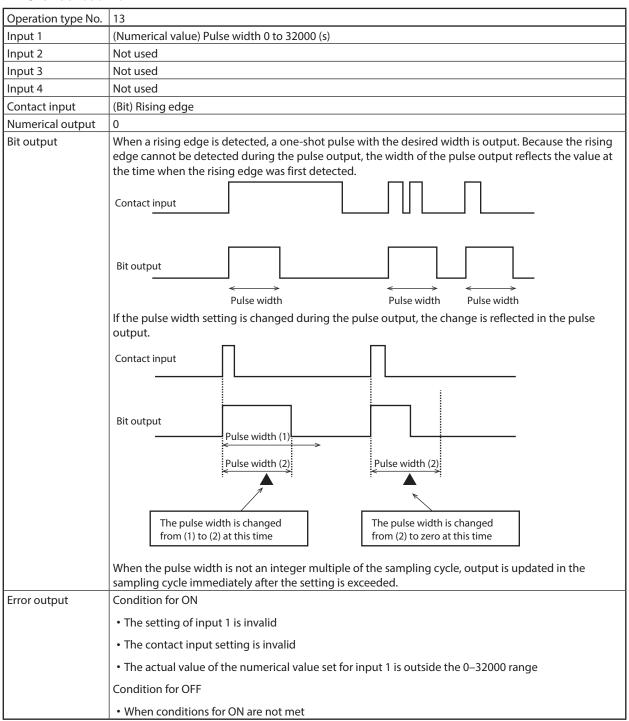


• For details on the Approximation by linearization table function, refer to 4-16, Linear Approximation (p. 4-105).

Hold

Operation type No.	12
Input 1	(Numerical value) X
Input 2	Not used.
Input 3	Not used.
Input 4	Not used.
Contact input	(Bit) Switching between operations
Numerical output	• X when contact input = OFF
	• The "hold" value of X (input) when contact input = ON
Bit output	Always OFF
Error output	Condition for ON
	The setting of input 1 is invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met

One shot timer



! Handling Precautions

 If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), the attribute of input 1 is limited to "Constant with a value of 0 or more."



• ▶ Input type (p. 4-143) (for details on the attributes)

• Timer

Operation type No.	14
Input 1	(Numerical value) Cycle 0 to 32000 (s)
Input 2	(Numerical value) Pulse width 0 to 32000 (s). Bit output is OFF when this value is 0.
Input 3	Not used
Input 4	Not used
Contact input	(Bit) Switching between operations
Numerical output	0
Bit output	The pulse with a specified pulse width is output at each cycle.
	Always ON when cycle ≤ pulse width.
	OFF when contact input is OFF.
	Contact input Bit output Pulse width Pulse width Pulse width Pulse width Cycle Cycle Cycle When the cycle or pulse width is not an integer multiple of the sampling cycle, output is updated at the sampling cycle immediately after the setting is exceeded.
Error output	Condition for ON
	Setting for input 1 or 2 is invalid
	The contact input setting is invalid
	• The actual value of the numerical value set for input 1 or 2 is outside the 0–32000 range
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.

Deviation monitor

Operation type No.	15
Input 1	(Numerical value) X (input)
Input 2	(Numerical value) Y (input)
Input 3	(Numerical value) Threshold. Regarded as 0 if the value is negative.
Input 4	(Numerical value) Hysteresis. Regarded as 0 if the value is negative.
Contact input	(Bit) Switching between operations
Numerical output	X – Y
Bit output	OFF when contact input = ON
	OFF when threshold < hysteresis
	For other cases, see below.
	• ON when $ X - Y \ge threshold$
	• OFF when $ X - Y <$ (threshold – hysteresis)
	Otherwise, ON/OFF does not change.
	Bit output Threshold Threshold Hysteresis Y
Error output	Condition for ON
	A setting for inputs 1 to 4 is invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.



- The deviation monitor operation is the same for the C7G and the C40B. Details are as follows.
 - Numerical operation specifications of the C40B

The C40B evaluates the absolute value of the deviation between input H1 and input H2 as compared with threshold P1 and outputs the result.

P2 is the hysteresis width.

Output is OFF when P1 < P2

Output is ON when $|H1 - H2| \ge P1$

Output is OFF when |H1 - H2| < (P1 - P2)

• Replacing C40B input with C7G input

H1 and H2 are replaced with input 1 (X input) and input 2 (Y input), respectively.

P1 and P2 are replaced with input 3 (threshold) and input 4 (hysteresis).

When you replace the inputs of the calculation in the C40B as described above, the result is as follows. This is the same operation as in the C7G.

Output is OFF when threshold < hysteresis

Output is ON when $|X - Y| \ge threshold$

Output is OFF when |X - Y| < (threshold - hysteresis)

Square root

Operation type No.	16
Operation type No.	(Numerical value) V (innext) Degraded as 0 if the value is progetive
Input 1	(Numerical value) X (input). Regarded as 0 if the value is negative.
Input 2	(Numerical value) D (dropout value %)
Input 3	(Numerical value) Y (low limit or high limit). The smaller of Y and Z is the low limit.
Input 4	(Numerical value) Z (high limit or low limit). The larger of Y and Z is the high limit.
Contact input	(Bit) Switching between operations
Numerical output	• X when contact input = ON
	• Low limit when $(X - low limit) \div (high limit - low limit) \times 100 < D$
	In other cases, the following calculation is performed.
	\(\sqrt{(X - low limit) \div (high limit - low limit)} \) \(\sqrt{(high limit - low limit) + low limit} \)
	Numerical output
	High limit Low limit
	Low limit High limit (equivalent to 0 %) (equivalent to 100 %)
	Equivalent to D %
Bit output	OFF when contact input = ON
	• ON when contact input = OFF and (X – low limit) ÷ (high limit – low limit) × 100 < D
	OFF in other cases
Error output	Condition for ON
	A setting for inputs 1 to 4 is invalid
	• The actual value of the number set for input 2 is outside the 0–100 range
	• Input 3 = input 4
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.

• Integration pulse output I

Operation type No.	17
Input 1	(Numerical value) X (input). Regarded as 0 if the value is negative.
Input 2	(Numerical value) Y (low limit or high limit). The smaller of Y and Z is the low limit.
Input 3	(Numerical value) Z (high limit or low limit). The larger of Y and Z is the high limit.
Input 4	(Numerical value) Pulse width (\times 0.1 s). Pulse width = sampling cycle when the value is 0 or smaller.
Contact input	(Bit) Numerical output = 0 and bit output = OFF when this value is OFF
Numerical output	• 0 when contact input = OFF
	• % value calculated as follows when contact input = ON % value = $(X - low \ limit) \div (high \ limit - low \ limit) \times 100$ However, % value is limited to the $0-1000$ % range. Ex.: When $X = 150$, $Y = 100$, $Z = 300$, % value = $(150 - 100) \div (300 - 100) \times 100 = 25$
Bit output	OFF when contact input = OFF
	The pulse per hour calculated as follows is output when contact input = ON. Pulses/h = 1000 × (% value ÷ 100) However, note that the % value is calculated by numerical output. Ex.: When X = 150, Y = 100, Z = 300, % value = (150 - 100) ÷ (300 - 100) × 100 = 25 Pulses/h = 1000 × (25 ÷ 100) = 250 Contact input Bit output is OFF when contact input is OFF Pulse width Pulse width Pulse width Pulse cycle : Pulse cycle : Pulse cycle Pulse cycle Pulse cycle(s) = 3600 ÷ pulses/h
Error output	Condition for ON
	A setting for inputs 1 to 4 is invalid
	• Input 2 = input 3
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.



- C7G and C40B integration pulse output I calculations are different. Details are as follows.
 - Numerical operation specifications of the C40B

The C40B converts input H1 into the number of pulses per hour through calculation using a fixed coefficient, 1000, and coefficient P1, and outputs the result.

The unit of H1 and P1 is %.

Number of pulses/h = $1000 \times (P1 \div 100) \times (H1 \div 100)$

• Replacing C40B input with C7G input

Replace H1 (%) with X (input).

If the unit of X (input) is not %, configure as shown below.

Y = Input low limit

 $Z = 1000 \div \text{high limit of the number of pulses} \times (\text{input high limit } - \text{input low limit}) + \text{input low limit}$

If the unit of X (input) is %, configure as shown below.

Y = 0

 $Z = 1000 \div \text{high limit of the number of pulses} \times 100$

Ex.: Configuration using the C40B

When connected to H1 (%), analog input in the 0–2000 range is scaled to 0–100 %.

When P1 (%) = 40 %, the high limit of the number of pulses for the analog input range is 400 pulses/h, calculated as follows using the fixed coefficient $1000: 1000 \times 40 \div 100 = 400$.

Configuration using the C7G

The C7G connects an analog input in the 0–2000 range to X without converting it to %.

Y is set to the input low limit (0).

Z is set to $1000 \div \text{high limit}$ of the number of pulses × (input high limit – input low limit) + input low limit (i.e., $1000 \div 400 \times 2000 + 0$) = 5000.

• Replacing C40B calculation with C7G calculation

An example of a calculation that follows the above configuration example is given below.

Ex.: C40B operation

When the scaling range is 0–2000 and the analog input is 1500, H1 = 75 % Number of pulses/h = $1000 \times (P1 \div 100) \times (H1 \div 100)$

 $= 1000 \times 0.4 \times 0.75 = 300 \text{ pulses/h}$

Configuration using the C7G

When analog input is 1500, X = 1500

% value = $(X - Y) \div (Z - Y) \times 100 = (1500 - 0) \div (5000 - 0) \times 100 = 30$ %

Number of pulses/h = $1000 \times (\% \text{ value} \div 100) = 1000 \times 0.3 = 300 \text{ pulses/h}$

• Integration pulse output II

Operation type No.	18
Input 1	(Numerical value) X (input %). Regarded as 0 if the value is negative.
Input 2	(Numerical value) Y (input range per hour). 0 to 32000
Input 3	(Numerical value) Z (weight of one pulse). 0 < Z ≤ 32000
Input 4	(Numerical value) Pulse width (\times 0.1 s). Pulse width = sampling
	cycle when the value is 0 or smaller.
Contact input	(Bit) Numerical output = 0 and bit output = OFF when this value is ON.
Numerical output	0
Bit output	OFF when contact input = ON
	• The pulse per hour calculated as follows is output when contact input = OFF. Pulses/h = $(X \div 100) \times (Y \div Z)$ Ex.: When $X = 50$, $Y = 20000$, $Z = 200$, Pulses/h = $(50 \div 100) \times (20000 \div 200) = 50$ Contact input Bit output is OFF when contact input is OFF when contact input is ON Pulse width Pulse width Pulse width Pulse cycle Pulse cycle Pulse cycle Pulse cycle Pulse cycle
Error output	Condition for ON
	A setting for inputs 1 to 4 is invalid
	• The actual value of the number set for input 2 is outside the 0–32000 range
	The actual value of the number set for input 3 is 0 or less, or 32000 or more
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.



- The C7G and C40B have the same integration pulse output II operation. Details are as follows.
 - Numerical operation specifications of the C40B The C40B converts input H1 into the number of pulses per hour through calculation using input range H2 and pulse weight P1 and outputs the result. The unit of H1 is %.

Number of pulses/h = (H1 \div 100) × (H2 \div P1)

• Replacing C40B input with C7G input

Replace H1 (%) and H2 (input range per hour) with X (input %) and Y (input range per hour), respectively.

Replace P1 (weight = one pulse) and P2 with Z (weight = one pulse) and the contact input, respectively.

• Replacing C40B calculation with C7G calculation

When you replace the inputs of the calculation in the C40B as described above, the result is as follows. This is the same operation as in the C7G. Number of pulses/h = $(X \div 100) \times (Y \div Z)$

Logarithm

Operation type No.	19
Input 1	(Numerical value) X (input)
Input 2	Not used
Input 3	Not used
Input 4	Not used
Contact input	(Bit) Switching between operations
Numerical output	• log ₁₀ X when contact input = OFF
	• log _e X when contact input = ON
Bit output	Always OFF
Error output	Condition for ON
	The setting of input 1 is invalid
	• Input 1 ≤ 0
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.

Exponent

Operation type No.	20
Input 1	(Numerical value) X (input)
Input 2	Not used
Input 3	Not used
Input 4	Not used
Contact input	(Bit) Switching between operations
Numerical output	• 10 ^X when contact input = OFF
	• e ^X when contact input = ON
Bit output	Always OFF
Error output	Condition for ON
	The setting of input 1 is invalid
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.

Derivation

Operation type No.	21
Input 1	(Numerical value) X (input)
Input 2	(Numerical value) T ₁ (lead time) 0 to 3600 (s)
Input 3	(Numerical value) T ₂ (lag time) 0 to 3600 (s)
Input 4	Not used
Contact input	(Bit) Switching between operations
Numerical output	• 0 when contact input = ON
·	The following calculation result when contact input = OFF
	Output = $\frac{T_1 \cdot S}{1 + T_2 \cdot S}$ × input (T1: lead time, T2: lag time, S: Laplace operator)
	Output when T1 \geq T2 Input Output when T1 \leq T2 Input Output when T1 \leq T2 Time When the sampling cycle is TS, the internal calculation uses the following formula. Output = $\frac{T_2}{T_S + T_2} \times \text{last output} + \frac{T_1}{T_S + T_2} \times (\text{input} - \text{last input})$ However, when T1 \geq 16 \times T2, calculation is done as if T1 = 16 \times T2.
Bit output	Always OFF
Error output	Condition for ON
Litor output	A setting for inputs 1 to 3 is invalid
	• The actual value of a number set for inputs 2 to 3 is outside the 0–3600 range
	The contact input setting is invalid
	Condition for OFF
	Supported by MAIN block firmware versions 6.3.x and later when conditions for ON are not met.
Notes	Supported by MAIN block firmware versions 6.3.x and later.

Integral

Operation type No.	22
Input 1	(Numerical value) X (input)
Input 2	(Numerical value) Y
Input 3	(Numerical value) T1 (time) 0 to 3600 (s)
Input 4	Not used
Contact input	(Bit) Switching between operations
Numerical output	• Y when contact input = OFF
	• The result of the following calculation when contact input = ON
	$Output = \frac{Input}{T_1 \cdot S}$
	(T1: time, S: Laplace operator) Output
	Input
	Time
	If the sampling cycle is TS, the internal calculation uses the following formula.
	Output = Last output + $\frac{T_s}{T_1}$ × input
Bit output	Always OFF
Error output	Condition for ON
	A setting for inputs 1 to 3 is invalid
	• The actual value of the number set for input 3 is 0 or less, or 3600 or more
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Supported by MAIN block firmware versions 6.3.x and later.

Dead time

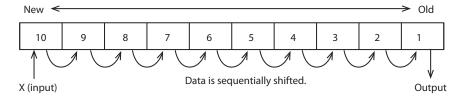
Operation type No.	101
Input 1	(Constant) Number of buffers to be used, –1000 to 1000. Negative
•	numbers are regarded as 0.
Input 2	(Numerical value) X (input)
Input 3	(Numerical value) Dead time (s)
Input 4	Not used
Contact input	(Bit) X is set to the number of all the buffers to be used when this is ON Output is updated by calculation when this is OFF.
Numerical output	X is output when contact input = ON, when the number of
·	buffers to be used ≤ 0, or when the dead time ≤ 0.
	The result of dead time calculation for X is output in other cases.
	The numerical value in X (input) becomes the numerical output after the dead time.
	X (input)
	
	Dead time Dead time Dead time
	Numerical output
	The input and numerical output of X are updated at the
	beginning of the update cycle. X is ignored at other times.
	X at power-on continues to be output from power-on until the dead time elapses.
	The update cycle is the quotient of the dead time divided by the number of buffers to be used or the sampling cycle, whichever is larger
	If the update cycle is not an integer multiple of the sampling cycle, data will not be updated at a fixed cycle because updating will be done in the sampling cycle after the update cycle.
Bit output	Always OFF
Error output	Condition for ON
	A setting for inputs 1 to 3 is invalid
	The total number of buffers used, including those used in other operations, is more than 800
	The contact input setting is invalid
	Condition for OFF
	When conditions for ON are not met
Notes	Ensure that the number of buffers used (including those used in other operations) is 800 or less.
	Changes made to the number of buffers to be used are reflected at the next power-on or restart using the SLP-C7.
	Supported by MAIN block firmware versions 6.3.x and later.



• Operation according to the sampling cycle, the number of buffers to be used, and the dead time setting takes place as follows.

Sampling cycle	Number of buffers to be used	Dead time	Update cycle	Numerical output
10 ms	30	0.3000 s	$0.3 \times 1000 \div 30 = 10 \text{ ms}$	X (input) from 0.3 s ago is updated every 10 ms.
10 ms	20	0.6000 s	$0.6 \times 1000 \div 20 = 30 \text{ ms}$	X (input) from 0.6 s ago is updated every 30 ms.
10 ms	30	0.0000 s	Because the dead time is 0.0 s, the update cycle is 10 ms like the sampling cycle.	X (input) is updated every 10 ms.
10 ms	0	0.3000 s	Because the number of buffers to be used is 0, the update cycle is 10 ms like the sampling cycle.	X (input) is updated every 10 ms.
10 ms	20	0.3000 s	$0.3 \times 1000 \div 20 = 15 \text{ ms}$ When the calculated update cycle (15 ms) is not an integer multiple of the sampling cycle (10 ms), data is not updated at a fixed cycle.	With X (input) at intervals of 10 ms and 20 ms, X (input) from about 0.3 s ago is updated every 10 ms and 20 ms. (The average update interval is 15 ms.)
50 ms	20	0.6000 s	$0.6 \times 1000 \div 20 = 30 \text{ ms}$ Because the sampling cycle (50 ms) is longer than the calculated update cycle (30 ms), the update cycle is 50 ms and the number of buffers to be used is 12, as calculated by $0.6 \times 1000 \div 50$.	X (input) from 0.6 s ago is updated every 50 ms.

- The internal processing of calculations at every update cycle is as follows.
 - (1) The second oldest data becomes the oldest data.
 - (2) Likewise, other data is shifted one by one to become the next older data.
 - (3) X (input) is saved as the newest data.
 - (4) The oldest data is output.
- When 10 buffers are used



Moving average

Operation type No.	102			
Input 1	(Constant) Number of buffers to be used, –1000 to 1000. Negative			
Imput	numbers are regarded as 0.			
Input 2	(Numerical value) X (input)			
Input 3	(Numerical value) Time (s)			
Input 4	Not used			
Contact input	(Bit) X is set to the number of all the buffers to be used when this is ON Output is updated by calculation when this is OFF.			
Numerical output	• X when contact input = ON, when the number of buffers to be used ≤ 0, or when the time ≤ 0.			
	The moving average operation result for X is output in other cases.			
	The arithmetic average of X (input) during the moving average time becomes the numerical output. X (input)			
	Moving average time Numerical output Moving average time Time			
	The input and numerical output of X are updated at the beginning of the update cycle. X is ignored at other times.			
	When the power is turned on, the moving average is calculated assuming that X at power-on has remained the same.			
	The update cycle is the quotient of the time divided by the number of buffers to be used or the sampling cycle, whichever is larger.			
	 The product of the sampling cycle × the number of buffers to be used is used as the moving average time when time ÷ number of buffers to be used < sampling cycle. 			
	If the update cycle is not an integer multiple of the sampling cycle, data will not be updated at a fixed cycle because updating will be done in the sampling cycle after the update cycle.			
Bit output	Always OFF			
Error output	Condition for ON			
	A setting for inputs 1 to 3 is invalid			
	The total number of buffers used, including those used in other operations, is more than 800			
	The contact input setting is invalid			
	Condition for OFF			
	When conditions for ON are not met			
Notes	Ensure that the number of buffers used (including those used in other operations) is 800 or less.			
	Changes made to the number of buffers to be used are reflected at the next power-on or restart using the SLP-C7.			
	Supported by MAIN block firmware versions 6.3.x and later.			

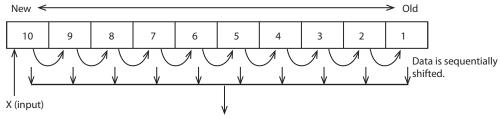


• Operation according to the sampling cycle, the number of buffers to be used, and the moving average time setting takes place as follows.

Sampling cycle	Number of buffers to be used	Time	Update cycle	Numerical output
10 ms	30	0.3000 s	$0.3 \times 1000 \div 30 = 10 \text{ ms}$	With X (input) at intervals of 10 ms, the average between 0.3 s ago and the current time is updated every 10 ms.
10 ms	20	0.6000 s	$0.6 \times 1000 \div 20 = 30 \text{ ms}$	With X (input) at intervals of 30 ms, the average between 0.6 s ago and the current time is updated every 30 ms.
10 ms	30	0.0000 s	Because the time is 0.0 s, the update cycle is 10 ms like the sampling cycle.	X (input) is output every 10 ms.
10 ms	0	0.3000 s	Because the number of buffers to be used is 0, the update cycle is 10 ms like the sampling cycle.	X (input) is output every 10 ms.
10 ms	20	0.3000 s	$0.3 \times 1000 \div 20 = 15 \text{ ms}$ When the calculated update cycle (15 ms) is not an integer multiple of the sampling cycle (10 ms), data is not updated at a fixed cycle.	With X (input) at intervals of 10 ms and 20 ms, the average between about 0.3 s ago and the current time is updated every 10 ms and 20 ms. (The average update interval is 15 ms.)
50 ms	20	0.6000 s	$0.6 \times 1000 \div 20 = 30 \text{ ms}$ Because the sampling cycle (50 ms) is longer than the calculated update cycle (30 ms), the update cycle is 50 ms and the moving average time is 1.0 s as calculated with $50 \times 20 \div 1000$.	With X (input) at intervals of 50 ms, the average between 1.0 s before and the current time is updated every 50 ms.

- The internal processing of calculations at every update cycle is as follows.
 - (1) The second oldest data becomes the oldest data.
 - (2) Likewise, other data is shifted one by one to become the next older data.
 - (3) X (input) is saved as the newest data.
 - (4) The arithmetic average of all the data is output.

• When 10 buffers are used



The arithmetic average is output.

■ When an error occurs

An error will occur if the input type or input value is illegal. The output from operation units when an error occurs is as follows.

Numerical output	0.0
Bit output	OFF
Error output	ON

■ Input type

The table below shows the data No., meaning, and attributes for each input type.

			Attribute		
Input type	Data number	Description	Numerical value	A constant with a value of 0 or more	Bit
Negative integer	-1000 to -1	Integer with the same value as the data No.	0		
0 or greater integer	0 to 1000	Integer with the same value as the data No.	0	0	
Undefined	1001 to 1023				
Standard bit code	1024 to 2047	A standard bit code with the same No. as the data No.			0
Standard numerical code	2048 to 3071	A standard numerical code with the same No. as the data No.	0		
Undefined	3072 to 5000				
Operation result bit	5001 to 5032	A bit output from the operation unit of the No. obtained by subtracting 5000 from the data No.			0
Undefined	5033 to 6000				
Operation result value	6001 to 6032	A numerical value output from the operation unit of the No. obtained by subtracting 6000 from the data No.	0		
Undefined	6033 to 7000				
User-defined bit	7001 to 7032	A user-defined bit code with the No. obtained by subtracting 7000 from the data No.			0
Undefined	7033 to 8000				
User-defined value	8001 to 8032	The user-defined numerical code with the No. obtained by subtracting 8000 from the data No.	0	△*	
Undefined	8033 to 9000				

^{*} The actual value specified by the data No. must be greater than 0.

4-20 CDS (Compact Data Storage)

CDS (compact data storage) is a function that stores health indexes and data such as SP, PV, and MV onto a microSD memory card using our proprietary process data processing technology. Using the data accumulated with CDS, process failures can be predicted and detected.

The specifications of the CDS function may differ depending on the version of the MAIN block firmware. Specifications of older versions (p. 4-157)

■ Recording cycle/operation type

Data is written by CDS in the cycle set in "Recording cycle."

The CDS function operates and records data when the state set in "Operation type" is ON.

The CDS function stops and does not record data if the state set in "Operation type" is OFF or if "0: Stop" is set in "Operation type."

- If the operation type has been set to DI1 or DI2, set the operation type of the applicable DI/DO to DI in the DI/DO bank.
- Changes made to the CDS bank setting during CDS operation are not reflected in CDS operation. The changes will be reflected the next time that CDS operates.

Item (bank)	Display	Description	Initial value
Recording cycle (CDS bank)	MENU > CDS	0: Same as sampling cycle	0
	Recording cycle	1: 0.1 s	
		2: 1 s	
		3: 10 s	
		4: 1 min	
		5: 10 min	
Operation type (CDS bank)	MENU > CDS	0: Stop	0
	Operation type	1: DI1 status	
		2: DI2 status	
		3 and 10: Reserved	
		11: Event 1	
		12: Event 2	
		13: Event 3	
		14: Event 4	
		15: Event 5	
		16: Event 6	
		17: Event 7	
		18: Event 8	
		19: Event 9	
		20: Event 10	
		21: Event 11	
		22: Event 12	
		23: Event 13	
		24: Event 14	
		25: Event 15	
		26: Event 16	
		27 to 1023: Reserved	
		1024 to 2047: Standard bits	
		14-2 Standard Bit Codes and	
		Standard Numerical Codes (p. 14-8)	

■ Data selection

The data type to be recorded by CDS and the recording method are determined by the settings of "Data selection."

• "0: Standard"

Data of the loop selected in [Loop type] setting is recorded. For the data type, types such as PID constant, health index (specific R value, R value), SP, PV, or MV are automatically determined.

If recording continues, and the maximum number of files or the maximum capacity of the microSD memory card is reached, and recording can no longer be done. To continue recording, delete files.

• "1: Custom"

The data set in "Number of data" and "Data 1" to "Data 40" is recorded.

If recording continues, and the maximum number of files or the maximum capacity of the microSD memory card is reached, and recording can no longer be done. To continue recording, delete files.

• "2: Ring"

The data set in "Number of data" and "Data 1" to "Data 40" is recorded.

If recording continues, the maximum number of files will be reached. After that, the oldest file is overwritten so that recording can continue. Even though recording continues, the maximum capacity of the microSD memory card will not be reached. However, if there are any standard or custom files remaining, the maximum capacity may be reached.

Item (bank)	Display	Description	Initial value
Data selection	MENU > CDS	0: Standard	0
(CDS bank)	Data selection	1: Custom	
		2: Ring	

■ Number of data / Data1 to Data40

When the setting of "Data selection" is Custom or Ring, the number of data items and data type can be set. Data 1-40 are valid for the number of items set by "Number of data."

If the setting of "Data selection" is Standard, the number of data items and data type are automatically determined, and the setting of these items is invalid.

Item (bank)	Display	Description	Initial value
Number of data items (CDS bank)	MENU > CDS Number of data	1 to 40	10
Data 1 (CDS bank)	MENU > CDS Data1	1024 to 2047: Standard bit codes 2048 to 3071: Standard numerical codes	1024
Data 2 (CDS bank)	MENU > CDS Data2	14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	1024
Data 3 (CDS bank)	MENU > CDS Data3		1024
Data 4 (CDS bank)	MENU > CDS Data4		1024
Data 5 (CDS bank)	MENU > CDS Data5		1024
Data 6 (CDS bank)	MENU > CDS Data6		1024
Data 7 (CDS bank)	MENU > CDS Data7		1024
Data 8 (CDS bank)	MENU > CDS Data8		1024
Data 9 (CDS bank)	MENU > CDS Data9		1024
Data 10 (CDS bank)	MENU > CDS Data10		1024
Data 11 (CDS bank)	MENU > CDS Data11		1024
Data 12 (CDS bank)	MENU > CDS Data12		1024
Data 13 (CDS bank)	MENU > CDS Data13		1024
Data 14 (CDS bank)	MENU > CDS Data14		1024
Data 15 (CDS bank)	MENU > CDS Data15		1024
Data 16 (CDS bank)	MENU > CDS Data16		1024
Data 17 (CDS bank)	MENU > CDS Data17		1024
Data 18 (CDS bank)	MENU > CDS Data18		1024
Data 19 (CDS bank)	MENU > CDS Data19		1024
Data 20 (CDS bank)	MENU > CDS Data20		1024

Item (bank)	Display	Description	Initial value
Data 21 (CDS bank)	MENU > CDS Data21	1024 to 2047: Standard bit codes 2048 to 3071: Standard numerical codes	1024
Data 22 (CDS bank)	MENU > CDS Data22		1024
Data 23 (CDS bank)	MENU > CDS Data23		1024
Data 24 (CDS bank)	MENU > CDS Data24		1024
Data 25 (CDS bank)	MENU > CDS Data25		1024
Data 26 (CDS bank)	MENU > CDS Data26		1024
Data 27 (CDS bank)	MENU > CDS Data27		1024
Data 28 (CDS bank)	MENU > CDS Data28		1024
Data 29 (CDS bank)	MENU > CDS Data29		1024
Data 30 (CDS bank)	MENU > CDS Data30		1024
Data 31 (CDS bank)	MENU > CDS Data31		1024
Data 32 (CDS bank)	MENU > CDS Data32		1024
Data 33 (CDS bank)	MENU > CDS Data33		1024
Data 34 (CDS bank)	MENU > CDS Data34		1024
Data 35 (CDS bank)	MENU > CDS Data35		1024
Data 36 (CDS bank)	MENU > CDS Data36		1024
Data 37 (CDS bank)	MENU > CDS Data37		1024
Data 38 (CDS bank)	MENU > CDS Data38		1024
Data 39 (CDS bank)	MENU > CDS Data39		1024
Data 40 (CDS bank)	MENU > CDS Data40		1024

■ Screen during CDS operation



- (1) CDS operating icon
 Appears when CDS is operating.
- (2) SD card icon
 Appears when a microSD memory card is inserted in the main unit. Blinks while being accessed.

- Because the operation of the CDS function is only to store data, it does not affect PID control.
- Data is written to the microSD memory card after a certain amount of data is accumulated. If the power is turned OFF before data is written, the accumulated data will be lost. To prevent this, turn off the DI, event, or standard bit selected for the operation type, and wait for the time required to write the accumulated data to the microSD memory card (approx. 1 second) before turning off the power.
- When the SD card icon in the bottom right of the screen is blinking, it is
 preparing to access the microSD memory card, so do not start the CDS
 function at this time.
- Use the microSD memory card only for storing the folders and files generated by this device. Do not use it for storing other folders or files.
- If Data selection is "Ring," do not delete or change the management file.

■ Files

The following table shows the folders and files in the CDS depending on the setting of "Data selection."

Standard microSD memory card CDS BLK: Serial number from 0 to 64 er	Custom Same as on the left XXXX_YYYYY_Z.CSV XXXX_Number of power ON/OFF cycles	Ring Same as on the left LOG LOG: Serial number from 001 to 100 200 20,000 xxx_yyyy.csv xxx: Same as _ in the folder
e CDS BLK: Serial number from 0 to 64 er	Same as on the left Same as on the left xxxx_yyyyy_z.csv xxxx: Number of power ON/OFF cycles	LOG LOG: Serial number from 001 to 100 200 20,000 xxx_yyyy.csv
e CDS BLK: Serial number from 0 to 64 er	Same as on the left Same as on the left Same as on the left xxxx_yyyyy_z.csv xxxx: Number of power ON/OFF cycles	LOG_ _: Serial number from 001 to 100 200 20,000 xxx_yyyy.csv
der 65,000 xxxx_yyyyy_z.dat xxxx: Number of power ON/OFF cycles yyyyy: Number of files created since power ON	Same as on the left xxxx_yyyyy_z.csv xxxx: Number of power ON/OFF cycles	20,000 xxx_yyyy.csv
xxxx_yyyyy_z.dat xxxx: Number of power ON/OFF cycles yyyyy: Number of files created since power ON	xxxx_yyyyy_z.csv xxxx: Number of power ON/OFF cycles	xxx_yyyy.csv
xxxx: Number of power ON/OFF cycles yyyyy: Number of files created since power ON	xxxx: Number of power ON/OFF cycles	
z: File division classification (0: first file, 1: following file)	yyyyy: Number of files created since power ON z: File division classification (0: first file, 1: following file)	name. yyyy: Serial number from 0001 to 0200
No management file	Same as on the left	xxx_yyyy.last xxx_yyyy: Same as the name of the last written file.
e Approx. 2 MB	Same as on the left	Approx. 192 KB
Characters: Shift-JIS (ASCII) Linefeed: CR+LF (hexadecimal 0D and 0A) Delimiter: , (hexadecimal 2C) Decimal point: , (hexadecimal 2F)	Same as on the left	Same as on the left
	None	Same as on the left
Consists of the context section and time sequence data section. "Sections (Standard)" table	Consists of the header section and data section. "Section (Custom and Ring)" table below	Same as on the left
10 data items × number of loops	Selected from "1 to 40."	Same as on the left
Records diagnostic data for enabled loops, including the PID constant, health index (specific R value, R value), SP, PV, and MV. "Sections (Standard)" table	Selected from "standard bit code and standard numerical code." 14-2 Standard Bit Codes and Standard Numerical Codes	Same as on the left
	Characters: Shift-JIS (ASCII) Linefeed: CR+LF (hexadecimal 0D and 0A) Delimiter: , (hexadecimal 2C) Decimal point: . (hexadecimal 2E) Included* Consists of the context section and time sequence data section. "Sections (Standard)" table below 10 data items × number of loops Records diagnostic data for enabled loops, including the PID constant, health index (specific R value, R value), SP, PV, and MV.	Characters: Shift-JIS (ASCII) Linefeed: CR+LF (hexadecimal 0D and 0A) Delimiter: , (hexadecimal 2C) Decimal point: .(hexadecimal 2E) Included* Consists of the context section and time sequence data section. "Sections (Standard)" table below 10 data items × number of loops Records diagnostic data for enabled loops, including the PID constant, health index (specific R value, R value), SP, PV, and MV. "Sections (Standard)" table "Sections (Standard)" table "Sections (Standard)" table "Selected from "1 to 40." Selected from "standard bit code and standard numerical code." 14-2 Standard Bit Codes and Standard

Itama			"Data selection" setting			
Item		Standard	Custom	Ring		
Recording operation	Recording cycle	Selected from "Same as sampling cycle, 0.1 s, 1 s, 10 s, 1 min, and 10 min."	Same as on the left	Same as on the left		
	Start and stop	Selected from "DI1 to 2, events 1 to 16, and standard bit code" 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	Same as on the left	Same as on the left		
	Alarm concerning the number of files and capacity	ng An SD card error alarm is issued in Same as on the		No alarm occurs as the oldest file is rewritten (however, if files recorded by standard or custom recording remain, an alarm may be issued).		

^{*} It is necessary to configure the settings for the health index.

Start the CDS and health index at the start of batch processing, and stop the CDS and health index when batch processing ends.

4-21 Health Index (p. 4-158)

Sections (Standard)

Section	Data	Notes
Context section (From Section Context to SectionEnd)	P (Proportional band) I (Integral time) D (Derivative time) OL (MV low limit)	Records the setting when CDS starts.
SectionEndy	OH (MV high limit) SP high limit	
	Specific R value	Normalization responsiveness (Kp/Tp)
	(Diagnostic parameter)	(Gain is defined as Kp and time constant as Tp in the transfer function.)
		Calculated from the data when the PV is rising during batch processing.
		Records the definite value when CDS ends.
Time sequence data section	Timestamp	Year/Month/Date Hour:Minutes:Seconds. Milliseconds
	SP	
(From Section TemporalData	PV	
to SectionEnd)	MV	
,	R value	
(Updated in each recording cycle)	DT5	Varies depending on the type of output block to which the MV is assigned.
		AO-C block: RMS current (CT)
		V-P block: RMS current (CT1)
		Other than the above: Fixed at 0
		(Fixed at 0 when Heat MV or Cool MV is assigned)
	DT6	Varies depending on the type of output block to which the MV is assigned.
		AO-C block: RMS voltage (VT)
		V-P block: RMS current (CT2)
		Other than the above: Fixed at 0
		(Fixed at 0 when Heat MV or Cool MV is assigned)
	DT7	Varies depending on the type of output block to which the MV is assigned.
		AO-C block: Actuator (heater) resistance
		(Calculated using the CT input current and the VT
		input voltage)
		Other than AO-C block: Fixed at 0
	DT8	Fixed at 0
	DT9	
	DT10	

Section (Custom and Ring)

Section	Data	Notes
Header section	Data number	Standard bit code, standard numerical code
(Rows 1 and 2)	Data name	
Data section	Timestamp	Year/Month/Date Hour:Minutes:Seconds. Milliseconds
(Row 3 and later)	Data	

Health index

Diagnostic operation	Start and stop	Selected from "DI1 and 2, events 1 to 16, and standard bit code" (set for each loop).
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)
	Graph display	The health index graph bank displays the last 10 specific R values (diagnostic parameters) for each control loop as points and numbers on a graph.
Setting	R value scale	0 to 10 (specifies the result of calculation \times a power of 10)
	Ideal data	0.0000 to 32000
	Deviation low limit	0.0000 to 32000 (no low limit if 0.0000)
	Deviation high limit	0.0000 to 32000 (no high limit if 0.0000)
	SP high limit	-32000 to +32000

4-21 Health Index (p. 4-158)

! Handling Precautions

• The bit (ON/OFF) data is also stored with a decimal point.

When ON: 1.000000 When OFF: 0.000000

- Some models of this device include a clock function and some do not.
- For models without a clock function, the date and time in the file attributes and the date and time in the timestamp for the time sequence section indicate the time that has elapsed after the device's power was turned on.

 The power-on date and time is "2000/1/1 00:00:00" (YYYYMMDD HH:MM:SS). Although data is stored in chronological sequence in a single file, when the power is turned on again, the date and time will be reset, and further data will be stored in a new file. For this reason, it is not possible to determine which file is newer. However, if the date and time of this device are corrected, the date and time will be up to date until the unit power is turned off, and the corrected date and time will also be applied to the time stamp in the time sequence section.

Determine which file is newer by the file name.

For model numbers with a clock function, the date and time in the file
attributes and the date and time in the timestamp for the time sequence
section are based on the calendar timer in the CLOCK block of this device. The
calendar timer is backed up by a battery for use when the device power is shut
off. Determine which file is newer by the date and time in the file attributes
and the file name.

- If the power is turned OFF while the CDS function is operating, or if data is written until the microSD memory card is full, a file will be created without updating the data in the context section and without writing "SectionEnd" in the time sequence section.
- If data is written until the microSD memory card is full, the last section of the data may be lost or an error may result. As long as the time stamps are arranged correctly in the time sequence data section, this section is recorded correctly.
- When the microSD memory card capacity is full, an alarm will be generated.
 Delete unneeded files on the microSD memory card as appropriate. File operations cannot be done from the display unit of this device. Either perform file operations using the SLP-C7 Smart Loader Package, or remove the microSD memory card and use a PC to delete data.
- If an alarm occurs, the data has not been saved correctly, and is corrupted.
- Do not format the microSD memory card.

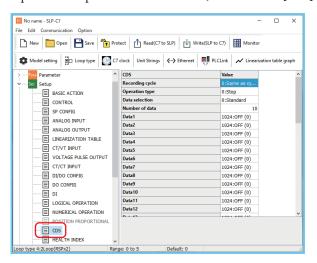


- Chapter 11. Maintenance and Troubleshooting and Block alarm screen (p. 11-2)
- This device does not specify time with the accuracy required for use as a data logger.
- Use the microSD memory card that was included with this device or the one listed in the Optional Parts.

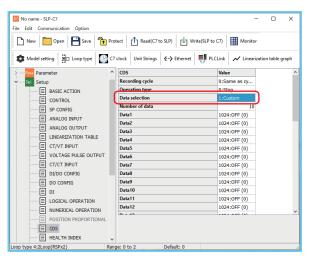
■ Customizing the number of data items and data types

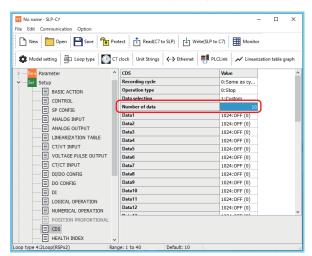
Data is customized using the parameter settings of the display unit or using the parameter settings of the SLP-C7 Smart Loader Package. An example is presented here using the SLP-C7 screen.

(1) Open the setup screen of the SLP-C7, and click the [CDS] icon.



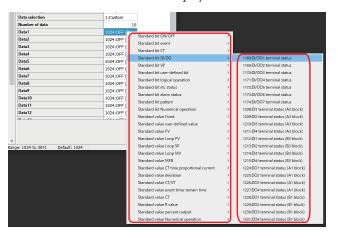
(2) Set "1" for "Data selection."



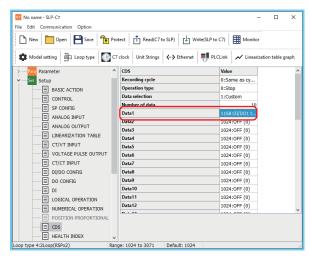


(3) Set the number of data items (1 to 40) for "Number of data."

(4) When you right-click the setting field of Data1, lists of standard bit codes and standard numerical codes are displayed.



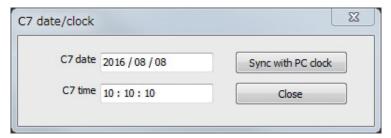
(5) Click the target value in the list to enter the standard bit code or standard numerical code for the setting value. This method of setting is available for the actual number of data items only.



■ Setting the date and time by the SLP-C7

The date and time can be set from the parameters of the device display unit and from the SLP-C7 Smart Loader Package. The setting procedure using the SLP-C7 is shown below.

- (1) Open the setup screen of the SLP-C7.
- (2) Clicking [C7 clock] on the toolbar opens the screen shown in the figure below.



- (3) Clicking [Sync with PC clock] sets the C7 to the same date and time as the PC.
- (4) Click [Close] to close the screen.

- For model numbers without a clock function, the date and time are initialized
 when the power is turned on again, and the clock is accurate within about 5
 seconds/day. To ensure that the date and time are accurate, set the date and
 time as needed.
- For models with a clock function, the date and time are retained when the power is turned on again, and the clock is accurate to within about 65 seconds/month. Set the date and time as needed.
- If the version of the MAIN block firmware is earlier than 3.x.x (where x stands for any number), the date and time cannot be set from the device display unit. In this case, set the time using the SLP-C7 Smart Loader Package.

■ microSD memory card operations from SLP-C7

Using a PC running the SLP-C7 Smart Loader Package, files on the microSD memory card can be transferred to the PC or deleted while the microSD memory card is loaded in the main unit. The procedure is as follows.

- (1) Open the [Health Index] screen of SLP-C7.
- (2) Clicking [SD Card] on the toolbar opens the screen shown in the figure below.



Clicking the [SD card identification] button displays the available space on the microSD memory card and the CDS data folders.

- (3) The folder on the PC where the data is transferred can be changed by clicking the folder icon at the right end of the destination folder field.
- (4) Select the folder where the files will be transferred from the CDS data folder list, click the [Start move] button to open the transfer operation screen, and then follow the onscreen instructions. The file transfer process may take some time to complete. A transfer in progress can be canceled. If the transfer process is canceled, the already transferred files will be on the PC, and the untransferred files will remain on the microSD memory card.
- (5) Click [All Delete] to delete all folders and files on the microSD memory card. This opens the delete operation screen. Follow the onscreen instructions.

- Operations involving the microSD memory card cannot be done while the CDS function operating.
- Do not start using the CDS function while the microSD memory card is being used.
- The time stamp of a file transferred to the PC will be the date and time of the transfer.

■ Specifications of older versions

Older versions of the MAIN block firmware have specifications that are different from those of the current version described in the following table.

Version (x stands for any number)	Difference from the current specifications
5.x.x	Ring recording is not available.
	• "2: Ring" cannot be selected in Data selection.
	• When Data selection is set to "0: Standard" and the recording cycle is set to 10 ms, and when a loop type with two or more loops is set, the recording cycle is automatically set to 50 ms.
	• When Data selection is set to "1: Custom" and the recording cycle is set to 10 ms, and when the number of data items is more than 10, only 10 data items from Data1 to 10 are recorded.
	When Data selection is set to "1: Custom," the file name is "XXXYYYYZ.csv."
	XXX: Number of power ON/OFF cycles of the equipment (hexadecimal)
	YYYY: Number of CDS files created since power ON (hexadecimal)
	Z: File division classification (0: first file, 1: following file)
	There is no data number in the header line of files recorded by custom recording.
4.x.x	Ring and custom recording are not available.
	• The setting items "Data selection," "Number of data," and "Data1" to "Data40" are not available.
	• When the recording cycle is set to 10 ms and a loop type with two or more loops is set, the recording cycle is automatically set to 50 ms.
3.x.x	Ring and custom recording are not available.
	• The setting items "Data selection," "Number of data," and "Data1" to "Data40" are not available.
	• When the recording cycle is set to 10 ms and a loop type with two or more loops is set, the recording cycle is automatically set to 50 ms.
	• The power-on date and time is "2014/1/1 00:00:00 (YYYYMMDD HH:MM:SS)."
	The date and time cannot be set from the device display unit.
	The CDS cannot be started using events 9 to 16 or standard bit codes.
2.x.x	Ring and custom recording are not available.
	• The setting items "Data selection," "Number of data," and "Data1" to "Data40" are not available.
	When the recording cycle is set to 10 ms and a loop type with two or more loops is set, the recording cycle is automatically set to 50 ms.
	• The power-on date and time is "2014/1/1 00:00:00 (YYYYMMDD HH:MM:SS)."
	The date and time cannot be set from the device display unit.
	The CDS cannot be started using events 1 to 16 or standard bit codes.

4-21 Health Index

The health Index is a function that uses our proprietary process-data processing technology to convert the process status to numerical values. The CDS (compact data storage) can be used to store the health index on a microSD memory card.

The health index includes the following elements.

- R value
- Specific R value

■ R value

The R value for each sampling cycle is calculated using the process gain (Kp) and delay (Tp) obtained from PID control calculation and the referencing of models.

$$R = Kp/Tp$$

To use R as a health index, start the CDS function at the start of a batch process, and stop the CDS function at the end of the batch process. An R value that represents the characteristics of the process is specified for one batch process. This is called the specific R value.

By comparing the specific R value that was determined when the process was healthy with the current specific R value, it may be possible to predict equipment failure.

■ Settings

Health index operation can be set for each control loop.

Item (bank)	Display	Description	Initial value
Operation type (Health index bank)	MENU > HealthIndex Operation type	0: Stop 1: DI1 status 2: DI2 status 3 to 10: Reserved 11: Event 1 12: Event 2	0
		13: Event 3 14: Event 4 15: Event 5 16: Event 6 17: Event 7 18: Event 8 19: Event 9 20: Event 10 21: Event 11 22: Event 12 23: Event 13 24: Event 14 25: Event 15 26: Event 16 27 to 1023: Reserved 1024 to 2047: Standard bits	
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	

Item (bank)	Display	Description	Initial value
R value scale (Health index bank)	MENU > HealthIndex R value scale	0 to 10	4
Ideal data (Health index bank)	MENU > HealthIndex Best data	0.0000 to 32000	0.0000
Deviation low limit (Health index bank)	MENU > HealthIndex Deviation low limit	0.0000 to 32000 No low limit when 0.0000	0.0000
Deviation high limit (Health index bank)	MENU > HealthIndex Deviation high limit	0.0000 to 32000 No high limit when 0.0000	0.0000
SP high limit (SP configuration bank)	MENU > SP Config SP high limit	-32000 to +32000	32000

! Handling Precautions

- The R value scale is the power of 10 by which to multiply the R value. For
 example, "4" means 10 to the fourth power, that is, multiplied by 10000. The
 range of R value varies greatly depending on the characteristics of the process
 to be controlled. Try to adjust the R value scale several times so that the R
 value is manageable.
- If the R value becomes too large, it is automatically limited to a 7-digit integer.
- The SP high limit is used as a condition for determining the specific R value. Set this value as close to the SP as possible. If the SP high limit exceeds the SP by a large margin, the specific R value cannot be determined. Therefore, the value remains set at the initial value of 0.0.
- If the operation type has been set to DI1 or DI2, set the operation type of the applicable DI/DO to DI in the DI/DO bank.

Operation

The R value is calculated when the DI or event selected for the operation type is ON.

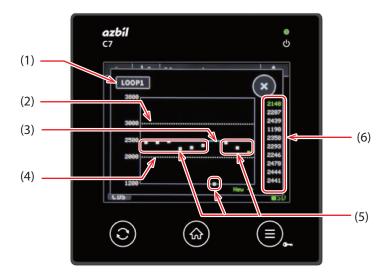
The R value is not calculated if the DI or event selected for the operation type is OFF, or if "0: Stop" is selected for the operation type.

- The health index's function is to calculate the R value and the specific R value only, so it does not affect PID control.
- Depending on the control status, the specific R value may not be identified correctly. Especially before and after a batch process, since the response to the MV is not reflected in the PV, the R value often becomes abnormal, which adversely affects the definition of the R value. For this reason, be sure to start the health index function after a batch process starts and the PV begins to change.

■ Graph display

The health index graph bank displays the last 10 specific R values for each control loop as points and numbers on a graph.

The graph shows the ideal data line, deviation low limit line, and deviation high limit line.



(1) Loop number indicator

Touching this changes the loop number.

(2) Deviation high limit

This line shows the value of the ideal data plus the deviation high limit.

(3) Ideal data

This line shows the ideal data.

(4) Deviation low limit

This line shows the deviation low limit subtracted from the ideal data.

(5) Latest specific R value points

This shows the last 10 specific R values. The value at the right end is the latest value.

(6) Specific R values

This shows the last 10 specific R values. These are the latest data values.

! Handling Precautions

• If the power is turned off and then on again, the specific R value data is deleted, and so the graph points and values are no longer displayed.

4-22 Display Unit Adjustment

The brightness of the LCD backlight and the position of the touch panel can be adjusted.

■ Brightness adjustment

When the monitor screen is displayed, press \equiv the menu button, and select the Basic Action bank to display the following items.

Item (bank)	Display	Description	Initial value
Brightness	MENU > BasicAction	1 to 5	4
(Basic action bank)	Display intensity	The larger the number, the greater the brightness.	

■ Position adjustment

The touch panel position is adjusted during manufacturing. However, the position may shift over time. If so, adjust the position.

When the monitor screen is displayed, hold down (2) the Change button for 4 seconds or longer to open the touch panel adjustment screen. There are four screens in total.

(1) Touch panel calibration 1 screen



Touch the center of the "+" mark shown in the upper right.

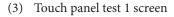
>>The Touch panel calibration 2 screen appears.

(2) Touch panel calibration 2 screen



Touch the center of the "+" mark shown in the lower left.

>>The Touch panel test 1 screen appears.





Touch the center of the "+" mark shown in the upper left.

- >>If touch panel test 1 is successful, the Touch panel test 2 screen appears.

 If the test fails, the screen returns to Touch panel calibration 1 of step 1, and it must be readjusted.
- (4) Touch panel test 2 screen



Touch the center of the "+" mark shown in the lower right.

>>If touch panel test 2 is successful, the Monitor screen is displayed again. If the test fails, the screen returns to the screen for step 1, and adjustment must be performed again.

- Since positional adjustment must be performed precisely, it is better to use a touch pen than your finger.
- To quit in the middle of positional adjustment, press (வ) the Home button.
- After exiting in the middle of positional adjustment, adjustment is invalidated and the screen returns to its status before adjustment.

4-23 Advanced Loop Type Setting

If the advanced loop type setting is enabled for [Loop type], any loop type can be selected regardless of the model number. However, input assignment is required for the PV and RSP. Virtual AIs (analog inputs) can also be used for input assignment. The loop type can be set by the SLP-C7 Smart Loader Package.

■ Loop types

Normally, the implemented analog inputs are assigned to the PV and RSP of each loop without overlapping. The number of analog inputs is different for each model, which means that the selectable loop types differ depending on the model.

However, if the advanced loop type setting is enabled, any loop type can be selected regardless of the model, because the standard numerical codes can be assigned to the PV and RSP instead of to analog inputs, and overlapping of assigned numerical codes is also allowed.

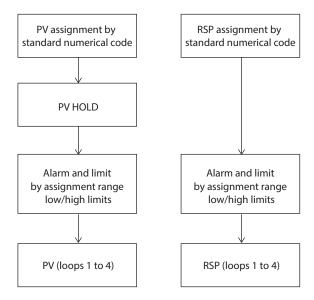


- \$\infty 4-1\$, "Loop Types," Model numbers and loop types (p. 4-1).
- \$\infty\$4-1, "Loop Types," Setting the loop type (p. 4-4).

■ Input assignment

Normally, when a loop type is selected, analog inputs of a certain block are automatically assigned to the PV and RSP.

In the case of advanced loop type setting, the standard numerical codes are assigned to the PV and RSP according to the setting.



● Loop 1

Item (bank)	Display	Description	Initial value
PV assignment (Input assignment bank)	MENU > InputAssignment PV assignment	2048 to 3071: Standard numerical codes	2312
RSP assignment (Input assignment bank)	MENU > InputAssignment RSP assignment		2048
Assignment range low limit (Input assignment bank)	MENU > InputAssignment Assignment range low limit	-32000 to +32000 A maximum of 5 digits, plus 4	0.0000
Assignment range high limit (Input assignment bank)	MENU > InputAssignment Assignment range high limit	digits after the decimal point, can be set.	1000.0

● Loop 2

Item (bank)	Display	Description	Initial value
PV assignment (Input assignment bank)	MENU > InputAssignment PV assignment	2048 to 3071: Standard numerical codes	2313
RSP assignment (Input assignment bank)	MENU > InputAssignment RSP assignment		2048
Assignment range low limit (Input assignment bank)	MENU > InputAssignment Assignment range low limit	-32000 to +32000 A maximum of 5 digits, plus 4	0.0000
Assignment range high limit (Input assignment bank)	MENU > InputAssignment Assignment range high limit	digits after the decimal point, can be set.	1000.0

● Loop 3

Item (bank)	Display	Description	Initial value
PV assignment (Input assignment bank)	MENU > InputAssignment PV assignment	2048 to 3071: Standard numerical codes	2314
RSP assignment (Input assignment bank)	MENU > InputAssignment RSP assignment		2048
Assignment range low limit (Input assignment bank)	MENU > InputAssignment Assignment range low limit	-32000 to +32000 A maximum of 5 digits, plus 4	0.0000
Assignment range high limit (Input assignment bank)	MENU > InputAssignment Assignment range high limit	digits after the decimal point, can be set.	1000.0

● Loop 4

Item (bank)	Display	Description	Initial value
PV assignment (Input assignment bank)	MENU > InputAssignment PV assignment	2048 to 3071: Standard numerical codes	2315
RSP assignment (Input assignment bank)	MENU > InputAssignment RSP assignment		2048
Assignment range low limit (Input assignment bank)	MENU > InputAssignment Assignment range low limit	-32000 to +32000 A maximum of 5 digits, plus	0.0000
Assignment range high limit (Input assignment bank)	MENU > InputAssignment Assignment range high limit	4 digits after the decimal point, can be set.	1000.0

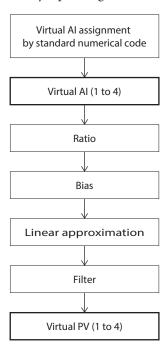
! Handling Precautions

- Items can be set regardless of the number of loops selected by [Loop type] or whether RSP is set or not.
- The input assignment range low limit and high limit work as the PV range in SP limit processing.
- The PV and RSP are limited to ± 10 % of the range defined by the input assignment range low limit and high limit.
- PID control processes the range from the input assignment range low limit to the high limit as 100 % of the proportional band.
- The alarm states of the AI blocks assigned to the PV and RSP are not reflected in the alarm for the loop.
- If the PV and RSP go beyond the range of the input assignment range low limit or high limit, an alarm occurs for the loop.

■ Virtual AI (analog Input)

If the advanced loop type setting is enabled, the application range of the control is widened by assigning the standard numerical codes to the PV and RSP. However, there is a potential problem because the ratio, bias, filter, and linear approximation functions that are available for the analog input are not available for the standard numerical codes. For this reason, virtual AIs to which the standard numerical codes are assigned and virtual PVs to the which the processing of the ratio, bias, filter, and linear approximation is added are made available.

There are four virtual AIs and four virtual PVs. Since virtual AIs and virtual PVs are included in the standard numerical codes, they can be assigned to the PVs and RSPs by input assignment.



● Virtual Al 1 to 4

Item (bank)	Display	Description	Initial value
Virtual Al assignment (Virtual analog input bank)	MENU > Virtual Analog Input Virtual Al assignment	2048 to 3071: Standard numerical codes	2048
Filter (Virtual analog input bank)	MENU > Virtual Analog Input Filter	0.0000: No filter 0.0001 to 120.00	0.0000
Ratio (Virtual analog input bank)	MENU > Virtual Analog Input Ratio	0.0010 to 10.000	1.0000
Bias (virtual analog input bank)	MENU > Virtual Analog Input Bias	-32000 to +32000 A maximum of 5 digits, plus 4 digits after the decimal point, can be set.	0.0000
Linearization table group definition (Virtual analog input bank)	MENU > Virtual Analog Input Linearization table group	0: No linearization 1 to 8: Groups 1 to 8	0

! Handling Precautions

• Virtual Als and virtual PVs do not have an alarm function. Use the alarm triggered by the low and high limits of the assignment range for input assignment.

4-24 Lock and Password

With the [Lock level] setting, the user can prohibit parameters from being shown on the C7 display and from being read or written using the SLP-C7.

In addition, by setting [Password], changing the [Lock level] setting can be prohibited.

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the lock and password function is not available.

setting

Item (bank)	Display	Description	Initial value
Lock level *2 (Lock bank)	MENU > Lock Lock level	0: Disable 1: Parameter lock *1	0
Verification (Lock level)	MENU > Lock Verification	0 to 20 alphanumeric characters and symbols *3	Blank (0 characters)
Password (Lock bank)	MENU > Lock Password	0 to 20 alphanumeric characters and symbols *4	Blank (0 characters)

^{*1.} If [Lock level] is set to "1",

- On the parameter bank menu screen, only [DATE TIME], [LOCK], and [FIRMWARE VERSION] are enabled.
- Parameters of the C7 cannot be read or written from the Setup screen of the SLP-C7.
- *2. The item is always displayed, and the setting can be changed when the same character string is set for [Verification] and [Password].
- *3. The setting can be changed when a different character string is set for [Verification] and [Password]. The [Verification] character string will be reset when the LOCK bank setting screen is opened or when [Password] is set.
- *4. The setting can be changed if the same character string is set for [Verification] and [Password]. It is necessary to enter a new password twice to set the password.

■ Lock and unlock with the password

When locked ([Verification] \neq [Password]), [Lock level] and [Password] cannot be changed but [Verification] cannot be changed.

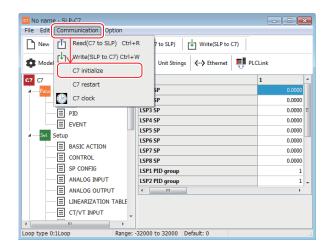
When unlocked ([Verification] = [Password]), [Lock level] and [Password] can be changed but [Verification] cannot be changed.

- If a character string different from that of [Verification] is set for [Password], it will not be possible to change the password.
- If the same character string as that of [Password] is set for [Verification], it will be possible to change the password.
- If [Password] is set to a value other than the default value (0 character) and the LOCK bank setting screen is opened, it will not be possible to change the password.
- If [Password] is set to the default value (0 character) and the LOCK bank setting screen is opened, it will be possible to change the password.

■ Resetting the lock level and password using the SLP-C7

If a password is forgotten, the default setting can be restored by the following procedure.

(1) Open the Setup screen of the SLP-C7.



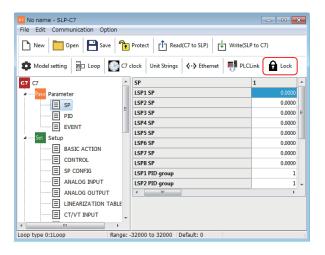
- (2) Click [Communication] \rightarrow [C7 initialize].
 - >>[Lock level] and [Password] will be reset to otheir default values (there will be no password setting).

Handling Precautions

• If [C7 initialize] is executed, not only the password but also the other parameters will be reset.

■ Setting [LOCK level] and [Password] using the SLP-C7

Clicking the [Lock] button on the Setup screen of the SLP-C7 opens the screen for setting [Lock level] and [Password]. Set the desired values. Next, click [Write (SLP to C7)] to write the [Lock level] and [Password] values to the C7 along with the other parameters.



4-25 Feed Forward Fitter (FF-FITTER)

Feed forward fitter (FF-FITTER) is a function for reducing the effects of disturbance on the PV by adding a feed forward (FF) MV to the PID MV. For "Operation type," set the disturbance trigger signal (for example, when the workpiece contacts the heater) as the condition for starting FF-FITTER.

Item (bank)	Display	Description	Initial value
Operation type (FF-FITTER bank)	MENU > FF-FITTER Operation type	0 to 1023: FF-FITTER use prohibited 1024 to 2047: Standard bit codes (FF-FITTER start/stop)	0
T1 (FF-FITTER bank)	MENU > FF-FITTER T1	0.0000 to 3200.0 s	0.0000
T1 MV type (FF-FITTER bank)	MENU > FF-FITTER T1 MV type	0: PID MV 1: Bumpless MV 2: FF1 MV	0
FF1 MV (FF-FITTER bank)	MENU > FF-FITTER FF1	-10.000 to +110.00 %	0.0000
T1a (FF-FITTER bank)	MENU > FF-FITTER T1a	0.0000 to 3200.0 s	0.0000
FF1a MV (FF-FITTER bank)	MENU > FF-FITTER FF1a	-10.000 to +110.00 %	0.0000
T2 (FF-FITTER bank)	MENU > FF-FITTER T2	0.0000 to 3200.0 s	0.0000
FF2 MV (FF-FITTER bank)	MENU > FF-FITTER FF2	-120.00 to +120.00 %	0.0000
T2 PID initialization type (FF-FITTER bank)	MENU > FF-FITTER T2 PID initialization type	0: PID MV 1: PID initial MV	0
T2 PID initial MV (FF-FITTER bank)	MENU > FF-FITTER T2 PID initial MV	-10.000 to +110.00 %	0.0000
FF3 MV (FF-FITTER bank)	MENU > FF-FITTER FF3	-120.00 to +120.00 %	0.0000
AT (FF-FITTER bank)	MENU > FF-FITTER	0: Disabled 1: Enabled	0
T1 AT adjustment factor (FF-FITTER bank)	MENU > FF-FITTER T1 AT adjustment factor	0.0000 to 3200.0	1.0000
T2 AT adjustment factor (FF-FITTER bank)	MENU > FF-FITTER T2 AT adjustment factor	0.0000 to 3200.0	1.0000
AT threshold (FF-FITTER bank)	MENU > FF-FITTER AT threshold	0.0000 to 32000	1.0000
AT FF3 data type (FF-FITTER bank)	MENU > FF-FITTER AT FF3 data type	0: (Maximum + Minimum) ÷ 2 1: Maximum value 2: Minimum value	0
AT status (FF-FITTER bank)	MENU > FF-FITTER AT status	0: Not in progress / ended normally 1: AT is in progress 2: Ended abnormally	0
AT saved value 1 (FF-FITTER bank)	MENU > FF-FITTER AT saved value 1	0.0000 to 3200.0 s	0.0000
AT saved value 2 (FF-FITTER bank)	MENU > FF-FITTER AT saved value 2	0.0000 to 3200.0 s	0.0000
AT saved value 3 (FF-FITTER bank)	MENU > FF-FITTER AT saved value 3	-32000 to +32000	0.0000
AT saved value 4 (FF-FITTER bank)	MENU > FF-FITTER AT saved value 4	-120.00 to +120.00 %	0.0000
AT saved value 5 (FF-FITTER bank)	MENU > FF-FITTER AT saved value 5	-120.00 to +120.00 %	0.0000

! Handling Precautions

- FF-FITTER does not work if a setting within the 0–1023 range is set for "Operation type." Also note that if such a setting is used in place of the disturbance trigger signal turning OFF, switching between FF-FITTER and PID control will not work properly.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the FF-FITTER function is not available.

■ Start and stop

FF-FITTER starts at the rising edge (OFF \rightarrow ON) of the bit set for "Operation type." FF-FITTER ends at the falling edge (ON \rightarrow OFF) of the bit set for "Operation type." If the bit set by "Operation type" is ON when this device is started (at power-on), FF-FITTER does not start.

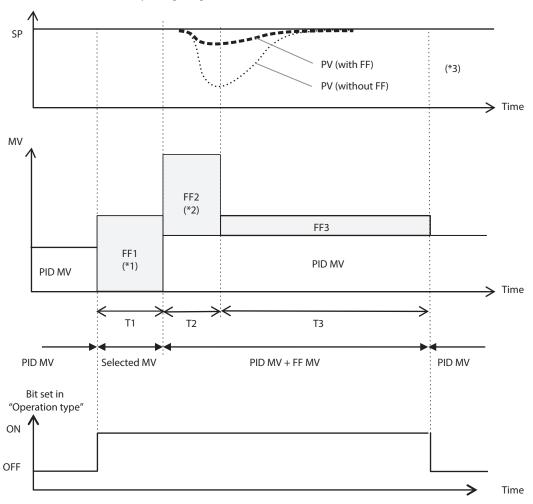
■ Conditions for executing FF-FITTER

FF-FITTER works when all the following conditions are satisfied.

- The control operation is either PID control reverse or direct operation.
- Fixed value output or MV tracking signal output is not selected.
- PID calculation AT or MFB adjustment AT is not in progress.
- "MV if PV is abnormal" is not being output.

■ Standard application

As shown in the figure below, after the bit specified by "Operation type" turns on, the MV set by FF1, FF2, and FF3 is output as FF according to the time set by T1 and T2, thereby mitigating PV fluctuation.



*1. MV type can be selected from three options by the "T1 MV type" setting.

If "0" (PID MV) is set, PID calculation continues.

If "1" (bumpless MV) is set, the PID MV at the beginning of T1 is output as a fixed value.

If "2" (FF1 MV) is set, the MV set by "FF1" is output.

The figure above is an example when "2" (FF1 MV) is selected.

- *2. Bumpless initialization of PID calculation is executed at the beginning of T2.

 MV type can be selected from two options by the "T2 PID initialization type" setting.

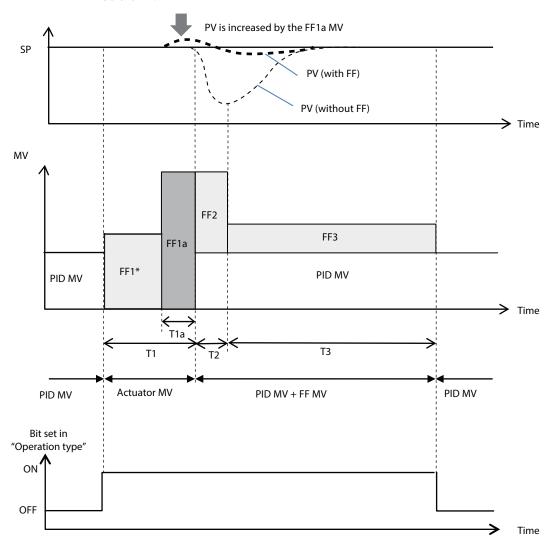
 If "0" (PID MV) is set, initialization is executed with the PID MV immediately before the beginning of T1.

 If "1" (PID initial MV) is set, initialization is executed with "T2 PID initial MV."
- *3. If the disturbance disappears, the PV may change in the opposite direction from when the disturbance occurred. In this case, because the bit set by "Operation type" turns OFF, the FF-FITTER function is disabled and normal PID control is executed.

ltem	Description
T1	Wait time from startup of FF-FITTER until application of FF2 MV If "T1 MV type" is set to "1" (bumpless MV) or "2" (FF1 MV), the effect of fluctuations in the PV or MV before the occurrence of disturbance can be reduced. The shorter T1 is, the faster FF2 MV is applied.
T2	Time during which transient PV fluctuations are canceled with FF2 MV immediately after the occurrence of a disturbance The longer the T2, the stronger the effect of canceling PV fluctuations.
ТЗ	Time during which a change in the control characteristics (shifting of the MV equilibrium point) is canceled during a disturbance Extends from the end of T2 until FF-FITTER stops.
FF1	The MV applied during T1 This setting is valid if "T1 MV type" is set to "2" (FF1 MV).
FF2	The FF MV applied during T2 Use this setting to cancel transient PV fluctuations due to disturbance.
FF3	The FF MV applied during T3 Use this setting to cancel changes in control characteristics (shifts of the MV equilibrium point) due to a disturbance.

■ Advanced use

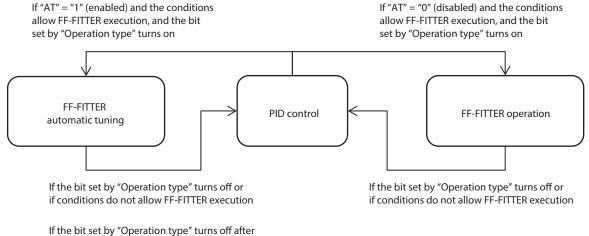
Compared to standard use, fluctuation of the PV can be further reduced by outputting the MV set in FF1a as FF (feed forward) during T1a, which is added before T2.



Item	Description
T1a	Time during which PV fluctuations are canceled by FF1a MV If T1a is not required, set this item to 0.0000 s.
FF1a	The MV applied during T1a If T1a > T1, the FF1 MV is not output, and only the FF1a MV is output.

■ Auto-tuning

FF-FITTER operates differently depending on whether "AT" is set to "0" (disabled) or "1" (enabled). With FF-FITTER automatic tuning enabled, the controller automatically updates the settings of T1, T2, FF2, and FF3 while executing normal PID control.



the T1, T2, FF2, and FF3 settings are calculated with the automatic tuning function, these settings will be updated.

- Use automatic tuning when a disturbance affects the PV.
- During automatic tuning, FF MV is invalid.
- After automatic update of T1, T2, FF2, and FF3, change the "AT" setting to "0" (disabled).



- If T1 is set by automatic tuning, it is the time from the start of FF-FITTER to the start of PV fluctuation. If a shorter time is set for T1 manually after automatic tuning, FF2 MV can be applied earlier.
- If a T2 that is set by automatic tuning is changed manually to a longer time, the effect of canceling PV fluctuations can be enhanced.
- If FF2 is set by automatic tuning, it is set to the maximum value (120 %) or the minimum value (-120 %). By changing the value manually without changing the sign (positive/negative), the effect of canceling PV fluctuations can be weakened.
- By changing the FF3 setting manually without changing the sign (positive/negative), the effect of canceling PV fluctuations can be adjusted.
- "T1 AT adjustment factor" and "T2 AT adjustment factor" are used to calculate T1 and T2 in automatic tuning. Use the initial values under normal circumstances.
- "AT threshold" is the change width (absolute value) for detecting a change in the PV in automatic tuning. Use the initial value under normal circumstances.

- "AT FF3 data type" is the type of MV that is used to calculate FF3 in automatic tuning. Use the initial value under normal circumstances.
- "AT status" is for operation checking and is automatically updated. The value cannot be changed manually.
- The values saved in "AT saved value 1" to "AT saved value 5" are for servicing by the manufacturer and are automatically updated. The values cannot be changed manually.

-MEMO-

Chapter 5. Screens

5-1 Monitor Screen and Graph Screen

■ Home screen

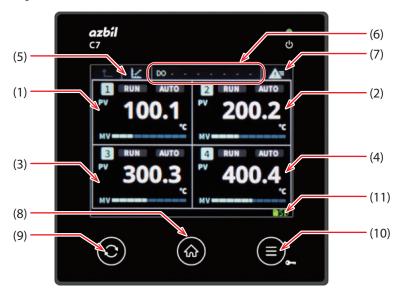
The Home screen varies in appearance depending on the number of loops controlled.

The number of loops is determined by "loop type," which is set using the SLP-C7 Smart Loader Package.

For 4 loops

The Home screen is a multi-loop monitor screen, separated into four loop displays in the four quarters of the screen.

Touching the display area of any loop shows the 1-loop monitor screen for that loop.



(1) to (4) Separate monitor displays for loops 1 to 4

The PV (numeric value), MV (bar graph), RUN/READY mode, and AUTO/MANUAL mode is shown for loops 1 to 4.

If auto tuning (AT) is started, the AT progress graph is displayed instead of the MV. The LSP/RSP mode is not displayed.

When the area of any loop is touched, the display changes to the 1-loop monitor screen for that loop.

(5) Graph icon

Touching this icon displays the graph screen.

(6) DO display

Displays the statuses of the DO1 to 7 terminals.

A green number shows ON status, a gray number shows OFF status, and "-" indicates the DI function.

Touching this portion of the screen displays the DI/DO monitor screen.

(7) Alarm 1 icon

The light blue icon shows that there are no alarms.

Touching this icon displays the block alarm screen.

(8) Home button

This button is disabled on the Home screen.

(9) Change button

Pressing this button displays the 1-loop monitor screen for LOOP1.

Holding down this button displays the touch panel calibration screen.

(10) Menu button

Pressing this button displays the parameter bank menu screen.

Holding down the button turns ON the key lock, in which case the parameter bank menu screen cannot be displayed.

(11) SD card icon

Displayed when a microSD memory card is inserted.

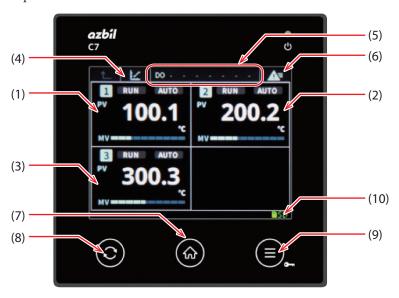
! Handling Precautions

 The figure above shows the screen layout when the "HOME screen layout" setting of the basic action bank is set to "0: Normal." When the setting is changed to "1: Left/right swap," the loop 1 and 2 displays change places, and the loop 3 and 4 displays change places.

For 3 loops

The Home screen is a multi-loop monitor screen, separated into four loop displays in the four quarters of the screen.

Touching the display area of any loop shows the 1-loop monitor screen for that loop.



(1) to (3) Separate monitor displays for loops 1 to 3

The PV (numeric value), MV (bar graph), RUN/READY mode, and AUTO/MANUAL mode is shown for loops 1 to 3.

If auto tuning is started, the AT progress graph is displayed instead of the MV. The LSP/RSP mode is not displayed.

When the area of any loop is touched, the display changes to the 1-loop monitor screen for that loop.

(4)Graph icon

Touching this icon displays the graph screen.

(5) DO display

Displays the statuses of the DO1 to 7 terminals.

A green number shows ON status, a gray number shows OFF status, and "-" indicates the DI function.

Touching this portion of the screen displays the DI/DO monitor screen.

(6) Alarm 1 icon

The light blue icon shows that there are no alarms.

Touching this icon displays the block alarm screen.

(7) Home button

This button is disabled on the Home screen.

(8) Change button

Pressing this button displays the 1-loop monitor screen for LOOP1. Holding down this button displays the touch panel calibration screen.

(9) Menu button

Pressing this button displays the parameter bank menu screen.

Holding down the button turns ON the key lock, in which case the parameter bank menu screen cannot be displayed.

(10) SD card icon

Displayed when a microSD memory card is inserted.

! Handling Precautions

• The figure above shows the screen layout when the "HOME screen layout" parameter setting of the Basic action bank is set at "0: Normal." When the setting is changed to "1: Left/right swap," the screen on which loop portions 1 and 2 are swapped, and loop portion 3 and non-display portion are swapped is displayed. When the setting is changed to "2: Vertically arranged," the loops are sorted and displayed in the order of loop 1, loop 2, and loop 3, from the top.

• For 3 loops: Vertically arranged

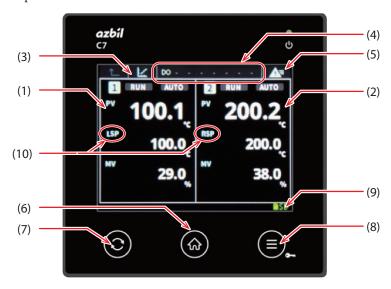
When the "HOME screen layout" setting of the basic action bank is set to "2: Vertically arranged," the three loops on the Home screen appear as shown in the figure below.



For 2 loops

The Home screen is a multi-loop monitor screen, separated into two loop displays located on the left and right sides.

Touching the display area of any loop shows the 1-loop monitor screen for that loop.



(1) to (2) Monitor display by loop

Displays the PV (numeric value), SP (numeric value), MV (numeric value), RUN/READY mode, and AUTO/MANUAL mode of loops 1 to 2.

When the AT is started, the AT progress graph is displayed. The LSP/RSP mode is not displayed.

When the area of any loop is touched, the display changes to the 1-loop monitor screen for that loop.

(3) Graph icon

Touching this icon displays the graph screen.

(4) DO display

Displays the statuses of the DO1 to 7 terminals.

A green number shows ON status, a gray number shows OFF status, and "-" indicates the DI function.

Touching this portion of the screen displays the DI/DO monitor screen.

(5) Alarm 1 icon

The light blue icon shows that there are no alarms.

Touching this icon displays the block alarm screen.

(6) Home button

This button is disabled on the Home screen.

(7) Change button

Pressing this button displays the 1-loop monitor screen for LOOP1.

Holding down this button displays the touch panel calibration screen.

(8) Menu button

Pressing this button displays the parameter bank menu screen.

Holding down the button turns ON the key lock, in which case the parameter bank menu screen cannot be displayed.

(9) SD card icon

Displayed when a microSD memory card is inserted.

(10) SP display (characters)

In the constant value operation mode, "LSP" is displayed in LSP mode, and "RSP" in RSP mode.

In the pattern operation mode, "SP" is displayed.

! Handling Precautions

• The figure above shows the screen layout when the "HOME screen layout" parameter setting of the Basic action bank is set at "0: Normal." When the setting is changed to "1: Left/right swap," the screen on which loop portions 1 and 2 are swapped is displayed. When the setting is changed to "2: Vertically arranged," the loops are sorted and displayed in the order of loop 1 and loop 2, from the top.

• For 2 loops: Vertically arranged

When the "HOME screen layout" setting of the basic action bank is set to "2: Vertically arranged," the two loops on the Home screen appear as shown in the figure below.



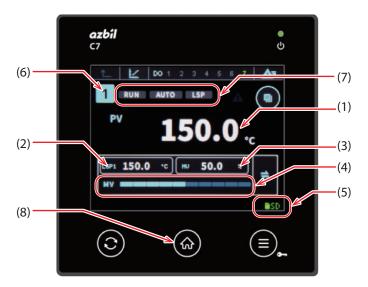
• For 1 loop

The Home screen is the 1-loop monitor screen.

1-loop monitor screen (p. 5-10) (for details on displays and button operation)



■ 1-loop monitor screen



(1) PV display

The decimal point position can be set using the PV decimal point position parameter (Basic action bank).

(2) SP display

The SP type (LSP group number or RSP) is displayed on the left. Touching it displays the SP menu screen. Note that if "Key lock level" (in the basic action bank) is set to "1" and if the keys are locked, the frame of this field disappears and the screen is not displayed when touched.

(3) MV display

Touching this displays the MANUAL mode change screen. Note that if "Key lock level" (basic action bank) is set to "1" and if the keys are locked, the frame of this field disappears and the screen is not displayed when touched.

(4) MV bar graph

The display range is 0 to 100 %.

(5) SD card icon

Displayed when a microSD memory card is inserted.

(6) Loop number

Displays the control loop number.

(7) Mode display

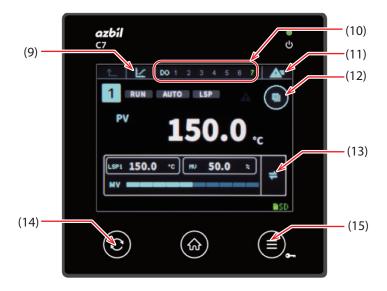
Displays the RUN/READY, AUTO/MANUAL, and LSP/RSP modes.

(8) Home button

Pressing this button returns to the Home screen.

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.



(9) Graph icon

Touching this icon displays the graph screen.

(10) DO display

Displays the statuses of the DO1 to 7 terminals.

A green number shows ON status, a gray number shows OFF status, and "-" indicates the DI function.

Touching this portion of the screen displays the DI/DO monitor screen.

(11) Alarm 1 icon

The light blue icon shows that no alarm occurs. Touching this icon displays the block alarm screen.

(12) Mode button

Touching this icon displays the mode change screen.

Note that if "Key lock level" (in the basic action bank) is set to "1" and if the keys are locked, the mode button turns dark gray and the screen is not displayed when touched.

(13) View change button

Touching this icon changes the display. Available values can be viewed from among the MANUAL MV, Cool MV and Heat MV of heating/cooling control, MFB, CT input, VT input, and resistance calculated from CT input and VT input.

6-1, "Operation Display List" 1-loop monitor screen (p. 6-2).

(14) Change button

Pressing this button displays the monitor screen for the next loop number. After the monitor screen for the last loop number has been displayed, the multi-loop monitor screen is displayed. If there is only one loop, the monitor screen does not change.

Holding down this button displays the touch panel calibration screen.

(15) Menu button

Pressing this button displays the parameter bank menu screen.

Holding down the button turns ON the key lock, in which case the parameter bank menu screen cannot be displayed.

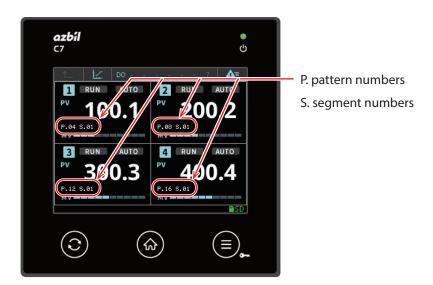
! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.

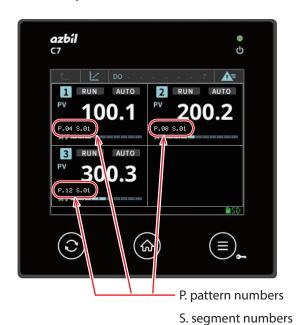
■ Pattern operation monitor screen

In the pattern operation mode, pattern numbers and segment numbers are displayed on the Home screen or 1-loop monitor screen.

For 4 loops



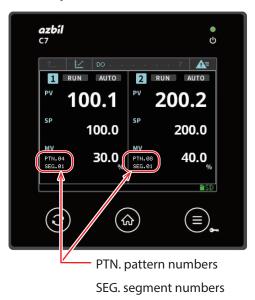
For 3 loops





PTN. pattern numbers SEG. segment numbers

For 2 loops



200.2

PV
100.1

PV
100.0

PTH.04

SEC.01

AUTO

SP 100.0

MV

200.2

PTH.08

SEC.01

AUTO

SP 200.0

MV

SEC.01

PTN. pattern numbers SEG. segment numbers

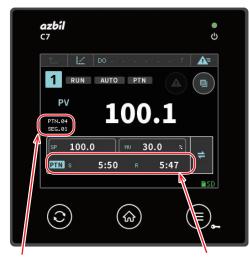
• For 1 loop



PTN. pattern numbers MV

MV bar graph

SEG. segment numbers SEG. seg



PTN. pattern numbers SEG. segment numbers

Specified pattern time and remaining time



PTN. pattern numbers SEG. segment numbers Specified segment time and remaining time

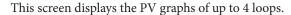


PTN. pattern numbers SEG. segment numbers Specified number of cycles and remaining cycles

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ Multi-loop graph screen





(1) Numeric icon

Touching this icon displays the Home screen.

(2) Left axis button

Shows which loop's PV scale is shown on the left axis of the graph.

Touching this button changes the scale on the left axis to the PV of another loop.

(3) Left axis scale

Displays the PV scale of the loop displayed on the left axis button.

The display range can be set using the graph scaling low limit and graph scaling high limit parameters (in the Graph bank) of this loop.

(4) Right axis button

Shows which loop's PV scale is shown on the right axis of the graph.

Touching this button changes the scale on the right axis to the PV of another loop.

(5) Right axis scale

Displays the PV scale of the loop displayed on the right axis button.

The display range can be set using the graph scaling low limit and graph scaling high limit parameters (in the Graph bank) of this loop.

(6) Graph time axis

The scale of the time axis is 60 times larger than the setting of the recording cycle parameter (in the Graph bank).

If the set value of the recording cycle is a multiple of 60, the scale of the time axis is h (hours)/DIV. In other cases, the scale is min (minutes)/DIV. Example:

- If the recording cycle setting is 30, the scale is 30 min/DIV.
- If the recording cycle setting is 60, the scale is 1 h/DIV.

(7) PV No. buttons

Displays the PV graph color of each loop. Touching this button displays the 1-loop graph screen for the PV No. that was touched.

(8) Change button

Pressing this button displays the 1-loop graph screen for LOOP1.

(9) Home button

Pressing this button displays the Home screen.

(10) Time

Displays the time on the C7.

Other displays and buttons conform to the Home screen.

- This product does not store the graph display data. When the power is turned
 off, the display contents are cleared. After the power has been turned on
 again, the product starts drawing the graph from the left end.
- When using this product with the 1 loop setting, the multi-loop graph screen cannot be displayed.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), time is not displayed.

■ 1-loop graph screen





(1) Numeric icon

Touching this icon displays the 1-loop monitor screen.

(2) Graph left axis

The scale for the PV and SP is the vertical axis on the left.

The display range can be set using the graph scaling low limit and graph scaling high limit parameters (in the Graph bank) of each loop.

(3) Graph right axis

The scale for the MV is the vertical axis on the right. The display range is fixed at $0-100\,\%$.

(4) Graph time axis

The scale of the time axis is 60 times larger than the setting of the recording cycle parameter (in the Graph bank).

If the set value of the recording cycle is a multiple of 60, the scale of the time axis is h (hours)/DIV. In other cases, the scale is min (minutes)/DIV. Example:

- If the recording cycle setting is 30, the scale is 30 min/DIV.
- If the recording cycle setting is 60, the scale is 1 h/DIV.
- (5) Change button

Pressing this button displays the 1-loop graph screen for the next loop number. If this is the last loop number, the multi-loop graph screen is displayed.

(6) Home button

Pressing this button displays the Home screen.

(7) Time

Displays the time on the C7.

Other displays and buttons follow the pattern of the 1-loop monitor screen.

- This product does not store the graph display data. When the power is turned off, the display contents are cleared. After the power has been turned on again, the product starts drawing the graph from the left end.
- If the MAIN block firmware is earlier than version 6.1.x (where x stands for any number), time is not displayed.

■ 1-loop monitor screen in MANUAL mode



(1) MV increase button

Increases the numeric value at the MV numeric change digit (yellow background).

(2) MV decrease button

Decreases the numeric value at the MV numeric change digit (yellow background).

(3) MV digit select button

Selects the MV numeric change digit. The background of the selected digit is displayed in yellow. However, note that the hundreds digit cannot be selected.

(4) [MV] button

Touching this button displays the mode change screen for changing MANUAL to AUTO

Note that if "Key lock level" (in the basic action bank) is set to "1" and if the keys are locked, the frame of this button disappears and the screen is not displayed when touched.

(5) View change button

Touching this icon changes the display.

Other displays and buttons follow the pattern of the 1-loop monitor screen.

! Handling Precautions

- This screen does not display the SP, CT input value, and VT input value. Additionally, there is no button for going directly to the SP menu screen.
- If the firmware version of the HMI block (display unit) is earlier than 4.x.x (where x stands for any number), a [MANUAL] button appears instead of the [MV] button, and there is no view change button.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.

5-19

■ 1-loop monitor screen during AT execution

When the AT is started, the 1-loop monitor screen automatically changes to the 1-loop monitor screen during AT execution.

Additionally, after the AT has been completed, the display returns to the 1-loop monitor screen.



(1) AT progress graph

AT progress is displayed in a graph.

(2) AT stop button

Touching this button stops the AT and returns the display to the 1-loop monitor screen.

Note that if "Key lock level" (in the basic action bank) is set to "1" and if the keys are locked, the frame of this button disappears and the screen is not displayed when touched.

Other displays and buttons follow the pattern of the 1-loop monitor screen.

- Periods of times necessary for the AT progress phases are not equal to each other.
- The right end of the AT progress graph means the AT end phase. However, when the AT is completed, the AT progress graph is not displayed. Therefore, the right end of the AT progress graph is almost never lit.
- This screen does not display the CT input value and VT input value. Additionally, there is no button for going directly to the SP menu screen.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.

■ 1-loop monitor screen when MFB AT is stopped

If a value of 1, 2, or 11 to 14 is set for "Output Type" in the PP (position proportional) bank, the motor drive output status can be displayed by displaying the 1-loop monitor screen of the relevant loop.

The figure below shows the appearance when MFB AT (MFB auto-tuning) is stopped.



(1) Displays the status of MFB AT.

UNTUNED: Auto-tuning has not been done.

TUNED: Auto-tuning has been done.

ERROR: Auto-tuning failed.

(2) Displays the status of motor drive output.

OPEN: OPEN relay status → Lit: ON, Not lit: OFF

CLOSE: CLOSE relay status → Lit: ON, Not lit: OFF

(3) Displays amount of MFB opening.

This displays the amount of MFB opening calculated from the MFB input and adjustment value.

• When "MFB" is light blue and steadily lit: MFB is being measured (not

estimated)

• When "MFB" is yellow and blinking: MFB is being estimated

• Number in white text: MFB input is normal (no wiring

disconnection)

• Number in red text: MFB input wiring disconnection

(4) View Change button

Touching this icon changes the display. This enables viewing of MV graphs and other content.

- If a value other than 1, 2, and 11 to 14 is set for "Output Type" in the PP (position proportional) bank, the motor drive output status is not displayed on the 1-loop monitor screen.
- If the "Control method selection" setting in the PP (position proportional) bank is set to 2 or 3, an MFB input wiring disconnection is not detected, and so the MFB opening value appears white.

■ 1-loop monitor screen during MFB AT

If a value of 1, 2, or 11 to 14 is set for "Output Type" in the PP (position proportional) bank, the motor drive output status can be displayed by displaying the 1-loop monitor screen of the relevant loop.

The figure below shows the screen's appearance during MFB AT (MFB autotuning).



(1) [MFB AT STOP] button

Touching this stops the MFB AT and changes to the MFB AT stopped screen.

Note that if "Key lock level" (in the basic action bank) is set to "1" and if the keys are locked, the frame of this button disappears and the screen is not displayed when touched.

(2) Displays the status of motor drive output.

OPEN: OPEN relay status → Lit: ON, Not lit: OFF CLOSE: CLOSE relay status → Lit: ON, Not lit: OFF

(3) Displays MFB input count.

When MFB AT ends, the counts at the fully-closed position and fully-opened position are saved to "Fully closed MFB count" and "Fully open MFB count" in the PP (positional proportional) bank.

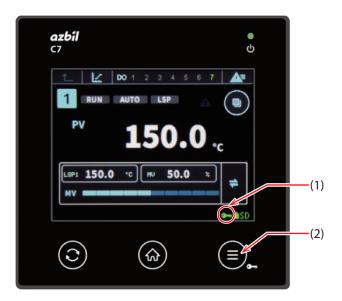
(4) View change button

Touching this icon changes the display. This enables viewing of MV graphs and other content.

- If a value other than 1, 2, and 11 to 14 is set for "Output Type" in the PP (position proportional) bank, the motor drive output status is not displayed on the 1-loop monitor screen.
- If the "Control method selection" setting of the PP (position proportional) bank is set to 2 or 3, MFB AT is not executed.

- If an MFB input wiring disconnection is detected, MFB AT does not start. Also, if an MFB input wiring disconnection is detected after starting MFB AT, the MFB AT process is stopped.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.

■ Screen at key lock



(1) Key lock icon

Displayed when the key lock is ON.

(2) Menu button

Holding down this button cancels the key lock status, allowing you to perform the button operation.

- The parameter bank menu screen cannot be displayed in the key lock status.
- Even in the key lock status, you can change the display on the monitor screen, switch between the monitor and graph screens, and display the DI/DO monitor and alarm screens.
- If "Key lock level" is set to "0" and if the keys are locked, the screen for changing SP or mode can be displayed and AT or MFB AT can be stopped.
- If "Key lock level" is set to "1" and if the keys are locked, the screen for changing SP or mode cannot be displayed and AT or MFB AT cannot be stopped.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available. Key lock operation is the same as when "Key lock level" is set to "0."
- Even if a screen other than the Home screen is displayed when the keys are locked, the display will revert to the Home screen if the power is turned off and then turned on again or if the the display unit cable is disconnected and reconnected.

■ 1-loop monitor screen if there is an alarm

If an alarm occurs in the displayed loop, the background of the screen is displayed in red.



(1) Alarm 1 icon

The red color shows that there is an alarm. Touching this icon displays the block alarm screen.

(2) Alarm 2 icon

The red color shows that there is an alarm. Touching this button displays the function alarm screen.

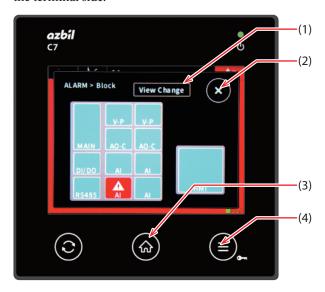
Other displays and buttons follow the pattern of the 1-loop monitor screen.

- If there is no alarm, the alarm 2 icon is displayed in dark gray and disabled.
- The alarm 2 icon is not displayed on the multi-loop monitor screen. To view it, change to the 1-loop monitor screen.
- When at least one of the standard bit codes assigned to 1 to 4 of user-defined alarms turns ON, a user-defined alarm is generated and the alarm 1 icon turns red.
- When a user-defined alarm occurs, the background color of the 1-loop monitor screen for the loop specified for the loop definition of user-defined alarms turns red, and the alarm 2 icon turns red.
- User-defined bit bank (p. 6-31)
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the user-defined alarm function is not available.

■ Block alarm screen

An alarm occurs in the block displayed in red.

This schematically displays the block positions when viewing the main unit from the terminal side.



(1) View change button

Touching this button displays the function alarm screen.

(2) Close button

Touching this button closes the screen and returns the display to the previous screen.

(3) Home button

Pressing this button displays the Home screen.

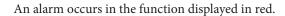
(4) Menu button

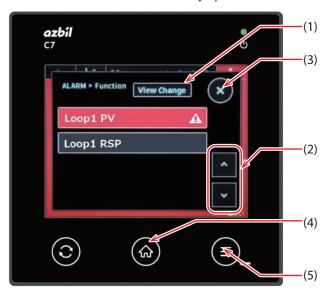
Pressing this button displays the parameter bank menu screen.

Block types and their indicators

Block Type	Indicator
Main	MAIN
DI/DO	DI/DO
RS-485	RS485
Current output	AO-C
Voltage pulse output	V-P
Motor drive output	MOTOR
Analog input	Al
Standard display unit	HMI
Additional display unit	HMI
Clock function	CLOCK
DI	DI
DO	DO

■ Function alarm screen





(1) View change button

Touching this icon displays the block alarm screen.

(2) Next page and previous page buttons

Touching the relevant button displays the function alarm on the next or previous page.

(3) Close button

Touching this button closes the screen and returns the display to the previous screen.

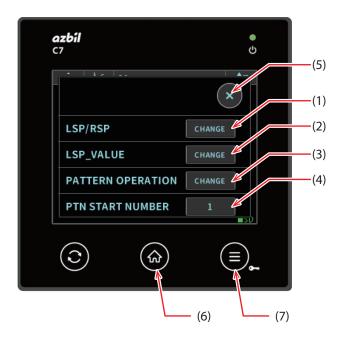
(4) Home button

Pressing this button displays the Home screen.

(5) Menu button

Pressing this button displays the parameter bank menu screen.

■ SP menu screen



(1) LSP/RSP change button

Touching this button displays the LSP/RSP selection screen.

(2) LSP setting change button

Touching this button displays the screen for changing the LSP setting.

(3) Pattern operation change button

Touching this button displays the screen for switching between constant value operation and pattern operation.

This button is not displayed if "Pattern" is set to "0: No pattern" by the SLP-C7 smart loader package.

(4) Patten start number change button

Touching this button displays the numeric keypad screen for entering the pattern start number.

This button is not displayed if "Pattern" is set to "0: No pattern" by the SLP-C7 smart loader package.

(5) Close button

Touching this button closes the screen and returns the display to the monitor screen.

(6) Home button

Pressing this button displays the home screen.

(7) Menu button

Pressing this button displays the parameter bank menu screen.

! Handling Precautions

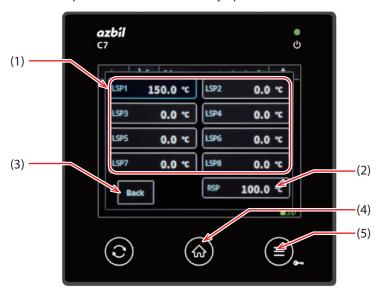
• If the HMI block firmware is earlier than version 6.x.x (where x stands for any

number), the pattern operation change button and patten start number change button are not displayed.

• If the MAIN block firmware is earlier than version 6.x.x (where x stands for any number), the pattern operation function is not available.

■ LSP/RSP select screen





(1) LSP group selection

Touch a desired LSP group to select it. The display does not return to the monitor screen even when this is selected.

(2) RSP selection

Touch this portion to select the RSP. The display does not return to the monitor screen even when this is selected.

(3) [Back] button

Touching this button returns the display to the monitor screen.

(4) Home button

Pressing this button displays the Home screen.

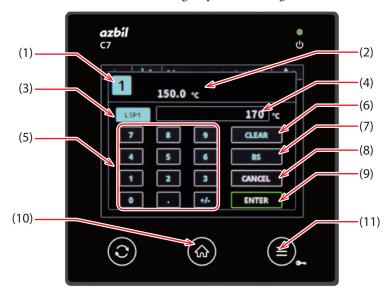
(5) Menu button

Pressing this button displays the parameter bank menu screen.

- The number of LSP system groups displayed may vary between 1 and 8 groups according to the setting for the number of LSP groups (in the SP CONFIG bank).
- When there is no RSP according to the model No. and loop type setting, no RSP is displayed.

■ LSP setting change screen





(1) Loop number

Displays the loop number of the LSP.

(2) SP value

Displays the current set value.

Since the LSP group selection is enabled even in the RSP mode, the SP value of this LSP group is displayed.

(3) LSP group number

Displays the currently selected LSP group number. Since the LSP group selection is enabled even in the RSP mode, this LSP group number is displayed.

(4) Input value

Displays the value that has been input using the numeric keypad. The initial value is 0.

(5) Numeric keypad

Touching the relevant key can input the numeric value or decimal point, or change the sign.

(6) [CLEAR] button

Touching this button clears the input value to 0.

(7) [BS] button

Touching this button clears one character at the right end of the input value. When the input value is only one character, the input value is returned to 0.

(8) [CANCEL] button

Touching this button returns the display to the monitor screen.

(9) [ENTER] button

Touching this button writes the input value to the SP of the LSP group and returns the display to the monitor screen.

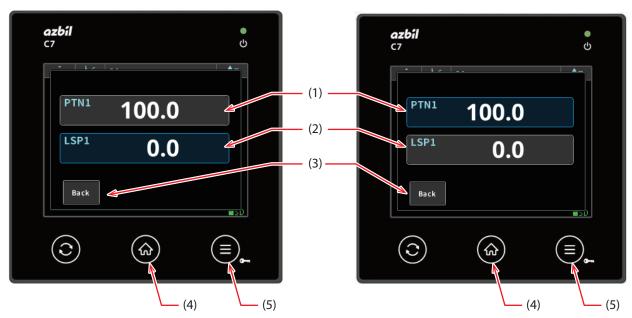
(10) Home button

Pressing this button displays the Home screen.

(11) Menu button

Pressing this button displays the parameter bank menu screen.

- An input value in the range from the SP low limit to the high limit and the PV range is valid. If the input value is invalid, the LSP does not change.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the input value setting range is fixed at "-32000 to +32000."
- Parameter setting: The setting range of the SP for LSP groups 1 to 8 in the SP bank is fixed at "-32000 to +32000."



■ Constant value operation / pattern operation switching screen

(1) Pattern selection button

Touching this button displays the pattern operation mode selection screen. Note that if the button frame is blue, the C7 is already in pattern operation mode, so nothing happens when you touch the button.

The display on the button consists of "PTN," the pattern number, and the SP for the pattern.

(2) Constant value operation selection button

Touching this button displays the constant value operation mode selection screen. Note that if the button frame is blue, the C7 is already in constant value operation mode, so nothing happens when you touch the button.

The display on the button consists of "LSP," the LSP group number, and the LSP; or "RSP" and the RSP.

(3) [Back] button

Touching this button closes the screen and returns the display to the monitor screen.

(4) Home button

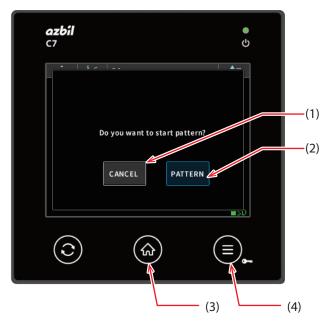
Pressing this button displays the home screen.

(5) Menu button

Pressing this button displays the parameter bank menu screen.

- If the HMI block firmware is earlier than version 6.x.x (where x stands for any number), the constant value operation / pattern operation switching screen is not displayed.
- If the MAIN block firmware is earlier than version 6.x.x (where x stands for any number), the pattern operation function is not available.

■ Pattern operation mode selection screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing the operation mode. The C7 remains in constant value operation mode.

(2) [PATTERN] button

Touching this button changes the mode from constant value operation to pattern operation, and returns the display to the monitor screen.

(3) Home button

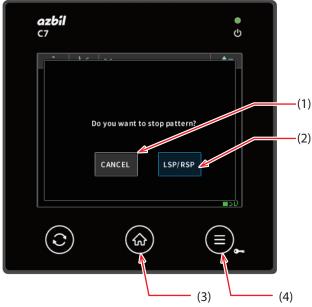
Pressing this button displays the home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

- If the HMI block firmware is earlier than version 6.x.x (where x stands for any number), the pattern operation mode selection screen is not displayed.
- If the MAIN block firmware is earlier than version 6.x.x (where x stands for any number), the pattern operation function is not available.





(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing the operation mode. The C7 remains in pattern operation mode.

(2) [LSP/RSP] button

Touching this button changes the mode from pattern operation to constant value operation, and returns the display to the monitor screen.

(3) Home button

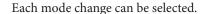
Pressing this button displays the home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

- If the HMI block firmware is earlier than version 6.x.x (where x stands for any number), the constant value operation mode selection screen is not displayed.
- If the MAIN block firmware is earlier than version 6.x.x (where x stands for any number), the pattern operation function is not available.

■ Mode menu screen





(1) AUTO/MANUAL mode display

Touching this portion displays the AUTO/MANUAL change screen.

AUTO display → Screen to change to MANUAL

MANUAL display → Screen to change to AUTO

(2) RUN/READY mode display

Touching this portion displays the RUN/READY change screen. RUN display \rightarrow Screen to change to READY READY display \rightarrow Screen to change to RUN

(3) AT mode display

Touching this portion displays the AT start/stop screen.

START display → AT start screen

STOP display → AT stop screen

(4) [PATTERN] button

Touching this button displays the mode menu screen (pattern).

(5) Close button

Touching this button returns the display to the previous screen.

(6) Home button

Pressing this button displays the Home screen.

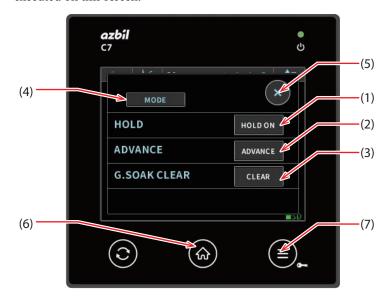
(7) Menu button

Pressing this button displays the parameter bank menu screen.

- The AT mode is not displayed in the MANUAL or READY mode.
- If pattern operation is disabled, the [PATTERN] button is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ Mode menu screen (pattern)

If pattern operation is enabled, operations related to pattern operation can be executed on this screen.



(1) [HOLD ON]/[HOLD OFF]button

Touching this button displays the HOLD mode change screen.

(2) [ADVANCE] button

Touching this button displays the ADVANCE operation screen.

(3) [CLEAR] button

Touching this button displays the G.SOAK clear screen.

(4) [MODE] button

Touching this button displays the mode menu screen.

(5) Close button

Touching this button returns the display to the previous screen.

(6) Home button

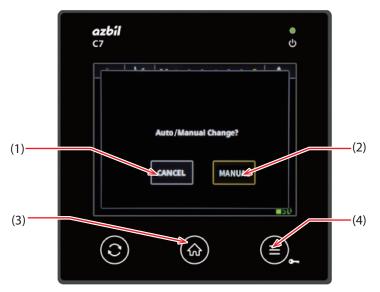
Pressing this button displays the Home screen.

(7) Menu button

Pressing this button displays the parameter bank menu screen.

- In the READY and END modes, the [HOLD ON]/[HOLD OFF]button display becomes dark and touch operation is disabled.
- In the READY and END modes, the [ADVANCE] button display becomes dark and touch operation is disabled.
- If the device is not in a G.SOAK wait, the [CLEAR] button display becomes dark and touch operation is disabled.
- If pattern operation is disabled, the mode menu screen (pattern) is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ AUTO/MANUAL change screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing AUTO/MANUAL.

(2) [MANUAL]/[AUTO] button

Touching this button switches the mode between AUTO and MANUAL and returns the display to the monitor screen.

Selecting MANUAL changes AUTO to MANUAL.

Selecting AUTO changes MANUAL to AUTO.

(3) Home button

Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

■ RUN/READY change screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing RUN/READY.

(2) [READY]/[RUN] button

Touching this button returns the display to the monitor screen with RUN/READY changed.

Selecting READY changes RUN to READY.

Selecting RUN changes READY to RUN.

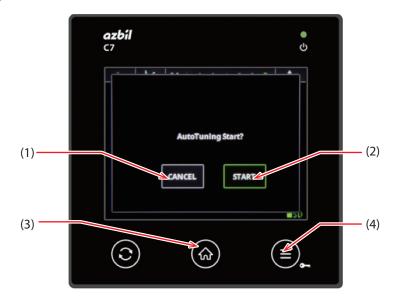
(3) Home button

Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

■ AT start/stop screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing the AT mode.

(2) [START]/[STOP] button

Touching this button changes the AT mode and returns the display to the monitor screen.

Touching the [START] button starts the AT.

Touching the [STOP] button stops the AT.

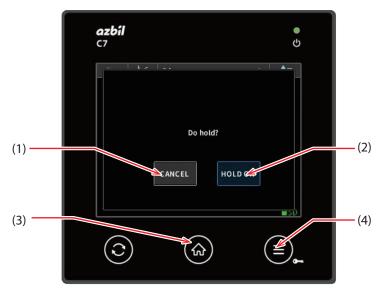
(3) Home button

Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen. \\

■ HOLD mode change screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without changing the HOLD mode.

(2) [HOLD ON] button, [HOLD OFF] button

Touching this button changes the HOLD mode and returns the display to the monitor screen.

Selecting HOLD ON changes HOLD OFF (the non-HOLD mode) to HOLD ON (HOLD mode).

Selecting HOLD OFF changes HOLD ON (HOLD mode) to HOLD OFF (the non-HOLD mode).

(3) Home button

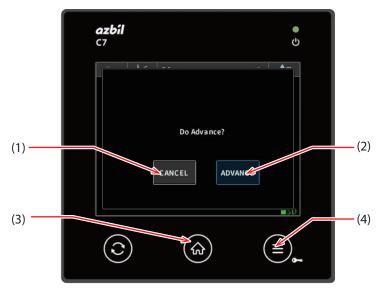
Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

- If pattern operation is disabled, the HOLD mode change screen is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ ADVANCE operation screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without executing ADVANCE.

(2) [ADVANCE] button

Touching this button executes ADVANCE and returns the display to the monitor screen.

Executing ADVANCE steps the operation forward to the start of the next segment.

(3) Home button

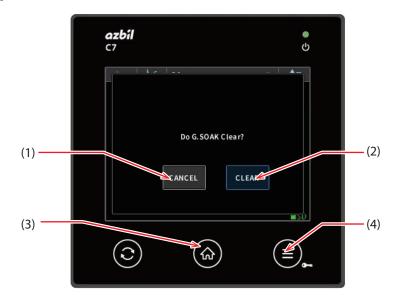
Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

- If pattern operation is disabled, the ADVANCE operation screen is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ G.SOAK clear screen



(1) [CANCEL] button

Touching this button returns the display to the monitor screen without clearing G.SOAK wait.

(2) [CLEAR] button

Touching this button clears G.SOAK wait and returns the display to the monitor screen.

(3) Home button

Pressing this button displays the Home screen.

(4) Menu button

Pressing this button displays the parameter bank menu screen.

- If pattern operation is disabled, the G.SOAK clear screen is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

■ DI/DO monitor screen





(1) DI terminal status

If the number has a green background, the DI terminal is ON.

If the number has a gray background, the DI terminal is OFF.

If the actual terminal ON/OFF time is shorter than the display update time, the terminal's activity may not be reflected on the display.

(2) DO terminal status

If the number has a green background, the DO terminal is ON.

If the number has a gray background, the DO terminal is OFF.

The TP (time proportioning) output ON/OFF is also displayed as the DO terminal status.

If the actual terminal ON/OFF time is shorter than the display update time, the terminal's activity may not be reflected on the display.

(3) Screen forward and back buttons

When $[\Lambda]$ is touched, the screen goes back to the previous screen, and when [V] is touched, the screen switches to the DI monitor, DO monitor, EV monitor, or SEG-EV monitor screen.

(4) Close button

Touching this button returns the display to the previous screen.

(5) Home button

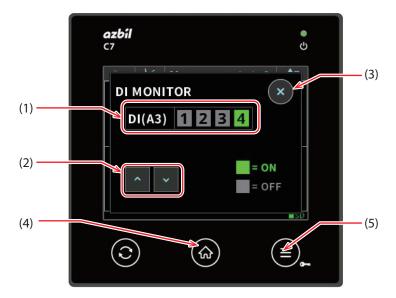
Pressing this button displays the Home screen.

(6) Menu button

Pressing this button displays the parameter bank menu screen.

■ DI monitor screen

When using models in which the DI block is located in slot A3 or B3, the states of terminals 1 to 4 of the DI block can be monitored.



(1) DI terminal status

Displays the name of the slot in which the DI block is located.

If the number has a green background, the DI terminal is ON.

If the number has a gray background, the DI terminal is OFF.

If the actual terminal ON/OFF time is shorter than the display update time, the terminal's activity may not be reflected on the display.

(2) Screen forward and back buttons

When $[\Lambda]$ is touched, the screen goes back to the previous screen, and when [V] is touched, the screen switches to the next enabled screen among the DI/DO monitor, DI monitor, DO monitor, EV monitor, and SEG-EV monitor screens.

(3) Close button

Touching this button returns the display to the previous screen.

(4) Home button

Pressing this button displays the Home screen.

(5) Menu button

Pressing this button displays the parameter bank menu screen.

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the DI monitor screen is not displayed.

■ DO monitor screen

When using models in which the DO block is located in slot A1 or B1, the states of terminals 1 to 4 of the DO block can be monitored.



(1) DO terminal status

Displays the name of the slot in which the DO block is located.

If the number has a green background, the DO terminal is ON.

If the number has a gray background, the DO terminal is OFF.

If the actual terminal ON/OFF time is shorter than the display update time, the terminal's activity may not be reflected on the display.

(2) Screen forward and back buttons

When $[\Lambda]$ is touched, the screen goes back to the previous screen, and when [V] is touched, the screen switches to the next enabled screen among the DI/DO monitor, DI monitor, DO monitor, EV monitor, and SEG-EV monitor screens.

(3) Close button

Touching this button returns the display to the previous screen.

(4) Home button

Pressing this button displays the Home screen.

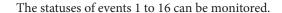
(5) Menu button

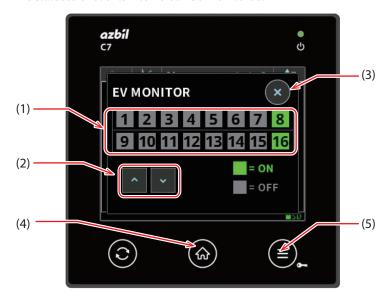
Pressing this button displays the parameter bank menu screen.

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the DO monitor screen is not displayed.

■ EV monitor screen





(1) Event status

A number with a green background indicates a terminal whose event is ON.

A number with a gray background indicates a terminal whose event is OFF.

If the actual event ON/OFF time is shorter than the display update time, the status may not be reflected on the display.

(2) Screen forward and back buttons

When $[\Lambda]$ is touched, the screen goes back to the previous screen, and when [V] is touched, the screen switches to the next enabled screen among the DI/DO monitor, DI monitor, DO monitor, and SEG-EV monitor screens.

(3) Close button

Touching this button returns the display to the previous screen.

(4) Home button

Pressing this button displays the Home screen.

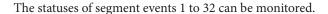
(5) Menu button

Pressing this button displays the parameter bank menu screen.

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the EV monitor screen is not displayed.

■ SEG-EV monitor screen





(1) Segment event status

A number with a green background indicates a terminal whose segment event is ON.

A number with a gray background indicates a terminal whose segment event is OFF

If the actual segment event ON/OFF time is shorter than the display update time, the status may not be reflected on the display.

(2) Screen forward and back buttons

When $[\Lambda]$ is touched, the screen goes back to the previous screen, and when [V] is touched, the screen switches to the next enabled screen among the DI/DO monitor, DI monitor, DO monitor, and EV monitor screens.

(3) Close button

Touching this button returns the display to the previous screen.

(4) Home button

Pressing this button displays the Home screen.

(5) Menu button

Pressing this button displays the parameter bank menu screen.

- If pattern operation is disabled, the SEG-EV monitor screen is not displayed.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the SEG-EV monitor screen is not displayed.

5-2 Parameter screen

■ Parameter bank menu screen

The parameter bank containing the parameter item to be displayed or set can be selected.



(1) Page number

Displays the page number of the parameter bank.

For example, "1/5" means that the 1st page of five pages is displayed.

(2) Next page button (right), previous page button (left)

Touching the relevant button displays the next or previous page of the parameter bank.

(3) Parameter bank button

Touching this button displays the parameter item menu screen of the touched parameter.

(4) Home button

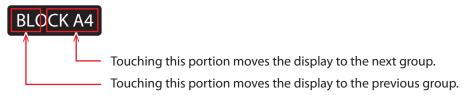
Pressing this button displays the Home screen.

■ Parameter item menu screen





- (1) Parameter bank
 Displays the parameter bank name to which the parameter item belongs.
- (2) Group button
 Displays the group name for the parameter item. The name may vary depending on the parameter bank.

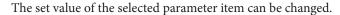


- (3) Next page button (right), previous page button (left)

 Touching the relevant button displays the next or previous page of the parameter item.
- (4) Parameter item buttons Displays the name and set value of the parameter item. Touching the parameter item displays the parameter item setting change screen for this item.
- (5) Close button Touching this button returns the display to the parameter bank menu screen.
- (6) Home button
 Pressing this button displays the Home screen.
- (7) Menu button
 Pressing this button displays the parameter bank menu screen.

- When there is no group for the parameter item, the group button is not displayed.
- The group buttons are displayed at two positions, one of the left side and another near the center.

■ Parameter item setting change screen





(1) Set value

Displays the current set value.

(2) Input value

Displays the value that has been input using the numeric keypad. The initial value is 0.

(3) Numeric keypad

Touching the relevant key can input the numeric value or decimal point, or change the sign.

When the set value has no decimal point, the decimal point key is not displayed. When the set value has no negative value, the sign key is not displayed.

(4) [CLEAR] button

Touching this button clears the input value to 0.

(5) [BS] button

Touching this button clears one character at the right end of the input value. When the input value is only one character, the input value is returned to 0.

(6) [CANCEL] button

Touching this button returns the display to the parameter item menu screen.

(7) [ENTER] button

Touching this button writes the input value to the set value and returns the display to the parameter item menu screen.

(8) Home button

Pressing this button displays the Home screen.

(9) Menu button

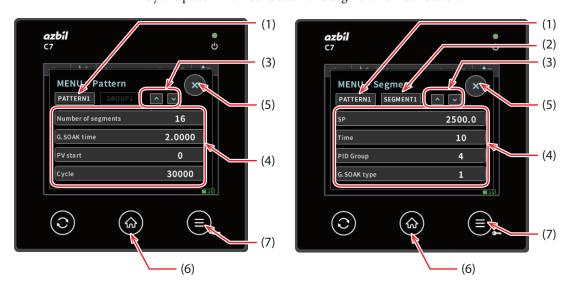
Pressing this button displays the parameter bank menu screen.

(10) [?] button

Displayed when there is an explanation on the parameter item. Touching this button opens the screen that explains the parameter item.

■ Pattern settings/segment settings

The setting procedures for the pattern bank and segment bank are the same as those for the normal parameter item menu. However, the group button is replaced by the pattern number button and segment number button.



(1) Pattern number button



(2) Segment number button



(3) Next page button (right), previous page button (left)

Touching the relevant button displays the next or previous page of the parameter item.

(4) Parameter item buttons

Displays the name and set value of the parameter item.

Touching the parameter item displays the parameter item setting change screen for this item.

(5) Close button

Touching this button returns the display to the parameter bank menu screen.

(6) Home button

Pressing this button displays the Home screen.

(7) Menu button

Pressing this button displays the parameter bank menu screen.

! Handling Precautions

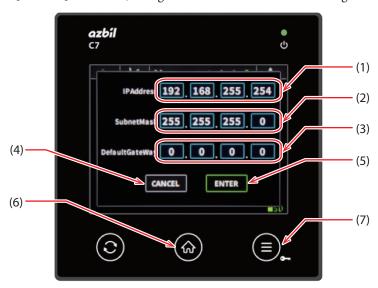
• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern bank and segment bank are not displayed.

■ IP address

The IP address bank screen and setting procedures differ from usual.

The IP address, subnet mask, and default gateway each have four individual address settings available.

After setting the individual addresses, touching [ENTER] finishes the setting change. If [CANCEL] is touched, changes in the individual address settings are not applied.



(1) IP address setting

Displays the set value of the IP address.

Touching this portion displays the setting change screen for the individual address you have touched.

(2) Subnet mask setting

Displays the set value of the subnet mask.

Touching this portion displays the setting change screen for the individual address you have touched.

(3) Default gateway setting

Displays the set value of the default gateway.

Touching this portion displays the setting change screen for the individual address you have touched.

(4) [CANCEL] button

Touching this button returns the display to the parameter item menu screen.

(5) [ENTER] button

Touching this button writes the IP address, subnet mask, and default gateway settings, and returns the display to the parameter item menu screen.

(6) Home button

Pressing this button displays the Home screen.

(7) Menu button

Pressing this button displays the parameter bank menu screen.

! Handling Precautions

• If the IP address, subnet mask, or default gateway was changed, the settings are applied when the power is turned on the next time. Turn the power off and then on again.

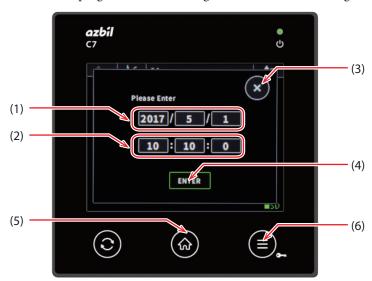
■ Date and Time

The setting procedure for the date and time screen is different from the regular procedure for screens.

The date and time each have three individual settings.

After changing the individual settings, touching [ENTER] finishes the setting change.

If $[\times]$ at the top right is touched, changes in the individual settings are not applied.



(1) Date setting

From the left, the settings for the date are displayed in the order: year, month, day.

Touching this displays the setting change screen for the individual setting you have touched.

(2) Time setting

From the left, the settings for the time are displayed in the order: hour, minute, second.

Touching this displays the setting change screen for the individual setting you have touched.

(3) Close button

Touching this button returns the display to the parameter item menu screen. In this case, no changes are made to the date and time settings.

(4) [ENTER] button

Touching this writes the set values for the date and time and restarts updating of the display of the date and time.

(5) Home button

Pressing this button displays the Home screen.

(6) Menu button

Pressing this button displays the parameter bank menu screen.

- For models without a clock function, the date and time when the power is turned on is January 1, 2000 at a time of 00:00:00.
- For models with a clock function, the date and time are backed up by a battery even when the power is cut off. However, if the battery runs out of power, when the device is turned on, the date and time will revert to January 1, 2000 at a time of 00:00:00.
- Display of the date and time are updated until the change of settings begins, but once the settings change process has started, updating of the date and time is stopped. Even though the display is not updated, the date and time continue to be updated.

■ Firmware Versions

The firmware version bank screen differs from usual.

MODEL (model number) and S/N (serial number) are displayed above the version table. The table shows the firmware versions for the MAIN, HMI (display unit), DI/DO, and RS-485 blocks. It also displays the block type and firmware version for each block inserted in slots A1 to A4 and B1 to B4. The version of the additional display unit is displayed at the slot position where the cable is connected.

Block types, their indicators, and corresponding slots

Block Type	Indicator	Corresponding Slot
Main	MAIN	Fixed at the top left position
Standard display unit	HMI	
DI/DO	DI/DO	
RS-485	RS-485	
Current output	AO-C	A1, A2, B1, B2
Voltage pulse output	V-P	A1, A2, B1, B2
Motor drive output	MOTOR	B2
Analog input	Al	A3, A4, B3, B4
Additional display unit	HMI	B1
Clock function	CLOCK	B1, B3
DI	DI	A3, B3
DO	DO	A1, B1



- (1) Close button
 - Touching this button returns the display to the parameter bank menu screen.
- (2) Home button
 Pressing this button displays the Home screen.
- (3) Menu button
 Pressing this button displays the parameter bank menu screen.

! Handling Precautions

• If the firmware version of the HMI block (display unit) is earlier than 5.x.x (where x stands for any number), MODEL (model number) and S/N (serial number) are not displayed.

-MEMO-

Chapter 6. Display and Setting Data

6-1 Operation Display Data

■ Home screen

Number of control loops	Screen	Item display	Description	Notes
4 loops 3 loops	4-loop screen 3-loop screen Displays the PV. Unit: If the PV sensor is a thermocouple or resistance temperature detector, °C is displayed. For DC voltage/current, the value is displayed in the set unit of measurement. Number of decimal places: Set by the "No. of decimal places for PV" parameter setting in the basic action bank.		The 4-loop screen is divided top and bottom, left and right by lines in a cross pattern. The 3-loop screen (0: Normal, 1: Left/right swap) is divided top and bottom, left and right by lines in a cross pattern, but loop 4 is	
		MV graph	Displays the MV as a bar graph. The line is displayed on the bar graph at intervals of 10 %. Display range: 0 to 100 % (a value that is 0 % or less is displayed as 0 % while a value that is 100 % or more is displayed as 100 %). Display resolution: 1 % The MV graph is not displayed when the AT is started.	not shown. The 3-loop screen (2: Vertically arranged) is separated into three parts arranged vertically on the screen.
		AT graph	The progress status of AT is displayed as a bar graph.	
		PTN	The AT graph is not displayed when the AT is stopped. Displays the number of the currently operating	Displayed during pattern
		PIN	pattern.	Displayed during pattern operation.
		SEG	Displays the number of the currently operating segment.	
2 loops		Displays the PV. Unit: If the PV sensor is a thermocouple or resistance temperature detector, °C is displayed. For DC voltage/current, the value is displayed in the set unit of measurement.	The 2-loop screen (0: Normal, 1: Left/right swap) is separated into left and right portions. The 2-loop screen (2:	
			Number of decimal places: Set by the "No. of decimal places for PV" parameter setting in the basic action bank.	Vertically arranged) is separated into two parts arranged vertically on the screen, and the MV graph
		SP	Displays the SP.	is also displayed.
			Unit: Same as for PV	
			Number of decimal places: Same as for PV	
		MV	Displays the MV. Unit: %	
			Number of decimal places: 1 digit after the decimal point	
		AT graph	The progress status of AT is displayed as a bar graph.	
			The AT graph is not displayed when AT is stopped.	
		PTN	Displays the number of the currently operating pattern.	Displayed during pattern operation.
		SEG	Displays the number of the currently operating segment.	
1 loop	1-loop screen	The 1-loop	monitor screen becomes the Home screen.	

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.
- If the advanced loop type setting is enabled for [Loop type], the units of the PV and SP follow the linear input unit character setting.

 4-2 Al (Block) Setting the linear input unit character (p. 4-6)

■ 1-loop monitor screen

Screen	Item display	Description	Notes
PV display	PV	Displays the PV. Unit: When the PV sensor is a thermocouple or resistance temperature detector, °C is displayed. For DC voltage or DC current, the set unit is displayed. Number of decimal places: Set by the "Number of decimal places for PV" parameter setting in the Basic action bank.	
Variable display(1)	SP	Displays the SP. In the LSP mode, the LSP group number is displayed In the RSP mode, the RSP is displayed. Unit: Same as for PV Number of decimal places: Same as for PV	Pressing the arrow button at the right side of the variable display area changes the items shown on the screen. Variable display (2) is applied when the
	MV	Displays the MV. Unit: % Number of decimal places: 1 digit after the decimal point	displayed loop is in heat/cool control. Variable display (3) is applied when output of
	MV graph	Displays the MV as a bar graph. The line is displayed on the bar graph at intervals of 10 % Display range: 0 to 100 % (values of 0 % or less are displayed as 0 % and values of 100 % or more are displayed as 100 %) Display resolution: 1 %	the MV, H-MV or C-MV of a displayed loop is specified for the motor drive output.
Variable display (2)	SP	Displays the SP. Same as SP display in variable display (1)	
	MV	Displays the MV. Same as MV display in variable display (1)	
	C-MV	Displays the Cool MV for heating/cooling control. Unit: % Number of decimal places: 1 digit after the decimal point	
	H-MV	Displays the Heat MV for heating/cooling control. Unit: % Number of decimal places: 1 digit after the decimal point	
Variable display (3)	SP	Displays the SP. Same as SP display in variable display (1)	
	MV	Displays the MV. Same as MV display in variable display (1)	
	MFB AT	Displays the MFB auto-tuning status. UNTUNED: Tuning not yet done TUNED: Tuning completed ERROR: Tuning failed	
	OPEN/CLOSE	Status of motor drive OPEN relay / CLOSE relay Lit: ON Off: OFF	
	MFB	Displays the valve opening. Unit: % Number of decimal places: 1 digit after the decimal point	

Screen	Item display	Description	Notes
Variable display (4)	SP	Displays the SP. Same as on variable display (1)	Variable display (4) and (5) are applied when the loop is specified to be displayed for the
	MV	Displays the MV. Same as on variable display (1)	AO-C (current output) block in the Basic action bank.
	СТ	Displays the CT input value. Unit: A Number of decimal places: 1 digit after the decimal point	The relationship between the number of digits after the decimal point for Resistance in variable display (5) and the displayed value is
	VT	Displays the VT input value. Unit: V Number of decimal places: 1 digit after the decimal point	shown below. 2 digits: 0.00 to 999.99 Ω 1 digit: 1000.0 to 9999.9 Ω
	Slot	Displays the slot position of an AO-C block, which has CT and VT input terminals.	0 digits: 10000 to 99999 Ω Variable display (6) is applied when the loop is
Variable display (5)	SP	Displays the SP. Same as in variable display (1)	specified to be displayed for the V-P (voltage pulse) block in the Basic action bank.
	MV	Displays the MV. Same as in variable display (1)	
	Resistance	Displays the resistance calculated from the current of the CT input and the voltage of the VT input. Unit: Ω Number of decimal places: 0 to 2 digits after the decimal point (value changed automatically within 5 digits)	
	Slot	Displays the slot position of an AO-C block, which has CT and VT input terminals.	
Variable display (6)	SP	Displays the SP. Same as SP display in variable display (1)	
	MV	Displays the MV. Same as MV display in variable display (1)	
	CT1	Displays the CT1 input value. Unit: A Number of decimal places: 1 digit after the decimal point	
	CT2	Displays the CT2 input value. Unit: A Number of decimal places: 1 digit after the decimal point	
	Slot	Displays the slot position of a V-P block, which has CT1 and CT2 input terminals.	
Variable display (MANUAL MV)	MANUAL MV	Displays the MANUAL MV. The MANUAL MV can be changed by operating the change digit position and up or down buttons. Unit: % Number of decimal places: 1 digit after the decimal point	Switches to this screen when the mode is switched from AUTO to MANUAL. (Switches to variable display (1) when the mode is switched from MANUAL to AUTO.) This screen is displayed between variable display (1) and (2).
Variable display (AT running)	SP	Displays the SP. In the LSP mode, the LSP group number is displayed. In the RSP mode, the RSP is displayed. Unit: Same as for the PV Number of decimal places: Same as for PV	Pressing the [x] button at the right side of the variable display area ends AT. Switches to this screen when the AT starts.
	MV	Displays the MV. Unit: % Number of decimal places: 1 digit after the decimal point	
	AT graph	The progress status of AT is displayed as a bar graph.	

Screen	Item display	Description	Notes				
Variable display	SP	Displays the SP. Same as SP display in variable display (1)					
(executing MFB AT)	MV	Displays the MV. Same as MV display in variable display (1)					
MFB AT		STOP: [MFB AT STOP] button					
	OPEN/CLOSE	Status of motor drive OPEN relay / CLOSE relay Lit: ON Off: OFF					
	CNT	Displays the MFB count value. Unit: None Number of decimal places: 0 digit after the decimal point					
No. / Segment	PTN	Displays the number of the currently operating pattern.	Displayed during pattern operation.				
No. display	SEG	Displays the number of the currently operating segment.					
Variable display	SP	Displays the SP. Same as SP display in variable display (1)	Displays the time for the segment being executed during pattern operation.				
(Pattern operation	MV	Displays the MV. Same as MV display in variable display (1)					
1)	SEG	Displays the time set for the segment next to "S." Displays the time remaining for the segment next to "R." Unit: Switches to hours/minutes, minutes/seconds, or seconds.					
Variable display	SP	Displays the SP. Same as SP display in variable display (1)	Displays the time for the pattern currently being executed.				
(Pattern operation	MV	Displays the MV. Same as MV display in variable display (1)	The pattern time does not reflect cycles and links.				
2)	PTN	Displays the time set for the pattern next to "S." Displays the time remaining for the pattern next to "R." Unit: Switches to hours/minutes, minutes/seconds, or seconds.					
Variable display	SP	Displays the SP. Same as SP display in variable display (1)	The number of the currently executing cycle is shown during pattern operation and when				
(Pattern operation	MV	Displays the MV. Same as MV display in variable display (1)	the number of cycle operations is set to a value other than 0.				
3)	CYC	Displays the set number of cycles next to "S." Displays the remaining number of cycles next to "R."	The cycle count does not take links into consideration.				

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.
- If the advanced loop type setting is enabled for [Loop type], the units of the PV and SP follow the linear input unit character setting.
 - 4-2 Al (Block) Setting the linear input unit character (p. 4-6)

■ Graph screen

Screen	Graph	Description	Notes
1-loop graph screen	PV	Displays the PV using a graphed line.	The vertical axis on the left is set by the
		The scale uses the vertical axis on the left.	"Graph scaling low limit for loops 1 to 4" and "Graph scaling high limit for loops
	SP	Displays the SP using a graphed line.	1 to 4" parameter settings of the Graph
		The scale uses the vertical axis on the left.	bank.
	MV	Displays the MV using a graphed line.	The vertical axis on the right is fixed to
		The scale uses the vertical axis on the right.	0 to 100 %.
	Horizontal axis (time axis)	The time for one scale gradation is displayed under the graph.	The range of the horizontal axis can be changed by the "Recording cycle for loops 1 to 4" parameter setting in the Graph bank.
Multi-loop graph	PV1	Displays the PV of loop 1 using a graphed line.	The PV corresponding to the number of
screen		The vertical axis is set by the "Graph scaling low	loops is displayed.
		limit for loop 1" and "Graph scaling high limit for loop 1" parameter settings of the Graph bank.	The scales of the vertical axes on the left and right can be selected from Loop1
	PV2	Displays the PV of loop 2 using a graphed line.	to 4.
		The vertical axis is set by the "Graph scaling low limit for loop 2" and "Graph scaling high limit for loop 2" parameter settings of the Graph bank.	
	PV3	Displays the PV of loop 3 using a graphed line.	
		The vertical axis is set by the "Graph scaling low limit for loop 3" and "Graph scaling high limit for loop 3" parameter settings of the Graph bank.	
	PV4	Displays the PV of loop 4 using a graphed line.	
		The vertical axis is set by the "Graph scaling low limit for loop 4" and "Graph scaling high limit for loop 4" parameter settings of the Graph bank.	
	Horizontal axis (Time axis)	The time for one scale gradation is displayed under the graph.	The range of the horizontal axis can be changed according to the "Recording cycle of multi-loop" parameter setting in the Graph bank.

Parameter Setting Display Data 6-2

The operations performed by "Write" in the "Communication" column of the table are as follows.

RAM: Data is only written to RAM. Data is not retained in the event of power failure.

EEPROM: Data is written to both RAM and EEPROM. Data is retained in the event of power failure.

Meanings of the symbols in the "Communication" column of the table are as follows.

- ✓ Possible with decimal point position settings 0 to 4
- * Possible with decimal point position settings 10 to 14
- # Possible with decimal point position settings 0 to 4 and 10 to 14
- Not possible

Decimal point position settings 10 to 14 specify RAM access. The value after subtracting 10 is the number of decimal places.

■ SP bank

Bank selection: SP

Loop selection: Loops 1 to 4

Group selection: LSP groups 1 to 8, RSP group

● Loops 1 to 4 (common)

			Initial	Com	munic	ation	
Item display	ltem	Description	Initial value	Read		rite	Notes
			value	ricad	RAM	EEPROM	
LSP1 / SP	LSP group 1 SP	-32000 to +32000	0.0000	#	*	✓	With decimal point
LSP1 / PID group	LSP group 1 PID group number	1 to 8	1	#	*	✓	
LSP2 / SP	LSP group 2 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP2 / PID group	LSP group 2 PID group number		1	#	*	✓	
LSP3 / SP	LSP group 3 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP3 / PID group	LSP group 3 PID group number		1	#	*	✓	
LSP4 / SP	LSP group 4 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP4 / PID group	LSP group 4 PID group number		1	#	*	✓	
LSP5 / SP	LSP group 5 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP5 / PID group	LSP group 5 PID group number		1	#	*	√	
LSP6 / SP	LSP group 6 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP6 / PID group	LSP group 6 PID group number		1	#	*	✓	
LSP7 / SP	LSP group 7 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP7 / PID group	LSP group 7 PID group number		1	#	*	✓	
LSP8 / SP	LSP group 8 SP	Same as LSP group 1	0.0000	#	*	✓	With decimal point
LSP8 / PID group	LSP group 8 PID group number		1	#	*	√	
RSP / SP	RSP group SP	Displays the RSP.	-	-	-	-	Setting is disabled.
RSP / PID group	RSP group PID group number	1 to 8	1	#	*	✓	

■ Event bank

Bank selection: EVENT Loop selection: None

Group selection: Event groups 1 to 16

• Event groups 1 to 16 (common)

	ltem		Initial	Com	munica	ation	
Item display		Description	value	Read	Wr	ite	Notes
			value	ricad	RAM	EEPROM	
Event main setting	Main setting	-32000 to +32000	0.0000	#	*	✓	Depending on the setting for the
Event subsetting	Subsetting	-32000 to +32000	0.0000	#	*	✓	operation type of
Hysteresis	Hysteresis	0.0000 to 32000	5.0000	#	*	✓	each event group in the Event Config
ON delay	ON delay time	0.0000 to 3200.0 s	0.0000	#	*	✓	bank, it may not
OFF delay	OFF delay time	0.0000 to 3200.0 s	0.0000	#	*	✓	be necessary to
							set some of the
							values shown at
							left. However, all of the values are
							displayed and can
							be specified.
							With decimal point

■ PID bank

Bank selection: PID

Loop selection: Loops 1 to 4 Group selection: PID groups 1 to 8

• Loop1 to 4 / PID groups 1 to 8 (common)

				Com	munic	ation	
Item display	Item	Description	Initial	Read	W	rite	Notes
. ,		<u>'</u>	value	neau	RAM	EEPROM	
P (Proportional band)	P(Proportional band)	0.1000 to 3200.0 %	5.0000	#	*	✓	With decimal point
I (Integral time)	I(Integral time)	0.0000 to 32000 s	120.00	#	*	√	With decimal point
D (Derivative time)	D(Derivative time)	0.0000 to 32000 s	30.000	#	*	✓	With decimal point
RE (Manual reset)	RE(Manual reset)	-10.000 to +110.00 %	50.000	#	*	✓	Enabled when the integral time of the same PID group is 0. With decimal point
OL (MV low limit)	OL(MV low limit)	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
OH (MV high limit)	OH(MV high limit)	-10.000 to +110.00 %	100.00	#	*	✓	With decimal point
Cool P (Proportional band)	Proportional band for cooling	0.1000 to 3200.0 %	5.0000	#	*	√	With decimal point
Cool I (Integral time)	Integral time for cooling	0.0000 to 32000 s	120.00	#	*	✓	With decimal point
Cool D (Derivative time)	Derivative time for cooling	0.0000 to 32000 s	30.000	#	*	✓	With decimal point
Cool OL (MV low limit)	MV low limit for cooling	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
Cool OH (MV high limit)	MV high limit for cooling	-10.000 to +110.00 %	100.00	#	*	✓	With decimal point

■ Analog input bank

Bank selection: ANALOG INPUT Block selection: A4, B4, A3, B3

Group selection: None

• Blocks A4, B4, A3, and B3 (common)

			1 22 1	Com	munic	ation	
Item display	Item	Description	Initial value	Read		ite	Notes
			value	neau	RAM	EEPROM	
Range type	Range type	Range of thermocouple :1 to 23 Range of resistance temperature detector (RTD) :41 to 69 Range of DC voltage/ DC current :86 to 92	88	1	-	√	For details, refer to Input types and ranges (p. 13-13).
Linear scaling low limit	Linear scaling low limit	-32000 to +32000	0.0000	#	*	√	Enabled for voltage input and current input. With decimal point
Linear scaling high limit	Linear scaling high limit	-32000 to +32000	1000.0	#	*	√	Enabled for voltage input and current input. With decimal point
Filter	Filter	0.0000 to 120.00	0.0000	#	*	√	With decimal point
Ratio	Ratio	0.0010 to 10.000	1.0000	#	*	✓	With decimal point
Bias	Bias	-32000 to +32000	0.0000	#	*	✓	With decimal point
Sqr-root extraction dropout	Square root extraction dropout	0.0000: Square root extraction is not used. 0.0001 to 10.000 %	0.0000	#	*	✓	Enabled for voltage input and current input. With decimal point.
Linearization table group	Linearization table group definition	0: No linearization 1 to 8	0	#	*	√	1
Temperature unit	Temperature unit	0:Celsius	0	√	-	✓	
		1:Fahrenheit					

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), "Sqr-root extraction dropout" is not available.

■ Basic action bank

This holds separate parameters for the standard display unit and additional display unit. The parameters for one of the display units cannot be set from the other display unit. However, "Sampling cycle," "Power supply frequency," "Time unit of patterns," and "Loop1 to 4 Run/Ready at startup" are parameters for the main unit, not for the display units, which means they can be set from any display unit.

Bank selection: BASIC ACTION

Loop selection: None Group selection: None

Standard display unit and additional display unit (common)

				Com	nmunic	ation	
Item display	ltem	Description	Initial value	Read		rite	Notes
Canada lina na anala	C	0.10	1		RAM	EEPROM	C
Sampling cycle	Sampling cycle	0: 10 ms	1	✓	-	✓	Same setting value for the standard
		1: 50 ms					display unit and
D 1	D 1	2: 100 ms					additional display
Power supply frequency	Power supply frequency	0: 50 Hz	0	✓	-	✓	unit
		1: 60 Hz	2		*		
Time unit of patterns	Time unit of patterns	0: 0.01 s	2	#	*	✓	
patterns		1: 0.1 s					
		2: s					
		3: min					
HOME screen	HOME screen layout	0: Normal	0	-	-	-	
layout		1: Left/right swap					
		2: Vertically arranged					
Loop1 Run/Ready at startup	Loop1 Run/Ready at startup	0: Value stored in EEPROM	0	#	*	✓	Same setting value for the standard
		1: RUN					display unit and
		2: READY					additional display
Loop2 Run/Ready at startup	Loop2 Run/Ready at startup	0: Value stored in EEPROM	0	#	*	√	unit
		1: RUN					
		2: READY					
Loop3 Run/Ready at startup	Loop3 Run/Ready at startup	0: Value stored in EEPROM	0	#	*	√	
		1: RUN					
		2: READY					
Loop4 Run/Ready at startup	Loop4 Run/Ready at startup	0: Value stored in EEPROM	0	#	*	✓	
		1: RUN					
		2: READY					
No. of decimal	No. of decimal places	0: No decimal point	1	-	-	-	Applies to the PV
places for PV1	for PV1	1: 1 digit after the decimal point					and SP for loop 1 on the monitor
		2: 2 digits after the decimal point					screen.
		3: 3 digits after the decimal point					
		4: 4 digits after the decimal point					

				Com	munic		
Item display	Item	Description	Initial value	Read	RAM	rite EEPROM	Notes
No. of decimal	No. of decimal places	0: No decimal point	1	-	-	-	Applies to the PV
places for PV2	for PV2	1: 1 digit after the					and SP for loop
		decimal point					2 on the monitor
		2: 2 digits after the decimal point					screen.
		3: 3 digits after the decimal point					
		4: 4 digits after the decimal point					
No. of decimal	No. of decimal places	0: No decimal point	1	-	_	-	Applies to the PV
places for PV3	for PV3	1: 1 digit after the					and SP for loop 3 on the monitor
		decimal point					screen.
		2: 2 digits after the decimal point					
		3: 3 digits after the decimal point					
		4: 4 digits after the decimal point					
No. of decimal	No. of decimal places	0: No decimal point	1	-	-	-	Applies to the PV
places for PV4	for PV4	1: 1 digit after the decimal point					and SP for loop 4 on the monitor
		2: 2 digits after the decimal point					screen.
		3: 3 digits after the decimal point					
		4: 4 digits after the decimal point					
Display loop for	A2 slot input value	0: Not displayed	1	-	-	-	
A2 slot input	display loop definition	1: Loop 1					
		2: Loop 2					
		3: Loop 3					
		4: Loop 4					
Display loop for	B2 slot input value	0: Not displayed	2	-	-	-	
B2 slot input	display loop definition	1: Loop 1					
		2: Loop 2					
		3: Loop 3					
		4: Loop 4					
Display loop for	A1 slot input value display loop definition	0: Not displayed	3	-	-	-	
A1 slot input	display loop definition	1: Loop 1					
		2: Loop 2					
		3: Loop 3					
Display loop for	B1 slot input value	4: Loop 4 0: Not displayed	4	_		_	
B1 slot input	display loop definition	1: Loop 1		_		_	
		2: Loop 2					
		3: Loop 3					
		4: Loop 4					
		1. LOOP 7				L	

				Con	nmunic	ation		
Item display	Item	Description	Initial value	Read	W	rite	Notes	
				neau	RAM	EEPROM		
Loop1 HOME	Loop1 HOME screen	0: Disabled	0	-	-	-	The loops that are	
screen setting	setting	1: Enabled					available and set	
Loop2 HOME	Loop2 HOME screen	0: Disabled	0	-	-	-	to 1 (Enabled) are	
screen setting	setting	1: Enabled					displayed on the user HOME screen.	
Loop3 HOME	Loop3 HOME screen	0: Disabled	0	-	-	-	user HOWL screen.	
screen setting	setting	1: Enabled						
Loop4 HOME	Loop4 HOME screen	0: Disabled	0	-	-	-		
screen setting	setting	1: Enabled						
Display intensity	Display intensity	1: Dark	4	-	-	-		
		2: Slightly dark						
		3: Normal						
		4: Slightly bright						
		5: Bright						
Language	Display language	0: English	0	_	_	_		
indication		1: Japanese						
Keylock level	Keylock level	0: Display of	0	_	_	_		
		parameter screens is						
		prohibited.						
		1: Display of						
		parameter screens						
		and mode/SP						
		change from a						
		monitor screen are prohibited						
Engineer mode	Engineer mode is	0 to 99999	0				For manufacturer's	
Engineer mode	enabled.	ענעצע טו ט		_	_	_	maintenance	
	CHADICA.		I				mannenance	

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the items "Time unit of patterns," "Loop1 to 4 Run/Ready at startup," and "HOME screen setting loop1 to 4" do not exist.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the key lock level setting is not available.

■ Control bank

Bank selection: CONTROL Loop selection: Loops 1 to 4

Group selection: None

• Loops 1 to 4 (common)

		_	Initial	Com	munic		
Item display	Item	Description	value	Read		ite EEPROM	Notes
Control action	Control action	0: PID control reverse (heating)	0	√	-	√	
		1: PID control direct (cooling)					
		2: PID control heating/ cooling action					
		3: (Reserved)					
		4: ON/OFF control reverse (heating)					
		5: ON/OFF control direct (cooling)					
Differential for ON/OFF control	Differential for ON/OFF control	0.0000 to 32000	5.0000	#	*	√	Valid when the control action is in ON/OFF control.
							With decimal point
Heat/Cool control dead zone	Heating/cooling control dead zone	-100.00 to +100.00 %	0.0000	#	*	√	Enabled when the control action is PID control heating and cooling action.
							With decimal point
PID initial MV	PID initial MV	-10.000 to +110.00 %	0.0000	#	*	✓	When the control action is changed, the setting may be reset to 0.0000 or 50.000. For details, see Handling Precautions p. 6-15.
PID initialization	PID initialization	0: Automatic	0	#	*	✓	With decimal point
		1: No initialization	-				
		2: Initialize (if a new SP is input)					
Type of change to	Type of change to	0: Bumpless	0	#	*	✓	
MANUAL	MANUAL	1: Preset					

			Initial	Com	munic		
Item display	Item	Description	value	Read		rite EEPROM	Notes
Preset MANUAL value	Preset MANUAL value	-10.000 to +110.00 %	0.0000	#	*	~	When the mode is MANUAL mode at power ON, the preset MANUAL value is used as the MV.
h 4) / ·	AAV	0.0000 N. I'. ''	0.0000	"	*		With decimal point
MV increase change limit	MV increase change limit	0.0000: No limit 0.0001 to 10000 %/s	0.0000	#	^	✓	With decimal point
MV decrease change limit	MV decrease change limit	0.0000: No limit 0.0001 to 10000 %/s	0.0000	#	*	✓	With decimal point
MV tracking changeover	MV tracking changeover	1024 to 2047: Standard bit codes	1024	#	*	√	
Reverse MV tracking signal	Reverse MV tracking signal	0: Direct 1: Reverse	0	#	*	✓	If set to "1," the value set by "MV tracking changeover" is reversed.
MV tracking signal	MV tracking signal	2048 to 3071: Standard numerical codes	2048	#	*	√	
AT type	AT type	0: Normal (regular control characteristics) 1: Fast (control characteristics for quick response to disturbances) 2: Stable (control characteristics for minimal PV fluctuation)	0	#	*	√	
MV low limit during AT	MV low limit during AT	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
MV high limit during AT	MV high limit during AT	-10.000 to +110.00 %	100.00	#	*	✓	With decimal point
AT adjustment factor, P	AT adjustment factor, P	0.0000 to 320.00	1.0000	#	*	√	With decimal point
AT adjustment factor, I	AT adjustment factor, I	0.0000 to 320.00	1.0000	#	*	✓	With decimal point
AT adjustment factor, D	AT adjustment factor, D	0.0000 to 320.00	1.0000	#	*	✓	With decimal point
SP lag factor	SP lag factor	0.0000 to 1000.0	0.0000	#	*	✓	With decimal point

			Initial	Com	munic	ation	
Item display	ltem	Description	value	Read	RAM	rite EEPROM	Notes
READY MV	READY MV	-10.000 to +110.00 %	0.0000	#	*	<u>CEPROW</u>	When the control action is changed, the setting may be automatically reset to 0.0000 or 50.000. For details, see Handling Precautions p. 6-15 With decimal point
READY MV (Heat)	Output at READY	-10.000 to +110.00 %	0.0000	#	*	√	Enabled when the
	(Heat)						control action is PID control heating
READY MV (Cool)	Output at READY	-10.000 to +110.00 %	0.0000	#	*	✓	and cooling action.
	(Cool)						With decimal point
MV action if PV is bad	MV action if PV is bad	0: Continue control operation 1: Output MV if PV is abnormal	0	#	*	✓	
MV if PV is bad	MV if PV is bad	-10.000 to +110.00 %	0.0000	#	*	√	Enabled when "MV action if PV is bad" is 1.
Fixed value	Fixed value output 1	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point With decimal point
output 1	. Med value output	101000 10 1 1 10100 70	0.0000				Transcential point
Fixed value output 2	Fixed value output 2	-10.000 to +110.00 %	0.0000	#	*	√	With decimal point
Fixed value output 3	Fixed value output 3	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
Fixed value output 4	Fixed value output 4	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
Fixed value output 5	Fixed value output 5	-10.000 to +110.00 %	0.0000	#	*	√	With decimal point
Fixed value output 6	Fixed value output 6	-10.000 to +110.00 %	0.0000	#	*	√	With decimal point
Fixed value output 7	Fixed value output 7	-10.000 to +110.00 %	0.0000	#	*	√	With decimal point
Fixed value output 8	Fixed value output 8	-10.000 to +110.00 %	0.0000	#	*	√	With decimal point
Zone action selection	Zone action selection	0: Not used 1: SP-based selection 2: PV-based selection	0	#	*	✓	
Zone 1	Zone 1	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 2	Zone 2	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 3	Zone 3	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 4	Zone 4	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 5	Zone 5	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 6	Zone 6	-32000 to +32000	32000	#	*	✓	With decimal point
Zone 7	Zone 7	-32000 to +32000	32000	#	*	✓	With decimal point
Zone hysteresis	Zone hysteresis	0.0000 to 32000	5.0000	#	*	✓	With decimal point

! Handling Precautions

- When "Control action" is changed from an action other than the PID control heating and cooling action to PID control heating and cooling action, "PID initial MV" and "Preset MANUAL value" are reset to 50.000 %.
- When "Control action" is changed from PID control heating and cooling action to an action other than the PID control heating and cooling action, "PID initial MV" and "Preset MANUAL value" are reset to 0.0000 %.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), "Fixed value output 1 to 8" do not exist.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "MV tracking changeover," "Reverse MV tracking signal," "MV tracking signal," "AT type," "AT adjustment factor for P," "AT adjustment factor for I," "AT adjustment factor for D," "Zone action selection," "Zone 1" to "Zone 7," and "Zone hysteresis" are not available.

■ SP configuration bank

Bank selection: SP CONFIG Loop selection: Loops 1 to 4

Group selection: None

• Loops 1 to 4 (common)

			Initial value	Communication			
Item display	ltem	Description		Read		rite	Notes
					RAM	EEPROM	
SP low limit	SP low limit	-32000 to +32000	-32000	#	*	✓	With decimal point
SP high limit	SP high limit	-32000 to +32000	32000	#	*	✓	With decimal point
SP ramp unit	SP ramp unit	0: s	0	#	*	✓	
		1: min					
		2: h					
LSP ramp up slope	LSP ramp up slope	0.0000 to 32000	0.0000	#	*	✓	With decimal point
LSP ramp down slope	LSP ramp down slope	0.0000 to 32000	0.0000	#	*	✓	With decimal point
RSP tracking	RSP tracking	0: Tracking OFF	0	#	*	✓	
		1: Tracking ON					
Number of LSP	Number of LSP system	1 to 8	1	#	*	✓	
system groups	groups						

■ Analog output bank

Bank selection: ANALOG OUTPUT

Block selection: A2, B2, A1, B1

Group selection: None

• Blocks A2, B2, A1, and B1 (common)

II. II. I	ltem	5	Initial	Com	munic		
Item display		Description	value	Read		ite EEPROM	Notes
Output range	Output range	0: 4–20 mA	0	✓	-	✓	
		1: 0–20 mA					
Output type	Output type	0: Fixed at 0 %	1	#	*	✓	
		1: MV					
		2: Heat MV (for heating/cooling control)					
		3: Cool MV (for heating/cooling control)					
		4: PV					
		5: SP					
		6: Deviation (PV – SP)					
		7 to 2047: Reserved					
		2048 to 3071: Standard numerical codes					
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
Loop definition	Loop definition	1: Loop 1	1	#	*	✓	
		2: Loop 2					
		3: Loop 3					
		4: Loop 4					
Output scaling low limit	Output scaling low limit	-32000 to +32000	0.0000	#	*	✓	With decimal point
Output scaling high limit	Output scaling high limit	-32000 to +32000	100.00	#	*	✓	With decimal point
Linearization table group	Linearization table group definition	0: No linearization	0	#	*	√	

10 12 1		5	Initial	Com	munic		N .
Item display	ltem	Description	value	Read		ite EEPROM	Notes
V change compensation	V change compensation	0: Disabled 1: Correction using voltage of slot A2 2: Correction using voltage of slot B2 3: Correction using voltage of slot A1 4: Correction using voltage of slot B1	0	#	*	✓	

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "V change compensation" is not available.

■ Event configuration bank

Bank selection: EVENT CONFIG

Loop selection: None

Group selection: Event groups 1 to 16

• Events 1 to 16 (common)

Item		Donaidia.		Communication Write			Notos
display	Item	Description	Initial value	Read		EEPROM	Notes
Operation	1 -	0: No event	0	#	*	✓	F or
type	type	1: PV high limit					details, refer
		2: PV low limit					to "Operation (p. 4-67),"
		3: PV high and low limits					"Operation
		4: Deviation high limit					type and
		5: Deviation low limit					Loop definition
		6: Deviation high and low limits					(p. 4-72)" in
		7: Deviation high limit (final SP basis)					the "Event"
		8: Deviation low limit (final SP basis)					section.
		9: Deviation high and low limits (final SP basis)					
		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: MFB high and low limits					
		17 to 25: Reserved					
		26: Standard numerical code high limit					
		27: Standard numerical code low limit					
		28: Standard numerical code high and low limits					
		29: PV change rate					
		30 to 54: Reserved					
		55: PV change rate high limit					
		56: PV change rate low limit					
		57: Standard numerical code change rate high limit					
		58: Standard numerical code change rate low limit					
		59 to 60: Reserved					
		61: Alarm (status)					
		62: READY (status)					
		63: MANUAL (status)					
		64: RSP (status)					
		65: AT running (status)					
		66: During SP ramp (status)					
		67: Control direct action (status)					
		68: Estimating MFB					
		69: Reserved					
		70: Timer					

ltem	Item	Description	Initial		munic	ation rite	Notes
display	Item	Description	value	Read	RAM	EEPROM	Notes
Loop	Loop	1: Loop 1	1	#	*	✓	
definition	definition	2: Loop 2					
		3: Loop 3					
		4: Loop 4					
		5 to 2047: Reserved					
		2048 to 3071: Standard numerical codes					
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
Direct/ reverse	Direct/ reverse	0: Direct	0	#	*	✓	
		1: Reverse					
Standby	Standby	0: No	0	#	*	✓	
		1: Standby					
		2: Standby + standby when the SP is modified					
READY mode	READY mode	0: Continue	0	#	*	✓	
operation	operation	1: Force OFF					

■ DI/DO configuration bank

Bank selection: DI/DO CONFIG

Loop selection: None

Group selection: DI/DO 1 to 7

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		ite	Notes
21/201/	51/501.0	. 5:			RAM	EEPROM	
DI/DO1 /	DI/DO1 Operation type	0: DI	0	✓	-	✓	
Operation type		1: DO					
DI/DO2/	DI/DO2 Operation type	Same as DI/DO 1	0	✓	-	✓	
Operation type							
DI/DO3 /	DI/DO3 Operation type	Same as DI/DO 1	0	✓	-	✓	
Operation type							
DI/DO4 /	DI/DO4 Operation type	0: DI	0	✓	-	✓	
Operation type		1: DO					
		2: TP (time proportioning)					
		output					
DI/DO5 /	DI/DO5 Operation type	Same as DI/DO 4	0	✓	-	✓	
Operation type							
DI/D06 /	DI/DO6 Operation type	Same as DI/DO 4	0	✓	-	✓	
Operation type							
DI/DO7 /	DI/DO7 Operation type	Same as DI/DO 4	0	✓	-	✓	
Operation type							

■ DO configuration bank

Bank selection: DO CONFIG Block selection: DI/DO, A1, B1

Group selection: DO 1 to 7 (for DI/DO), DO 1 to 4 (for blocks A1 and B1)

Block DI/DO

Item display	Item	Description	Initial value	Com Read	munica Wr	ation rite EEPROM	Notes
DO1 / Output type	DO1 Output type	0: OFF	0	#	*	✓	The output type is
	, , , , , , , , , , , , , , , , , , , ,	1 to 10: Reserved					enabled only for
		11: Event 1					numbers set for DO in the DI/DO
							configuration bank.
		12: Event 2					
		13: Event 3					
		14: Event 4					
		15: Event 5					
		16: Event 6					
		17: Event 7					
		18: Event 8					
		19: Event 9					
		20: Event 10					
		21: Event 11					
		22: Event 12					
		23: Event 13					
		24: Event 14					
		25: Event 15					
		26: Event 16					
		27 to 1023: Reserved					
		1024 to 2047: Standard bits					
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
DO2 / Output type	DO2 Output type	Same as DO1	0	#	*	✓	Same as DO1
DO3 / Output type	DO3 Output type	Same as DO1	0	#	*	✓	Same as DO1
DO4 / Output type	DO4 Output type	Same as DO1	0	#	*	✓	Same as DO1
DO5 / Output type	DO5 Output type	Same as DO1	0	#	*	✓	Same as DO1
DO6 / Output type	DO6 Output type	Same as DO1	0	#	*	√	Same as DO1
DO7 / Output type	DO7 Output type	Same as DO1	0	#	*	✓	Same as DO1

• Blocks A1 and B1 (common)

Item display	Item Description		Initial		munic Wi	ation rite	Notes
. ,			value	Read	RAM	EEPROM	
DO1 / Output type	DO1 Output type	Same as Block DI/DO	0	#	*	✓	
		DO1 output type					
DO2 / Output type	DO2 Output type	Same as DO1	0	#	*	✓	
DO3 / Output type	DO3 Output type	Same as DO1	0	#	*	✓	
DO4 / Output type	DO4 Output type	Same as DO1	0	#	*	✓	

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the Block A1 and B1 items are not available.

■ DI bank

Bank selection: DI Loop selection: None

Group selection: DI groups 1 to 32

• DI groups 1 to 32 (common)

Item display	ltem	Description	Initial				Notes
		·	value	Read	RAM	EEPROM	
Item display Operation type	Item Operation type	Description 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: Reserved 8: PV Hold 9 and 10 : Reserved 11: Fixed value output selection (0/+1) 12: Fixed value output selection (0/+2) 13: Fixed value output selection (0/+2) 13: Fixed value output selection (0/+4) 14: Reserved 15: Output linearization table group selection (0/+1) 16: Output linearization table group selection (0/+2) 17: Output linearization table group selection (0/+4) 18 to 20: Reserved 21: RUN/READY mode selection 22: AUTO/MANUAL mode selection 23: LSP/RSP mode selection 24: AT stop/start selection 25: to 40: Reserved 41: Control operation direct/reverse selection 42 to 45: Reserved 46: Timer stop/start selection 47: Release all latches 48 to 50: Reserved 51: RUN/READY mode selection (edge) 52: AUTO/MANUAL mode selection (edge) 53: LSP/RSP mode selection (edge) 54: RUN selection (edge) 55: READY selection (edge) 55: READY selection (edge) 57: MANUAL selection (edge) 57: MANUAL selection (edge) 58 to 59: Reserved 60: Constant value operation / Pattern operation mode selection 61: ADVANCE (edge) 62: HOLD			munica Wr RAM *	ite	For the LSP group selection, the LSP group number is 1 plus the total of the weights (+1, +2, +4) For the PID group selection, the PID group number is 1 plus the total of weights (+1, +2, +4) For the fixed value output selection, the total of the weights is the fixed value number. If the total is 0, fixed value output is not performed. For the output linearization table group selection, the output linearization table group number is the value obtained by adding the total of the weighs to the linearization table group definition value.
		14: Reserved 15: Output linearization table group selection (0/+1) 16: Output linearization table group selection (0/+2) 17: Output linearization table group selection (0/+4) 18 to 20: Reserved 21: RUN/READY mode selection 22: AUTO/MANUAL mode selection 23: LSP/RSP mode selection 24: AT stop/start selection 25 to 40: Reserved 41: Control operation direct/ reverse selection 42 to 45: Reserved 46: Timer stop/start selection 47: Release all latches 48 to 50: Reserved 51: RUN/READY mode selection (edge) 52: AUTO/MANUAL mode selection (edge) 53: LSP/RSP mode selection (edge) 54: RUN selection (edge) 55: READY selection (edge) 56: AUTO selection (edge) 57: MANUAL selection (edge) 58 to 59: Reserved 60: Constant value operation / Pattern operation mode selection					the total of the weights is the fixe value number. If the total is 0, fixed value output is not performed. For the output linearization table group selection, to output linearizati table group num is the value obtain by adding the total of the weighs to the linearization table group definition

			Initial	Com	munica		
Item display	Item	Description	value	Read	Wr RAM	EEPROM	Notes
Input type	Input type	0: Always OFF 1: Always ON 2 to 10: Undefined	0	#	*	✓	The status of DI block terminals is included in the standard bit codes.
		11: DI1 12: DI2 13:DI3					
		14: DI4 15: DI5					
		16: DI6 17: DI7 18 to 1023: Undefined					
		1024 to 2047: Standard bits 14-2 Standard Bit Codes					
		and Standard Numerical Codes (p. 14-8)					
Loop definition	Loop definition	When the operation type is timer stop/start selection, 0: All timer events	0	#	*	✓	
		1 to 16: Event number for timer event					
		When the operation type is Linearization table group selection,					
		1: Block A2 2: Block B2					
		3: Block A1 4: Block B1					
		(valid only when the block type is AO-C or V-P)					
		When the operation type is "Release all latches,"					
		0 to 16: Setting invalid (any set value will be ignored)					
		For other operation types: 0: All loops					
		1: Loop 1 2: Loop 2					
		3: Loop 3 4: Loop 4					

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), DI groups 9 to 32 are not available.

■ TP (time proportioning) bank

Bank selection: TP (TIME PROPORTIONAL)

Block selection: DI/DO, A2, B2, A1, B1

(when A2, B2, A1, B1 are V-P blocks)

Group selection: DO groups 4 to 7 (for DI/DO block)

None (for the A2, B2, A1, B1 blocks)

• Block DI/DO / DO groups 4 to 7 (common)

Item display	Item	Description	Initial value	Com Read		ite	Notes
					RAM	EEPROM	
TP output type	TP output type	0: OFF	0	#	*	✓	The output type is also set for ON/OFF
		1: MV of loop 1					control.
		2: MV of loop 2					control.
		3: MV of loop 3					
		4: MV of loop 4					
		5 to 10:Reserved					
		11: Heat MV of loop 1					
		(for heating/					
		cooling control)					
		12: Cool MV of loop 1					
		(for heating/ cooling control)					
		_					
		13: Heat MV of loop 2 (for heating/					
		cooling control)					
		14: Cool MV of loop 2					
		(for heating/					
		cooling control)					
		15: Heat MV of loop 3					
		(for heating/					
		cooling control)					
		16: Cool MV of loop 3					
		(for heating/ cooling control)					
		17: Heat MV of loop 4					
		(for heating/					
		cooling control)					
		18: Cool MV of loop 4					
		(for heating/					
		cooling control)					
		19 to 2047: Reserved					
		2048 to 3071:					
		Standard numerical					
		codes					
		14-2 Standard Bit					
		Codes and Standard Numerical Codes					
		(p. 14-8)					
TP cycle	TP cycle	0.1000 to 120.00 s	10.000	✓	-	✓	With decimal point

Itam display	ltem	Description	Initial	Com	munic	ation rite	Notes
Item display	item	Description	value	Read		EEPROM	notes
TP operation type	TP operation type	0: Priority on controllability	0	✓	-	√	
		1: Priority on device life (only one ON/ OFF operation within the time proportional cycle)					
Linearization table group	Linearization table group definition	0: No linearization 1 to 8	0	#	*	✓	
V change compensation	V change compensation	0: Disabled 1: Correction using voltage of slot A2 2: Correction using voltage of slot B2	0	#	*	✓	
		3: Correction using voltage of slot A1 4: Correction using voltage of slot B1					

• Blocks A2, B2, A1, and B1 (common)

			Initial	Com	munic		
Item display	ltem	Description	value	Read		ite EEPROM	Notes
TP output type	TP output type	0: OFF 1: MV of loop 1 2: MV of loop 2 3: MV of loop 3 4: MV of loop 4 5 to 10:Reserved 11: Heat MV of loop 1 (for heating/	0	#	*	✓	The output type is also set for ON/OFF control.
		cooling control) 12: Heat MV of loop 1 (for heating/ cooling control) 13: Heat MV of loop 2 (for heating/ cooling control)					
		14: Heat MV of loop 2 (for heating/ cooling control)					
		15: Heat MV of loop 3 (for heating/ cooling control)					
		16: Heat MV of loop 3 (for heating/ cooling control)					
		17: Heat MV of loop 4 (for heating/ cooling control)					
		18: Heat MV of loop 4 (for heating/ cooling control) 19 to 2047: Reserved					
		2048 to 3071: Standard numerical codes					
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
TP cycle	TP output cycle	0.1000 to 120.00 s	2.0000	✓	-	✓	With decimal point
TP operation type	TP operation type	0: Priority on controllability	0	✓	-	√	-
		1: Priority on device life (only one ON/ OFF operation within the time proportional cycle)					
Linearization table group	Linearization table group definition	0: No linearization 1 to 8	0	#	*	✓	

Item display	ltem	Description	Initial value	Com Read		ation ite EEPROM	Notes
V change	V change	0: Disabled	0	#	*	✓	
compensation	compensation	1: Correction using voltage of slot A2					
		2: Correction using voltage of slot B2					
		3: Correction using voltage of slot A1					
		4: Correction using voltage of slot B1					

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "V change compensation" is not available.

■ Logical operation bank

Bank selection: LOGICAL OPERATION Loop selection: Groups 1 to 32 (LOGIC1-32)

Group selection: None

• Logical operations Groups 1 to 32 (common)

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		rite EEPROM	Notes
Operation type	Calculation type	1: Logical Operation 1	1	#	*	EEPROIM ✓	
, , , , ,		(A and B) or (C and D)					
		2: Logical Operation 2					
		(A or B) And (C or D)					
		3: Logical Operation 3					
		(A or B or C or D)					
		4: Logical Operation 4					
		(A and B and C and D)					
Input assignment A	Input assignment A	1024 to 2047	1024	#	*	✓	Rising is detected
Input assignment B	Input assignment B	(Standard bit code)	1024	#	*	✓	if the target data
Input assignment C	Input assignment C	(Staridard bit code)	1024	#	*	✓	is set to ON at power-on when
Input assignment D	Input assignment D		1024	#	*	✓	the setting is "2:
Input bit polarity A	Input bit polarity A	0: Direct	0	#	*	✓	Rising."
Input bit polarity B	Input bit polarity B	1: Reverse	0	#	*	✓	Falling is not
Input bit polarity C	Input bit polarity C		0	#	*	✓	detected if the
Input bit polarity D	Input bit polarity D	2: Rising	0	#	*	✓	target data is
		3: Falling					set to OFF at power-on when
							the setting is "3:
							Falling."
ON delay	ON delay time	0.0000 to 3200.0 s	0.0000	#	*	✓	The time
OFF delay	OFF delay time	0.0000 to 3200.0 s	0.0000	#	*	✓	resolution of the operation is the
							sampling cycle.
							With decimal point
Inversion	Inversion	0: Direct	0	#	*	√	point
		1: Reverse					
Latch	Latch	0: Not latched	0	#	*	√	
		1: Latched when					
		turned ON					
		2: Latched when					
		turned OFF					
		(Except for OFF when					
		power is turned ON)					

! Handling Precautions

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the available logical operation groups are groups 1 to 16.
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "Latch" is not available.

■ Numerical operation bank

Bank selection: NUMERICAL OPERATION

Loop selection: UNIT 1 to 32

Group selection: None

Numerical operation UNIT 1 to 32 (common)

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		rite	Notes
			value	ineau	RAM	EEPROM	
Operation type	Operation type	0 to 22, 101, 102	0	-	-	-	
Input assignment 1	Input assignment 1	-1000 to +9000	0	#	*	✓	
Input assignment 2	Input assignment 2	<u>Details</u>	0	#	*	✓	
Input assignment 3	Input assignment 3	Details	0	#	*	✓	
Input assignment 4	Input assignment 4	-1000 to +1000: Usage	0	#	*	✓	
		depends on the type of					
		operation.					
		1024 to 2047: Standard					
		bit codes					
		bit codes					
		2048 to 3071: Standard					
		numerical codes					
		5001 to 6000:					
		Operation result (bit)					
		numbers					
		6001 to 7000:					
		Operation result					
		numbers					
		7001 to 8000: user-					
		defined bit numbers					
		defined bit numbers					
		8001 to 9000: user-					
		defined value numbers					
Contact input	Contact input	1024 to 8000	1024	#	*	✓	
assignment	assignment	Details					
		1024 to 2047: Standard					
		bit codes					
		5001 to 6000:					
		Operation result (bit)					
		numbers					
		7001 to 8000: user-					
		defined bit numbers					

! Handling Precautions

- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), numerical operations are not supported.
- To change the operation type setting, use the SLP-C7. The setting displayed on this device cannot be changed from the display unit. The setting cannot be read or written by communication.

■ User-defined bit bank

Bank selection: USER DEFINED BIT

Loop selection: None Group selection: None

			Initial	Com	munic		
Item display	Item	Description	value	Read		rite EEPROM	Notes
User-defined bit1	User-defined bit 1	0 to 1	0	✓	-	✓ LLI NOIVI	
User-defined bit2	User-defined bit 2	0 to 1	0	✓	_	1	
User-defined bit3	User-defined bit 3	0 to 1	0	√	-	√	
User-defined bit4	User-defined bit 4	0 to 1	0	✓	_	✓	
User-defined bit5	User-defined bit 5	0 to 1	0	√	-	√	
User-defined bit6	User-defined bit 6	0 to 1	0	✓	-	√	
User-defined bit7	User-defined bit 7	0 to 1	0	✓	-	√	
User-defined bit8	User-defined bit 8	0 to 1	0	✓	-	✓	
User-defined bit9	User-defined bit 9	0 to 1	0	✓	-	√	
User-defined bit10	User-defined bit 10	0 to 1	0	✓	-	✓	
User-defined bit11	User-defined bit 11	0 to 1	0	√	-	✓	
User-defined bit12	User-defined bit 12	0 to 1	0	√	-	✓	
User-defined bit13	User-defined bit 13	0 to 1	0	✓	-	✓	
User-defined bit14	User-defined bit 14	0 to 1	0	✓	-	✓	
User-defined bit15	User-defined bit 15	0 to 1	0	✓	-	✓	
User-defined bit16	User-defined bit 16	0 to 1	0	✓	-	✓	
User-defined bit17	User-defined bit17	0 to 1	0	√	-	√	
User-defined bit18	User-defined bit18	0 to 1	0	✓	-	✓	
User-defined bit19	User-defined bit19	0 to 1	0	✓	-	✓	
User-defined bit20	User-defined bit20	0 to 1	0	✓	-	✓	
User-defined bit21	User-defined bit21	0 to 1	0	✓	-	✓	
User-defined bit22	User-defined bit22	0 to 1	0	✓	-	√	
User-defined bit23	User-defined bit23	0 to 1	0	✓	-	✓	
User-defined bit24	User-defined bit24	0 to 1	0	✓	-	✓	
User-defined bit25	User-defined bit25	0 to 1	0	✓	-	✓	
User-defined bit26	User-defined bit26	0 to 1	0	√	-	√	
User-defined bit27	User-defined bit27	0 to 1	0	✓	-	✓	

Item display	ltem	Description	Initial value	Com Read		ation rite EEPROM	Notes
User-defined bit28	User-defined bit28	0 to 1	0	√	-	✓	
User-defined bit29	User-defined bit29	0 to 1	0	√	-	✓	
User-defined bit30	User-defined bit30	0 to 1	0	√	-	√	
User-defined bit31	User-defined bit31	0 to 1	0	√	-	✓	
User-defined bit32	User-defined bit32	0 to 1	0	√	-	√	



• Parameters in the RAM area for user-defined bits can be accessed via communication. Subserved User-defined bits (RAM) (p. 6-64)

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the number of user-defined bits is 16.

■ User-defined value bank

Bank selection: USER DEFINED VALUE

Loop selection: None Group selection: None

			Initial	Com	munic		
Item display	Item	Description	value	Read		rite EEPROM	Notes
User-defined value1	User-defined value 1	-32768 to +32767	0.0000	#	*	✓	With decimal point
User-defined value2	User-defined value 2	-32768 to +32767	0.0000	#	*	✓	
User-defined value3	User-defined value 3	-32768 to +32767	0.0000	#	*	✓	
User-defined value4	User-defined value 4	-32768 to +32767	0.0000	#	*	✓	
User-defined value5	User-defined value 5	-32768 to +32767	0.0000	#	*	✓	
User-defined value6	User-defined value 6	-32768 to +32767	0.0000	#	*	✓	
User-defined value7	User-defined value 7	-32768 to +32767	0.0000	#	*	✓	
User-defined value8	User-defined value 8	-32768 to +32767	0.0000	#	*	✓	
User-defined value9	User-defined value 9	-32768 to +32767	0.0000	#	*	✓	
User-defined value10	User-defined value 10	-32768 to +32767	0.0000	#	*	✓	
User-defined value11	User-defined value 11	-32768 to +32767	0.0000	#	*	✓	
User-defined value12	User-defined value 12	-32768 to +32767	0.0000	#	*	√	
User-defined value13	User-defined value 13	-32768 to +32767	0.0000	#	*	✓	
User-defined value14	User-defined value 14	-32768 to +32767	0.0000	#	*	√	
User-defined value15	User-defined value 15	-32768 to +32767	0.0000	#	*	✓	
User-defined value16	User-defined value 16	-32768 to +32767	0.0000	#	*	✓	
User-defined value17	User-defined value17	-32768 to +32767	0.0000	#	*	✓	
User-defined value18	User-defined value18	-32768 to +32767	0.0000	#	*	✓	
User-defined value19	User-defined value19	-32768 to +32767	0.0000	#	*	✓	
User-defined value20	User-defined value20	-32768 to +32767	0.0000	#	*	√	
User-defined value21	User-defined value21	-32768 to +32767	0.0000	#	*	√	
User-defined value22	User-defined value22	-32768 to +32767	0.0000	#	*	✓	
User-defined value23	User-defined value23	-32768 to +32767	0.0000	#	*	√	

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		rite	Notes
			value			EEPROM	
User-defined value24	User-defined value24	-32768 to +32767	0.0000	#	*	√	
User-defined value25	User-defined value25	-32768 to +32767	0.0000	#	*	✓	
User-defined value26	User-defined value26	-32768 to +32767	0.0000	#	*	√	
User-defined value27	User-defined value27	-32768 to +32767	0.0000	#	*	✓	
User-defined value28	User-defined value28	-32768 to +32767	0.0000	#	*	√	
User-defined value29	User-defined value29	-32768 to +32767	0.0000	#	*	✓	
User-defined value30	User-defined value30	-32768 to +32767	0.0000	#	*	✓	
User-defined value31	User-defined value31	-32768 to +32767	0.0000	#	*	√	
User-defined value32	User-defined value32	-32768 to +32767	0.0000	#	*	√	

- If the MAIN block firmware is earlier than version 6.x.x (where x stands for any number), the setting range is "-32000 to +32000."
- If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the number of user-defined values is 16.

■ User-defined alarm bank

Bank selection: USERDEFINED ALARM

Loop selection: None

Group selection: Groups 1 to 4

• Groups 1 to 4 (common)

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		rite	Notes
			7 41 41 4		RAM	EEPROM	
Assignment1	Assignment 1	1024 to 2047:	1024	#	*	✓	
Assignment2	Assignment 2	Standard bits	1024	#	*	✓	
Assignment3	Assignment 3	For the standard bit	1024	#	*	✓	
Assignment4	Assignment 4	codes, refer to 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	1024	#	*	*	
Loop definition	Loop definition	0: No 1: Loop 1 2: Loop 2 3: Loop 3 4: Loop 4	0	#	*	~	

! Handling Precautions

- If "1792:Alarm (logical OR of all displayed alarms)" is set for any of user-defined alarm assignments 1–4, and a user-defined alarm occurs, it will not be possible to clear the alarm without turning this device off or restarting it.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no user-defined alarm bank.

■ CT input bank

Bank selection: CT

Block selection: A2, B2, A1, B1

Group selection: None for the AO-C (current output) block.

"CT1" and "CT2" for the V-P (voltage-pulse output) block

• Blocks A2, B2, A1, and B1 (common)

			Initial	Com	munica	ation	
Item display	Item	Description	value	Read		ite EEPROM	Notes
Number of turns	Number of turns	100 to 4000	800	#	*	V V	For AO-C block
Number of power wire loops	Number of power wire loops	1 to 6	1	#	*	√	TOTAL C SIGUR
Filter	Filter	0.0000: No filter	0.0000	#	*	✓	For AO-C block
		0.0001 to 120.00 s					With decimal point
CT1 / Number of turns	Number of CT1 turns	100 to 4000	800	#	*	✓	For V-P block
CT1 / Number of power wire loops	Number of CT1 power wire loops	1 to 6	1	#	*	✓	
CT1 /Filter	CT1 filter	0.0000: No filter	0.0000	#	*	✓	For V-P block
		0.0001 to 120.00 s					With decimal point
CT1 / CT operation	CT1 CT operation	0: Continuous current measurement	0	✓	-	√	For V-P block
		1: Heater burnout detection for OUT					
CT1 / CT measurement wait time	Waiting time for CT1 CT measurement	30 to 300 ms	30	✓	-	√	
CT1 / Burnout detection value	CT1 heater burnout detection current value	0.0000 to 350.00 A	0.0000	#	*	✓	For V-P block With decimal
CT1 / Over-current detection value	CT1 minimum current defined as overcurrent	0.0000 to 350.00 A	0.0000	#	*	✓	point
CT1 / Short-circuit detection value	CT1 minimum current defined as short-circuit	0.0000 to 350.00 A	0.0000	#	*	✓	
CT1 / Hysteresis	CT1 hysteresis	0.0000 to 350.00 A	0.5000	#	*	✓	
CT1 / Delay time	CT1 delay time	0.0000 to 3200.0 s	2.0000	#	*	✓	
CT1 / Unmeasured value condition	CT1 condition for restoring status before measurement	1024 to 2047 (Standard bit code)	1024	#	*	✓	For V-P block
CT2 / Number of turns	Number of CT2 turns	100 to 4000	800	#	*	✓	
CT2 / Number of power wire loops	Number of CT2 power wire loops	1 to 6	1	#	*	√	
CT2 /Filter	CT2 filter	0.0000: No filter	0.0000	#	*	✓	For V-P block
		0.0001 to 120.00 s					With decimal point
CT2 / CT operation	CT2 CT operation	0: Continuous current measurement	0	✓	-	✓	For V-P block
		1: Heater burnout detection for OUT					

			Initial	Com	munic			
Item display	ltem	Description	value	Read		rite	Notes	
			varac	ricua	RAM	EEPROM		
CT2 / CT measurement wait time	Waiting time for CT2 CT measurement	30 to 300 ms	30	✓	-	✓	For V-P block	
CT2 / Burnout detection value	CT2 heater burnout detection current value	0.0000 to 350.00 A	0.0000	#	*	✓	For V-P block With decimal	
CT2 / Over-current detection value	CT2 minimum current defined as overcurrent	0.0000 to 350.00 A	0.0000	#	*	✓	point	
CT2 / Short-circuit detection value	CT2 minimum current defined as short-circuit	0.0000 to 350.00 A	0.0000	#	*	✓		
CT2 / Hysteresis	CT2 hysteresis	0.0000 to 350.00 A	0.5000	#	*	✓		
CT2 / Delay time	CT2 delay time	0.0000 to 3200.0 s	2.0000	#	*	✓		
CT2 / Unmeasured	CT2 condition for	1024 to 2047	1024	#	*	✓	For V-P block	
value condition	restoring status before measurement	(Standard bit code)						

• If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), the filter, CT1 filter, and CT2 filter settings are not available.

■ VT input bank

Bank selection: VT

Block selection: A2, B2, A1, B1

Group selection: None

• Blocks A2, B2, A1, and B1 (common)

Item display	ltem	Description	Initial		nmunication Write		Notes	
item display	rtem	Description	value	Read		EEPROM	Notes	
Primary voltage	Primary voltage	1.0000 to 500.00	200.00	#	*	✓	With decimal point	
Secondary voltage	Secondary voltage	1.0000 to 11.000	10.000	#	*	✓		
Reference voltage	Reference voltage	1.0000 to 500.00	200.00	#	*	✓		
Filter	Filter	0.0000 to 120.00	0.0000	#	*	✓		

! Handling Precautions

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), "Reference voltage" and "Filter" are not available.

■ PP (position proportional) bank

Bank selection: PP (POSITION PROPORTIONAL)

Loop selection: None Group selection: None

			Initial	Com	munica		
Item display	Item	Description	value	Read		ite EEPROM	Notes
Output type	Output type	0: Output OFF	1	#	*	✓	
		1: MV of loop 1					
		2: MV of loop 2					
		3 to 10: Reserved					
		11: Heat MV of loop 1 (for heating/ cooling control)					
		12: Heat MV of loop 1 (for heating/ cooling control)					
		13: Heat MV of loop 2 (for heating/ cooling control)					
		14: Heat MV of loop 2 (for heating/ cooling control)					
		15 to 2047					
		: Reserved					
		2048 to 3071					
		: Standard numerical codes					
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
Selection of control method	Control method selection	0: MFB control + estimated position control	0	√	-	√	
		1: MFB control + close upon line break					
		2: Estimated position control					
		3: Estimated position control + position adjustment at power-on					
Dead zone	Dead zone	0.5000 to 25.000 %	10.000	✓	-	✓	With decimal point

			Initial	Com	munic		
Item display	Item	Description	value	Read		rite EEPROM	Notes
Auto-tuning	Auto-tuning	0: Auto-tuning stop 1: Auto-tuning start 2: Auto-tuning not implemented 3: Auto-tuning completed 4: Auto-tuning failed	2	~	-	1	0 and 1 can be set but are not saved. 2 to 4 are saved automatically when auto-tuning finishes, but can also be set and saved manually.
Fully closed MFB count	Fully closed MFB count	0 to 8000	2000	-	-	-	Saved automatically
Full opening MFB count	Fully open MFB count	0 to 8000	6000	-	-	-	when auto-tuning finishes normally, but can also be set and saved manually.
Full opening time	Full opening time	5.0000 to 240.00 s	40.000	-	-	-	
Linearization table group	Linearization table definition	0: No linearization	0	#	*	√	

■ Linearization table bank

Bank selection: LINEARIZATION TABLE

Loop selection: None

Group selection: Groups 1 to 8

• Table groups 1 to 8 (common)

			Initial	Com	munica	ation	
Item display	ltem	Description	value	Read		ite EEPROM	Notes
Operation type	Operation type	0: Breakpoint	0	#	*	√	
		1: Bias					
Breakpoint A1	Breakpoint A1	-32000 to +32000	-32000	#	*	✓	With decimal point
Breakpoint A2	Breakpoint A2	-32000 to +32000	32000	#	*	✓	,
Breakpoint A3	Breakpoint A3	-32000 to +32000	-32000	#	*	✓	
Breakpoint A4	Breakpoint A4	-32000 to +32000	-32000	#	*	✓	
Breakpoint A5	Breakpoint A5	-32000 to +32000	-32000	#	*	✓	
Breakpoint A6	Breakpoint A6	-32000 to +32000	-32000	#	*	√	
Breakpoint A7	Breakpoint A7	-32000 to +32000	-32000	#	*	✓	
Breakpoint A8	Breakpoint A8	-32000 to +32000	-32000	#	*	✓	
Breakpoint A9	Breakpoint A9	-32000 to +32000	-32000	#	*	✓	
Breakpoint A10	Breakpoint A10	-32000 to +32000	-32000	#	*	✓	
Breakpoint A11	Breakpoint A11	-32000 to +32000	-32000	#	*	√	
Breakpoint A12	Breakpoint A12	-32000 to +32000	-32000	#	*	√	
Breakpoint A13	Breakpoint A13	-32000 to +32000	-32000	#	*	✓	
Breakpoint A14	Breakpoint A14	-32000 to +32000	-32000	#	*	√	
Breakpoint A15	Breakpoint A15	-32000 to +32000	-32000	#	*	✓	
Breakpoint A16	Breakpoint A16	-32000 to +32000	-32000	#	*	√	
Breakpoint A17	Breakpoint A17	-32000 to +32000	-32000	#	*	√	
Breakpoint A18	Breakpoint A18	-32000 to +32000	-32000	#	*	√	
Breakpoint A19	Breakpoint A19	-32000 to +32000	-32000	#	*	√	
Breakpoint A20	Breakpoint A20	-32000 to +32000	-32000	#	*	√	
Breakpoint B1	Breakpoint B1	-32000 to +32000	-32000	#	*	✓	
Breakpoint B2	Breakpoint B2	-32000 to +32000	32000	#	*	✓	
Breakpoint B3	Breakpoint B3	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B4	Breakpoint B4	-32000 to +32000	0.0000	#	*	√	
Breakpoint B5	Breakpoint B5	-32000 to +32000	0.0000	#	*	√	
Breakpoint B6	Breakpoint B6	-32000 to +32000	0.0000	#	*	√	
Breakpoint B7	Breakpoint B7	-32000 to +32000	0.0000	#	*	√	
Breakpoint B8	Breakpoint B8	-32000 to +32000	0.0000	#	*	√	
Breakpoint B9	Breakpoint B9	-32000 to +32000	0.0000	#	*	√	
Breakpoint B10	Breakpoint B10	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B11	Breakpoint B11	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B12	Breakpoint B12	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B13	Breakpoint B13	-32000 to +32000	0.0000	#	*	√	
Breakpoint B14	Breakpoint B14	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B15	Breakpoint B15	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B16	Breakpoint B16	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B17	Breakpoint B17	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B18	Breakpoint B18	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B19	Breakpoint B19	-32000 to +32000	0.0000	#	*	✓	
Breakpoint B20	Breakpoint B20	-32000 to +32000	0.0000	#	*	✓	

• If the MAIN block firmware is version 3.x.x to 6.2.x (where x stands for any number), the initial values of "breakpoint A3" to "breakpoint A10" are 0.0000 and the breakpoint A11–A20 settings and breakpoint B11–B20 settings are not available.

■ Cascade bank

Bank selection: CASCADE Loop selection: None Group selection: None

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read	Write		Notes
·			value	neau	RAM	EEPROM	
Scaling method	Scaling method	0: Fixed	0	#	*	✓	
		1: SP basis					
		2: PV basis					
Scaling low limit	Scaling low limit	-32000 to +32000	0.0000	#	*	✓	With decimal point
Scaling high limit	Scaling high limit	-32000 to +32000	100.00	#	*	✓	
Filter	Filter	0.0000: No filter	0.0000	#	*	✓	
		0.0001 to 120.00 s					

■ Graph bank

Bank selection: GRAPH
Loop selection: Loops 1 to 4
Group selection: None

1. 1. 1		5	Initial	Com	munic		Notes
Item display	ltem	Description	value	Read	RAM	rite EEPROM	
LOOP1 / Sampling	Loop 1	1 to 3600 s	1	-	-	-	
cycle	Recording cycle						
LOOP1 / Graph	Loop 1	-32000 to +32000	0.0000	-	-	-	
scaling low limit	Graph scaling low limit						
LOOP1 / Graph	Loop 1	-32000 to +32000	100.00	-	-	-	
scaling high limit	Graph scaling high limit						
LOOP2 / Sampling	Loop 2	1 to 3600 s	1	-	-	-	
cycle	Recording cycle						
LOOP2 / Graph	Loop 2	-32000 to +32000	0.0000	-	-	-	
scaling low limit	Graph scaling low limit						
LOOP2 / Graph	Loop 2	-32000 to +32000	100.00	-	-	-	
scaling high limit	Graph scaling high limit						
LOOP3 / Sampling	Loop 3	1 to 3600 s	1	-	-	-	
cycle	Recording cycle						
LOOP3 / Graph	Loop 3	-32000 to +32000	0.0000	-	-	-	
scaling low limit	Graph scaling low limit						
LOOP3 / Graph	Loop 3	-32000 to +32000	100.00	-	-	-	
scaling high limit	Graph scaling high limit						
LOOP4 / Sampling	Loop 4	1 to 3600 s	1	-	-	-	
cycle	Recording cycle						
LOOP4 / Graph	Loop 4	-32000 to +32000	0.0000	-	-	-	
scaling low limit	Graph scaling low						
	limit						
LOOP4 / Graph	Loop 4	-32000 to +32000	100.00	-	-	-	
scaling high limit	Graph scaling high limit						
MULTI / Sampling	Multi-loop	1 to 3600 s	1	_	_	_	For multi-loop
cycle	Recording cycle						graph screen

■ Ethernet bank

Bank selection: ETHERNET

Loop selection: None Group selection: None

	ltem	Description	Initial value	Communication			
Item display				Read	Write		Notes
_ ' ′					RAM	EEPROM	
Modbus/TCP port	Modbus/TCP port	0 to 65535	502	-	-	-	
number	number						

■ IP address bank

Bank selection: IP ADDRESS

Loop selection: None Group selection: None

				Communication			
Item display	ltem	Description	Initial value	Read	W	rite	Notes
		-		Read	RAM	EEPROM	
IP address	IP address	0.0.0.0 to	192.168.255.254	-	-	-	
		255.255.255					
Subnet mask	Subnet mask	0.0.0.0 to	255.255.255.0	-	-	-	
		255.255.255					
Default gateway	Default gateway	0.0.0.0 to	0.0.0.0	-	-	-	
		255.255.255					

■ RS-485 bank

Bank selection: RS-485 Loop selection: None Group selection: None

			Initial	Com	munic	ation	
Item display	Item	Description	value	Read		rite	Notes
			value	Neau	RAM	EEPROM	
Station address	Station address	0: No communication	0	✓	-	✓	
		1 to 127					
Transmission speed	Transmission speed	1: 9600 bps	2	✓	-	✓	
		2: 19200 bps					
		3: 38400 bps					
		4: 57600 bps					
		5: 115200 bps					
Data type (parity)	Data type	0: Even parity	0	✓	-	✓	
	(Parity)	1: Odd parity					
		2: No parity					
Data type (stop bits)	Data type	0: 1 bit	0	✓	-	✓	
	(Stop bits)	1: 2 bits					
Minimum response time	Minimum response time	1 to 250 ms	3	✓	_	√	

■ CDS bank

Bank selection: CDS Loop selection: None Group selection: None

Item display	ltem	Description	Initial		munic	ation rite	Notes
		Description	value	Read	RAM	EEPROM	
Recording cycle	Recording cycle	0: Same as sampling cycle	0	#	*	✓	
		1: 0.1 s					
		2: 1 s					
		3: 10 s					
		4: 1 min					
		5: 10 min					
Operation type	Operation type	0: Stop	0	#	*	✓	
		1: DI1 status					
		2: DI2 status					
		3 to 10: Reserved					
		11: Event 1					
		12: Event 2					
		13: Event 3					
		14: Event 4					
		15: Event 5					
		16: Event 6					
		17: Event 7					
		18: Event 8					
		19: Event 9					
		20: Event 10					
		21: Event 11					
		22: Event 12					
		23: Event 13					
		24: Event 14					
		25: Event 15					
		26: Event 16					
		27 to 1023: Reserved					
		1024 to 2047: Standard bits					
		14-2 Standard					
		Bit Codes and Standard Numerical Codes (p. 14-8)					

			Initial	Com	munica	ation	
Item display	ltem	Description	value	Read		rite EEPROM	Notes
Data Selection	Data selection	0: Standard	0	#	*	<u>EEPROINI</u>	
Data Sciention	Data sciection	1: Custom	Ü				
		2:Ring					
Number of data	Number of data items	1 to 40	10	#	*	√	Enabled when
Data1	Data 1	1024 to 2047:	1024	#	*	√	Data Selection is set to
Data2	Data 2	Standard bits	1024	#	*	√	"1:Custom" or
Data3	Data 3	2048 to 3071:	1024	#	*	✓	"2:Ring."
Data4	Data 4	Standard numerical codes	1024	#	*	√	
Data5	Data 5]	1024	#	*	√	
Data6	Data 6	14-2 Standard Bit	1024	#	*	√	
Data7	Data 7	Codes and Standard Numerical Codes	1024	#	*	✓	
Data8	Data 8	(p. 14-8)	1024	#	*	√	
Data9	Data 9		1024	#	*	✓	
Data10	Data 10	_	1024	#	*	✓	
Data11	Data 11	_	1024	#	*	✓	
Data12	Data 12	_	1024	#	*	✓	
Data13	Data 13	_	1024	#	*	✓	
Data14	Data 14		1024	#	*	✓	
Data15	Data 15		1024	#	*	✓	
Data16	Data 16		1024	#	*	✓	
Data17	Data 17		1024	#	*	✓	
Data18	Data 18		1024	#	*	✓	
Data19	Data 19		1024	#	*	✓	
Data20	Data 20		1024	#	*	✓	
Data21	Data 21		1024	#	*	✓	
Data22	Data 22		1024	#	*	✓	
Data23	Data 23		1024	#	*	✓	
Data24	Data 24		1024	#	*	✓	
Data25	Data 25		1024	#	*	✓	
Data26	Data 26		1024	#	*	✓	
Data27	Data 27		1024	#	*	✓	
Data28	Data 28		1024	#	*	✓	
Data29	Data 29		1024	#	*	✓	
Data30	Data 30		1024	#	*	✓	
Data31	Data 31		1024	#	*	✓	
Data32	Data 32]	1024	#	*	✓	
Data33	Data 33		1024	#	*	✓	
Data34	Data 34	_	1024	#	*	✓	
Data35	Data 35]	1024	#	*	✓	
Data36	Data 36]	1024	#	*	✓	
Data37	Data 37	[1024	#	*	✓	
Data38	Data 38	[1024	#	*	✓	
Data39	Data 39]	1024	#	*	✓	
Data40	Data 40		1024	#	*	✓	

- When Data Selection is "0: Standard," Number of data and Data1 to Data40 are disabled.
- When Data Selection is set to "1: Custom" or "2: Ring," data items for the number set in "Number of data items" are enabled from among Data1 to Data40.
- If the version of the MAIN block firmware is earlier than 5.x.x (where x is a wildcard), "Data Selection," "Number of data," and "Data1" to "Data40" are not available. Operation is identical to the case when the data selection is "0: Standard."

■ Health index bank

Bank selection: HEALTH INDEX Loop selection: Loops 1 to 4 Group selection: None

● Loops 1 to 4 (common)

Item display	ltem	Description	Initial		munio W	ation rite	Notes
. ,		·	value	Read	RAM	EEPROM	
Operation type	Operation type	0: Stop 1: DI1 status 2: DI2 status 3 to 10: Reserved 11: Event 1 12: Event 2 13: Event 3 14: Event 4 15: Event 5 16: Event 6 17: Event 7 18: Event 8 19: Event 9 20: Event 10 21: Event 11 22: Event 12 23: Event 13 24: Event 14 25: Event 15 26: Event 16 27 to 1023: Reserved 1024 to 2047: Standard bits 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	0	#	*		
R value scale	R value scale	0 to 10	4	#	*	✓	
Best data	Ideal data	0.0000 to 32000	0.0000	#	*	✓	With decimal point
Deviation low limit	Deviation low limit	0.0000 to 32000	0.0000	#	*	√	No low limit when 0 With decimal point
Deviation high limit	Deviation high limit	0.0000 to 32000	0.0000	#	*	✓	No high limit when 0 With decimal point

■ Health index graph bank

Bank selection: HEALTH INDEX GRAPH

Loop selection: Loops 1 to 4 Group selection: None

Screen	Item	Displayed information	Notes
LOOP1	Latest specific R value	0 to 9999999	The rightmost point on the graph is the
	1st previous specific R value		latest.
	2nd previous specific R value		
	3rd previous specific R value		
	4th previous specific R value		
	5th previous specific R value		
	6th previous specific R value		
	7th previous specific R value		
	8th previous specific R value		
	9th previous specific R value		
LOOP2	Same as LOOP1	0 to 9999999	The rightmost point on the graph is the latest.
	(10 specific R values)		the latest.
LOOP3	Same as LOOP1	0 to 9999999	The rightmost point on the graph is
	(10 specific R values)		the latest.
LOOP4	Same as LOOP1	0 to 9999999	The rightmost point on the graph is the latest.
	(10 specific R values)		the fatest.

■ Date and time bank

Bank selection: DATE TIME

Loop selection: None Group selection: None

Item display	ltem	Description	Initial value	Notes
Date	Date	Year, month, day	2000/1/1	Set to the initial value at power ON
Time	Time	Hour, minute, second	0:00:00	when there is no CLOCK block, or when there is a CLOCK block but the battery is dead.

■ Input assignment bank

Bank selection: INPUT ASSIGNMENT

Loop selection: Loops 1 to 4

Group selection: None

● Loop 1

		5	Initial	Communication			
Item display	ltem	Description		Poad	1	Write	Notes
			value	ineau	RAM	EEPROM	
PV assignment	PV assignment	2048 to 3071: Standard	2312	#	*	✓	2312 is "PV (block
		numerical codes					A4)."
RSP assignment	RSP assignment	2048 to 3071: Standard	2048	#	*	✓	2048 is "fixed to
		numerical codes					0.0."
Assignment range low	Assignment	-32000 to +32000	0.0000	#	*	✓	With decimal point
limit	range low limit						
Assignment range high	Assignment	-32000 to +32000	1000.0	#	*	✓	With decimal point
limit	range high limit						

● Loop 2

Item display	Item	Description	Initial		nmunication Write		Notes
			value	Read	RAM	EEPROM	
PV assignment	PV assignment	2048 to 3071: Standard	2313	#	*	✓	2313 is "PV (block
		numerical codes					B4)."
RSP assignment	RSP assignment	2048 to 3071: Standard	2048	#	*	✓	2048 is "fixed to
		numerical codes					0.0."
Assignment range low	Assignment	-32000 to +32000	0.0000	#	*	✓	With decimal point
limit	range low limit						
Assignment range high	Assignment	-32000 to +32000	1000.0	#	*	✓	With decimal point
limit	range high limit						

● Loop 3

Item display	ltem	Description	Initial	Commu		nication Write	Notes
			value	Read	RAM	EEPROM	
PV assignment	PV assignment	2048 to 3071: Standard	2314	#	*	✓	2314 is "PV (block
		numerical codes					A3)."
RSP assignment	RSP assignment	2048 to 3071: Standard	2048	#	*	✓	2048 is "fixed to
		numerical codes					0.0."
Assignment range low	Assignment	-32000 to +32000	0.0000	#	*	✓	With decimal point
limit	range low limit						
Assignment range high	Assignment	-32000 to +32000	1000.0	#	*	✓	With decimal point
limit	range high limit						

Loop 4

Item display	Item	Description	Initial			nication Write	Notes
		, , ,	value	Read	RAM	EEPROM	
PV assignment	PV assignment	2048 to 3071: Standard	2315	#	*	✓	2315 is "PV (block
		numerical codes					B3)."
RSP assignment	RSP assignment	2048 to 3071: Standard	2048	#	*	✓	2048 is "fixed to 0.0."
		numerical codes					
Assignment range low	Assignment	-32000 to +32000	0.0000	#	*	✓	With decimal point
limit	range low limit						
Assignment range high	Assignment	-32000 to +32000	1000.0	#	*	✓	With decimal point
limit	range high limit						

! Handling Precautions

- If the advanced loop type setting is enabled for [Loop type], the input assignment bank can be displayed and set. The loop type can be set by the SLP-C7 Smart Loader Package.
- For PV assignment and RSP assignment, the standard numerical codes are set. In addition to the PV of the AI block, the PVs and RSPs of other loops, as well as virtual AIs, can be assigned. Although PVs of unimplemented blocks or invalid numerical values can also be assigned, operation will not be performed correctly.
- If the PV and RSP are lower than the alarm setting low limit or higher than the alarm setting high limit, an alarm is generated.
- PID calculation uses the difference between the range low limit for the proportional band and range high limit for the proportional band as 100 % of the proportional band.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no input assignment bank.

■ Virtual analog input bank

Bank selection: VIRTUAL ANALOG INPUT

Loop selection: Virtual AI 1 to 4

Group selection: None

Virtual Al 1

Item display	ltem	Description	Initial value	<u>Co</u> Read		Unication Write EEPROM	Notes
Virtual Al assignment	Virtual Al	2048 to 3071: Standard	2111	#	*	✓	2111 is "User-
	assignment	numerical codes					defined number 1."
		14-2 Standard Bit					
		Codes and Standard					
		Numerical Codes					
		(p. 14-8)					
Filter	Filter	0.0000 to 120.00	0.0000	#	*	✓	With decimal point
Ratio	Ratio	0.0010 to 10.000	1.0000	#	*	✓	With decimal point
Bias	Bias	-32000 to +32000	0.0000	#	*	✓	With decimal point
Linearization table	Linearization	0: No linearization	0	#	*	✓	
group	table group definition	1 to 8					

• Virtual AI 2

Item display	Item	Description	Initial value	Co Read		Mrite EEPROM	Notes
Virtual Al assignment	Virtual AI assignment	2048 to 3071: Standard numerical codes	2112	#	*	✓	2112 is "User- defined number 2."
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
Filter	Filter	0.0000 to 120.00	0.0000	#	*	✓	With decimal point
Ratio	Ratio	0.0010 to 10.000	1.0000	#	*	✓	With decimal point
Bias	Bias	-32000 to +32000	0.0000	#	*	✓	With decimal point
Linearization table group	Linearization table group definition	0: No linearization 1 to 8	0	#	*	✓	

• Virtual AI 3

Item display	Item	Description	Initial value			unication Write EEPROM	Notes
Virtual AI assignment	Virtual Al assignment	2048 to 3071: Standard numerical codes	2113	#	*	√	2113 is "User- defined number 3."
		14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)					
Filter	Filter	0.0000 to 120.00	0.0000	#	*	✓	With decimal point
Ratio	Ratio	0.0010 to 10.000	1.0000	#	*	✓	With decimal point
Bias	Bias	-32000 to +32000	0.0000	#	*	✓	With decimal point

			Initial	Со	mmι	ınication	
Item display	ltem	Description		Poad		Write	Notes
			value	Read	RAM	EEPROM	
Linearization table	Linearization	0: No linearization	0	#	*	✓	
group	table group	1 to 8					
	definition	1100					

Virtual Al 4

Item display	Item	Description	Initial value			Write EEPROM	Notes
Virtual Al assignment	Virtual Al assignment	2048 to 3071: Standard numerical codes 14-2 Standard Bit	2114	#	*	✓	2114 is "User- defined number 4."
		Codes and Standard Numerical Codes (p. 14-8)					
Filter	Filter	0.0000 to 120.00	0.0000	#	*	✓	With decimal point
Ratio	Ratio	0.0010 to 10.000	1.0000	#	*	✓	With decimal point
Bias	Bias	-32000 to +32000	0.0000	#	*	✓	With decimal point
Linearization table	Linearization table group	0: No linearization	0	#	*	√	
group	definition	1 to 8					

! Handling Precautions

- If the advanced loop type setting is enabled for [Loop type], the virtual analog input bank can be displayed and set. The loop type can be set by the SLP-C7 Smart Loader Package.
- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no virtual analog input bank.

■ Feed forward fitter bank

Bank selection: FF-FITTER

Loop selection: Loops 1 to 4

Group selection: None

• Loops 1 to 4 (common)

11 12 1		D	Initial			nication	N
Item display	Item	Description	value	Read	RAM	Write EEPROM	Notes
Operation type	Operation type	0 to 1023: FF-FITTER prohibited	0	#	*	✓	Specifies the FF- FITTER start signal.
		1024 to 2047: standard bit codes (FF-FITTER start/stop)					
T1	T1	0.0000 to 3200.0 s	0.0000	#	*	✓	Target of AT With decimal
T1 MV type	T1 MV type	0: PID MV	0	#	*	√	point
, , , , , , , , , , , , , , , , , , ,		1: Bumpless MV					
		2: FF1 MV					
FF1	FF1 MV	-10.000 to +110.00 %	0.0000	#	*	✓	Valid if "T1 MV type" is "2"
							With decimal point
T1a	T1a	0.0000 to 3200.0 s	0.0000	#	*	✓	With decimal
FF1a	FF1a MV	-10.000 to +110.00 %	0.0000	#	*	✓	With decimal point
T2	T2	0.0000 to 3200.0 s	0.0000	#	*	✓	With decimal point
FF2	FF2 MV	-120.00 to +120.00 %	0.0000	#	*	√	Target of AT With decimal
T2 PID initialization type	T2 PID initialization type	0: PID MV 1: PID initial MV	0	#	*	✓	Valid if T1 or T1a is a value other than
T2 PID initial MV	T2 PID initial MV	-10.000 to +110.00 %	0.0000	#	*	√	0.0000 Valid if "T2 PID initialization type" is "1"
							With decimal point
FF3	FF3 MV	-120.00 to +120.00 %	0.0000	#	*	✓	With decimal point
AT	AT	0: Disabled 1: Enabled	0	#	*	✓	If this item is set to "1" when the FF-FITTER start signal is turned on or off, the AT target settings will be updated automatically. The "AT" setting remains "1" after
							updating, so it must be reset to "0" manually.

T1 AT adjustment factor	T1 AT adjustment	0.0000 to 3200.0	1.0000	#	*	✓	With decimal
	factor						point
T2 AT adjustment factor	T2 AT adjustment	0.0000 to 3200.0	1.0000	#	*	✓	With decimal
	factor						point
AT threshold	AT threshold	0.0000 to 32000	1.0000	#	*	✓	With decimal
							point
AT FF3 data type	AT FF3 data type	0: (Maximum +	0	#	*	✓	
		Minimum) ÷ 2					
		1: Maximum value					
		2: Minimum value					
AT status	AT status	0: AT is not in progress /	0	✓	-	-	Updated at every
		AT completed normally					AT execution
		1: AT is in progress					Reset to "0" when
		2. 47					the power is
		2: AT ended abnormally					turned back on
AT Saved value1	AT Saved value 1	0.0000 to 3200.0 s	0.0000	✓	-	-	Used for servicing
AT Saved value2	AT Saved value 2	0.0000 to 3200.0 s	0.0000	✓	-	-	by manufacturer
AT Saved value3	AT Saved value 3	-32000 to +32000	0.0000	✓	-	-	1
AT Saved value4	AT Saved value 4	-120.00 to +120.00 %	0.0000	✓	-	-	With decimal
AT Saved value5	AT Saved value 5	-120.00 to +120.00 %	0.0000	√	-	-	point

• If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), the "feed forward fitter (FF-FITTER) bank" is not available.

6-3 Pattern Setting Display Data

The operations performed by "Write" in the "Communication" column of the table are as follows.

RAM: Data is only written to RAM. Data is not retained in the event of power failure.

EEPROM: Data is written to both RAM and EEPROM. Data is retained in the event of power failure.

Meanings of the symbols in the "Communication" column of the table are as follows.

- \checkmark : Possible with decimal point position settings 0 to 4
- *: Possible with decimal point position settings 10 to 14
- #: Possible with decimal point position settings 0 to 4 and 10 to 14
- -: Not possible

Decimal point position settings 10 to 14 specify RAM access. The value after subtracting 10 is the number of decimal places.

■ Pattern configuration bank

Bank selection: PATTERN CONFIG

Loop selection: Loops 1 to 4

Group selection: None

● Loops 1 to 4 (common)

			Initial	Com	munic	ation	
Item display	ltem	Description	value	Read		rite	Notes
			value	nead	RAM	EEPROM	
PTN start number	Pattern start number	1 to 16	1	#	*	✓	
PTN start number	Pattern start number	1 to 16	1	#	*	✓	
low limit	low limit						
PTN start number	Pattern start number	1 to 16	16	#	*	✓	
high limit	high limit						
PTN SP increase	Pattern SP increase	0.0000 to 32000	0.0000	#	*	✓	With decimal point
change limit	change limit	No limit when 0.0000					
PTN SP decrease	Pattern SP decrease	0.0000 to 32000	0.0000	#	*	✓	With decimal point
change limit	change limit	No limit when 0.0000					

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no pattern configuration bank.

■ Pattern bank

Bank selection: PATTERN
Pattern selection: Patterns 1 to 16

Segment selection: None

The table below lists the relevant items for one pattern. These items are the same for

patterns 1 to 16.

Pattern settings

			Initial	Com	munic			
Item display	Item	Item Description value Read		Read	RAM EEPROM		Notes	
Number of	Number of segments	1 to 32	32	✓	√	✓		
segments								
G.SOAK time	G.SOAK time	0.0000 to 300.00 s	2.0000	✓	✓	✓	With decimal point	
PV start	PV start	0: Disable PV start	0	✓	✓	✓	PV start is only possible	
		1: Enable PV start					for segment 2.	
Cycle	Cycle	0 to 32000 times	0	✓	✓	✓		
Pattern link	Pattern link	0: No link	0	✓	✓	✓		
		1 to 16: Link						
		destination						
		pattern						
		number						
End of operation	End of operation	0: READY	0	✓	✓	✓		
		1: END						
		2: Constant value						
		operation						

! Handling Precautions

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no pattern bank.
- If the MAIN block firmware is version 6.0.x. to 6.1.x (where x stands for any number), the high limit and the initial value for "Number of segments" is 16.



• When pattern settings are written via communication, RAM and EEPROM (the normal memory area) are differentiated by the data address.

9 - 5 Pattern Communication Data (p. 9-16)

■ Segment bank

Bank selection: SEGMENT
Pattern selection: Patterns 1 to 16
Segment selection: Segments 1 to 32

The table below lists the relevant items for one segment. These items are the same for segments 1 to 32 of patterns 1 to 16.

Segment settings

				Com	munic	ation	
Item display	Item	Description	Initial value	Read		rite EEPROM	Notes
SP	SP	-32000 to +32000	0.0	√	√ V	✓	With decimal
							point
Time	Time	0 to 30000	0	✓	✓	✓	Time unit of
							patterns
PID Group	PID group	For segment 1, 1 to 8	For segment 1, 1	✓	✓	✓	The setting 0
	number	For segments other	For segments other				indicates the
		than segment 1, 0 to 8	than segment 1, 0				same group
		than segment 1, 0 to 0	dian segment 1, 0				number as that
							of the previous
							segment.
G.SOAK type	G.SOAK type	0: No G.SOAK	0	✓	✓	✓	
		1: G.SOAK at the					
		segment end point					
		2: G.SOAK at the					
		segment start point					
G.SOAK width	G.SOAK width	0.0000 to 32000	0.0000	✓	✓	√	With decimal point
Segment event	Segment event	0: No segment event	0	✓	✓	✓	
		1 to 32: Segment					
		event 1 to 32					

! Handling Precautions

- If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), there is no segment bank.
- If the MAIN block firmware is version 6.0.x. to 6.1.x (where x stands for any number), segment selection is 1 to 16 and the high limit for "Segment events" is 16.



• When segment settings are written via communication, RAM and EEPROM (the normal memory area) are differentiated by the data address.

9 - 5 Pattern Communication Data (p. 9-16)

6-4 Parameter Data for Communication

The operations performed by "Write" in the "Communication" column of the table are as follows.

RAM: Data is only written to RAM. Data is not retained in the event of power failure.

EEPROM: Data is written to both RAM and EEPROM. Data is retained in the event of power failure.

Meanings of the symbols in the "Communication" column of the table are as follows.

- ✓: Possible with decimal point position settings 0 to 4
- *: Possible with decimal point position settings 10 to 14
- #: Possible with decimal point position settings 0 to 4 and 10 to 14
- -: Not possible

Decimal point position settings 10 to 14 specify RAM access. The value after subtracting 10 is the number of decimal places.

■ Monitor (RAM)/Loop1 to 4

	5	Cor		nication	
Item	Description		RAM	Nrite EEPROM	Notes
Loop1: (RAM) RUN/READY	0: RUN, 1: READY	√	✓	-	
Loop1: (RAM) AUTO/MANUAL	0: AUTO, 1: MANUAL	✓	✓	-	
Loop1: (RAM) LSP/RSP	0: LSP, 1: RSP	✓	✓	-	
Loop1: (RAM) Current LSP	-32000 to +32000	✓	✓	-	With decimal
Loop1: (RAM) Current proportional band	0.1 to 3200 %	✓	✓	-	point
Loop1: (RAM) Current integral time	0 to 32000 s	✓	✓	-	
Loop1: (RAM) Current derivative time	0 to 32000 s	✓	✓	-	
Loop1: (RAM) Current manual reset	-10 to +110 %	✓	✓	-	
Loop1: (RAM) Current MV low limit	-10 to +110 %	✓	✓	-	
Loop1: (RAM) Current MV high limit	-10 to +110 %	✓	✓	-	
Loop1: (RAM) Current proportional band for cooling	0.1 to 3200 %	✓	✓	-	
Loop1: (RAM) Current integral time for cooling	0 to 32000 s	✓	✓	-	
Loop1: (RAM) Current derivative time for cooling	0 to 32000 s	✓	✓	-	
Loop1: (RAM) Current MV low limit for cooling	-10 to +110 %	✓	✓	-	
Loop1: (RAM) Current MV high limit for cooling	-10 to +110 %	✓	✓	-	

Note: The items for loops 2 to 4 are the same as those for loop 1.

■ Monitor/Mode

Item	Description	Coi Read	,	nication Write EEPROM	Notes
Loop1: RUN/READY	0: RUN, 1: READY	✓	-	✓	
Loop1: AUTO/MANUAL	0: AUTO, 1: MANUAL	✓	-	✓	
Loop1: LSP/RSP	0: LSP, 1: RSP	✓	-	✓	
Loop1: AT stop/start	0: AT stop, 1: AT start	✓	✓	-	

Note: The items for loops 2 to 4 are the same as those for loop 1.

■ Monitor/Operation display (Loop1 to 4)

		Со	mmu	nication	
ltem	Description	Read		Write	Notes
			RAM	EEPROM	
Loop1: PV	Depends on the AI range	✓	-	-	With decimal
Loop1: SP	-32000 to +32000	✓	-	-	point
	Writing is limited by the common				
	range of the SP limit low to high				
	limits and PV range.				
Loop1: MV	-10 to +110 %	✓	-	-	
Loop1: Manual MV	-10 to +110 %	✓	✓	-	
Loop1: Heat MV	-10 to +110 %	✓	-	-	
Loop1: Cool MV	-10 to +110 %	✓	-	-	
Loop1: SP group number	1 to 8	✓	-	-	
Loop1: SP (final value)	-32000 to +32000	✓	-	-	With decimal
Loop1: Deviation (PV – SP)	-32768 to +32767	✓	-	-	point
Loop1: Deviation (PV – SP) final SP basis	-32768 to +32767	✓	-	-	
Loop1: Current LSP	-32000 to +32000	✓	-	✓	
Loop1: RSP	Depends on the AI range	✓	-	-]
Loop1: PID group number	1 to 8	✓	-	-	
Loop1: Current proportional band	0.1 to 3200 %	✓	-	✓	With decimal
Loop1: Current integral time	0 to 32000 s	✓	-	✓	point
Loop1: Current derivative time	0 to 32000 s	✓	-	✓	
Loop1: Current manual reset	-10 to +110 %	✓	-	✓]
Loop1: Current MV low limit	-10 to +110 %	✓	-	✓	
Loop1: Current MV high limit	-10 to +110 %	✓	-	✓	
Loop1: Current proportional band for cooling	0.1 to 3200 %	✓	-	✓	
Loop1: Current integral time for cooling	0 to 32000 s	✓	-	✓	
Loop1: Current derivative time for cooling	0 to 32000 s	✓	-	✓	1
Loop1: Current MV low limit for cooling	-10 to +110 %	✓	-	✓	
Loop1: Current MV high limit for cooling	-10 to +110 %	✓	-	✓	1
Loop1: AT progress	0 to 5 (direct or reverse action)	✓	-	-	
	0 to 8 (heating/cooling)				

Note: The items for loops 2 to 4 are the same as those for loop 1.

■ Monitor/Operation display (AO-C block)

Item	Description			nication Write EEPROM	Notes
Block A1 (AO-C): CT current	0 to 350 A Depends on the setting for the number of turns and on the number of passes by the power wire	√	-	-	With decimal point
Block A1 (AO-C): VT voltage	0 to 264 V Depends on the primary and secondary voltage settings		-	-	
Block A1 (AO-C): CT/VT resistance	0 to 32767 Ω VT input / CT input	✓	-	-	

Note:The items for blocks A2, B1, and B2 are the same as those for block A1.

■ Monitor/operation display (V-P block)

Item	Description	Communication Read Write RAM EEPROM		Write	Notes
Block A1 (V-P): CT1 Continuous current / Current at output ON	0 to 350 A Depends on the setting for the number of turns and on the number of passes by the power wire	√	-	-	With decimal point
Block A1 (V-P): CT1 Current at output OFF	Same as above	✓	-	-	
Block A1 (V-P): CT1 Time proportioning current	Same as above	✓	-	-	
Block A1 (V-P): CT2 Continuous current / Current at output ON	Same as above	√	-	-	
Block A1 (V-P): CT2 Current at output OFF	Same as above	✓	-	-	
Block A1 (V-P): CT2 Time proportioning current	Same as above	✓	-	-	
Block A1 (V-P): Output terminal	0: OFF, 1: ON	✓	-	-	

Note: The items for blocks A2, B1, and B2 are the same as those for block A1.

■ Monitor/Status (DI/DO block)

		Cor		nication	
ltem	Description	Read	RAM	Nrite EEPROM	Notes
DI/DO DI1	0: OFF, 1: ON	✓	-	-	Valid when set
DI/DO DI2	Same as above	✓	-	-	to DI
DI/DO DI3	Same as above	✓	-	-	
DI/DO DI4	Same as above	✓	-	-	
DI/DO DI5	Same as above	✓	-	-	
DI/DO DI6	Same as above	✓	-	-	
DI/DO DI7	Same as above	✓	-	-	
DI/DO DO1	Same as above	✓	-	-	Valid when set to
DI/DO DO2	Same as above	✓	-	-	DO
DI/DO DO3	Same as above	✓	-	-	
DI/DO DO4	Same as above	✓	-	-	
DI/DO DO5	Same as above	✓	-	-	
DI/DO DO6	Same as above	✓	-	-	
DI/DO DO7	Same as above	✓	-	-	

■ Monitor/Status (Events 1 to 16)

ltem	Description		l ,	nication Write	Notes
		Read	RAM	EEPROM	
Event 1	0: OFF, 1: ON	✓	-	-	
Event 2	Same as above	✓	-	-	
Event 3	Same as above	✓	-	-	
Event 4	Same as above	✓	-	-	
Event 5	Same as above	✓	-	-	
Event 6	Same as above	✓	-	-	
Event 7	Same as above	✓	-	-	
Event 8	Same as above	✓	-	-	
Event 9	Same as above	✓	-	-	
Event 10	Same as above	✓	-	-	
Event 11	Same as above	✓	-	-	
Event 12	Same as above	✓	-	-	
Event 13	Same as above	✓	-	-	
Event 14	Same as above	✓	-	-	
Event 15	Same as above	✓	-	-	
Event 16	Same as above	✓	-	-	
Events 1 to 16 (bit field)	Bit field	✓	-	-	Bit fields (p. 9-8)

■ Monitor/Status (other)

Item	Description	Co Read	,	nication Write EEPROM	Notes
SD card status	0: Card not inserted	✓	-	-	
	1: Recognizing card				
	2: Card inserted				

■ Alarm condition

		Co		nication	
ltem	Description	Read	RAM	Write	Notes
Alarm (logical sum of all alarms that can be displayed)	0: No errors, 1: Error	1	KAIVI	EEPROM -	
Block diagnosis alarm	0: No errors	· /			
Block diagnosis alaim		*	-	-	
	1: Block type error				
Memory diagnosis alarm	0: No errors	✓	-	-	
	1: Block with memory failure				
Block failure alarm (bit field)	Bit field	✓	-	-	Bit fields
DO overcurrent alarm (bit field)	Bit field	✓	-	-	(p. 9-8)
SD card alarm	0: No errors, 1: Error	✓	-	-	
Battery alarm	0: No errors, 1: Error	✓	-	-	
CT/VT alarm (AO-C block)	0: No errors	✓	-	-	
	1: AO-C block with CT input error or VT input error				
CT alarm (V-P block)	0: No errors	✓	-	-	
	1: V-P block with CT1 input error or CT2 input error				
Loop1 alarm (bit field)	Bit field	✓	-	-	Bit fields
Loop 2 alarm (bit field)	Bit field	✓	-	-	(p. 9-8)
Loop 3 alarm (bit field)	Bit field	✓	-	-	
Loop 4 alarm (bit field)	Bit field	✓	-	-	
User-defined alarm 1	0: No errors, 1: Error	✓	-	-	
User-defined alarm 2	0: No errors, 1: Error	✓	-	-	
User-defined alarm 3	0: No errors, 1: Error	✓	-	-	
User-defined alarm 4	0: No errors, 1: Error	✓	-	-	

■ Monitor/Position proportional

Item	Description	Daad	,	nication Write EEPROM	Notes
OPEN output	0: OFF, 1: ON	✓	-	-	
CLOSE output	0: OFF, 1: ON	✓	-	-	
Estimating status	0: Not estimating, 1: Estimating	✓	-	-	
Adjustment status	0: Not adjusting, 1: Adjusting	✓	-	-	
Input error	0: No errors, 1: Error	✓	-	-	
Adjustment error	0: No errors, 1: Error	✓	-	-	
Opening amount (estimated)	-10 to +110 %	✓	-	-	With decimal point
Opening amount (actual value)	-10 to +110 %	✓	-	-	
MFB count	0 to 32767	✓	-	-	

■ Monitor/Pattern mode

Item	Description	Co Read		nication Write EEPROM	Notes
Loop1 Constant value operation/pattern operation	0: Constant value operation 1: Pattern operation	#	*	✓	
Loop1 ADVANCE	0: Perform ADVANCE 1: Do not perform ADVANCE	√	✓	-	
Loop1 HOLD	0: Do not perform HOLD 1: Perform HOLD	√	✓	-	
Loop1 G.SOAK	0: G.SOAK clear 1: G.SOAK wait	√	✓	-	Only "0" can be written.

Note: The items for loops 2 to 4 are the same as those for loop 1.

■ Monitor/Pattern monitor

		Co		nication	
Item	Description	Read	DAM	Write EEPROM	Notes
Loop 1 Pattern No.	1 to 16	✓	KAIVI	EEPROW	
·		<u> </u>		_	
Loop 1 Segment No.	1 to 32	✓	-	-	
Loop 1 Pattern SP	-32000 to +32000	✓	-	-	With decimal point
Loop 1 Progress time in segment	0 to 32000	✓	-	-	
Loop 1 Progress time in pattern	0 to 32000	✓	-	-	
Loop 1 Number of executing cycle	0 to 32000	✓	-	-	
Loop 1 Remaining time in segment	0 to 32000	✓	-	-	
Loop 1 Remaining time in pattern	0 to 32000	✓	-	-	
Loop 1 Number of remaining cycle	0 to 32000	✓	-	-	
Loop 1 Setting time in segment	0 to 32000	✓	-	-	
Loop 1 Setting time in pattern	0 to 32000	✓	-	-	
Loop 1 Number of setting cycle	0 to 32000	✓	-	-	
Loop 1 Pattern increase change limit status	0: Not executing	✓	-	-	
	1: Executing				
Loop 1 Pattern decrease change limit status	0: Not executing	✓	-	-	
	1: Executing				

Note: The items for loops 2 to 4 are the same as those for loop 1.

■ Monitor/Segment event

	2	Col		nication	
ltem	Description	Read	RAM	Write EEPROM	Notes
Segment event 1	0: OFF, 1: ON	✓	-	-	
Segment event 2	,	✓	_	-	
Segment event 3		√	-	-	
Segment event 4		✓	-	-	
Segment event 5		✓	-	-	
Segment event 6		✓	-	-	
Segment event 7		✓	-	-	
Segment event 8		✓	-	-	
Segment event 9		✓	-	-	
Segment event 10		✓	-	-	
Segment event 11		✓	-	-	
Segment event 12		✓	-	-	
Segment event 13		✓	-	-	
Segment event 14		✓	-	-	
Segment event 15		✓	-	-	
Segment event 16		✓	-	-	
Segment event 17		✓	-	-	
Segment event 18		✓	-	-	
Segment event 19		✓	-	-	
Segment event 20		✓	-	-	
Segment event 21		✓	-	-	
Segment event 22		✓	-	-	
Segment event 23		✓	-	-	
Segment event 24		✓	-	-	
Segment event 25		✓	-	-	
Segment event 26		✓	-	-	
Segment event 27		✓	-	-	
Segment event 28		✓	-	-	
Segment event 29		✓	-	-	
Segment event 30		✓	-	-	
Segment event 31		✓	-	-	
Segment event 32		✓	-	-	
Segment events 1 to 16 (bit field)	Bit field	✓	-	-	Bit fields
Segment event 17 to 32(bit field)	Bit field	✓	-	-	(p. 9-8)

■ SP Configuration (LSP group selection)

		Communication			
Item	Description	Daad	,	Write	Notes
	·	Read	RAM	EEPROM	
LSP group selection	1 to 8	#	*	✓	
(RAM) LSP group selection	1 to 8	✓	✓	-	

■ User-defined bits (RAM)

		Cor		nication	
ltem	Description	Read	RAM	Write EEPROM	Notes
User-defined bit 1 (RAM)	0: OFF, 1: ON	√	KAIVI ✓	-	
User-defined bit 2 (RAM)		√	√	-	
User-defined bit 3 (RAM)	-	√	√	-	
User-defined bit 4 (RAM)		√	✓	-	
User-defined bit 5 (RAM)		✓	✓	-	
User-defined bit 6 (RAM)		√	√	-	
User-defined bit 7 (RAM)		✓	✓	-	
User-defined bit 8 (RAM)		✓	✓	-	
User-defined bit 9 (RAM)		✓	✓	-	
User-defined bit 10 (RAM)		✓	✓	-	
User-defined bit 11 (RAM)		✓	✓	-	
User-defined bit 12 (RAM)		✓	✓	-	
User-defined bit 13 (RAM)		✓	✓	-	
User-defined bit 14 (RAM)		✓	✓	-	
User-defined bit 15 (RAM)		✓	✓	-	
User-defined bit 16 (RAM)		✓	✓	-	
User-defined bit 17 (RAM)		✓	✓	-	
User-defined bit 18 (RAM)		✓	✓	-	
User-defined bit 19 (RAM)		✓	✓	-	
User-defined bit 20 (RAM)		✓	✓	-	
User-defined bit 21 (RAM)		✓	✓	-	
User-defined bit 22 (RAM)		✓	✓	-	
User-defined bit 23 (RAM)		✓	✓	-	
User-defined bit 24 (RAM)		✓	✓	-	
User-defined bit 25 (RAM)		✓	✓	-	
User-defined bit 26 (RAM)		✓	✓	-	
User-defined bit 27 (RAM)		✓	✓	-	
User-defined bit 28 (RAM)		✓	✓	-	
User-defined bit 29 (RAM)		✓	✓	-	
User-defined bit 30 (RAM)		✓	✓	-	
User-defined bit 31 (RAM)		✓	✓	-	
User-defined bit 32 (RAM)		✓	✓	-	

■ User-defined values(RAM)

				nication	
ltem	Doscription	Cor		Nrite	Notes
l item	Description	Read	RAM	EEPROM	ivotes
User-defined value 1(RAM)	-32768 to +32767	✓	√ V	-	With decimal point
User-defined value 2(RAM)		✓	✓	-	
User-defined value 3(RAM)		✓	✓	-	
User-defined value 4(RAM)		✓	✓	-	
User-defined value 5(RAM)		✓	✓	-	
User-defined value 6(RAM)		✓	✓	-	
User-defined value 7(RAM)		✓	✓	-	
User-defined value 8(RAM)		✓	✓	-	
User-defined value 9(RAM)		✓	✓	-	
User-defined value 10(RAM)		✓	✓	-	
User-defined value 11(RAM)		✓	✓	-	
User-defined value 12(RAM)		✓	✓	-	
User-defined value 13(RAM)		✓	✓	-	
User-defined value 14(RAM)		✓	✓	-	
User-defined value 15(RAM)		✓	✓	-	
User-defined value 16(RAM)		✓	✓	-	
User-defined value 17(RAM)		✓	✓	-	
User-defined value 18(RAM)		✓	✓	-	
User-defined value 19(RAM)		✓	✓	-	
User-defined value 20(RAM)		✓	✓	-	
User-defined value 21(RAM)		✓	✓	-	
User-defined value 22(RAM)		✓	✓	-	
User-defined value 23(RAM)		✓	✓	-	
User-defined value 24(RAM)		✓	✓	-	
User-defined value 25(RAM)		✓	✓	-	
User-defined value 26(RAM)		✓	✓	-	
User-defined value 27(RAM)		✓	✓	-	
User-defined value 28(RAM)		✓	✓	-	
User-defined value 29(RAM)		✓	✓	-	
User-defined value 30(RAM)		✓	✓	-	
User-defined value 31(RAM)		✓	✓	-	
User-defined value 32(RAM)		✓	✓	-	

■ Device info.

Item	Description	Co Read		nication Write EEPROM	Notes
Date code (year)	Production year (last two digits)	✓	-	-	
Date code (month/day)	Production date	✓	-	-	
Serial No.	Serial No.	✓	-	-	
Calender Year (2000–2099)	Year	✓	✓	-	
Calender Month (1–12)	Month	✓	✓	-	
Calender Day (1–31)	Day	✓	✓	-	
Calender Hour (0–23)	Hours	✓	✓	-	
Calender Minute (0–59)	Minutes	✓	✓	-	
Calender Second (0–59)	Seconds	✓	✓	-	
Calendar update of Year, Month, and Day	1: Update	✓	✓	-	The value read is always 0.
Calendar update of Hour, Minute and Second	1: Update	✓	√	-	The value read is always 0.

■ Standard bits

Can be read with 0 digits after the decimal point.

Writing to RAM or EEPROM cannot be done.

■ Standard numerical code

Can be read with 0 to 4 digits after the decimal point.

Writing to RAM or EEPROM cannot be done.

Chapter 7. Modbus RTU Communication Functions

7-1 Overview of Communications

This controller can communicate with a host unit such as a personal computer, PLC, or display unit using the RS-485 communication Modbus RTU protocol.

■ Features

This controller's communication functions have the following features:

- A 3-wire RS-485 system is used.
- Up to 31 of C7 controller units operating as slave stations can be connected to one host unit operating as the master station.
- Any desired communication data address can be set for almost all parameters of this controller. Communication data addresses are set at the factory for general parameters that are used frequently, but they can be changed.
- Communication data addresses can be set using the SLP-C7 Smart Loader Package. Up to 200 communication data addresses can be set. They are used also for Modbus TCP.

! Handling Precautions

• In the case of Modbus communications, the communication data address of this controller that is set on the host unit may change to [host address -1] in a communication message.

Example: If the communication data address is set to "1001" on the host unit, it changes to "1000" in sent communication messages.

Model C7 performs the send/receive process to the communication data address specified in the communication messages.

Take the host unit's specifications into account when using this device.

- Because data is not updated for up to 5 s after turning on or restarting this
 controller, reading and writing of data by communication during this time will
 not be reflected in the controller.
- If the communication specification of the host unit is RS-232C, an RS-232C/RS-485 communication converter (sold separately) is needed.

■ Settings

For Modbus communication, use the following settings.

Item name	Settings	Initial value
Station address	0: No communication 1 to 127	0
Transmission speed	1: 9600 bps 2: 19200 bps 3: 38400 bps 4: 57600 bps 5: 115200 bps	2
Data type (parity)	0: Even parity 1: Odd parity 2: No parity	0
Data type (Stop bits)	0: 1 bit 1: 2 bits	0
Minimum response time	1 to 250 ms	3

! Handling Precautions

- The communication settings cannot be changed through RS-485 communication.
- Configure the settings above according to the characteristics of the host unit and RS-232C/RS-485 communication converter used.

■ Communication procedure

The communication procedure is as follows.

- (1) An instruction message is sent from the host unit (master station) to one unit of this device (slave station).
- (2) The slave station receives the instruction message and executes the read or write process according to the contents of the message.
- (3) Furthermore, the slave station sends a response message appropriate for the process details.
- (4) The master station receives the response message.

! Handling Precautions

 Multiple protocols such as CPL, Modbus ASCII, and Modbus RTU cannot be used together on the same RS-485 transmission line.

7-2 Message Structure

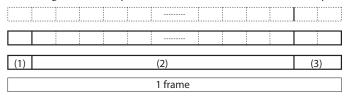
■ Message structure

All messages use binary data.

A Modbus RTU message consists of (1) to (3) below.

Commands that are sent from the master station and responses from the slave station are stored in (2).

All messages use binary data. (One block shown below is 1 byte.)



- (1) Station address (1 byte)
- (2) Send message, response message
- (3) Check code (2 bytes)

Station address

Of the messages that this controller receives, it responds only to those that mention its station address. In the message, the station address is 1 byte. However, if the station address is 0, even if the addresses match, there is no response to the message. In its response, this controller returns the same station address as that in the response message.

Check code (CRC)

This value is used for checking if the message was corrupted due to a problem (e.g., electrical noise) during communications. The check code is 2 bytes.

The following shows how the check code (CRC) is created.

The section from the station address to just before the check code in the message is included in the calculation. For calculation, the binary data in the message is used without change. The check code is 16-bit data and can be calculated using the C language function "get_crc16()" described below. In a message, the first bytes of the code follow the last bytes. This order is the reverse of that of other 16-bit data.

```
[Description] Calculates CRC 16 bits.
[Argument 1] Character string length (number of bytes)
[Argument 2] Pointer at the top of the character string
[Function value] Calculation result

unsigned short get_crc16 ( signed int len, const unsigned char *p )
{
 unsigned short crc16;
 unsigned short next;
 unsigned short carry;
 signed int i;
 crc16 = 0xffff;
 while ( len > 0 )
 {
 next = ( unsigned short ) *p;
```

```
crc16 ^= next;
for ( i = 0; i < 8; i++ )
{
    carry = crc16 & 0x00001;
    crc16 >>= 1;
    if ( carry != 0 )
    {
      crc16 ^= 0xa001;
    }
    p++;
    len--;
}
return crc16;
```

• End-of-frame judgment

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 time-out time shown below, the frame is determined to have ended.

However, note that the time-out time has a fluctuation of ± 1 ms.

Set transmission speed (bps)	Time-out time Transmission speed (bps)
9600	5 ms or more
19200	3 ms or more
38400	2 ms or more
57600	2 ms or more
115200	2 ms or more

■ Command type

Command (send message) types supported by this device are as follows.

Command type	Function code	Conformance class
Multiple data read	03H (1 byte)	class 0
Multiple data write	10H (1 byte)	class 0
1 data write	06H (1 byte)	class 1*

^{*}This device does not support class 1 commands other than 1 data write.

■ Exception codes

In the case of a response message when there was an error, one of the exception codes shown below is put after the function code.

Error type	Exception code	Description
Illegal function code	01H (1 byte)	Function code not supported by this controller
Illegal data address	02H (1 byte)	A data address that could not be read or written was included
Illegal data	03H (1 byte)	Error other than those shown above
Busy	06H (1 byte)	Device cannot process the data. Please send again.

m1 , 1 1 1 1 1 ,1	. 1, 1	11 1 1 . 11
The table below shows the	nrocessing related	to illegal data addresses
The table below shows the	processing related	to megai data addicescs.

Start data address	Second and later data addresses	Exception code	Message processing
Correct	All correct	Exception code for illegal data address is not added.	For a read command, all the data is read. For a write command, all the data is written.
Correct	Incorrect address is included.	For a read command, no illegal data address exception code is added. For a write command, the illegal data address exception code is added.	For a read command, data is read for the correct addresses, and the values of incorrect addresses are read as 0. For a write command, data is written for correct addresses and is not written for incorrect addresses.
Incorrect	All correct	Exception code for	For a read command, data is not read.
Incorrect	Incorrect address is included.	illegal data address is added.	For a write command, data is written for correct addresses and is not written for incorrect addresses.

If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the processing related to illegal data addresses is as shown in the table below.

Start data address	Second and later data addresses	Exception code	Message processing
Correct	All correct	Exception code for illegal data address is not added.	For a read command, all the data is read. For a write command, all the data is written.
Correct	Incorrect address is included.	Exception code for illegal data address is added.	For a read command, data is not read. For a write command, data is written for
Incorrect	Incorrect address is included.		correct addresses and is not written for incorrect addresses.
Incorrect	All correct		

■ Amount of data

The amount of data that can be read or written using a 1-frame message is shown below.

Common and town	Function and	Modbus function	Amoun	Amount of data	
Command type	Function code	(for reference)	RAM	EEPROM	
Multiple data read	03H	Read Holding Registers	1 to 32	1 to 32	
Multiple data write	10H	Preset Multiple Registers	1 to 32	1 to 32	
1 data write	06H	Preset Single Register	1	1	



- For details on the specifications for Modbus communication, refer to the following.
 - Modicon Modbus Protocol Reference Guide (PI-MBUS-300 Rev. J) by MODICON, Inc.
- Copen Modbus/TCP Specification (Release 1.0) by Andy Swales (Schneider Electric)

7-3 Description of Commands

■ Multiple data read command (03H)

Reads the continuous data addresses in hexadecimal notation.

Query message

Specifies the first data address and the number of data items. The structure of the query message is as follows.

01H	03H	03H E9H	00H 02H	15H BBH
(1)	(2)	(3)	(4)	(5)

- (1) Station address
- (2) Function code (Read Holding Registers)
- (3) First data address
- (4) Number of data
- (5) Check code (CRC)

• Response message

The structure of the response message is as follows.

• Example in normal status

ı	01H	03H	04H	03H 01H	00H 03H	
	(1)	(2)	(3)	(4)	(5)	(6)

- (1) Station address
- (2) Function code (Read Holding Registers)
- (3) Number of bytes (= Number of data \times 2)
- (4) Read data 1
- (5) Read data 2
- (6) Check code (CRC)
- Example in error status

	01H	83H	01H	
,	(1)	(2)	(3)	(4)

- (1) Station address
- (2) Error code (Read Holding Registers)
- (3) Exception code (p. 7-4)
- (4) Check code (CRC)

■ Multiple data write command (10H)

Writes continuous data addresses in hexadecimal notation.

Query message

Specifies the start address and the amount of data and 1 or more data items. The structure of the query message is as follows.

Example: The values at addresses 01A0H and 0E53H are written to two continuous data addresses starting at 05DDH.

ı	01H	10H	05H DDH	00H 02H	04H	01H A0H	0EH	53H	45H	В9Н
1	(1)	(2)	(3)	(4)	(5)	(6)	(7	7)	3)	3)

- (1) Station address
- (2) Function code (Preset Multiple Registers)
- (3) First data address
- (4) Number of data
- (5) Number of bytes(=Number of data x 2)
- (6) Write data 1
- (7) Write data 2
- (8) Check code (CRC)

Response message

The structure of the response message is as follows.

• Example in normal status

1	01H	10H	05H DDH	00H	02H		
	(1)	(2)	(3)	(4	1)	(5	5)

- (1) Station address
- (2) Function code (Preset Multiple Registers)
- (3) First data address
- (4) Number of data
- (5) Check code (CRC)
- Example in error status

0AH	90H	01H	
(1)	(2)	(3)	(4)

- (1) Station address
- (2) Error code (Preset Multiple Registers)
- (3) Exception code (p. 7-4)
- (4) Check code (CRC)

■ 1 data write command (06H)

Writes data only with one data address in hexadecimal notation.

Query message

Specifies the data address and data. The structure of the query message is as follows.

Example: The value of 01A0H is written to the data address of 05DDH.

ı	01H	06H	05H DDH	01H A0H	18H D4H
	(1)	(2)	(3)	(4)	(5)

- (1) Station address
- (2) Function code (Preset Single Register)
- (3) Data address
- (4) Write data
- (5) Check code (CRC)

• Response message

The response message in the normal status is the same as the send message.

• Example in normal status

01H	06H	05H DDH	01H A0H	
(1)	(2)	(3)	(4)	(5)

- (1) Station address
- (2) Function code (Preset Single Register)
- (3) Data address
- (4) Write data
- (5) Check code (CRC)
- Example in error status

0AH	86H	01H	
(1)	(2)	(3)	(4)

- (1) Station address
- (2) Error code (Preset Single Register)
- (3) Exception code (p. 7-4)
- (4) Check code (CRC)

7-4 Numeric Value Expression

The data addresses, the number of data, and the data values are expressed using hexadecimal notation.

■ Hexadecimal

The specifications of hexadecimal numbers are shown in the table below.

If the specifications are not satisfied, this controller returns an error response without processing the instruction message.

Item	Specifications	Out of spec examples
Allowable characters	00H to FFH (all)	
Number of characters	2 or 1	00H 01H 02H (3 characters)
Expressible numeric	8000H to 7FFFH (signed data)	
values	0000H to FFFFH (unsigned data)	
(2 characters)	, ,	
Expressible numeric	00H to FFH (unsigned data)	
values		
(1 character)		
Examples of normal	00H 00H	
character strings	12H ABH	
	01H 23H	
	FFH FFH	
	10H	
	04H	

! Handling Precautions

• In Modbus communication, numeric values are expressed in order from the high-order to the low-order (big endian).

7-5 Send/Receive Timing

■ Time specifications for instruction and response messages

For the timing of the transmission of instruction messages from the master station and response messages from the slave station, take the following into account.

• Response monitoring time

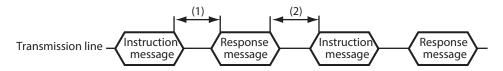
The response time from when the master station finishes sending an instruction message until it begins to receive a response message from the slave station is 2000 ms or less. (No. 1 in the diagram)

Therefore, set the response monitoring time to 2000 ms or longer.

Generally, if response monitoring times out, the instruction message is resent.

Transmission start time

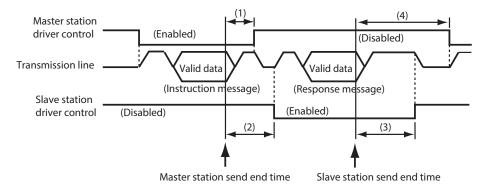
The master station needs to wait for 10 ms or longer from when it finishes receiving the response message until it begins sending the next instruction message (whether to the same slave station or a different slave station). (No. 2 in the diagram)



- (1) Master station send end time Slave station send start time = 2000 ms or less
- (2) Slave station send end time Master station send start time = 10 ms or more

■ Specifications of RS-485 driver control timing

If the master station directly controls data transmission/reception through 3-wire RS-485, carefully check the timing shown below.



- (1) Master station send end time Driver disabled time = 0.5 ms or less
- (2) Slave station receive end time Driver enabled time = Communication minimum response time
- (3) Slave station send end time Driver disabled time = 10 ms or less
- (4) Master station receive end time Driver enabled time = 10 ms or more

Chapter 8. Modbus TCP Communication Functions

8-1 Overview of Communications

This controller can communicate with a host unit such as a personal computer, PLC, or display unit using the Modbus TCP protocol, which is compliant with Ethernet TCP/IP.

■ Features

This controller's communication functions have the following features:

- The host unit can communicate with this device using Ethernet by specifying the IP address of this device.
- Any desired communication data addresses can be set for almost all parameters
 of this device. Communication data addresses are set at the factory for general
 parameters that are used frequently, but they can be changed.
- Communication data addresses can be set using the SLP-C7 Smart Loader Package. Up to 200 communication data addresses can be set. They are used also for Modbus RTU.

! Handling Precautions

- This device can be connected to three host communication units by Modbus TCP. There are three usable connections. (In the same way, three Modbus TCP connections are available when using Modbus RTU with RS-485.)
- In the case of Modbus communications, the communication data address of this controller that is set on the host unit may change to [host address -1] in a communication message.

Example: If the communication data address is set to "1001" on the host unit, it changes to "1000" in sent communication messages.

This device uses the communication data address specified in communication messages for its send/receive processing.

Take the host unit's specifications into account when using this device.

Because data is not updated for up to 5 s after turning on or restarting this
controller, reading and writing of data by communication during this time will
not be reflected in the controller.

Settings

For Modbus TCP communication, use the following settings.

Item	Initial value
IP address	192.168.255.254
Netmask	255.255.255.0
Default gateway	0.0.0.0
Modbus TCP port number	502

! Handling Precautions

• When the IP address, subnet mask, default gateway, or Modbus TCP port number is changed, the setting is reflected from the next time the power is turned ON. Turn the power off and then on again.

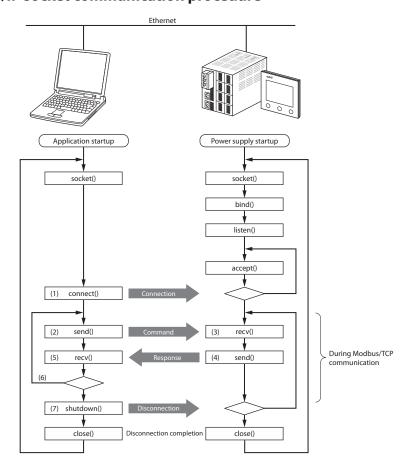
■ Communication procedure

Modbus TCP uses the TCP/IP socket interface for communication.

The procedure for using the TCP/IP socket interface may vary depending on the host unit. The following describes how to use the TCP/IP socket interface with a general computer.

- (1) The host unit (master station) establishes a TCP/IP socket connection with one unit of this device (as a slave station).
- (2) The master station sends an instruction message to the slave station.
- (3) The slave station receives the instruction message and executes read or write processing according to the contents of the message.
- (4) Furthermore, the slave station sends a response message appropriate for the processing details.
- (5) The master station receives the response message.
- (6) To continue the Modbus TCP communication, return to (2).
- (7) To finish the Modbus TCP communication, the master station disconnects the slave station using the TCP/IP socket disconnection process.

■ General TCP/IP socket communication procedure



8-2 Message structure

■ Message structure

The TCP/IP frame is utilized. A Modbus TCP message is shown in the TCP data section.

Modbus TCP

(1)	(2)	(3)	(4)	(5)	(6)

- (1) Transaction Identifier (2 bytes) Not defined particularly.
- (2) Protocol Identifier (2 bytes) 0000H for the Modbus protocol
- (3) Length (2 bytes) Shows the number of bytes in (4) to (6).
- (4) Unit Identifier (1 byte) Specify FFH or 00H.
- (5) Function (1 byte) Specify the function code.
- (6) Data (n bytes) Data column depending on the function code

Detailed data

Transaction Identifier

A request and its response have the same value.

The host station can use the transaction identifier to confirm that the data is the response to the request.

Protocol Identifier

Specify 0000H for the Modbus protocol.

Length

Shows the data length in bytes based on the unit identifier.

Unit Identifier

Specify FFH or 00H.

Function

Specifies the function code.

Data

Communications data

Frame detection method

A TCP frame is equivalent to one Modbus TCP frame.

Port

The Modbus TCP port number is 502 (changeable).

Function code

Function Codes 3 (03H), 16 (10H), and 6 (06H) are supported.

■ Exception code

In the case of a response message when there was an error, one of the exception codes shown below is put after the function code.

Error type	Exception code	Description
Illegal function code	"01" (2 bytes)	Function code not supported by this controller
Illegal data address	"02" (2 bytes)	A data address that could not be read or written was included
Illegal data	"03" (2 bytes)	Error other than those shown above
BUSY	"06" (2 bytes)	This device cannot process the data. Please send again.

The table below shows the processing related to illegal data addresses.

Start data address	Second and later data addresses	Exception code	Message processing
Correct	All correct	Exception code for illegal data address is not added.	For a read command, all the data is read. For a write command, all the data is written.
Correct	Incorrect address is included.	For a read command, no illegal data address exception code is added. For a write command, the illegal data address exception code is added.	For a read command, data is read for the correct addresses, and the values of incorrect addresses are read as 0. For a write command, data is written for correct addresses and is not written for incorrect addresses.
Incorrect	All correct	Exception code for	For a read command, data is not read.
Incorrect	Incorrect address is included.	illegal data address is added.	For a write command, data is written for correct addresses and is not written for incorrect addresses.

If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the processing related to illegal data addresses is as shown in the table below.

Start data address	Second and later data addresses	Exception code	Message processing
Correct	All correct	Exception code for illegal data address is not added.	For a read command, all the data is read. For a write command, all the data is written.
Correct	Incorrect address is included.	Exception code for illegal data address	For a read command, data is not read. For a write command, data is not written.
Incorrect	Incorrect address is included.	is added.	roi a write command, data is not written.
Incorrect	All correct		

■ Amount of data

The amount of data that can be read or written using a 1-frame message is shown below.

Company of the second	Franctica codo	Modbus function	Amount of data	
Command type	Function code	(for reference)		EEPROM
Multiple data read	03H	Read Holding Registers	1 to 32	1 to 32
Multiple data write	10H	Preset Multiple Registers	1 to 32	1 to 32
1 data write	06H	Preset Single Register	1	1



- For details on the specifications for Modbus communication, refer to the following.
 - Modicon Modbus Protocol Reference Guide (PI-MBUS-300 Rev. J) by MODICON, Inc.
- Open MODBUS/TCP Specification (Release 1.0) by Andy Swales (Schneider Electric)

8-3 Description of Commands

■ Application section

Following data representation

X X

is 1 byte in hexadecimal notation. (High nibble on the left)

■ Multiple data read command (03H)

• For 1 data

Query

	•	
0 3		
(1)	(2)	(3)

- (1) Function code (Read Holding Registers)
- (2) First data address
- (3) Number of data (=1)

Normal response

0 3		
(1)	(2)	(3)

- (1) Function code (Read Holding Registers)
- (2) Number of bytes (= 2)
- (3) Read data

Error response

8 3		
(1)	(2)	

- (1) Error code (Read Holding Registers)
- (2) Exception code (= 01H/02H/03H/06H)

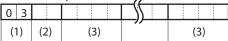
• For multiple data

Ouerv

_	Quely				
	0 3				
	(1)	(2)	(3)		

- (1) Function code (Read HoldingRegisters)
- (2) First data address
- (3) Number of data

Normal response



- (1) Function code (Read Holding Registers)
- (2) Number of bytes (=Number of data x2)
- (3) Read data (Data for the number of read data continues.)

Error response

8 3	
(1)	(2)

- (1) Error code (Read Holding Registers)
- (2) Exception code (= 01H/02H/03H/06H)

■ Multiple data write command (10H)

• For 1 data

Query

-	(
1 0				
(1)	(2)	(3)	(4)	(5)

- (1) Function code (Preset Multiple Registers)
- (2) Start data address
- (3) Number of data (= 1)
- (4) Number of bytes (= Number of data x 2)
- (5) Write data

Normal response

	1	0					
Ī	(1)		(2)		(3	3)	

- (1) Function code (Preset Multiple Registers)
- (2) First data address
- (3) Number of data (= 1)

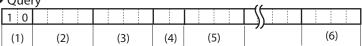
Error response

9 0	
(1)	(2)

- (1) Error code (Preset Multiple Registers)
- (2) Exception code (= 01H/02H/03H/06H)

• For multiple data

Query



- (1) Function code (Preset Multiple Registers)
- (2) Start data address
- (3) Number of data
- (4) Number of bytes (= Number of data x 2)
- (5) Write data

Normal response

_	Normai response									
	1	0							T	
	(1)		(2)			(3	3)		

- (1) Function code (Preset Multiple Registers)
- (2) First data address
- (3) Number of data

Error response



- (1) Error code (Preset Multiple Registers)
- (2) Exception code (= 01H/02H/03H/06H)

■ 1 data write command (06H)

Query

0 6		
(1)	(2)	(3)

- (1) Function code (Preset Single Register)
- (2) Write address
- (3) Write data

Normal response

0 6		
(1)	(2)	(3)

- (1) Function code (Preset Single Register)
- (2) Write address
- (3) Write data (echo back)

Error response



- (1) Error code (Preset Single Register)
- (2) Exception code (= 01H/02H/03H/06H)

Chapter 9. User-defined Addresses

9-1 Overview of User-defined Addresses

Data addresses for communication can be defined for this device. Data addresses of parameters that are frequently used for communication have already been set at the factory.



- 9-3 Initial Values of User-Defined Addresses (p. 9-12).
- For pattern communication data, data addresses are set using a different method from that for parameters. \$\sigma 9 5\$ Pattern Communication Data (p. 9-16).

■ User-defined addresses

The characteristics of user-defined addresses are given below.

Data address format	Decimal number (setting with hexadecimal numbers is also possible.)
Data address setting range	0 to 49999
January Control of the Control of th	(0 is an invalid address.)
Parameter	Data addresses can be set for parameters for setting or monitoring.
	Data addresses can be set for almost all parameters of this device.
Decimal point position	0: 0 digits after the decimal point
	1: 1 digit after the decimal point
	2: 2 digits after the decimal point
	3: 3 digits after the decimal point
	4: 4 digits after the decimal point
	5 to 9: Invalid
	10: 0 digits after the decimal point, RAM area
	11: 1 digit after the decimal point, RAM area
	12: 2 digits after the decimal point, RAM area
	13: 3 digits after the decimal point, RAM area
	14: 4 digits after the decimal point, RAM area
	The number of digits after the decimal point necessary to convert the parameter into data for communication (integers).
	Example: When a parameter of 12.34 is converted to an integer with 1 digit after the decimal point, for communication purposes the parameter is converted to 123.
Number of definitions	200 max.

! Handling Precautions

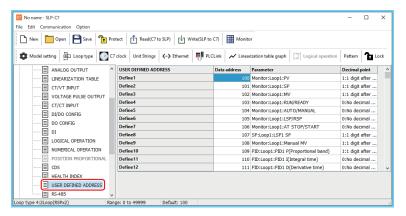
- If the version of the MAIN block firmware is earlier than 5.x.x (where x stands for any number), settings 0 to 4 are enabled and 10 to 14 (in RAM) are invalid for the decimal point position.
- Settings 5 to 14 for the decimal point position may be invalid, depending on the parameter type. Only the parameters that can be set in SLP-C7 are enabled.

9-2 Address Definition Method

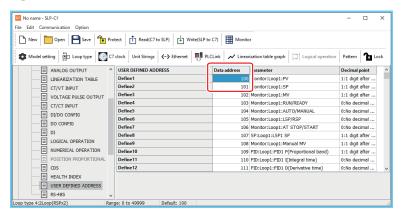
To define the data address, use the SLP-C7 Smart Loader Package. How to define the data address is described below using the SLP-C7 screen as an example.

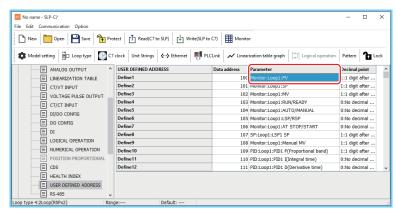
Setting a user-defined address

(1) Open the Setup screen of the SLP-C7 and click the [User-Defined Address] icon.



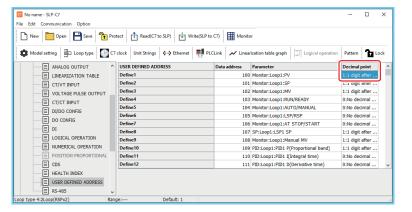
(2) Input the data address for communication into [Data address].





(3) Right-clicking the set value in [Parameter] allows you to select the parameter.

(4) Enter the number of digits after the decimal point in [Decimal point]. Writing data to the RAM area can also be specified by this setting. Refer to Subserved the setting addresses (p. 9-1).

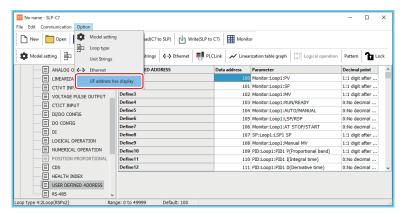


! Handling Precautions

- If the version of the MAIN block firmware is earlier than 5.x.x (where x stands for any number), settings 0 to 4 are enabled and 10 to 14 (in RAM) are invalid for the decimal point position.
- When writing data to Calender Year, Month, and Day of [Device Info.], write the
 data in one message containing the three data items of Calender Year, Month,
 and Day and Calendar update of Year, Month, and Day (writing value = 1).
- When writing data to Calender Hour, Minutes, and Second of [Device Info.], write the data in one message containing the three data items of Calender Hour, Minutes, and Second and Calendar update of Hour, Minute and Second (writing value = 1).

Changing the data address display system

When setting the data address with the SLP-C7, you can select the decimal or hexadecimal system for the display method.



Click [Option] and then click [UF Address hex display] to change the display method

■ Normal memory area and RAM area

Data addresses can be specified for parameters in the normal memory area and the RAM area. In the user-defined address settings, the user can select parameter data in either area that is used for communication.

Normal memory area

Almost all parameters of this device are in the normal memory area, and these parameters are classified into parameters for setting and for monitoring. User-defined addresses can be set for either type of parameter.

Parameter data for setting in the normal memory area is stored in EEPROM. Therefore, the data is retained even if a power failure occurs. Parameter data for monitoring in the normal memory area is not stored in EEPROM and almost all of the data is read-only, but the AT mode (start/stop) and MANUAL MV can be written

! Handling Precautions

- The EEPROM has a read/write cycle lifespan. For data with a high read/write frequency, write to parameters in the RAM area.
 - General specifications, Memory backup (p. 13-9) in Chapter 13, "Specifications."
- The MANUAL MV is not retained if a power failure occurs. If a power failure occurs, the preset MANUAL value is used for the MV.

RAM area

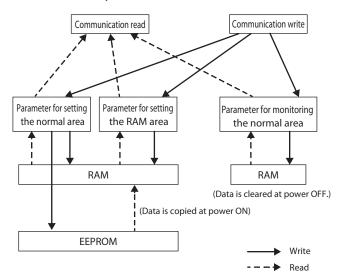
For the parameters that are read or written frequently, both the normal memory area and the RAM area are available. If the parameter is frequently read or written, specify a data address for the parameter in the RAM area.

There are two methods for specifying parameters in the RAM area.

- Select a parameter whose name includes "Monitor (RAM)" for [Parameter] in the user-defined address setting.
- Enter one of the settings from 10 to 14, which specify the RAM area, for [Decimal point] in the user-defined address settings.

! Handling Precautions

 The parameter values in the RAM area are not retained if a power failure occurs. After a power failure, parameter values previously written in the normal memory area are restored.



- When a parameter is read through communication, the data is read from RAM.
- When data is written to a setting parameter in the normal memory area, the data is written to both RAM and EEPROM.
- When data is written to a setting parameter in the RAM area, the data is written only to RAM.
- When data is written to a monitoring parameter in the normal memory area, the data is written only to RAM.
- When the power is turned on, the data is copied from EEPROM to RAM.
- If the firmware version of the MAIN block is earlier than 5.x.x (where x stands for any number), RAM area specification by the decimal point position setting is disabled. If the firmware version of the SLP-C7 is earlier than 1.6.x (where x stands for any number), the RAM area cannot be specified by the decimal point position setting.

■ Precautions when using both the normal memory area and the RAM area for the same parameter

After data is written to the RAM area, if a value different from the RAM area is written to the normal memory area, the value will be retained even if a power loss occurs.

However, after data is written to the RAM area, if the same value as the RAM area is written to the normal memory area, the value will not be retained if a power loss occurs.



• For detailed operation examples, see 41-3 Precautions for Communication Function (p. 14-21).

Also, note the following information.

• The SLP-C7 Smart Loader Package writes to the normal memory area.

The following methods are available for writing the same value to the normal memory area as the value written to the RAM area.

• Method 1:

Write a value to the RAM area, write a different value to the RAM area, and then write the same value to the normal memory area as was first written to the RAM area.

Example: Write 100 to the RAM area. \rightarrow Write 101 to the RAM area. \rightarrow Write 100 to the normal memory area.

This writing method is complex, but it allows the C7 to continue control. Because the number of writing cycles to the normal memory area is less than in Method 2, this method is beneficial in terms of the EEPROM writing life span.

• Method 2:

Write a value to the RAM area, write a different value to the normal memory area, and then write to the normal memory area the same value as was written to the RAM area.

Example: Write 100 to the RAM area. \Rightarrow Write 101 to the normal memory area. \Rightarrow Write 100 to the normal memory area.

This writing method is complex, but it allows the C7 to continue control.

• Method 3:

Turn the power of the C7 off and on again, and then write to the normal memory area.

This writing procedure is simple, but a power operation is required that interrupts control by the C7. Care is also required because operation after turning the power on again starts with the value written in the normal memory area before the power loss.

• Method 4:

When writing from the SLP-C7 Smart Loader Package, select [Communication] \rightarrow [C7 Restart] from the menu in the Setup screen of SLP-C7, to restart the C7, and then write the data from SLP-C7.

This writing procedure is simple, but the restart interrupts control by the C7. Care is also required because operation after the restart starts with the value written in the normal memory area before the restart.

■ Bit fields

• Event status (bit field)

The event status (bit field) items that can be set among the user-defined addresses with the SLP-C7 are shown below.

```
Monitor > Status > Event 1 to Event 16 (bit field)
 Bit15 = Event 16
 Bit14 = Event 15
 Bit13 = Event 14
 Bit12 = Event 13
 Bit11 = Event 12
 Bit10 = Event 11
 Bit9 = Event 10
 Bit8 = Event 9
 Bit7 = Event 8
 Bit6 = Event 7
 Bit5 = Event 6
 Bit4 = Event 5
 Bit3 = Event 4
 Bit2 = Event 3
 Bit1 = Event 2
 Bit0 = Event 1
Monitor > Segment Event > Segment Event 1 to Segment Event 16 (bit field)
 Bit15 = Segment Event 16
 Bit14 = Segment Event 15
 Bit13 = Segment Event 14
 Bit12 = Segment Event 13
 Bit11 = Segment Event 12
 Bit10 = Segment Event 11
 Bit9 = Segment Event 10
 Bit8 = Segment Event 9
 Bit7 = Segment Event 8
 Bit6 = Segment Event 7
 Bit5 = Segment Event 6
 Bit4 = Segment Event 5
 Bit3 = Segment Event 4
 Bit2 = Segment Event 3
 Bit1 = Segment Event 2
 Bit0 = Segment Event 1
```

Monitor > Segment Event > Segment Event 17 to Segment Event 32 (bit field)

Bit15 = Segment Event 32

Bit14 = Segment Event 31

Bit13 = Segment Event 30

Bit12 = Segment Event 29

Bit11 = Segment Event 28

Bit10 = Segment Event 27

Bit9 = Segment Event 26

Bit8 = Segment Event 25

Bit7 = Segment Event 24

Bit6 = Segment Event 23

Bit5 = Segment Event 22

Bit4 = Segment Event 21

Bit3 = Segment Event 20

Bit2 = Segment Event 19

Bit1 = Segment Event 18

Bit0 = Segment Event 17

• Alarm (bit field)

The alarm (bit field) items that can be set among the user-defined addresses with the SLP-C7 are shown below.

```
Monitor > Alarm Status > Block Failure Alarm (bit field)
 Bit15 = MAIN block
 Bit14 = DI/DO block
 Bit13 = RS-485 block
 Bit12 = HMI block
 Bit11 to Bit8 = Empty (fixed to 0)
 Bit7 = Block B4
 Bit6 = Block B3
 Bit5 = Block B2
 Bit4 = Block B1
 Bit3 = Block A4
 Bit2 = Block A3
 Bit1 = Block A2
 Bit0 = Block A1
Monitor > Alarm Status > DO Overcurrent Alarm (bit field)
 Bit15 = Empty (fixed to 0)
 Bit14 = DI/DO block
 Bit13 to Bit8 = Empty (fixed to 0)
 Bit7 = Block B4
 Bit6 = Block B3
 Bit5 = Block B2
 Bit4 = Block B1
 Bit3 = Block A4
 Bit2 = Block A3
 Bit1 = Block A2
 Bit0 = Block A1
Monitor > Alarm Status > Loop 1 Alarm (bit field)
 Bit15 = User-defined alarm
 Bit 14 to Bit 4 = \text{Empty} (fixed to 0)
 Bit3 = RSP high limit error
 Bit2 = RSP low limit error
 Bit1 = PV high limit error
```

Bit0 = PV low limit error

```
Monitor > Alarm Status > Loop 2 Alarm (bit field)
```

Bit15 = User-defined alarm

Bit14 to Bit4 = Empty (fixed to 0)

Bit3 = RSP high limit error

Bit2 = RSP low limit error

Bit1 = PV high limit error

Bit0 = PV low limit error

Monitor > Alarm Status > Loop 3 Alarm (bit field)

Bit15 = User-defined alarm

Bit14 to Bit4 = Empty (fixed to 0)

Bit3 = RSP high limit error

Bit2 = RSP low limit error

Bit1 = PV high limit error

Bit0 = PV low limit error

Monitor > Alarm Status > Loop 4 Alarm (bit field)

Bit15 = User-defined alarm

Bit14 to Bit4 = Empty (fixed to 0)

Bit3 = RSP high limit error

Bit2 = RSP low limit error

Bit1 = PV high limit error

Bit0 = PV low limit error

9-3 Initial Values of User-Defined Addresses

In this device, the initial settings are set for some user-defined addresses.

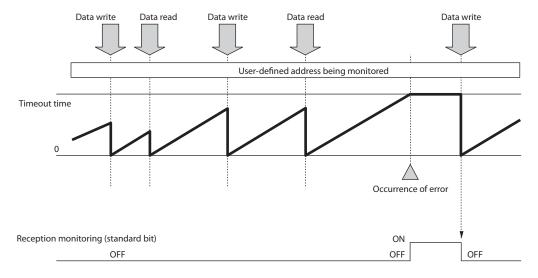
Setting item	Address	Parameter	Decimal point position
User-defined address 1	100	Monitor: Loop1: PV	1
User-defined address 2	101	Monitor: Loop1: SP	1
User-defined address 3	102	Monitor: Loop1: MV	1
User-defined address 4	103	Monitor: Loop1: RUN/READY	0
User-defined address 5	104	Monitor: Loop1: AUTO/MANUAL	0
User-defined address 6	105	Monitor: Loop1: LSP/RSP	0
User-defined address 7	106	Monitor: Loop1: AT stop/start	0
User-defined address 8	107	SP: Loop1: LSP1 SP	1
User-defined address 9	108	Monitor: Loop1: Manual MV	1
User-defined address 10	109	PID: Loop1: PID1 P (Proportional band)	1
User-defined address 11	110	PID: Loop1: PID1 I (Integral time)	0
User-defined address 12	111	PID: Loop1: PID1 D (Derivative time)	0
User-defined address 13	112	PID: Loop1: PID1 RE (Manual reset)	1
User-defined address 14	113	PID: Loop1: PID1 OL (MV low limit)	1
User-defined address 15	114	PID: Loop1: PID1 OH (MV high limit)	1
User-defined address 16	115	Monitor: Sum of alarms (Logical sum of all alarms)	0
User-defined address 17	200	Monitor: Loop2: PV	1
User-defined address 18	201	Monitor: Loop2: SP	1
User-defined address 19	202	Monitor: Loop2: MV	1
User-defined address 20	203	Monitor: Loop2: RUN/READY	0
User-defined address 21	204	Monitor: Loop2: AUTO/MANUAL	0
User-defined address 22	205	Monitor: Loop2: LSP/RSP	0
User-defined address 23	206	Monitor: Loop2: AT stop/start	0
User-defined address 24	207	SP: Loop2: LSP1 SP	1
User-defined address 25	207	Monitor: Loop2: Manual MV	1
User-defined address 26	209	PID: Loop2: PID1 P (Proportional band)	1
User-defined address 27	210	PID: Loop2: PID1 I (Integral time)	0
User-defined address 28	210	PID: Loop2: PID1 D (Derivative time)	0
User-defined address 29	212	PID: Loop2: PID1 RE (Manual reset)	1
User-defined address 30	213	PID: Loop2: PID1 OL (MV low limit)	1
User-defined address 31	213	PID: Loop2: PID1 OH (MV high limit)	1
User-defined address 32	300	Monitor: Loop3: PV	1
User-defined address 32	300	Monitor: Loop3: FV	1
User-defined address 34	301	Monitor: Loop3: MV	1
User-defined address 35	+		
	303	Monitor: Loop3: RUN/READY	0
User-defined address 36 User-defined address 37	304	Monitor: Loop3: AUTO/MANUAL Monitor: Loop3: LSP/RSP	0
	305		-
User-defined address 38	306	Monitor: Loop3: AT stop/start	0
User-defined address 39	307	SP: Loop3: LSP1 SP	1
User-defined address 40	308	Monitor: Loop3: Manual MV	1
User-defined address 41	309	PID: Loop3: PID1 P (Proportional band)	1
User-defined address 42	310	PID: Loop3: PID1 I (Integral time)	0
User-defined address 43	311	PID: Loop3: PID1 D (Derivative time)	0
User-defined address 44	312	PID: Loop3: PID1 RE (Manual reset)	1
User-defined address 45	313	PID: Loop3: PID1 OL (MV low limit)	1
User-defined address 46	314	PID: Loop3: PID1 OH (MV high limit)	1

Setting item	Address	Parameter	Decimal point position
User-defined address 48	401	Monitor: Loop4: SP	1
User-defined address 49	402	Monitor: Loop4: MV	1
User-defined address 50	403	Monitor: Loop4: RUN/READY	0
User-defined address 51	404	Monitor: Loop4: AUTO/MANUAL	0
User-defined address 52	405	Monitor: Loop4: LSP/RSP	0
User-defined address 53	406	Monitor: Loop4: AT stop/start	0
User-defined address 54	407	SP: Loop4: LSP1 SP	1
User-defined address 55	408	Monitor: Loop4: Manual MV	1
User-defined address 56	409	PID: Loop4: PID1 P (Proportional band)	1
User-defined address 57	410	PID: Loop4: PID1 I (Integral time)	0
User-defined address 58	411	PID: Loop4: PID1 D (Derivative time)	0
User-defined address 59	412	PID: Loop4: PID1 RE (Manual reset)	1
User-defined address 60	413	PID: Loop4: PID1 OL (MV low limit)	1
User-defined address 61	414	PID: Loop4: PID1 OH (MV high limit)	1

9-4 Reception Monitoring

Reception can be monitored for Modbus RTU (RS-485) or Modbus TCP (Ethernet) read instruction messages or write instruction messages for up to three user-defined addresses.

The figure below illustrates the process when reception is monitored for both reading and writing for one user-defined address.



■ Reception monitoring settings

Reception monitoring can be set using the SLP-C7 Smart Loader Package. The settings cannot be configured from a display unit. When the reception monitoring function is assigned to a user-defined address, settings can be configured from the host device via communication.

		Initial value	Communication		ation	
Item	Settings		Read		ite	Notes
			ricad	RAM		
Reception monitoring start delay time	0 to 1000 s	0	#	*	✓	
Reception monitoring 1 monitoring	0: Not used	0	#	*	✓	
address	1 to 49999: User-defined address					
Reception monitoring 1 time-out time	1 to 3600 s	180	#	*	✓	
Reception monitoring 1 mode	0: Without reception monitoring	0	#	*	✓	
	1: With read reception monitoring					
	2: With write reception monitoring					
	3: With both read and write					
	reception monitoring					
Reception monitoring 2 monitoring address	Same as reception monitoring 1	0	#	*	✓	
Reception monitoring 2 time-out time		180	#	*	✓	
Reception monitoring 2 mode		0	#	*	✓	
Reception monitoring 3 monitoring	Same as reception monitoring 1	0	#	*	✓	
address						
Reception monitoring 3 time-out time		180	#	*	✓	
Reception monitoring 3 mode		0	#	*	✓	

! Handling Precautions

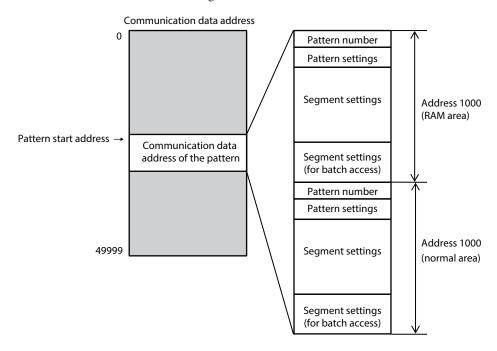
- The reception monitoring status of reception monitoring 1 to 3 is reflected in Reception monitoring 1 to 3 in the standard bit codes. These are OFF when normal and ON when abnormal.
- Enabled for both Modbus RTU (RS-485) and Modbus TCP (Ethernet).
- The received instruction message is judged to have been received regardless of whether the response message is normal or abnormal.

9-5 Pattern Communication Data

A data address for communication for pattern and segment settings can be defined for this device. Although the data address is provided only for one pattern, communication access (reading and writing) is available for all patterns, since the pattern number can be specified.

■ Data address overview

- 2,000 continuous data addresses are provided for pattern and segment settings. The first 1,000 are in the RAM area, and the other 1,000 are in the normal area.
- Pormal memory area and RAM area (p. 9-4)
- The pattern start address can be set. The addresses of the data following the pattern start address are determined automatically by the offset from the start address
- The setting range for the pattern start address is from 0 to 48000. However, if 0 is set, communication access to the pattern data cannot be made.
- To set the pattern start address, use the SLP-C7 Smart Loader Package.
- The data addresses are arranged as shown below.



! Handling Precautions

- There are two types of communication data for the segment settings.
 "Segment settings" contain all types of segment settings, and the addresses are separated by segment.
 - "Segment settings (for batch access)" consists of the SP and segment time settings, and the addresses are continuous.
- The pattern configuration settings are not included in the above pattern communication data. User-defined addresses are set for these settings, as in the case of other parameters.

- The 2,000 data addresses for pattern settings and segment settings cannot overlap with the user-defined addresses for other parameters.
- The number of data items that can be read or written with a one-frame message depends on the type of communication.

Amount of data (p. 7-5) (for Modbus/RTU)

Amount of data (p. 8-5) (for Modbus/TCP)

■ Decimal point

• For communication, the G.SOAK time pattern setting is converted to integer data in accordance with the "Decimal point (G.SOAK time)" setting, and the SP and G.SOAK width segment settings are converted in accordance with the "Decimal point (SP, G.SOAK width)" setting.

0 to 4 decimal places can be set for "Decimal point."

Example: If "Decimal point" is set to 1, 0.1 in the setting would be converted to 1 for the purpose of communication.

If the SP = 12.345, it would be converted to 123 by multiplying by 10 and rounding off.

Writing of SP = 123 is converted to 12.300 by dividing by 10.

Example: If "Decimal point" is set to 2, 0.01 in the setting would be converted to 1 for the purpose of communication.

If the SP = 12.345, it would be converted to 1235 by multiplying by 100 and rounding off.

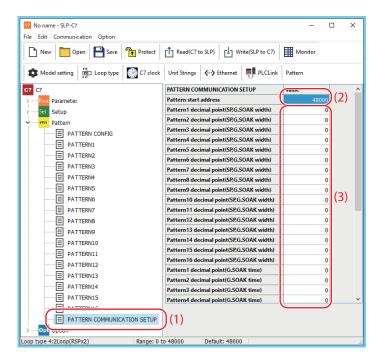
Writing of SP = 1235 is converted to 12.350 by dividing by 100.

• "Decimal point (G.SOAK time)" and "Decimal point (SP, G.SOAK width)" are set separately for each pattern. To set these items, use the SLP-C7 Smart Loader Package.

■ PATTERN COMMUNICATION SETUP

To set the pattern start address, decimal point (SP, G.SOAK width), and decimal point (G.SOAK time), use the SLP-C7 Smart Loader Package. An example is presented here using the SLP-C7 screen.

(1) Open the Setup screen of SLP-C7 and click the [PATTERN COMMUNICATION SETUP] icon.



- (2) Input the desired value for [Pattern start address].
- (3) Enter the desired values for [Decimal point (SP, G.SOAK width)] and [Decimal point (G.SOAK time)] located in the lower portion of the Setup screen.

! Handling Precautions

• If the version of the MAIN block firmware is earlier than 6.x.x (where x stands for any number), the pattern operation function is not available.

Pattern communication access procedure

Preparation

Before writing or reading, set the pattern start address, decimal point (SP, G.SOAK width), and decimal point (G.SOAK time) using the SLP-C7 Smart Loader Package.

Writing all pattern data

- (1) Write the pattern number of the pattern to be written in "Pattern number" at the start of the address.
- (2) Write the pattern settings.
- (3) Write the segment settings starting from Segment 1. End the writing after writing the settings for the last segment.

• Reading all pattern data

- (1) Write the pattern number of the pattern to be read in "Pattern number" at the start of the address.
- (2) Read the pattern settings.
- (3) Read the segment settings starting from Segment 1. End the reading after reading the settings of the last segment.

• Writing only the SP and the time of the pattern data

- (1) Write the pattern number of the pattern to be written in "Pattern number" at the start of the address.
- (2) Write the segment settings (for batch access) for multiple segments. End the writing after writing the settings of the last segment.

Reading only the SP and the time of the pattern data

- (1) Write the pattern number of the pattern to be written in "Pattern number" at the start of the address.
- (2) Read the segment settings (for batch access) for multiple segments. End the reading after reading the settings of the last segment.

! Handling Precautions

- Write the pattern number at the start of writing or reading. However, it is also possible to write the pattern number and pattern settings in one message.
- There is no restriction on the order of writing and reading of the pattern settings, segment settings, and segment settings (for batch access) after writing the pattern number. It is possible to write or read the pattern settings after the segment settings, skip some segments, write data for only one segment, or alternate between writing and reading.

■ Data address details

The following table shows the offset and corresponding item for the data addresses of the pattern settings, segment settings, and segment settings (for batch access).

The value obtained by adding the offset in the table below to the pattern start address is the communication data address.

Pattern number

Offset	Item
0	Pattern number

Pattern settings

Offset	ltem	
1	(Reserved)	
2	(Reserved)	
3	Number of segments	
4	G.SOAK time	
5	PV start	
6	Cycle	
7	Pattern link	
8	End of operation	

Segment settings

Offset	ltem
100	Segment 1: SP
101	Segment 1: Time
102	Segment 1: PID group number
103	G.SOAK type
104	Segment 1: G.SOAK width
105	Segment 1: Segment event
106 to 109	(Reserved)
110 to 115	Segment 2: Same as for Segment 1.
116 to 119	(Reserved)
120 to 125	Segment 3: Same as for Segment 1.
126 to 129	(Reserved)
130 to 135	Segment 4: Same as for Segment 1.
136 to 139	(Reserved)
140 to 145	Segment 5: Same as for Segment 1.
146 to 149	(Reserved)
150 to 155	Segment 6: Same as for Segment 1.
156 to 159	(Reserved)
160 to 165	Segment 7: Same as for Segment 1.
166 to 169	(Reserved)
170 to 175	Segment 8: Same as for Segment 1.
176 to 179	(Reserved)
180 to 185	Segment 9: Same as for Segment 1.
186 to 189	(Reserved)
190 to 195	Segment 10: Same as for Segment 1.
196 to 199	(Reserved)
200 to 205	Segment 11: Same as for Segment 1.
206 to 209	(Reserved)
210 to 215	Segment 12: Same as for Segment 1.
216 to 219	(Reserved)
220 to 225	Segment 13: Same as for Segment 1.
226 to 229	(Reserved)
230 to 235	Segment 14: Same as for Segment 1.
236 to 239	(Reserved)
240 to 245	Segment 15: Same as for Segment 1.
246 to 249	(Reserved)
250 to 255	Segment 16: Same as for Segment 1.
256 to 259	(Reserved)
260 to 265	Segment 17: Same as for Segment 1.
266 to 269	(Reserved)
270 to 275	Segment 18: Same as for Segment 1.
276 to 279	(Reserved)
280 to 285	Segment 19: Same as for Segment 1.
286 to 289	(Reserved)
290 to 295	Segment 20: Same as for Segment 1.
296 to 299	(Reserved)
300 to 305	Segment 21: Same as for Segment 1.
306 to 309	(Reserved)

Offset	ltem
310 to 315	Segment 22: Same as for Segment 1.
316 to 319	(Reserved)
320 to 325	Segment 23: Same as for Segment 1.
326 to 329	(Reserved)
330 to 335	Segment 24: Same as for Segment 1.
336 to 339	(Reserved)
340 to 345	Segment 25: Same as for Segment 1.
346 to 349	(Reserved)
350 to 355	Segment 26: Same as for Segment 1.
356 to 359	(Reserved)
360 to 365	Segment 27: Same as for Segment 1.
366 to 369	(Reserved)
370 to 375	Segment 28: Same as for Segment 1.
376 to 379	(Reserved)
380 to 385	Segment 29: Same as for Segment 1.
386 to 389	(Reserved)
390 to 395	Segment 30: Same as for Segment 1.
396 to 399	(Reserved)
400 to 405	Segment 31: Same as for Segment 1.
406 to 409	(Reserved)
410 to 415	Segment 32: Same as for Segment 1.
416 to 419	(Reserved)

! Handling Precautions

• For the data addresses of the reserved items, the value read is 0. In addition, 0 is the only value that can be written to them.

• Segment settings (for batch access)

Offset	ltem
800	Segment 1: SP
801	Segment 1: Time
802	Segment 2: SP
803	Segment 2: Time
804	Segment 3: SP
805	Segment 3: Time
806	Segment 4: SP
807	Segment 4: Time
808	Segment 5: SP
809	Segment 5: Time
810	Segment 6: SP
811	Segment 6: Time
812	Segment 7: SP
813	Segment 7: Time
814	Segment 8: SP
815	Segment 8: Time
816	Segment 9: SP
817	Segment 9: Time
818	Segment 10: SP
819	Segment 10: Time
820	Segment 11: SP
821	Segment 11: Time
822	Segment 12: SP
823	Segment 12: Time
824	Segment 13: SP
825	Segment 13: Time
826	Segment 14: SP
827	Segment 14: Time
828	Segment 15: SP
829	Segment 15: Time
830	Segment 16: SP
831	Segment 16: Time
832	Segment 17: SP
833	Segment 17: Time
834	Segment 18: SP Segment 18: Time
835 836	Segment 19: SP
837	Segment 19: Time
838	Segment 20: SP
839	Segment 20: Time
840	Segment 21: SP
841	Segment 21: Time
842	Segment 22: SP
843	Segment 22: Time
844	Segment 23: SP
845	Segment 23: Time
846	Segment 24: SP

Offset	Item	
847	Segment 24: Time	
848	Segment 25: SP	
849	Segment 25: Time	
850	Segment 26: SP	
851	Segment 26: Time	
852	Segment 27: SP	
853	Segment 27: Time	
854	Segment 28: SP	
855	Segment 28: Time	
856	Segment 29: SP	
857	Segment 29: Time	
858	Segment 30: SP	
859	Segment 30: Time	
860	Segment 31: SP	
861	Segment 31: Time	
862	Segment 32: SP	
863	Segment 32: Time	

-MEMO-

Chapter 10. PLC Link Communication

10-1 Data Transfer

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-C7 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	32 lines	4 sheets	32 lines
Triggered data transfer	4 sheets	32 lines		

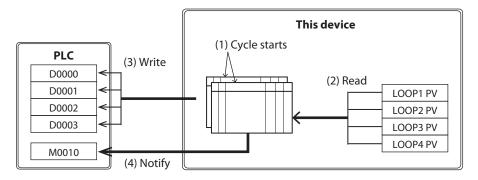
Cyclic data transfer

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.

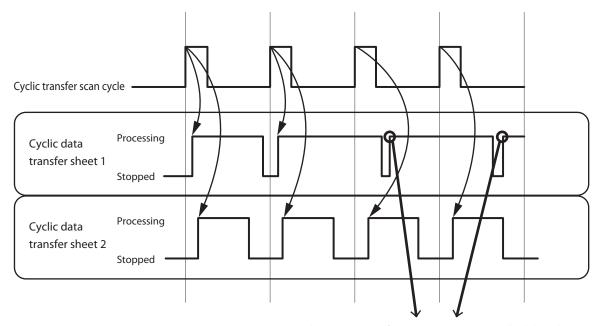


- (1) The controller starts cyclic data transfer for the specified sheet at the timing of the [Cyclic transfer scan cycle] setting.
- (2) Data is read from the controller.
- (3) The read data is written to the PLC.
- (4) When transfer of the data specified for the sheet is complete, a completion notification is written.

The cyclic transfer scan cycle and cyclic data transfer operations are as follows.

In each cycle, data transfer is executed for all sheets whose data has not been transferred.

Sheets that are in progress but cannot be completed in time are done immediately after the transfer is complete. For the sheets for which completion of data transfer continues to be delayed, transfer is executed consecutively with no pause.



Executed continuously if completion is continually delayed

! Handling Precautions

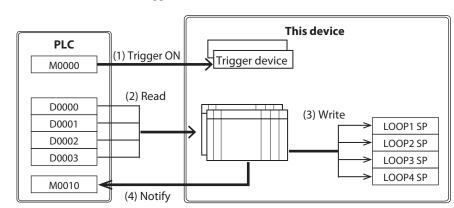
- If the cyclic transfer scan cycle is too short for the amount of data to be transferred, the cyclic data transfer process may be delayed continuously, resulting in all sheets being executed consecutively instead of periodically. This means that data is transferred on a cycle longer than the [Cyclic transfer scan cycle] setting.
- If a process such as CDS writing is being executed, data may not be transferred in the specified cycle.
- The normal memory area and RAM area are available for the data written from the PLC to the C7. Chapter 9. User-defined Addresses Normal memory area and RAM area (p. 9-4)

• 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 value, PID setting, etc.) from the PLC
- Changing the controller operations (RUN/READY mode selection, etc.) from the PLC

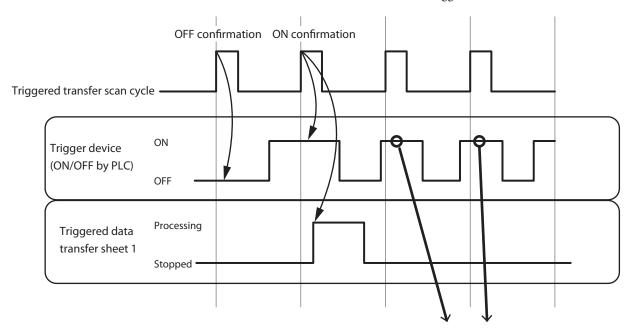


The controller executes triggered data transfer as follows.

- (1) The controller reads the trigger device at the timing of the [Triggered transfer scan cycle] setting 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.

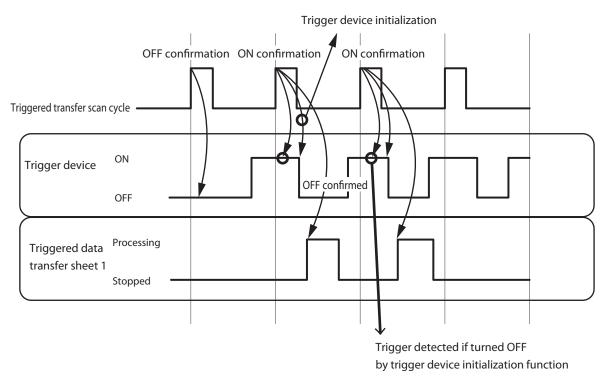
The triggered transfer scan cycle and triggered data transfer operations are as follows.

Data transfer is started for all sheets for which trigger device = ON is detected.



Trigger cannot be detected if PLC ON/OFF is too fast for triggered scan

When the [Trigger device initialization] setting is [Yes], the trigger device is turned off immediately after the trigger is detected. When the trigger device is turned off by the trigger device initialization function, the status is the same as when the controller finds that the trigger device is off. Therefore, in the next trigger scan cycle, the trigger is detected if it is on.



■ Connectible PLCs

The connectible PLCs are shown in the table below.

Company name	Series name	Protocol	Transport layer
Mitsubishi Electric	MELSEC iQ-R	SLMP (3E) Binary	TCP
Corporation	MELSEC Q		
	MELSEC L		
	MELSEC iQ-F		
Keyence	KV-7000 series	SLMP (3E) Binary	TCP
Corporation	KV-5000/3000 series*		
	KV Nano series		

^{*} The C7 cannot be connected to models KV-1000 and KV-700.

■ Usable devices

The address ranges of the devices (data) usable with each model are as follows.

• C7 controller (this device)

Various monitoring data and parameters can be selected in the PLC link settings in the SLP-C7 Smart Loader Package.

Mitsubishi Electric, SLMP

Device type	Address range
Input relay	X000000 to X00FFFF
Output relay	Y000000 to Y00FFFF
Internal relay	M0000000 to M2147483647
Special relay	SM0000000 to SM0032767
Link special relay	SB000000 to SB7FFFFFF
Edge relay	V0000000 to V0032767
Latch relay	L0000000 to L0032767
Link relay	B000000 to B7FFFFFF
Annunciator	F0000000 to F0032767
Timer (contact)	TS0000000 to TS2147483647
Timer (coil)	TC0000000 to TC2147483647
Estimate timer (contact)	SS0000000 to SS2147483647
Estimate timer (coil)	SC0000000 to SC2147483647
Counter (contact)	CS0000000 to CS2147483647
Counter (coil)	CC0000000 to CC2147483647
Data register	D0000000 to D2147483647
Link register	W000000 to W7FFFFFF
Index register	Z0000000 to Z0000032
File register (R)	R0000000 to R0032767
File register (R)	ZR0000000 to ZR2147483647
Special register	SD0000000 to SD0032767
Link special register	SW000000 to SW7FFFFFF
Timer current value	TN0000000 to TN2147483647
Estimate timer current value	SN0000000 to SN2147483647
Counter current value	CN0000000 to CN2147483647

• Mitsubishi Electric, iQ-F SLMP

Device type	Address range
Input relay	X000000 to X177777
Output relay	Y000000 to Y177777
Internal relay	M0000000 to M2147483647
Special relay	SM0000000 to SM0032767
Link special relay	SB000000 to SB7FFFFFF
Latch relay	L0000000 to L0032767
Link relay	B000000 to B7FFFFFF
Annunciator	F0000000 to F0032767
Timer (contact)	TS0000000 to TS2147483647
Timer (coil)	TC0000000 to TC2147483647
Estimate timer (contact)	SS0000000 to SS2147483647
Estimate timer (coil)	SC0000000 to SC2147483647
Counter (contact)	CS0000000 to CS2147483647
Counter (coil)	CC0000000 to CC2147483647
Data register	D0000000 to D2147483647
Link register	W000000 to W7FFFFFF
Index register	Z0000000 to Z0000032
File register (R)	R0000000 to R0032767
Special register	SD0000000 to SD0032767
Link special register	SW000000 to SW7FFFFFF
Timer current value	TN0000000 to TN2147483647
Estimate timer current value	SN0000000 to SN2147483647
Counter current value	CN0000000 to CN2147483647

Keyence

Device type	Address range
Relay	R000000 to R099915
Internal auxiliary relay	MR000000 to MR399915
Latch relay	LR000000 to LR099915
Data memory	DM00000 to DM65534
Extended data memory	EM00000 to EM65534
File register	FM00000 to FM32767
File register	ZF00000 to ZF524287
Link relay	B0000 to B7FFF
Link register	W0000 to W7FFF
Control relay	CR000000 to CR008915
Control memory	CM00000 to CM08999

■ Completion notification data

When transfer of data within a sheet is completed during cycle data transfer and trigger data transfer, completion notification data is written. The contents of the completion notification data are as follows.

Туре	Code	Description
Communication succeeded	0	Normal response
Data access error	1	Timeout without response
Illegal address	2	Wrong data address
Data attribute error	3	Attempt to overwrite write-protected data (including write-protection because of the status of the instrument)
Data range error	4	Attempt to write an out-of-range value
EEPROM write error	5	Writing to EEPROM failed.
EEPROM read error	6	Reading from EEPROM failed.
I/O block state mismatch	7	I/O block type error, I/O block failure
I/O block timeout	8	I/O block came off the C7, I/O block failure
Data conversion error	9	16-bit data conversion overflow
Other C7 error	10	Error other than the above
PLC error	Other than the above	Error because of the PLC

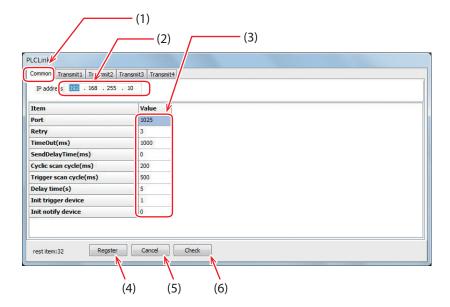
10-2 PLC Link Setting Method

To set up PLC link communication, use the SLP-C7 Smart Loader Package.

Open the Setup screen of SLP-C7 and click the [PLC Link] button to open the [PLC Link] window.

An example is presented here using the SLP-C7 screen.

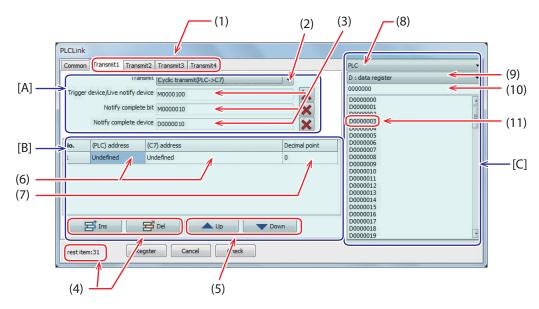
■ Common settings



- (1) Select the [Common] tab to configure the PLC connection settings common to transfer 1 to 4.
- (2) Enter the IP address of the PLC.
- (3) Enter a value for each item.
- (4) 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.
- (5) Click the [Cancel] button to discard the configured PLC link settings.
- (6) Click the [Check] button to check that all the transfer setting addresses have been defined.

■ 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 [Operation type].
- (3) Drag and drop an address in section [C] to [Trigger device / live notification device], [Completion notification bit], and [Completion notification data].

Section [B] Transfer data settings

- (4) The number of lines can be increased or decreased with [Ins] and [Del]. One line corresponds to one item. Up to 32 items can be specified in total for transfer 1 to transfer 4 combined. [Remaining items] is displayed at the bottom of the screen.
- (5) Other lines can be selected by using [Up] and [Down].
- (6) Set [PLC Address] and [C7 Address] by dragging and dropping an address in section [C].
- (7) Set the number of decimal places for converting data with decimal points to integer data for communication. For example, if 1 digit after the decimal place is set, data with a decimal point is converted to integer data 10 times larger.

Section [C] Address list

- (8) Select [Device (PLC or C7)].
- (9) Select [Data type].
- (10) Enter the first address in the list. Right-click with the mouse to increase or decrease.
- (11) An address can be selected from the list and dragged and dropped to sections [A] and [B].

■ Transfer setting examples

Cyclic data transfer (PLC → C7)

Used for continuously writing parameters from the PLC to the C7.

In this example, data items D0000100 to D0000103 are converted to data with 1 digit after the decimal point and transferred to the C7 periodically.

Transfer operation settings

Transfer type Cyclic data transfer (PLC \Rightarrow C7)

Live notification device M0000100

Device to receive completion notification bit M0000010

Device to receive completion notification data D0000010

Note

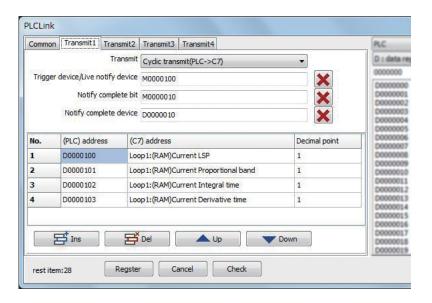
- Data is periodically transferred according to the [Cyclic transfer scan cycle] setting on the [Common] tab.
- "0" and "1" are written alternately and periodically to the live notification device.
- If [Init Notify Device] is set to [Enabled] on the [Common] tab, "0" is written to the device to receive the completion notification bit immediately before the data transfer.
- After the data transfer, "1" is written to the device to receive the completion notification bit.
- After the data transfer, if the transfer is successful, "0" is written to the device to receive completion notification data. If an error occurred in the transfer, a non-zero value is written to the device.

Transfer data settings

 $D0000100 \rightarrow Loop1: (RAM)$ Current LSP Decimal place 1 $D0000101 \rightarrow Loop1: (RAM)$ Current proportional band Decimal place 1 $D0000102 \rightarrow Loop1: (RAM)$ Current integral time Decimal place 1 $D0000103 \rightarrow Loop1: (RAM)$ Current derivative time Decimal place 1

! Handling Precautions

• Use the RAM writing address when transferring (writing) to the C7 periodically.



■ Cyclic data transfer (C7 → PLC)

Used for monitoring the C7 data on the PLC.

In this example, C7 data is converted to data with 1 digit after the decimal point and transferred to D0000200 to D0000201 periodically.

• Transfer operation settings

Transfer type Cyclic data transfer (C7 \Rightarrow PLC)

Live notification device M0000101

Device to receive completion notification bit M0000011

_

Device to receive completion notification data

Note

• Data is periodically transferred according to the [Cyclic transfer scan cycle] setting on the [Common] tab.

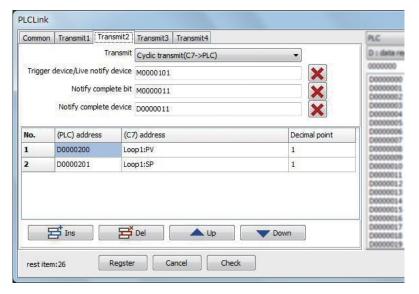
D0000011

- "0" and "1" are written alternately and periodically to the live notification device.
- If [Init Notify Device] is set to [Enabled] on the [Common] tab, "0" is written to the device to receive the completion notification bit immediately before the data transfer.
- After the data transfer, "1" is written to the device to receive the completion notification bit.
- After the data transfer, if the transfer is successful, "0" is written to the device to receive completion notification data. If an error occurred in the transfer, a non-zero value is written to the device.

Transfer data settings

Loop1: PV Decimal place 1 → D0000200

Loop1: SP Decimal place 1 → D0000201



■ Triggered data transfer (PLC → C7)

Used for writing from the PLC to the C7 parameters at timing determined by the PLC.

This example shows the transfer of M0000016 and M0000017 to the C7 mode when M0000050 changes from OFF to ON.

Transfer operation settings

Transfer type Cyclic data transfer (PLC \rightarrow C7)

Trigger device M0000050

Device to receive completion notification bit M0000060

Device to receive completion notification data D0000050

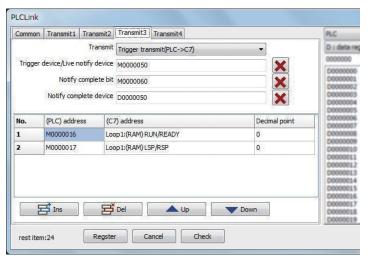
Note

- If [Init Trigger Device] is set to [Enabled] on the [Common] tab, "0" is written to the trigger device when a trigger is detected.
- If [Init Notify Device] is set to [Enabled] on the [Common] tab, "0" is written to the device to receive the completion notification bit when a trigger is detected.
- After the data transfer, "1" is written to the device to receive the completion notification bit.
- After the data transfer, if the transfer is successful, "0" is written to the device to receive completion notification data. If an error occurred in the transfer, a non-zero value is written to the device.

Transfer data settings

M0000016 → Loop1: (RAM) RUN/READY Decimal place 0

 $M0000017 \rightarrow Loop1: (RAM) LSP/RSP$ Decimal place 0



■ Triggered data transfer (C7 → PLC)

Used for writing from the C7 to the PLC data at a C7 event.

This example shows the transfer of the C7 data to D0000070 and D0000071 when Event 1 of the C7 changes from OFF to ON.

Transfer operation settings

Transfer type Cyclic data transfer (C7 \rightarrow PLC)

Trigger device Event 1

Device to receive completion notification bit M0000051

Device to receive completion notification data D0000051

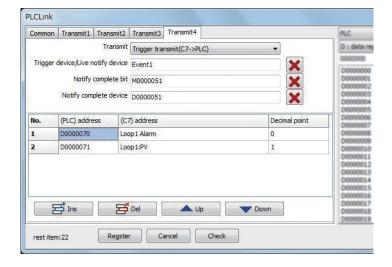


- If [Init Trigger Device] is set to [Enabled] on the [Common] tab, "0" is written to the trigger device when a trigger is detected.
- If [Init Notify Device] is set to [Enabled] on the [Common] tab, "0" is written to the device to receive the completion notification bit when a trigger is detected.
- After the data transfer, "1" is written to the device to receive the completion notification bit.
- After the data transfer, if the transfer is successful, "0" is written to the device to receive completion notification data. If an error occurred in the transfer, a non-zero value is written to the device.

Transfer data settings

Loop1: Alarm Decimal place 0 → D0000070

Loop1: PV Decimal place $1 \rightarrow D0000071$



10-3 List of PLC Link Settings

The PLC link settings include the PLC connection settings, transfer settings, and data settings.

■ PLC connection settings

Setting item	Description	Initial value	Notes
IP address	0.0.0.1 to 255.255.255.254	192.168.255.10	
Port	0 to 65535	1025	
Number of retries	0 to 10 times	3	
Timeout time	100 to 60000 ms	1000	Availability depends on your firmware version.
Transmission delay time	0 to 1000 ms	0	
Cyclic transfer scan cycle	100 to 1000 ms	200	
Triggered transfer scan cycle	100 to 1000 ms	500	
Startup delay time	0 to 60 s	5	
Trigger device initialization	0: No 1: Yes	1	
Notification device initialization		0	
	1: Yes		

! Handling Precautions

- If the MAIN block firmware is version 6.3.x (where x stands for any number) or later, this device operates with a timeout of 1000 ms even if the timeout time is set to shorter than 1000 ms.
- If the MAIN block firmware is version is earlier than version 6.3.x (where x stands for any number) and the device is connected to a Mitsubishi PLC, set the timeout time to 4000 ms or longer. If a time shorter than 4000 ms is set, faulty communication may result, depending on the configuration of the Mitsubishi PLC, etc.

■ Transfer settings

Transfer sheets 1 to 4 can be set independently.

Setting item	Description	Initial value	Notes
Transfer type	Cyclic data transfer (PLC → C7)	Not set	
	Cyclic data transfer (C7 → PLC)		
	Triggered data transfer (PLC → C7)		
	Triggered data transfer (C7 → PLC)		
Trigger device address	[When trigger device is PLC]	Not set	For triggered data transfer
	See the list of address ranges for the PLC device type.		
	Usable devices (p. 10-5)		
	[When trigger device is C7]		
	Selectable from the C7 monitor data and parameters.		

Setting item	Description	Initial value	Notes
Live notification device address	See the list of address ranges for the PLC device type.	Not set	For cyclic data transfer
	Usable devices (p. 10-5)		
Completion notification bit address	See the list of address ranges for the PLC device type.	Not set	
	Usable devices (p. 10-5)		
Completion notification data address	See the list of address ranges for the PLC device type.	Not set	
	Usable devices (p. 10-5)		

! Handling Precautions

• If the firmware version of the MAIN block is 3.x.x (where x stands for any number), completion notification data can be set, but it is not written.

■ Data settings

Transfer sheets 1 to 4 can be set independently. Up to 32 data items can be specified in total for all sheets combined. The settings for each data item are shown in the table below.

Setting item	Description	Initial value	Notes
PLC device type address	See the list of address ranges for the PLC device type.	Not set	
C7 data	Selectable from the C7 monitor data and parameters.	Not set	
No. of decimal places	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	
	4: 4 digits after the decimal point		

10-4 Mitsubishi PLC

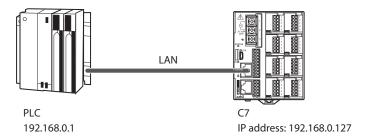
The following describes the communication settings of the Mitsubishi PLC.

■ iQ-R series CPU direct connection

Usage examples of the following devices are provided.

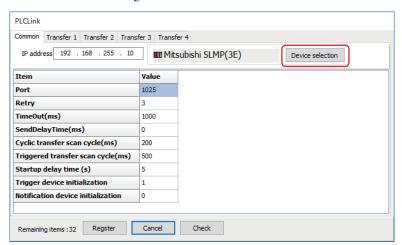
PLC	R04CPU
Communication interface	CPU module Ethernet port
Communication protocol	TCP/IP, SLMP (3E), binary code

Device structure

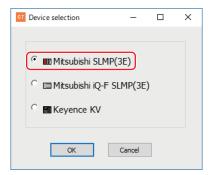


SLP-C7 settings

(1) On the PLC Link settings screen, click the [Device selection] button.



(2) Select "Mitsubishi SLMP (3E)" and click the [OK] button.



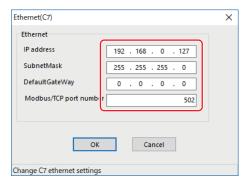
PLCLink Common Transfer 1 Transfer 2 Transfer 3 Transfer 4 IP address 192 . 168 . 0 . 1 Mitsubishi SLMP(3E) Device selection 1025 Port Retry TimeOut(ms) 1000 SendDelayTime(ms) Cyclic transfer scan cycle(ms) 200 Triggered transfer scan cycle(ms) 500 Startup delay time (s) Trigger device initialization Notification device initialization Remaining items :32 Regster Cancel Check

(3) Configure the PLC Link settings according to the device settings of the Mitsubishi PLC.

IP address: 192.168.0.1

Port number: 1025

(4) Configure the Ethernet settings for the C7.



IP address: 192.168.0.127

Subnet mask: 255.255.255.0

Default gateway: 0.0.0.0

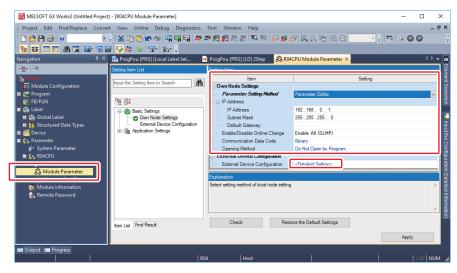
PLC settings

Configure the settings as shown below in GX-Works3.

- (1) Go to Project > New and create a new project, with "RCPU" set for Series and "R04" for Type.
- (2) Double-click [Module Parameter] of "Parameter."

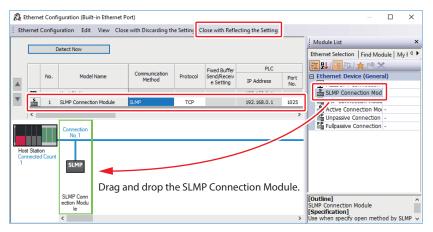
>>The R04CPU Module Parameter setting window appears.

(3) Select [Basic Settings] and set each item of Own Node Settings.



Setting item		Setting
IP Address	IP Address	192.168.0.1
	Subnet Mask	255.255.255.0
Enable/Disable Online Change		Enable All (SLMP)
Communication Data Code		Binary
Opening Method		Do Not Open by Program

- (4) Click "Detailed Setting" of [External Device Configuration].
 - >> The Ethernet Configuration setting window for the Built-in Ethernet Port appears.
- (5) Select "SLMP Connection Module" from the Module List, and drag and drop it.
 - >> The selected SLMP device is added to the first row. Configure the device settings, and click the [Close with Reflecting the Setting] button.



Setting item	Setting
Model Name	SLMP Connection Module
Protocol	TCP
PLC Port No.	1025

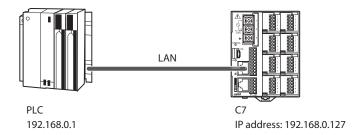
- >>The Module Parameter Ethernet Port setting window appears.
- (6) Click the [Apply] button to close the window.

■ Q series CPU direct connection

Usage examples of the following devices are provided.

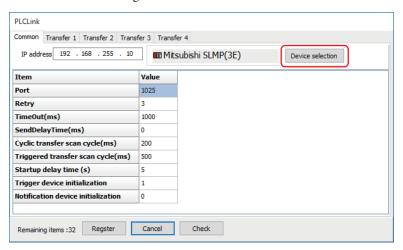
PLC	Q04UDEHCPU
Communication interface	CPU module Ethernet port
Communication protocol	TCP/IP, SLMP (3E), binary code

Device structure



SLP-C7 settings

(1) On the PLC Link settings screen, click the [Device selection] button.



(2) Select "Mitsubishi SLMP (3E)" and click the [OK] button.



PLCLink Common Transfer 1 Transfer 2 Transfer 3 Transfer 4 IP address 192 . 168 . 0 . 1 Mitsubishi SLMP(3E) Device selection 1025 Port Retry 1000 TimeOut(ms) SendDelayTime(ms) Cyclic transfer scan cycle(ms) 200 Triggered transfer scan cycle(ms) 500 Startup delay time (s) Trigger device initialization

Check

(3) Configure the PLC Link settings according to the device settings of the Mitsubishi PLC.

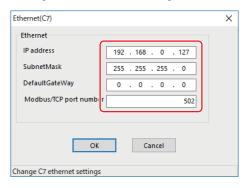
IP address: 192.168.0.1

Remaining items :32 Regster Cancel

Port number: 1025

Notification device initialization

(4) Configure the Ethernet settings for the C7.



IP address: 192.168.0.127

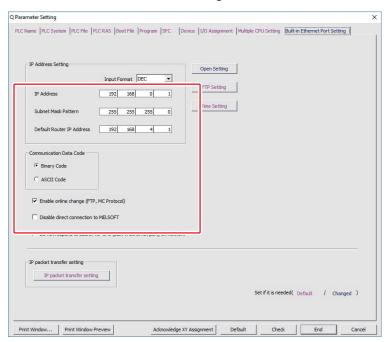
Subnet mask: 255.255.255.0

Default gateway: 0.0.0.0

PLC settings

Configure the settings as shown below in GX-Developer.

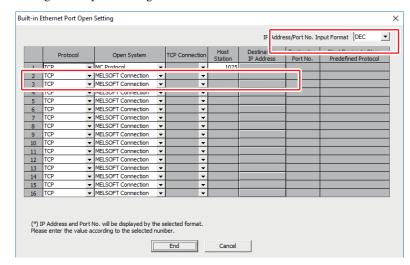
- (1) Go to "Project" > "New" and create a new project, with "Q04UDEHCPU" set for the CPU type.
- (2) Double-click the PC parameter.
 - >> The Q Parameter Setting window appears.
- (3) Select the [Built-in Ethernet Port Setting] tab and set each item.



Setting item	Setting
IP Address	192.168.0.1
Subnet Mask Pattern	255.255.255.0
Default Router IP Address	Set the default router IP address.
Communication Data Code	Binary Code
Enable online change	Check the checkbox.

(4) Click the [Open Setting] button.

>>The Built-in Ethernet Port Open Setting window appears.



(5) Configure the port settings on the first row, and click the [End] button.

Setting item	Setting
Port No. Input Format	DEC
Protocol	TCP
Open System	MC Protocol
Host Station Port No.	1025

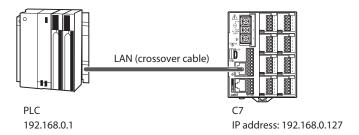
- >>The Q Parameter Setting window appears.
- (6) Click the [End] button to close the window.

■ Q series Ethernet interface module

Usage examples of the following devices are provided.

PLC	Q04UDEHCPU
Communication interface	Ethernet interface module QJ71E71-100
Communication protocol	TCP/IP, SLMP (3E), binary code

Device structure

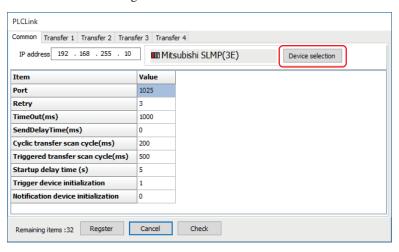


! Handling Precautions

• Use a LAN crossover cable or a hub with an Auto MDI/MDI-X function to connect the Q series Ethernet interface module to the C7.

SLP-C7 settings

(1) On the PLC Link settings screen, click the [Device selection] button.



(2) Select "Mitsubishi SLMP (3E)" and click the [OK] button.



PLCLink Common Transfer 1 Transfer 2 Transfer 3 Transfer 4 IP address 192 . 168 . 0 . 1 Mitsubishi SLMP(3E) Device selection 1025 Port Retry 1000 TimeOut(ms) SendDelayTime(ms) Cyclic transfer scan cycle(ms) 200 Triggered transfer scan cycle(ms) 500 Startup delay time (s)

Check

(3) Configure the PLC Link settings according to the device settings of the Mitsubishi PLC.

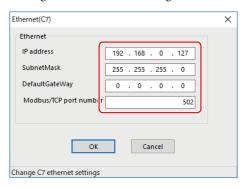
IP address: 192.168.0.1

Remaining items :32 Regster Cancel

Port number: 1025

Trigger device initialization Notification device initialization

(4) Configure the Ethernet settings for the C7.



IP address: 192.168.0.127

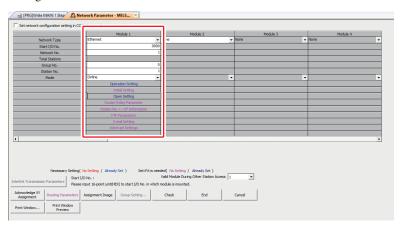
Subnet mask: 255.255.255.0

Default gateway: 0.0.0.0

PLC settings

Configure the settings as shown below in GX-Developer.

- (1) Go to Project > New and create a new project, with "Q04UDEHCPU" set for the CPU type.
- (2) Double-click Network Parameter.
 - >>The Network Parameter selection window appears.
- (3) Click the [Ethernet/CC IE/MELSECNET] button.
 - >> The Network Parameter Ethernet/CC IE/MELSECNET Sheet Quantity Setting window appears.
- (4) Set [Start I/O No.], [Network No.] and [Station No.] according to the configuration used.



- (5) Click the [Operation Setting] button in the table.
 - >>The Ethernet Operation Setting window appears.
- (6) Set each item and click the [END] button.

Setting item	Setting
Communication Data Code	Binary Code
Initial Timing	Always wait for OPEN (Communication possible at STOP time)
Input Format	DEC
IP Address	192.168.0.1
Send Frame Setting	Ethernet (V2.0)
TCP Existence Confirmation Setting	Use the KeepAlive
Enable Online Change	Check the checkbox.

- >> The Network Parameter Ethernet/CC IE/MELSECNET Sheet Quantity Setting window appears.
- (7) Click the [Open Setting] button in the table.
 - >> The Network Parameter Ethernet Port Open Setting window appears.

(8) Configure the port settings on the first row.

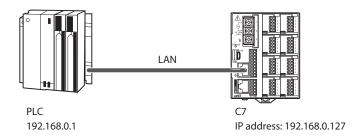
Setting item	Setting
Port No. Input Format	DEC
Protocol	TCP
Open System	Unpassive
Fixed Buffer Communication	Procedure Exist
Host Station Port No.	1025

■ iQ-F series CPU direct connection

Usage examples of the following devices are provided.

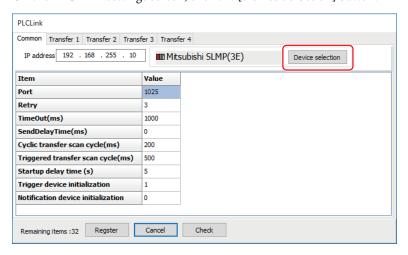
PLC	FX-5UCPU
Communication interface	CPU module Ethernet port
Communication protocol	TCP/IP, SLMP (3E), binary code

Device structure



SLP-C7 settings

(1) On the PLC Link settings screen, click the [Device selection] button.



(2) Select "Mitsubishi iQ-F SLMP (3E)" and click the [OK] button.



PLCLink Common Transfer 1 Transfer 2 Transfer 3 Transfer 4 192 . 168 . 0 . 1 ■ Mitsubishi iQ-F SLMP(3E) Device selection Item 1025 Port Retry 1000 TimeOut(ms) SendDelayTime(ms) Cyclic transfer scan cycle(ms) 200 Triggered transfer scan cycle(ms) 500 Startup delay time (s) Trigger device initialization Notification device initializatio

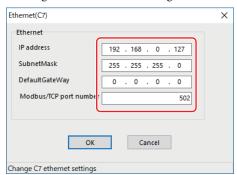
Check

(3) Configure the PLC Link settings according to the device settings of the Mitsubishi PLC.

IP address: 192.168.0.1 Port number: 1025

Remaining items :32 Regster Cancel

(4) Configure the Ethernet settings for the C7.

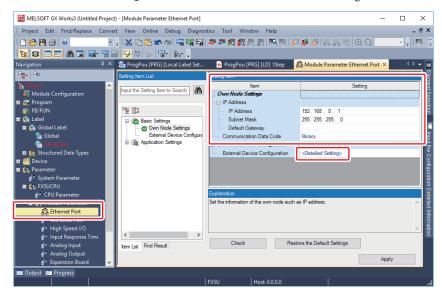


IP address: 192.168.0.127 Subnet mask: 255.255.255.0 Default gateway: 0.0.0.0

PLC settings

Configure the settings as shown below in GX-Works3.

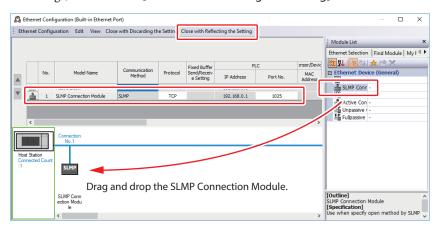
- (1) Go to Project > New and create a new project, with "FX5CPU" set for Series and "FX5U" set for Type. Double-click [Module Parameter] of "Parameter."
- (2) Double-click "Ethernet Port" of "Parameter."
 - >>The Module Parameter Ethernet Port setting window appears.
- (3) Select [Basic Settings] and set each item of Own Node Settings.



Setting item		Setting
IP Address	IP Address	192.168.0.1
	Subnet Mask Pattern	255.255.255.0
Communication Data Code		Binary

- (4) Click "Detailed Setting" of [External Device Configuration].
 - >> The Ethernet Configuration setting window for the Built-in Ethernet Port appears.

- (5) Select [SLMP Connection Module] from the Module List, and drag and drop it.
 - >>The selected SLMP device is added to the first row. Configure the device settings, and click the [Close with Reflecting the Setting] button.



Setting item	Setting
Model Name	SLMP Connection Module
Protocol	TCP
PLC Port No.	1025

- >>The Module Parameter Ethernet Port setting window appears.
- (6) Click the [Apply] button to close the window.

10-5 Keyence PLC

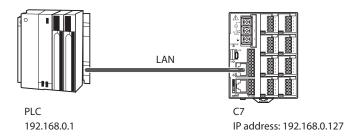
The following describes the communication settings of the Keyence PLC.

■ CPU direct connection

Usage examples of the following devices are provided.

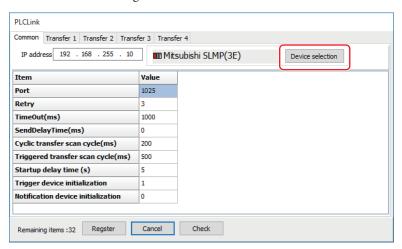
PLC	KV7500
Communication interface	CPU module Ethernet port
Communication protocol	MC Protocol

Device structure

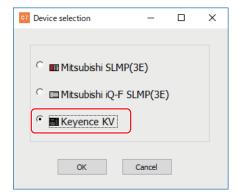


SLP-C7 settings

(1) On the PLC Link settings screen, click the [Device selection] button.



(2) Select "Keyence KV" and click the [OK] button.



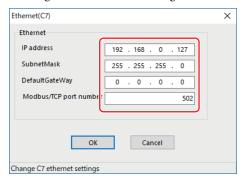
PLCLink Common Transfer 1 Transfer 2 Transfer 3 Transfer 4 192 . 168 . 0 1 ■ Keyence KV Device selection Item 5000 Port Retry 1000 TimeOut(ms) SendDelayTime(ms) Cyclic transfer scan cycle(ms) 200 Triggered transfer scan cycle(ms) 500 Startup delay time (s) Trigger device initialization Notification device initialization Remaining items :32 Regster Cancel Check

(3) Configure the PLC Link settings according to the device settings of the Keyence PLC.

IP address: 192.168.0.1

Port number: 5000

(4) Configure the Ethernet settings for the C7.



IP address: 192.168.0.127

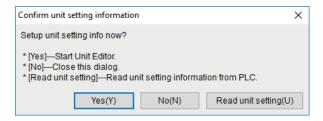
Subnet mask: 255.255.255.0

Default gateway: 0.0.0.0

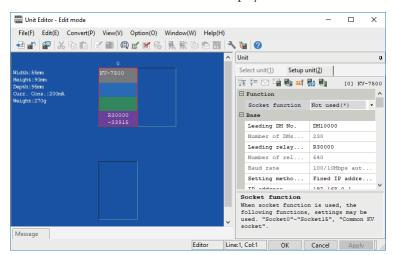
PLC settings

Using KV STUDIO, change the settings as shown below.

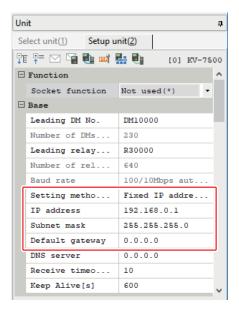
- (1) Go to Project > New and create a new project, with "KV7500" set for the type.
 - >>A confirmation message about unit configuration settings is displayed.



- (2) Select [Yes (Y)] to start Unit Editor.
 - >>The [Unit Editor Edit mode] screen is displayed.

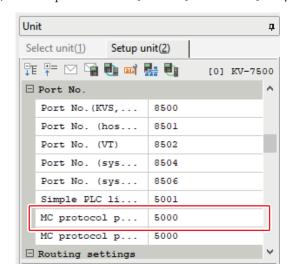


(3) Set the IP address of the PLC in the [Base] field on the [Setup unit] tab.



Setting item	Settings
Setting method of IP address	Fixed IP address
IP address	192.168.0.1
Subnet mask	255.255.255.0

(4) Set the port No. in the [Port No.] field on the [Setup unit] tab.



Setting item	Settings
MC protocol port No.	5000

-MEMO-

Chapter 11. Maintenance and Troubleshooting

11-1 Maintenance

■ Cleaning

If the device is dirty, wipe it with a soft, dry cloth.

Never use an organic solvent such as thinner or benzene.

■ Parts replacement

Do not replace parts.

The CLOCK and MOTOR blocks can be replaced.

For the replacement method, see the user's manual included with the replacement block.

■ Replacement of the CLOCK block

Replace the block with Azbil's replacement CLOCK block (model No. 84501420-001),

following the instructions in the user's manual included with the replacement CLOCK block.

When discarding the removed CLOCK block, please dispose of it appropriately in accordance with the instructions in the user's manual.

! Handling Precautions

- Wait for at least 10 minutes after turning off the power to the C7 and all connected devices before replacing the block.
- A special tool for replacement that comes with the replacement CLOCK block and a screwdriver are needed to remove the block. Have a suitable screwdriver on hand.
- Be sure to set the date and time after installing the new block.

■ Replacing the MOTOR block

Replace the MOTOR block with Azbil's replacement MOTOR block (model No. 84501421-001),

following the instructions in the user's manual included with the replacement MOTOR block.

When discarding the removed MOTOR block, please dispose of it appropriately in accordance with the instructions in the user's manual.

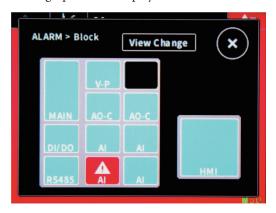
! Handling Precautions

- Wait for at least 10 minutes after turning off the power to the C7 and all connected devices before replacing the block.
- A special tool for replacement that comes with the replacement MOTOR block and a screwdriver are needed to remove the block. Have a suitable screwdriver on hand.

11-2 Alarm

■ Block alarm screen

Pressing the block alarm icon in the upper right corner of the monitor screen and the graph screen displays the block alarm screen.



The block alarm screen schematically shows the blocks of the main unit and the display unit. On this screen, the alarm status is distinguished by color.

• Blue block: Normal

• Red block: Alarm (error)

• Black: Not implemented

Pressing the [View Change] button displays the function alarm screen.

Pressing the [X] button returns the display to the original screen.

■ Block alarm

The following shows the possible cause and corrective action for each block alarm.

Block alarm	Cause	Corrective action
MAIN	There is not enough space on the microSD memory card.	Delete files from the microSD memory card.
	The microSD memory card is faulty.	Replace the microSD memory card.
	Internal memory error was detected.	Request repair or replacement of the main unit.
	The CDS was started without the microSD	Turn OFF CDS, insert the microSD memory card,
	memory card inserted.	and then start CDS again.
	One of user-defined alarms 1 to 4 is ON.	Eliminate the problem in the standard bit codes assigned to user-defined alarms 1 to 4.
	There is a PV or RSP alarm for a loop.	Ensure that the PV and RSP assigned by enabling the advanced loop type setting for [Loop type] are within the range defined by the alarm setting low and high limits.
	An error occurred in any of numerical	Check numerical operations 1 to 32 and eliminate
	operations 1 to 32.	the cause of the error.
DI/DO	Overcurrent of DO was detected.	Check and correct the loads and wiring.
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
RS-485	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
AO-C, V-P	CT input or VT input exceeds the high limit.	Reduce the CT input or VT input to less than the high limit.
(Slots A1, A2, B1, B2)	CT input circuit or VT input circuit has failed.	Request repair or replacement of the main unit.
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
AI	Analog input is out of range.	Adjust the analog input to within the high and low range.
(Slots A3, A4, B3, B4)	Wiring of analog input is incorrect.	Check the sensor, signal generator, and wiring, and fix if necessary.
	Sensor or wiring is disconnected.	in inceessary.
	Signal generator has failed.	
	Analog input setting is incorrect.	Check the analog input setting, and fix if necessary.
	Analog input circuit has failed.	Request repair or replacement of the main unit.
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
CLOCK	Low battery or dead battery was detected.	Replace the CLOCK block with a new one.
(Slot B1, B3)	After replacement of the CLOCK block, the new CLOCK block was not fully inserted into	Insert the block again.
	the slot.	
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.

Chapter 11. Maintenance and Troubleshooting

		1
Block alarm	Cause	Corrective action
MOTOR	After replacement of the MOTOR block, the	Insert the block again.
(Slot B2)	new MOTOR block was not fully inserted into the slot.	
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
DI	Block has failed.	Request repair or replacement of the main unit.
(Slot A3, B3)	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
DO	Overcurrent of DO was detected.	Check and correct the loads and wiring.
(Slot A1, B1)	Block has failed.	Request repair or replacement of the main unit.
(SIOCAT, DT)	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
	Internal memory error was detected.	Request repair or replacement of the main unit.
НМІ	Internal memory error was detected.	Request repair or replacement of the display unit.
(Square on right side of screen)		
HMI (CL-+ P1)	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit and display unit.
(Slot B1)	Internal memory error was detected.	Request repair or replacement of the display unit.

■ Function alarm screen

Pressing the function alarm icon in the upper right corner of the PV display on the 1-loop monitor screen displays the function alarm screen. However, if there is no alarm, and the icon is darkened, the icon is not available.



On the function alarm screen, the alarm status is distinguished by color for each function.

- Function in gray: Normal.
- Function in red: Alarm (error)

Pressing the $[\]$ and $[\]$ buttons displays the alarms for other functions.

Pressing the [View Change] button displays the block alarm screen.

Pressing the [X] button returns to the original screen.

! Handling Precautions

• Touching the function (rectangle display) in which an alarm is generated displays the description screen for the alarm. Pressing [X] button closes the description screen.

■ Function alarm

The following shows the possible cause and corrective action for each function alarm.

Function alarm	Cause	Corrective action
Loop1 PV Loop1 RSP	Analog input is out of range.	Adjust the analog input to within the high and low range.
Loop2 PV	Wiring of analog input is incorrect.	Check the sensor, signal generator,
Loop2 RSP	Sensor or wiring is disconnected.	and wiring, and fix if necessary.
Loop3 PV	Signal generator has failed.	
Loop3 RSP Loop4 PV	Analog input setting is incorrect.	Check the analog input setting, and fix if necessary.
Loop4 RSP	Analog input circuit has failed.	Request repair or replacement of the main unit.
MEMORY DIAGNOSIS	Internal memory error was detected.	Request repair or replacement of the main unit or display unit.
CT/VT (AO-C)	CT input or VT input exceeds the high limit.	Reduce the CT input or VT input to less than the high limit.
	CT input circuit or VT input circuit has failed.	Request repair or replacement of the main unit.
CT (V-P)	CT input exceeds the high limit.	Reduce the CT input to less than the high limit.
	CT input circuit has failed.	Request repair or replacement of the main unit.
BLOCK DIAGNOSIS	After replacement of the CLOCK or MOTOR block, the new block was not fully inserted into the slot.	Insert the CLOCK or MOTOR block again.
	Block has failed.	Request repair or replacement of the main unit.
	A block type that does not match the model No. was inserted.	Request repair or replacement of the main unit.
DO OVERCURRENT	Overcurrent of DO was detected.	Check and correct the loads and wiring.
SD CARD	There is not enough space on the microSD memory card.	Delete files from the microSD memory card.
	The microSD memory card is faulty.	Replace the microSD memory card.
	CDS was started without the microSD memory card inserted.	Turn OFF CDS, insert the microSD memory card, and then start CDS again.
BATTERY	Low battery or dead battery was detected.	Replace the CLOCK block with a new one.
Numerical Operation	An error occurred in any of numerical operations 1 to 32.	Check numerical operations 1 to 32 and eliminate the cause of the error.
Buffer setting	The number of units that use buffers for calculations or the total number of buffers used during calculations exceeds the specified value.	Check the numerical operations that use buffers and eliminate the cause of the error.
USER-DEFINED ALARM 1 USER-DEFINED ALARM 2 USER-DEFINED ALARM 3 USER-DEFINED ALARM 4	Among the statuses set for Assignment 1 to Assignment 4 of the user-defined alarms, at least one of them is 1 (ON).	Ensure that all the statuses set for Assignment 1 to Assignment 4 of the user-defined alarms are 0 (OFF).

11-3 Display Error

■ Display unit does not work.

The following shows the possible cause and corrective action when the display unit does not work.

Cause	Corrective action
The key lock is set.	Press and hold the button to unlock the key.
The display unit cable is disconnected.	Reconnect the display unit cable.
The display unit cable has a broken wire.	Replace the display unit cable.
The display unit has failed.	Request repair or replacement of the display unit.
The screen is broken.	Request repair or replacement of the display unit.

■ Nothing is shown on display unit.

The following shows the possible cause and corrective action when nothing is shown on display unit.

Status of main unit and display unit	Cause	Corrective action
Status indicator of main unit is not lit.	The main unit power is turned off.	Turn on the main unit power.
Status indicator of main unit is green, and power indicator of display unit	The distance from the main unit to the display unit is 30 m or more.	Make the distance from the main unit to the display unit less than 30 m.
is not lit.	The display unit cable is not suitable.	Use a Cat5e or higher cable.
	The display unit cable is disconnected.	Reconnect the display unit cable.
	The display unit cable has a broken wire.	Replace the display unit cable.
Status indicator of main unit is green, and power indicator of display unit is green.	The display unit has failed.	Request repair or replacement of the display unit.
Status indicator of main unit is red or not lit. (When main unit power is turned on and there is no alarm.)	The main unit has failed.	Request repair or replacement of the main unit.

■ An error is indicated on the display unit

The following shows the possible causes and corrective action when an error with a red background is shown on the display unit.

Error type	Cause	Corrective action
Connection error	Some of the wires in the display unit cable are broken.	Replace the display unit cable.
	The display unit has an external power source and the display unit cable is disconnected.	Reconnect the display unit cable.
	The display unit has an external power source and the main unit power is turned off.	Turn on the main unit power.
	The display unit has an external power source and the power of the main unit only has been turned off previously.	Turn off the display unit power and then turn it on again. Note If the firmware version of the MAIN block is 4.x.x (where x stands for any number) or later, recovery from the error is automatic when the main unit power is turned on.
	The integrating cable was wired incorrectly.	Correctly wire the display unit side ferrule of the integrating cable.
Configuration error	The Model No. and loop type setting are not compatible.	Set the loop type again using the SLP-C7 Smart Loader Package.

■ The firmware version of the display unit does not match.

If the firmware version of the MAIN block and the HMI block (display unit) do not match, a warning screen as shown in the figure below may be displayed, or necessary items may not be displayed, or unnecessary items may be displayed on the monitor screen or parameter screen.



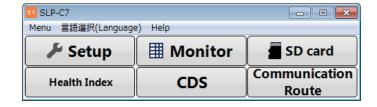
! Handling Precautions

- If the HMI block firmware is earlier than version 6.2.x (where x stands for any number), the warning screen in the above figure is not displayed.
- The correct combination of firmware versions can be checked in the list of the release dates of the firmware versions in 14-4 Firmware Version History (p. 14-24).

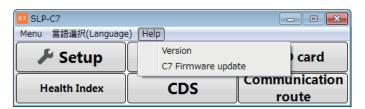
■ Checking and updating the firmware version using the SLP-C7

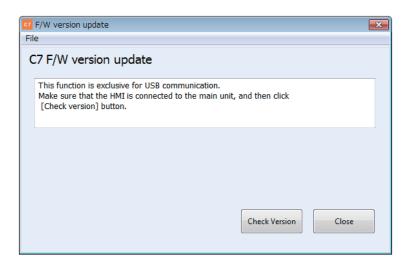
The following can be performed using the SLP-C7 Smart Loader Package.

- Checking the combination of firmware versions
- Updating the firmware version of the HMI block (display unit)
- (1) Start the SLP-C7.



(2) On the menu bar, select [Help] and then [C7 Firmware update].





(3) The F/W version update screen appears.

(4) Click the [Check Version] button.

SLP-C7 checks the firmware version, and sequentially displays instruction screens for when a firmware version update is required and when it is not required.

For details, refer to the user's manual for SLP-C7.

-MEMO-

Chapter 12. DISPOSAL

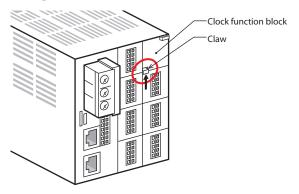


When discarding this unit, dispose of it as industrial waste, following local regulations.

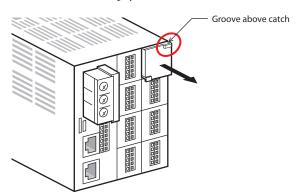
■ Removing the battery for product disposal

The procedure for removing the battery without using a jig before discarding this product is described below. Note that this may damage the device or cause faulty operation.

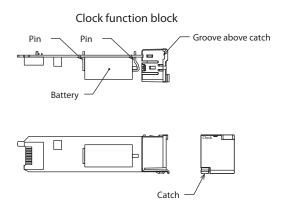
(1) Pull up the catch at the bottom left of the CLOCK block.



(2) Place a screwdriver in the groove above the catch at the upper right of the CLOCK block, and pry the block out of the controller.



(3) Cut off the pins on the battery with a tool like nippers, and remove the battery from the board.



! Handling Precautions

 A jig must to be used to replace the CLOCK block. If the CLOCK block is removed without using a jig, damage or faulty operation of the device may result. For the replacement method, see the user's manual included with the replacement CLOCK block.

Chapter 13. Specifications

■ Specifications

Al block

Input type: Full multi-range for thermocouple, resistance

temperature detector (RTD), DC current, and DC

voltage.

Number of control loops: 4 loops max. (configurable by the SLP-C7 Smart Loader

Package)

Sampling cycle: 10 ms, 50 ms, 100 ms (factory setting 50 ms)

Burnout: Depends on the input range (Input types and ranges

(p. 13-13)).

Judgment of over-range: Below −10 % or above 110 % of the range

Decimal point position: 0 to 4 digits after the decimal point are displayed. Values

are displayed so that the entire value does not exceed 5 digits. (Note: Effective resolution depends on the range.)

Thermocouple

Reference junction compensation accuracy:

±0.5 °C (with ambient temperature of 21 to 28 °C, under

standard conditions)

±1.5 °C (with ambient temperature of 0 to 50 °C, under standard conditions except for ambient temperature)

Reference junction compensation method:

Compensation within the device

Input bias current: 0.12 µA max. (under standard conditions)

Note: Current flows from the + terminal.

Allowable input voltage: −1.5 to +1.5 V

RTD

Measuring current: 1.0 mA (typical, from terminals A and B, under

standard conditions)

Allowable wiring resistance: 85Ω max. (per wire)

Effect of wiring resistance: $0.013 \, ^{\circ}\text{C}/\Omega$ (under standard conditions, within

allowable wiring resistance)

DC voltage/DC current

Input bias current: 0–10 V range: $10~\mu A$ max. (under standard conditions)

1–50–5 V range: 5 μA max. (under standard conditions)

-10 to $+10~\mathrm{V}$ range: -10 to $+10~\mu\mathrm{A}$ (under standard conditions)

Allowable input voltage: DC voltage input: -15 to +15 V

DC current input: -1.5 to +1.5 V

Scaling: -32000 to +32000 U

(5 digits max. within the above range, 4 digits max. after

the decimal point, reverse scaling possible)

Input impedance: DC voltage input: $1 \text{ M}\Omega$ or more

DC current input: 50Ω

Display unit (included)

Additional display unit (C7D-_____)

Screen specifications: 3.5 inch QVGA LCD

Status indication (LED): 1 (power)

Status indication (in LCD): DO status, alarm status

Operation button: Touch panel (resistive) and 3 hardware buttons

Power for display unit: Power from main unit if distance from main unit

(display unit connector / additional display unit block)

to display unit is less than 30 m

Power from external power source (5 V DC) if distance from main unit (display unit connector / additional display unit block) to display unit is 30 to 100 m

Protection rating: IP67 (front side of display unit only)

Interface language: English/Japanese (switchable)

Service life of LCD: 5 years (half-life of backlight brightness at ambient

temperature 25 °C, brightness setting 4)

• (DI) digital input/(DO) digital output block

Inputs and outputs: 7 max. (switch between DI/DO/TP by setting), common

Digital input (DI)

Connectable output type: No-voltage contacts or open collector (sink type)

Open terminal voltage: 7 V max.

Terminal current (when shorted):

1 mA (under standard conditions)

Allowable ON contact resistance (no-voltage contact):

500 Ω max. (under standard conditions)

Allowable OFF contact resistance (no-voltage contact):

100 k Ω or more (under standard conditions)

Allowable ON residual voltage for open collector

1 V max. (under standard conditions)

Allowable OFF-state leakage current for open collector:

100 μA max. (under standard conditions)

Input sampling cycle: 10 ms

Minimum detectable pulse width for ON:

20 ms min. (for 10 ms sampling cycle), 50 ms min. (for 50 ms sampling cycle), 100 ms min. (for 100 ms sampling

cycle)

Description of function allocation:

RUN/READY mode selection, AUTO/MANUAL mode selection, LSP/RSP mode selection, SP group selection, CDS stop/start, Fixed value output selection, Output linearization table group selection, Pattern selection, etc.

Digital output (DO)

Output method: Open collector (sink type)

Load voltage: 4.5 to 28.8 V DC

Maximum load current: 100 mA for each terminal

Overcurrent detection: 130 mA min.

When an overcurrent is detected, the output is turned OFF, and the status is checked every 5 seconds. If the status returns to normal, the output returns to normal

automatically.

ON-state residual voltage: 0.5 V max. (under standard conditions)

OFF-state leakage current: 100 µA max. (under standard conditions)

Description of function allocation:

Select from event status or standard bit

• Time proportional output (TP)

Output method: As generally for digital output

Outputs: 4 max. (settable with No. 4 to 7)

Minimum OFF time/ON time:

1 ms when time proportional cycle is less than 10 s 250 ms when time proportional cycle is 10 s or more

AO-C block

Current output × 1

Type: 4–20 or 0–20 mA DC

Output type: Select from control output (MV), process value (PV),

set value (SP), standard number, etc.

Accuracy: $\pm 0.1 \% FS$

Allowable load resistance: 600Ω max.

Output resolution: 1/16000 min.

● CT (current) input × 1

Recommended current transformers:

QN206A (hole diameter: 5.8 mm, 800 turns), QN212A (hole diameter:12 mm, 800 turns) Note:

Not UL-certified

Current measurement range: 0.4 to 50.0 A AC, 50/60 Hz (peak current: 71 A

max. with 800 turns and 1 pass of the power wire)

Maximum allowable current: 70 A AC (peak current: 99 A max. with 800 turns

and 1 pass of the power wire)

Indication accuracy: $\pm 1 \%$ FS ± 1 digit (under standard conditions; does

not include CT accuracy)

Indication resolution: 0.1 A AC

Indication update cycle: 100 ms

● VT (voltage) input × 1

Recommended voltage transformer:

81406725-003 (not UL-certified)

Voltage measurement range: 24 to 240 V AC, 50 Hz/60 Hz (peak voltage: 339 V

max., recommended voltage: transformer primary

side 200 V, secondary side 10 V)

Maximum allowable voltage: 264 V AC (peak voltage 373 V max., recommended

voltage: transformer primary side 200 V,

secondary side 10 V)

Indication accuracy: $\pm 1 \% FS \pm 1 \text{ digit}$

Indication resolution: 0.1 V AC

Input impedance: $160 \text{ k}\Omega$ (typical)

Indication update cycle: 100 ms

V-P block

Voltage pulse output × 1

Output voltage: 12 V DC +15 %/-10 % (under standard conditions)

Allowable current: 25 mA max.

Load limit current: 30 mA ± 10 %

OFF-state leakage current: 100 µA max. (under standard conditions)

Output response time: 100 µs max., 10 % to 90 % of output voltage

● CT (current) input × 2

Specifications: Same as CT (current) input of the AO-C block

MOTOR block

MFB (motor feedback) input

Allowable potentiometer: 100 to 2500 Ω (2500 Ω max., including amount for

wiring resistance)

Indication accuracy: ± 0.5 % FS (under standard conditions)

Sampling cycle: 100 ms

Burnout indication: Downscale for Y line break, upscale for line break in

other locations

Motor drive output relay

Contact configuration: Switching between OPEN output and CLOSE output

(with function for turning both outputs OFF at the same

time)

Contact rating: 2 A, 250 V AC ($COS\phi = 0.4$)

2.5 A, 24 V DC (L/R = 0.7 ms)

Contact voltage: 250 V AC max. or 125 V DC max.

Service life: 100,000 operations min. (at the rated specifications)

Min. switching specifications: 40 mA / 24 V DC

DI block

Number of inputs: 4, common

Connectable output type: No-voltage contacts or open collector

Input method: Photo coupler (bidirectional)

Rated input voltage: 24 V DC + 20 % / -15 %

Terminal current: 4 mA (with 24 V DC input)

ON voltage/current: 19 V or more / 3 mA or more

OFF voltage/current: 7 V or less / 1 mA or less

Input sampling cycle: 10 ms

Minimum detectable pulse width for ON:

20 ms min. (for 10 ms sampling cycle), 50 ms min. (for 50 ms sampling cycle), 100 ms min. (for 100 ms

sampling cycle)

Description of function allocation:

RUN/READY mode selection, AUTO/MANUAL mode selection, LSP/RSP mode selection, SP group selection,

CDS stop/start, etc.

DO block

Number of outputs: 4, common

Output method: Open collector (sink type)

Load voltage: 4.5 to 28.8 V DC

Maximum load current: 100 mA for each terminal

Overcurrent detection: 130 mA min.

When an overcurrent is detected, the output is turned OFF, and the status is checked every 5 seconds. If the status returns to normal, the output returns to normal

automatically.

ON-state residual voltage: 0.5 V max. (under standard conditions)

OFF-state leakage current: 100 µA max. (under standard conditions)

Description of function allocation:

Select from event status or standard bit

CLOCK block (with battery)

Clock function: Hours, minutes, seconds, calendar (years 2000 to 2099,

supports leap years)

Clock accuracy: Monthly error of less than ±65 s

Service life: 10 years (battery life when not energized, under

standard conditions)

Internal battery: Lithium battery

Block replacement: Possible (sold separately: optional part)

Additional display unit block

Number of connectible units: 1

Connector: RJ-45

Control unit

Control action: PID control reverse action (heating)

PID control direct action (cooling)
PID control heating and cooling

ON/OFF control reverse action (heating) ON/OFF control direct action (cooling)

PID control

Proportional band (P): 0.1 to 3200 %

(5 digits max. within this range, 4 digits max. after the

decimal point)

Integral time (I): 0 to 32000 s

(5 digits max. within this range, 4 digits max. after the

decimal point)

Derivative time (D): 0 to 32000 s

(5 digits max. within this range, 4 digits max. after the

decimal point)

MV limit: -10 to +110 %

(5 digits max. within this range, 4 digits max. after the

decimal point)

RE (Manual reset): -10 to +110 %

(5 digits max. within this range, 4 digits max. after the

decimal point)

Number of PID groups: 8 (per loop)

PID group selection: In constant value operation (LSP/RSP) mode, a PID

group can be set for each SP group or can be selected

by the DI or zone PID function.

In pattern operation mode, a PID group can be set for each segment or can be selected by the zone PID

function.

Output variation limit: 0.0 to 10000 %/s (5 digits max. within this range, 4

digits max. after the decimal point). No limit when the

setting is 0.0.

Auto-tuning: PID automatic setting using the limit cycle method

Differential for ON/OFF control:

0 to 32000 (5 digits max. within this range, 4 digits max.

after the decimal point)

SP

Number of LSP groups for constant value operation: 8 (per loop)

Number of patterns for pattern operation: 16 (common to all loops)

Number of segments for pattern operation: Up to 16 (for each pattern)

External communication

Ethernet

Transmission line type: Compliant with IEEE 802.3u 100BASE-TX (Fast

Ethernet)

Communications system: Full duplex

Number of connections: 4

The total number of connections for Modbus/TCP and loader communication via Ethernet is 1 to 3, and the number of connections for PLC link communication is

fixed at 1.

Transmission speed: 100 Mbps max.

No. of physical ports (connectors):

1 (RJ-45)

Cable: UTP cable (4P), Cat 5e min. (straight) (both ends ANSI/

TIA/EIA-568-B)

Protocol: Modbus/TCP, Mitsubishi SLMP (3E) (for PLC link

communication)

Loader communication (via Ethernet)

RS-485 communications

Signal level: RS-485-compliant

Network: Multidrop (up to 31 slave stations for 1 host station)

Communication/synchronization method:

Half-duplex, start/stop synchronization

Maximum cable length: 500 m max.

Number of communication lines:

3-wire system

Transmission speed: 9600, 19200, 38400, 57600, 115200 bps

Terminating resistor: External (120 Ω , ½ W min.)

Data length: 8 bits

Stop bits: 1 or 2

Parity bit: Even, odd, or none

Protocol: Modbus/RTU

Loader communications

Dedicated PC loader: SLP-C7FJ91 (free version) or SLP-C7-J91 (paid version)

Recommended cable: USB-Micro USB (type A/B) cable (USB 2.0-supported,

5 m max.) or Ethernet cable

Power supply: When connected with a USB cable, the device can be

powered by the PC and parameters can be changed.

Data storage

SD: microSD/SDHC-compliant (4 GB) (for the compact data

storage and health index functions)

General specifications

Memory backup: EEPROM (durability: 1 million erase-write cycles min.,

for parameter settings)

Power consumption: 25 VA max., 10 W max. (AC models)

12 W max. (DC models)

Power ON inrush current:

25 A max., 10 ms max.

Start delay at power ON: 10 s (required until normal operation begins under

standard conditions)

Allowable transient power loss:

20 ms max. (AC models) 5 ms max. (DC models)

Insulation resistance: $20 \text{ M}\Omega$ min. (between power supply terminal (#1 or

#2) and frame ground terminal (#3), with a 500 V DC

megger)

Dielectric voltage: AC models

1500 V AC, 1 min

Between AC power supply terminals (#1 or #2) and

frame ground terminal (#3)

Between AC power supply terminals (#1 or #2) and

secondary terminals

Between AC power supply terminals (#1 or #2) and

motor block terminals (#1 to #3

Between motor block output terminals (#1 to #3)

and frame ground terminal (#3)

Between motor block output terminals (#1 to #3) and secondary terminals (excluding motor block

output terminals (#1 to #3))

DC models

1500 V AC, 1 min

Between motor block output terminals (#1 to #3) and frame ground terminal (#3)

Between motor block output terminals (#1 to #3) and DC power supply terminals (#1 or #2)

Between motor block output terminals (#1 to #3) and secondary terminals (excluding motor block output terminals (#1 to #3))

500 V AC for 1 min

Between DC power supply terminals (#1 or #2) and

frame ground terminal (#3)

Between DC power supply terminals (#1 or #2) and secondary terminals (except for motor block output

terminals (#1 to #3))

Case material: Main unit: Modified PPE (case), PC (board holder,

front mask)

Display unit: Modified PPE (case), PET film (protective

sheet)

Case color: Black

Regulations and approvals:

	Regulations	Approvals	Remarks		
UL		QUYX.E246616	UL 61010-1 (UL-compliant models only)		
cUL		QUYX7.E246616	CAN/CSA-C22.2 No.61010-1-12 (UL-compliant models only)		
CE	EMC		EN 61326-1 (For use in industrial locations)		
CE	LVD		EN 61010-1		
CE	RoHS		EN IEC63000		
UKCA	2016 N0.1091		EN 61326-1 (For use in industrial locations)		
UKCA	2016 N0.1101		EN 61010-1		
UKCA	2012 N0.3032		EN IEC63000		
KC mark		MSIP-REM-A2B-A131			

During EMC testing, the reading or output may fluctuate

by ±10 % FS.

Overvoltage category: Category II (IEC 60364-4-443, IEC 60664-1)

Installation: Main unit: Mounting on a DIN rail (standard) or on

the display unit using the integrating bracket

Display unit: Mounting using dia. 3 mm screws

(standard) or the integrating bracket (mount in a 92×92 mm hole)

Weight: Main unit: 500 g max.

Display unit: 150 g max.

Integrating bracket: 150 g max.

Accuracy of built-in clock:

Monthly error less than ± 140 s

Resets to 2000/01/01 00:00:00 (initial value) at each power-on (including recovery from power loss). However, resets to 2014/01/01 00:00:00 (initial value) if firmware version of the MAIN block is 3.x.x or earlier. When the CLOCK block is used, accuracy is according to

its specifications.

Pattern operation: Monthly error less than ± 140 s

Standard conditions

Ambient temperature: 23 °C -2/+5 °C

Ambient humidity: $60 \pm 5 \% RH$

Power voltage: 105 V AC ±10 % (AC models)

24 V DC ±5 % (DC models)

Power supply frequency: 50 Hz ±1 % or 60 Hz ±1 % (AC models)

Vibration: 0 m/s²

Shock: 0 m/s²

Mounting angle: Main unit: Reference plane ±3°

Display unit: No restrictions

Space: For the main unit, leave at least 100 mm above, below, on

the right, on the left, and in front of the unit.

For the display unit, no space is needed above, below, on

the right, or on the left.

Operating conditions

Ambient temperature: Main unit: 0 to 50 °C (when mounting a single unit)

0 to 40 °C (when gang-mounted)

Display unit: 0 to 50 °C

Ambient humidity: 10 to 90 % RH (without condensation)

Rated power voltage: 100 to 240 V AC (operating input voltage 85 to 264 V AC,

AC models)

24 V DC (operating input voltage 20.4 to 28.8 V DC, DC

models)

Power supply frequency: 50 Hz ±2 % or 60 Hz ±2 % (AC models)

Vibration: 0 to 5 m/s 2 (10 to 60 Hz for 2 h each in the x, y, and z

directions)

Shock: $0 \text{ to } 100 \text{ m/s}^2$

Mounting angle: Main unit: Reference plane ±10°

Display unit: No restrictions

Elevation: 2000 m max.

Pollution degree: 2

Installation location: Indoors

Space: For the main unit, leave at least 50 mm above, below, and

in front of the unit. No space is needed on the right or left. For the display unit, no space is needed above, below, on

the right, or on the left.

However, for integrated installation, space is needed for the mounting brackets on the right and left of the main

unit and above and below the display unit.

Transport/storage conditions

Ambient temperature: −20 to +70 °C

Ambient humidity: 10 to 95 % RH (without condensation)

Vibration: 0 to 10 m/s 2 (10 to 60 Hz for 2 h each in the x, y, and z

directions)

Shock: 0 to 300 m/s^2 (3 times each in the x, y, and z directions)

■ Input types and ranges

Input type	Range type	Sensor	Range	e (Celsius)	Range	(Fał	nrenheit)	Accuracy	Resolution	Burnout
Thermocouple	1	K	-200 t	:o +1200°C	-300	to	+2200 °F	±0.1 % FS ±1 digit *1	0.1 °C	Upscale (110 % FS)
	2	K	0 t	o 1200 °C	0	to	2200 °F	±0.1 % FS ±1 digit	0.1 °C	
	3	K	0 t	:o 800°C	0	to	1500 °F	±0.1 % FS ±1 digit	0.1 °C	
	4	K	0 t	o 600 °C	0	to	1100 °F	±0.1 % FS ±1 digit	0.1 °C	
	5	K	0 t	o 400 °C	0	to	700 °F	±0.1 % FS ±1 digit	0.1 °C	
	6	K	-200 t	o +400 °C	-300	to	+700 °F	±0.1 % FS ±1 digit *1	0.1 °C	
	7	K	-200 t	o +200 °C	-300	to	+400 °F	±0.1 % FS ±1 digit *1	0.1 °C	
	8	J	0 t	o 1200 °C	0	to	2200 °F	±0.1 % FS ±1 digit	0.1 °C	
	9	J	0 t	o 800°C	0	to	1500 °F	±0.1 % FS ±1 digit	0.1 °C	
	10	J	0 t	o 600°C	0	to	1100 °F	±0.1 % FS ±1 digit	0.1 °C	
	11	J	-200 t	o +400 °C	-300	to	+700 °F	±0.1 % FS ±1 digit *1	0.1 °C	
	12	E	0 t	o 800 °C	0	to	1500 °F	±0.1 % FS ±1 digit	0.1 °C	
	13	Е	0 t	o 600°C	0	to	1100 °F	±0.1 % FS ±1 digit	0.1 °C	
	14	Т	−200 t	o +400 °C	-300	to	+700 °F	±0.1 % FS ±1 digit *1	0.1 °C	
	15	R	0 t	o 1600 °C	0	to	3000 °F	±0.1 % FS ±1 digit *2	0.1 °C	
	16	S	0 t	o 1600°C	0	to	3000 °F	±0.1 % FS ±1 digit *2	0.1 °C	
	17	В	0 t	o 1800 °C	0	to	3300 °F	±0.2 % FS ±1 digit *3	0.1 °C	
	18	N	0 t	o 1300 °C	0	to	2300 °F	±0.1 % FS ±1 digit	0.1 °C	
	19	PLII	0 t	o 1300 °C	0	to	2300 °F	±0.1 % FS ±1 digit	0.1 °C	Upscale (105 % FS)
	20	WRe5-26	0 t	o 1400 °C	0	to	2400 °C	±0.1 % FS ±1 digit	0.1 °C	Upscale (110 % FS)
	21	WRe5-26	0 t	o 2300 °C	0	to	4200 °C	±0.1 % FS ±1 digit	0.1 °C	
	23	PR40-20	0 t	o 1900 °C	0	to	3400 °C	±0.5 % FS ±1 digit *4	0.1 °C	

^{*1.} For –200 to 0 °C, \pm 0.2 % FS \pm 1 digit

^{*4.} For 0 to 300 °C, ± 2.5 % FS ± 1 digit. For 300 to 800 °C, ± 1.5 % FS ± 1 digit

Input type	Range type	Sensor	Range	e(Ce	elsius)	Range	(Fał	nrenheit)	Accuracy	Resolution	Burnout
RTD	41	Pt100	-200	to	+500 °C	-300	to	+900 °F	±0.1 % FS ±1 digit	0.1 °C	Upscale (110 % FS)
	43	Pt100	-200	to	+200 °C	-300	to	+400 °F	±0.1 % FS ±1 digit	0.01 °C	
	45	Pt100	-100	to	+300 °C	-150	to	+500 °F	±0.1 % FS ±1 digit	0.01 °C	
	47	Pt100	-100	to	+200 °C	-150	to	+400 °F	±0.1 % FS ±1 digit	0.01 °C	
	49	Pt100	-100	to	+150 °C	-150	to	+300 °F	±0.1 % FS ±1 digit	0.01 °C	
	51	Pt100	-50	to	+200 °C	-50	to	+400 °F	±0.1 % FS ±1 digit	0.01 °C	
	53	Pt100	-50	to	+100 °C	-50	to	+200 °F	±0.1 % FS ±1 digit	0.01 °C	
	55	Pt100	-60	to	+40 °C	-60	to	+100 °F	±0.1 % FS ±1 digit	0.01 °C	
	57	Pt100	-40	to	+60 °C	-40	to	+140 °F	±0.1 % FS ±1 digit	0.01 °C	
	59	Pt100	-10	to	+60 °C	-10	to	+140 °F	±0.1 % FS ±1 digit	0.01 °C	
	61	Pt100	0	to	100 °C	0	to	200 °F	±0.1 % FS ±1 digit	0.01 °C	
	63	Pt100	0	to	200°C	0	to	400 °F	±0.1 % FS ±1 digit	0.01 °C	
	65	Pt100	0	to	300 °C	0	to	500 °F	±0.1 % FS ±1 digit	0.01 °C	
	67	Pt100	0	to	500 °C	0	to	900 °F	±0.1 % FS ±1 digit	0.1 °C	
	69	Pt100	-200	to	+850 °C	-300	to	+1550 °F	±0.1 % FS ±1 digit	0.1 °C	900 °C, 1650 °F

^{*2.} For 0 to 100 °C, \pm 0.2 % FS \pm 1 digit

^{*3.} For 0 to 260 °C, ± 4 % FS ± 1 digit. For 260 to 800 °C, ± 0.4 % FS ± 1 digit

Input type	Range type	Sensor	Range	Accuracy	Resolution	Burnout
Linear	86	Voltage (V)	1 to 5 V	±0.1 % FS ±1 digit	1/90000	Downscale
					min.	(-10 % FS)
	87	Voltage (V)	0 to 5 V	±0.1 % FS ±1 digit		Burnout cannot be detected
						(about 0 % FS)
	88	Voltage (V)	0 to 10 V	±0.1 % FS ±1 digit		Burnout cannot be detected
						(about 0 % FS)
	89	Current (mA)	0 to 20 mA	±0.1 % FS ±1 digit		Burnout cannot be detected
						(about 0 % FS)
	90	Current (mA)	4 to 20 mA	±0.1 % FS ±1 digit		Downscale
						(-10 % FS)
	92	Voltage (V)	-10 to $+10$ V	±0.1 % FS ±1 digit		Burnout cannot be detected
						(about 50 % FS)

Input	type	Range type	Sensor	Range	Accuracy	Resolution	Burnout
Not u	sed	0	None	Fixed to 0	-	-	-

! Handling Precautions

- If the MAIN block firmware is earlier than version 6.0.x, range types 18, 19, 23, and 92 are not available.
- If the MAIN block firmware is earlier than version 6.2.x, range type 69 is not available.

■ Input sensor standards

Thermocouple K, E, J, T, B, R, S,N: JIS C 1602:2015

WRe5-26: ASTM E988-96 (Reapproved 2002)

(JIS C 1602:2015, C thermocouple)

PLII,PR40-20: ASTM E1751/E1751M-15

Resistance temperature detector

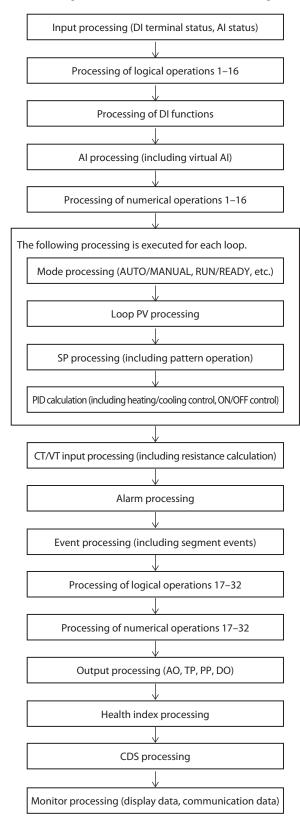
Pt100: JIS C 1604-2013

Chapter 14. Appendix

14-1 Function Block Diagrams

■ Processing procedure

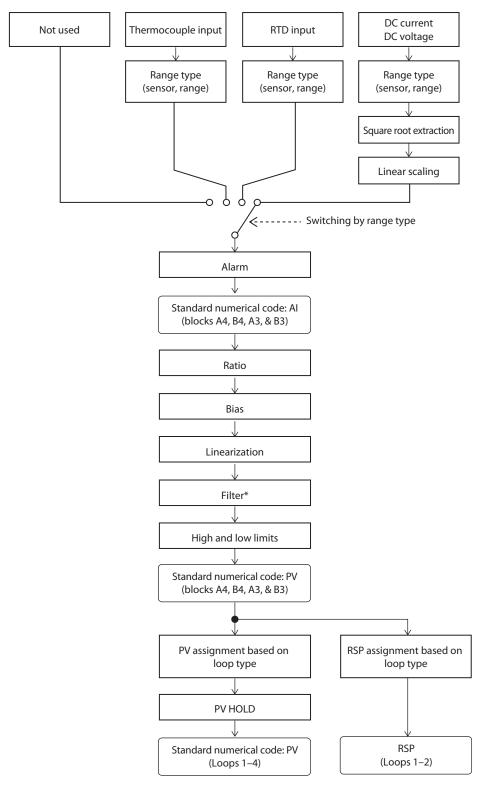
Processing is done in the order shown in the figure below for each sampling cycle.



! Handling Precautions

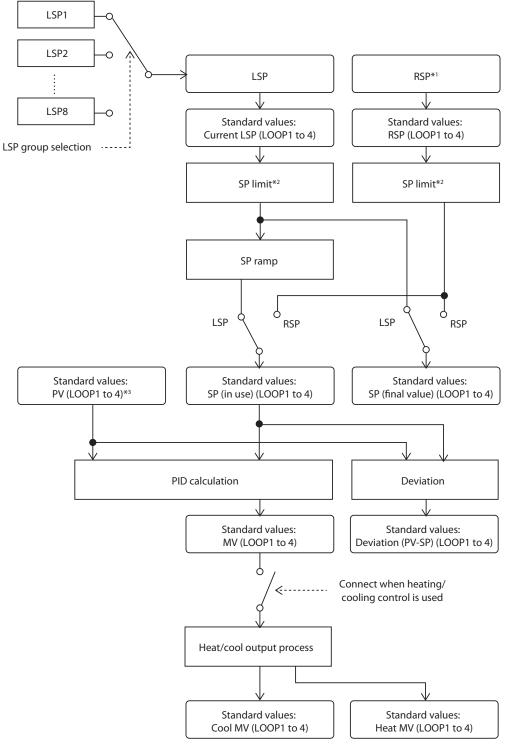
- The update cycle for CT input, VT input, and resistance is 100 ms.
- The update cycle for MFB (motor feedback) input and PP (position proportional) output is 100 ms.
- The TP (time proportional) output ON/OFF update cycle is 1 ms when the time proportional cycle is less than 10 s and 250 ms when the time proportional cycle is 10 s or more.
- The HMI (display unit) display update cycle is 200 ms.

■ AI (analog input) process block diagram



^{*} Filter is disabled if an alarm is generated.

■ SP process / PID process block diagram



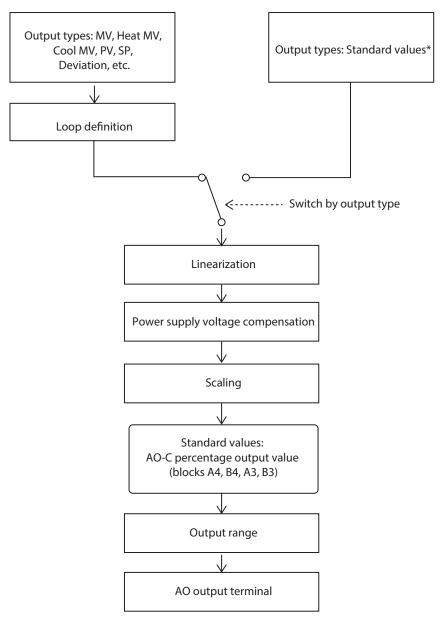
^{*1} AI (analog input) process block diagram (p. 14-3) (for details about the RSP)

^{*3} AI (analog input) process block diagram (p. 14-3) (for details about the PV)



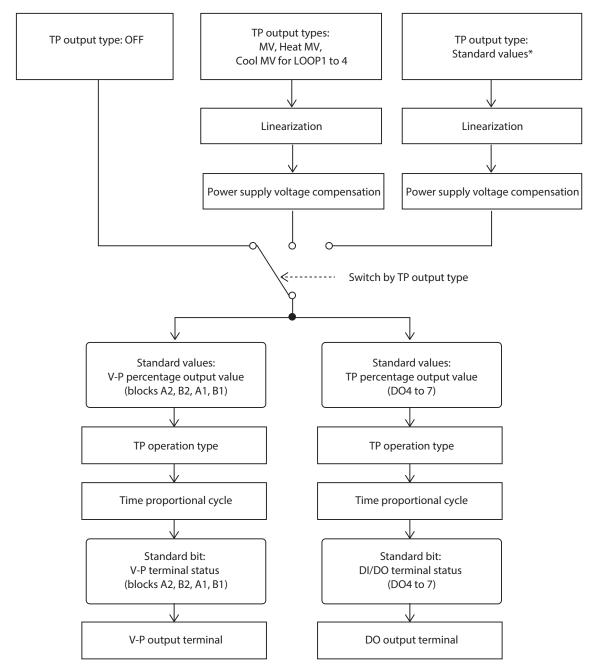
^{*2} Limited due to SP low limit/high limit and PV range

■ AO (analog output) process block diagram



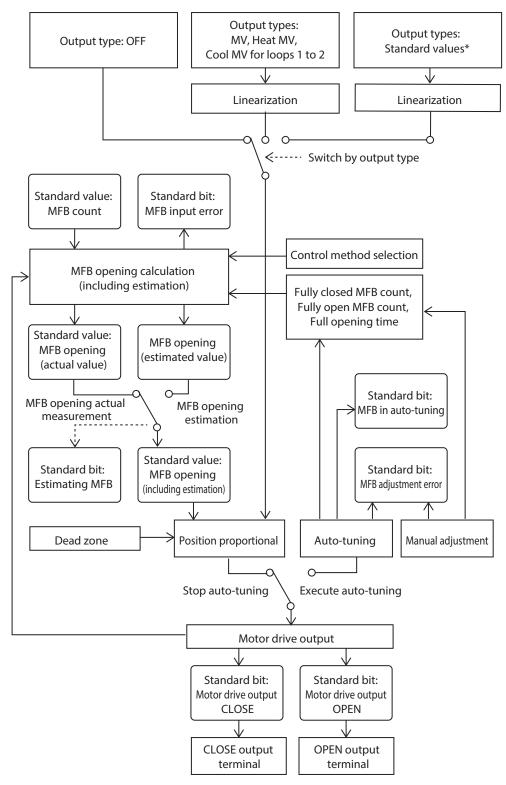
^{*} Output type "2048:0.0 (fixed value)" is included in the standard numerical codes.

■ TP (time proportioning) output process block diagram



 $^{^{*}}$ Output type "2048:0.0 (fixed value)" is included in the standard numerical codes.

■ PP (position proportional) output process block diagram



 $^{^{*}}$ Output type "2048:0.0 (fixed value)" is included in the standard numerical codes.

14-2 Standard Bit Codes and Standard Numerical Codes

■ Standard bit codes

The range of standard bit codes is 1024 to 2047.

Numbers not listed below are reserved for the system, so do not use them for configuration.

Standard bit code	Meaning	Description	Notes
1024	Always 0 (OFF)	0: OFF (fixed value)	Availability depends on your
1025	Always 1 (ON)	1: ON (fixed value)	firmware version.*1
1088	Event 1	0: OFF	7
1089	Event 2		
1090	Event 3	1: ON	
1091	Event 4		
1092	Event 5		
1093	Event 6		
1094	Event 7		
1095	Event 8		
1096	Event 9		
1097	Event 10		
1098	Event 11		
1099	Event 12		
1100	Event 13		
1101	Event 14		
1102	Event 15		
1103	Event 16		
1120	CT1 heater burnout detection (block A2)	0: No burnout	Two CT inputs for the V-P block.
1121	CT2 heater burnout detection (block A2)	1: Burnout detected	Different codes are assigned
1122	CT1 heater burnout detection (block B2)		depending on the position of the
1123	CT2 heater burnout detection (block B2)		block.
1124	CT1 heater burnout detection (block A1)		A saila lailite a dans an da ann ann
1125	CT2 heater burnout detection (block A1)		Availability depends on your firmware version.*1
1126	CT1 heater burnout detection (block B1)		iiiiiware version."
1127	CT2 heater burnout detection (block B1)		_
1128	CT1 overcurrent detection (block A2)	0: No overcurrent	
1129	CT2 overcurrent detection (block A2)	1: Overcurrent detected	
1130	CT1 overcurrent detection (block B2)		
1131	CT2 overcurrent detection (block B2)		
1132	CT1 overcurrent detection (block A1)		
1133	CT2 overcurrent detection (block A1)		
1134	CT2 overcurrent detection (block B1)		
1135 1136	CT2 overcurrent detection (block B1) CT1 short-circuit detection (block A2)	0: No short-circuit	-
1136	CT2 short-circuit detection (block A2)	o. NO SHOLE-CITCUIT	
1137	CT1 short-circuit detection (block A2)	1: Short-circuit detected	
1138	CT2 short-circuit detection (block B2)		
1140	CT1 short-circuit detection (block A1)		
1141	CT2 short-circuit detection (block A1)		
1142	CT1 short-circuit detection (block A1)		
1143	CT2 short-circuit detection (block B1)		
1168	DI/DO1 terminal status	0: OFF	Three digital input/outputs for the
	DI/DO2 terminal status		DI/DO block.
1169		1: ON	
1170	DI/DO3 terminal status		Availability depends on your firmware version.*1

Standard bit code	Meaning	Description	Notes
1171	DI/DO4 terminal status	0: OFF	Four digital input/outputs for the
1172	DI/DO5 terminal status	1: ON	DI/DO block.
1173	DI/DO6 terminal status		Availability depends on your
1174	DI/DO7 terminal status		firmware version.*1*2
1208	DI1 terminal status (block A3)	0: OFF	Four digital inputs for the DI block.
1209	DI2 terminal status (block A3)	1: ON	Different codes are assigned
1210	DI3 terminal status (block A3)		depending on the position of the
1211	DI4 terminal status (block A3)		block.
1212	DI1 terminal status (block B3)		Availability depends on your
1213	DI2 terminal status (block B3)		firmware version.*3
1214	DI3 terminal status (block B3)		
1215	DI4 terminal status (block B3)		
1224	DO1 terminal status (block A1)	0: OFF	Four digital outputs for the DO
1225	DO2 terminal status (block A1)	1: ON	block.
1226	DO3 terminal status (block A1)		Different codes are assigned
1227	DO4 terminal status (block A1)		depending on the position of the
1228	DO1 terminal status (block B1)		block.
1229	DO2 terminal status (block B1)		Availability depends on your
1230	DO3 terminal status (block B1)		firmware version.*3
1231	DO4 terminal status (block B1)		
1280	V-P terminal status (block A2)	0: OFF	One voltage output for the V-P block.
1281	V-P terminal status (block B2)	1: ON	Different codes are assigned
1282	V-P terminal status (block A1)		depending on the position of the block.
1283	V-P terminal status (block B1)		Availability depends on your firmware version.*1
1290	Result of numerical operation 1 (bit)	0: OFF	Availability depends on your
1291	Result of numerical operation 2 (bit)] 1: ON	firmware version.*4
1292	Result of numerical operation 3 (bit)	1.01	
1293	Result of numerical operation 4 (bit)		
1294	Result of numerical operation 5 (bit)		
1295	Result of numerical operation 6 (bit)		
1296	Result of numerical operation 7 (bit)		
1297	Result of numerical operation 8 (bit)		
1298	Result of numerical operation 9 (bit)		
1299	Result of numerical operation 10 (bit)		
1300	Result of numerical operation 11 (bit)		
1301	Result of numerical operation 12 (bit)		
1302	Result of numerical operation 13 (bit)		
1303	Result of numerical operation 14 (bit)		
1304	Result of numerical operation 15 (bit)		
1305	Result of numerical operation 16 (bit)	7	

Standard bit code	Meaning	Description	Notes
	D 1: (0.055	A 11 1111 1
1306	Result of numerical operation 17 (bit)	0: OFF	Availability depends on your firmware version.*4
1307	Result of numerical operation 18 (bit) Result of numerical operation 19 (bit)	1: ON	iiiiiware version."
1308		-	
1309 1310	Result of numerical operation 20 (bit) Result of numerical operation 21 (bit)	-	
1310	Result of numerical operation 21 (bit) Result of numerical operation 22 (bit)	+	
1312	Result of numerical operation 22 (bit)	\dashv	
1313	Result of numerical operation 23 (bit)	\dashv	
1314	Result of numerical operation 25 (bit)	-	
1315	Result of numerical operation 26 (bit)	-	
1316	Result of numerical operation 27 (bit)	-	
1317	Result of numerical operation 28 (bit)	-	
1318	Result of numerical operation 29 (bit)	7	
1319	Result of numerical operation 30 (bit)	7	
1320	Result of numerical operation 31 (bit)	-	
1321	Result of numerical operation 32 (bit)	-	
1360	Segment event 1	0: OFF	Availability depends on your
1361	Segment event 2		firmware version.*3
1362	Segment event 3	1: ON	minware version:
1363	Segment event 4	-	
1364	Segment event 5	-	
1365	Segment event 6	7	
1366	Segment event 7	7	
1367	Segment event 8	7	
1368	Segment event 9	7	
1369	Segment event 10	7	
1370	Segment event 11	7	
1371	Segment event 12		
1372	Segment event 13		
1373	Segment event 14	7	
1374	Segment event 15		
1375	Segment event 16		
1376	Segment event 17	0: OFF	Availability depends on your
1377	Segment event 18	1. ON	firmware version.*4
1378	Segment event 19	1: ON	
1379	Segment event 20		
1380	Segment event 21		
1381	Segment event 22	_	
1382	Segment event 23		
1383	Segment event 24		
1384	Segment event 25	_	
1385	Segment event 26	_	
1386	Segment event 27		
1387	Segment event 28	_	
1388	Segment event 29	_	
1389	Segment event 30		
1390	Segment event 31	_	
1391	Segment event 32		

Standard bit code	Meaning	Description	Notes
1408	User-defined bit 1	0: OFF	Availability depends on your
1409	User-defined bit 2	1.00	firmware version.*1
1410	User-defined bit 3	1: ON	
1411	User-defined bit 4		
1412	User-defined bit 5		
1413	User-defined bit 6		
1414	User-defined bit 7		
1415	User-defined bit 8		
1416	User-defined bit 9		
1417	User-defined bit 10		
1418	User-defined bit 11		
1419	User-defined bit 12		
1420	User-defined bit 13		
1421	User-defined bit 14		
1422	User-defined bit 15		
1423	User-defined bit 16		
1424	User-defined bit 17	0: OFF	Availability depends on your
1425	User-defined bit 18	1: ON	firmware version.*4
1426	User-defined bit 19		
1427	User-defined bit 20		
1428	User-defined bit 21		
1429	User-defined bit 22		
1430	User-defined bit 23		
1431	User-defined bit 24		
1432	User-defined bit 25		
1433	User-defined bit 26		
1434	User-defined bit 27		
1435	User-defined bit 28		
1436	User-defined bit 29		
1437	User-defined bit 30		
1438	User-defined bit 31		
1439	User-defined bit 32		
1440	Result of logical operation 1	0: OFF	Availability depends on your
1441	Result of logical operation 2	1: ON	firmware version.*1
1442	Result of logical operation 3		
1443	Result of logical operation 4		
1444	Result of logical operation 5		
1445	Result of logical operation 6		
1446	Result of logical operation 7		
1447	Result of logical operation 8		
1448	Result of logical operation 9		
1449	Result of logical operation 10		
1450	Result of logical operation 11		
1451	Result of logical operation 12		
1452	Result of logical operation 13		
1453	Result of logical operation 14		
1454	Result of logical operation 15		
1455	Result of logical operation 16		

Standard bit code	Meaning	Description	Notes
1456	Result of logical operation 17	0: OFF	Availability depends on your
1457	Result of logical operation 18] 1: ON	firmware version.*3
1458	Result of logical operation 19		
1459	Result of logical operation 20		
1460	Result of logical operation 21		
1461	Result of logical operation 22		
1462	Result of logical operation 23		
1463	Result of logical operation 24		
1464	Result of logical operation 25		
1465	Result of logical operation 26		
1466	Result of logical operation 27		
1467	Result of logical operation 28		
1468	Result of logical operation 29		
1469	Result of logical operation 30		
1470	Result of logical operation 31		
1471	Result of logical operation 32		
1504	CDS running	0: CDS stopped	Availability depends on your
		1: CDS running	firmware version.*1
1505	Loop 1 health index running	0:Health index stopped	
1506	Loop 2 health index running	1:Health index running	
1507	Loop 3 health index running		
1508	Loop 4 health index running		
1517	Display unit connection status	0: Not connected	
1518	Additional display unit connection status	1: Connected	
1568	Loop 1 RUN/READY status	0: RUN mode	Availability depends on your
1569	Loop 2 RUN/READY status	1: READY mode	firmware version.*1
1570	Loop 3 RUN/READY status		
1571	Loop 4 RUN/READY status		
1584	Loop 1 AUTO/MANUAL status	0: AUTO mode	
1585	Loop 2 AUTO/MANUAL status	1: MANUAL mode	
1586	Loop 3 AUTO/MANUAL status		
1587	Loop 4 AUTO/MANUAL status		
1600	Loop 1 AT stop/start status	0: AT stopped	
1601	Loop 2 AT stop/start status	1: AT running	
1602	Loop 3 AT stop/start status	, ,	
1603	Loop 4 AT stop/start status		
1608	Loop 1 AT abnormal end	0: No abnormal AT end	Availability depends on your
1609	Loop 2 AT abnormal end	1: AT ended abnormally.	firmware version.*3
1610	Loop 3 AT abnormal end	ĺ	
1611	Loop 4 AT abnormal end		
1616	Loop 1 LSP/RSP status	0: LSP mode	Availability depends on your
1617	Loop 2 LSP/RSP status	1: RSP mode	firmware version.*1
1618	Loop 3 LSP/RSP status		
1619	Loop 4 LSP/RSP status		

Standard			
bit code	Meaning	Description	Notes
1648	Loop 1 SP ramp-up in progress	0: Currently there is no SP	Availability depends on your
1649	Loop 2 SP ramp-up in progress	ramp-up.	firmware version.*1
1650	Loop 3 SP ramp-up in progress	1: SP ramp-up is in progress.	
1651	Loop 4 SP ramp-up in progress		
1652	Loop 1 SP ramp-down in progress	0: Currently there is no SP	
1653	Loop 2 SP ramp-down in progress	ramp-down.	
1654	Loop 3 SP ramp-down in progress	1: SP ramp-down is in	
1655	Loop 4 SP ramp-down in progress	progress.	
1670	Enforcing loop 1 pattern SP increase change limit	0: Pattern SP increase change limit is not being enforced.	Availability depends on your firmware version.*3
1671	Enforcing loop 2 pattern SP increase change limit	1: Pattern SP increase change limit is being enforced.	
1672	Enforcing loop 3 pattern SP increase change limit	sering emorecu.	
1673	Enforcing loop 4 pattern SP increase change limit		
1674	Enforcing loop 1 pattern SP decrease change limit	0: Pattern SP decrease change limit is not being	
1675	Enforcing loop 2 pattern SP decrease change limit	enforced. 1: Pattern SP decrease	
1676	Enforcing loop 3 pattern SP decrease change limit	change limit is being enforced.	
1677	Enforcing loop 4 pattern SP decrease change limit		
1712	Loop 1 pattern operation mode	0: Constant value operation	SP ramp mode and RSP mode
1713	Loop 2 pattern operation mode	mode	are included in constant value
1714	Loop 3 pattern operation mode	1: Pattern operation mode	operation mode.
1715	Loop 4 pattern operation mode		Availability depends on your firmware version.*3
1720	Loop 1 HOLD state	0: Not in pattern operation	Availability depends on your
1721	Loop 2 HOLD state	HOLD mode	firmware version.*3
1722	Loop 3 HOLD state	1: Currently in pattern	
1723	Loop 4 HOLD state	operation HOLD mode	
1728	Loop 1 END state	0: Not in pattern operation	
1729	Loop 2 END state	END mode	
1730	Loop 3 END state	1: Currently in pattern	
1731	Loop 4 END state	operation END mode	
1736	Loop 1 G.SOAK state	0: Not in pattern operation	
1737	Loop 2 G.SOAK state	G.SOAK wait state	
1738	Loop 3 G.SOAK state	1: Currently in pattern	
1739	Loop 4 G.SOAK state	operation G.SOAK wait state	
1792	Alarm (logical OR of all displayed alarms)	0: No alarms 1: An alarm has occurred.	Availability depends on your firmware version.*1

Standard bit code	Meaning	Description	Notes
1824	Loop 1 PV low limit error	0: No errors	Availability depends on your
1825	Loop 1 PV high limit error	1: An error has occurred.	firmware version.*1
1826	Loop 1 RSP low limit error		
1827	Loop 1 RSP high limit error		
1828	Loop 2 PV low limit error		
1829	Loop 2 PV high limit error		
1830	Loop 2 RSP low limit error		
1831	Loop 2 RSP high limit error		
1832	Loop 3 PV low limit error		
1833	Loop 3 PV high limit error		
1834	Loop 3 RSP low limit error		
1835	Loop 3 RSP high limit error		
1836	Loop 4 PV low limit error		
1837	Loop 4 PV high limit error		
1838	Loop 4 RSP low limit error		
1839	Loop 4 RSP high limit error		
1880	MFB input error	0: No errors	MFB input and drive output of the
		1: An error has occurred.	MOTOR block
1884	Adjusting MFB	0: Not being adjusted.	Availability depends on your
		1: Being adjusted.	firmware version.*2
1888	Estimating MFB	0: Not being estimated.	
1000	Listinating Wil D		
1006	MED II .	1: Being estimated.	
1896	MFB adjustment error	0: No errors	
		1: An error has occurred.	
1900	Motor drive output OPEN	0: OPEN relay OFF	
		1: OPEN relay ON	
1904	Motor drive output CLOSE	0: CLOSE relay OFF	
		1: CLOSE relay ON	
1920	Reception monitoring 1		9-4 Reception Monitoring
1921	Reception monitoring 2	1: Message reception error	
1922	Reception monitoring 3	1. Message reception end	Availability depends on your firmware version.*2
1940	User-defined alarm 1	0: No alarms	
1941	User-defined alarm 2		■1-loop monitor screen if there is an alarm (p. 5-24)
1942	User-defined alarm 3	1: An alarm has occurred.	·
1943	User-defined alarm 4		Availability depends on your firmware version.*3
1952	CT/VT input error (block A2 CT)	0: No errors	CT input / VT input of the AO-C
			block
1953 1954	CT/VT input error (block A2 VT) CT/VT input error (block B2 CT)	1: An error has occurred.	
1954	CT/VT input error (block B2 VT)		Different codes are assigned depending on the position of the
1955	CT/VT input error (block A1 CT)		block.
1956	CT/VT input error (block A1 VT)		Availability depends on your
1957	CT/VT input error (block B1 CT)		firmware version.*1
1958	CT/VT input error (block B1 VT)		The second secon

Standard bit code	Meaning	Description	Notes
1960	CT/CT input error (block A2 CT1)	0: No errors	2 CT inputs of the V-P block
1961	CT/CT input error (block A2 CT2)	1: An error has occurred.	Different codes are assigned
1962	CT/CT input error (block B2 CT1)		depending on the position of the
1963	CT/CT input error (block B2 CT2)		block.
1964	CT/CT input error (block A1 CT1)		Availability depends on your
1965	CT/CT input error (block A1 CT2)		firmware version.*1
1966	CT/CT input error (block B1 CT1)		
1967	CT/CT input error (block B1 CT2)		
1973	Memory error	0: No alarms	Function alarm (p. 11-6)
1977	Battery error (CLOCK block)	1: An alarm has occurred.	Availability depends on your
1991	Block error		firmware version.*1
1992	SD card error		I IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
1993	Numerical operation alarm	0: No alarms	Availability depends on your
		1: An alarm has occurred.	firmware version.*4
1994	Buffer setting alarm	0: No alarms	Availability depends on your
		1: An alarm has occurred.	firmware version.*5
2000	Block alarm IO failure (block A1)	0: No alarms	
2000	Block alarm IO failure (block A1)	1	■Block alarm (p. 11-3)
2001	Block alarm IO failure (block A3)	1: An alarm has occurred.	Availability depends on your
2002	Block alarm IO failure (block A4)		firmware version.*1
2003	Block alarm IO failure (block B1)		
2004	Block alarm IO failure (block B2)		
2005	Block alarm IO failure (block B2)	_	
2006	Block alarm IO failure (block B3)	-	
2007	Block alarm HMI block failure	_	
2008	Block alarm SUB2 block failure (RS-485)	_	
2009	Block alarm SUB1 block failure (RS-485)	_	
2010	Block alarm MAIN block failure	-	

^{*1} If the MAIN block firmware is earlier than version 4.0.x (where x stands for any number), the standard bit codes are not supported.

^{*2} If the MAIN block firmware is earlier than version 5.0.x (where x stands for any number), DI/DO 4–7 time proportional (TP) output terminal status, MFB input error, adjusting MFB, estimating MFB, MFB adjustment error, motor drive output OPEN, motor drive output CLOSE, and reception monitoring 1–3 are not supported.

^{*3} If the MAIN block firmware is earlier than version 6.0.x (where x stands for any number), DI1–4 terminal status, DO1–4 terminal status, segment event 1–16, result of logical operation 17–32, AT abnormal end, enforcing pattern SP increase change limit, enforcing pattern SP decrease change limit, pattern operation mode, HOLD state, END state, G.SOAK state, and user-defined alarm 1–4 are not supported.

^{*4} If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), result of numerical operation 1-32 (bit), segment event 17-32, user-defined bit 17-32, and numerical operation alarm are not supported.

^{*5} If the MAIN block firmware is earlier than version 6.3.x (where x stands for any number), buffer setting alarm is not supported.

■ Standard numerical codes

The range of the standard numbers is 2048 to 3071.

Codes not listed below are reserved for the system, so do not use them for configuration.

	configuration.		
Standard numerical code No.	Meaning	Description	Notes
2048	Always 0.0	Always 0.0	With decimal point.
2111	User-defined value 1	-32768 to +32767	A
2112	User-defined value 2		Availability depends on your firmware version.*1
2113	User-defined value 3		IIIIIware version.
2114	User-defined value 4		
2115	User-defined value 5		
2116	User-defined value 6		
2117	User-defined value 7		
2118	User-defined value 8		
2119	User-defined value 9		
2120	User-defined value 10		
2121	User-defined value 11		
2122	User-defined value 12		
2123	User-defined value 13		
2124	User-defined value 14		
2125	User-defined value 15		
2126	User-defined value 16		
2127	User-defined value 17	-32768 to +32767	With decimal point.
2128	User-defined value 18		Availability depends on your
2129	User-defined value 19		firmware version.*3
2130	User-defined value 20		inniwate version.
2131	User-defined value 21		
2132	User-defined value 22		
2133	User-defined value 23		
2134	User-defined value 24		
2135	User-defined value 25		
2136	User-defined value 26		
2137	User-defined value 27		
2138	User-defined value 28		
2139	User-defined value 29		
2140	User-defined value 30		
2141	User-defined value 31		
2142	User-defined value 32		
2288	Virtual Al 1	-32768 to +32767	With decimal point.
2289	Virtual AI 2		Availability depends on your
2290	Virtual AI 3		firmware version.*2
2291	Virtual AI 4		Tillivale version.
2296	Virtual PV 1		
2297	Virtual PV 2		
2298	Virtual PV 3		
2299	Virtual PV 4		

1	I		
Standard numerical code No.	Meaning	Description	Notes
2304	AI (block A4)	-32768 to +32767	With decimal point.
2305	AI (block B4)		There are low and high limits
2306	AI (block A3)		depending on the input type
2307	AI (block B3)		and range type.
2312	PV (block A4)		
2313	PV (block B4)		■AI (analog input) process
2314	PV (block A3)		block diagram (p. 14-3)
2315	PV (block B3)		Availability depends on your
2320	Loop 1 PV		firmware version.*1
2321	Loop 2 PV		
2322	Loop 3 PV		
2323	Loop 4 PV		
2336	Loop 1 SP (in use)	-32768 to +32767	With decimal point
2337	Loop 2 SP (in use)		SP process / PID process
2338	Loop 3 SP (in use)		block diagram (p. 14-4)
2339	Loop 4 SP (in use)		
2352	Loop 1 SP (final value)		Availability depends on your
2353	Loop 2 SP (final value)		firmware version.*1
2354	Loop 3 SP (final value)		
2355	Loop 4 SP (final value)		
2368	Loop 1 current LSP	-32768 to +32767	With decimal point.
2369	Loop 2 current LSP		SP process / PID process
2370	Loop 3 current LSP		block diagram (p. 14-4)
2371	Loop 4 current LSP		
2384	Loop 1 RSP		Availability depends on your
2385	Loop 2 RSP		firmware version.*3
2386	Loop 3 RSP		
2387	Loop 4 RSP		
2416	Loop 1 MV	-10.0 to +110.0 %	With decimal point.
2417	Loop 2 MV		SP process / PID process
2418	Loop 3 MV		block diagram (p. 14-4)
2419	Loop 4 MV		
2432	Loop 1 Heat MV		Availability depends on your firmware version.*1
2433	Loop 2 Heat MV		iirmware version."
2434	Loop 3 Heat MV		
2435	Loop 4 Heat MV		
2448	Loop 1 Cool MV		
2449	Loop 2 Cool MV		
2450	Loop 3 Cool MV		
2451	Loop 4 Cool MV	10.01 110.05	West I is a second
2464	MFB opening amount (estimated)	-10.0 to +110.0 %	With decimal point
		(0.0 to 100.0 % in estimation mode)	■PP (position proportional) output process block diagram
2472	MFB opening amount (actual value)	-10.0 to +110.0 %	(p. 14-7).
			Availability depends on your firmware version.*1
2479	MFB count value	0 to 8000	■PP (position proportional) output process block diagram (p. 14-7).
			Availability depends on your firmware version.*1

		T	
Standard			
numerical	Meaning	Description	Notes
code No.			
2496	CT1 measured current when output ON (block A2)	0.0 to 350.0 A	With decimal point.
2497	CT2 measured current when output ON (block A2)	(Amount of current when V-P	Two CT inputs for the V-P block.
2498	CT1 measured current when output ON (block B2)	output is ON)	-
2499	CT2 measured current when output ON (block B2)		Different codes are assigned
2500	CT1 measured current when output ON (block A1)		depending on the position of
2501	CT2 measured current when output ON (block A1)		the block.
2502	CT1 measured current when output ON (block B1)		Availability depends on your
2503	CT2 measured current when output ON (block B1)		firmware version.*1
2512	CT1 measured current when output OFF (block A2)	0.0 to 350.0 A	
2513	CT2 measured current when output OFF (block A2)	Current value when V-P	
2514	CT1 measured current when output OFF (block B2)	output is OFF)	
2515	CT2 measured current when output OFF (block B2)		
2516	CT1 measured current when output OFF (block A1)		
2517	CT2 measured current when output OFF (block A1)		
2518	CT1 measured current when output OFF (block B1)		
2519	CT2 measured current when output OFF (block B1)		
2528	Loop 1 deviation (PV – SP)	-32768 to +32767	With decimal point.
2529	Loop 2 deviation (PV – SP)		Availability depends on your
2530	Loop 3 deviation (PV – SP)		firmware version.*1
2531	Loop 4 deviation (PV – SP)		inniware version.
2544	CT input value (block A2)	0.0 to 350.0 A	With decimal point.
2545	CT input value (block B2)	(CT input current)	CT input / VT input for the AO-C
2546	CT input value (block A1)	(C) input current)	block.
2547	CT input value (block B1)		
2548	VT input value (block A2)	0.0 to 500.0 V	Different codes are assigned
2549	VT input value (block B2)	(VT input voltage)	depending on the position of
2550	VT input value (block A1)	(VI input voitage)	the block.
2551	VT input value (block B1)		Availability depends on your
2552	Resistance (block A2)	0 to 32767 Ω	firmware version.*1
2553	Resistance (block B2)	Resistance is calculated from	
2554	Resistance (block A1)	the CT input current and VT	
2555	Resistance (block B1)	input voltage.)	
2656	Event 1 timer remaining time	0 to 32000 s	With decimal point.
2657	Event 2 timer remaining time	0 10 0 2 0 0 0	·
2658	Event 3 timer remaining time		Time remaining until change in
2659	Event 4 timer remaining time		ON delay or OFF delay.
2660	Event 5 timer remaining time		Availability depends on your
2661	Event 6 timer remaining time		firmware version.*1
2662	Event 7 timer remaining time		
2663	Event 8 timer remaining time		
2664	Event 9 timer remaining time		
2665	Event 10 timer remaining time		
2666	Event 11 timer remaining time		
2667	Event 12 timer remaining time		
2668	Event 13 timer remaining time		
2669	Event 14 timer remaining time		
2670	Event 15 timer remaining time		
2671	Event 16 timer remaining time		
	, =	1	1

numerical code No. 2736 CT1 Time proportioning current (block A2) 2737 CT2 Time proportioning current (block A2) 2738 CT1 Time proportioning current (block B2) 2739 CT2 Time proportioning current (block B2) 2739 CT2 Time proportioning current (block B2) 2730 CT2 Time proportioning current (block B1) 2741 CT2 Time proportioning current (block B1) 2742 CT1 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2744 CT2 Time proportioning current (block B1) 2745 Loop 1 specific R value 2753 Loop 2 specific R value 2754 Loop 3 specific R value 2755 Loop 3 specific R value 2756 Loop 1 R value 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 Specific R value 2763 Loop 6 R value 2764 Loop 6 R value 2765 Loop 7 R value 2765 Loop 7 R value 2766 Loop 7 R value 2766 Loop 7 R value 2767 AO-C percent output value (block A2) 2770 AO-C percent output value (block A2) 2771 AO-C percent output value (block B2) 2770 AO-C percent output value (block B2) 2771 AO-C percent output value (block B2) 2771 AO-C percent output value (block B2) 2772 V-P percent output value (block B2) 2773 V-P percent output value (block B2) 2774 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2789 TP percent output value (block B2) 2789 TP percent output value (block B2) 2789 TP percent output value (block B2) 2780 Numerical operation result 1 2800 Numerical operation result 2 2800 Numerical operation result 1 2801 Numerical operation result 1 2811 Numerical operation result 12 2812 Numerical operation result 13 2813 Numerical operation result 15 2815 Numerical operation result 17 2816 Numerical operation result 11 2817 Numerical operation result 11 2818 Numerical operation	<u> </u>			
code No. 2736 CT1 Time proportioning current (block A2) 0.0 to 350.0 A With decimal point. 2737 CT2 Time proportioning current (block A2) 2739 CT2 Time proportioning current (block A1) Two CT inputs for the V-P block. 2740 CT1 Time proportioning current (block A1) Different codes are assigned depending on the position of the block. 2741 CT2 Time proportioning current (block B1) Different codes are assigned depending on the position of the block. 2742 CT1 Time proportioning current (block B1) Different codes are assigned depending on the position of the block. 2742 CT2 Time proportioning current (block B1) Different codes are assigned depending on the position of the block. 2752 Loop 1 specific R value Two CT2 Time proportioning current (block B1) 2753 Loop 2 specific R value Two CT2 Time proportioning current (block B1) 2764 Loop 3 specific R value Two CD2 Specific R value 2765 Loop 4 specific R value Two CD4 Specific R value 2761 Loop 2 R value Two CD4 Specific R value 2763 Loop 3 specific R value Two CD4 Specific R value 2764 Availability depends on value to the value (block B1) Two Cp specific R value	Standard	Moaning	Description	Notes
2736		Wiediling	Description	Notes
2737 CT2 Time proportioning current (block A2) 2739 CT1 Time proportioning current (block B2) 2739 CT2 Time proportioning current (block B2) 2740 CT1 Time proportioning current (block A1) 2741 CT2 Time proportioning current (block A1) 2742 CT1 Time proportioning current (block A1) 2743 CT2 Time proportioning current (block A1) 2744 CT2 Time proportioning current (block B1) 2745 CT2 Time proportioning current (block B1) 2746 CT2 Time proportioning current (block B1) 2750 Loop 1 specific R value 2751 Loop 2 specific R value 2752 Loop 3 specific R value 2754 Loop 3 specific R value 2755 Loop 1 R value 2756 Loop 1 R value 2756 Loop 1 R value 2756 Loop 1 R value 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 Specific R value 2764 A0-C percent output value (block A2) 2769 A0-C percent output value (block B2) 2770 A0-C percent output value (block B2) 2771 A0-C percent output value (block B1) 2771 A0-C percent output value (block B2) 2773 V-P percent output value (block B2) 2774 V-P percent output value (block B2) 2775 V-P percent output value (block B2) 2776 V-P percent output value (block B2) 2777 V-P percent output value (block B2) 2778 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2780 TP percent output value (block B2) 2800 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 5 2805 Numerical operation result 1 2806 Numerical operation result 1 2807 Numerical operation result 1 2808 Numerical operation result 1 2809 Numerical operation result 1 2810 Numerical operation result 1 2811 Numerical operation result 1 2812 Numerical operation result 1 2813 Numerical operation result 15 2815 Numerical operation result 16 2816 Numerical operation result 17 2817 Numerical operation result 17 2818 Numerical operation result 18 2818		CT1 Time propertioning surrent (black A2)	0.0 to 250.0 A	With docimal point
2738 CT1 Time proportioning current (block B2) 2739 CT2 Time proportioning current (block A1) 2741 CT2 Time proportioning current (block A1) 2742 CT1 Time proportioning current (block A1) 2743 CT2 Time proportioning current (block A1) 2743 CT2 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2744 CT2 Time proportioning current (block B1) 2753 Loop 1 specific R value 2753 Loop 2 specific R value 2754 Loop 3 specific R value 2755 Loop 4 specific R value 2756 Loop 1 R value 2757 Loop 2 R value 2758 Loop 2 R value 2759 A0-C percent output value (block A2) 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 R value 2763 A0-C percent output value (block B2) 2770 A0-C percent output value (block B2) 2770 A0-C percent output value (block B1) 2771 A0-C percent output value (block B1) 2772 V-P percent output value (block B1) 2773 V-P percent output value (block B2) 2776 V-P percent output value (block B2) 2777 V-P percent output value (block B1) 2778 V-P percent output value (block B1) 2779 V-P percent output value (block B1) 2789 TP percent output value (block B1) 2790 TP percent output value (block B1) 2790 TP percent output value (block B2) 2790 TP percent output value (block B2) 2800 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 5 2803 Numerical operation result 5 2806 Numerical operation result 1 2810 Numerical operation result 1 2811 Numerical operation result 1 2811 Numerical operation result 12 2812 Numerical operation result 14 2814 Numerical operation result 15 2815 Numerical operation result 16 2816 Numerical operation result 16 2816 Numerical operation result 17 2817 Numerical operation result 18 2818 Numerical operation result 19			0.0 to 330.0 A	·
2739 C12 Time proportioning current (block 82) 2740 C11 Time proportioning current (block A1) 2741 C12 Time proportioning current (block A1) 2742 C11 Time proportioning current (block B1) 2743 C12 Time proportioning current (block B1) 2744 C11 Time proportioning current (block B1) 2745 C12 Time proportioning current (block B1) 2746 C12 Time proportioning current (block B1) 2757 Loop 1 specific R value 2758 Loop 2 specific R value 2759 Loop 3 specific R value 2750 Loop 1 R value 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 R value 2763 Loop 4 R value 2764 A0-C percent output value (block B2) 2770 A0-C percent output value (block B2) 2771 A0-C percent output value (block B1) 2771 A0-C percent output value (block A1) 2772 V-P percent output value (block B2) 2773 V-P percent output value (block B2) 2774 V-P percent output value (block B2) 2775 V-P percent output value (block B2) 2776 V-P percent output value (block B2) 2777 V-P percent output value (block B2) 2778 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2779 V-P percent output value (block B2) 2789 TP percent output value (block B2) 2799 V-P percent output value (block B2) 2790 TP percent output value (block B2) 2790 TP percent output value (block B1) 2800 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 5 2803 Numerical operation result 5 2805 Numerical operation result 6 2806 Numerical operation result 1 2810 Numerical operation result 1 2811 Numerical operation result 12 2812 Numerical operation result 14 2814 Numerical operation result 15 2815 Numerical operation result 15 2816 Numerical operation result 17 2817 Numerical operation result 17 2818 Numerical operation result 18 2818 Numerical operation result 18 2818 Numerical operation result 19			1	Two CT inputs for the V-P block.
2740 CT1 Time proportioning current (block A1) 2741 CT2 Time proportioning current (block A1) 2742 CT1 Time proportioning current (block A1) 2743 CT2 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2744 CT1 Time proportioning current (block B1) 2745 CT2 Time proportioning current (block B1) 2752 Loop 1 specific R value 2753 Loop 2 specific R value 2754 Loop 3 specific R value 2755 Loop 4 specific R value 2760 Loop 3 R value 2761 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 R value 2763 Loop 4 R value 2764 A0-C percent output value (block A2) 2770 A0-C percent output value (block A2) 2771 A0-C percent output value (block B1) 2771 A0-C percent output value (block B1) 2772 V-P percent output value (block A1) 2773 V-P percent output value (block B2) 2774 V-P percent output value (block B1) 2775 V-P percent output value (block B1) 2776 V-P percent output value (block B1) 2777 V-P percent output value (block B1) 2778 V-P percent output value (block B1) 2779 V-P percent output value (block B1) 2780 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 3 2803 Numerical operation result 4 2804 Numerical operation result 5 2805 Numerical operation result 6 2806 Numerical operation result 1 2811 Numerical operation result 1 2812 Numerical operation result 1 2813 Numerical operation result 1 2814 Numerical operation result 1 2815 Numerical operation result 1 2816 Numerical operation result 15 2817 Numerical operation result 16 2818 Numerical operation result 17 2818 Numerical operation result 18 2818 Numerical operation result 19	-		-	Different codes are assigned
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2742 CT1 Time proportioning current (block B1) 2743 CT2 Time proportioning current (block B1) 2754 CT2 Time proportioning current (block B1) 2755 Loop 1 specific R value 2754 Loop 2 specific R value 2754 Loop 3 specific R value 2755 Loop 4 specific R value 2756 Loop 1 R value 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 2 R value 2763 Loop 2 R value 2764 AO-C percent output value (block A2) 2770 AO-C percent output value (block B2) 2771 AO-C percent output value (block B1) 2771 AO-C percent output value (block B1) 2777 V-P percent output value (block B2) 2778 V-P percent output value (block B2) 2779 V-P percent output value (block B1) 2779 V-P percent output value (block B1) 2779 V-P percent output value (block B1) 2789 TP percent output value (block B1) 2789 TP percent output value (block B1) 2789 TP percent output value (block B1) 2780 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 4 2804 Numerical operation result 5 2805 Numerical operation result 5 2806 Numerical operation result 1 2807 Numerical operation result 1 2808 Numerical operation result 1 2809 Numerical operation result 1 2810 Numerical operation result 1 2811 Numerical operation result 14 2814 Numerical operation result 14 2815 Numerical operation result 15 2815 Numerical operation result 16 2816 Numerical operation result 19 2818 Numerical operation result 19 2818 Numerical operation result 19			1	the block.
2743 CT2 Time proportioning current (block B1) 2752 Loop 1 specific R value 2753 Loop 2 specific R value 2754 Loop 2 specific R value 2755 Loop 4 specific R value 2756 Loop 1 specific R value 2756 Loop 1 specific R value 2757 Loop 2 specific R value 2758 Loop 2 specific R value 2759 Loop 3 specific R value 2760 Loop 1 R value 2761 Loop 2 R value 2762 Loop 3 R value 2763 Loop 4 R value 2763 AO-C percent output value (block A2) 2769 AO-C percent output value (block A2) 2770 AO-C percent output value (block A2) 2771 AO-C percent output value (block B1) 2772 V-P percent output value (block B2) 2773 V-P percent output value (block B1) 2774 V-P percent output value (block B2) 2775 V-P percent output value (block B2) 2776 V-P percent output value (block B2) 2777 V-P percent output value (block B2) 2779 V-P percent output value (block B1) 2787 TP percent output value (block B1) 2789 TP percent output value (block B2) 2790 TP percent output value (block B2) 2790 TP percent output value (block B2) 2801 Numerical operation result 1 2801 Numerical operation result 2 2802 Numerical operation result 4 2804 Numerical operation result 5 2805 Numerical operation result 5 2806 Numerical operation result 6 2807 Numerical operation result 8 2808 Numerical operation result 1 2811 Numerical operation result 11 2811 Numerical operation result 11 2811 Numerical operation result 11 2811 Numerical operation result 15 2815 Numerical operation result 16 2816 Numerical operation result 17 2817 Numerical operation result 18 2818 Numerical operation result 19	-		1	Current measurement and
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Standard numerical code No.	Meaning	Description	Notes
2820	Numerical operation result 21	-32768 to +32767	With decimal point.
2821	Numerical operation result 22		4-19 Numerical Operations
2822	Numerical operation result 23		(p. 4-117)
2823	Numerical operation result 24		(p. 4-117)
2824	Numerical operation result 25		Availability depends on your
2825	Numerical operation result 26		firmware version.*3
2826	Numerical operation result 27		
2827	Numerical operation result 28		
2828	Numerical operation result 29		
2829	Numerical operation result 30		
2830	Numerical operation result 31		
2831	Numerical operation result 32		

^{*1} If the MAIN block firmware is earlier than version 5.0.x (where x stands for any number), the standard numerical codes are not supported.

^{*2} If the MAIN block firmware is earlier than version 6.0.x (where x stands for any number), virtual AI 1–4 and virtual PV 1–4 are not supported.

^{*3} If the MAIN block firmware is earlier than version 6.2.x (where x stands for any number), user-defined value 17–32, current LSP, RSP, and result of numerical operation 1–32 are not supported.

14-3 Precautions for Communication Function

■ Examples of operations when using both the normal memory area and RAM area for the same parameter

Several operation examples are shown for the following setting example (common to Modbus/RTU and /TCP).

The communication in the operation examples is applicable to both Modbus/RTU and Modbus/TCP communication.



• Chapter 9. User-defined Addresses Precautions when using both the normal memory area and the RAM area for the same parameter (p. 9-6)

Setting example (common)

- (1) Turn the C7 on. Do not write via communication yet.
- (2) Configure the settings as shown below in the SLP-C7.
 - SP bank

Loop 1 LSP group 1 LSP: 100.00

User-defined address bank

Data address 1007: Loop 1 LSP group 1 LSP, Decimal point position: 0, RAM area

Data address 1008: Loop 1 LSP group 1 LSP, decimal point position: 0, Normal area

(3) Write the parameters from the SLP-C7 to the C7.

Operation example 1: Writing to the RAM area, and then writing a different value to the normal memory area

- (1) Turn the C7 on. The Loop 1 LSP group 1 LSP is 100.00.
- (2) Write 200 to data address 1007 (RAM area) via communication. The Loop1 LSP group 1 LSP changes to 200.00. At this time, the value in RAM is 200.00, and in the normal memory area it is 100.00.
- (3) Write 300 to data address 1008 (normal memory area) via communication. Because this value is different from the value in RAM, it is written to the normal memory area.

The Loop1 LSP group 1 LSP changes to 300.00.

At this time, the value in RAM is 300.00, and in the normal memory area it is 300.00.

(4) Turn the C7 off and then on again. The Loop1 LSP group 1 LSP is 300.00.

Operation example 2: Writing to the RAM area, and then writing the same value to the normal memory area

- (1) Turn the C7 on. The Loop1 LSP group 1 LSP is 100.00.
- (2) Write 200 to data address 1007 (RAM area) via communication. The Loop1 LSP group 1 LSP changes to 200.00. At this time, the value in RAM is 200.00, and in the normal memory area it is 100.00.
- (3) Write 200 to data address 1008 (normal memory area) via communication. <u>Because the value of the LSP is different from the present value in the normal memory area, the value is written to the normal memory area.</u>
 The Loop1 LSP group 1 LSP remains at 200.00.
 At this time, the value in RAM is 200.00, and the value in the normal memory area is 200.00.
- (4) Turn the C7 off and then on again. The Loop1 LSP group 1 LSP is 100.00.

• Operation example 3: Writing to the RAM area, and then writing the same value using the SLP-C7 setting function.

- (1) Turn the C7 on. The Loop1 LSP group 1 LSP is 100.00.
- (2) Write 200 to data address 1007 (RAM area) via communication. The Loop1 LSP group 1 LSP changes to 200.00. At this time, the value in RAM is 200.00, and in the normal memory area it is 100.00.
- (3) On the Setup screen of the SLP-C7, set 200.00 for Loop1 LSP group 1 LSP, and then write the parameters to the C7.

 Because the value of the LSP is different from the present value in the normal memory area, the value is written to the normal memory area.

 The Loop1 LSP group 1 LSP remains at 200.00.

 At this time, the value in RAM is 200.00, and the value in the normal memory area is 200.00.
- (4) Turn the C7 off and then on again. The Loop1 LSP group 1 LSP is 100.00.

Operation example 4: Writing to RAM, and then writing the same value using the SLP-C7 numeric monitor

- (1) Turn the C7 on. The Loop1 LSP group 1 LSP is 100.00.
- (2) Write 200 to data address 1007 (RAM area) via communication. The Loop1 LSP group 1 LSP changes to 200.00. At this time, the value in RAM is 200.00 and it is 100.00 in the normal memory area.
- (3) Write 200.00 to Loop1 SP on the numeric monitor screen of the SLP-C7. Because the value of the LSP is different from the present value in the normal memory area, the value is written to the normal memory area. The Loop1 LSP group 1 LSP remains at 200.00. At this time, the value in RAM is 200.00, and the value in the normal memory area is 200.00.
- (4) Turn the C7 off and then on again. The Loop1 LSP group 1 LSP is 100.00.

Operation example 5: Writing to the RAM area, turning the power off and on, and then writing the same value to the normal memory area

- (1) Turn the C7 on. The Loop1 LSP group 1 LSP is 100.00.
- (2) Write 200 to data address 1007 (RAM area) via communication. The Loop1 LSP group 1 LSP changes to 200.00. At this time, RAM has "200.00" and the normal memory area has "100.00."
- (3) Turn the C7 off and then on again.The Loop1 LSP group 1 LSP changes to 100.00.At this time, RAM has "100.00" and the normal memory area has "100.00."
- (4) Write 200 to data address 1008 (normal memory area) via communication. Because this value is different from the value in RAM, it is written to the normal memory area. The Loop1 LSP group 1 LSP changes to 200.00. At this time, the value in RAM is 200.00, and the value in the normal memory area is 200.00.
- (5) Turn the C7 off and then on again. The Loop1 LSP group 1 LSP is 200.00.

14-4 Firmware Version History

This section describes the functions that were added and the specifications that changed for each firmware version.

■ Support start date: September 2016

Block	Firmware version (X is 0 to 9)	
MAIN block	2.0.x	
HMI block (display unit)	2.0.x	
DI/DO block	2.0.x	
RS-485 block	2.0.x	
AO block	2.0.x	
Al block	2.0.x	

Added functions

Description	User's Manual Reference	User's Manual Change
Support for addition of current output for 1 and 2 in column B, and PV and RSP for 3 and 4 in column B in Model No.	Model Selection Guide (p. 1-2)	1 and 2 in column B: Added "1,""2" 3 and 4 in column B: Added "1,""2"
	6-2 Parameter Setting Display Data Analog input bank (p. 6-8), Analog output bank (p. 6-16), CT input bank (p. 6-36), VT input bank (p. 6-37)	Added item for block of column B
Support for multiple loops (1 loop + 1 RSP, 2 loops, 2 loops + 1 RSP, 2 loops + 2 RSPs, 3 loops, 3 loops + 1 RSP, 4 loops)	1 - 5 Button Operation Monitor and graph screen transitions (p. 1-16)	Added loop types
	5-1 Monitor Screen and Graph Screen Home screen (p. 6-1), Multi-loop graph screen (p. 5-16)	Added loop types
	4-1 Loop Types Model numbers and loop types (p. 4-1), Setting the loop type (p. 4-4)	Added loop types
	6-1 Operation Display Data Home screen (p. 6-1), Graph screen (p. 6-5)	Added items for loops 2 to 4
	6-2 Parameter Setting Display Data SP bank (p. 6-6), PID bank (p. 6-7), Control bank (p. 6-12), SP configuration bank (p. 6-15), Event configuration bank (p. 6-18), DI bank (p. 6-22), CDS bank (p. 6-44)	Added items and settings for loops 2 to 4
Support for unit display of linear input in display unit	4-2 Al (Analog Input) Setting the linear input unit character (p. 4-6)	Added the content at left
Partial support for the Help screen of the parameter settings in the display unit	5 - 2 Parameter screen Parameter item setting change screen (p. 5-49)	Added a description of the [?] button
Changed the design of the function alarm screen and partial support for the alarm details screen in the display unit	5-1 Monitor Screen and Graph Screen Function alarm screen (p. 5-26)	Changed the position of the alarm icon

Description	User's Manual Reference	User's Manual Change
Added the health index bank in the display unit (specific R value display for loops 1 to 4)	No description in the current user's manual because this is an old specification	
Support for ON/OFF control	4-4 Control Functional block diagram of ON/OFF control (p. 4-20), ON/OFF control (p. 4-34)	Added ON/OFF control
	6-2 Parameter Setting Display Data Control bank (p. 6-12)	Increased the set value range of "Control action of loops 1 to 4"
Support for SP lag	4-4 Control SP lag (p. 4-33)	Changed the contents of "Handling Precautions"
Added SP events, MV events, PV change rate events	4-9 Events Operation (p. 4-67), Operation type and Loop definition (p. 4-72)	Added operation types
	6-2 Parameter Setting Display Data Event configuration bank (p. 6-18)	Increased the set value range of "EV1 to 8 Operation types"
Support for TP (time proportioning) output	4-11 TP (Time Proportioning) Output	Added the content at left
	6-2 Parameter Setting Display Data DI/DO configuration bank (p. 6-20)	Increased the set value range of "DI/DO4 to 7 Operation types"
	6-2 Parameter Setting Display Data TP (time proportioning) bank (p. 6-25)	Added the content at left
Added a function for synchronizing the time stamp of the file time sequence data section with the PC time in the CDS	4-20 CDS (Compact Data Storage) Setting the date and time by the SLP-C7 (p. 4-155)	Added the content at left
Added the CDS operating icon in the display unit	4 - 20 CDS (Compact Data Storage) Screen during CDS operation (p. 4-148)	Added the content at left

Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the key lock specifications in the display unit	5-1 Monitor Screen and Graph Screen	Changed the content of "Handling Precautions"
	Screen at key lock (p. 5-23)	
Some of the block names in the firmware version bank	5 - 2 Parameter screen Firmware Versions (p. 5-55)	Changed the block name from DIO to DI/DO
Changed the design of the 1-loop graph screen in the display unit	5-1 Monitor Screen and Graph Screen 1-loop graph screen (p. 5-18)	Changed the orientation of the PV, SP, and MV text
Changed so that the PV range is taken into consideration in the SP limit	4-6 SP Pattern SP increase/decrease change limit (p. 4-59)	Added "Handling Precautions"
Changed so that the SD icon blinks during SD card recognition in the display unit	4 - 20 CDS (Compact Data Storage) Screen during CDS operation (p. 4-148)	Changed the content of "Handling Precautions"

Changed the naming rule for files in the CDS	4-20 CDS (Compact Data Storage) Files (p. 4-149)	Changed the content of " Naming rule"
Changed so that files are divided in the CDS	4-20 CDS (Compact Data Storage) Files (p. 4-149)	Changed the content of "Handling Precautions"
Changed the English description for type of change to MANUAL in the display unit	6-2 Parameter Setting Display Data Control bank (p. 6-12) (Changed again in June 2017)	Changed from "Ope upon change to MAN" to "Operation upon to MANUAL"
Changed the English description for MV action if PV is bad in the display unit	Data Control bank (p. 6-12) (Changed again in June 2017)	Changed from "MV behavior if PV is abnormal" to "MV select as PV error"
Changed the block order for the parameter settings in the analog input bank	6 - 2 Parameter Setting Display Data Analog input bank (p. 6-8)	Changed from (A4 \rightarrow A3 \rightarrow B4 \rightarrow B3) to (A4 \rightarrow B4 \rightarrow A3 \rightarrow B3)
Changed the block order for the parameter settings in the analog output bank, CT input bank, and VT input bank	6 - 2 Parameter Setting Display Data Analog output bank (p. 6-16), CT input bank (p. 6-36), VT input bank (p. 6-37)	Changed from $(A2 \rightarrow A1 \rightarrow B2 \rightarrow B1)$ to $(A2 \rightarrow B2 \rightarrow A1 \rightarrow B1)$
Changed the design of the parameter item setting change screen in the display unit	5 - 2 Parameter screen Parameter item setting change screen (p. 5-49)	Deleted the loop numbers to the left side of the set values

■ Support start date: December 2016

Block	Firmware version (X is 0 to 9)
MAIN block	3.0.X
HMI block (display unit)	3.0.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO block	3.0.X
Al block	3.0.X

Added functions

Description	User's Manual Reference	User's Manual Change
Support for Japanese interface in display unit	1 - 5 Button Operation Japanese language display (p. 1-15)	Added the content at left
	6-2 Parameter Setting Display Data Basic action bank (p. 6-9)	Added "Interface language"
Added the Help screen of the parameter settings in the display unit	5 - 2 Parameter screen Parameter item setting change screen (p. 5-49)	Not changed
Added the alarm details screen in the display unit	5-1 Monitor Screen and Graph Screen Function alarm screen (p. 5-26)	Added a description of the [Function alarm] button

Description	User's Manual Reference	User's Manual Change
Added "Vertically arranged" to the HOME screen layout for 2-loop and 3-loop in the display unit	5-1 Monitor Screen and Graph Screen Home screen (p. 6-1),	Added descriptions for vertically arranged 2-loop and 3-loop screens
	6-2 Parameter Setting Display Data Basic action bank (p. 6-9)	Increased the set value range of "HOME screen layout"
Added display of resistance (calculated from the CT input value and VT input value) in the display unit	5-1 Monitor Screen and Graph Screen	Changed the description of the [DISPLAY CHANGE] icon
Support for the linearization table in analog output, TP (time proportioning) output, analog output	1-loop monitor screen (p. 5-10) 4-2 Al (Analog Input) 4-11 TP (Time Proportioning) Output, 4-12 Analog Output (AO) Linearization table group definition (p. 4-94)	Added the content at left
	6-2 Parameter Setting Display Data Linearization table bank (p. 6-40)	Added the content at left
	6-2 Parameter Setting Display Data Analog input bank (p. 6-8),	Added "Linearization table group definition"
	TP (time proportioning) bank (p. 6-25)	
Support for internal cascade control	4-17 Internal Cascade (p. 4-110)	Added the content at left
	6-2 Parameter Setting Display Data Cascade bank (p. 6-41)	Added the content at left
Added the HEALTH INDEX graph	4-21 Health Index	Added the content at left
	Graph display (p. 4-160)	
	6-2 Parameter Setting Display Data Health index graph bank (p. 6-47)	Added the content at left
Added "11 (Event 1) to 18 (Event 8)" to the operation types of the CDS	4-20 CDS (Compact Data Storage) Settings (p. 4-158)	Increased the set value range of "Operation types"
	6-2 Parameter Setting Display Data CDS bank (p. 6-44)	Increased the set value range of "Operation types"
Added resistance to the file time sequence data section in the CDS	4-20 CDS (Compact Data Storage) Files (p. 4-149)	Added resistance (calculated from the CT input value and VT input value) to "Time sequence data section"
Support for file operation for microSD memory card from the SLP-C7	4-20 CDS (Compact Data Storage) microSD memory card operations from SLP-C7 (p. 4-156)	Added the content at left
Added "Monitor: Event1 to Event8" to the user-defined address (bitmap data)	Chapter 9. User-defined Addresses	Not changed
Support for PLC link communication	Chapter 10. PLC Link Communication	Added the content at left

Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the design of the 2-loop multi monitor screen in the display unit	5-1 Monitor Screen and Graph Screen Home screen (p. 6-1), For 2 loops (p. 5-6)	Changed so that the mode is displayed with text "LSP" and "RSP"
Changed the processing details of PID initialization when the LSP is changed	4-4 Control PID control initialization (p. 4-25)	Not changed
Changed so that the operation of each health index can be set separately for each loop	4-21 Health Index	Separated the health index section from the description in 4-19, "CDS (Compact Data Storage)"
	6-2 Parameter Setting Display Data Health index bank (p. 6-46)	Added "Operation type," "Best data," "Deviation low limit," and "Deviation high limit" items for each loop in "HEALTH INDEX bank"
		Moved the "R value scale" item for each loop of "CDS bank" to " HEALTH INDEX bank"
		Deleted the "Definite R value" item for each loop from " HEALTH INDEX bank"
Changed the definite R value confirmation screen from a numeric display to a graph display in the display unit	€ 4-21 Health Index	Added the content at left
	Graph display (p. 4-160)	
	6-2 Parameter Setting Display Data Health index graph bank (p. 6-47)	Added the content at left
Changed the number of connectors from 1 to 3 in Modbus TCP communication	Chapter 8. Modbus TCP Communication Functions Features (p. 8-1)	Increased the connections from 1 to 3

■ Support start date: June 2017

Block	Firmware version (X is 0 to 9)
MAIN block	4.0.X
HMI block (display unit, additional display unit)	4.0.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
Al block	3.0.X
CLOCK block	1.0.X

Description	User's Manual Reference	User's Manual Change
Support for V-P (voltage pulse output) block	1 - 2 Model No. Model Selection Guide (p. 1-2)	1 and 2 in column A: Added V, W, N 1 and 2 in column B: Added V, W, N, G, H, L, P
	1-4 Input/output Configuration Input and output configuration diagram	Added voltage pulse output to the input and output configuration diagram
	4-11 TP (Time Proportioning) Output Function block diagram	Added the diagram "For V-P block"
	4-11 TP (Time Proportioning) Output	Added items for blocks A2, B2, A1, B2
	TP output type (p. 4-81) TP cycle (p. 4-82)	
	6-2 Parameter Setting Display Data TP (time proportioning) bank (p. 6-25)	Added items for blocks A2, B2, A1, B2
	Chapter 13. Specifications Voltage pulse output (p. 13-5)	Added specifications for voltage pulse output
Added a detection function for heater burnout/overcurrent/short-circuit via the CT input of the V-P (voltage pulse output) block	4-14 CT (Current Transformer) Input Current measurement and error detection (p. 4-97)	Added the content at left
	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Added variable display 5
	6 - 2 Parameter Setting Display Data CT input bank (p. 6-36),	Added the item "For V-P block"
Support for additional display unit	1-2 Model No. Model Selection Guide (p. 1-2)	Slots B1 and B2: Added G, H
	Connecting the cable between the main unit and display unit (p. 3-22)	Added a description of the additional display unit
	6-2 Parameter Setting Display Data Basic action bank (p. 6-9)	Added the "Additional display unit" item

Description	User's Manual Reference	User's Manual Change
Support for clock function	1-2 Model No.	Slots B1 and B2: Added L, P
	Model Selection Guide (p. 1-2) 5 - 2 Parameter screen Date and Time (p. 5-53)	Added the content at left
	4-20 CDS (Compact Data Storage) Files (p. 4-149), Setting the date and time by the SLP-C7 (p. 4-155)	Added a precaution for the model Nos. "With clock function" to the "Handling Precautions"
	6-2 Parameter Setting Display Data Date and time bank (p. 6-47)	Added the content at left
Support for heating/cooling control	4-4 Control Functional block diagram of heating/ cooling control (p. 4-21)	Added the content at left
	4-4 Control Control action (p. 4-22) Special control output (p. 4-24), PID control (p. 4-27)	Changed "2: Reserved" in the set values of "Control action" to "2: PID control heating and cooling action" Added "Output at READY (Heat)," "Output at READY (Cool)," "Proportional band for cool side," "Integral time for cool side," "Derivative time for cool side," "Output low limit for cool side," and "Output high limit for cool side" items
	4-5 AT (Auto-tuning) (p. 4-37)	Added a description of AT for heat/cool control to "Handling Precautions"
	4-11 TP (Time Proportioning) Output TP output type (p. 4-81)	Increased the set value range of "TP operation types"
	4-12 Analog Output (AO) Output type (p. 4-89)	Changed "2 to 3: Reserved" in the set values of "Output types" to "2: Heat MV (for heating/cooling control)" and "3: Cool MV (for heating/cooling control)"
	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Added Variable display 2 Changed previous Variable displays 2 and 3 to 3 and 4
	6-2 Parameter Setting Display Data PID bank (p. 6-7)	Added "Proportional band for cooling," "Integral time for cooling," "Derivative time for cooling," "Output low limit for cooling," and "Output high limit for cooling" items
	6-2 Parameter Setting Display Data Control bank (p. 6-12)	Added "Heating/Cooling control dead zone," "Output at READY (Heat)," and "Output at READY (Cool)" items.
	6-2 Parameter Setting Display Data Analog output bank (p. 6-16),	Changed "2 to 3: Reserved" in the set values of "Output types" to "2: Heat MV (for heating/cooling control)" and "3: Cool MV (for heating/cooling control)"
	6-2 Parameter Setting Display Data TP (time proportioning) bank (p. 6-25)	Increased the set value range of "TP output types"

Description	User's Manual Reference	User's Manual Change
Added logical operation functions	4-18 Logical Operations	Added the content at left
	6-2 Parameter Setting Display Data Logical operation bank (p. 6-29)	Added the content at left
Added user-defined bits	14-2 Standard Bit Codes and Standard Numerical Codes Standard bit codes (p. 14-8)	The standard bit codes include numbers corresponding to user-defined bits 1 to 16.
	6-2 Parameter Setting Display Data User-defined bit bank (p. 6-31)	Added the content at left
Added standard bits	14-2 Standard Bit Codes and Standard Numerical Codes Standard bit codes (p. 14-8)	Added the content at left
Added PID group selection to the operation types of DI (digital input) Added standard bits to the input types of DI (digital input)	4-8 DI (Digital Input) DI assignment (p. 4-61)	Changed "4 to 20: Undefined" in the set values of "Operation types" to "4 to 6: PID group selection, 7 to 20: Undefined"
		Increased the set value range of "Input types"
	6-2 Parameter Setting Display Data DI bank (p. 6-22)	Same as above
Added standard bits to the output types for DO (digital output)	DO assignment (p. 4-77)	Increased the set value range of "Output types"
	6-1 Operation Display Data DO configuration bank (p. 6-21)	Same as above
Added standard bits to the operation types of the health index	4-21 Health Index Settings (p. 4-158)	Increased the set value range of "Operation types"
	6-2 Parameter Setting Display Data Health index graph bank (p. 6-47)	Same as above
Added ON-delay and OFF-delay to event output	4-9 Events Function block diagram	Added an "ON-delay and OFF-delay" block
	4-9 Events Event main setting, event subsetting, hysteresis, delay (p. 4-75)	Added "ON-delay time" and "OFF-delay time" items
	6-2 Parameter Setting Display Data Event bank (p. 6-7)	Added "ON-delay" and "OFF-delay" items
Added "19 (Event 9) to 26 (Event 16) and 1024 to 2047 (Standard bits)" to the operation types of the CDS	4-20 CDS (Compact Data Storage) Recording cycle/operation type (p. 4-144)	Increased the set value range of "Operation types"
	6-2 Parameter Setting Display Data CDS bank (p. 6-44)	Same as above
Support for complete data notification in the PLC link function	10-3 List of PLC Link Settings Transfer settings (p. 10-15)	Changed the content of "Handling Precautions"

Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the number of events from 8 to 16	4-9 Events Operation type and Loop definition (p. 4-72) Direct/reverse, Standby, and READY mode operation (p. 4-73) Event main setting, event subsetting, hysteresis, delay (p. 4-75)	Combined the items that were previously divided between events 1 to 8, and added "There are 16 events in total for loops 1 to 4." above the item table.
	4-10 DO (Digital Output) DO assignment (p. 4-77)	Increased the set value range of "Output types"
	6-2 Parameter Setting Display Data Event bank (p. 6-7), Event configuration bank (p. 6-18)Event configuration bank (p. 6-18)	Added "Event 9" to "Event 16" items
Changed so that transition is possible to other screens in addition to the MV operation screen while in MANUAL mode in the 1-loop monitor screen	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Deleted the AUTO/MANUAL mode distinction and used the "Variable display (MANUAL MV)" description instead
Changed the conditions for loops displaying the CT input value, VT input value, and Resistance in the 1-loop monitor	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Added a slot position display to CT input, VT input, and Resistance
screen from the "Loop definition" setting of analog output to the "Input value display loop definition" of Basic action	6-2 Parameter Setting Display Data Basic action bank (p. 6-9)	Added an "Input value display loop definition" item for slots A2, B2, A1, and B1
Changed the decimal point position for Resistance in the 1-loop monitor screen	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Changed from "Fixed at 1 digit after the decimal point" to "Changes automatically within 0 to 2 digits after the decimal point"
Changed the display of the I/O slot section in the block alarm screen	Screen	Added "List of block types and displays"
	Block alarm screen (p. 5-25)	
	Block alarm screen (p. 11-2)	Changed the slot number displays (A1 to A4, B1 to B4) to block type displays (AI, AO-C, V-P) for the slots
Changed the English description for type of change to MANUAL in the display unit	6-2 Parameter Setting Display Data Control bank (p. 6-12)	Changed from "Operation upon to MANUAL" to "Type of change to MANUAL"
Changed the English description for MV action if PV is bad in the display unit	6-2 Parameter Setting Display Data Control bank (p. 6-12)	Changed from "MV select as PV error" to "MV action if PV is bad"
Changed the English description for MV if PV is bad in the display unit	6-2 Parameter Setting Display Data Control bank (p. 6-12)	Changed from "MV value as PV error" to "MV if PV is bad"
Changed unnecessary settings for I/O block types and loop types to make them undisplayable in the display unit	6-2 Parameter Setting Display Data (p. 6-6)	Not changed
Changed the display of the I/O slot section in the firmware version bank	5 - 2 Parameter screen Firmware Versions (p. 5-55)	Added a table for the list of block types and displays and compatible slots

Description	User's Manual Reference	User's Manual Change
when the display unit is not connected	1-3 Names of Parts and Their Functions Main unit (p. 1-6) Status indicator 11-2 Alarm Block alarm (p. 11-3)	Not changed
Changed the displayed content in the function alarm screen	11 - 2 Alarm Function alarm screen (p. 11-5)	Changed CT/VT to CT/VT (AO-C) Added CT (V-P), BATTERY

■ Support start date: August 2017

Block	Firmware version (X is 0 to 9)
MAIN block	5.0.X
HMI block (display unit, additional display unit)	5.0.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
Al block	3.0.X
CLOCK block	1.0.X
MOTOR block	1.0.X

Description	User's Manual Reference	User's Manual Change
Support for MOTOR block	1 - 2 Model No. Model Selection Guide (p. 1-2)	Added a table for the motor drive model Nos.
	1 - 3 Names of Parts and Their Functions Main unit (p. 1-6)	Added Motor Drive to the block layout example
	1 - 4 Input/output Configuration Input and output configuration diagram (p. 1-7)	Added motor drive output
	Motor drive output (MOTOR) (block position: B2) (p. 1-7)	
	1 - 5 Button Operation Screen transitions (p. 1-9)	Added "PV, SP, MV, MFB (MOTOR block)" to the monitor screen
	1 - 5 Button Operation Parameter bank (p. 1-10)	Added PP (position proportioning)
	5-1 Monitor Screen and Graph Screen 1-loop monitor screen when MFB AT is stopped (p. 5-21) 1-loop monitor screen during MFB AT	Added the content at left
	(p. 5-22) 5-1 Monitor Screen and Graph Screen Block alarm screen (p. 5-25)	Added a description of block type = motor drive output, display = MOTOR
	5 - 2 Parameter screen Firmware Versions (p. 5-55)	

Description	User's Manual Reference	User's Manual Change
Support for MOTOR block	3-3 Crimp Terminals / Ferrules	Added the content at left
	Ferrules (p. 3-5)	
	4-13 Motor Drive Output (Position Proportional Control) (p. 4-89)	Added the content at left
	6-1 Operation Display Data 1-loop monitor screen (p. 6-2)	Added a description for the display of MFB and motor drive output to "Variable display"
	6-2 Parameter Setting Display Data	Added the content at left
	PP (position proportional) bank (p. 6-38)	
	☞ 11-2 Alarm	Added MOTOR (slot B2) to "Block alarm"
	Block alarm (p. 11-3)	alailii
	Chapter 13. Specifications	Added the content at left
	MOTOR block (p. 13-5)	
	14-2 Standard Bit Codes and Standard Numerical Codes	Added MFB input error, MFB is under adjustment, MFB estimation in progress, MFB
	Standard bit codes (p. 14-8)	adjustment error, Motor drive output OPEN, and Motor drive output CLOSE
Added PV Hold to Al (Analog Input)	4-2 AI (Analog Input) Function block diagram	Added PV Hold
	4-2 AI (Analog Input) PV Hold (p. 4-11)	Added the content at left
Added Hold PV, Control operation direct/reverse selection, and Timer	4-8 DI (Digital Input) (p. 4-60)	Added PV hold, Control operation direct/reverse
stop/start selection to the operations	DI assignment (p. 4-61)	selection, and Timer stop/start
of DI (Digital Input)	Setting items table (p. 4-61)	selection to "Operation types"
	Operation types table (p. 4-64)	
	6-2 Parameter Setting Display Data DI bank (p. 6-22)	Same as above
Added 13 operation types to the events	4-9 Events Operation (p. 4-67), Operation type and Loop definition (p. 4-72)	Added MFB high and low limits, standard numerical code high limit, standard numerical code low limit, standard numerical code high and low limits, PV change rate high limit, PV change rate low limit, standard numerical code change rate low limit, standard numerical code change rate low limit, During AT (status), SP ramp (status), Control direct action (status), MFB estimation in progress (status), and Timer to "Operation types" Added standard numbers to "Loop definition"
	6-2 Parameter Setting Display Data	Same as above
	Event configuration bank (p. 6-18)	
	Livent configuration bank (p. 0-10)	

Description	User's Manual Reference	User's Manual Change
Added Bias specification method in	4-16 Linear Approximation (p. 4-105)	Added the content at left
Linear approximation table	Linearization by specifying bias (p. 4-106)	
	6-2 Parameter Setting Display Data	Added "Operation types" items
	Linearization table bank (p. 6-40)	
Added user-defined values	1-5 Button Operation Parameter bank (p. 1-10)	Added user-defined values (USER DEFINED VALUE)
	6-2 Parameter Setting Display Data User-defined bit bank (p. 6-31)	Added the content at left
	14-2 Standard Bit Codes and Standard Numerical Codes 14-2 Standard Bit Codes and Standard Numerical Codes (p. 14-8)	The standard numerical codes include numbers corresponding to user-defined values 1 to 16.
Added standard numerical codes	4-9 Events Operation (p. 4-67), Operation type and Loop definition (p. 4-72)	Added standard numerical code high limit, standard numerical code low limit, standard numerical code high and low limits, standard numerical code change rate high limit, and standard numerical code change rate low limit to "Operation types" Added standard numbers to "Loop definition"
	6-2 Parameter Setting Display Data	Same as above
	Event configuration bank (p. 6-18) 4-11 TP (Time Proportioning) Output TP output type (p. 4-81)	Added standard numerical codes to "TP output types"
	6-2 Parameter Setting Display Data	Same as above
	TP (time proportioning) bank (p. 6-25)	
	4-12 Analog Output (AO) Output type (p. 4-89)	Added standard numerical codes to "Output types"
	6-2 Parameter Setting Display Data	Same as above
	Analog output bank (p. 6-16),	
	14-2 Standard Bit Codes and Standard Numerical Codes	Added the content at left

Description	User's Manual Reference	User's Manual Change
Added the data custom function to	4-20 CDS (Compact Data Storage)	Added "Data selection," "Number
the CDS	Data selection (p. 4-145)	of data items," and "Data1" to "Data40"
	Number of data / Data1 to Data40 (p. 4-146)	
	6-2 Parameter Setting Display Data	Same as above
	CDS bank (p. 6-44)	
	4-20 CDS (Compact Data Storage)	Added the content at left
	Files (p. 4-149),	
	Customizing the number of data items and data types (p. 4-153)	
	Chapter 13. Specifications	Added recording (for Data selection: Custom) to "Item"
Added the reception monitoring	9-4 Reception Monitoring (p. 9-14)	Added the content at left
function	14-2 Standard Bit Codes and Standard Numerical Codes	Added Reception monitoring 1 to 3
	Standard bit codes (p. 14-8)	

• Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the time proportioning current from undefined to 0.0 A when CT operation in Time proportioning current is Heater	4-14 CT (Current Transformer) Input (p. 4-95)	Added the description "Time proportioning current = 0.0 A."
burnout detection for the OUT terminal and TP operation type is Priority on controllability	Current measurement and error detection CT operation Handling Precautions (p. 4-98)	
Increased the setting range of "Decimal point position" for user-defined addresses and enabled RAM area definition	Chapter 9. User-defined Addresses (p. 9-1)	Changed the setting range of the decimal point position from "0 to 4" to "0 to 4, 10 to 14"
	9-2 Address Definition Method User-defined addresses (p. 9-1)	Added a description of defining the RAM area using the decimal point position setting
	RAM area (p. 9-5)	
Added a display for the model No. and S/N (serial number) to the firmware version display screen	5 - 2 Parameter screen Firmware Versions (p. 5-55)	Added a description of the display for the model No. and S/N (serial number)
Changed so that the ON/OFF status of standard bit codes 1171 to 1174 (DI/DO4 terminal status to DI/DO7 terminal status) is reflected even when using digital output with TP	14-2 Standard Bit Codes and Standard Numerical Codes Standard bit codes (p. 14-8)	Not changed

■ Support start date: August 2018

Block	Firmware version (X is 0 to 9)
MAIN block	6.0.X
HMI block (display unit, additional display unit)	6.0.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
AI block	3.1.X
CLOCK block	1.0.X
MOTOR block	1.0.X
DI block	1.0.X
DO block	1.0.X

Description	User's Manual Reference	User's Manual Change
Added AI (Analog Input) range types	Chapter 13. Specifications	Added PLII, PR40-20, and N to thermocouple
	Input types and ranges (p. 13-13)	Added –10 to +10 V to Linear
Added the advanced loop type setting	4-1 Loop Types (p. 4-1)	Added a description of advanced
option for [Loop type]	Model numbers and loop types (p. 4-1)	loop type setting to "Handling Precautions"
	Setting the loop type (p. 4-4)	Precautions
	4-22 Advanced Loop Type Setting	Added the content at left
	Loop types (p. 4-163)	
	Input assignment (p. 4-163)	
	Virtual AI (analog Input) (p. 4-165)	
	6-2 Parameter Setting Display Data	Added the content at left
	Input assignment bank (p. 6-48)	
	Virtual analog input bank (p. 6-50)	
	Chapter 11 Block alarm (p. 11-3)	Added the PV and RSP alarms for loops to the MAIN block alarm
	14-2 Standard Bit Codes and Standard Numerical Codes	Added Virtual AI to 1 to 4, Virtual PV 1 to 4
	Standard numerical codes (p. 14-16)	
Support for the DI (Digital Input) block	4-8 DI (Digital Input)	Added a description of the DI
	Function block diagram	block
	5-1 Monitor Screen and Graph Screen	Added the content at left
	DI monitor screen (p. 5-43)	
	14-2 Standard Bit Codes and Standard Numerical Codes	Added DI1 to DI4 terminal status (blocks A3 and B3)
	Standard bit codes (p. 14-8)	
	Chapter 11 Block alarm (p. 11-3)	Added the block alarm for DI (slots A3 and B3)
Support for the DO (digital output) block	4-10 DO (Digital Output) (p. 4-76)	Added a description of the DO block
	Function block diagram	Added the content at left
	5-1 Monitor Screen and Graph Screen	raded the content at left
	DO monitor screen (p. 5-44)	Added the content at left
	6-2 Parameter Setting Display Data	raded the content at left
	DO configuration bank (p. 6-21)	Added DO1 to DI4 terminal
	€ 14-2 Standard Bit Codes and Standard Numerical Codes	status (blocks A1 and B1)
	Standard bit codes (p. 14-8)	
	Chapter 11 Block alarm (p. 11-3)	Added the block alarm for DO (slots A1 and B1)

Description	User's Manual Reference	User's Manual Change
Added pattern operation	1 - 6 Operation Modes	Added pattern operation to the operation mode transition
	€ 4-3 Mode	Added the content at left
	Pattern start number (p. 4-57)	
	READY/RUN/HOLD/END mode (p. 4-15)	
	ADVANCE (p. 4-17)	
	G.SOAK clear (p. 4-18)	
	€ 4-6 SP	Added the function block of
	Function block diagram (p. 4-41)	pattern operation
	4-7 Pattern Operation	Added the content at left
	5-1 Monitor Screen and Graph Screen	Added the content at left
	Pattern operation monitor screen (p. 5-13)	
	5-1 Monitor Screen and Graph Screen	Added the [PATTERN] button
	Mode menu screen (p. 5-34)	
	5-1 Monitor Screen and Graph Screen	Added the content at left
	Mode menu screen (pattern) (p. 5-35)	
	HOLD mode change screen (p. 5-39)	
	ADVANCE operation screen (p. 5-40)	
	G.SOAK clear screen (p. 5-41)	
	6-1 Operation Display Data	Added display of pattern number and segment number
	Home screen (p. 6-1)	Added display of pattern
	1-loop monitor screen (p. 6-2)	operation 1 to 3
	6-2 Parameter Setting Display Data	Added time unit of patterns
	Basic action bank (p. 6-9)	
	6-3 Pattern Setting Display Data (p. 6-54)	Added the content at left
	9-5 Pattern Communication Data (p. 9-16)	Added the content at left
	14-2 Standard Bit Codes and Standard Numerical Codes	Added segment events 1 to 16, Loop 1 to 4 pattern SP increase
	Standard bit codes (p. 14-8)	change limit in execution, pattern SP decrease change limit in execution, pattern operation mode, HOLD state, END state, and G.SOAK state
Added the user-defined HOME screen	1 - 5 Button Operation Screen transitions of the user HOME screen (p. 1-20)	Added the content at left
	6-2 Parameter Setting Display Data Basic action bank (p. 6-9)	Added HOME screen setting 1 to 4
	שמות מכנוטוז שמווג (ף. ט־א)	

Description	User's Manual Reference	User's Manual Change
Added the DI MONITOR, DO MONITOR, EV MONITOR, and SEG-EV MONITOR	5-1 Monitor Screen and Graph Screen	Changed the DI/DO MONITOR screen
	DI/DO monitor screen (p. 5-42)	Added the DI MONITOR screen,
	DI monitor screen (p. 5-43)	DO MONITOR screen, and EV
	DO monitor screen (p. 5-44)	MONITOR screen
	EV monitor screen (p. 5-45)	
	SEG-EV monitor screen (p. 5-46)	
Added AT abnormal end	4-5 AT (Auto-tuning) (p. 4-37)	Added the content at left
	AT abnormal end, Clearing an AT abnormal end (p. 4-39)	
	14-2 Standard Bit Codes and Standard Numerical Codes	Added Loop 1 to 4 AT abnormal end
	Standard bit codes (p. 14-8)	
Changed the lower and upper limits for the LSP	5-2 Parameter screen	Changed the setting range of the LSP
setting	LSP setting change screen (p. 5-29)	from "–32000 to +32000" to "within the range from the SP low limit to high limit and PV range"
Added the fixed value output function	€ 4-4 Control	Added fixed value output selection
	Functional block diagram of PID control (p. 4-19)	
	Functional block diagram of ON/OFF control (p. 4-20)	
	Functional block diagram of heating/cooling control (p. 4-21)	
	€ 4-4 Control	Added the content at left
	Fixed value output (p. 4-23)	
	4-5 AT (Auto-tuning) (p. 4-37)	Added fixed value output to the
	Handling Precautions (p. 4-40)	conditions that cause an AT stop
	6-2 Parameter Setting Display Data	Added fixed value output 1 to 8 to
	Control bank (p. 6-12)	the items
	6-2 Parameter Setting Display Data	Added 11 to 13 as valid settings for "Operation type"
Added fixed value output selection, output	DI bank (p. 6-22)	Added the content at left
linearization table group selection, RUN/	4-8 DI (Digital Input)	raded the content at left
READY mode selection (edge), AUTO/ MANUAL mode selection (edge), and LSP/RSP	DI assignment (p. 4-61)	Added the cetting values for the
mode selection (edge), and LSP/RSP mode selection (edge) to the operation type	0-2 Farameter Setting Display Data	Added the setting values for the functions described on the left to
of DI (digital input)	DI bank (p. 6-22)	"Operation type"

Description	User's Manual Reference	User's Manual Change
Added linearization table group definition by DI (digital input) to linear approximation of analog output and time proportioning output (blocks A2, B2, A1, B1)	4-16 Linear Approximation Example using linear approximation by analog input (p. 4-106)	Added the content at left
	4-11 TP (Time Proportioning) Output Linearization table group definition (p. 4-94)	Added a description of linearization table group definition by DI
	4-12 Analog Output (AO) Linearization table group definition (p. 4-94)	
Added "Ring" to the data selection items for CDS	4-20 CDS (Compact Data Storage) (p. 4-144)	The entire section was rewritten and a description of "Ring" was added
Added user-defined alarms	5-1 Monitor Screen and Graph Screen 1-loop monitor screen if there is an alarm (p. 5-24)	Added a description of the user-defined alarm to "Handling Precautions"
	6-2 Parameter Setting Display Data User-defined alarm bank (p. 6-35)	Added the content at left
	14-2 Standard Bit Codes and Standard Numerical Codes	Added user-defined alarms 1 to 4
	Standard bit codes (p. 14-8) Chapter 11 Block alarm (p. 11-3)	Added user-defined alarm to the MAIN block alarm
	Chapter 11 Function alarm (p. 11-6)	Added user-defined alarms 1 to 4

• Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the bank name and group name of the parameter settings for DO	DO assignment (p. 4-77)	Changed the bank name from DO to DO Config Changed the group name from GROUP1–7 to DO1–7
	6-2 Parameter Setting Display Data DO configuration bank (p. 6-21)	Same as above

Description	User's Manual Reference	User's Manual Change
Changed the number of logical operation groups from 16 to 32	4-18 Logical Operations (p. 4-113)	Changed the number of groups from 16 to 32
	4-18 Logical Operations Processing order for logical operations (p. 4-113)	Changed the logical operations executed before PID calculation from Groups 1 to 4 to Groups 1 to 16
		Changed the logical operations executed after PID calculation from Groups 5 to 16 to Groups 17 to 32
	6-2 Parameter Setting Display Data Logical operation bank (p. 6-29)	Added logical operation groups 17 to 32
	14-2 Standard Bit Codes and Standard Numerical Codes	Added the results of logical operations 17 to 32
	Standard bit codes (p. 14-8)	
Changed the naming rule for files in the CDS	4-20 CDS (Compact Data Storage) Files (p. 4-149)	The entire section was rewritten and the changes were reflected
	(עדו ד.ע)	Added the table of the specifications of older versions

■ Support start date: March 2019

Block	Firmware version (X is 0 to 9)
MAIN block	6.1.X
HMI block (display unit, additional display unit)	6.1.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
Al block	3.1.X, 3.2.X
CLOCK block	1.0.X
MOTOR block	1.0.X
DI block	1.0.X
DO block	1.0.X

Added functions

Description	User's Manual Reference	User's Manual Change
Added options "12," "22," and "23" to the loop type settings	4-1 Loop Types (p. 4-1) Model numbers and loop types (p. 4-1)	Added options "12," "22," and "23"
Added "Keyence KV" as a connectible PLC to PLC link settings	Usable devices (p. 10-5)	The "Keyence" table was added.
	10 - 5 Keyence PLC (p. 10-32)	Added the section shown on the left
Added the description of user-defined values (RAM)	6-4 Parameter Data for Communication (p. 6-57)	Added the section shown on the left
	User-defined values(RAM) (p. 6-65)	

Specification changes

Description	User's Manual Reference	User's Manual Change
Added support for pattern operation mode in	☆ 4 - 7 Pattern Operation (p. 4-48)	Added "Handling Precautions."
internal cascade control (for master device)	4-3 Mode (p. 4-12)	Added "Handling Precautions."
	Constant value operation / Pattern operation (p. 4-13)	
Synchronized the modes (RUN/READY and	4-3 Mode (p. 4-12)	Added "Handling Precautions."
AUTO/MANUAL) of master and slave loops in internal cascade control	AUTO/MANUAL mode (p. 4-12)	
	RUN/READY mode (p. 4-14)	
Display of time on graph screens	5-1 Monitor Screen and Graph Screen (p. 5-1)	Added descriptions of time
	Multi-loop graph screen (p. 5-16)	
	1-loop graph screen (p. 5-18)	
Changed the address range of Mitsubishi iQ-F SLMP for PLC link settings	10 - 1 Data Transfer (p. 10-1)	The "Mitsubishi Electric, iQ-F SLMP" table was added.
	Usable devices (p. 10-5)	

■ Support start date: January 2020

Block	Firmware version (X is 0 to 9)
MAIN block	6.2.X
HMI block (display unit, additional display unit)	6.2.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
Al block	3.2.X
CLOCK block	1.0.X
MOTOR block	1.0.X
DI block	1.0.X
DO block	1.0.X

Description	User's Manual Reference	User's Manual Change
Added the FF-FITTER function	4-4 Control (p. 4-19)	Added the section shown on the left
	4-25 Feed Forward Fitter (FF-FITTER) (p. 4-169)	
Added the numerical operation function	4-19 Numerical Operations (p. 4-117)	Added the section shown on the left
Added the power supply voltage compensation function	4-11 TP (Time Proportioning) Output (p. 4-79)	Added a description of power supply voltage compensation
	4-12 Analog Output (AO) (p. 4-85)	
	4-15 VT (Voltage Transformer) Input (p. 4-103)	
Added the lock and password functions	4-24 Lock and Password (p. 4-167)	Added the section shown on the left
Added the key lock level selection function for a key lock that is applied by a long press on the menu button	Screen (p. 5-1) ■1-loop monitor screen (p. 5-10) ■1-loop monitor screen in MANUAL mode (p. 5-19) ■1-loop monitor screen during AT execution (p. 5-20) ■1-loop monitor screen during MFB AT (p. 5-22)	Added a description for when key lock level = 1
Added AI (Analog Input) range types	Chapter 13. Specifications Input types and ranges (p. 13-13)	Added RTD −200 to +850 °C
Added the Zone PID function	✓ 4-4 Control ■Zone PID (p. 4-28)	Added the section shown on the left
Added "AT type" and "AT adjustment factors" for AT	4-5 AT (Auto-tuning) (p. 4-37)	Added a description of AT type and AT adjustment factors
Added the MV tracking function	4-4 Control	Added the section shown on the left
Added a function to latch logical operation results	■MV tracking (p. 4-29) 4-18 Logical Operations Latch (p. 4-116)	Added the section shown on the left

Description	User's Manual Reference	User's Manual Change
Added "Release all latches," "RUN selection (edge)," and "READY selection (edge)" to "Operation type" in the DI function		Added a description of the "47," "54," and "55" settings in "Operation type"
<u> </u>	14-2 Standard Bit Codes and Standard Numerical Codes Standard numerical codes (p. 14-16)	Added current LSP and RSP for loops 1–4

Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the number of segments for the pattern function from 16 to 32	6-3 Pattern Setting Display Data	Changed the number of segments from 1–16 to 1–32
pattern unction from 10 to 32	■Pattern bank (p. 6-55)	
	■Segment bank (p. 6-56)	
Changed the number of segment events for the pattern function from 16 to 32	6-3 Pattern Setting Display Data	Changed the number of segment events from 1–16 to 1–32
·	■Segment bank (p. 6-56)	
Changed the number of user-defined bits from 16 to 32	6-2 Parameter Setting Display Data	Added user-defined bits 17–32
	■User-defined bit bank (p. 6-31)	
Changed the number of user-defined values from 16 to 32	6-2 Parameter Setting Display Data	Added user-defined values 17–32
	■User-defined value bank (p. 6-33)	
The ADVANCE button is disabled (and is	5-1 Monitor Screen and Graph	No change
grayed out) when ADVANCE is disabled.	Screen	
	■Mode menu screen (pattern) (p. 5-35)	
In internal cascade control, the slave loop's	\$ 4-6 SP	No change
mode does not affect whether SP ramp for the master loop starts at the PV of the master loop at power-on.	■SP ramp up and down slopes (p. 4-46)	

■ Support start date: May 2021

Block	Firmware version (X: 0–9)
MAIN block	6.3.X
HMI block (display unit, additional display unit)	6.3.X
DI/DO block	3.0.X
RS-485 block	3.0.X
AO-C block	3.0.X
V-P block	1.0.X
AI block	3.2.X
CLOCK block	1.0.X
MOTOR block	1.0.X
DI block	1.0.X
DO block	1.0.X

Added functions

Description	User's Manual Reference	User's Manual Change
Added the square root extraction function to DC voltage/current input.	4-2 AI (Analog Input) Square root extraction dropout (p. 4-8)	Added the section shown on the left
Added AUTO switch (edge) and MANUAL switch (edge) to the DI function.	4-8 DI (Digital Input) ■DI assignment (p. 4-61)	Added the two types of settings and operations shown on the left
Added the CT input filter function.	4-14 CT (Current Transformer) Input CT input filter (p. 4-96)	Added the section shown on the left
Added 11 types of operation (timer, deviation monitor, square route, integration pulse I, integration pulse I, integration pulse I, logarithm, exponent, derivation, integral, dead time, and moving average) to the numerical operation functions.	4-19 Numerical Operations Operation type (p. 4-118)	Added the 11 types of operation shown on the left

• Specification changes

Description	User's Manual Reference	User's Manual Change
Changed the number of breakpoints in a linearization table group from 10 to 20.	■ Linearization by specifying breakpoints (p. 4-105), ■ Linearization by specifying bias (p. 4-106)	Added breakpoints 11–20.
	■Linearization table bank (p. 6-40)	
Changed the initial values of breakpoints A3–A10 in the linearization table.	6-2 Parameter Setting Display Data Linearization table bank (p. 6-40)	Changed the initial value from 0.0000 to -32000.
Changed the input types of some numerical operation functions (soft switching selector, change rate limiter, lead/lag, and one-shot timer).	4-19 Numerical Operations Operation type (p. 4-118)	Changed the input type of the operation on the left.

14-5 Abbreviations and Terms

The following terms and abbreviations are used in this manual.

AI: Analog input.

ADV: Advance. Function used in pattern operations that steps the program operation forward to the start

of the next segment.

AO: Analog output.

AT: Auto tuning. Auto adjustment of control parameters.

AUTO: Automatic Automatic operation state.

CDS: Compact data storage. Saving control data to the microSD memory card.

CLOCK: Clock.

CLOSE: Close. Rotates the motor toward the closed position.

COOL: Cool. Cooling.

CT: Current transformer.

CYC: Cycle. Function used in pattern operations that returns to the start of the pattern and repeats it after

reaching the end.

DI: Digital Input.

DI/DO: Digital Input / Digital Output.

DO: Digital Output.

END: End. State reached when operation stops at the end of a pattern.

EV: Event. Event ON/OFF status can be selected by error detection, etc.

FF-FITTER: Feed Forward Fitter. Feed forward (FF) operation for disturbance suppression.

G.SOAK: Guarantee Soak. Function that guarantees that the PV has reached the SP. Can be used for ramp

segments in addition to soak segments.

HEAT: Heat. Heating.

HMI: Human machine interface.

A display unit comprising an LCD, touch panel, and mechanical keys.

HOLD: Hold. State in which operation stops during pattern operation.

HOME: Home. Default screen and status of display and button operations.

LSP: Local set point. The set point saved in the controller.

MANUAL: Manual Manual operation state.

MENU: Menu. The button used to start parameter setup.

MFB: Motor feedback. Feedback for the motor opening.

MV: Manipulated variable. The output of the controller.

OH: Output high. High limit setting for the manipulated variable.

OL: Output low. Low limit setting for the manipulated variable.

OPEN: Open. Motor shaft rotates toward the open position.

PID: Control parameters

P (proportional band)
I (integral time)
D (derivative time)

PP: Position Proportional output.

PTN: Pattern. A series of SP changes during "pattern operation." Consists of one or more segments.

PV: Process variable. Measured value.

RAMP: Ramp Segment. A segment in which the SP changes in pattern operation.

READY: Ready. A standby state in which control operation is stopped.

RSP: Remote set point. Set point through analog input.

RUN: Run. State in which control operations are running.

SEG: Segment. A constituent of a pattern, configured by one set point and one length of time.

SEG-EV: Segment event. Only one segment event can be turned ON in pattern operation.

SOAK: Soak segment. A segment in which the SP is constant in pattern operation.

SP: Set point. The set value (target value).

TP: Time proportioning.

V-P: Voltage pulse.

VT: Voltage transformer.

Revision History of CP-SP-1402E

Date	Edn.	Revised pages	Description
Jan. 2017	1		
Mar. 2017	2		Overall revision.
Nov. 2017	3		Overall revision. 3rd ed = 6th Jp ed.
Dec. 2018	4		Overall revision. 4th ed = 8th Jp ed.
Nov. 2019	5		Overall revision. 5th ed = 9th Jp ed.
May 2020	6		Overall revision. 6th ed = 10th Jp ed.
Aug. 2020	7	i	UL 61010-1, CAN/CSA C22.2 No. 61010-1 GB is deleted
		1-3, 1-5, 1-7	
		1-4, 1-6 13-10	CE and KC
M 2024	•		UL 61010-1, CAN/CSA C22.2 No. 61010-1 (UL-compliant models only)
May 2021	8	1-7	"10" was changed to "10 pieces."
		1-8	Notes for the microSD memory card was deleted. "DI/DO block (7 digital inputs or outputs, selectable)" was changed.
		3-8 4-8	"Linearization table group definition" was changed.
		4-65	"(before reversing)" was deleted.
		4-116	"Lead" was changed to "Lag."
		5-43	"1 to 16" was changed to "1 to 32."
		13-4	"Control unit" was moved to front of "External communication."
		13-4	"or selected by the DI function" was deleted.
		13-4	"No. of settings for local SP (LSP)" was deleted.
		13-9	"General specifications" was changed.
		13-13	"0%" was changed to "50%."
Feb. 2022	9	i	Safety Requirements: Changed the descriptions.
		1-3 to 1-5	Changed the descriptions in the table.
		1-10	ANALOG INPUT: Added the descriptions.
		1-13	CT: Added the descriptions.
			LINEARIZATION TABLE: Changed the descriptions.
		1-22	Operation Modes: Changed the descriptions.
		2-1	Standard mounting: Added the descriptions.
		3-4	Crimp terminals: Changed the descriptions in the table.
		3-5	Handling Precautions: Changed the descriptions.
		3-13 to 3-16	Added "Voltage pulse output block (voltage pulse outputs and 2 CT inputs)."
		4-5	4-2 AI (Analog Input): Changed the descriptions in the figure.
		4-8 to 4-9	Added "Square root extraction dropout."
		4-19 4-20	Functional block diagram of PID control: Changed the figure. Functional block diagram of ON/OFF control: Changed the figure.
		4-21	Functional block diagram of heating/cooling control: Changed the descriptions
		1-21	in the figure.
		4-29 to 4-31	Added "Example: Switching the MV between loop 1 and loop 2 by MV tracking."
		4-33	ON/OFF control: Added the descriptions in the table.
		4-34	Added "DI/DO block."
		4-35	Added "V-P block."
		4-36	Added "AO-C block."
		4-53	DI assignment: Changed the descriptions in the table.
		4-55	Handling Precautions: Added the descriptions.
		4-56	Added the descriptions in the table.
		4-95	Number of turns and number of power wire loops: Changed the descriptions in
			the table.

Date	Edn.	Revised pages	Description
Feb. 2022	9	4-96 to 4-97	Added "CT input filter."
		4-97	Current measurement and error detection: Changed the descriptions in the table.
		4-103	Primary voltage and secondary voltage: Changed the descriptions in the table.
		4-104	Power supply voltage compansation: Changed the descriptions in the table.
			Handling Precautions: Added the descriptions.
		4-105	4-16 Linear Approximation: Changed the descriptions.
			Handling Precautions: Added the descriptions.
			Linearization by specifying breakpoints: Changed the descriptions and figure.
		4-106	Linearization by specifying bias: Changed the descriptions and figure.
		4-107	Example using linear approximation by analog input: Changed the descriptions
			in the table.
		4-109	When the increase in magnitude of the breakpoints on the A-axis is not in
			numerical order: Changed the descriptions.
		4-117	Processing order for numerical operations: Changed the descriptions. Added
			the figure.
		4-118	Operation type: Changed the descriptions in the table.
		4-119	Changed "Details of numerical operations."
		4-120	Division: Deleted the descriptions in the table. Added "Handling Precautions."
		4-122	Soft switching selector: Changed the descriptions in the table. Added
			"Handling Precautions" and "Note."
		4-123	High/low limiter: Changed the descriptions in the table.
		4-124	Change rate limiter: Changed the descriptions in the table. Added "Handling
			Precautions" and "Note."
		4-125	Lead/lag: Changed the descriptions in the table. Added "Handling Precautions"
			and "Note."
		4-126	Linearization table: Changed the descriptions in the table. Added "Note."
		4-127	Hold: Changed the descriptions in the table.
		4-128	One shot timer: Changed the descriptions in the table. Added "Handling
			Precautions" and "Note."
		4-129 to 4-142	Added the descriptions of Details of numerical operations (Timer, Deviation
			monitor, Square root, Integration pulse output I, Integration pulse output II,
			Number of pairs, Exponent, Derivation, Integral, Dead time, Moving average).
		4-152	Handling Precautions: Changed the descriptions.
		4-156	Handling Precautions: Added the descriptions.
		5-27 to 5-28	SP menu screen: Changed the figure and descriptions.
		5-31	Added "Constant value operation / pattern operation switching screen."
		5-32	Added "Pattern operation mode selection screen."
		5-33	Added "Constant value operation mode selection screen."
		6-8	Analog input bank: Added the descriptions in the table.
		6-23	DI bank: Changed the descriptions in the table.
		6-30	Numerical operation bank: Changed the descriptions in the table.
			Handling Precautions: Added the descriptions.
		6-35	Handling Precautions: Added the descriptions.
		6-36	CT input bank: Added "Filter", "CT1 /Filter" and "CT2 /Filter" in the table.
		6-37	CT input bank: Added "Handling Precautions."
		6-40	Virtual analog input bank: Changed the descriptions in the table.
		6-41	Added "Handling Precautions."
		6-53	Added "Handling Precautions."
		7-1	Changed the descriptions.

Date	Edn.	Revised pages	Description
Feb. 2022	9	10-7	Added "Completion notification data."
		10-10,	Added "Note."
		10-12 to 10-14	Added "Note."
		10-15	PLC connection settings: Added the descriptions in the table.
			Handling Precautions: Added the descriptions.
		10-24	Added the "Handling Precautions."
		11-6	Function alarm: Added "Buffer setting" in the table.
		11-8	The firmware version of the display unit does not match: Changed the
			descriptions.
		12-1	Changed the symbol of the crossed-out wheeled bin.
		13-4	Current output × 1: Changed the descriptions.
		13-11	Standard conditions: Changed the descriptions.
			Operating conditions: Changed the descriptions.
		14-1 to 14-2	Added "Processing procedure."
		14-3	AI (analog input) process block diagram: Changed the descriptions in the
			figure.
		14-4	SP process / PID process block diagram: Changed the descriptions in the
			figure.
		14-8 to 14-20	14-2 Standard Bit Codes and Standard Numerical Codes: Changed the
			descriptions in the table.
		14-43	Support start date: March 2019: Added the descriptions in the table.
		14-44	Support start date: January 2020: Added the descriptions in the table.
		14-45 to 14-46	Added "Support start date: May 2021."
		14-48	14-5 Abbreviations and Terms: Added "PP."
Jun. 2022	10	4-19	Functional block diagram of PID control: Changed the descriptions.
		4-21	Functional block diagram of heating/cooling control: Changed the
			descriptions.
Jun. 2023	11	3-5	Ferrules: Added the descriptions.
		3-24	Display unit external power supply: Changed the descriptions.
		4-20	Functional block diagram of ON/OFF control: Changed the figures.
		4-59	Pattern SP increase/decrease change limit: Changed the descriptions.
		4-101	Note: Changed the figures.
		9-6	Precautions when using both the normal memory area and the RAM area for
			the same parameter: Deleted the descriptions.
		13-1	Thermocouple: Changed "27 °C" to "28 °C."
		13-10	A table of applicable regulations and approvals was added. Deleted the
			descriptions.
		14-22	Operation example 2, Operation example 3, and Operation example 4:
			Changed the descriptions.
Oct. 2023	12	4-26	MV change limit: Added the descriptions.

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

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, antiflame 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.

^{*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.

- (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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