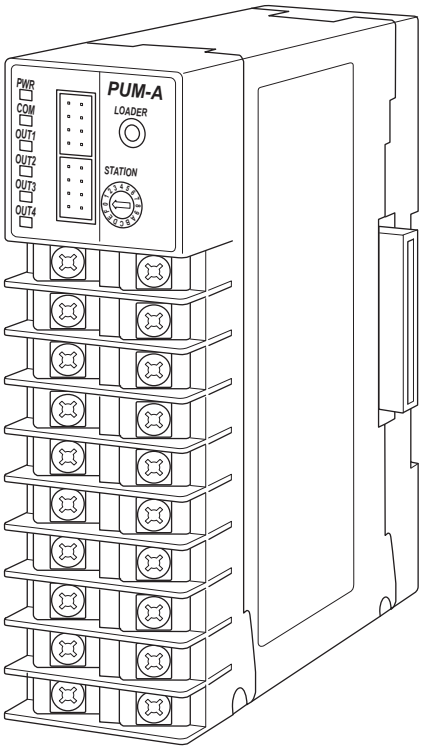
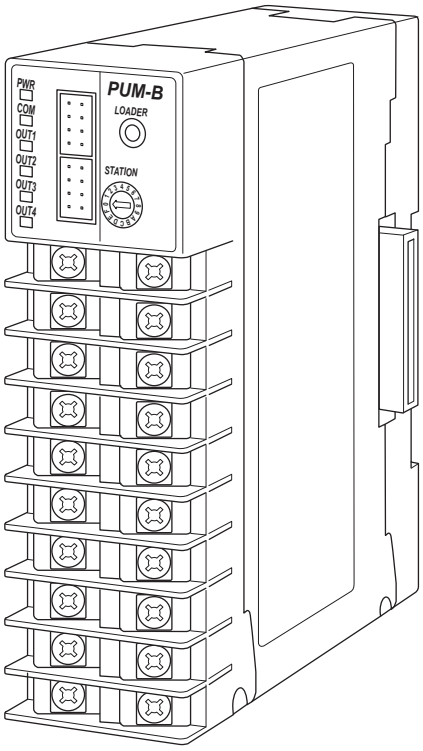
User's Manual

# MULTI-LOOP MODULE TYPE TEMPERATURE CONTROLLER <Control Module>

**TYPE: PUMA/B**




Fuji Electric Co., Ltd.

INP-TN5A0198c-E

## Please Read First (Safety Warnings)

Please read this section thoroughly before using and observe the mentioned safety warnings fully.

Safety warnings are categorized as “Warning” or “Caution”.

| | |
|---|---|
| ⚠Warning | Improper use of the equipment may result in death or serious injuries. |
| ⚠Caution | Improper use of the equipment may cause injury to the user or property damage. |

## ⚠Warning

### Installation and Wiring

- This equipment is intended to be used under the following conditions.

| | |
|---|---|
| Ambient temperature | –10 to 50 degree C |
| Ambient humidity | 90% RH or below (with no condensation) |
| Vibration | 10 to 70Hz less than 9.8m/s² (1G) |
| Warm-up time | 30 min. or more |
| Installation category | IEC1010-1: class II |
| Pollution level | IEC1010-1: degree 2 |

- Between the temperature sensor and the location where the voltage reaches or generates the values described below, secure clearance space and creepage distance as shown in the table below.

  If such space cannot be secured, the EN61010 safety compliance may become invalid.

| Voltage used or generated by any assemblies | Clearance Space [mm] | Creepage Space [mm] |
|---|---|---|
| Up to 50 Vrms or Vdc | 0.2 | 1.2 |
| Up to 100 Vrms or Vdc | 0.2 | 1.4 |
| Up to 150 Vrms or Vdc | 0.5 | 1.6 |
| Up to 300 Vrms or Vdc | 1.5 | 3.0 |
| Above 300 Vrms or Vdc | Please consult our distributor | |

- For the above, if voltage exceeds 50Vdc (called danger voltage), basic insulation is required between the earth and all terminals of the equipment.

  Note that the insulation class for this equipment is as follows. Before installing, please confirm that the insulation class for equipment meets usage requirements.

| Power | PV1 Input |
|---|---|
| Loader communication port<br>RS-485 communication port<br>CT Input (CT1A, B - CT4A,B) | PV2 Input |
| | PV3 Input |
| | PV4 Input |
| OUT1 (relay contact output) | OUT1 (SSR drive, current) |
| OUT2 (relay contact output) | OUT2 (SSR drive, current) |
| OUT3 (relay contact output) | OUT3 (SSR drive, current) |
| OUT4 (relay contact output) | OUT4 (SSR drive, current) |

Basic insulation (1500Vac)
Functional insulation (1000Vac)
Functional insulation (500Vac)

- In cases where damage or problems with this equipment may lead to serious accidents, install appropriate external protective circuits.
- To prevent damage and failure of the equipment, provide the rated power voltage.
- To prevent electric shock and equipment failure, do not turn the power ON until all wiring is complete.
- Before turning the power ON, confirm that clearance space has been secured to prevent shock or fire.
- Do not touch the terminal while the machine is ON. Doing so risks shock or equipment errors.
- Never disassemble, convert, modify or repair this equipment. Doing so risks abnormal operation, shock or fire.

### Maintenance

- When installing or removing the equipment, turn the power OFF. Otherwise, shock, operational errors or failures may be caused.
- Periodic maintenance is recommended for continuous and safe use of this equipment.
- Some parts installed on this equipment have a limited life and/or may deteriorate with age.
- The warranty period for this unit (including accessories) is one year, if the product is used properly.

## ⚠Caution

### Cautions when Installing

Please avoid installing in the following locations.

- Locations in which the ambient temperature falls outside the range of 0 to 50 degrees C when equipment is in use.
- Locations in which the ambient humidity falls outside the range of 45 to 85% RH when equipment is in use.
- Locations with rapid temperature changes, leading to dew condensation.
- Locations with corrosive gases (especially sulfide gas, ammonia, etc.) or flammable gases.
- Locations with vibration or shock directly.

- Locations in contact with water, oil, chemicals, steam or hot water.
  (If the equipment gets wet, there is a risk of electric shock or fire, so have it inspected by Fuji distributor.)
- Locations with high concentrations of atmospheric dust, salt or iron particles.
- Locations with large inductive interference, resulting in static electricity, magnetic fields or noise.
- Locations in direct sunlight.
- Locations that build up heat from radiant heat sources, etc.

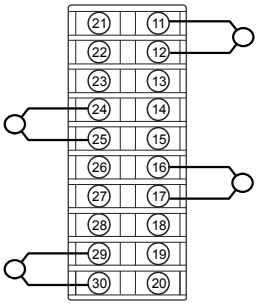
## Cautions when Mounting to Cabinets / DIN Rails

- In case of mounting the temperature controllers to DIN rails, remember to push up the locking tabs to fasten the controllers onto DIN rail.
- To connect controllers, first release all locking tabs. Then, connect controllers and push up all locking tabs. Make sure that all locking tabs are fastened.
- Never fail to turn the power OFF, before detaching the terminal block or removing the main unit from the base part.
- In order to aid heat dissipation, do not block the top and the bottom of the equipment.
- When mounting / dismounting controllers to / from DIN rails, 30mm of clearance above and under the controllers should be provided.

## Cautions for Wiring

- For thermocouple input, use the designated compensation lead. For resistance bulb input, use wires with small lead wire resistance and without any resistance difference among three wires.
- Input signal wire and output signal wire should be separated from each other. And both should be shielded.
- If the output operation frequency is high, selecting a SSR/SSC drive output type is recommended.
  [Proportionate cycles]
  Relay output: 30 sec. or more
  SSR/SSC drive output: 1 sec. or more
- When inductive loads such as magnetic opening/closing equipment, etc. as relay output equipment are connected, use of "Z-trap," manufactured by Fuji Electric Device Technology Co., Ltd., is recommended in order to protect the contacts against opening/closing surges and to ensure long-term use.
  Model names: ENE241D-07A
  (For 100V power voltage)
  ENE471D-07A
  (For 200V power voltage)
  Attachment position:
  Please connect between the relay control output contacts.

(Example)



Z-trap connecting diagram

- To comply with CE marking (EMC), we recommend to attach ferrite core to communication cable and power cable.
- For wiring to the terminal block, apply crimp type terminals size M3.
  Use terminal screws in this product only.
  Screw size: M3×7 (with square washer)
  Screw tightening torque: 0.78N•m (8kgf•cm)
- To avoid the influence of inductive noise, input signal wires should be separated from electric power lines or load lines.

## Error Operation

- The alarm function does not work properly when an error occurs unless the settings are made correctly. Always verify its setting before operation.
- In case of error input, PWR LED will flash. When replacing the sensor, make sure to turn the power OFF.

## Others

- Please do not wipe the equipment with organic solvents such as alcohol or benzene, etc. If wiping is necessary, use a neutral cleaning agent.
- Do not use mobile phones near this equipment (within 50cm). Otherwise a malfunction may result.
- Malfunctions may occur if the equipment is used near a radio, TV, or wireless device.
- This equipment requires approx. 20 seconds before it starts to output.
- Before installing and wiring, take necessary measures for electrostatic discharge (ESD).
- The power supply for this product is 24V DC. Please use the power source of appropriate volume depending on the number of units you connect.

  Recommended power supply :

  Cosel Electronics Co., Ltd. PBA Series

  Omron Corporation S8VM Series

# Contents

# 1 Overview

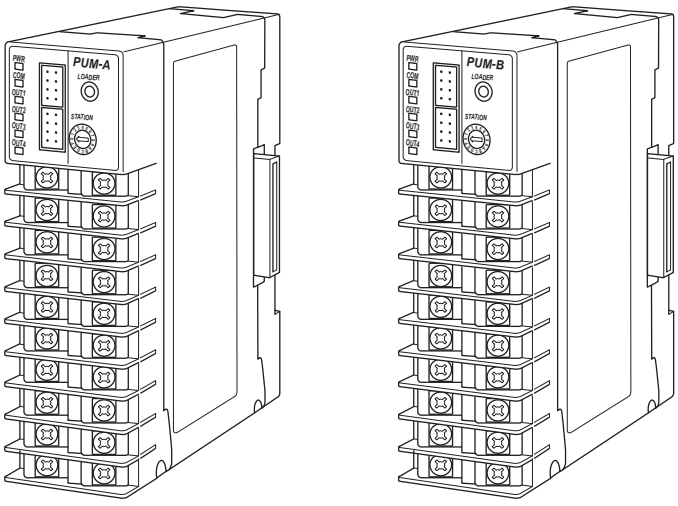
# 1.1 Overview

PUMA/B is a control module, which monitors and controls temperature.

| | |
|---|---|
| PUMA: | Model with 4 control channels |
| PUMB: | Model with 2 control channels |

- PUMA/B functions as the core of temperature control system made up of module type temperature controller PUM series.
- The type of input signal can be selected from thermocouple/resistance bulb and voltage/current.
- Temperature control is done by five types of control actions; 2 position control, PID control, Fuzzy PID control, PID 2 control, and Valve control PUMA/B is equipped with 2 points of CT terminals per channel in order to monitor heater break or short-circuit and can detect three phase heater break.
- Space and labor saving wiring ; with only one unit directly connected to power supply and RS-485, all connected controllers are also connected to them internally via side connectors.

**PUMA** **PUMB**




Hereinafter, PUMA/B will be referred to as “this equipment” or “control module”.

## Confirming accessories

Before using the product, please confirm that all of following accessories are included.

| Description | Quantity |
|---|---|
| Temperature Controller Control Module | 1 unit |
| Instruction manual (Installation) | 1 copy |
| I/V unit (250 ohm resistance) | 1 unit per voltage/current input |

# 1.2 Model Code

## Control Module (4 channels)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | 13 | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | U | M | | | | | | – | 0 | | | 0 | 0 | Module type |
| | | | A | | | | | | | | | | | 4ch control module |
| | | | | | | | | | | | | | | Input type |
| | | | | T | | | | | | | | | | Thermocouple / resistance bulb (all channels) |
| | | | | A | | | | | | | | | | Voltage / current (all channels) |
| | | | | C | | | | | | | | | | Thermocouple / resistance bulb (ch 1,2), voltage / current (ch3,4) |
| | | | | | | | | | | | | | | OUT1,2 output type |
| | | | | | A | | | | | | | | | Relay output |
| | | | | | C | | | | | | | | | SSR drive output |
| | | | | | E | | | | | | | | | Current output |
| | | | | | | | | | | | | | | OUT3,4 output type |
| | | | | | | A | | | | | | | | Relay output |
| | | | | | | C | | | | | | | | SSR drive output |
| | | | | | | E | | | | | | | | Current output |
| | | | | | | | | | | | | | | Instruction manual |
| | | | | | | | | | | A | | | | Japanese |
| | | | | | | | | | | B | | | | English |
| | | | | | | | | | | | | | | Option 1 |
| | | | | | | | | | | | Y | | | Not fitted |
| | | | | | | | | | | | C | | | CT input (8 points) |

## Control Module (2 channels)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | 13 | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | U | M | | | | | | – | 0 | | | 0 | 0 | Module type |
| | | | B | | | | | | | | | | | 2ch control module |
| | | | | | | | | | | | | | | Input type |
| | | | | T | | | | | | | | | | Thermocouple / resistance bulb (all channels) |
| | | | | A | | | | | | | | | | Voltage / current (all channels) |
| | | | | | | | | | | | | | | OUT1, 2 output type |
| | | | | | A | | | | | | | | | Relay output |
| | | | | | C | | | | | | | | | SSR drive output |
| | | | | | E | | | | | | | | | Current output |
| | | | | | | | | | | | | | | OUT3, 4 output type |
| | | | | | | Y | | | | | | | | Not fitted |
| | | | | | | A | | | | | | | | Relay output |
| | | | | | | C | | | | | | | | SSR drive output |
| | | | | | | E | | | | | | | | Current output |
| | | | | | | | | | | | | | | Instruction manual |
| | | | | | | | | | | A | | | | Japanese |
| | | | | | | | | | | B | | | | English |
| | | | | | | | | | | | | | | Option 1 |
| | | | | | | | | | | | Y | | | Not fitted |
| | | | | | | | | | | | C | | | CT input (4 points) |

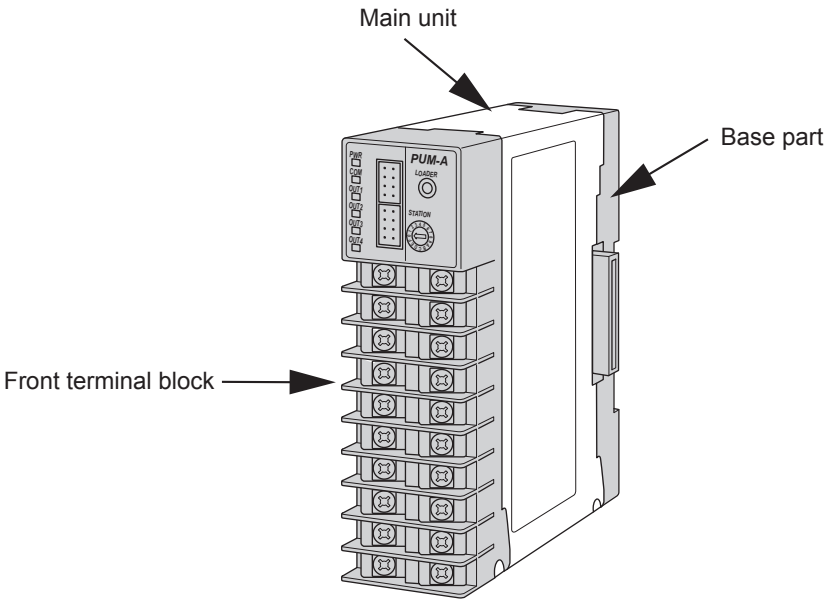
# Accessories

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| P | U | M | Z | * | | | |

| | | | | Description |
|---|---|---|---|---|
| A | 0 | 1 | | RS-485 terminating resistance |
| A | 0 | 2 | | DIN rail mounting end plate |
| A | 0 | 3 | | Side connecting terminal cover (right & left 1 set) |
| A | 0 | 4 | | Front face screw terminal cover |
| L | 0 | 1 | | Loader connecting cable (RS-232C) |
| C | 0 | 1 | | CT input terminal cable (for 4 points) (l=1m) |
| C | 0 | 3 | | CT input terminal cable (for 4 points) (l=3m) |
| C | 0 | 5 | | CT input terminal cable (for 4 points) (l=5m) |
| C | T | 1 | | CT for 1 to 30A (CTL-6-S-H) |
| C | T | 2 | | CT for 2 to 50A (CTL-12-S36-8) |

# 1.3 Part Names and Functions

## External View




### Front terminal block

The front terminal block is equipped with loader communication port, station No. configuration switch, and LED indicator lamps.

- Equipped with CT connector
- Removable from the main body without tools in seconds.

### Main unit

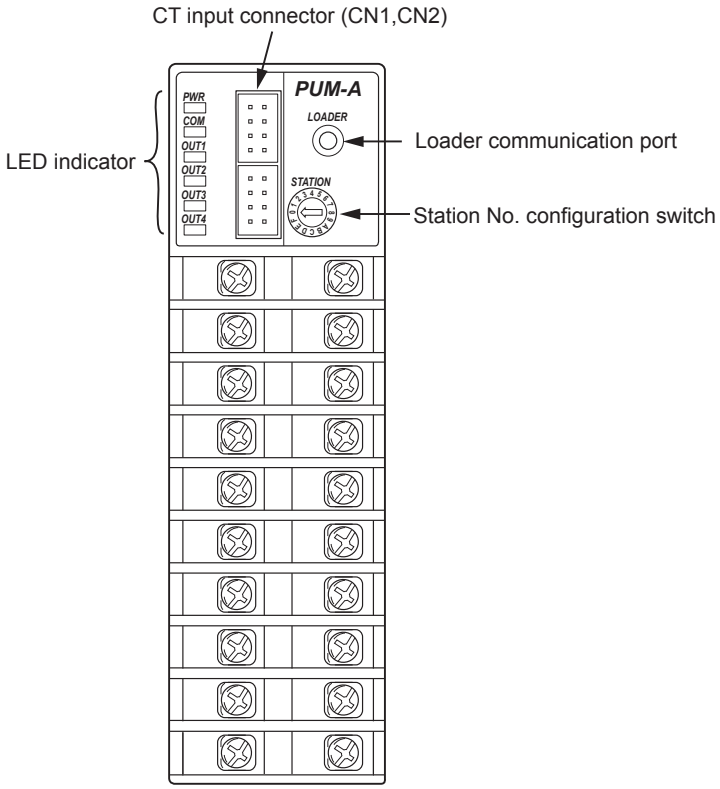
The main unit of the controller

The main unit can be removed from the base part without tools in seconds.

### Base part

The base part incorporates power terminal, RS-485 terminal and lateral connection connectors with a DIN-rail mounting structure.

# Front Terminal Block




## LED indicator

LED lamps indicate the following operational conditions.

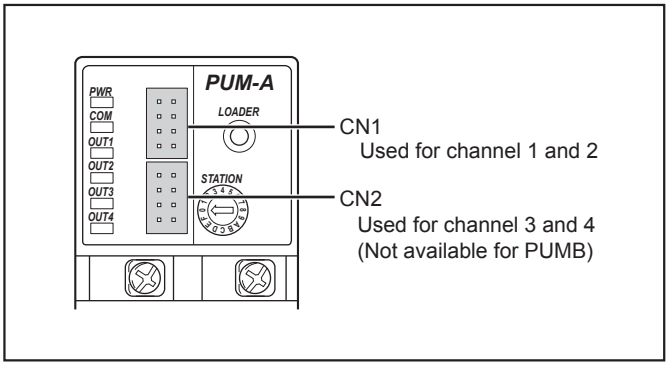
| LED | LED Status | Color | Operational condition |
|---|---|---|---|
| PWR | Illuminated | green | Normal operation (Slave station of internal communication) |
| | Blinking | green | Normal operation (Master station of internal communication) |
| | Illuminated | red | System fault (A/D converter error, internal communication error) |
| | Blinking | red | Input error |
| COM | Illuminated | green | RS-485 receiving |
| | Illuminated | orange | RS-485 transmitting |
| OUT1 to OUT4 | Illuminated | green | Corresponding channel outputting |
| | Illuminated | red | Corresponding channel input error |

*Actions to be displayed for COM and OUT1 to 4 can be allocated by programming.

## CT input connector

CT input connector can be connected to a CT for current detection using an optional CT input terminal cable. CT input cable is required for both CN1 and CN2 separately. CN1 is used for channel 1 and 2, and CN2 for channel 3 and 4. Each channel has 2 points ([A] and [B]) of CT input terminals. Please note that CN2 is not available for 2 channel model type (PUMB).

*Arrangement of comector can be change by parameter.




## Loader communication port

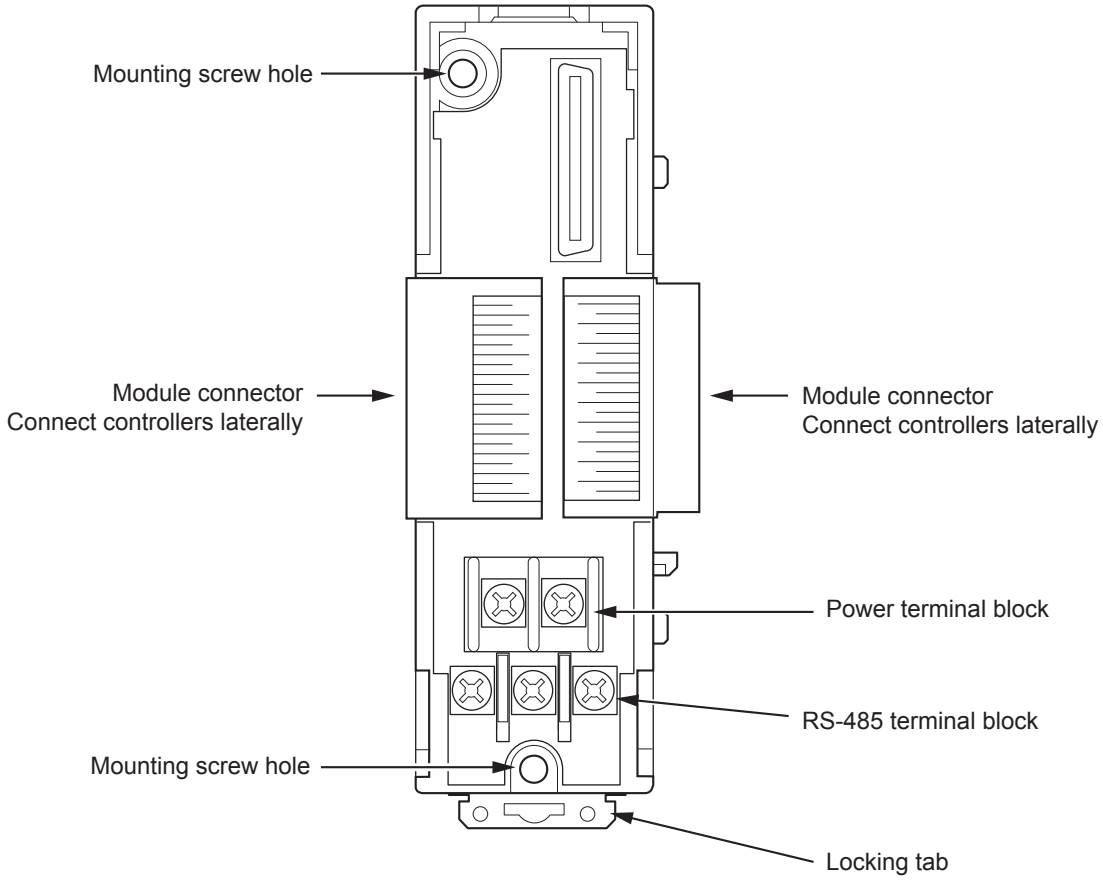
Loader communication port is an interface to connect PUM with a PC with parameter loader software installed using an optional loader connecting cable.

## Station No. configuration switch

Station No. configuration switch sets the station number of each controller. Apply a fine tip flat-head screwdriver to turn the Station No. configuration switch. Each of connected controllers must have a different Station number from other controllers. Duplicate station numbers may cause malfunction of the equipment.

| SW setting | Station No. |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |
| 4 | 5 |
| 5 | 6 |
| 6 | 7 |
| 7 | 8 |
| 8 | 9 |
| 9 | 10 |
| A | 11 |
| B | 12 |
| C | 13 |
| D | 14 |
| E | 15 |
| F | 16 |

# Base Part




## Module connector

Module connectors connect controllers laterally.

## Power terminal block

Power terminal block connects power supply to PUMA/B.

If any one of connected controllers is directly connected with power supply, power will be provided to all of controllers via side connectors.

## RS-485 terminal block

RS-485 terminal block connects an RS-485 communication cable to perform serial communication with PLC, operation display, and PC, etc.

If any one of connected controllers is directly connected with RS-485, all of controllers will be also connected via side connectors.

## Locking tab

Locking tab fastens a controller onto DIN rail when mounting controllers to a DIN rail. Locking tabs also fasten controllers onto each other.

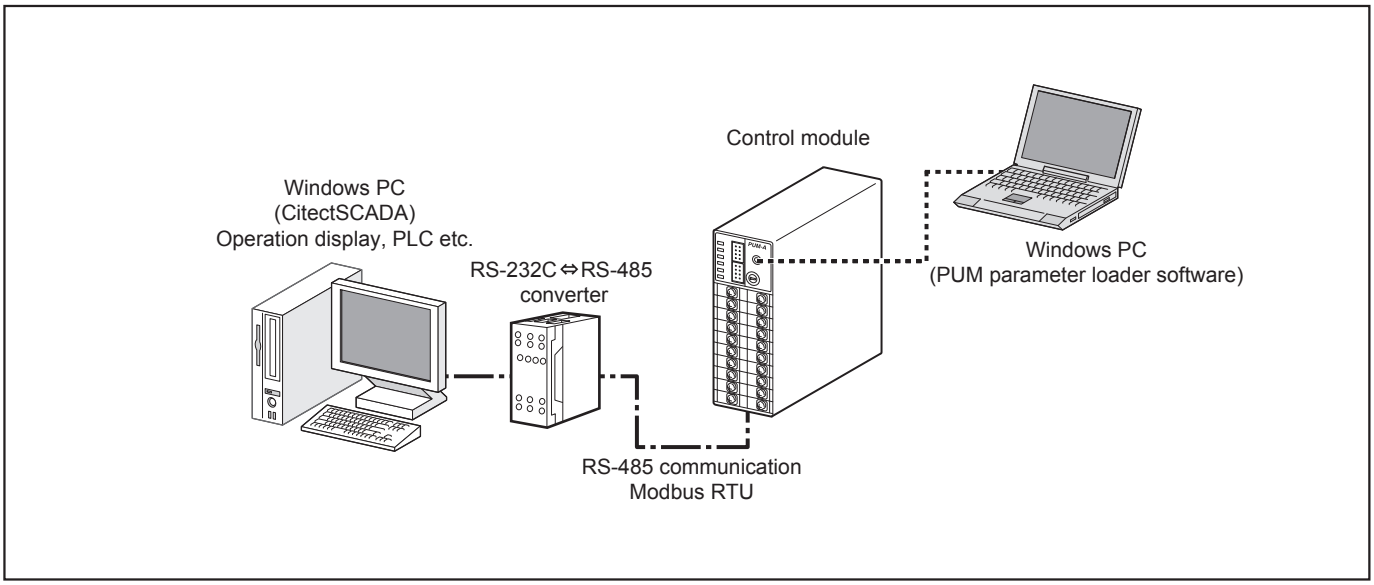
# 2 System Configuration Example

# 2.1 System Configuration Example

The followings are examples of a temperature controller system of multi-loop module type temperature controller PUM series.

## Stand Alone

- This is the minimum configuration consisting of one control module controller only.
- Temperature control is performed at maximum 4 channels.
- Heater break and short circuit can be monitored using CT terminal.
- Configuration and operation can be done via PUM parameter loader software connected with loader communication port. Configuration and operation are performed using PC, PLC, and Operation display connected by RS-485 communication.



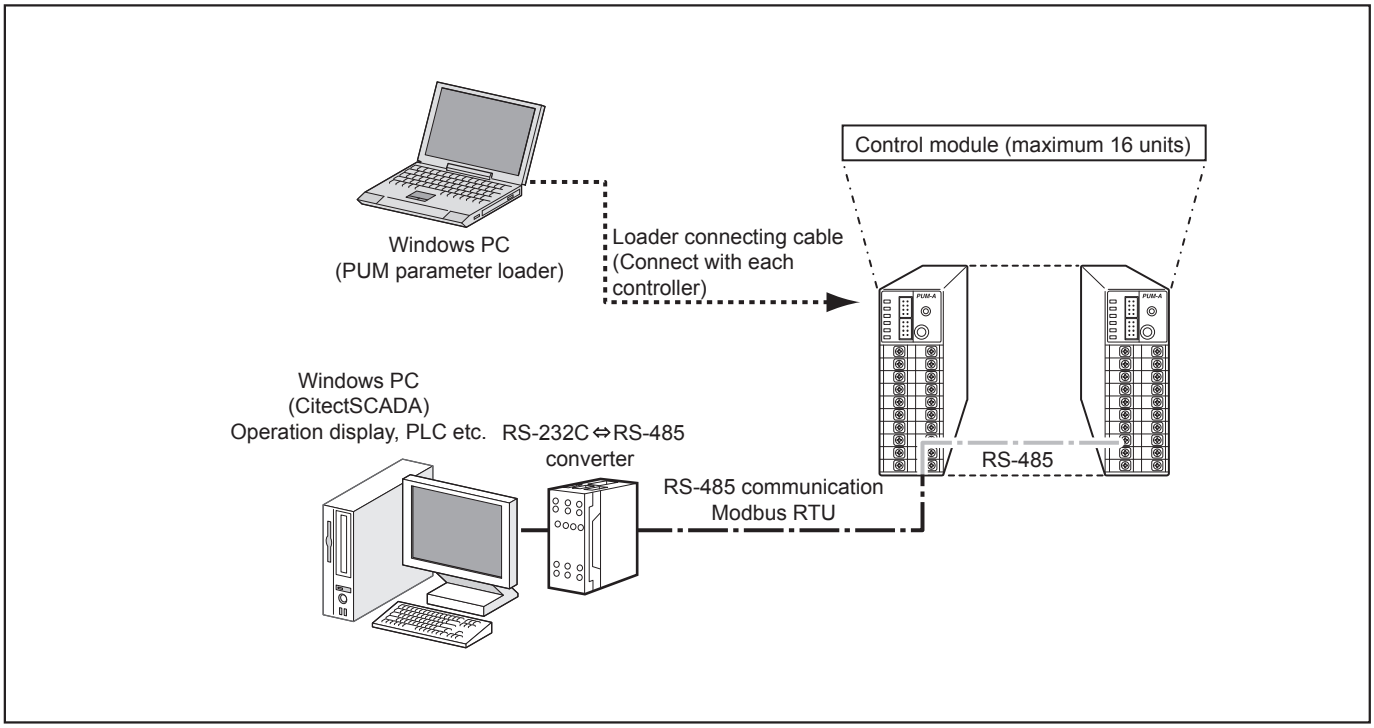

### Basic setting items

In case of this example, the following settings are required.

- RS-485 communication setting ▶▶ 4-119

# Multi-channel, Stand Alone System

- When more channels are required for temperature control, maximum 64 channels are available by connecting up to 16 units of control module.
- RS-485 and power supply can be shared among all connected controllers if one of connected controllers is directly connected to them, which saves time, labor and space for wiring.
- To configure controllers via loader communication port, connect all controllers one by one with a loader connecting cable and configure each controller separately.




## Basic setting items

In case of this example, the following settings are required.

- Station number setting ▶▶ 1-8
- RS-485 communication setting ▶▶ 4-119

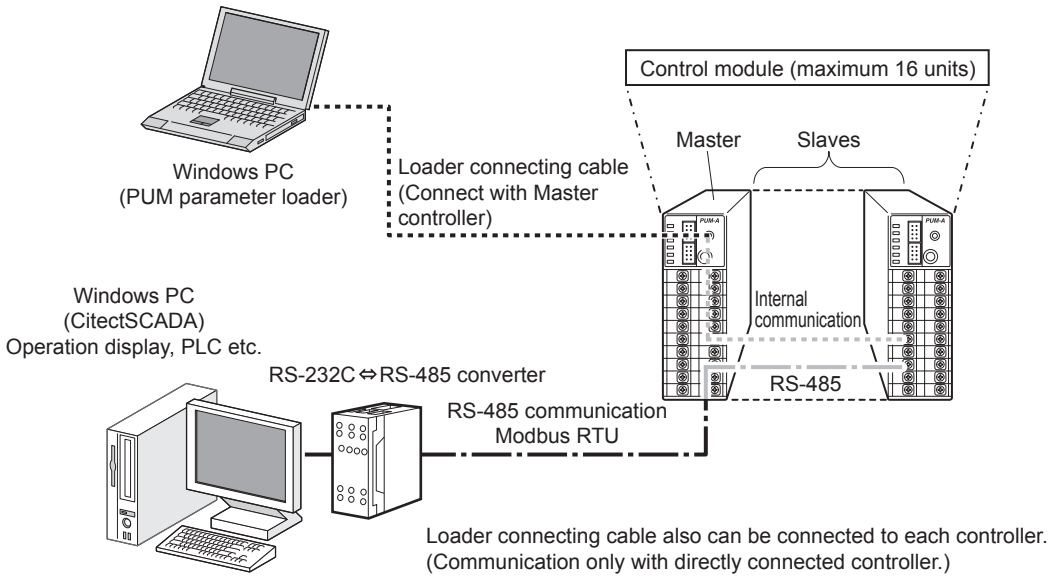
Point

- Station number of control module controller (1 to 16)

  In order to perform communication correctly, setting station number ▶▶ 1-8 is required. Set the leftmost controller to “1”. Number the rest of controllers consecutively as “2”, “3”, .....”16”. Make sure that there is no duplicate station number in the same system.

# Multi-channel, Master/Slave System

- Maximum 64 channels are available by connecting up to 16 units of control module.
- RS-485 and power supply can be shared among all connected controllers if the leftmost master controller is directly connected to them, which saves time, labor and space for wiring.
- Distribution, linkage operation, and Remote SV functions can be used by setting each controller as master or slave.
- In this configuration, all connected controllers can be configured by connecting the leftmost master controller with a loader connecting cable.




## Basic setting items

In case of this example, the following settings are required.

- Station number setting ▶▶ 1-8
- Master/slave setting ▶▶ 4-121
- RS-485 communication setting ▶▶ 4-119

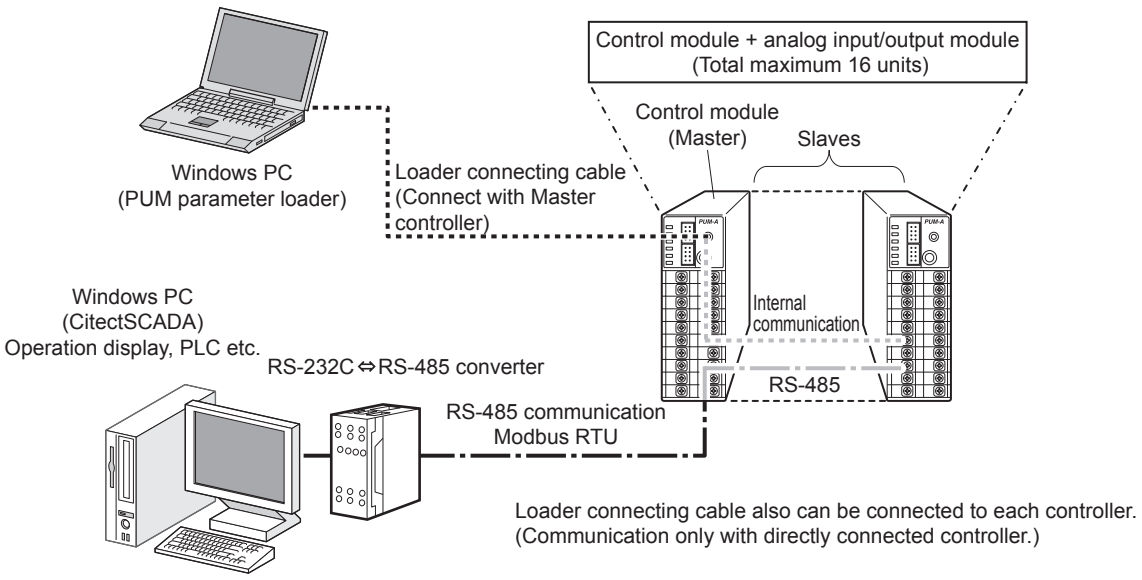
Point

- Master/slave setting
  Set the leftmost unit of connected controllers as “Master” and the rest of them as “Slave”. Each controller needs to be set as “Master” or “Slave” via a loader communication port only one. When connecting parameter loader software via loader communication port, it is only necessary to connect it with the master controller and all of slave controllers can be also configured. (If a slave controller is directly connected, the setting for other controllers cannot be done.)
  PWR indicator lamp shows whether the unit is “Master” or “Slave”.

| PWR indicator | Action |
|---|---|
| Master controller | Green lamp will blink at startup and during operation. |
| Slave controller | Green lamp will be illuminated at startup and during operation. |

# System Configuration Using Analog Input/Output Module Controllers

- By adding analog input/output module to the system, re-transmission output and remote SV functions can be used as extended input/output of control module. They can be also used as analog input/output from the host equipment.
- Total maximum 16 units (64 channels) of control module and analog input/output module controllers can be connected.




## Basic setting items

In case of this example, the following settings are required.

- Station number setting ▶▶ 1-8
- Master/slave setting ▶▶ 4-121
- RS-485 communication setting ▶▶ 4-119
- Output source setting ▶▶ 4-30
- Remote SV ▶▶ 4-23

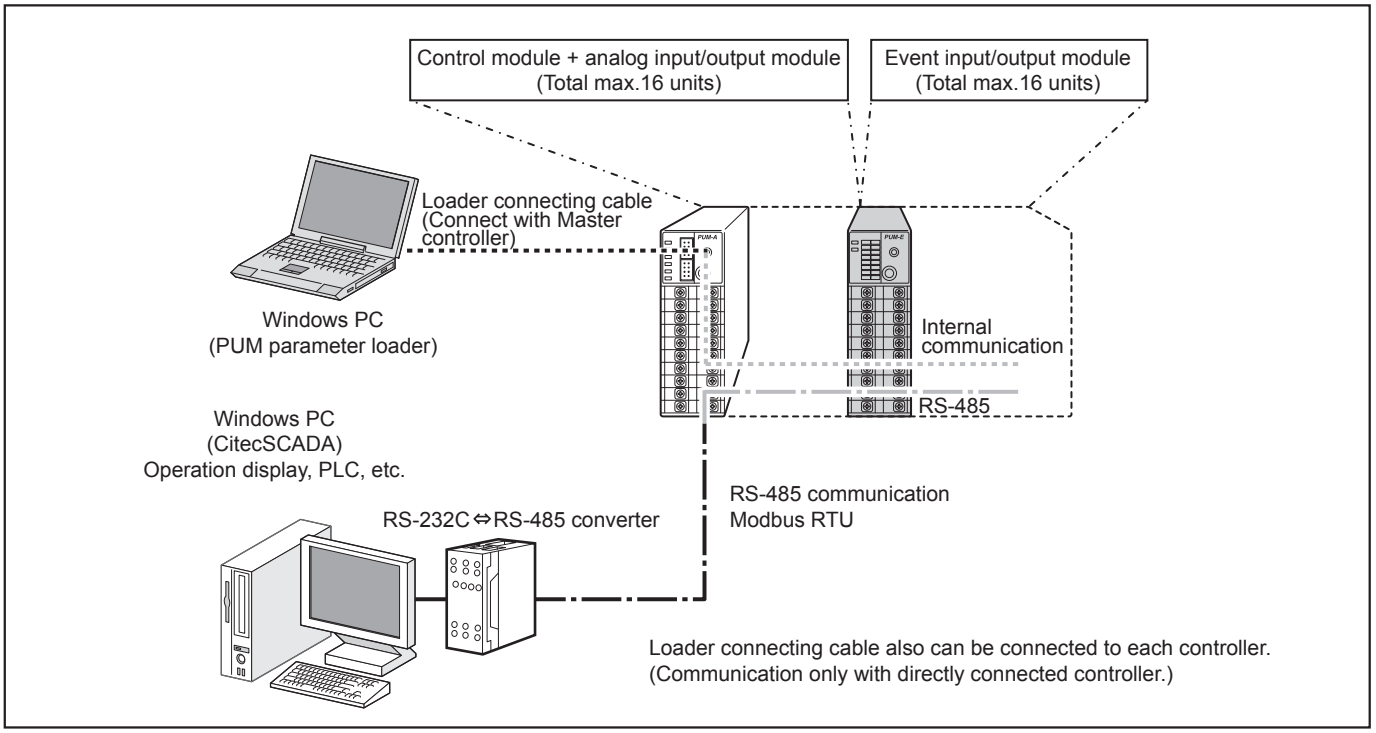
# System Configuration Using Event Input/Output Module Controllers

The following functions are added if event input/output module are included in the system.

- Control modules are operated by digital input.
- Event output such as alarm and distributed output are possible.

**Point**

- As for digital input (DI) function, setting source module is designated on the control module.
- As for digital output (DO) function, source module is designated on the event input/output module.




**Note**

- Station number of event input/output module controller (17 to 32)
  The station number of event input/output module must start with “17”. Number the rest of controllers consecutively as “17”, “18”, .....”32”. Make sure that there is no duplicate station number in the same system.

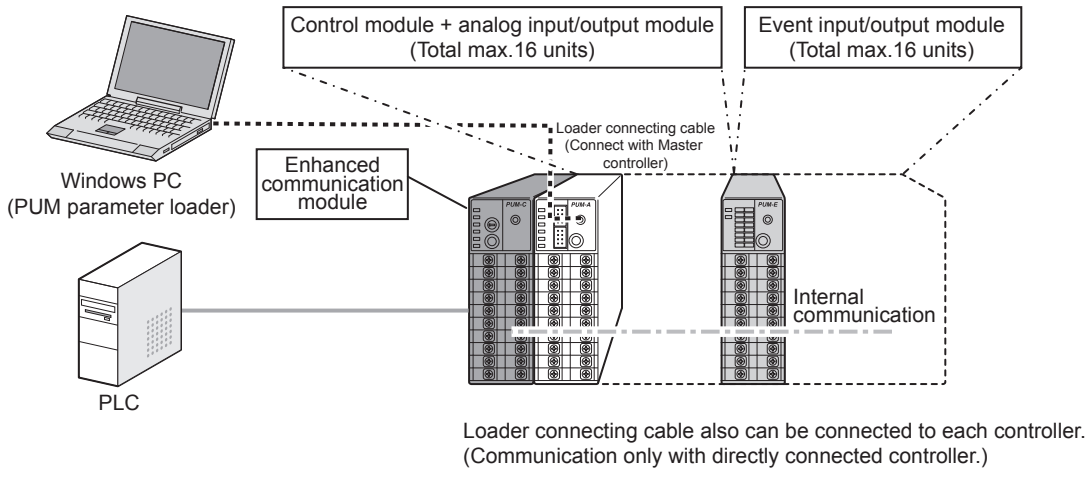
## Basic setting items

In case of this example, the following settings are required.

- Station number setting ▶▶ 1-8
- Master/slave setting ▶▶ 4-121
- RS-485 communication setting ▶▶ 4-119
- DI input function ▶▶ 4-124
- Event output setting ▶▶ 4-98
- Output source setting ▶▶ Event input/output user's manual

# System Configuration Using Enhanced Communication Module

• By adding enhanced communication module to the system, communication with PLC of various manufactures is possible.




## Basic setting items

In the case of communication via CC-Link, the following settings are required.

- Station number setting ▶▶ 1-8
- Master/slave setting ▶▶ 4-121
- CC Link Station number setting ▶▶ Enhanced communication module (CC-Link) user's manual
- CC-Link communication setting ▶▶ Enhanced communication module (CC-Link) user's manual

**Note**

Only connectable modules to an enhanced communication module (CC-Link) are a control module and an event I/O module.

In the case of programless communications, the following settings are required.

- Station number setting ▶▶ 1-8
- Master/slave setting ▶▶ 4-121
- Programless communication setting ▶▶ Enhanced communication module (Mitsubishi's PLC programless communication) user's manual

**Point**

To use enhanced communication module, change the setting of "Enhanced communication module (PUMC) communication permission" to "1:PUMC connected (RS-485 Disable)" ▶▶ 4-120 on all of connected control module, analog input/output module, and event input/output module.

# 3 Installation

# 3.1 Installation Procedure

The procedures from installation to startup via PUM parameter loader software are shown below by each configuration system. Then, the procedures of communication setting of host equipment and trial run are shown.

## Stand Alone System

Legend: 1 Necessary step; 1 Step necessary depending on conditions

**1 Installation**

Confirm installation dimensions.
- ●External dimensions ▶▶ 3-8

Decide installation method
- ●DIN-rail mounting ▶▶ 3-11
- ●Mounting with screws ▶▶ 3-15

**2 Wiring**

Please do not turn the power ON until all wiring is complete.
- ●Power / RS-485 communication ▶▶ 3-17
- ●Front terminals ▶▶ 3-16
- ●CT input terminal ▶▶ 3-19

**3 Preparing loader software**

- ●Connect PC on which PUM loader software is installed with a controller using loader connecting cable. ▶▶ 5-7
- ●Start the loader software. ▶▶ PUM parameter loader instruction manual

**4 Communication parameter setting**

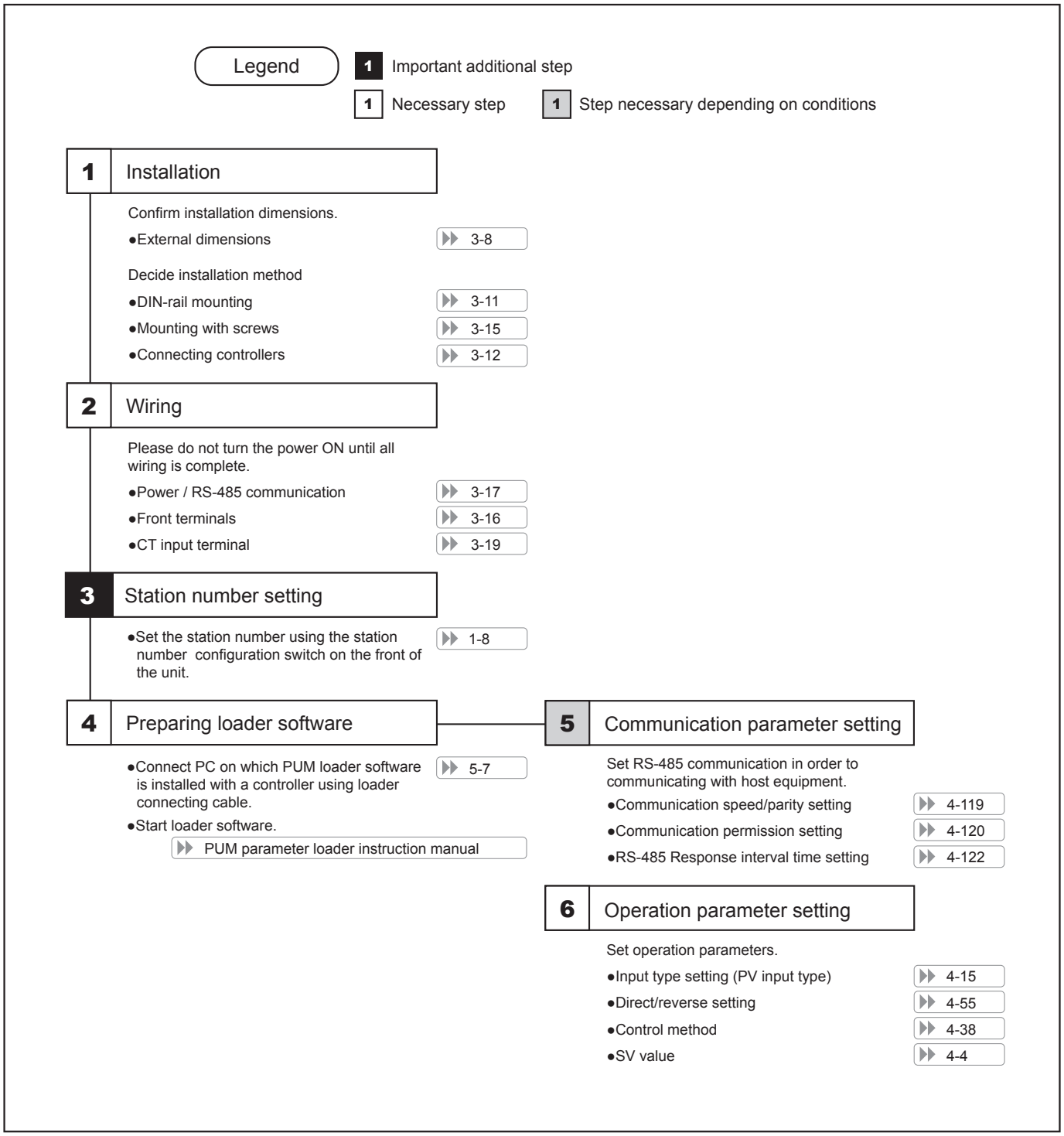
Set RS-485 communication in order to communicating with host equipment.
- ●Communication speed/parity setting ▶▶ 4-119
- ●Communication permission setting ▶▶ 4-120
- ●RS-485 Response interval time setting ▶▶ 4-122

**5 Operation parameter setting**

Set operation parameters.
- ●Input type setting (PV input type) ▶▶ 4-15
- ●Direct/reverse setting ▶▶ 4-55
- ●Control method ▶▶ 4-38
- ●SV value ▶▶ 4-4

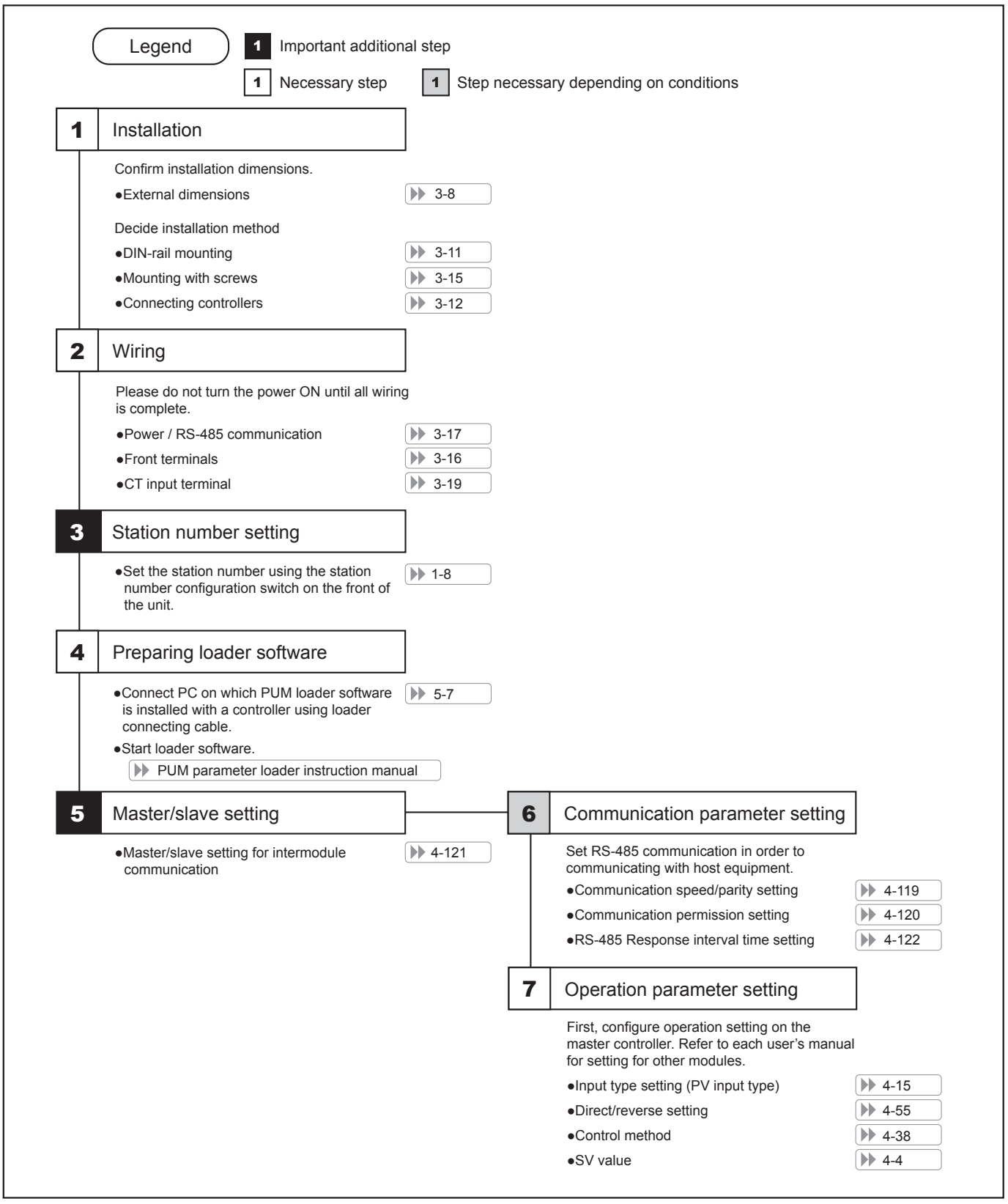
# Multi-channel, Stand Alone System

- Station number setting is added.
- To configure parameter, connect each controller with PUM parameter loader software.



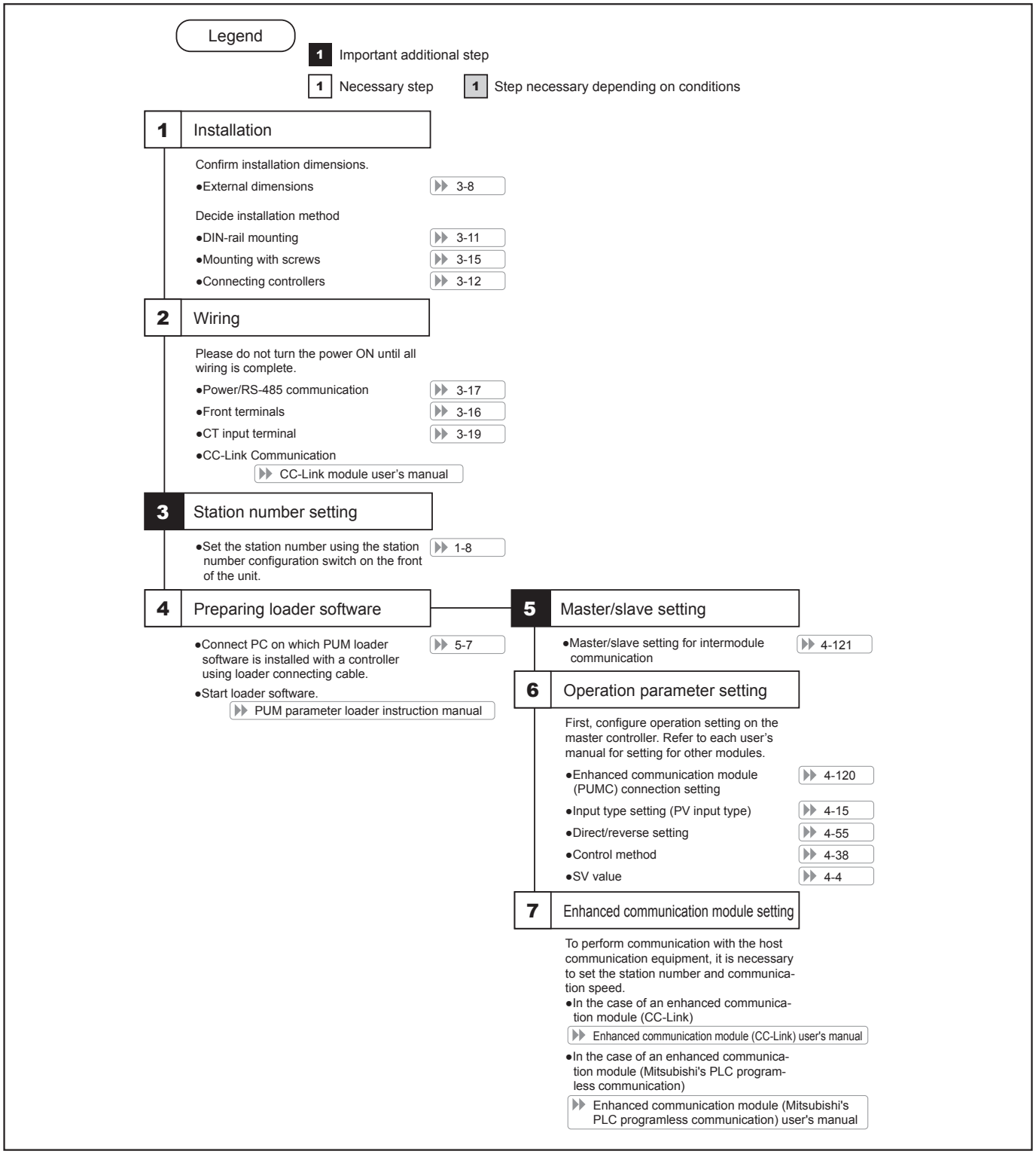
# Multi-channel, Master/Slave System

- Station number setting and master/slave setting are added.
- Connect the master controller with PUM parameter loader to configure all controllers at the same time.
- When adding analog input/output module or event input/output module, follow the procedure shown below.



# System Configuration Using Enhanced Communication Module

- Station number setting and master/slave setting are added.
- “Enhanced communication module (PUMC) connection permission” parameter setting on all of the control/event/analog module in the system is required to set to “1: PUMC connected (RS-485 Disable)”.
- Connect the master controller with PUM parameter loader to configure all controllers at the same time.
- When setting parameters of the enhanced communication module, connect the parameter loader for PUM directly to the loader communication port of the enhanced communication module.



## Setting on RS-485 Host Communication Equipment

- The settings on the host communication equipment and PUM must be the same to perform communication correctly.
- Do not turn the power of any controllers ON until all the wiring is complete.

**1 Wiring for communication line**

Please do not turn the power of any controllers ON until all wiring is complete.
Refer to 3.6 Terminal block diagram and install wiring for communication line. ▶▶ 3-16

**2 Preparation of communication program**

- ●Prepare host equipment with a communication program installed.
- ●Start the communication program.

**3 Communication port setting**

**4 Communication condition setting**

Set communication speed, etc. Setting must be the same as the PUM.

**5 Power ON**

Turn the power ON after all wiring is completed.

## Trial Run

- Perform a trial run after installation and settings are complete.

**1 Check operations at manual mode**

Start the unit at manual mode to check that the objects being controlled are operating correctly. ▶▶ 4-8

**2 Trial run**

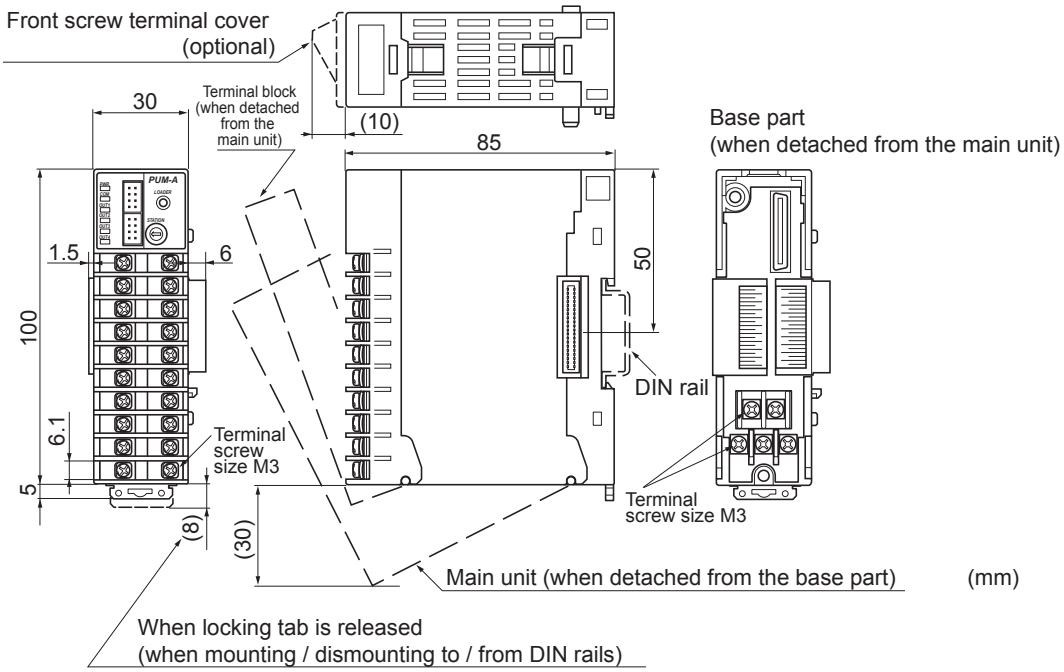
- ●Execute auto tuning ▶▶ 4-6
- ●Perform a trial run

  Modify the parameter setting if necessary based on the result.

# 3.2 Dimensions

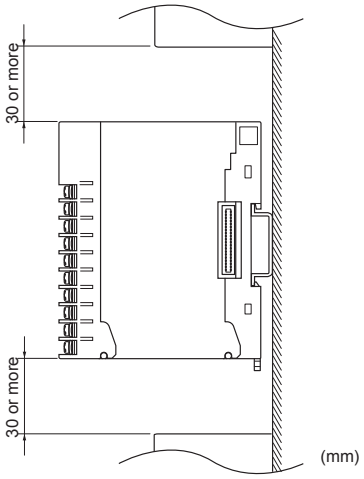
## Dimensions

Refer to the dimensions shown below and provide enough clearance space when installation controllers.




### Cautions when mounting

In order to aid heat dissipation, 30mm of clearance (50mm recommended) above and under the controllers should be provided.




Point

When mounting / dismounting controllers to / from DIN rails, 30mm of clearance above and under the controllers should be provided.

# 3.3 Mounting Controllers

## How to Remove Front Terminal Block / Base Part from the Main Unit

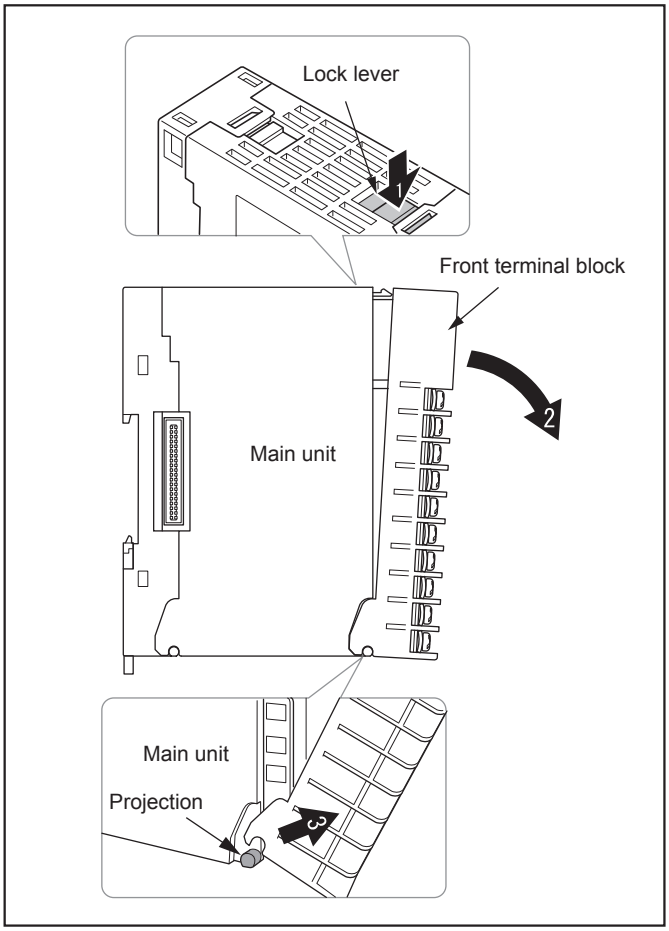
Front terminal block and base part of this equipment are removable from the main unit without tools in seconds, which enables easy mounting and maintenance.

### How to remove front terminal block

1. Press the lock lever on the top of the main unit.
2. Pull down the front terminal block.
3. Detach the cutout on the lower end of the front terminal block from the projection on the main unit.

Point

- When attaching the front terminal block to the main unit, take the reverse procedure to removing the front terminal block from the main unit.
- Make sure that the lock lever of the main unit is fitted into the front terminal block.

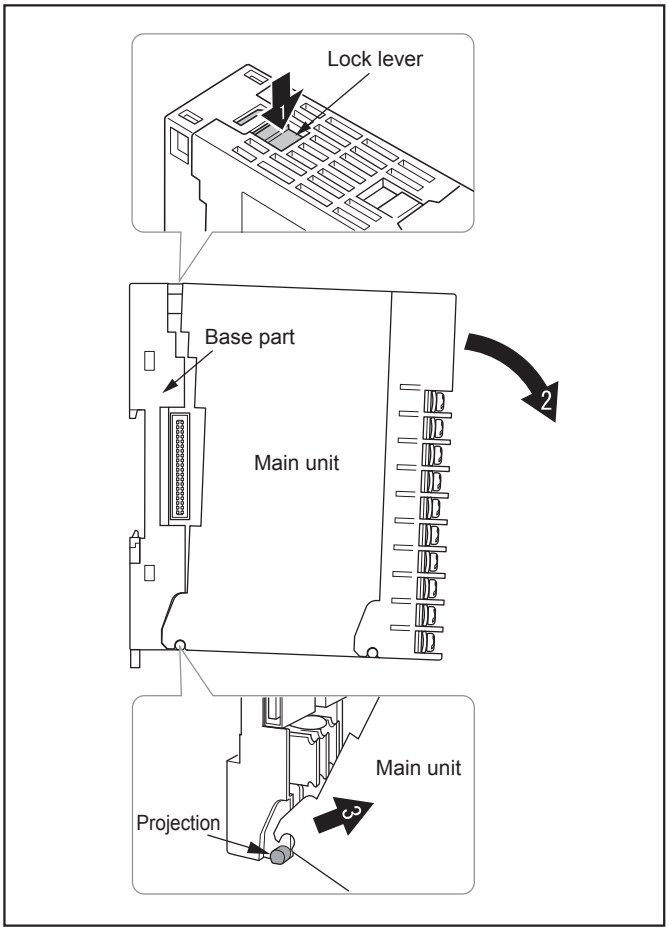


## How to remove base part

1. Press the lock lever on the top of the main unit.
2. Pull down the upper part of main unit.
3. Detach the cutout on the lower end of back of main unit from the projection on the base part.

Point

- When attaching the base part to the main unit, take the reverse procedure to removing the base part from the main unit.
- Make sure that the lock lever of the main unit is fitted into the base part.

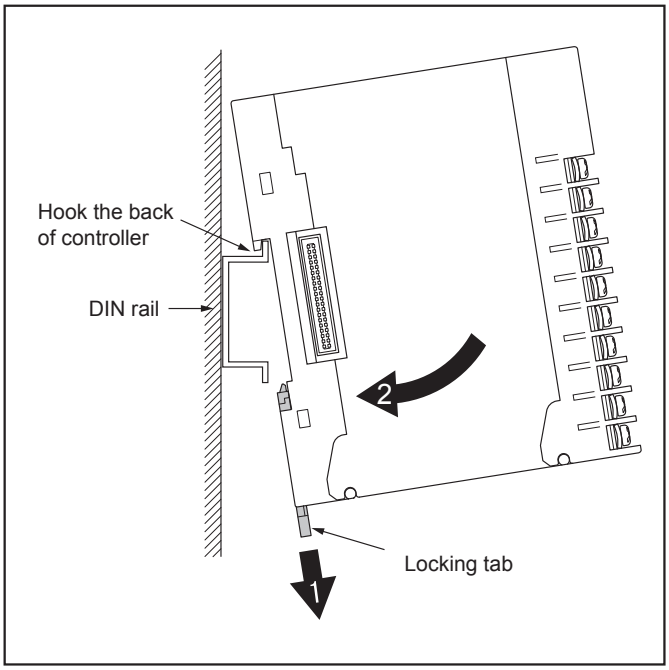


# Mounting to DIN Rails

## Mount controllers

1. Pull down the locking tab of the base part.

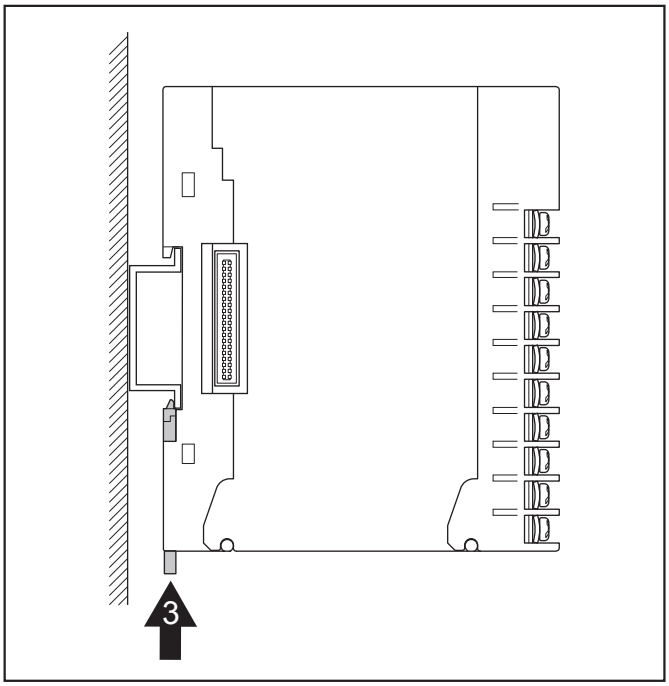
   Hook the back of the controller onto the upper part of DIN rail.
2. Push the controller in the direction of arrow 2.




3. Push up the locking tab to fasten the controller onto DIN rail.

Point

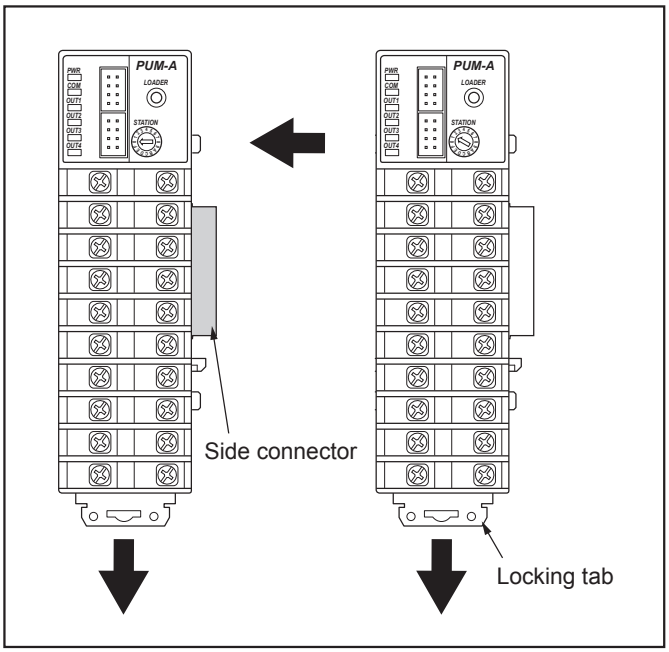
- When connecting controllers after mounting to DIN rail, push up the locking tab after doing so.



## Connecting controllers

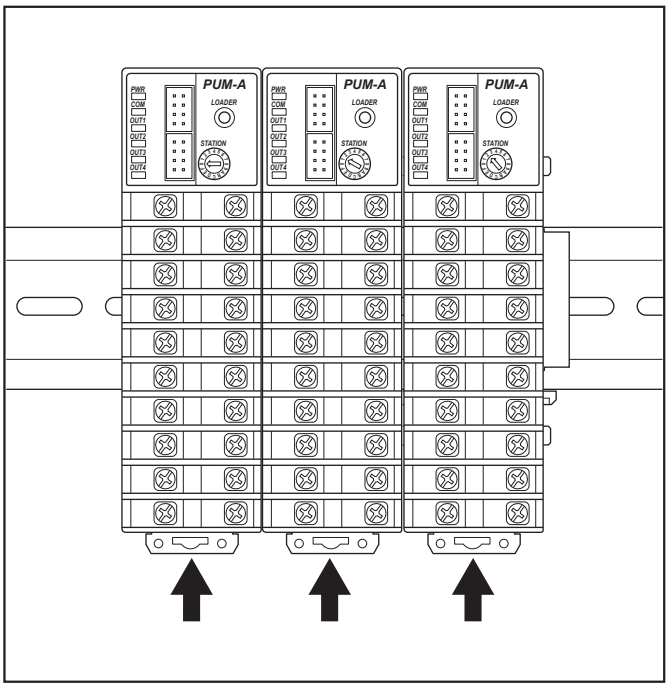
1. Check that locking tabs are pulled down (released).

2. Connect controllers with each other using side connectors.



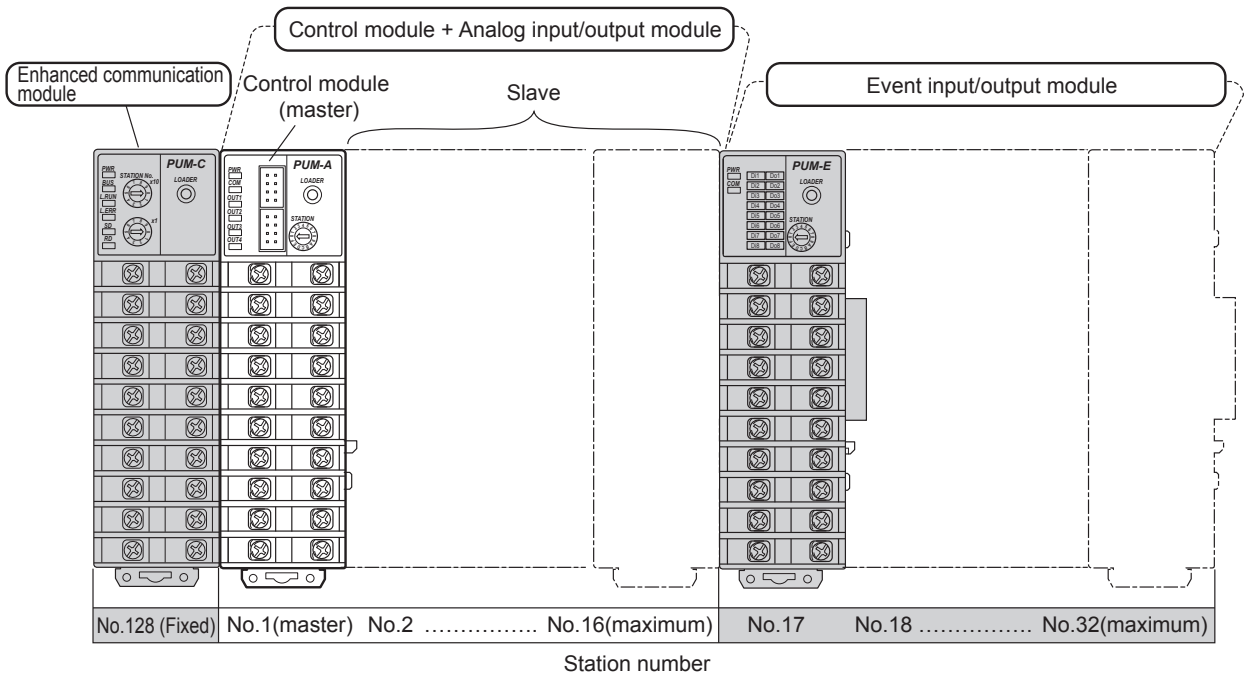

3. After mounting connected controllers onto DIN rail, make sure to push up all locking tabs. Controllers are fastened to DIN rail and to each other.

4. All connected controllers are connected to power supply and RS-485 via side connectors if one of controllers is directly connected to them.



# Order of Controllers

PUM series module type temperature controllers should be connected in the order shown below.




Point

Basically connect controllers from left to right in the order of station number.

- Assign station numbers 1 to 16 to control module and analog input/output module. Maximum 16 units in total can be connected. Make sure that there is no duplicate station number in the same system.
- When setting slave or master, set the control module controller of station No.1 as the master controller. The master controller should be on the extreme left if an enhanced communication module is not used.
- Assign station numbers 17 to 32 to event input/output module. Maximum 16 units can be connected. Make sure that there is no duplicate station number in the same system.

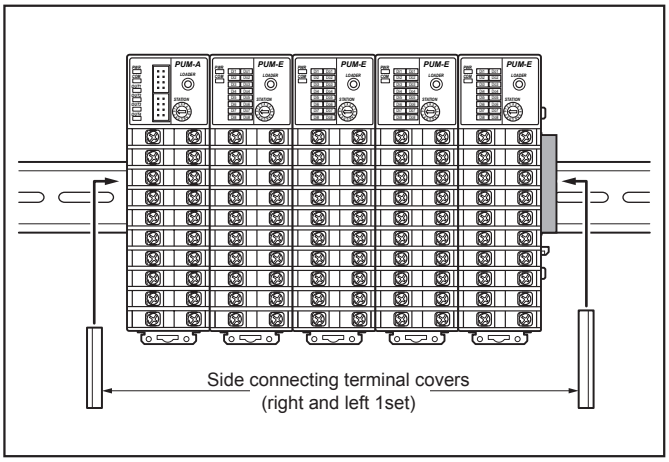
When using an enhanced communication module, always remember to place it on the extreme left.

- An enhanced communication module should be on the left of the master control module controller, which places it at the far left end of connected controllers.

# 3.4 Attaching Accessories (Optional)

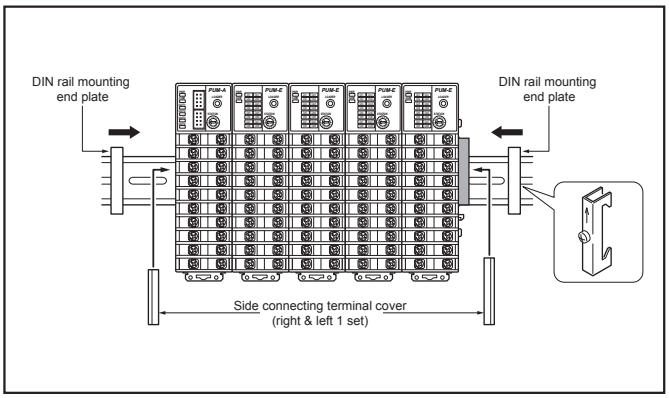
## Attaching Side Connecting Terminal Covers

Side connectors on the both ends of connected controllers are exposed. To prevent accidents and to protect them, we recommend to attach side connecting terminal covers (PUMZ*A03) to the ends of the rightmost and leftmost controllers.




## Attaching End Plates

In order to secure controllers onto DIN rail more tightly, end plates (PUMZ*A02) are also available.




Note

- When attaching end plates, make sure to attach side connecting terminal covers first.

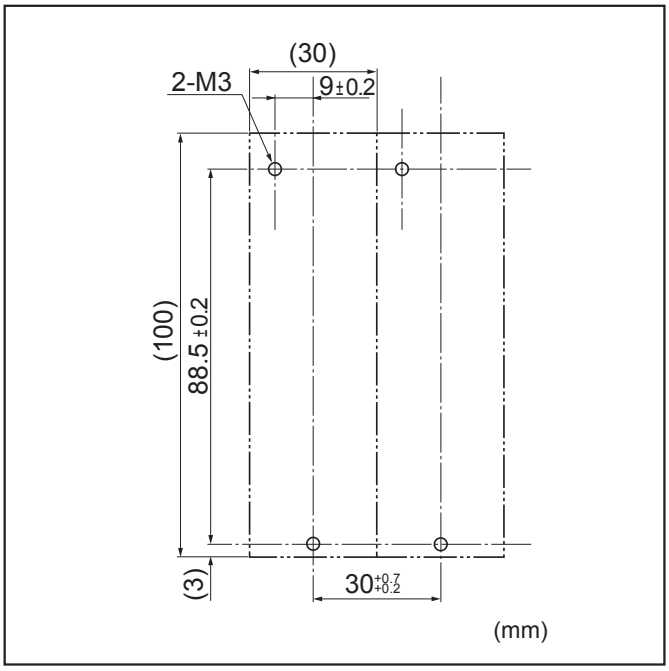
# 3.5 Mounting with Screws

When mounting controllers with screws inside a cabinet, check the screw hole size of the base part and the mounting position beforehand.

Point

- Mounting screws are not included in the product. Prepare two M3 screws per unit.

1. Refer to the right figure for the mounting screw hole size and the pitch to decide the mounting position.



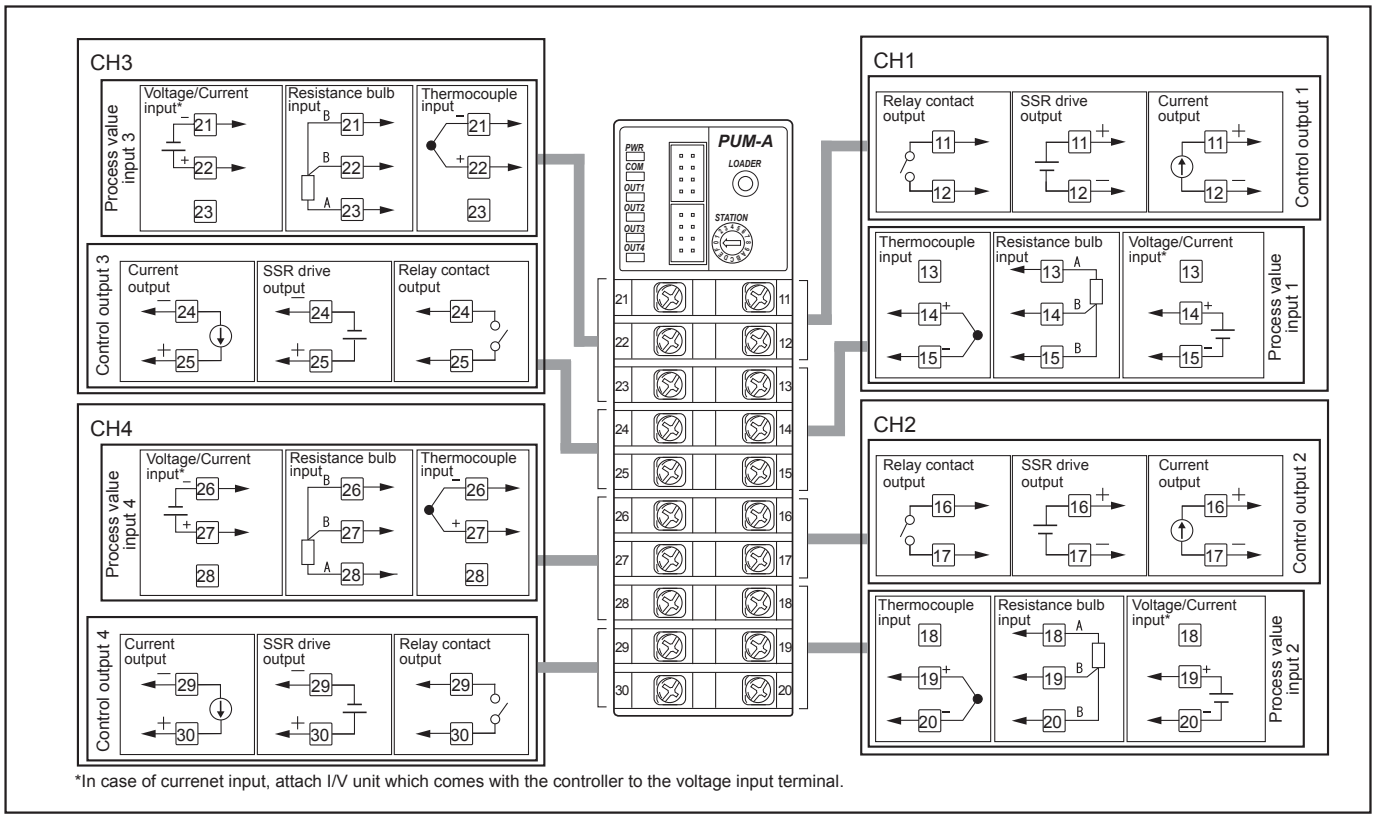

2. Remove the main units from the base parts.

   (3.3 Mounting controllers) ▶▶ 3-9

3. Connect base parts. Push up to fasten all the locking tabs.
4. Fixate the base parts onto the mounting position inside the cabinet with screws.
5. Attach the main units to the base parts.

# 3.6 Terminal Block Diagram

## Wiring




*In case of currenet input, attach I/V unit which comes with the controller to the voltage input terminal.

Point

- Input terminal of CH3 and CH4 cannot be used on PUMB. However, output terminal of CH3 and CH4 can be used depending on the model code.
- Note that the insulation class for this equipment is as follows. Before installing, please confirm that the insulation class for the equipment meets usage requirements.

| Power | PV1 |
|---|---|
| Loader communication port | PV2 |
| RS-485 communication port | PV3 |
| CT Input (CT1A, B - CT4A,B) | PV4 |
| OUT1 (relay contact output) | OUT1(SSR drive, current) |
| OUT2 (relay contact output) | OUT2(SSR drive, current) |
| OUT3 (relay contact output) | OUT3(SSR drive, current) |
| OUT4 (relay contact output) | OUT4(SSR drive, current) |

Basic insulation (1500VAC) ═ Functional insulation (1000VAC) ── Functional insulation (500VAC)

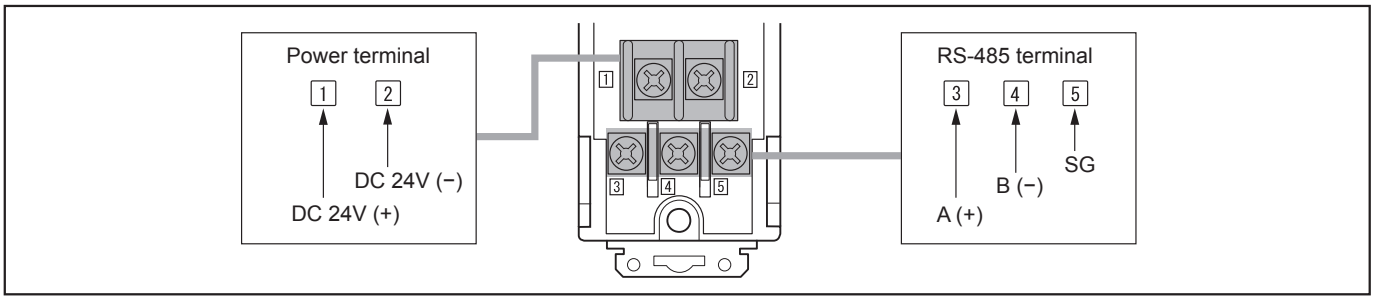
# Wiring for Power Supply / RS-485

## Terminal layout

Power terminal and RS-485 terminal are on the base part of each controller.

The terminal layout of all controllers is the same.

Power supply and RS-485 are connected to connected controllers via side connectors if one of controllers is directly connected to them.




Note

- For wiring to the terminal block, apply crimp type terminals size M3.
  Make sure to use screws included in this product only.

  Screw size : M3 x 7 (with square washer)

  Screw tightening torque : 0.78N•m (8kgf•cm)

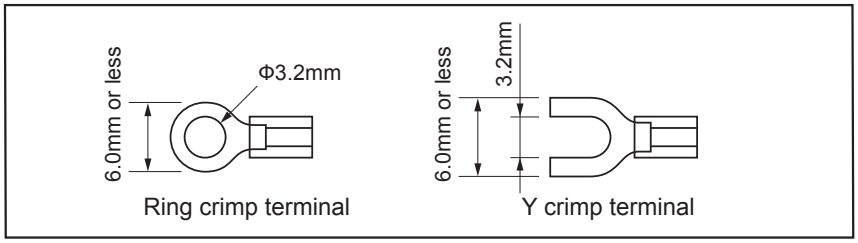
- Apply power cable with allowable current capacity larger than the total consumption current of all connected controllers.
- For wiring to RS-485, a cable equivalent to KPEV-SB 0.5sq should be used.
- For wiring to power terminal, do not apply more than two cables to one terminal.
  (Power cable should be connected to power terminal directly from the power unit.)
- Please prepare power cables and crimp terminals of the size indicated below.

Power cable

| Cable type | Size |
|---|---|
| Thermocouple (Compensation lead wire) | 1.25mm$^2$ or less |
| Power supply | 1.25mm$^2$ or less |

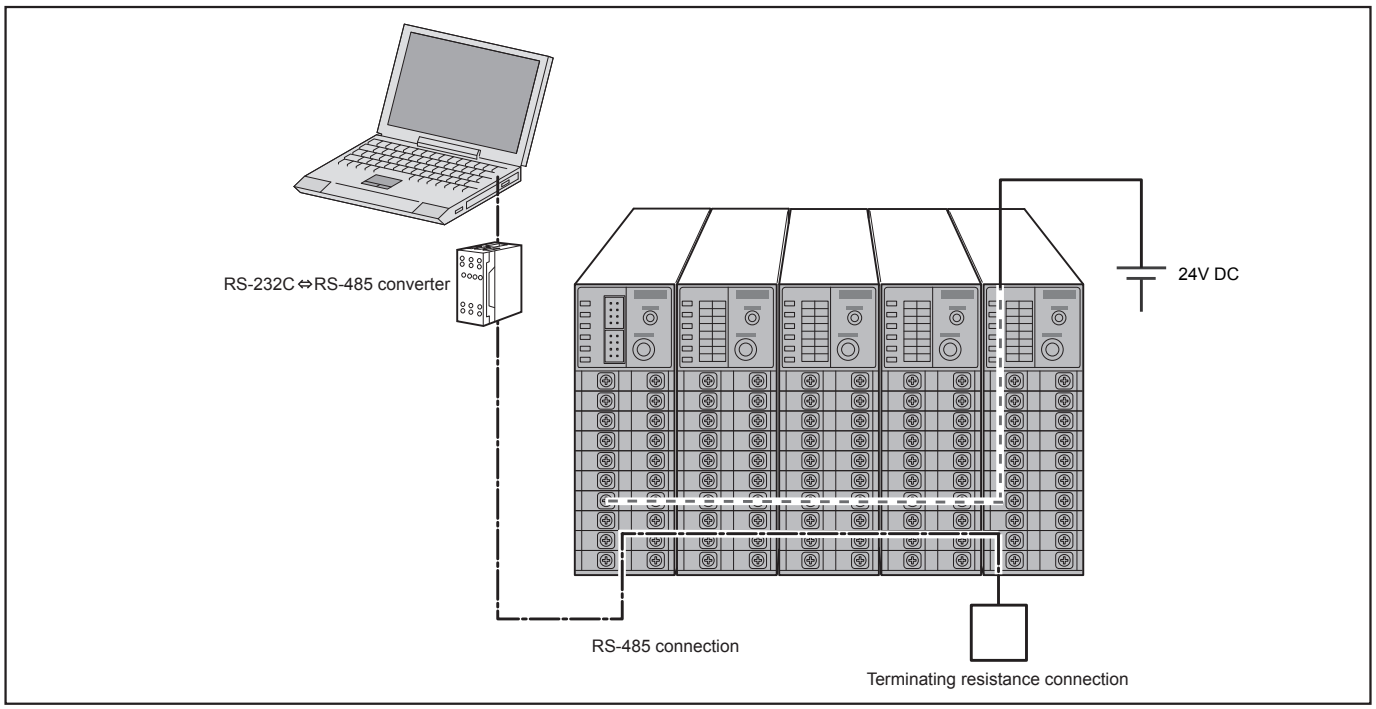
Crimp terminal

| Cable size | Screw tightening torque |
|---|---|
| 0.25 to 1.25mm$^2$ | 0.8 N•m |



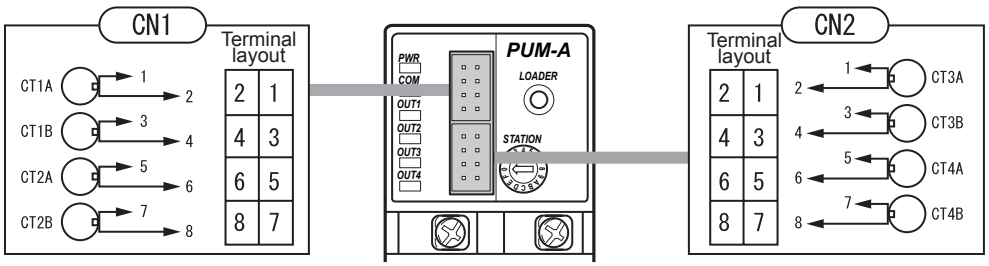
## Connection of RS-485 terminating resistance

RS-485 terminating resistance should be connected to the controller at the opposite end from the controller to which RS-485 communication line is connected.



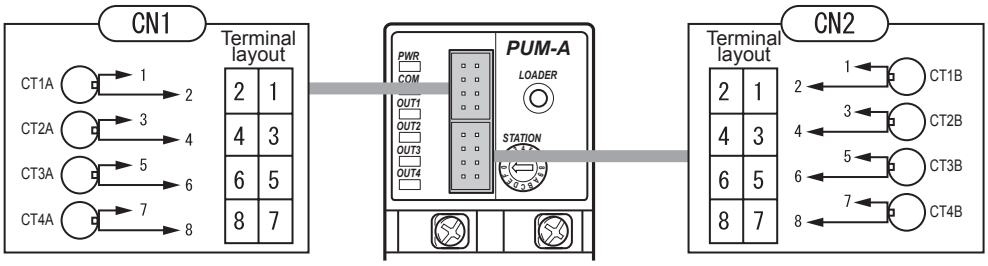
# Wiring for Heater Break Detection CT

## AB arrangement




*Pins No.2, 4, 6, and 8 of CN1 and CN2 are connected internally.
*CN2 cannot be used on PUMB.

## AA arrangement




*Number 2, 4, 6 and 8 pins of CN1 and CN2 are connected inside.

Note

- The shape of CT input terminal is unique. Special connecting cable for CT input terminal is required.

  Prepare 1 set per 4 points of input, which means 1 set each is required for CN1 and CN2.

  Connecting cable for CT input terminal (for 4 points of input)

  : PUMZ*C01 (L=1m)

  : PUMZ*C03 (L=3m)

  : PUMZ*C05 (L=5m)

# 4

# System Setting

# 4.1 Operating Method

## Operating Method

Following settings can be performed during operation.

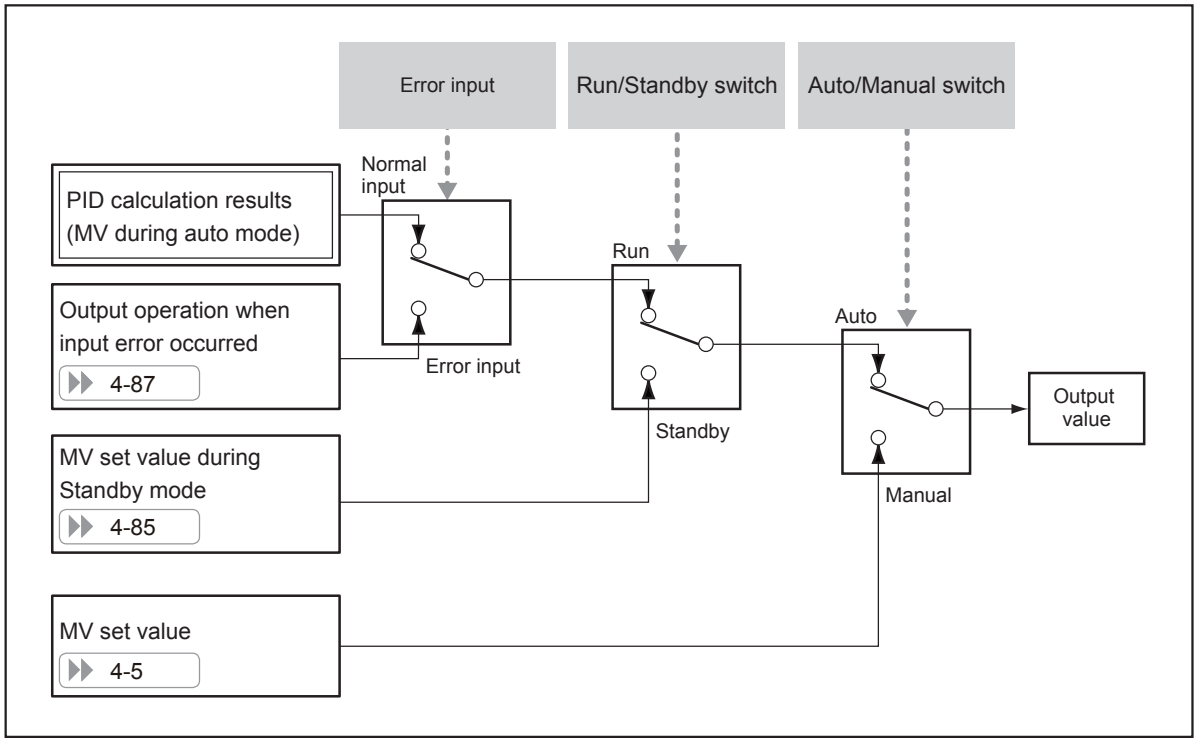
### Basic operation

- SV value setting 4-4
- MV value setting 4-5
- Running Auto-tuning 4-6

### Operation mode switching

- Auto/manual switch 4-8
- Run/Standby switch 4-9
- Remote/Local switch 4-10
- Digital output latch release 4-11

### Control output values during operation



## SV Value Setting

This is setting for the SV value which is used during Local operation. ▶▶ 4-10
The parameter to set SV value has the local SV value and the communication SV value.

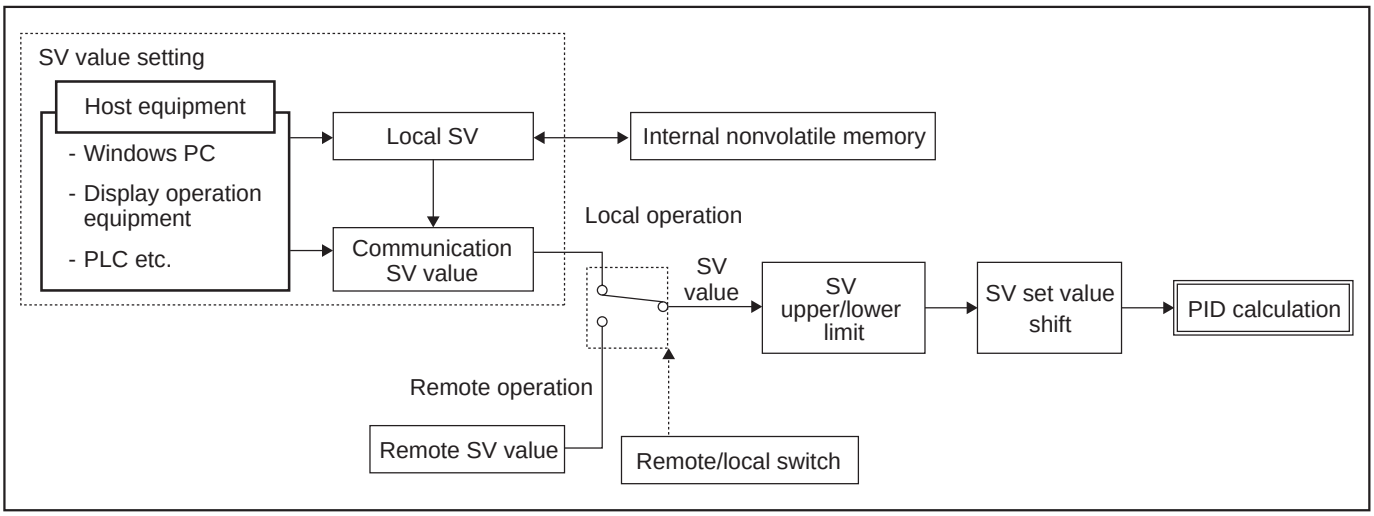
If a SV value is often changed, use a communication SV value.

(Because a local SV value is limited in number of rewriting the internal memory of the main unit)

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Local SV value | SV limit (lower) to SV limit (upper) | %FS | 0 | R/W | Ch1: 40001 (0000h) 41001 (03E8h) |
| | | | | | Ch2: 40002 (0001h) 42001 (07D0h) |
| | | | | | Ch3: 40003 (0002h) 43001 (0BB8h) |
| | | | | | Ch4: 40004 (0003h) 44001 (0FA0h) |
| Communication SV value | SV limit (lower) to SV limit (upper) | %FS | 0 | R/W | Ch1: 40023 (0016h) 41100 (044Bh) |
| | | | | | Ch2: 40024 (0017h) 42100 (0833h) |
| | | | | | Ch3: 40025 (0018h) 43100 (0C1Bh) |
| | | | | | Ch4: 40026 (0019h) 44100 (1003h) |

A local SV value is limited in the “SV upper/lower limit” ▶▶ 4-59, it can be offset by the “SV set value shift setting” ▶▶ 4-60.



- Local SV value: The SV value that values are stored in an internal nonvolatile memory.
  When the power on, starts operation at the SV value that is same as the value before turning the power off.

- Communication SV value: The SV value that the values are not stored.
  When the power on, starts operation at the same value as the local SV value.
  If the local SV value is changed, the communication SV value is also changed to the same value.

  Examples of use
  - when the SV value is changed during operation
  - In the case although the SV value is changed sometimes during operation, want to fix the certain SV value at startup.

**Note**

- Do not change the SV value during remote operation. ▶▶ 4-10
- When change the SV value, or the change from the remote operation to the local operation, the SV value is stored.
- When using an enhanced communication module (Mitsubishi's PLC programless communication, CC-Link communication, and RS-485 high-speed communication), use a communication SV value. A local SV value is not possible to register.

## MV Value Setting

Sets the control output value.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| MV value | –3.0 to 103.0 | % | 0 | R/W | Ch1: 40005 (0004h)<br>41002 (03E9h) |
| | | | | | Ch2: 40006 (0005h)<br>42002 (07D1h) |
| | | | | | Ch3: 40007 (0006h)<br>43002 (0BB9h) |
| | | | | | Ch4: 40008 (0007h)<br>44002 (0FA1h) |

During Auto mode operation, the current PID calculation results are written in the relevant register. It is possible to write MV value in a register manually, however, the written values will not be reflected. ▶▶ 4-8
During Manual mode operation, the current MV value can be set. ▶▶ 4-8

## Running Auto-tuning

Running Auto-tuning automatically sets the optimal PID parameters.

Before running Auto-tuning, the following parameter setting is required.

- PV input type, PV input scale lower and upper, Decimal place setting ▶▶ 4-15
- Output proportion cycle (Relay output or SSR drive output is selected) ▶▶ 4-28
- Current output range ▶▶ 4-29

**Point**

Followings are PID parameters.

- Proportional band [P] ▶▶ 4-43
- Integration time [ I ] ▶▶ 4-43
- Derivative time [D] ▶▶ 4-43
- Anti-reset windup [ARW] ▶▶ 4-52

**Note**

Do not run Auto-tuning in facilities such as pressure or flow controls where rapid response is required.

ON/OFF (2 position) control is used during Auto-tuning, which may cause large changes in PV depending on circumstances.

If you are running a process that cannot tolerate large changes in PV, refrain from using auto-tuning.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Auto-tuning RUN command | 0: Stop/End<br>1: Normal type<br>2: Low PV type | None | 0 | R/W | Ch1: 41005 (03ECh) |
| | | | | | Ch2: 42005 (07D4h) |
| | | | | | Ch3: 43005 (0BBCh) |
| | | | | | Ch4: 44005 (0FA4h) |

**Note**

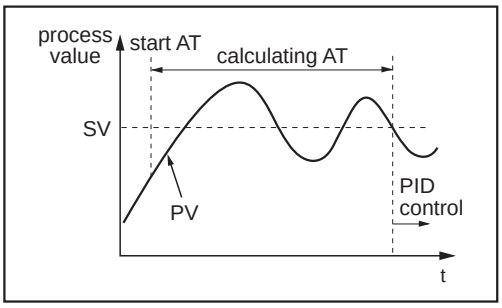
When valve control is set, with manual mode in putted MV value can not be operated.

### Set value of Auto-tuning RUN command

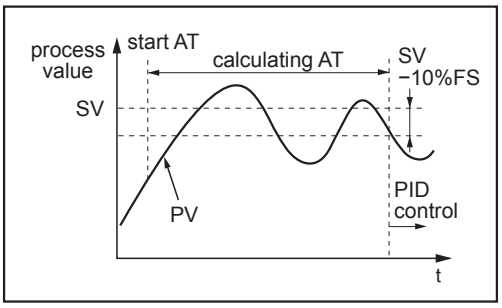
Refer to the table below and decide the set value.

| Set value | Operation mode | Function |
|---|---|---|
| 0 | Stop/End | Stop or end Auto-tuning |
| 1 | Normal type | Auto-tuning with SV as the baseline. Normally select this type. |
| 2 | Low PV type | Requests PID and ON/OFF operation at a baseline of SV−10%. Use this setting if you are trying to prevent overshoot. |

- Auto tuning action when set value is “1”.




- Auto-tuning action when set value is “2”.




### Instructions on running Auto-tuning

Auto-tuning will not be performed in manual mode ▶▶ 4-8 or standby mode ▶▶ 4-9

The PID parameters after Auto-tuning has finished normally will be saved even if power is cut off.

**Note**

PID parameters will not be changed if the power is cut OFF during Auto-tuning.

In such a case, run Auto-tuning again if necessary.

If Auto-tuning has not finished after four or more hours have passed, check the followings;

- Input/output connections ▶▶ 3-16
- Direct/Reverse action setting ▶▶ 4-55
- PV input basic setting ▶▶ 4-15

In the following cases, Auto-tuning must be restarted.

- Large change in SV ▶▶ 4-4
- Change in PV input type, PV input scale lower and upper ▶▶ 4-15
- Large change in the condition of controlled target

## Auto/Manual Switch

The setting of whether control output should be calculation results or the manually set value is performed. ▶▶ 4-5

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Manual mode switch | 0: Auto<br>1: Manual | None | 0 | R/W | Ch1: 40013 (000Ch)<br>41003 (03EAh) |
| | | | | | Ch2: 40014 (000Dh)<br>42003 (07D2h) |
| | | | | | Ch3: 40015 (000Eh)<br>43003 (0BBAh) |
| | | | | | Ch4: 40016 (000Fh)<br>44003 (0FA2h) |

When the set value is “0: Auto”, calculation results will be output as control output, while the set value is “1: Manual”, MV set value (See MV value setting ▶▶ 4-5) will be output.

**Point**

- When the mode is switched to “1: Manual” during Auto-tuning ▶▶ 4-6, Auto-tuning will be stopped. To run Auto-tuning, switch to “0: Auto” mode.
- In Manual operation, MV set value (See MV value setting ▶▶ 4-5) will be output even if an input error occurred.
- When DI function No.2 (See DI function select ▶▶ 4-124) is assigned, Auto/Manual switch can be activated by digital input.

## RUN/Standby Switch

The setting of whether the operation mode should be RUN or Standby is performed.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| RUN/Standby switch | 0: RUN<br>1: Standby | None | 0 | R/W | Ch1: 40017 (0010h)<br>41004 (03EBh) |
| | | | | | Ch2: 40018 (0011h)<br>42004 (07D3h) |
| | | | | | Ch3: 40019 (0012h)<br>43004 (0BBBh) |
| | | | | | Ch4: 40020 (0013h)<br>44004 (0FA3h) |

Refer to Standby MV value setting ▶▶ 4-85 for setting detail of output value and alarm output in Standby operation.

**Point**

When DI function No.1 (See DI function select ▶▶ 4-124 ) is assigned, RUN/Standby switch can be activated by digital input.

**Note**

- When the mode is switched to “1: Standby” during Auto-tuning ▶▶ 4-6 , Auto-tuning will be stopped. To run Auto-tuning, switch to “0: RUN” mode.
- When Standby mode, the delay on timer will be reset. It will be activated again when the mode is switched to “0: RUN”.

## Remote/Local Switch

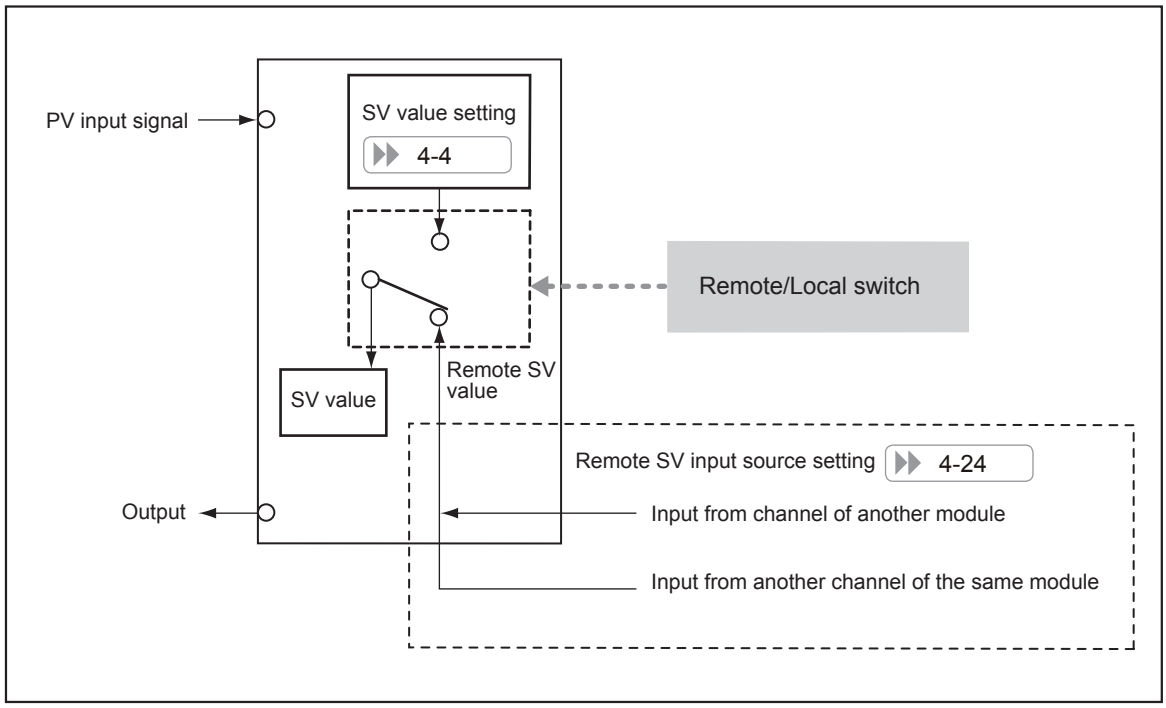
The setting of whether to use local SV value 4-4 or Remote SV value is performed.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Remote mode switch | 0: Local<br>1: Remote | None | 0 | R/W | Ch1: 40009 (0008h)<br>41007 (03EEh) |
| | | | | | Ch2: 40010 (0009h)<br>42007 (07D6h) |
| | | | | | Ch3: 40011 (000Ah)<br>43007 (0BBEh) |
| | | | | | Ch4: 40012 (000Bh)<br>44007 (0FA6h) |

When the set value is “0: Local”, local SV value (See SV value setting 4-4 ) is adopted.

When the set value is “1: Remote”, Remote SV value (See Remote SV input source setting 4-24 ) which is input from the designated channel is adopted




**Point**

When DI function No.3 (See DI function select 4-124 ) is assigned, Remote/Local switch can be activated by digital input.

## Digital Output Latch Release

The setting of whether to release digital output latch or not is performed.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Digital output latch release command | 0: OFF<br>1: Release latch | None | 0 | R/W | Ch1: 41031 (0406h) |
| | | | | | Ch2: 42031 (07EEh) |
| | | | | | Ch3: 43031 (0BD6h) |
| | | | | | Ch4: 44031 (0FBEh) |

When the set value is “1: Release latch”, digital output (DO1 to DO5) latch will be released simultaneously.

**Note**

- When DI function No.17 (See DI function select ▶▶ 4-124 ) is assigned, Digital output latch release command can be activated by digital input.
- When DI function No.18 to 22 (See DI function select ▶▶ 4-124 ) are assigned, Digital output (DO1 to DO5) latch will be released separately.

# 4.2 Input Setting

## Input Setting

Followings are settings related to PV input.

The parameters reset the main unit is necessary when change the setting are marked (RST) in each setting explanation or parameter.

**Note**

There are two types of control module, 4Ch control module and 2Ch control module. Those settings are required for each input channel.

The following setting is inevitable.

- PV input basic setting ▶▶ 4-15

The following settings are configured as needed.

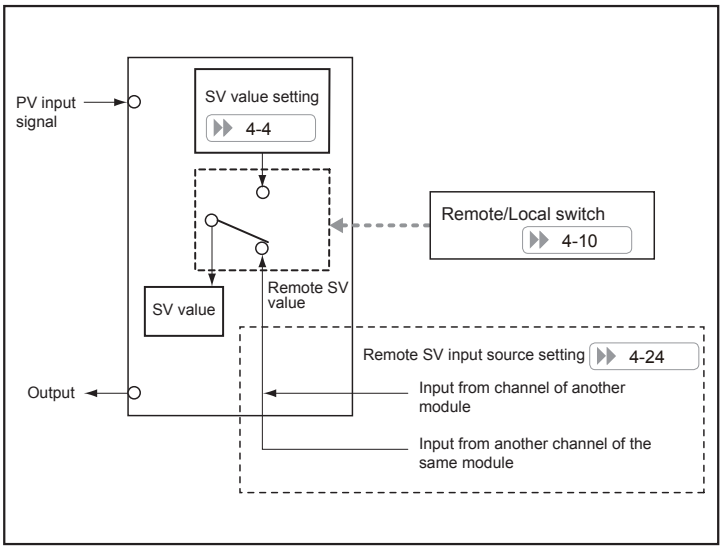
- PV input filter setting ▶▶ 4-20
- PV input shift setting ▶▶ 4-21
- PV display zero & span adjustment setting ▶▶ 4-22
- Cold junction compensation setting ▶▶ 4-23

The following settings are required when using Remote SV function.

- Remote SV input source setting ▶▶ 4-24
- Remote SV zero & span adjustment setting ▶▶ 4-26

## Point

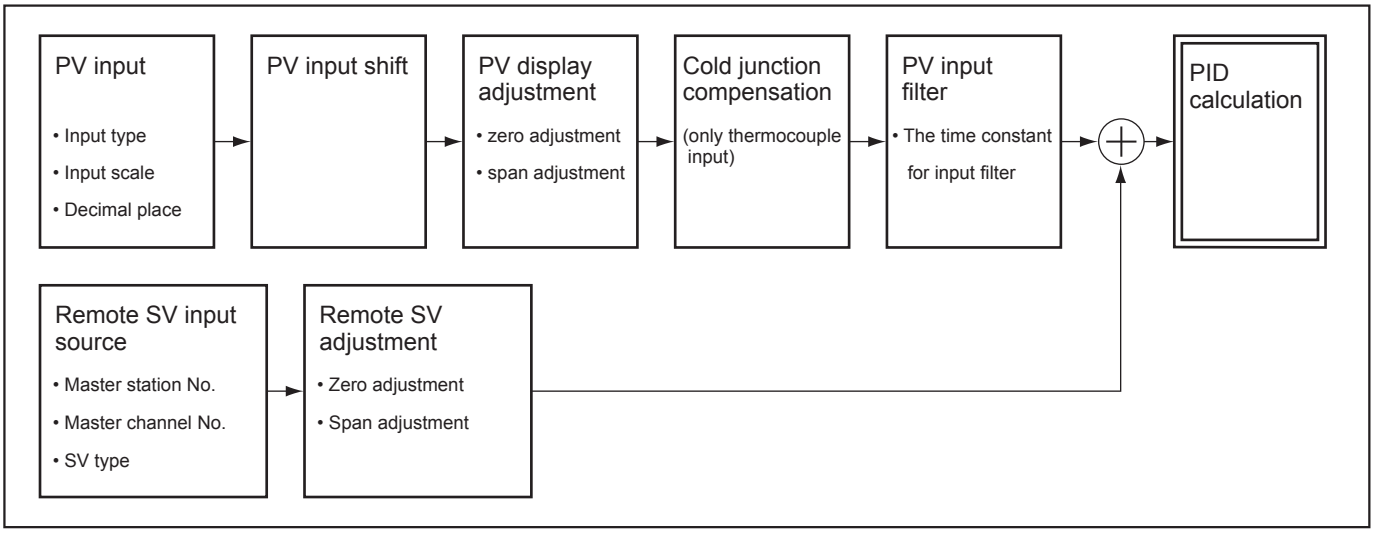
In remote SV function, PV input signal from another channel in the same module, or from channel of another module is used as SV value.




## Note

PV input setting is required separately on the channel, which is the input source, when using Remote SV function.

### Flow of input functions



## PV Input Basic Setting RST

Type of PV input signal (Resistance bulb, thermocouple, voltage) has to be set for each channel.

As the type of PV input signal is specified, parameters such as PV input scale lower, PV input scale upper, and decimal place.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Input master Ch. | 0 to 4 | N/A | 0 | R/W | Ch1: 41535 (05FEh) |
| | | | | | Ch2: 42535 (09E6h) |
| | | | | | Ch3: 43535 (0DCEh) |
| | | | | | Ch4: 44535 (11B6h) |
| Destination for inputting PV | 0: PV<br>1: MV1<br>2: PV<br>(DI changeover) | N/A | 0 | R/W | Ch1: 41539 (0602h) |
| | | | | | Ch2: 42539 (09EAh) |
| | | | | | Ch3: 43539 (0DD2h) |
| | | | | | Ch4: 44539 (11BAh) |
| PV input type | 0 to 40 | None | 7 (Thermocouple/ Resistance bulb input type) | R/W | Ch1: 40151 (0096h)<br>41029 (0404h) |
| | | | | | Ch2: 40152 (0097h)<br>42029 (07ECh) |
| | | | 22 (Voltage input type) | | Ch3: 40153 (0098h)<br>43029 (0BD4h) |
| | | | | | Ch4: 40154 (0099h)<br>44029 (0FBCh) |
| PV input scale lower | −1999 to 9999 | None | 0 (Thermocouple/ Resistance bulb input type) | R/W | Ch1: 41212 (04BBh) |
| | | | | | Ch2: 42212 (08A3h) |
| | | | 0.0 (Voltage input type) | | Ch3: 43212 (0C8Bh) |
| | | | | | Ch4: 44212 (1073h) |
| PV input scale upper | −1999 to 9999 | None | 400 (Thermocouple/ Resistance bulb input type) | R/W | Ch1: 41213 (04BCh) |
| | | | | | Ch2: 42213 (08A4h) |
| | | | 100.0 (Voltage input type) | | Ch3: 43213 (0C8Ch) |
| | | | | | Ch4: 44213 (1074h) |
| Decimal place | 0 to 2 | None | 0 (Thermocouple/ Resistance bulb input type) | R/W | Ch1: 41214 (04BDh) |
| | | | | | Ch2: 42214 (08A5h) |
| | | | 1 (Voltage input type) | | Ch3: 43214 (0C8Dh) |
| | | | | | Ch4: 44214 (1075h) |

### Input Master Ch.

Input master Ch can be selected only from the Ch. of own module.

In case input the other Ch., specify the channel number 1 to 4.

When "0" is set, own channel is selected automatically.

For example:1 is selected in accordance with channel 1, 2 is selected in accordance with channel 2, 3 is selected in accordance with channel 3, 4 is selected in accordance with channel 4

### Destination for Inputting PV

| Parameter | Function |
|---|---|
| PV | Use the own module's Ch. for inputting which has specified at input master Ch. |
| MV1 | |
| PV (DI changeover) | Use the specified Ch. at DI input for input. Note2) |

Operation when input error occurred

| Parameter | Function |
|---|---|
| PV | Input error information of the selected Ch. is set. Note1) |
| MV1 | Error information such as input under flow, input over flow, input under range and input over range will not be set. (No error) |
| PV (DI changeover) | Input error information of the selected Ch is set. Note1) |

Note1) Information of Master Ch is set as input error information of following address.

| Parameter name | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Channel 1 to 4 Error factor indication | 0 to FFFF | N/A | - | R | Ch1: 31008 (03EFh)<br>31054 (041Dh) |
| | | | | | Ch2: 32008 (07D7h)<br>32054 (0805h) |
| | | | | | Ch3: 33008 (0BBFh)<br>33054 (0BEDh) |
| | | | | | Ch4: 34008 (0FA7h)<br>34054 (0FD5h) |

Note2) Refer to the following setting value regarding PV selection of DI function

| Parameter name | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI-1 to 8 function selection | 0 to 57 | N/A | 0 | R/W | ▶▶ 4-124 |

| Setting value | Setting range | Explanation | Operation | Judgment condition |
|---|---|---|---|---|
| 56 | Input master Ch. changeover | Change the input master Ch. by DI status. | DI status:<br>00=Ch.1, 01=Ch.2,<br>10=Ch.3, 11=Ch.4 | Level |
| 57 | | | | |

Note

- When only "56" is set at DI changeover setting, only Ch1 and Ch2 are changeable by DI.
- When only "57" is set at DI changeover setting, only Ch1 and Ch3 are changeable by DI.
- When several "56" / "56" are set at selection of DI function, Large DI number will take priority.

e.g : When 56 is set at both DI1 and DI2, DI2 will take prioprity.

- When setting is changed, please turn on the power supply of the main unit again.

## Measurement range and decimal place limit according to the input type code

| Input type | | Setting code | Measurement range | | Decimal place | |
|---|---|---|---|---|---|---|
| | | | [degree C] | [degree F] | [degree C] | [degree F] |
| Resistance bulb | JPT100Ω | 0 | 0 to 150 | 32 to 302 | 1 | 1 |
| | | 1 | −150 to 600 | −238 to 1112 | 1 | 0 |
| | Pt100Ω | 2 | 0 to 150 | 32 to 302 | 1 | 1 |
| | | 3 | −150 to 300 | −238 to 572 | 1 | 1 |
| | | 4 | −150 to 850 | −238 to 1562 | 1 | 0 |
| Thermo couple | J | 5 | 0 to 400 | 32 to 752 | 1 | 1 |
| | | 6 | 0 to 800 | 32 to 1472 | 1 | 0 |
| | K | 7 | 0 to 400 | 32 to 752 | 1 | 1 |
| | | 8 | 0 to 800 | 32 to 1472 | 1 | 0 |
| | | 9 | 0 to 1200 | 32 to 2192 | 0 | 0 |
| | R | 10 | 0 to 1600 | 32 to 2912 | 0 | 0 |
| | B | 11 | 0 to 1800 | 32 to 3272 | 0 | 0 |
| | S | 12 | 0 to 1600 | 32 to 2912 | 0 | 0 |
| | T | 13 | −199 to 400 | −326 to 752 | 1 | 0 |
| | E | 14 | −199 to 800 | −326 to 1472 | 1 | 0 |
| | N | 18 | 0 to 1300 | 32 to 2372 | 0 | 0 |
| | PL-II | 19 | 0 to 1300 | 32 to 2372 | 0 | 0 |
| DC voltage | DC0-5V | 21 | −1999 to 9999 (scaling range) | | 2 | 2 |
| | DC1-5V | 22 | | | 2 | 2 |
| | DC0-10V | 23 | | | 2 | 2 |
| | DC2-10V | 24 | | | 2 | 2 |
| | DC±5V | 25 | | | 2 | 2 |
| | DC±10V | 26 | | | 2 | 2 |
| unused | - | 30 | - | - | - | - |
| Resistance bulb | Pt100 | 31 | -200 to 850 | -328 to 1562 | 0 | 0 |
| | | 32 | -200 to 800 | -328 to 1472 | 1 | 0 |
| Thermo couple | J | 35 | -200 to 850 | -328 to 1562 | 0 | 0 |
| | | 36 | -150 to 850 | -238 to 1562 | 1 | 0 |
| | | 37 | -200 to 800 | -328 to 1472 | 1 | 0 |
| | K | 38 | -200 to 850 | -328 to 1562 | 0 | 0 |
| | | 39 | -150 to 850 | -238 to 1562 | 1 | 0 |
| | | 40 | -200 to 800 | -328 to 1472 | 1 | 0 |

When the input type has been changed, the measurement range will be re-written. Meanwhile, the decimal place will remain unchanged if it is within the limit of the new input type. If it is over the limit, the upper limit of the new input type will be automatically set. If the decimal place has to be changed, change the setting of “Decimal place” to a new value.

**Note**

- When PV input type is resistance bulb or thermocouple, input range cannot be changed.
- When PV input type is voltage, make sure to set input range.
- Note that there may be a sudden change in input value at the moment input type has been changed.
- When the range of PV input scale lower and upper has been set to 10000 or over, the operation mode will switch to standby.

**Note**

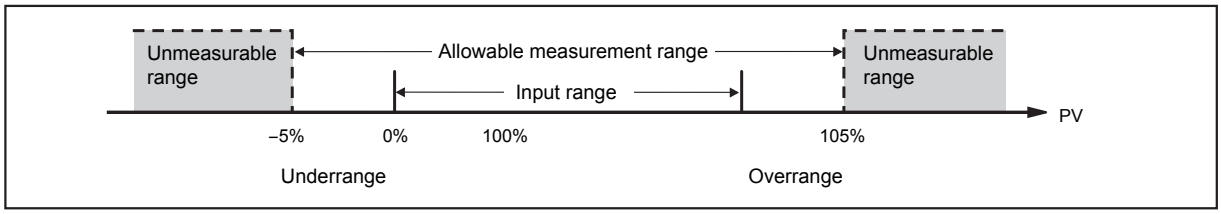
Normally, PV input signal is input as a value without decimal place. Set the decimal place if necessary within the setting limit.

Ex) Handle the value “400” as “400.0” to control values to one decimal place.

-> Set the decimal place at “1”

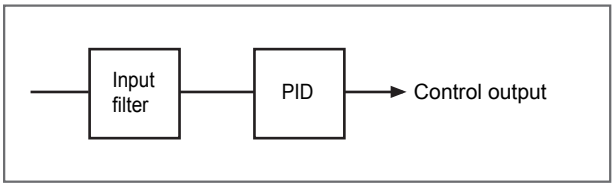
### Overrange and underrange

PV input signal also has ±5% of allowable measurement range besides the lower and upper range.



## PV Input Filter Setting

Set the input filter damping of low-pass filter, which reduces noise and signal waver.

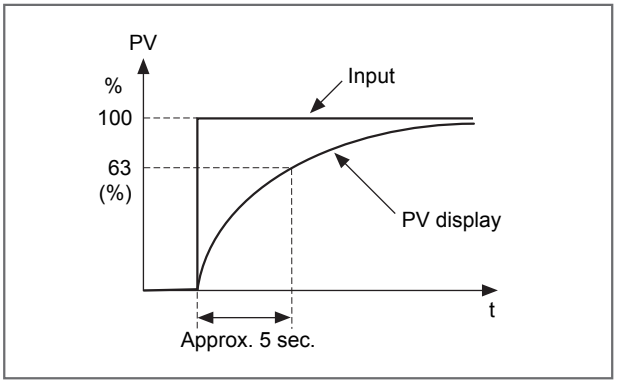



Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| PV input filter | 0.0 to 120.0 | Sec. | 2.0 | R/W | Ch1: 41220 (04C3h) |
| | | | | | Ch2: 42220 (08ABh) |
| | | | | | Ch3: 43220 (0C93h) |
| | | | | | Ch4: 44220 (107Bh) |

Set the number of seconds which PV input signal takes to change to 63.2%.

For example, when the input suddenly steps from 0% to 100% with the input filter constant set to 5 seconds, the PV value will change from 0% to 63.2% in 5 seconds in a gentle curve.



## PV Input Shift Setting

Sets the shift amount in order to adjust the PV value before it is displayed.

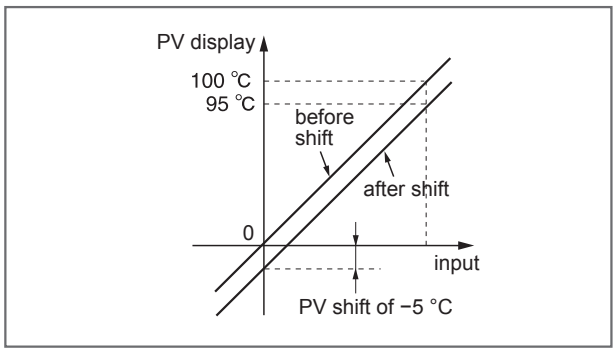
Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| PV input shift | −10 to 10 | %FS | 0 | R/W | Ch1: 41216 (04BFh) |
| | | | | | Ch2: 42216 (08A7h) |
| | | | | | Ch3: 43216 (0C8Fh) |
| | | | | | Ch4: 44216 (1077h) |

This is used when combining PV input with other instruments.

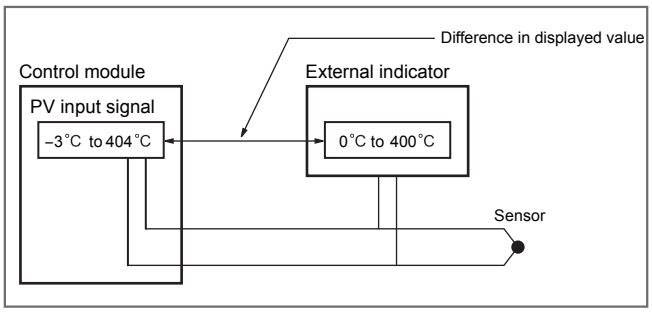
For example, to shift PV −5°C, set the value of “PV input shift” to “−5”

PV display will be the value after −5°C shift as shown in the right figure.



## PV Display Zero & Span Adjustment Setting

Sets the shift amount in order to adjust PV display zero and span. The shift amount should be the actual difference value with the opposite sign.




Each channel (Ch1 to Ch4) has parameters shown below.

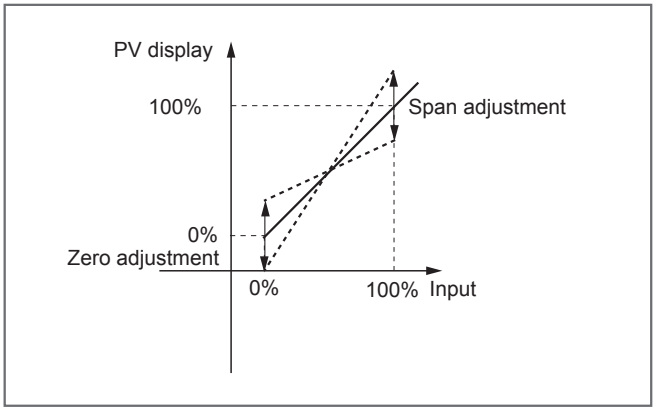
| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| PV display zero adjustment | –50 to 50 | %FS | 0 | R/W | Ch1: 41221 (04C4h) |
| | | | | | Ch2: 42221 (08ACh) |
| | | | | | Ch3: 43221 (0C94h) |
| | | | | | Ch4: 44221 (107Ch) |
| PV display span adjustment | –50 to 50 | %FS | 0 | R/W | Ch1: 41222 (04C5h) |
| | | | | | Ch2: 42222 (08ADh) |
| | | | | | Ch3: 43222 (0C95h) |
| | | | | | Ch4: 44222 (107Dh) |

Set the following equipment before using these parameters or starting revisions.

– mV Generator
  1V to 5V (for voltage input)
  0mV to 100mV (for thermocouple input)
– Dial resistance unit
  100.0 to 400.0Ω (for resistance thermometer bulb input)

Set the difference value which has been caused when 0% PV input signal is sent to “PV display zero adjustment” with the opposite sign, and the difference value caused when 100% PV input signal is sent to “PV display span adjustment” with the opposite sign.

For example, if a zero deviation is –3°C and a span deviation is 4°C, set PV display zero adjustment value to 3°C, and set PV display span adjustment value to –4°C



**Note**

In case of thermocouple input, be sure to set the cold junction compensation ▶▶ 4-23 to OFF before checking the displayed value. Remember to set it back to ON when adjustment is complete.

**Point**

PV display zero and span adjustment function is independent from the controller adjustment value. Set the value to 0 to restore the factory settings.

## Cold Junction Compensation Setting

In case of thermocouple input, decide whether to set turning cold junction compensation to ON or OFF.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Cold junction compensation | 0: OFF<br>1: ON | None | 1 | R/W | Ch1: 41223 (04C6h) |
| | | | | | Ch2: 42223 (08AEh) |
| | | | | | Ch3: 43223 (0C96h) |
| | | | | | Ch4: 44223 (107Eh) |

This setting should be “1: ON” during normal operation. Set to "0: OFF" when cold junction compensation is being performed externally, when checking temperature deviation or when cold junction compensation function is not necessary.

## Remote SV Input Source Setting RST

Set the master station No. (module) and master Ch.No. of each channel whose setting will be adopted for SV value when using Remote SV function.

Other Ch. of own module and PV / MV of other module can be used for inputting Also, When cascade loop control is conducted, select the "MV" in the type of SV.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Remote SV master station No. | 0 to 16 | N/A | 0 | R/W | Ch1: 41532 (05FBh) |
| | | | | | Ch2: 42532 (09E3h) |
| | | | | | Ch3: 43532 (0DCBh) |
| | | | | | Ch4: 44532 (11B3h) |
| Remote SV master Ch No. | 1 to 4 | N/A | each Ch | R/W | Ch1: 41533 (05FCh) |
| | | | | | Ch2: 42533 (09E4h) |
| | | | | | Ch3: 43533 (0DCCh) |
| | | | | | Ch4: 44533 (11B4h) |
| Type of SV | 0: PV<br>1: MV | N/A | 0 | R/W | Ch1: 41531 (05FAh) |
| | | | | | Ch2: 42531 (09E2h) |
| | | | | | Ch3: 43531 (0DCAh) |
| | | | | | Ch4: 44531 (11B2h) |

### Remote SV master St. and master Ch.

In case of using PV input signal of the same module as Remote SV input source, Set the master station No. to "0" or the station No. of the module "(the No. of station number setting switch at front + 1)", set the master Ch No. to "the Ch No. of the input source module".

In case of using PV input signal of other module as Remote SV input source, Set the master station No. to the station No. of the input source module "(the No. of station number setting switch at front +1)", set the master Ch NO. to "the Ch No. of the input source module"

### SV type

| Setting value | Function |
|---|---|
| 0 | PV value |
| 1 | MV value *Note |

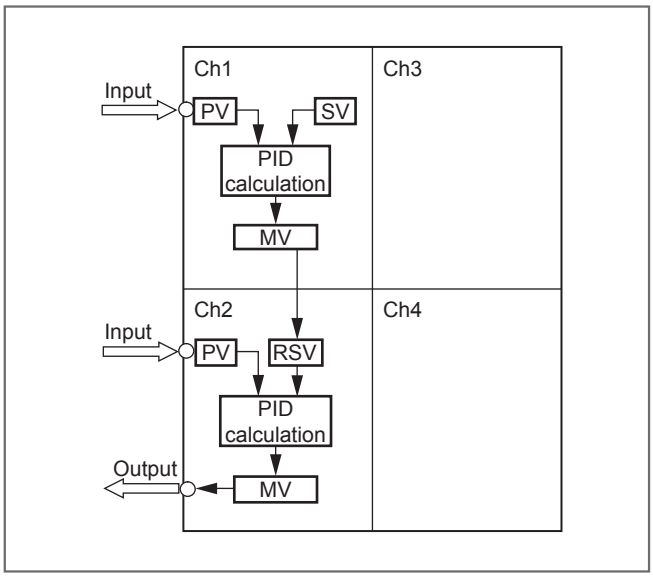
*Note) In case of own module, PID calculation result will be used as MV value.

*Note) In case of other module, The MV value (MV1 or MV2) which is set at MV transmission type will be used.

## Cascade control

Cascade control can be conducted without external wiring by selecting the MV resulting from PID calculation as remote SV.

For example Cascade control is set that Ch.1 is for Master loop. Ch.2 is for slave loop.




**Note**

- When remote SV is used, make sure to use with matching the PV scale of master loop and slave loop.
- Remote SV value is limited at the SV lower and upper limit set values. ▶▶ 4-59
- Input error detect function is not available for Remote SV input.
- Remote SV value will be always “0”, if the input source is the station and Ch No. on which the setting is being done.
- In case DI master station No., output master station No and linkage operation master station No. have been also set as well as Remote SV master station No., the red lamp of PWR LED will be illuminated (system FAULT) if none of the station numbers exist. PWR LED lamp will not be illuminated if any of the station numbers exists.
- When MV value is selected, different MV value will be used at own module or other module.
  In case of own module: MV value resulting from PID calculation is used.
  Even when dual output is set, the MV value of single output is used.
  In case of other module: MV1 (heating output) or MV2 (cooling output) which is selected at MV transmitting type setting is used.

## Remote SV Zero and Span Adjustment

Sets the shift amount to adjust the zero and span position.

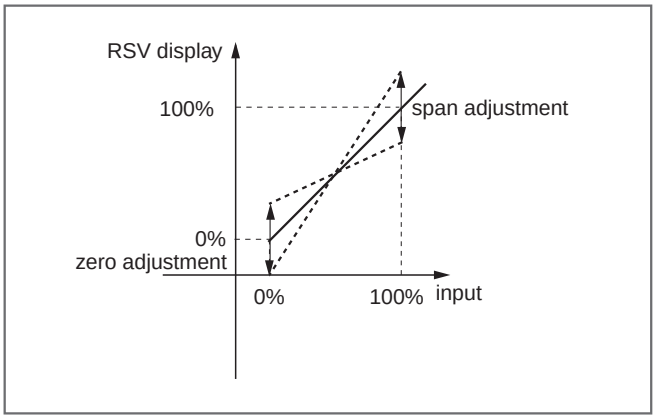
Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| RSV zero adjustment | –50 to 50 | %FS | 0 | R/W | Ch1: 41225 (04C8h) |
| | | | | | Ch2: 42225 (08B0h) |
| | | | | | Ch3: 43225 (0C98h) |
| | | | | | Ch4: 44225 (1080h) |
| RSV span adjustment | –50 to 50 | %FS | 0 | R/W | Ch1: 41226 (04C9h) |
| | | | | | Ch2: 42226 (08B1h) |
| | | | | | Ch3: 43226 (0C99h) |
| | | | | | Ch4: 44226 (1081h) |

This setting is made when further adjustment of PV input value used as Remote SV input is required.

See how the zero and span position are adjusted from Remote SV input value as shown in the right figure.

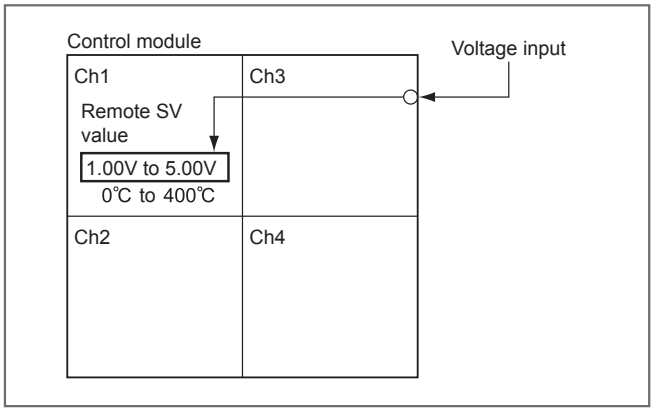
Set the shift amount of “Remote SV zero adjustment” to the value required when input is 0%. Set the shift amount of “Remote SV span adjustment” to the value required when input is 100%.




Example)

Remote SV input source : Ch 3 (input cord “22”, voltage input 1 to 5V)

Remote SV is applied to : Ch1




Before adjustment)

When Ch input is 0%, Remote SV value deviation is +5°C.

When Ch input is 100%, Remote SV value deviation is –15°C.

Adjustment procedure)

Input the following values to set the shift amount.

Ch1 RSV zero adjustment : –5

Ch1 RSV span adjustment : +15

# 4.3 Output Setting

## Output Setting

Output type differs depending on the model type being used.

The icons shown below appear beside the relative setting items.

- Relay output type, SSR drive output type…… RELAY/SSR
- Current output type …… CURRENT

Before using this module, make sure to complete necessary settings according to the model type used.

Also, parameters reset the main unit is necessary when changing the setting is marked in each setting explanation (RST).

**Note**

The output signal which different from the type being used cannot be output.

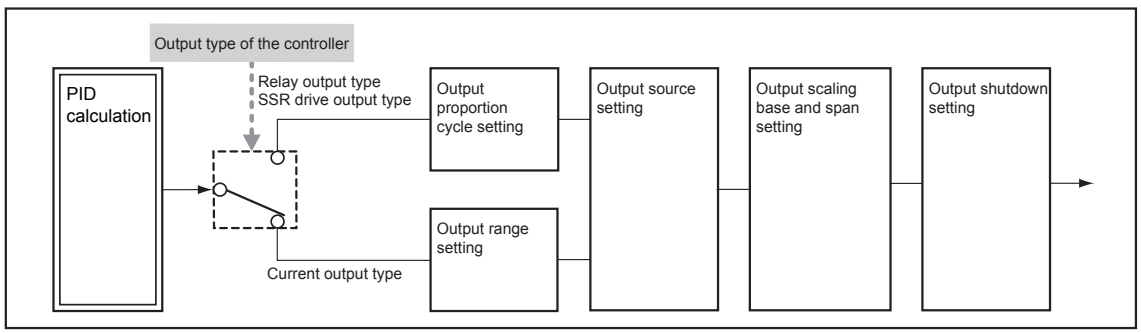
### Output setting for relay output and SSR drive output type

- Output proportion cycle setting ▶▶ 4-28
- Output source setting ▶▶ 4-30
- Output scaling base and span setting ▶▶ 4-33
- Output shutdown setting ▶▶ 4-34

### Output setting for current output type

- Current output range setting ▶▶ 4-29
- Output source setting ▶▶ 4-30
- Output scaling base and span setting ▶▶ 4-33
- Output shutdown setting ▶▶ 4-34

### Flow of output functions



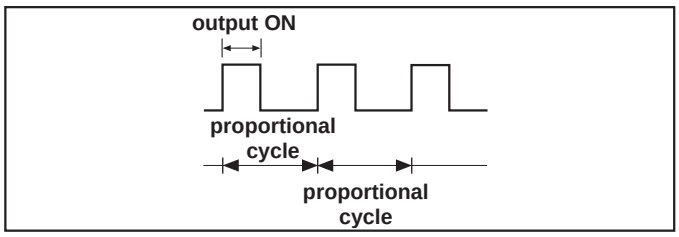
## Output Proportional Cycle Setting

RELAY/SSR

Sets the proportional cycle of Relay output and SSR drive output.

### Point

When using relay output and SSR drive output, output will switch ON/OFF at regular intervals. These intervals are called proportional cycles.




Each output channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Output proportional cycle | 1 to 120 | Sec. | 30 (Relay output type) | R/W | Ch1: 40176(00AFh) |
| | | | | | Ch2: 40182(00B5h) |
| | | | 2 (SSR drive output type) | | Ch3: 40188(00BBh) |
| | | | | | Ch4: 40194(00C1h) |

Recommended settings as shown below.

| | |
|---|---|
| Relay output | The shorter the proportional cycle, the finer the control, however shorter proportional cycles also shorten the lifespan of the contact points and operating device. Be sure to balance control and controller lifespan when adjusting the proportional cycles.<br>Approx: 30 sec. |
| SSR drive output | Because there are no mechanical parts to this controller, use a short proportional cycle if the operating device is working properly.<br>Approx: 1 sec. to 2 sec. |

### Note

- When current output is used, these settings are ignored.
- To synchronize each channel after changing output proportional setting, be sure to reset the module.

## Current Output Range Setting

CURRENT

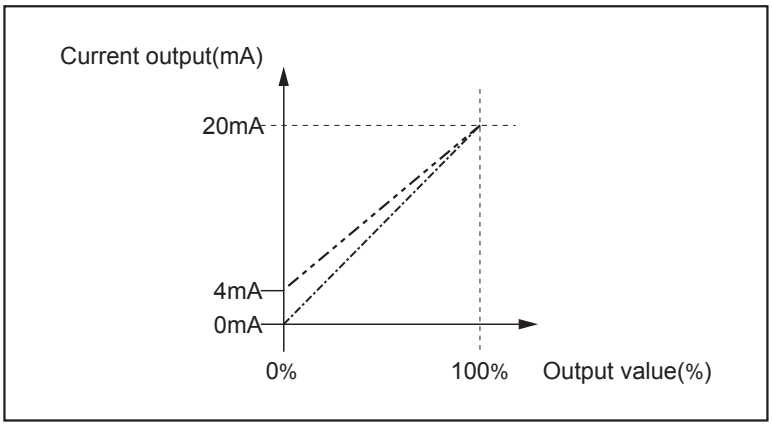
Set the output range when current output is used.

Each output channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Current output range | 4 (0 to 20mA)<br>5 (4 to 20mA) | None | 5 | R/W | Ch1: 40166 (00A5h)<br>41801 (0708h) |
| | | | | | Ch2: 40167 (00A6h)<br>42801 (0AF0h) |
| | | | | | Ch3: 40168 (00A7h)<br>43801 (0ED8h) |
| | | | | | Ch4: 40169 (00A8h)<br>44801 (12C0h) |

Current output range differs according to the set value as follows;

| Set value | 0% output | 100% output |
|---|---|---|
| 4 | 0mA | 20mA |
| 5 | 4mA | 20mA |




**Note**

When relay output or SSR drive output is used, this setting is ignored.

## Output Source Setting

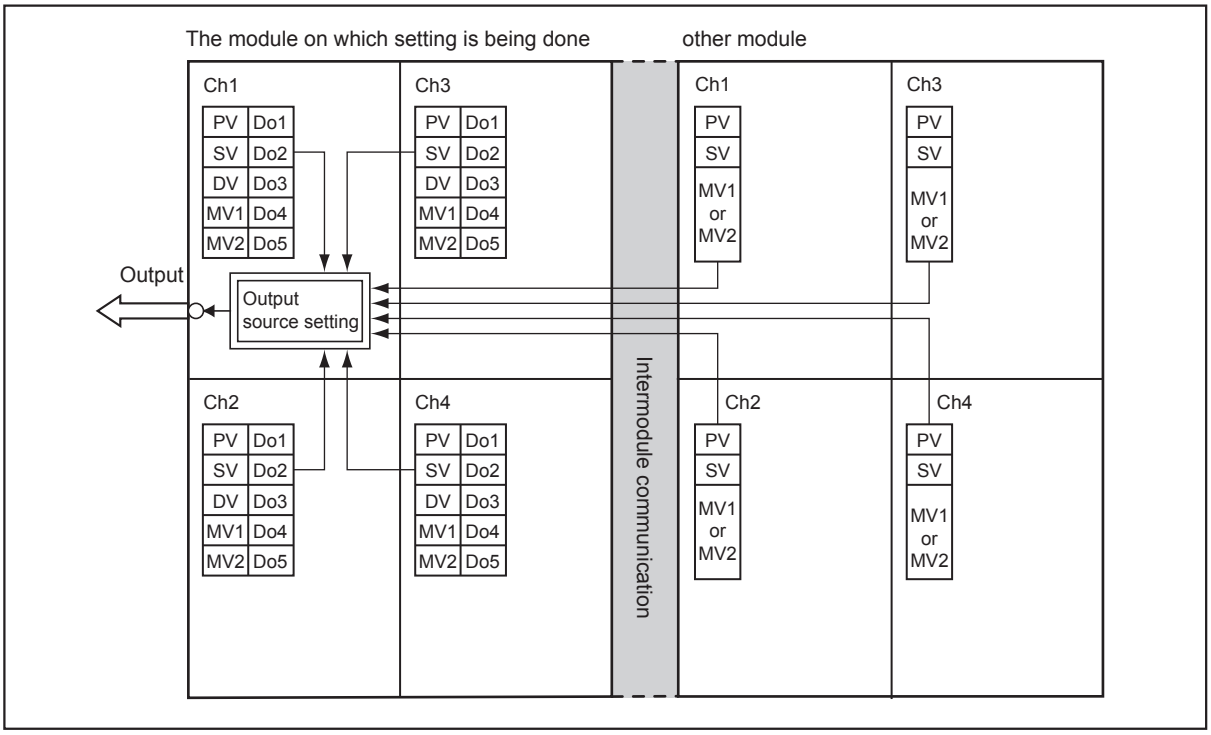
RST RELAY/SSR CURRENT

Sets the master station No., master Ch No., and output type for each output channel.

Each output channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Output masuter Station No. | 0 to 16 | None | 0 | R/W | Ch1: 40172 (00ABh)<br>41804 (070Bh) |
| | | | | | Ch2: 40178 (00B1h)<br>42804 (0AF3h) |
| | | | | | Ch3: 40184 (00B7h)<br>43804 (0EDBh) |
| | | | | | Ch4: 40190 (00BDh)<br>44804 (12C3h) |
| Output masuter Ch No. | 1 to 4 | None | 1 to 4 (Ch No. of the module being set) | R/W | Ch1: 40173 (00ACh)<br>41805 (070Ch) |
| | | | | | Ch2: 40179 (00B2h)<br>42805 (0AF4h) |
| | | | | | Ch3: 40185 (00B8h)<br>43805 (0EDCh) |
| | | | | | Ch4: 40191 (00BEh)<br>44805 (12C4h) |
| Output type | 0 to 13 | None | 3 (MV1 of the module being set) | R/W | Ch1: 40171 (00AAh)<br>41803 (070Ah) |
| | | | | | Ch2: 40177 (00B0h)<br>42803 (0AF2h) |
| | | | | | Ch3: 40183 (00B6h)<br>43803 (0EDAh) |
| | | | | | Ch4: 40189 (00BCh)<br>44803 (12C2h) |

## Image of output source setting (for output Ch1)




## Setting output master station and output master Ch

– When using values of the same module

Set the output master station No. to “0” or the station No. of the module being set. Set the output master Ch No. to the Ch No. which has the values to be used.

– When using values of another module

Set the output master station No. to the station No. (station number configuration switch No. + 1) of the output source + 1. Set the output master Ch No. to Ch No. of the output master station which has the values to be used.

## Output type setting

Types of values which can be used as output values are as shown in the following figure.

Output Ch. unused for control can output Do.

When select the no output, relay/SSR output will be fixed and current output will be fixed 0mA.

| Set value | Output values | | Relay/SSR | Current output |
|---|---|---|---|---|
| 0 | Own module | PV | × | ○ |
| 1 | | SV | × | ○ |
| 2 | | DV | × | ○ |
| 3 | | MV1 (heating output) | ○ | ○ |
| 4 | | MV2 (cooling output) | ○ | ○ |
| 5 | Other modules | PV | × | ○ |
| 6 | | SV | × | ○ |
| 7 | | MV | ○ | ○ |
| 8 | Own module | DO1 | ○ | ○ |
| 9 | | DO2 | ○ | ○ |
| 10 | | DO3 | ○ | ○ |
| 11 | | DO4 | ○ | ○ |
| 12 | | DO5 | ○ | ○ |
| 13 | - | No output | ○ (OFF) | ○ (0mA) |

**Note**

- When the value of the module on which setting is being done is selected, the setting of output master station No. will be ignored.
  The module being set will be automatically selected.
- If the module is a relay output or SSR drive output model, only MV values and DO 1 to 5 and no output (3,4,7 to 13) can be selected for the output type.
- When output the MV of other module, MV value to be set at "MV transmission type setting" of the module of output source will be output.
- DV of other module can not be outputted.
- When setting is changed, please turn on the power supply of the main unit again.
- In case remote input master station No., DI master station No. and linkage operation master station No. have been also set as well as output master station No., the red lamp of PWR LED will be illuminated (system FAULT) if none of the station numbers exist. PWR LED lamp will not be illuminated if any of the station numbers exists.

## Output Scaling Base and Span Setting

RELAY/SSR CURRENT

Sets the amount which the output scaling base and span should shift to adjust output signal.

Each output channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Output scaling base | –100.0 to 100.0 | % | 0.0 | R/W | Ch1: 40175 (00AEh)<br>41807 (070Eh) |
| | | | | | Ch2: 40181 (00B4h)<br>42807 (0AF6h) |
| | | | | | Ch3: 40187 (00BAh)<br>43807 (0EDEh) |
| | | | | | Ch4: 40193 (00C0h)<br>44807 (12C6h) |
| Output scaling span | –100.0 to 1000.0 | % | 100.0 | R/W | Ch1: 40174 (00ADh)<br>41806 (070Dh) |
| | | | | | Ch2: 40180 (00B3h)<br>42806 (0AF5h) |
| | | | | | Ch3: 40186 (00B9h)<br>43806 (0EDDh) |
| | | | | | Ch4: 40192 (00BFh)<br>44806 (12C5h) |

If the value to be output is equal to 0% or lower than the value set to the output scaling base, output will be 0%.

If the value to be output is equal to 100% or higher than the value set to the output scaling span, output will be 100%

For example, to change the output scaling from 20% to 80%, set the output scaling base to "20" and the output scaling span to “80”, 20% to 80% of values to be output will be 0% to 100% output as shown Fig.1.

If set th output scaling to "0" and output scaling span to "1000", 0 to 1000% output will be 0 to 100% output as shown Fig.2.

Fig. 1

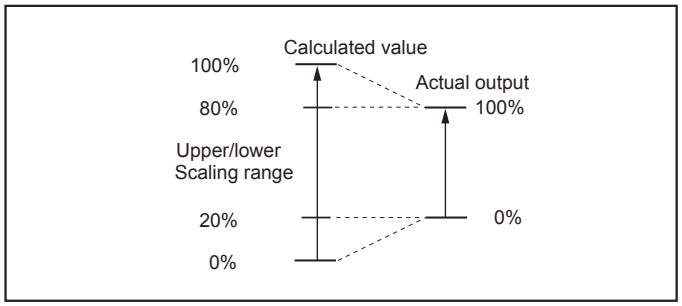
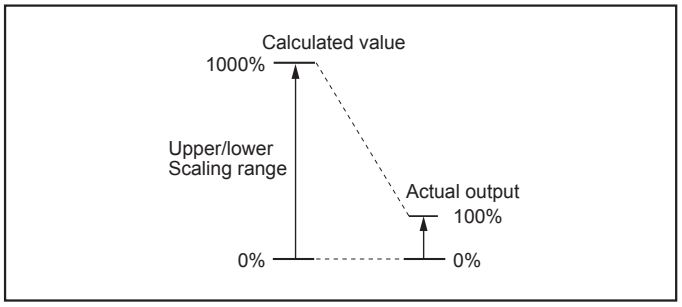



Fig. 2




**Note**

Make sure that "output scaling base" set value is smaller than "output scaling span" set value.

## Output Shutdown Setting

RELAY/SSR CURRENT

Sets the Ch No. of own station to stop output.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Output shutdown | 0 to 15 (0000 to 11111) | None | 0 (0000b) | R/W | 40201 (00C8h) |

### Output shutdown setting for each Ch

Set “1” to each bit No. corresponding to each channel to stop output.

| Set value | | | | | Ch No. to stop output | | | |
|---|---|---|---|---|---|---|---|---|
| | bit3 (Ch4) | bit2 (Ch3) | bit1 (Ch2) | bit0 (Ch1) | Ch1 | Ch2 | Ch3 | Ch4 |
| 0 | 0 | 0 | 0 | 0 | | | | |
| 1 | 0 | 0 | 0 | 1 | ○ | | | |
| 2 | 0 | 0 | 1 | 0 | | ○ | | |
| 3 | 0 | 0 | 1 | 1 | ○ | ○ | | |
| 4 | 0 | 1 | 0 | 0 | | | ○ | |
| 5 | 0 | 1 | 0 | 1 | ○ | | ○ | |
| 6 | 0 | 1 | 1 | 0 | | ○ | ○ | |
| 7 | 0 | 1 | 1 | 1 | ○ | ○ | ○ | |
| 8 | 1 | 0 | 0 | 0 | | | | ○ |
| 9 | 1 | 0 | 0 | 1 | ○ | | | ○ |
| 10 | 1 | 0 | 1 | 0 | | ○ | | ○ |
| 11 | 1 | 0 | 1 | 1 | ○ | ○ | | ○ |
| 12 | 1 | 1 | 0 | 0 | | | ○ | ○ |
| 13 | 1 | 1 | 0 | 1 | ○ | | ○ | ○ |
| 14 | 1 | 1 | 1 | 0 | | ○ | ○ | ○ |
| 15 | 1 | 1 | 1 | 1 | ○ | ○ | ○ | ○ |

**Note**

Bit numbers and Ch number are in reverse order.

**Point**

Output shutdown also can be performed by digital input from even input/output module. Refer to the section “Digital input function setting ▶▶ 4-124 ” in“4-7 Optional functions setting”.

## MV Transmission Type Setting RST

Select the MV from heating output (MV1) or cooling output (MV2) to transmit to other module.

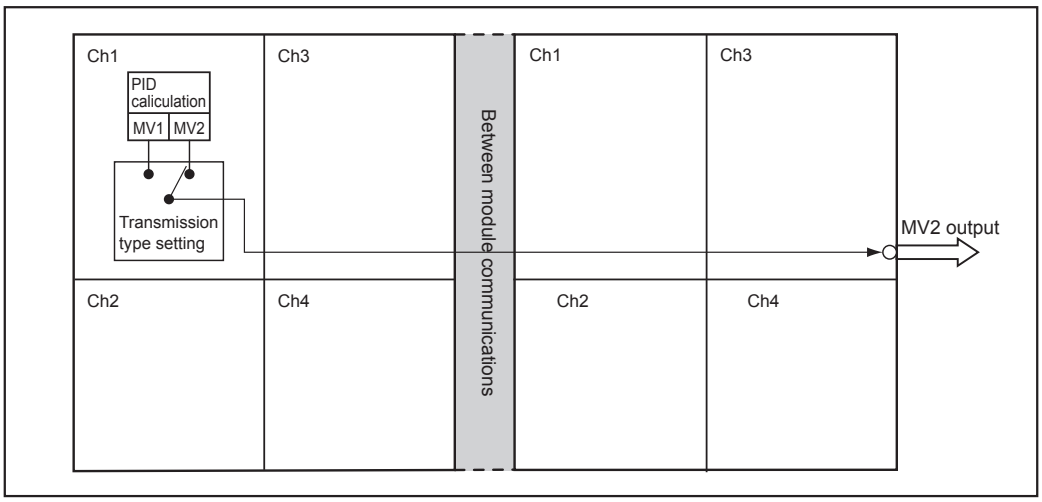
Configure the settings when dual control is conducted and cooling output (MV2) is outputted from other control module or event module.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| MV transmission type | 0: MV1<br>1: MV2 | N/A | 0 | R/W | Ch1: 40195 (00C2h)<br>41810 (0711h) |
| | | | | | Ch2: 40196 (00C3h)<br>42810 (0AF9h) |
| | | | | | Ch3: 40197 (00C4h)<br>43810 (0EE1h) |
| | | | | | Ch4: 40198 (00C5h)<br>44810 (12C9h) |

| Setting value | Function |
|---|---|
| 0 | Heating output (MV1) |
| 1 | Cooling output (MV2) |

### Example of setting (MV2 transmission)




**Note**

- The output which can be transmitted to other module is only heating output (MV1) or cooling output (MV2).
- When setting is changed, please turn on the power supply of main unit again.

**Relative parameters**

- Output source setting 4-30

# 4.4 Control Setting

## Control Setting

Control method can be selected from the following four types.

| | |
|---|---|
| ON/OFF (2 position) control | Control output switches ON and OFF according to magnitude relationship between PV and SV. Control system can be established using simple elements such as solid stay relay. Suitable where low degree of accuracy is required. |
| PID control | PID calculation and controls proceed according to the previously set PID parameters. PID parameters can be set manually or through Auto-tuning (AT). It is the most basic control in this equipment. |
| FUZZY PID control | Reduces the amount of overshoot during control. It is effective when you want to suppress overshoot while changing SV, even during processes where it may take a long time to reach the target value. |
| PID control against open-loop | Suppresses the amount of overshoot during control for processes that turn the control target off and then on again. It is effective when the control target turns on and off while power flows continuously to the temperature controller. |
| Valve control | Carry out the adjustment and control of the motorized valve position by OPEN and CLOSE connection output. |

### Control type setting

- Control algorithm select ▶▶ 4-38

### Control parameter setting

- Proportional band[P], Integration time[I], Derivative time[D] setting ▶▶ 4-43
- Anti-reset windup setting ▶▶ 4-52
- ON/OFF control hysteresis setting ▶▶ 4-53
- ON/OFF hysteresis setting ▶▶ 4-54
- Direct/reverse action setting ▶▶ 4-55
- Cooling proportional band coefficient ▶▶ 4-56
- Dead band setting ▶▶ 4-57
- Output convergence value setting ▶▶ 4-58

### Target value setting

- SV lower and upper limits setting ▶▶ 4-59
- SV Offset ▶▶ 4-60
- Ramp SV setting ▶▶ 4-82

### Output control setting

- Control output limiter type setting ▶▶ 4-83
- Standby MV setting ▶▶ 4-85
- Soft start setting ▶▶ 4-86
- Operation setting when input error occurred ▶▶ 4-87

### Operational control setting

- Start up mode setting ▶▶ 4-88

## Control Algorithm Select

Sets the control mode.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Proportional band[P] (*1) | 0.0 to 999.9<br>0.0: ON/OFF control<br>Other than 0.0:<br>varies depending on type of control algorithm | % | 5.0 | R/W | Ch1: 41102 (044Dh)<br>Ch2: 42102 (0835h)<br>Ch3: 43102 (0C1Dh)<br>Ch4: 44102 (1005h) |
| Control algorithm (*2) | 0: PID control<br>1: FUZZY PID control<br>2: PID control against open-loop | None | 0 | R/W | Ch1: 41291 (050Ah)<br>Ch2: 42291 (08F2h)<br>Ch3: 43291 (0CDAh)<br>Ch4: 44291 (10C2h) |
| Valve control | 0: PID control<br>1: SRV 1<br>2: SRV 2 | N/A | 0 | R/W | Ch1: 41312 (051Fh)<br>Ch2: 42312 (0907h)<br>CH3: 43312 (0CEFh)<br>Ch4: 44312 (10D7h) |

*1 Setting for control mode is explained here. For over all proportional band setting, refer to “Proportional band[P], Integration time[I], Derivative time[D] setting” ▶▶ 4-43

*2 This setting will be valid when Proportional band[P] has been set to values other than “0.0”.

### Valve Control

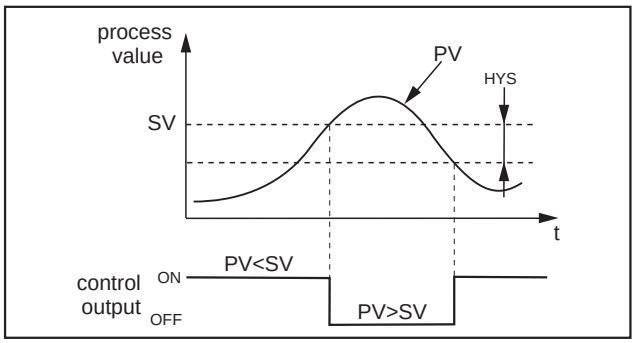
| Setting value | Operation mode | |
|---|---|---|
| 0 | PID control | • Valve control is disabled (regular PID control) |
| 1 | SRV 1 | • Controls the motorized valve opening through [OPEN], [CLOSE] connection points. |
| 2 | SRV 2 | • At the time the power supply is turned ON, valve will be closed completely and then start to control the valve (Required time of close signal output at power turned ON is defined depending on valve stroke time)<br>• Control method is as same as SRV 1. |

## ON/OFF (2 position) control

Operates when Proportional band[P] is set to 0.0. ▶▶ 4-43 ON/OFF control switches the control output to ON (100%) or OFF (0%) according to the SV/PV magnitude relationship. For setting output hysteresis, refer to “ON/OFF control hysteresis setting” ▶▶ 4-53 , and “ON/OFF hysteresis setting” ▶▶ 4-54

– Reverse Operation (Heating)

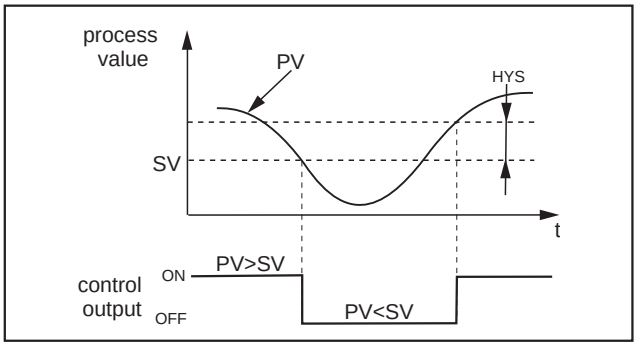
Method used to control the electrical heating furnace. As the PV input signal increases, control output decreases or turns OFF. Set the hysteresis to an appropriate value according to the control target.




| Parameter | Set value |
|---|---|
| Proportional band[P] ▶▶ 4-43 | 0.0 |
| Direct/Reverse action ▶▶ 4-55 | Heating (reverse) / Cooling (None) |
| ON/OFF control hysteresis ▶▶ 4-53 | Optional |

– Direct Operation (Cooling)

Method used to control the cooling machine. As the PV input signal increases, control output increases or turns ON. Set the hysteresis to an appropriate value according to the control target.




| Parameter | Set value |
|---|---|
| Proportional band[P] ▶▶ 4-43 | 0.0 |
| Direct/Reverse action ▶▶ 4-55 | Heating (direct) /Cooling (None) |
| ON/OFF control hysteresis ▶▶ 4-53 | Optional |

**Note**

– During ON/OFF control, Integration[I] and Derivative[D] settings do not affect control. ▶▶ 4-43

– If the hysteresis width is narrow, and PV and SV are nearly equal, the output may frequently switch ON and OFF. Note that doing so may affect the operation life of the relay contact output.

### PID control

Operates when the control algorithm is set to “0: PID control” and Proportional band[P] ≠0.0. ▶▶ 4-43 In PID control, values which have been calculated based on the set values of Proportional band[P], Integration time[I], Derivative time[D] ▶▶ 4-43, and anti-reset windup ▶▶ 4-52 are output.

**Point**

Optimal values for each parameter will be set by running Auto-tuning. ▶▶ 4-6

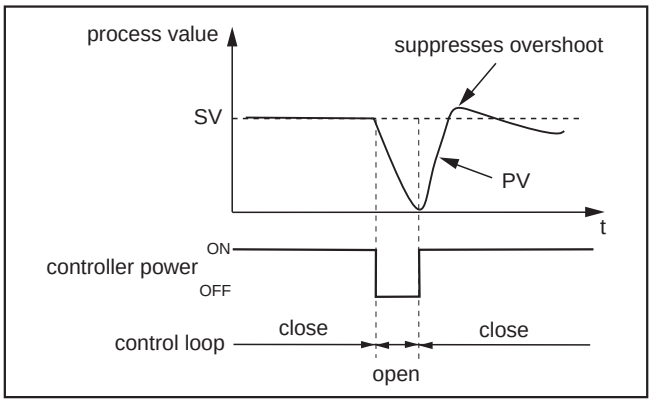
### FUZZY PID control

Operates when the control algorithm is set to “1: FUZZY PID control”. This control minimizes the overshoot compared to normal PID.

Fuzzy PID control can only be used after Auto-tuning ▶▶ 4-6 has been activated to set Proportional band[P], Integration time[I], Derivative time[D] ▶▶ 4-43, and anti-reset windup. ▶▶ 4-52

### PID control against open-loop

Operates when the control algorithm is set to “2: PID control against open-loop”. This control reduces overshoot during control for the processes that turns the controlled equipments ON, OFF, and ON again. The algorithm adopted prevents overintegration of the PID calculations even while the control loop is open.




PID control against open-loop can only be used after Auto-tuning ▶▶ 4-6 has been activated to set Proportional band[P], Integration time[I], Derivative time[D] ▶▶ 4-43, and anti-reset windup. ▶▶ 4-52

## Selection of Calculation Cycle

When the input type is power voltage, Calculation cycle (control cycle) 100msec can be used to control.

Type of the inputting corresponding to calculation cycle 100m sec is shown below table.

| Input type | | Measurement range | Unit | Code | 100msec control |
|---|---|---|---|---|---|
| Resistance bulb | JPt100Ω | 0 to 150 | [ºC] | 0 | × |
| | | -150 to 600 | [ºC] | 1 | × |
| | Pt100Ω | 0 to 150 | [ºC] | 2 | × |
| | | -150 to 300 | [ºC] | 3 | × |
| | | -150 to 850 | [ºC] | 4 | × |
| Thermocouple | J | 0 to 400 | [ºC] | 5 | × |
| | | 0 to 800 | [ºC] | 6 | × |
| | K | 0 to 400 | [ºC] | 7 | × |
| | | 0 to 800 | [ºC] | 8 | × |
| | | 0 to 1200 | [ºC] | 9 | × |
| | R | 0 to 1600 | [ºC] | 10 | × |
| | B | 0 to 1800 | [ºC] | 11 | × |
| | S | 0 to 1600 | [ºC] | 12 | × |
| | T | -199 to 400 | [ºC] | 13 | × |
| | E | -199 to 800 | [ºC] | 14 | × |
| | N | 0 to 1300 | [ºC] | 18 | × |
| | PL-Ⅱ | 0 to 1300 | [ºC] | 19 | × |
| DC voltage | DC0-5V | 0 to 5 | [V] | 21 | ○ |
| | DC1-5V | 1 to 5 | [V] | 22 | ○ |
| | DC0-10V | 0 to 10 | [V] | 23 | ○ |
| | DC2-10V | 2 to 10 | [V] | 24 | ○ |
| | DC±5V | -5 to 5 | [V] | 25 | ○ |
| | DC±10V | -10 to 10 | [V] | 26 | ○ |
| Unassign | - | - | | 30 | - |
| Resistance bulb | Pt100 | -200 to 850 | [ºC] | 31 | × |
| | | -200 to 800 | [ºC] | 32 | × |
| Thermocouple | J | -200 to 850 | [ºC] | 35 | × |
| | | -150 to 850 | [ºC] | 36 | × |
| | | -200 to 800 | [ºC] | 37 | × |
| | K | -200 to 850 | [ºC] | 38 | × |
| | | -150 to 850 | [ºC] | 39 | × |
| | | -200 to 800 | [ºC] | 40 | × |

## Specified Process Setting RST

Set the calculation cycle

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Specified process | 0: 200msec<br>1: 100msec | N/A | 0 | R/W | Ch1: 41294 (A14Eh) |
| | | | | | Ch2: 42294 (A536h) |
| | | | | | Ch3: 43294 (B4D6h) |
| | | | | | Ch4: 44294 (AD06h) |

| Setting value | Function |
|---|---|
| 200msec | Calculation cycle is 200msec |
| 100msec | Calculation cycle is 100msec only when power voltage input |

**Note**

- When calculation cycle is set to 100msec, do not set any setting other than the power voltage inputting as input type.
- When setting is changed, please turn on the power supply of the main unit again.

## Proportional Band (P), Integration Time (I), Derivative Time (D) Setting

Set the parameters for PID control. Running Auto-tuning will automatically set optimal value for each parameter. ▶▶ 4-6
Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Proportional band [P] | 0.0 to 999.9 (*1) | % | 5.0 | R/W | Ch1: 41102 (044Dh) |
| | | | | | Ch2: 42102 (0835h) |
| | | | | | Ch3: 43102 (0C1Dh) |
| | | | | | Ch4: 44102 (1005h) |
| Integration time [I] | 0 to 3200 (*2) | Sec. | 240 | R/W | Ch1: 41103 (044Eh) |
| | | | | | Ch2: 42103 (0836h) |
| | | | | | Ch3: 43103 (0C1Eh) |
| | | | | | Ch4: 44103 (1006h) |
| Derivative time [D] | 0.0 to 999.9 (*3) | Sec. | 60.0 | R/W | Ch1: 41104 (044Fh) |
| | | | | | Ch2: 42104 (0837h) |
| | | | | | Ch3: 43104 (0C1Fh) |
| | | | | | Ch4: 44104 (1007h) |

*1 Setting for PID control is explained here. For ON/OFF control action setting, refer to “Control algorithm select” ▶▶ 4-43
In case of heating/cooling control, cooling proportional band will be set.

*2 Setting “Integration time[I]” to 0 will stops integral integral control.

*3 Setting “Derivative time[D]” to 0.0 will stops derivative control.

Following control method can be selected by setting parameters.

| | |
|---|---|
| ON/OFF (2 position) control | When PID parameter P = 0.0, ON/OFF control is used, regardless of the values for I and D. Use this function when you want to add simple controls without worrying about the controllability. ▶▶ 4-43 |
| PID control | Use this function when you want to control with high controllability. Operates when P ≠ 0.0, I ≠ 0, and D ≠ 0.0, but P, I, and D must be adjusted to optimal values for the control target. In normal situations, run Auto-tuning to optimally adjust P, I, and D before using this function. See “Running auto-tuning”. ▶▶ 4-6 |
| PI control | When P ≠ 0.0, I ≠ 0, and D = 0.0, D control is turned off and PI control is used. |
| P control | When P ≠ 0.0, I = 0, and D = 0.0, I and D controls are turned off and P control is used. In principle, P control generates offset and PV does not always equal SV. In this situation, adjust the amount of offset by setting "Output convergence value". See “Output convergence value setting”. ▶▶ 4-58 |

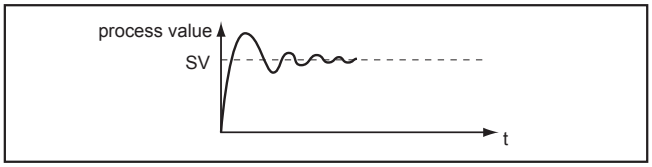
**Note**

Please do not run Auto-tuning ▶▶ 4-6 when ON/OFF (2 position) control is selected. Running Auto-tuning change Proportional band from 0.0 and ON/OFF control will not operate.

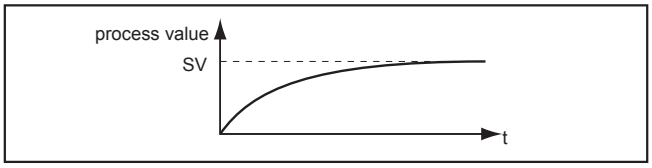
## Proportional control action

Proportional control action outputs the value proportion to the deviation between PV and SV.

When P is small, it takes less time to reach SV and to stabilize, however, hunching and overshoot may result.



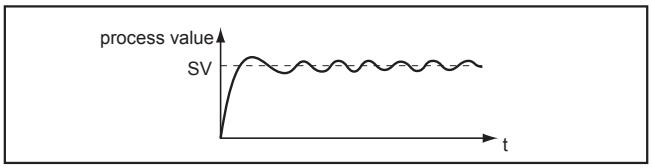

When P is big, it takes more time to reach SV and to stabilize, however, hunching and overshoot can be suppressed.



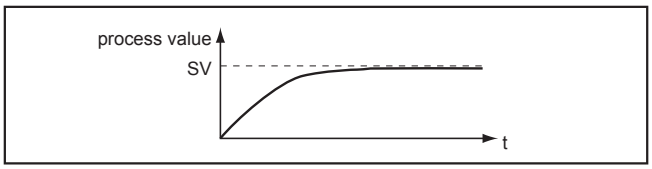

## Integral control action

Integral control action eliminates offset caused by the proportional control action.

When I is small, it takes less time to reach SV and to stabilize, however, overshoot/undershoot, and hunching may result.



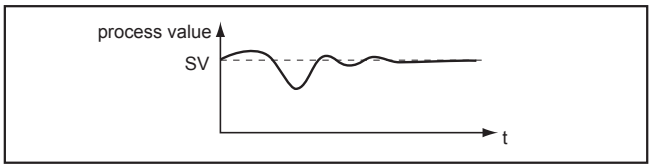

When I is big, it takes more time to reach SV and to stabilize, however, overshoot/undershot and hunching can be suppressed.



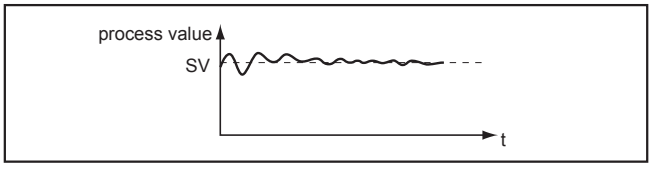

## Derivative control action

Derivative control action suppresses hunching caused by proportional control action and integral control action.

When D is small, it takes more time to reach SV and to stabilize, however, hunching can be suppressed.



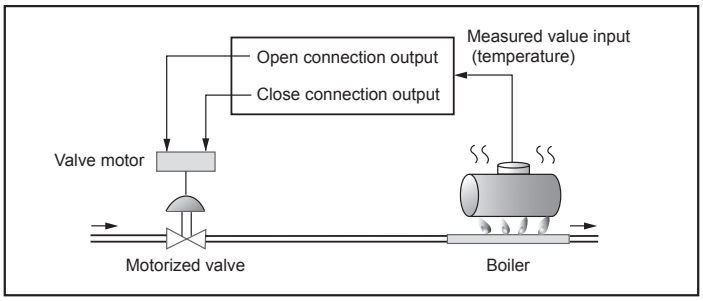

When D is big, it takes less time to reach SV and to stabilize, however, hunching may result.



# Valve Control

There are two type of valve controls that regular heating control or heating and cooling control and valve control in this unit. Select one of them depending on usage.

Valve control can carry out the adjustment and control of the motorized valve position by OPEN and CLOSE connection output.

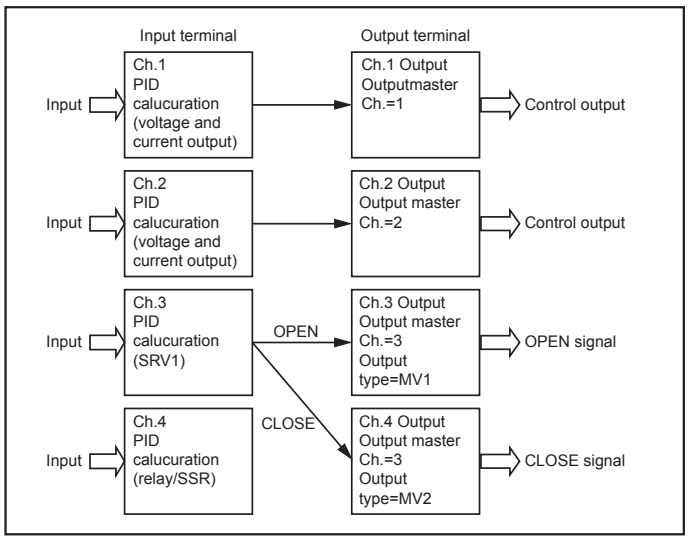



### Following parameter setting are needed prior to control the valve

- Valve control setting 4-46
- Dead band setting 4-47
- Valve stroke time 4-48
- Output setting 4-49
- Select the function of DI1 to 8 (when manual operation) 4-124

### The relationship between input and output, when valve control

Setting example: Open signal is sending from Ch3 through Ch3 of PID calculation result and CLOSE signal is sending from Ch.4 through Ch 3 of PID calculation result.




**Note**

- When select the valve control, make sure to specify the destination to which MV1 and MV2 are output.
- When the valve control is performed, OPEN signal is output from MV1, CLOSE signal is output from MV2.
- OPEN and CLOSE signal of valve control can not be output from other module.
  Output can be made only by own module.
- LED light of each ch. used for input and output of valve control does not blink red even if input error occurs.
  LED light of each Ch will be turned green when output.

## Valve Control Setting

Select the valve control type.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Valve control | 0: PID control<br>1: SRV 1<br>2: SRV 2 | N/A | 0 | R/W | Ch1: 41312 (051Fh) |
| | | | | | Ch2: 42312 (0907h) |
| | | | | | CH3: 43312 (0CEFh) |
| | | | | | Ch4: 44312 (10D7h) |

| Setting value | Operation mode |
|---|---|
| 0: PID control | • Valve control is disabled (regular PID control) |
| 1: SRV 1 | • Controls the motorized valve opening through [OPEN], [CLOSE] connection points. |
| 2: SRV 2 | • At the time the power supply is turned ON, valve will be closed completely and then start to control the valve (Required time of close signal output at power turned ON is defined depending on valve stroke time)<br>• Control method is as same as SRV1. |

**Note**

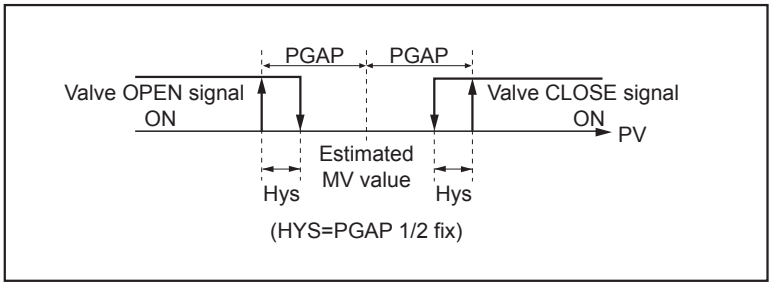
– Both of SRV 1 and SRV 2 control can not be used to control the valve opening.
This valve control is operated by using the estimated MV value.

– When dual control is conducted, be sure to set the valve control parameter to "0: PID control".
In case of valve control, both single and dual control can not be operated.

## Dead Band Setting

Set up the dead band which never output the neither OPEN nor CLOSE signal.

A dead band for valve operation prevents the valve from hunting, thereby improving the output stability.




Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Dead band | 0.0 to 100.0 | % | 50.0 | R/W | Ch1: 41295 (050Eh) |
| | | | | | Ch2: 42295 (08F6h) |
| | | | | | Ch3: 43295 (0CDEh) |
| | | | | | Ch4: 44295 (10C6h) |

**Note**

- Selecting a smaller dead band will make the valve movement more frequent, thereby making its life shorter. Select an appropriate value according to a control result.
- Hysteresis of valve OPEN/CLOSE signal is fixed at half of dead band

## Valve stroke time setting

Set the valve full stroke time to conduct the valve control.

Be sure to set the full stroke time accurately from fully closing to opening of the motorized valve.

Please refer to the motorized valve maker's catalog for the correct stroke time.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Valve stroke time | 5 to180 | sec | 5.0 | R/W | Ch1: 41296 (050Fh) |
| | | | | | Ch2: 42296 (08F7h) |
| | | | | | Ch3: 43296 (0CDFh) |
| | | | | | Ch4: 44296 (10C7h) |

**Note**

In case the setting value of valve stroke time is different from the full stroke time of motorized valve in current use, Control can not be performed accurately.

# Output Setting

Specify the Ch. to output the OPEN/CLOSE signal for valve control

### Output Master St.

Only output from own module is available for valve control

Be sure to set output master St. to "0"

- Output master St. ▶▶ 4-30

### Output Master Ch.

Specify the Ch. to output in own module

When valve control is conducted, use the outputs of two channels for OPEN/CLOSE signal.

- Output master Ch. ▶▶ 4-30

### Output Type

Specify the OPEN/CLOSE signal

OPEN signal =MV 1, CLOSE signal =MV 2

- Output type ▶▶ 4-30

**Note**

When valve control is selected, be sure to specify to which MV 1 and MV 2 are output.

## Manual Setting

Motorized valve can be operated manually by connecting the event input/output module.

When "54: OPEN" is selected at DI1-8 function selection, OPEN signal is output by DI turned ON if control mode is set to manual operation.

When "55: CLOSE" is selected at DI1-8 function selection, CLOSE signal is output by DI turned ON if control mode is set to manual operation.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI-1 function selection to DI-8 function selection | 54: OPEN<br>55: CLOSE | N/A | 0 | R/W | ▶▶ 4-124 |

- Setting of digital input function ▶▶ 4-124

**Note**

- When valve control parameter is set to "SRV2", manual operation can not be performed during CLOSE signal outputting at start up.
- Both OPEN and CLOSE of DI are turned ON, OPEN and CLOSE signals will not be output.
- If MV value is changed during manual operation mode, OPEN and CLOSE signals will not be output.

# Monitor Function

Output status can be monitored when valve control is performed.

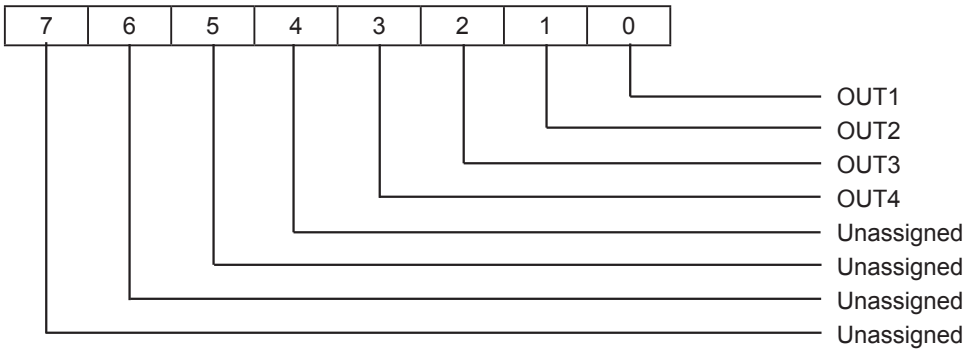
There are two type of parameters, one indicates each OUT1 to 4 status individually, the another indicates all status with bit unit.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| PWM Output status monitor (ALL) | 0 to 15 | N/A | - | R | 30066 (0041h) |
| PWM Output status monitor (each Ch) | 0: OFF<br>1: ON | N/A | - | R | Ch1: 31906 (0771h) |
| | | | | | Ch2: 32906 (0B59h) |
| | | | | | Ch3: 33906 (0F41h) |
| | | | | | Ch4: 34906 (1329h) |
| Estimated MV value | 0.0 to 100.0% | N/A | - | R | Ch1: 30391 (03A2h)<br>31907 (0772h) |
| | | | | | Ch2: 30392 (03A3h)<br>32907 (0B5Ah) |
| | | | | | Ch3: 30393 (03A4h)<br>33907 (0F42h) |
| | | | | | Ch4: 30394 (03A5h)<br>34907 (132Ah) |

### PWM Output Status Monitor (all)

In case the output type is relay /SSR, ON/OFF status of all Ch. can be monitored.

BIT3 to BIT0 is corresponding to OUT4 to OUT1.




### PWM Output Status Monitor (each Ch.)

In case output type is Relay /SSR, ON/OFF can be monitored.

### Estimated MV value indication

Indicate the estimated valve position for valve control.

**Note**

– Estimated MV indication is calculated by valve stroke time and OPEN/CLOSE output time.
Estimated valve position may be different from the actual valve position.

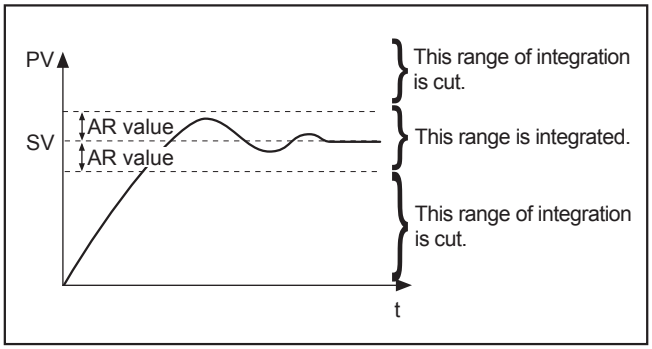
## Anti-reset Windup Setting

Anti-reset windup is a function that limits the range of valid integration. Running Auto-tuning will automatically set the optimal value. 4-6

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Anti-reset windup | 0 to 100 | %FS | 100 | R/W | Ch1: 41109 (0454h) |
| | | | | | Ch2: 42109 (083Ch) |
| | | | | | Ch3: 43109 (0C24h) |
| | | | | | Ch4: 44109 (100Ch) |

By limiting the range of valid integration, it suppresses overshoot resulted from excessive integral control action.




**Point**

This module implements fuzzy control. If “FUZZY PID control” is selected 4-37, overshoot can be minimized without using anti-reset windup function.

# ON/OFF Control Hysteresis Setting

Sets the hysteresis for control output during ON/OFF (2 position) control.

When heating/cooling control is selected and both heating and cooling outputs have been set to ON/OFF actions (3 positions control), hysteresis will be set to heating(reverse) output. 4-55

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| ON/OFF control hysteresis | 0.0 to 50.0 | %FS | 0.25 (*1) | R/W | Ch1: 41105 (0450h) |
| | | | | | Ch2: 42105 (0838h) |
| | | | | | Ch3: 43105 (0C20h) |
| | | | | | Ch4: 44105 (1008h) |

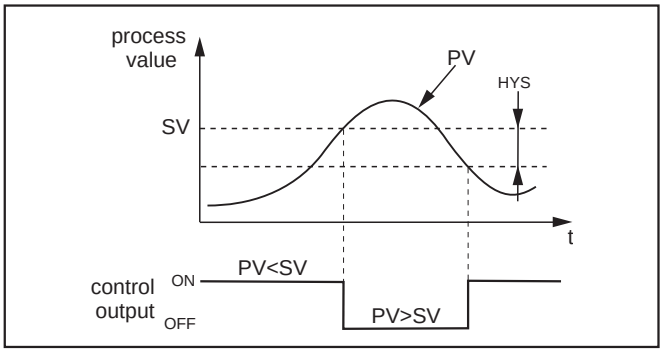
*1 If the input type is 7 (K: 0 to 400 degrees C), the value is 1°C. 4-15

### Controllability depending on the size of the hysteresis

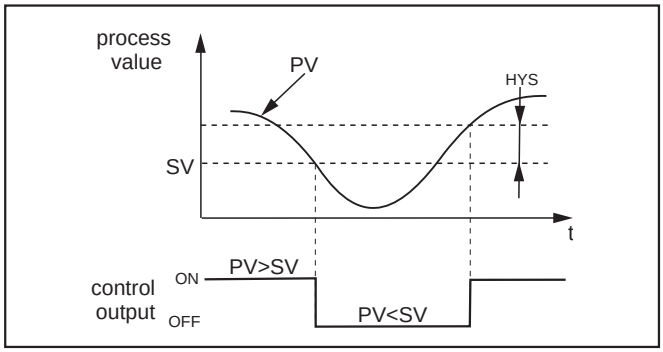
| | |
|---|---|
| Small hysteresis | • High-precision control<br>• Frequency of output relays is high, so lifespan is short |
| Large hysteresis | • Low-precision control<br>• Frequency of output relays is low, so lifespan is long |

The relationship between SV and hysteresis in direct and reverse actions is shown below.

– Reverse action




– Direct action




**Note**

If the hysteresis width is narrow, and PV and SV are nearly equal, the output may frequently switch ON and OFF. Note that doing so may affect the operation life of the contact output.

Action of hysteresis which has been set is specified on “Hysteresis action setting”. 4-54

## ON/OFF Hysteresis Setting

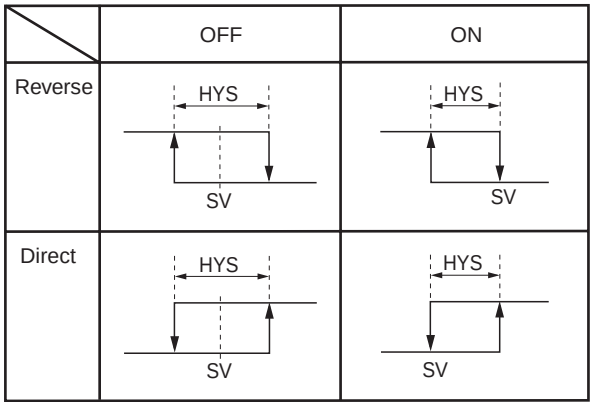
Specifies the hysteresis mode during ON/OFF (2 position) control.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| ON/OFF hysteresis setting | 0: OFF<br>1: ON | None | 1 (ON) | R/W | Ch1: 41292 (045Bh) |
| | | | | | Ch2: 42292 (08F3h) |
| | | | | | Ch3: 43292 (0CDBh) |
| | | | | | Ch4: 44292 (10C3h) |

OFF: Performs two position control at SV+HYS/2 and SV-HYS/2.

ON: Performs two position control at SV, SV+HYS and SV, SVHYS.




Also refer to “ON/OFF control hysteresis setting” ▶▶ 4-53

# Direct/Reverse Action Setting

Specifies whether the control operation is direct or reverse, single or dual (heating/cooling).

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Direct/Reverse setting [MV1/MV2] | 0 to 5 | None | 0 | R/W | Ch1: 41110 (0455h) |
| | | | | | Ch2: 42110 (083Dh) |
| | | | | | Ch3: 43110 (0C25h) |
| | | | | | Ch4: 44110 (100Dh) |

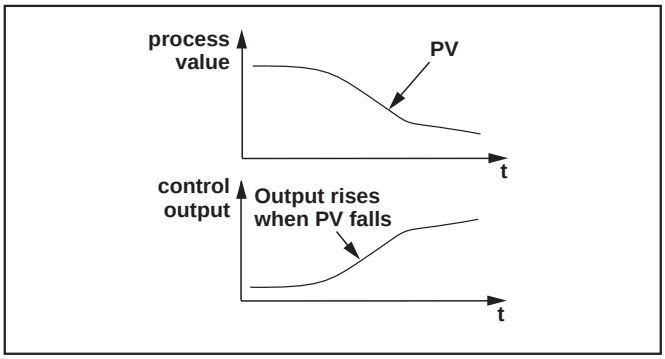
### Direct/Reverse set values

Refer to the table below specifying the set value.

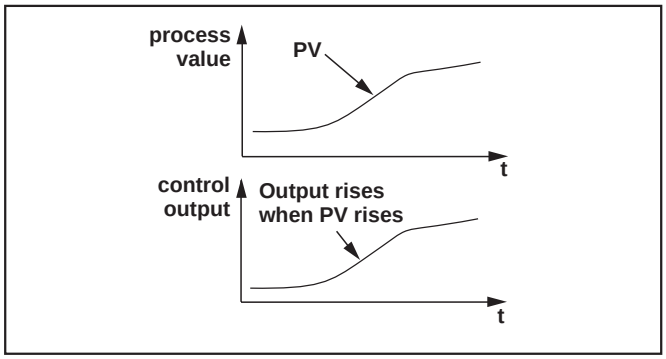
| Set value | Operation mode | MV1(heat output) | MV2 (cool output) |
|---|---|---|---|
| 0 | Single control | Reverse | None |
| 1 | | Direct | None |
| 2 | Dual control (heating/cooling control) | Reverse | Direct |
| 3 | | Direct | Reverse |
| 4 | | Reverse | Reverse |
| 5 | | Direct | Direct |

In most heating/cooling control, control is done with MV1 (heating) in reverse action and MV2 (cooling) in direct action.

– Reverse action




– Direct action




**Note**

– To perform heating/cooling control operation, be sure to set the output convergence value to 50%. 4-58

– When using heating/cooling operation in heating/cooling control, cool output always outputs from MV2.

# Cooling Proportional Band Coefficient Setting

Sets Cooling proportional band coefficient.

**Note**

This setting is valid when heating/cooling control are set. ▶▶ 4-55

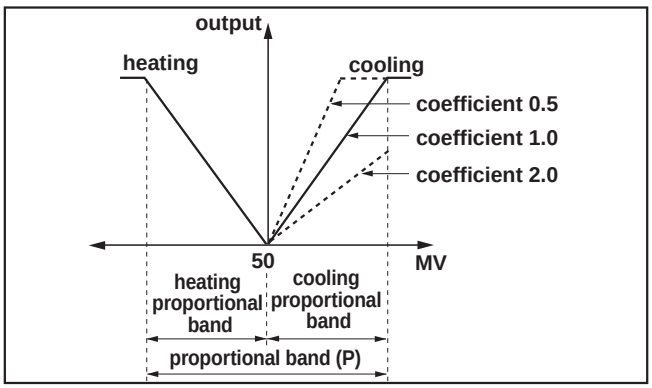
Cooling proportional band is set after the optimal value for Heating proportional band ▶▶ 4-43 is set.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Cooling proportional band [cool] | 0.0 to 100.0 | None | 1.0 | R/W | Ch1: 41106 (0451h) |
| | | | | | Ch2: 42106 (0839h) |
| | | | | | Ch3: 43106 (0C21h) |
| | | | | | Ch4: 44106 (1009h) |

The relationship between heating control output and cooling control output is outlined below.

Specify the cooling proportional band when the same coefficient cannot control heating and cooling equally because of the characteristic difference. Set the value so that the heating and cooling output will be balanced.




Cooling proportional band can be calculated using the formula below.

Cooling proportional band = (Heating proportional band/2) x Cooling proportional band coefficient

For example,

What is the coefficient that will give a cooling proportional band of 10% when heating proportional band = 50% with full scale.

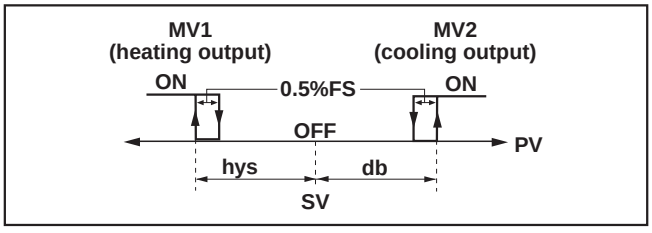
10%FS = (50%/2) x Cooling proportional band coefficient

Therefore,

Cooling proportional band coefficient = 10%FS / (50% / 2) = 0.4%FS

To use cooling in ON/OFF (2 position) control, set Cooling proportional band coefficient to “0.0”. With heating/cooling control is selected ▶▶ 4-55, set both Heating proportional band and Cooling proportional band coefficient to “0.0”, and both heating and cooling will be set to ON/OFF actions control (3 positions including dead band and hysteresis). In this situation, ON/OFF control hysteresis is set to 0.5% FS (fixed) for heating and cooling outputs.

The point of operation for the heating output can be shifted with ON/OFF control hysteresis setting. ▶▶ 4-53
The point of operation for the cooling output can be shifted with Dead band setting. ▶▶ 4-57



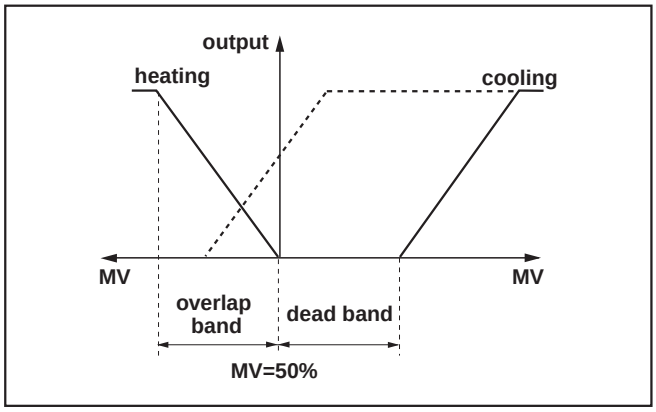
## Dead Band Setting

Sets the overlap band or dead band (both outputs OFF) during heating/cooling control.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Dead band | –50.0 to 50.0 | % | 0 | R/W | Ch1: 41107 (0452h) |
| | | | | | Ch2: 42107 (083Ah) |
| | | | | | Ch3: 43107 (0C22h) |
| | | | | | Ch4: 44107 (100Ah) |

Cooling proportional band shifts with the setting value as shown below.




It is called Dead band when the value is positive and Overlap band when the value is negative.

Dead band and Overlap band are measured as a percentage of MV and can be converted to a percentage variation by the following formula.

Dead band [%] = deviation x 100/Proportional band [%]

Example: Proportional Band (P) = 5.0%, with a desired dead band of 1.0%FS deviation from SV:

Dead band [%] = 1.0 x 100/5.0 [%] = 20 [%]

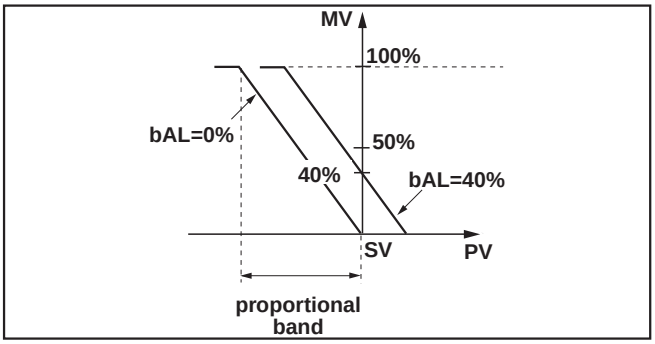
## Output Convergence Value Setting

Sets the amount of offset added to MV value.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Output convergence value | −100.0 to 100.0 | % | 0 | R/W | Ch1: 41108 (0453h) |
| | | | | | Ch2: 42108 (083Bh) |
| | | | | | Ch3: 43108 (0C23h) |
| | | | | | Ch4: 44108 (100Bh) |

The output convergence value function outputs to PV and SV a calculated result of the PID computed MV plus the offset.




Note

When heating/cooling control is selected, make sure to set the output convergence value to 50%. 4-55

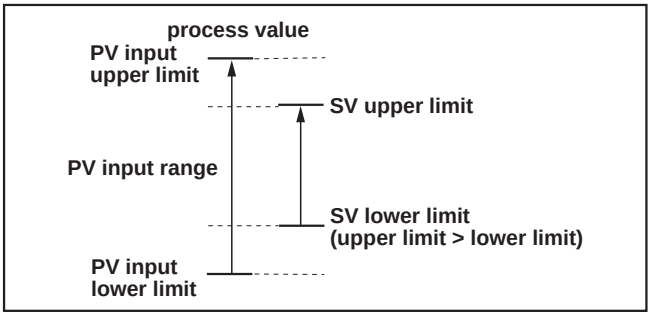
## SV Lower and Upper Limits Setting

These settings specify the range to which SV can be set. SV can be set to any value in the measurement range. 4-15

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| SV lower limit | 0 to 100 | %FS | 0 | R/W | Ch1: 41218 (04C1h) |
| | | | | | Ch2: 42218 (08A9h) |
| | | | | | Ch3: 43218 (0C91h) |
| | | | | | Ch4: 44218 (1079h) |
| SV upper limit | 0 to 100 | %FS | 100 | R/W | Ch1: 41219 (04C2h) |
| | | | | | Ch2: 42219 (08AAh) |
| | | | | | Ch3: 43219 (0C92h) |
| | | | | | Ch4: 44219 (107Ah) |

The relationship between SV limits and the measurement range is as shown below.




**Note**

- If SV changed when setting the SV lower/upper limit, the value changed is stored.
- Set the lower and upper SV limits only after completing PV input scale lower and upper settings (See “PV input basic settings” 4-15 )
- SV 4-4 which have been set before setting the SV lower and upper limits are affected by new SV limits.
- Make sure to set the value of SV upper limit greater than SV lower limit.

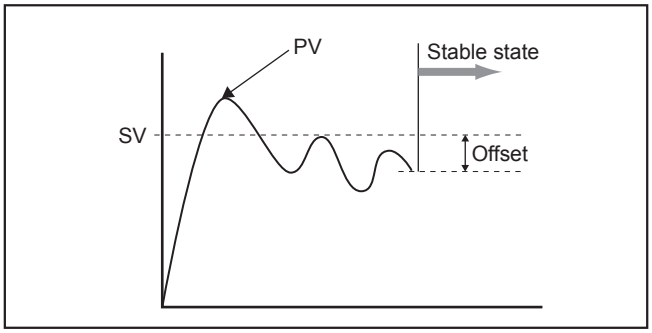
## SV Offset

Sets the amount of offset added to SV value.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| SV value shift | –10 to 10 | %FS | 0 | R/W | Ch1: 41217 (0453h) |
| | | | | | Ch2: 42217 (083Bh) |
| | | | | | Ch3: 43217 (0C23h) |
| | | | | | Ch4: 44217 (100Bh) |

This function is used to eliminate remaining offset when using P control. The value set is applied to the SV used for PID calculation.




**Note**

- Controls act on the calculated SV with SV offset added.
- Alarm determination acts on SV without SV offset.
- SV value which are displayed on a monitor are values without SV offset. ▶▶ 4-4

# Ramp/Soak

This function automatically runs after setting SV and the times for the SV changes.

Each channel has each ramp soak parameter and each channel can be operated individually.

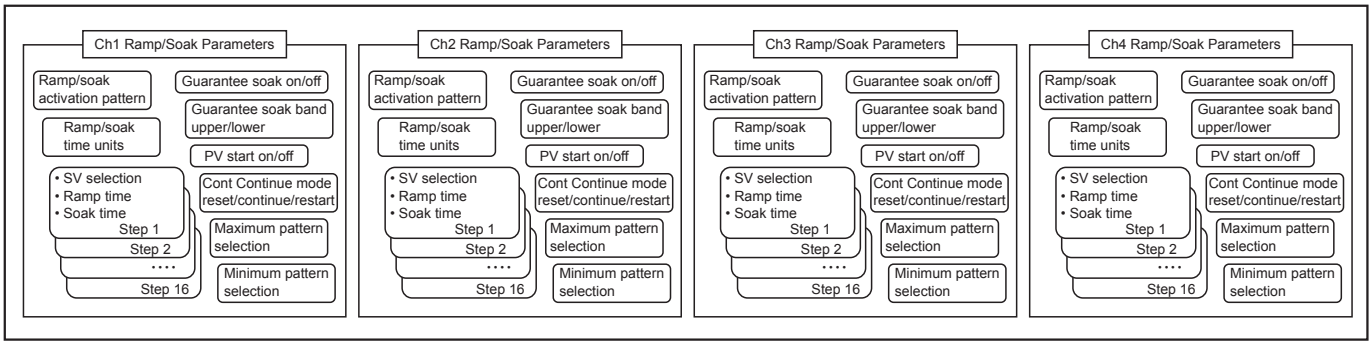
The Ramp/soak function can be executed in the pattern of 64STEP or less by matching STEP setting for 4 Ch.

- Ramp: Changing SV tends to reach a target SV
- Soak: Maintain a set SV

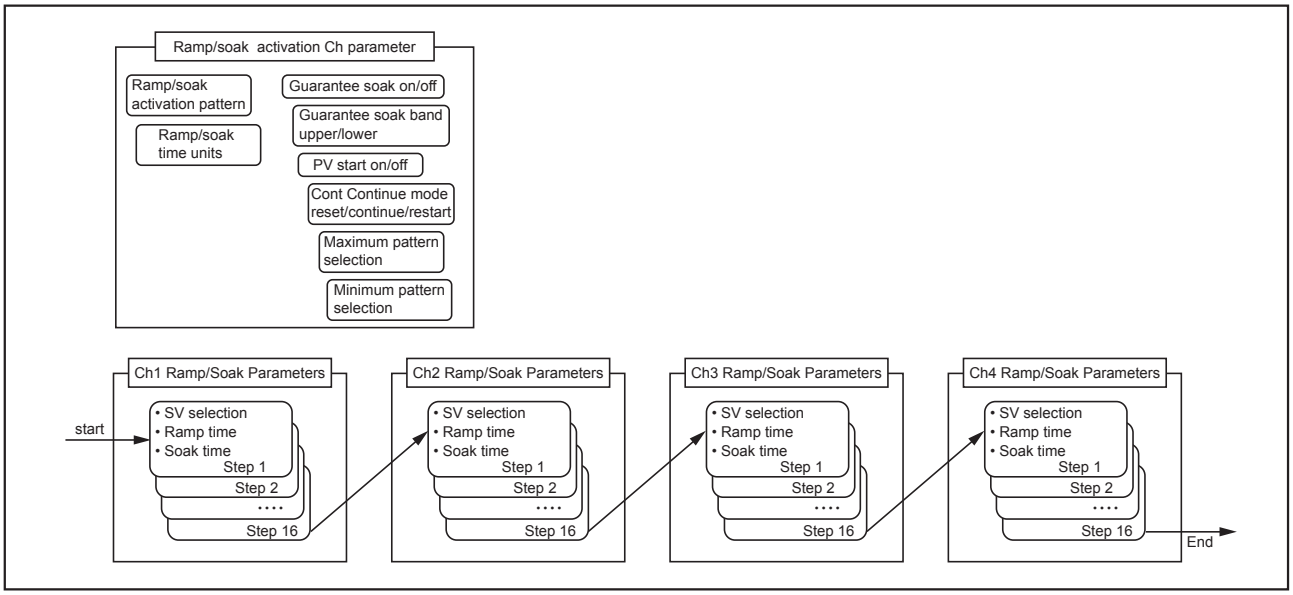
The ramp/soak menu (ch4) consists of the following function blocks.

Please refer to the "Ramp/soak pattern" for detailed explanation of "normal pattern" "special pattern" "64STEP pattern "

- Normal pattern / special pattern




- 64-STEP pattern



Make sure to set the following parameter prior to execute the Ramp/Soak.

- Ramp/Soak Command 4-63
- Pattern Arrangement 4-64
- Ramp/Soak Activation Pattern 4-66
- Ramp/Soak Time Unit 4-68
- Ramp/Soak SV Select (step1) to (step16) 4-69
- Ramp Time (step1) to (step16) 4-69
- Soak Time (step1) to (step16) 4-69
- Guaranteed Soak 4-73
- PV Start 4-75
- Continue mode 4-76

**Note**

– When Ramp/Soak is activated, function of Ramp SV 4-82 can not be performed.
– When 64-STEP pattern is used, PV scale of all the Ch. should be matching each other.

## Ramp/Soak Command

Execute the Ramp/Soak command.

Status of Ramp/Soak command is also displayed.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak command | 0: OFF<br>1: RUN<br>2: HOLD | N/A | 0 | R/W | Ch1: 41006 (A0E2h) |
| | | | | | Ch2: 42006 (A416h) |
| | | | | | Ch3: 43006 (A7FEh) |
| | | | | | Ch4: 44006 (ABE6h) |

Ramp/Soak command can be operated by means of setting the following three conditions.

| Setting value | Operation status | Function |
|---|---|---|
| 0 | OFF | The ramp/soak is stopped. |
| 1 | RUN | The ramp/soak starts. |
| 2 | HOLD | The ramp/soak holds. To release the hold, select "RUN" again. |

The parameter information is also changed automatically depending on the ramp/soak status.

| Setting value | Operation status | Function |
|---|---|---|
| 3 | End | This is indicated when Ramp/soak ends. Note1) |
| 4 | GS | This is indicated when guaranteed soak is on. Note1) |

Note1) These setting value can not be set externally.

Do not change the parameter while these status is indicated.

**Note**

- When you change parameter, make sure to set the Ramp/ Soak command to "0".
- When Continue Mode is set to "1: Con", Do not set "HOLD" frequently more than 10times/per hour.

## Pattern arrangement

Select the Ramp/Soak pattern arrangement.

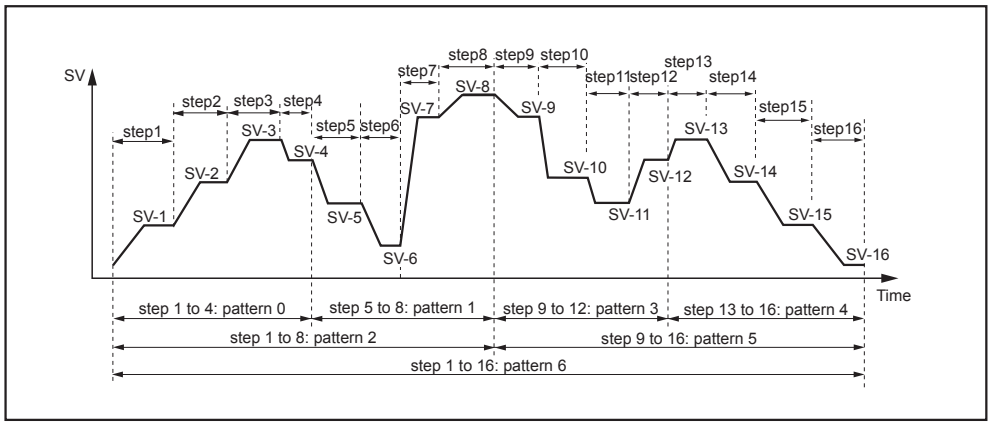
Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Pattern arrangement | 0: Normal pattern<br>1: Special pattern<br>2: 64 STEP | N/A | 0 | R/W | Ch1: 41408 (A1C0h) |
| | | | | | Ch2: 42408 (A5A8h) |
| | | | | | CH3: 43408 (A990h) |
| | | | | | Ch4: 44408 (AD78h) |

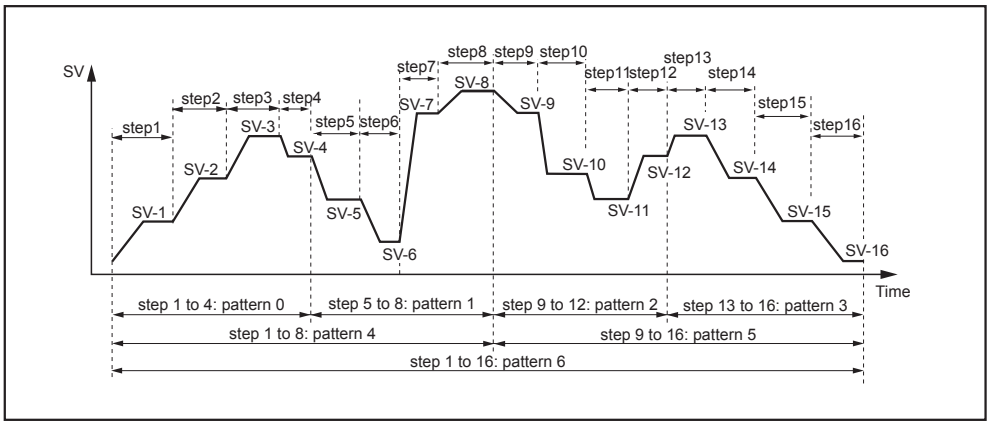
Select the setting value according to following table.

| Setting value | Pattern |
|---|---|
| Normal pattern | The number of execution steps specified by the Ramp/Sork execution pattern is made a standard selection item. The number of maximum steps becomes 16 steps. |
| Special pattern | The selection items of the number of execution steps specified by the Ramp/Soak execution pattern are made a different combination from "Normal pattern". The number of maximum steps becomes 16 steps. The execution pattern which can be selected is as same as "Normal pattern". |
| 64STEP | Activation pattern of 64 steps or less can be set by using the parameter of Ch1 to Ch4 in the Ramp/Soak Activation Pattern. |

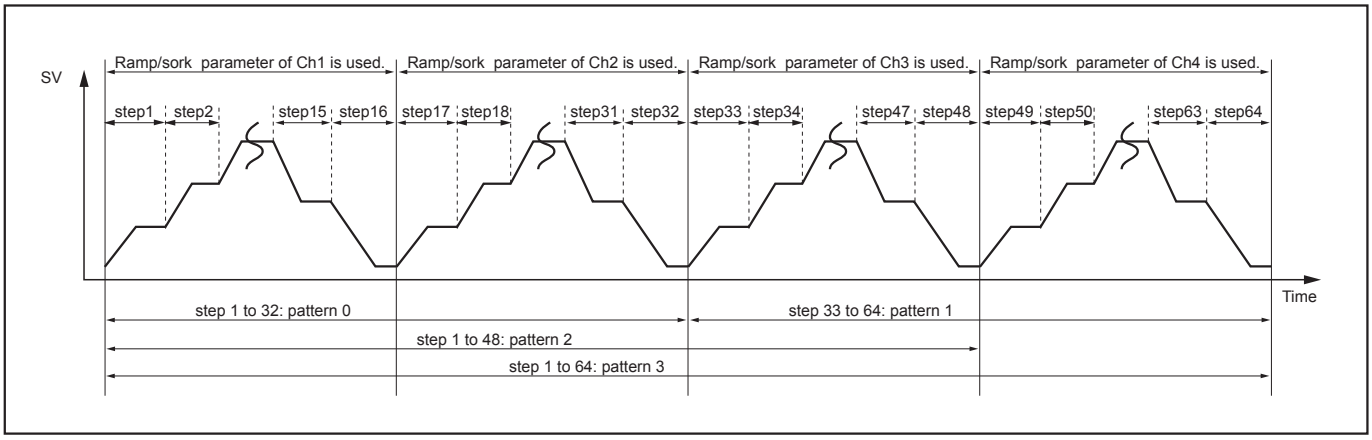
### Image chart of  Pattern of Normal arrangement.



## Image chart of Pattern of Special arrangement




## Image chart of Pattern of 64STEP arrangement




**Note**

- When use the 64 STEP pattern, match the PV scale of all Ch. each other.
- Do not change this parameter during Ramp/Soak operation.
  When you change this parameter, make sure to set the Ramp/Soak command to "0".

## Ramp/Soak Activation Pattern

Select the one of 7 activation patterns and execute it.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak activation pattern (STEP No.) | 0 to 7 | N/A | 6 | R/W | Ch1: 41431 (A1D7h) |
| | | | | | Ch2: 42431 (A5DFh) |
| | | | | | CH3: 43431 (A9A7h) |
| | | | | | Ch4: 44431 (AD8Fh) |

Select the setting value according to following table.

| Setting value | Activation pattern |
|---|---|
| 0 | 1-4 / 1-4 / 1-32 |
| 1 | 5-8 / 5-8 / 33-64 |
| 2 | 1-8 / 9-12 / 1-48 |
| 3 | 9-12 / 13-16 / 1-64 |
| 4 | 13-16 / 1-8 / according to DI |
| 5 | 9-16 / 9-16 / according to DI |
| 6 | 1-16 / 1-16 / according to DI |
| 7 | according to DI / according to DI /according to DI |

Mark form) [(A) / (B) / (C)]

(A)…Running step of "Normal pattern".

(B)…Running step of "Special pattern"

(C)…Running step of "64STEP pattern"

Refer to "Activation pattern setting value and running step number of each arrangement".

Activation pattern setting value and running step number of each arrangement

| Pattern arrangement | Pattern No. | Running step |
|---|---|---|
| 0 | 0 | Step 1 to step 4 |
| | 1 | Step 5 to step 8 |
| | 2 | Step 1 to step 8 |
| | 3 | Step 9 to step 12 |
| | 4 | Step 13 to step 16 |
| | 5 | Step 9 to step 16 |
| | 6 | Step 1 to step 16 |
| | 7 | according to DI |
| 1 | 0 | Step 1 to step 4 |
| | 1 | Step 5 to step 8 |
| | 2 | Step 9 to step 12 |
| | 3 | Step 13 to step 16 |
| | 4 | Step 1 to step 8 |
| | 5 | Step 9 to step 16 |
| | 6 | Step 1 to step 16 |
| | 7 | according to DI |
| 2 | 0 | Step 1 to step 32 |
| | 1 | Step 33 to step 64 |
| | 2 | Step 9 to 16 |
| | 3 | Step 1 to step 64 |
| | 4 | according to DI |
| | 5 | according to DI |
| | 6 | according to DI |
| | 7 | according to DI |

**Note**

- When use the 64 STEP pattern, match the PV scale of all Ch. each other.
- Do not change this parameter during Ramp/Soak operation.
  When you change this parameter, make sure to set the Ramp/Soak command to "0".
- When activation pattern DI is selected, make sure not to change the DI status during Ramp/Soak operation.

## Ramp/Soak Time Unit

Set the Ramp/Soak time unit for Ramp/Soak activation

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak Time Units | 0: hh.MM (hour: min)<br>1: MM.SS (min: sec) | N/A | 0 | R/W | Ch1: 41432 (A1D8h) |
| | | | | | Ch2: 42432 (A5C0h) |
| | | | | | Ch3: 43432 (A9A8h) |
| | | | | | Ch4: 44432 (AD90h) |

**Note**

- When pattern arrangement is set to "2: 64STEP", Ramp/Soak time unit will be operated with the time setting of the Ch. at where pattern arrangement is set.
- Do not change this parameter during Ramp/Soak operation.
  When you change this parameter, make sure to set the Ramp/Soak command to "0".

## Ramp/Soak SV, Ramp time, Soak time

Set the ramp/soak SV, Ramp time and Soak time.

The following parameter is set from each Ch1 to Ch4 for 16 steps.

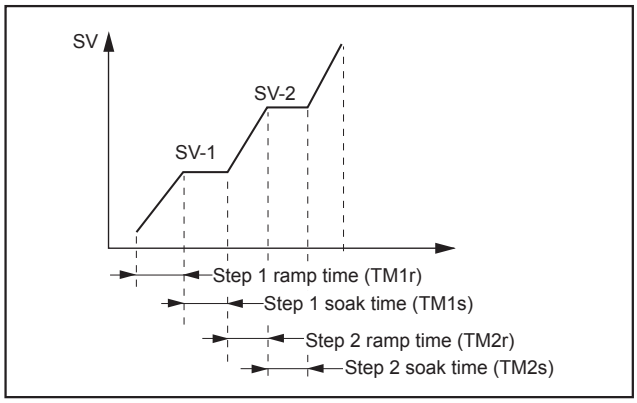
Note) Please set parameter "SV selection" after setting the SV limit.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| SV Select (step1) | 0 to100% | %FS | 0 | R/W | Ch1: 41451 (A1EBh) |
| | | | | | Ch2: 42451 (A5D3h) |
| | | | | | Ch3: 43451 (A9BBh) |
| | | | | | Ch4: 44451 (ADA3h) |
| Ramp Time (step1) | 00: 00 to 99: 59 | (hour: min/ min: sec) | 00:00 | R/W | Ch1: 41452 (A1ECh) |
| | | | | | Ch2: 42452 (A5D4h) |
| | | | | | Ch3: 43452 (A9BCh) |
| | | | | | Ch4: 44452 (ADA4h) |
| Time Soak (step1) | 00: 00 to 99: 59 | (hour: min/ min: sec) | 00:00 | R/W | Ch1: 41453 (A1EDh) |
| | | | | | Ch2: 42453 (A5D5h) |
| | | | | | Ch3: 43453 (A9BDh) |
| | | | | | Ch4: 44453 (ADA5h) |
| ⋮ | | | | | |
| SV Select (step16) | 0 to100% | %FS | 0 | R/W | Ch1: 41496 (A218h) |
| | | | | | Ch2: 42496 (A600h) |
| | | | | | Ch3: 43496 (A9E8h) |
| | | | | | Ch4: 44496 (ADD0h) |
| Ramp Time (step16) | 00: 00 to 99: 59 | (hour: min/ min: sec) | 00:00 | R/W | Ch1: 41497 (A219h) |
| | | | | | Ch2: 42497 (A601h) |
| | | | | | Ch3: 43497 (A9E9h) |
| | | | | | Ch4: 44497 (ADD1h) |
| Time Soak (step16) | 00: 00 to 99: 59 | (hour: min/ min: sec) | 00:00 | R/W | Ch1: 41498 (A21Ah) |
| | | | | | Ch2: 42498 (A602h) |
| | | | | | Ch3: 43498 (A9EAh) |
| | | | | | Ch4: 44498 (ADD2h) |

Select the setting value according to following table.

| Parameter | Function |
|---|---|
| SV Select | Set the target value to control. |
| Ramp Time | Set the time which achieve to the SV setting value. |
| Soak Time | Se the time which maintain the SV setting value. Note1) |

Note1) Time is not counted at the Guaranteed Soak

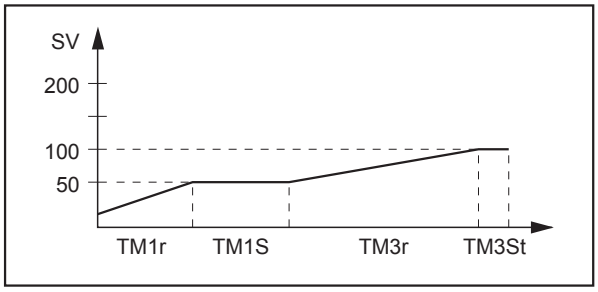



## Note

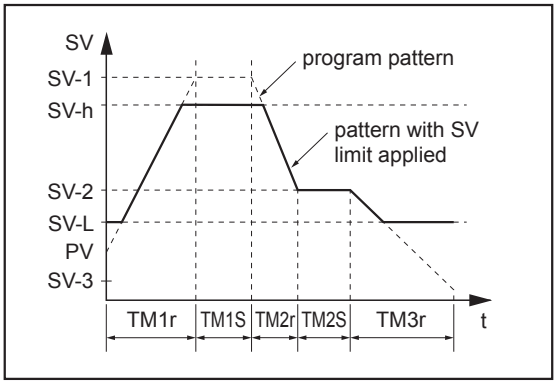
– Steps which are set to "0: 00" as setting value of both Ramp time and Soak time will be slipped.

[For example: ]

| Parameter | Setting value |
|---|---|
| SV Select 1 | 50 |
| Ramp Time 1 (TMr 1) | 0:10 |
| Soak Time 1 (TM1S) | 0:20 |
| SV Select 2 | 200 |
| Ramp Time 2 (TMr2) | 0:00 |
| Soak Time 2 (TM2S) | 0:00 |
| SV Select 3 | 100 |
| Ramp Time 3 (TMr3) | 0:10 |
| Soak Time 3 (TM3S) | 0:20 |




– The SV limit function (SV-h, SV-L) is still on while Ramp/Soak is running.
The set value (SV-n) does not change, but the value is limited during ramp/soak.
For that reason, the value may not change at the set times for the following patterns.



## Ramp/Soak Mode

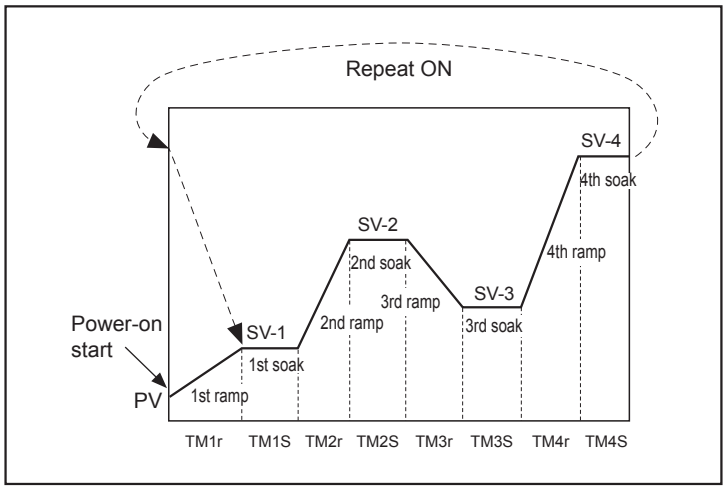
Set the Power-on start ON/OFF, END time output, OFF time output and repeat operation ON/OFF

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak mode | 0 to 15 | N/A | 0 | R/W | Ch1: 41433 (0598h) |
| | | | | | Ch2: 42433 (0980h) |
| | | | | | Ch3: 43433 (0D68h) |
| | | | | | Ch4: 44433 (1150h) |

You can choose from the following 16 types of modes according to the combination of operation method.

| MOD | Power-on start | END time output | OFF time output | Repeat operation |
|---|---|---|---|---|
| 0 | none | Maintain control | Maintain control | none |
| 1 | none | Maintain control | Maintain control | on |
| 2 | none | Maintain control | Standby Mode | none |
| 3 | none | Maintain control | Standby Mode | on |
| 4 | none | Standby Mode | Maintain control | none |
| 5 | none | Standby Mode | Maintain control | on |
| 6 | none | Standby Mode | Standby Mode | none |
| 7 | none | Standby Mode | Standby Mode | on |
| 8 | on | Maintain control | Maintain control | none |
| 9 | on | Maintain control | Maintain control | on |
| 10 | on | Maintain control | Standby Mode | none |
| 11 | on | Maintain control | Standby Mode | on |
| 12 | on | Standby Mode | Maintain control | none |
| 13 | on | Standby Mode | Maintain control | on |
| 14 | on | Standby Mode | Standby Mode | none |
| 15 | on | Standby Mode | Standby Mode | on |




| Function | Explanation |
|---|---|
| Power-on start | Starts ramp/soak from the current PV value when the equipment is turned on. |
| END time output setting | After pattern end, set the output status.<br>Maintain: Maintains the same state at the end of ramp soak when ramp/soak is end.<br>Standby: RUN/Standby is held standby status when ramp/soak is end. MV setting value of the standby is used as output. |
| OFF output setting | Set the output status when Ramp/Soak command is set to OFF.<br>Maintain: Maintain the SV value OFF, when Ramp/Soak command is set to OFF.<br>Standby: RUN/Standby is held standby status when ramp/soak command is set to OFF. MV setting value of the standby is used as output. |
| Repeat operation | Set the use/unused of repeat of activation pattern |

**Note**

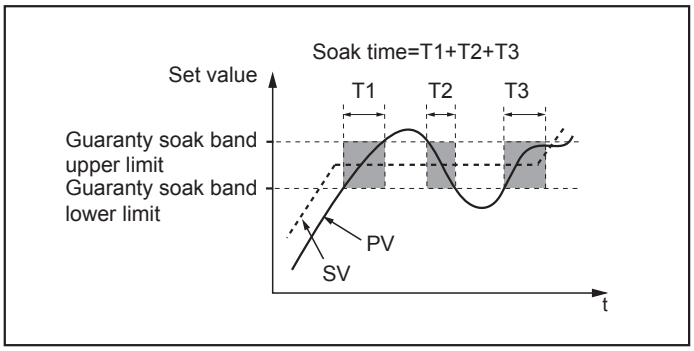
- Do not change this parameter during Ramp/Soak operations. When you change parameter, make sure to set the command to "0" for Ramp/Soak operation.
- When "Power on start" is enable, "Delay start" is disable.

## Guaranteed Soak

This function guarantees soak time. Soak time only counts down when SV is in the proper temperature range.

In the diagram below, the total of the shaded regions counts towards soak time.

When this total matches the specified soak time, the cycle proceeds to the next step.




Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Guaranty soak | 0: OFF<br>1: ON | N/A | 0 | R/W | Ch1: 41441 (A1E1h) |
| | | | | | Ch2: 42441 (A5D9h) |
| | | | | | Ch3: 43441 (A9B1h) |
| | | | | | Ch4: 44441 (AD99h) |
| Guaranty soak band upper limit | 0 to 50 | %FS | 1.25%FS | R/W | Ch1: 41443 (A1E3h) |
| | | | | | Ch2: 42443 (A5CBh) |
| | | | | | Ch3: 43443 (A9B3h) |
| | | | | | Ch4: 44443 (AD9Bh) |
| Guaranty soak band lower limit | 0 to 50 | %FS | 1.25%FS | R/W | Ch1: 41442 (A1E2h) |
| | | | | | Ch2: 42442 (A5CAh) |
| | | | | | Ch3: 43442 (A9B2h) |
| | | | | | Ch4: 44442 (AD9Ah) |

Select the setting value according to following table.

| Parameter | Function |
|---|---|
| Guaranty soak ON/OFF | Set the ON/OFF of Guaranty soak function. |
| Guaranty soak band (Upper) | Set the Guaranty soak upper limit in temperature range. |
| Guaranty soak band (Lower) | Set the Guaranty soak lower limit in temperature range. |

**Note**

– Do not change this parameter during Ramp/Soak operation.
When you change this parameter, make sure to set the Ramp/Soak command to "0".

## PV start

When the ramp soak starts (RUN), this function searches the first point where the measurement value (PV) and the program pattern match, and starts operation at that point.

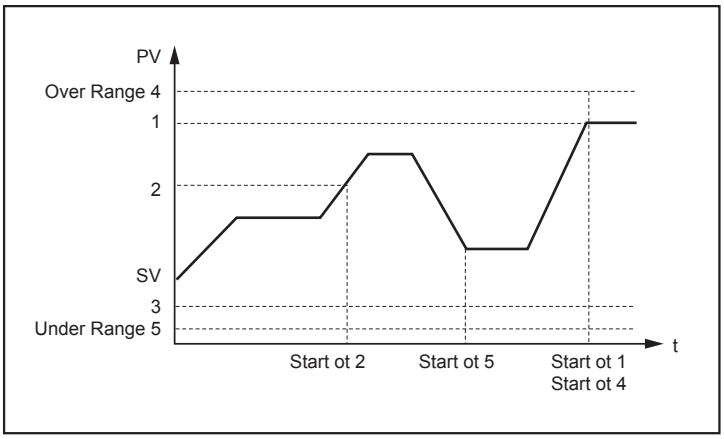
Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| PV start | 0: OFF<br>1: ON | N/A | 0 | R/W | Ch1: 41444 (A1E4h) |
| | | | | | Ch2: 42444 (A5CCh) |
| | | | | | Ch3: 43444 (A9B4h) |
| | | | | | Ch4: 44444 (AD9Ch) |

| Parameter | Function |
|---|---|
| OFF | Set the PV start function disable |
| ON | Set the PV start function enable |

Difference of starting position according to PV value.

1) When PV is matching SV setting value in the program, it will start from Soak period of matching SV.
2) When PV is in a range of the SV set value of the Ramp period, the Ramp is started on the way in the Ramp period.
3) When PV does not match SV in the program within the PV input range, Ramp is started from PV value towarding to the first target SV.
4) When the PV value is an over range, it is started from the Soak period of program SV setting value MAX value.
5) When the PV value is under range, it is started from the Soak period of program SV setting value MIN value.




**Note**

- When Continue mode is set to "1: Con", PV start is disabled.
- Do not change this parameter during Ramp/Soak operation.
  When you change this parameter, make sure to set the Ramp/Soak command to "0".

## Continue mode

When the power turns off during operation due to power outage or other reasons, this function can specify the ramp soak operation when the power turns on.

Every 5 minuets the segment position is saved for using power outage recovery. Thus Ramp/Soak can be restored to the segment position where ramp soak is saved at power outage recovery.

Restore the status up to 5 minuets before.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Continue Mode | 0: rSE<br>1: Con<br>2: ini | N/A | 0 | R/W | Ch1: 41445 (05A4h) |
| | | | | | Ch2: 42445 (098Ch) |
| | | | | | Ch3: 43445 (0D74h) |
| | | | | | Ch4: 44445 (115Ch) |

| Parameter | Function |
|---|---|
| rSE | Ramp/Soak is not be operated. |
| Con | Continue the operation from the status of the time which power is turned off. |
| ini | Start the Ramp/Soak from the first step again.<br>(In case Ramp/Soak is stopped or END, Ramp/Soak is not be operated again.) |

**Note**

- When power outage occurred while Ramp/Soak is hold, Ramp/Soak will be restored with hold.
- When power outage occurred while Ramp/Soak stopped or END, Ramp/Soak will be restored with stopped.
- When continue mode is set to "1: Con", Do not set the Ramp/Soak to hold frequently more than 10times/per hour.
- Do not change this parameter during Ramp/Soak operation.
  When you change this parameter, make sure to set the Ramp/Soak command to "0".

## Ramp/Soak Monitor

This function can monitor the Ramp/Soak progress.

The Ramp/Soak progress position (segment position) and elapsed time (hour: min or min: sec) can be checked externally.

Elapsed time is displayed by unit of Ramp/Soak time to be set.

## Ramp/Soak progress

Display the progress of the ramp/soak (segment position).

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak progress. | 0 to129 | N/A | - | R | Ch1: 30034 (0021h)<br>31009 (03F0h) |
| | | | | | Ch2: 30035 (0022h)<br>32009 (07D8h) |
| | | | | | Ch3: 30036 (0023h)<br>33009 (0BC0h) |
| | | | | | Ch4: 30037 (0024h)<br>34009 (9C48h) |

| Displayed value | Function |
|---|---|
| 0 | OFF |
| 1 to 128 | Ramp/Soak progress is displayed by the number of segments. |
| 129 | Ramp/soak ends. |

## Ramp/Soak Elapsed Time

Ramp/Soak elapsed time is displayed (hour: min or min: sec).

Ramp/Soak elapsed time is displayed by unit of Ramp/Soak time to be set.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp/Soak elapsed time | 00: 00 to 99: 59 | hour: min/ min: sec | - | R | Ch1: 30038 (0025h)<br>31010 (03F1h) |
| | | | | | Ch2: 30039 (0026h)<br>32010 (07D9h) |
| | | | | | Ch3: 30040 (0027h)<br>33010 (0BC1h) |
| | | | | | Ch4: 30041 (0028h)<br>33010 (9C49h) |

**Note**

– When segment is changed, display of Ramp/Soak elapsed time will be reset "00: 00".

## Operation by DI Event

When event input/output module is connected to the control module, Ramp/Soak function can be operated by DI function select.

Setting value of DI function select are following.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI-1 to 8 function select | 0 to 57 | N/A | 0 | R/W | 4-124 |

| Setting value | ON | OFF | Operation | Judgment condition |
|---|---|---|---|---|
| 12 | OFF | - | Ramp/soak OFF | Edge |
| 13 | RUN | HOLD | Ramp/soak RUN/HOLD | Edge |
| 38 | +1 | - | Pattern No.+1 | Level |
| 39 | +2 | - | Pattern No.+2 | Level |
| 40 | +4 | - | Pattern No.+4 | Level |
| 42 | RUN | - | Ramp soak RUN | Edge |
| 43 | HOLD | - | Ramp soak HOLD | Edge |
| 44 | Delay start enable | | Ramp soak RUN at DI1 startup | with no condition |
| 45 | Delay start enable | | Ramp soak RUN at DI2 startup | with no condition |
| 46 | Delay start enable | | Ramp soak RUN at DI3 startup | with no condition |
| 47 | Delay start enable | | Ramp soak RUN at DI4 startup | with no condition |
| 48 | Delay start enable | | Ramp soak RUN at DI5 startup | with no condition |

**Note**

– When pattern No.+1, +2 and +4 are selected at DI 1 to 8, do not change of DI input during Ramp/Soak operation.

## Event Output Setting by DO event type

Following functions can be used by DO output event type.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DO1 to 5 event type | 0 to 218 | N/A | 0 | R/W | 4-91 |

| Setting value | Event type | Operation | Function |
|---|---|---|---|
| 55 | Ramp/Soak delay start | Ramp/Soak delay start enable | Execute the delay start(actually, DO is not turned ON) |
| 80 | Ramp/Soak event output | OFF | Output the Ramp/Soak status from DO |
| 81 | | RUN | |
| 82 | | HOLD | |
| 83 | | Guaranty soak | |
| 84 | | END | |
| 91 | Time signal | Time signal (1st segment) | Output the DO at specified segment. |
| : | | : | |
| 122 | | Time signal (32nd segment) | |
| 123 | | Time signal (33rd segment) | |
| : | | : | |
| 218 | | Time signal (128th segment) | |

**Note**

– Do not change this parameter during Ramp/Soak operation.
When you change this parameter, make sure to set the Ramp/Soak command to "0".

## Delay Start Function

Ramp soak can be automatically started (RUN) after a certain period of time has elapsed since the power of the controller is turned on.

This function is enabled by setting the digital input function and the digital output function.

Delay start function is more effective by setting DI1 to DI16, DO1to DO5 and ALM1 delay time to ALM5 delay time, ALM1 delay time unit to ALM5delat time unit.

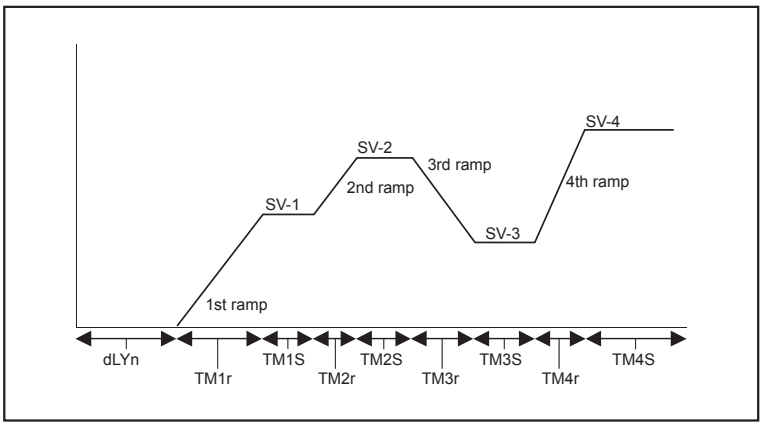
Setting range of each parameter when enabling delay start:

| Parameter | Setting value |
|---|---|
| DI1 to 16 Function select | 44 to 48 |
| DO1 to 5 Event output type | 55 |
| ALM1 to 5 Delay time | 00: 00 to 99: 59 |
| ALM1 to 5 Delay time units | min: sec / hour: min |

The following steps will explain how to assign the delay start to DI 2, Do2 and to set the delay time to 15 minutes.

Note) For the detailed setting for each parameter, see the setting procedure for each parameter.

| Parameter | Setting value |
|---|---|
| DI2 Function select | 45 |
| DO2 Event output type | 55 |
| ALM1 to 5 Delay time | 15: 00 |
| ALM1 to 5 Delay time units | min: sec |




(Meaning of sign)
dLYn: DeLay time of ALM n
SV-1: SV Select (step1)
SV-2: SV Select (step2)
SV-3: SV Select (step3)
SV-4: SV Select (step4)
TM1r: Ramp Time (step1)
TM1S: Time Soak (step1)
TM2r: Ramp Time (step2)
TM2S: Time Soak (step2)
TM3r: Ramp Time (step3)
TM3S: Time Soak (step3)
TM4r: Ramp Time (step4)
TM4S: Time Soak (step4)

**Note**

- Ramp/Soak function can not be used with Ramp SV function.
- When "power on start" is enabled with Ramp/Soak mode, delay start is disabled.
- Do not change delay start setting during Ramp/Soak operation.
  When you change delay start, make sure to set the Ramp/Soak command to "0".
- Delay start is operated without inputting at the actual DI.

## Ramp SV Setting

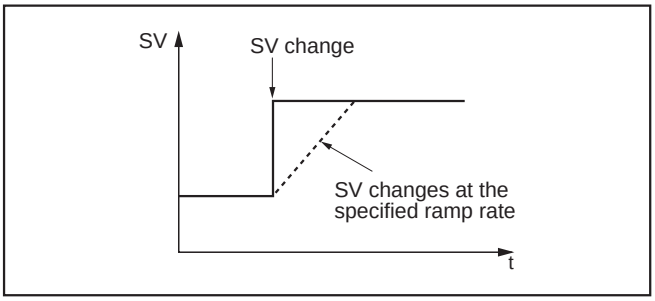
This function changes a previously set SV to the new value at the ramp rate.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Ramp SV ON/OFF | 0: OFF<br>1: ON | None | 1 | R/W | Ch1: 41299 (0512h) |
| | | | | | Ch2: 42299 (08FAh) |
| | | | | | Ch3: 43299 (0CE2h) |
| | | | | | Ch4: 44299 (10CAh) |
| Ramp SV decline | 0 to 100 | %FS | 0 | R/W | Ch1: 41300 (0513h) |
| | | | | | Ch2: 42300 (08FBh) |
| | | | | | Ch3: 43300 (0CE3h) |
| | | | | | Ch4: 44300 (10CBh) |
| Ramp SV incline | 0 to 100 | %FS | 0 | R/W | Ch1: 41301 (0514h) |
| | | | | | Ch2: 42301 (08FCh) |
| | | | | | Ch3: 43301 (0CE4h) |
| | | | | | Ch4: 44301 (10CCh) |
| Ramp SV slope time units | 0: Slope deg/hr.<br>1: Slope deg/min. | None | 0 | R/W | Ch1: 41302 (0515h) |
| | | | | | Ch2: 42302 (08FDh) |
| | | | | | Ch3: 43302 (0CE5h) |
| | | | | | Ch4: 44302 (10CDh) |

SV does not change stepwise, but smoothly at the set ramp rate. Incline and decline rates can be set independently.

Operation is as follows for changing SV.




**Note**

- When Ramp SV decline and incline are set to "0", Ramp SV function will not be performed.
- If set the ramp SV to "valid" in the standby, the SV value comes to be the same as the PV value
- If turning on the power in the state of Ramp SV is "valid", the Ramp SV operation gets start at the PV at the power ON.

## Control Output Limiter Type Setting

When limits are specified for the output value, you can choose whether or not to apply the limits.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| MV1 lower limits | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41255 (04E6h) |
| | | | | | Ch2: 42255 (08CEh) |
| | | | | | Ch3: 43255 (0CB6h) |
| | | | | | Ch4: 44255 (109Eh) |
| MV1 upper limits | –3.0 to 103.0 | % | 103.0 | R/W | Ch1: 41256 (04E7h) |
| | | | | | Ch2: 42256 (08CFh) |
| | | | | | Ch3: 43256 (0CB7h) |
| | | | | | Ch4: 44256 (109Fh) |
| MV2 lower limits | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41257 (04E8h) |
| | | | | | Ch2: 42257 (08D0h) |
| | | | | | Ch3: 43257 (0CB8h) |
| | | | | | Ch4: 44257 (10A0h) |
| MV2 upper limits | –3.0 to 103.0 | % | 103.0 | R/W | Ch1: 41258 (04E9h) |
| | | | | | Ch2: 42258 (08D1h) |
| | | | | | Ch3: 43258 (0CB9h) |
| | | | | | Ch4: 44258 (10A1h) |
| Output limiter type setting | 0 to 15 | None | 0 | R/W | Ch1: 41259 (04EAh) |
| | | | | | Ch2: 42259 (08D2h) |
| | | | | | Ch3: 43259 (0CBAh) |
| | | | | | Ch4: 44259 (10A2h) |

Point

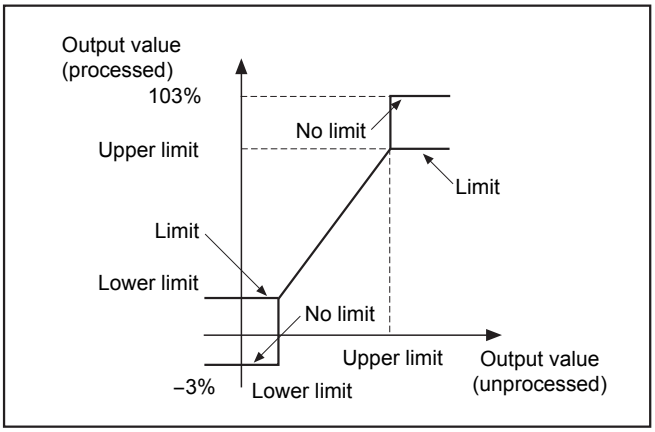
When heating/cooling control is selected, MV1 lower and upper limits are applied to heating output, and MV2 lower and upper limits to cooling output.

### Output limiter type setting

Refer to the table below and determine the set value.

| Set value | MV1 | | MV2 | |
|---|---|---|---|---|
| | Lower limits | Upper limits | Lower limits | Upper limits |
| 0 | –3.0% | 103% | –3.0% | 103% |
| 1 | Lower limits | 103% | –3.0% | 103% |
| 2 | –3.0% | Upper limits | –3.0% | 103% |
| 3 | Lower limits | Upper limits | –3.0% | 103% |
| 4 | –3.0% | 103% | Lower limits | 103% |
| 5 | Lower limits | 103% | Lower limits | 103% |
| 6 | –3.0% | Upper limits | Lower limits | 103% |
| 7 | Lower limits | Upper limits | Lower limits | 103% |
| 8 | –3.0% | 103% | –3.0% | Upper limits |
| 9 | Lower limits | 103% | –3.0% | Upper limits |
| 10 | –3.0% | Upper limits | –3.0% | Upper limits |
| 11 | Lower limits | Upper limits | –3.0% | Upper limits |
| 12 | –3.0% | 103% | Lower limits | Upper limits |
| 13 | Lower limits | 103% | Lower limits | Upper limits |
| 14 | –3.0% | Upper limits | Lower limits | Upper limits |
| 15 | Lower limits | Upper limits | Lower limits | Upper limits |

The output changes according to the limit, as follows.



## Standby MV Setting

Sets the output value and alarm ON/OFF during standby mode. 4-9

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Standby MV1 value | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41268 (04F3h) |
| | | | | | Ch2: 42268 (08DBh) |
| | | | | | Ch3: 43268 (0CC3h) |
| | | | | | Ch4: 44268 (10ABh) |
| Standby MV2 value | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41269 (04F4h) |
| | | | | | Ch2: 42269 (08DCh) |
| | | | | | Ch3: 43269 (0CC4h) |
| | | | | | Ch4: 44269 (10ACh) |
| Standby mode setting | 0: ALM=OFF<br>1: ALM=ON | None | 0 | R/W | Ch1: 41270 (04F5h) |
| | | | | | Ch2: 42270 (08DDh) |
| | | | | | Ch3: 43270 (0CC5h) |
| | | | | | Ch4: 44270 (10ADh) |

**Note**

The above settings are valid only when the output type is set to MV (set value: 3,4, or 7). See “Output source setting” 4-37

When the output type is other than MV, the value of output source is output.

## Soft Start Setting

This function prevents the control output from becoming the maximum output when turning on the module.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Soft start MV1 value | –3.0 to 103.0 | % | 103.0 | R/W | Ch1: 41262 (04EDh) |
| | | | | | Ch2: 42262 (08D5h) |
| | | | | | Ch3: 43262 (0CBDh) |
| | | | | | Ch4: 44262 (10A5h) |
| Soft start MV2 value | –3.0 to 103.0 | % | 103.0 | R/W | Ch1: 41263 (04EEh) |
| | | | | | Ch2: 42263 (08D6h) |
| | | | | | Ch3: 43263 (0CBEh) |
| | | | | | Ch4: 44263 (10A6h) |
| Soft start time | 00:00 to 99:59 | hr.: min. | 0 | R/W | Ch1: 41264 (04EFh) |
| | | | | | Ch2: 42264 (08D7h) |
| | | | | | Ch3: 43264 (0CBFh) |
| | | | | | Ch4: 44264 (10A7h) |

### Soft start time setting

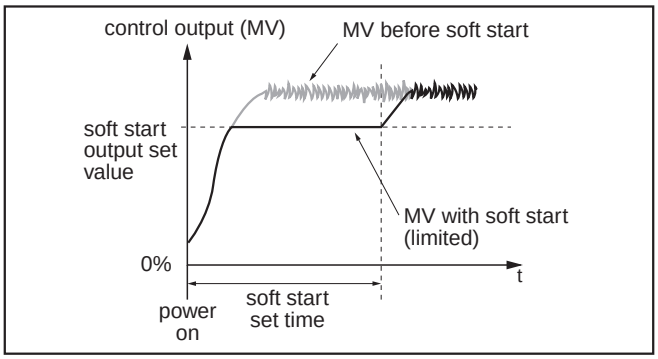
Soft start time set value is as follows;

Set value for 1 hour and a half : 0130 = 130

**Note**

Soft star will not be performed if Soft start time is set to 0.

The controls place an upper limit on the output for a set time period after the power is turned on. This function is useful for effects such as suppressing the heater output during equipment startup, or lightening the load. After the specified time has passed after switching on the equipment or if Soft start time is set to 0, the soft start function ends and normal controls begin.




**Note**

– During manual mode ▶▶ 4-8 , the manual output value ▶▶ 4-5 has priority, but soft start will continue to keep track of the set time period.

– Soft start function cannot be used when dual outputs control is selected. ▶▶ 4-55

## Operation Setting when Input Error Occurred

Specifies the output value of MV1/MV2 should this module fall go into the FAULT state (Input Error). Also sets whether to maintain or stop the control when the PV input burnout is detected.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| FAULT MV1 set value | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41260 (04EBh) |
| | | | | | Ch2: 42260 (08D3h) |
| | | | | | Ch3: 43260 (0CBBh) |
| | | | | | Ch4: 44260 (10A3h) |
| FAULT MV2 set value | –3.0 to 103.0 | % | –3.0 | R/W | Ch1: 41261 (04ECh) |
| | | | | | Ch2: 42261 (08D4h) |
| | | | | | Ch3: 43261 (0CBCh) |
| | | | | | Ch4: 44261 (10A4h) |
| Control when input burnout is detected | 0: Stop control<br>1: Continue control | None | 0 | R/W | Ch1: 41407 (057Eh) |
| | | | | | Ch2: 42407 (0966h) |
| | | | | | Ch3: 43407 (0D4Eh) |
| | | | | | Ch4: 44407 (1137h) |

**Note**

- If “Control when input burnout is detected” is set to “0: Stop control”, the unit will go into FAULT state and “FAULT MV1/2 set value” will be output when PV input burnout is detected.
- If “Control when input burnout is detected” is set to “1: Continue control”, PID calculation is performed with the burned-out PV value and the preset SV value. Select “0: Stop control” unless otherwise required.
- In manual mode ▶▶ 4-8, the manually set value ▶▶ 4-5 is preferentially output.

## Start up Mode Setting

Sets the mode at startup by channel.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Mode at startup | 0 to 3 | None | 0 | R/W | Ch1: 41304 (0517h) |
| | | | | | Ch2: 42304 (08FFh) |
| | | | | | Ch3: 43304 (0CE7h) |
| | | | | | Ch4: 44304 (10CFh) |

### Setting the mode at start up

Select the mode from the following options.

| Set value | Mode |
|---|---|
| 0 | Control output auto mode |
| 1 | Control output manual mode |
| 2 | Control output auto mode + Remote SV mode |
| 3 | Standby mode |

When changing a mode from one to another, refer to the instructions of each mode.

# 4.5 Event Output Setting

## Event Output

Followings are types of events this equipment can output.

| Event type | Description |
|---|---|
| Alarm | Control parameters (PV/SV/MV), or the status of loads connected to each channel. Activates alarms when monitored values exceeded the preset values. |
| Timer code | Switches ON/OFF when it detects the timer which has been set at “ALM delay time” having activated or stopped. ▶▶ 4-98 |
| Status | Indicates the operation status of this equipment in bits. |

Each channel of this module has output registers (DO1 to DO5) for 5 event outputs.

### Event output setting

To output events, make sure to complete the following settings. Some event types requires DO event type and DO option function settings only.

- DO event type ▶▶ 4-91
- DO option function ▶▶ 4-102
- ALM set value ▶▶ 4-96
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101

### Confirming event switching ON/OFF

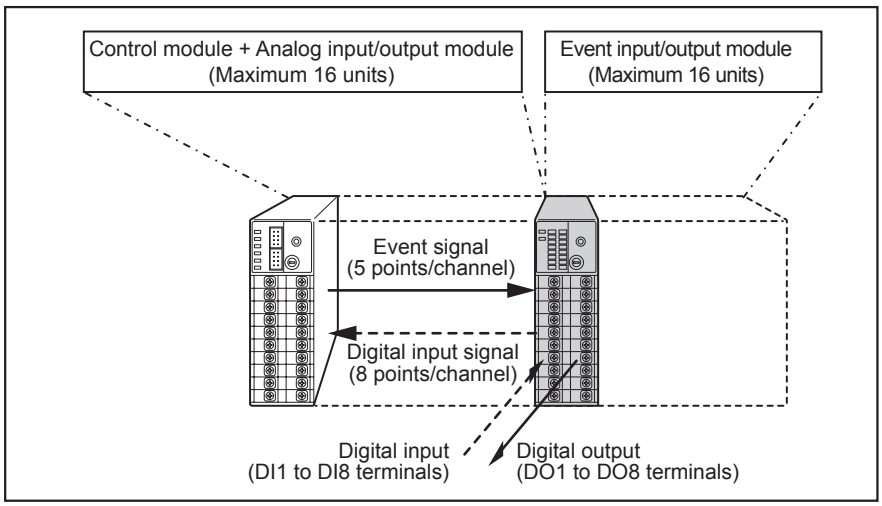
When this equipment is used stand-alone, or with analog input/output modules only, events assigned to DO1 to DO5 can be confirmed by checking LED lamps on the front face of this equipment.

## How to output event signal of control module into event input/output module

In order to output event signal of control module into event input/output module, connect this module to use as event input/output module.

**Note**

- With digital input (DI), event module used as input source is configured on control module. ▶▶ 4-124
- With digital output (DO), control module used as output source and its output channels are configured on event input/output module.




**Basic setting items**

- Communication settings ▶▶ 4-119
- Output source setting ▶▶ Event input/output module user's manual

## DO Event Types

Assign triggers such as alarms, timer, or the status of this equipment to each DO.

Event types assigned to DO1 to DO5 are as shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| DO1 event type | 0 to 218 | None | 0 | R/W | Ch1 | 41032(0407h) |
| | | | | | Ch2 | 42032(07EFh) |
| | | | | | Ch3 | 43032(0BD7h) |
| | | | | | Ch4 | 44032(0FBFh) |
| DO2 event type | 0 to 218 | None | 0 | R/W | Ch1 | 41040(040Fh) |
| | | | | | Ch2 | 42040(07F7h) |
| | | | | | Ch3 | 43040(0BDFh) |
| | | | | | Ch4 | 44040(0FC7h) |
| DO3 event type | 0 to 218 | None | 0 | R/W | Ch1 | 41048(0417h) |
| | | | | | Ch2 | 42048(07FFh) |
| | | | | | Ch3 | 43048(0BE7h) |
| | | | | | Ch4 | 44048(0FCFh) |
| DO4 event type | 0 to 218 | None | 0 | R/W | Ch1 | 41056(041Fh) |
| | | | | | Ch2 | 42056(0807h) |
| | | | | | Ch3 | 43056(0BEFh) |
| | | | | | Ch4 | 44056(0FD7h) |
| DO5 event type | 0 to 218 | None | 0 | R/W | Ch1 | 41064(0427h) |
| | | | | | Ch2 | 42064(080Fh) |
| | | | | | Ch3 | 43064(0BF7h) |
| | | | | | Ch4 | 44064(0FDFh) |

**Point**

– When an alarm event is assigned, alarm signal is output in the range highlighted in grey of the behavior diagram.

– When alarm hold function is required, select an alarm event with hold function. ▶▶ 4-103

**Note**

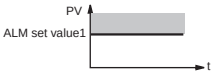
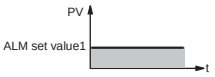
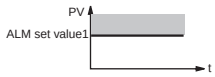
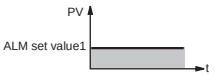
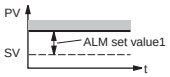
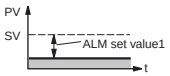
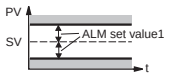
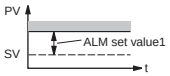
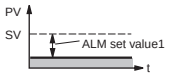
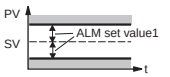
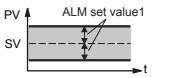
Please do not set values other than event numbers indicated in the table below.

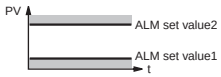
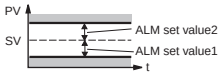
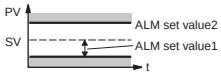
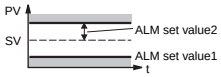
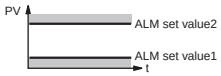
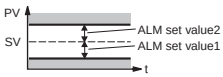
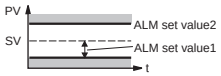
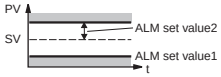
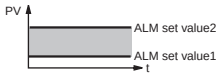
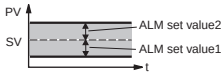
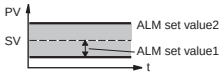
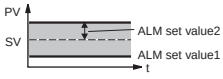
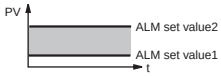
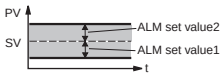
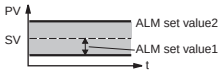
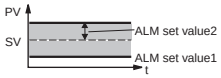
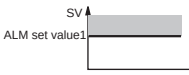
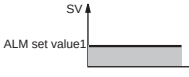
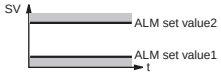
Select event number from the table below.

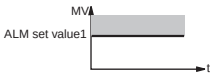
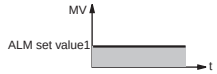
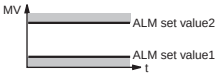
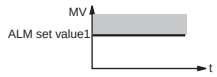
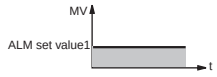
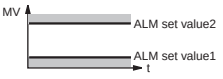
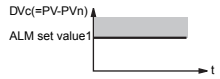
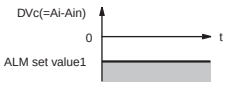
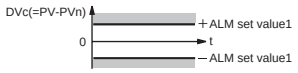
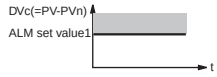
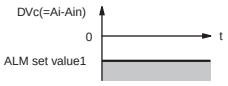
– No event

| Event category | Event No. | Event type | Behavior diagram | Reference |
|---|---|---|---|---|
| — | 0 | None | — | — |

– Alarm event

| Event category | Event No. | Event type | Behavior diagram | Reference |
|---|---|---|---|---|
| PV absolute alarm | 1 | Upper limit absolute |  | — |
| | 2 | Lower limit absolute |  | — |
| | 3 | Upper limit absolute with hold |  | — |
| | 4 | Lower limit absolute with hold |  | — |
| Deviation alarm | 5 | Upper limit deviation |  | — |
| | 6 | Lower limit deviation |  | — |
| | 7 | Upper/lower limit deviation |  | — |
| | 8 | Upper limit deviation with hold |  | — |
| | 9 | Lower limit deviation with hold |  | — |
| | 10 | Upper/lower limit deviation with hold |  | — |
| Range alarm1 | 11 | Range upper/lower limit deviation |  | — |

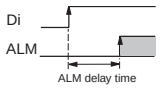
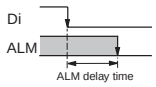
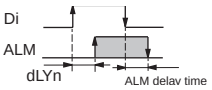
| Event category | Event No. | Event type | Behavior diagram | Reference |
|---|---|---|---|---|
| Upper / lower limit alarm | 16 | Upper/lower limit absolute |  | — |
| | 17 | Upper/lower limit deviation |  | — |
| | 18 | Upper limit absolute, lower limit deviation |  | — |
| | 19 | Upper limit deviation, lower limit absolute |  | — |
| | 20 | Upper/lower limit absolute with hold |  | — |
| | 21 | Upper/lower limit deviation with hold |  | — |
| | 22 | Upper limit absolute, lower limit deviation with hold |  | — |
| | 23 | Upper limit deviation, lower limit absolute with hold |  | — |
| Range alarm2 | 24 | Range upper/lower limit absolute |  | — |
| | 25 | Range upper/lower limit deviation |  | — |
| | 26 | Range upper limit absolute, lower limit deviation |  | — |
| | 27 | Range upper limit deviation, lower limit absolute |  | — |
| | 28 | Range upper/lower limit absolute with hold |  | — |
| | 29 | Range upper/lower limit deviation with hold |  | — |
| | 30 | Range upper limit absolute, lower limit deviation with hold |  | — |
| | 31 | Range upper limit deviation, lower limit absolute with hold |  | — |
| SV alarm | 32 | SV upper limit |  | 4-105 |
| | 33 | SV lower limit |  | |
| | 34 | SV upper/lower limit |  | |

| Event category | Event No. | Event type | Behavior diagram | Reference |
|---|---|---|---|---|
| MV alarm | 35 | MV upper limit (heat) |  | 4-106 |
| | 36 | MV lower limit (heat) |  | |
| | 37 | MV upper/lower limit (heat) |  | |
| | 38 | MV upper limit (cool)) |  | |
| | 39 | MV lower limit (cool) |  | |
| | 40 | MV upper/lower limit (cool) |  | |
| Interchannel PV deviation alarm | 41 | Interchannel upper limit deviation |  | 4-107 |
| | 42 | Interchannel lower limit deviation |  | |
| | 43 | Interchannel upper/lower limit deviation |  | |
| | 44 | Interchannel upper limit deviation with hold |  | |
| | 45 | Interchannel lower limit deviation with hold |  | |
| | 46 | Interchannel upper/lower limit deviation with hold |  | |
| Break/short-circuit alarm | 61 | Loop break alarm | — | 4-109 |
| | 64 | CT[A] HB alarm | — | 4-111 |
| | 65 | CT[B] HB alarm | | |
| | 66 | CT[A] HB alarm or CT[B] HB alarm | | |
| | 67 | CT[A] load short-circuit alarm | — | 4-116 |
| | 68 | CT[B] load short-circuit alarm | | |
| | 69 | CT[A] load short-circuit alarm or CT[B] load short-circuit alarm | | |

**Point**

- When selecting an event type with either of upper limit or lower limit only, the event always refers to “ALM set value 1”.
- Event No.11 detects whether both negative and positive deviation between PV and SV is within the range of "ALM set value1".

– Events other than alarms

| Event category | Event No. | Event type | Behavior diagram | Reference |
|---|---|---|---|---|
| Timer | 52 | ON delay timer |  | 4-99<br>4-100 |
| | 53 | OFF delay timer |  | |
| | 54 | ON/OFF delay timer |  | |
| Condition output | 71 | During auto-tuning | — | 4-6 |
| | 72 | Normal Operation | — | |
| | 73 | Standby | — | 4-9 |
| | 74 | Manual Mode operating | — | 4-8 |
| | 75 | Remote SV operating | — | 4-10 |
| | 76 | During ramp SV | — | 4-82 |
| | 77 | COM Monitor | — | 4-141 |

## Relevant parameters

- ALM set value1 / ALM set value2 4-96
- ALM delay time 4-99
- ALM delay time units 4-100
- ALM hysteresis 4-101
- DO option functions 4-102

## ALM Set Value1 / ALM Set Value2

Two different values can be set for alarm event output registers DO1 to DO5. Values set to ALM1 to 5 are applied to DO1 to DO5 respectively.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| ALM1 set value1 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41033(0408h) |
| | | | | | Ch2 | 42033(07F0h) |
| | | | | | Ch3 | 43033(0BD8h) |
| | | | | | Ch4 | 44033(0FC0h) |
| ALM1 set value2 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41034(0409h) |
| | | | | | Ch2 | 42034(07F1h) |
| | | | | | Ch3 | 43034(0BD9h) |
| | | | | | Ch4 | 44034(0FC1h) |
| ALM2 set value1 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41041(0410h) |
| | | | | | Ch2 | 42041(07F8h) |
| | | | | | Ch3 | 43041(0BE0h) |
| | | | | | Ch4 | 44041(0FC8h) |
| ALM2 set value2 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41042(0411h) |
| | | | | | Ch2 | 42042(07F9h) |
| | | | | | Ch3 | 43042(0BE1h) |
| | | | | | Ch4 | 44042(0FC9h) |
| ALM3 set value1 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41049(0418h) |
| | | | | | Ch2 | 42049(0800h) |
| | | | | | Ch3 | 43049(0BE8h) |
| | | | | | Ch4 | 44049(0FD0h) |
| ALM3 set value2 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41050(0419h) |
| | | | | | Ch2 | 42050(0801h) |
| | | | | | Ch3 | 43050(0BE9h) |
| | | | | | Ch4 | 44050(0FD1h) |
| ALM4 set value1 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41057(0420h) |
| | | | | | Ch2 | 42057(0808h) |
| | | | | | Ch3 | 43057(0BF0h) |
| | | | | | Ch4 | 44057(0FD8h) |
| ALM4 set value2 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41058(0421h) |
| | | | | | Ch2 | 42058(0809h) |
| | | | | | Ch3 | 43058(0BF1h) |
| | | | | | Ch4 | 44058(0FD9h) |

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| ALM5 set value1 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41065(0428h) |
| | | | | | Ch2 | 42065(0810h) |
| | | | | | Ch3 | 43065(0BF8h) |
| | | | | | Ch4 | 44065(0FE0h) |
| ALM5 set value2 | 0 to 100%FS (Absolute alarm) −100 to 100%FS (Deviation alarm) | %FS | 2.5 | R/W | Ch1 | 41066(0429h) |
| | | | | | Ch2 | 42066(0811h) |
| | | | | | Ch3 | 43066(0BF9h) |
| | | | | | Ch4 | 44066(0FE1h) |

* FS represents PV input range (full scale).

**Point**

– When selecting an event type with either of upper limit or lower limit only, the event always refers to "ALM set value 1".

– For an event which has both upper and lower limits such as Range alarm event, both "ALM set value 1" and "ALM set value2" are referred to.

**Note**

– An event which monitors input from CT terminal refers to values set other than here. ▶▶ 4-111

– To assign loop break detection alarm, also complete parameter settings of “loop break detection time” and “loop break detection band”. ▶▶ 4-109

**Relative parameters**

- DO event types ▶▶ 4-91
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101
- DO option functions ▶▶ 4-102
- Object Channel No. for interchannel ALM ▶▶ 4-107

## Operation Before and After Events Output Setting

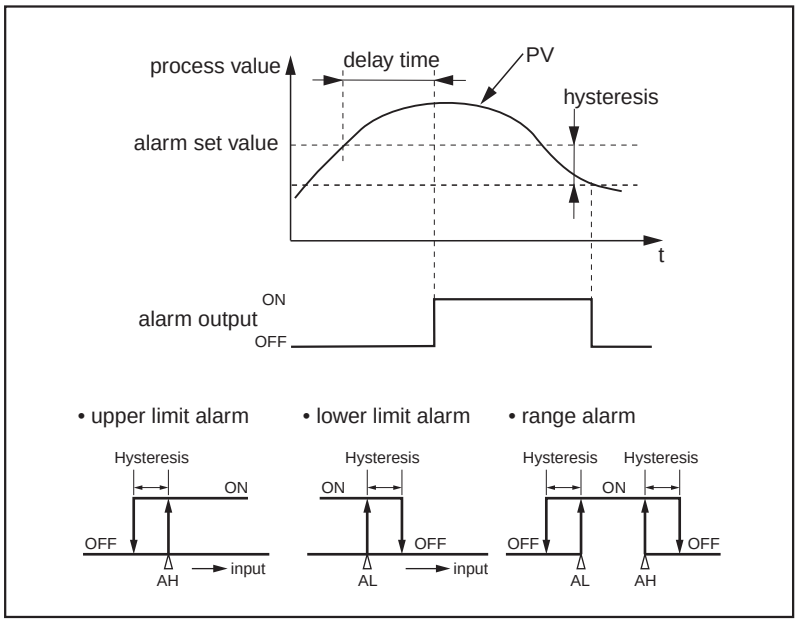
As an example, the operation of alarm event output is explained.

Following parameters can be set to specify operations before and after alarm events output.

| Setting items | Description |
|---|---|
| ALM delay time /<br>ALM delay time units | Specifies the amount of time from the occurrence of the alarm event to the ON output.<br>Also specifies the unit of time (alarm delay time unit) used to measure the alarm delay. |
| ALM hysteresis | Specifies alarm detection and recovery width. |
| DO output latch function | Can be added by DO option functions. Latches (maintains) the state when an event occurs until the latch is released. |

The alarm settings, ALM delay time and hysteresis are related as follows.

Example of an Upper Limit Alarm



## ALM delay time

Is the amount of time from the occurrence of the alarm event to the ON output. The set values are applied to events other than alarm events. Values set to ALM1 to 5 are applied to DO1 to DO5 respectively.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| ALM1 delay time | 00:00 to 99.59 | Separate setting | 00:00 | R/W | Ch1 | 41037 (040Ch) |
| | | | | | Ch2 | 42037 (07F4h) |
| | | | | | Ch3 | 43037 (0BDCh) |
| | | | | | Ch4 | 44037 (0FC4h) |
| ALM2 delay time | 00:00 to 99.59 | Separate setting | 00:00 | R/W | Ch1 | 41045 (0414h) |
| | | | | | Ch2 | 42045 (07FCh) |
| | | | | | Ch3 | 43045 (0BE4h) |
| | | | | | Ch4 | 44045 (0FCCh) |
| ALM3 delay time | 00:00 to 99.59 | Separate setting | 00:00 | R/W | Ch1 | 41053 (041Ch) |
| | | | | | Ch2 | 42053 (0804h) |
| | | | | | Ch3 | 43053 (0BECh) |
| | | | | | Ch4 | 44053 (0FD4h) |
| ALM4 delay time | 00:00 to 99.59 | Separate setting | 00:00 | R/W | Ch1 | 41061 (0424h) |
| | | | | | Ch2 | 42061 (080Ch) |
| | | | | | Ch3 | 43061 (0BF4h) |
| | | | | | Ch4 | 44061 (0FDCh) |
| ALM5 delay time | 00:00 to 99.59 | Separate setting | 00:00 | R/W | Ch1 | 41069 (042Ch) |
| | | | | | Ch2 | 42069 (0814h) |
| | | | | | Ch3 | 43069 (0BFCh) |
| | | | | | Ch4 | 44069 (0FE4h) |

* When the time units is “min./sec.”, the maximum time is 99 min.59 sec., and when the time unit is hr./min, the maximum time is 99 hr.59 min.

### ALM delay time units

Specifies the unit of time “sec./min.” or “hr./min.” used to measure the alarm delay. Values set to ALM1 to 5 are applied to DO1 to DO5 respectively.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| ALM1 delay time units | 0: sec.<br>1: min. | — | 0 | R/W | Ch1 | 41038 (040Dh) |
| | | | | | Ch2 | 42038 (07F5h) |
| | | | | | Ch3 | 43038 (0BDDh) |
| | | | | | Ch4 | 44038 (0FC5h) |
| ALM2 delay time units | 0: sec.<br>1: min. | — | 0 | R/W | Ch1 | 41046 (0415h) |
| | | | | | Ch2 | 42046 (07FDh) |
| | | | | | Ch3 | 43046 (0BE5h) |
| | | | | | Ch4 | 44046 (0FCDh) |
| ALM3 delay time units | 0: sec.<br>1: min. | — | 0 | R/W | Ch1 | 41054 (041Dh) |
| | | | | | Ch2 | 42054 (0805h) |
| | | | | | Ch3 | 43054 (0BEDh) |
| | | | | | Ch4 | 44054 (0FD5h) |
| ALM4 delay time units | 0: sec.<br>1: min. | — | 0 | R/W | Ch1 | 41062 (0425h) |
| | | | | | Ch2 | 42062 (080Dh) |
| | | | | | Ch3 | 43062 (0BF5h) |
| | | | | | Ch4 | 44062 (0FDDh) |
| ALM5 delay time units | 0: sec.<br>1: min. | — | 0 | R/W | Ch1 | 41070 (042Dh) |
| | | | | | Ch2 | 42070 (0815h) |
| | | | | | Ch3 | 43070 (0BFDh) |
| | | | | | Ch4 | 44070 (0FE5h) |

Point

ALM delay ON/OFF can be used as triggers for different kinds of events. ▶▶ 4-91

## ALM hysteresis

Specifies alarm detection and recovery width.

Values set to ALM1 to 5 are alarm hysteresis which are applied to DO1 to DO5 respectively.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| ALM1 hysteresis | 0 to 50%FS | %FS | 0.25 | R/W | Ch1 | 41035 (040Ah) |
| | | | | | Ch2 | 42035 (07F2h) |
| | | | | | Ch3 | 43035 (0BDAh) |
| | | | | | Ch4 | 44035 (0FC2h) |
| ALM2 hysteresis | 0 to 50%FS | %FS | 0.25 | R/W | Ch1 | 41043 (0412h) |
| | | | | | Ch2 | 42043 (07FAh) |
| | | | | | Ch3 | 43043 (0BE2h) |
| | | | | | Ch4 | 44043 (0FCAh) |
| ALM3 hysteresis | 0 to 50%FS | %FS | 0.25 | R/W | Ch1 | 41051 (041Ah) |
| | | | | | Ch2 | 42051 (0802h) |
| | | | | | Ch3 | 43051 (0BEAh) |
| | | | | | Ch4 | 44051 (0FD2h) |
| ALM4 hysteresis | 0 to 50%FS | %FS | 0.25 | R/W | Ch1 | 41059 (0422h) |
| | | | | | Ch2 | 42059 (080Ah) |
| | | | | | Ch3 | 43059 (0BF2h) |
| | | | | | Ch4 | 44059 (0FDAh) |
| ALM5 hysteresis | 0 to 50%FS | %FS | 0.25 | R/W | Ch1 | 41067 (042Ah) |
| | | | | | Ch2 | 42067 (0812h) |
| | | | | | Ch3 | 43067 (0BFAh) |
| | | | | | Ch4 | 44067 (0FE2h) |

* FS represents PV input range (full scale).

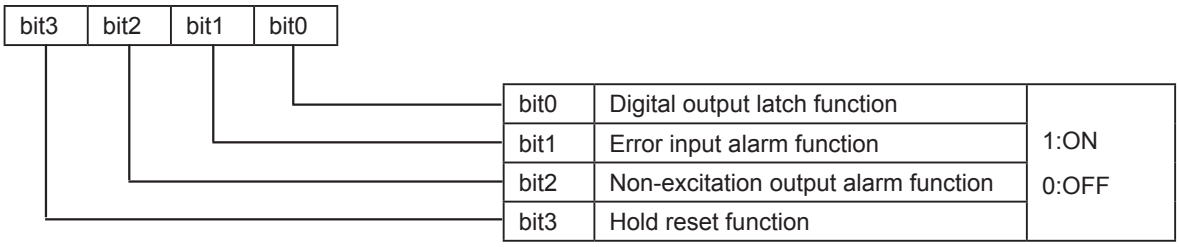
### Relative parameters

- DO event types ▶▶ 4-91
- ALM set value1 / ALM set value2 ▶▶ 4-96
- DO option functions ▶▶ 4-102

## DO Option Function

DO1 to DO5 can each have four types of option functions. The four types of option functions (ON/OFF) are assigned in bit units. Option functions used for DO1 to DO5 are as follows,

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| DO1 option function setting | 0000 to 1111 bit data (0 to 15) | None | 0000 (No setting) | R/W | Ch1 | 41036(040Bh) |
| | | | | | Ch2 | 42036 (07F3h) |
| | | | | | Ch3 | 43036 (0BDBh) |
| | | | | | Ch4 | 44036 (0FC3h) |
| DO2 option function setting | 0000 to 1111 bit data (0 to 15) | None | 0000 (No setting) | R/W | Ch1 | 41044 (0413h) |
| | | | | | Ch2 | 42044 (07FBh) |
| | | | | | Ch3 | 43044 (0BE3h) |
| | | | | | Ch4 | 44044 (0FCBh) |
| DO3 option function setting | 0000 to 1111 bit data (0 to 15) | None | 0000 (No setting) | R/W | Ch1 | 41052 (041Bh) |
| | | | | | Ch2 | 42052 (0803h) |
| | | | | | Ch3 | 43052 (0BEBh) |
| | | | | | Ch4 | 44052 (0FD3h) |
| DO4 option function setting | 0000 to 1111 bit data (0 to 15) | None | 0000 (No setting) | R/W | Ch1 | 41060 (0423h) |
| | | | | | Ch2 | 42060 (080Bh) |
| | | | | | Ch3 | 43060 (0BF3h) |
| | | | | | Ch4 | 44060 (0FDBh) |
| DO5 option function setting | 0000 to 1111 bit data (0 to 15) | None | 0000 (No setting) | R/W | Ch1 | 41068 (042Bh) |
| | | | | | Ch2 | 42068 (0813h) |
| | | | | | Ch3 | 43068 (0BFBh) |
| | | | | | Ch4 | 44068 (0FE3h) |




### DO output latch function

Latches (maintains) the state when an event occurs. The latch functions will remain ON until the digital output latch release command is set ▶▶ 4-104

### Error input alarm function

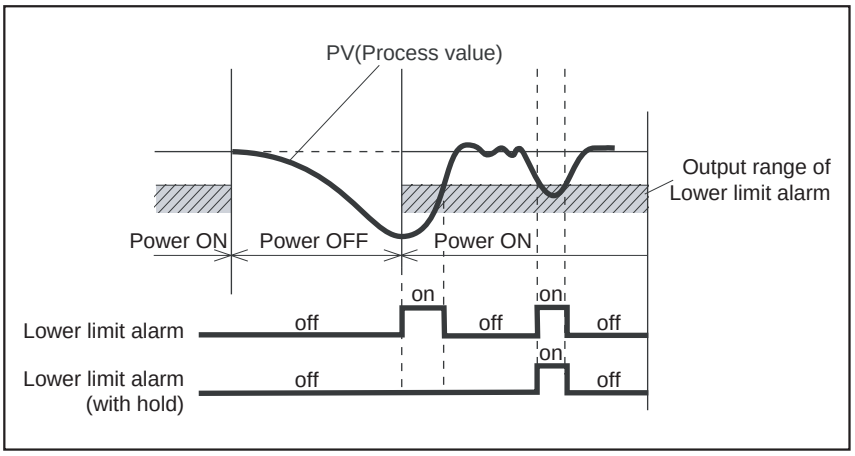
Outputs an event when an error input enters the unit. Set the DO event type ▶▶ 4-91 to "0" to use this function.

### Non-excitation output function

Inverts the output and outputs from the DO terminal when an event occurs.

### Hold and hold reset function

When alarm events are assigned, sometimes alarms are faultily detected soon after the power was turned ON. When an alarm event with hold function is assigned for a DO event type ▶▶ 4-91, the alarm first to occur after the power was turned ON will be ignored to avoid unnecessary alarm outputs.




When an alarm with hold is applied, the hold function is reset when any of the following actions occur.

| | | |
|---|---|---|
| - Change SV value | - Change alarm type | - Change alarm settings |
| - Cancel standby | - Turn power OFF and ON | |

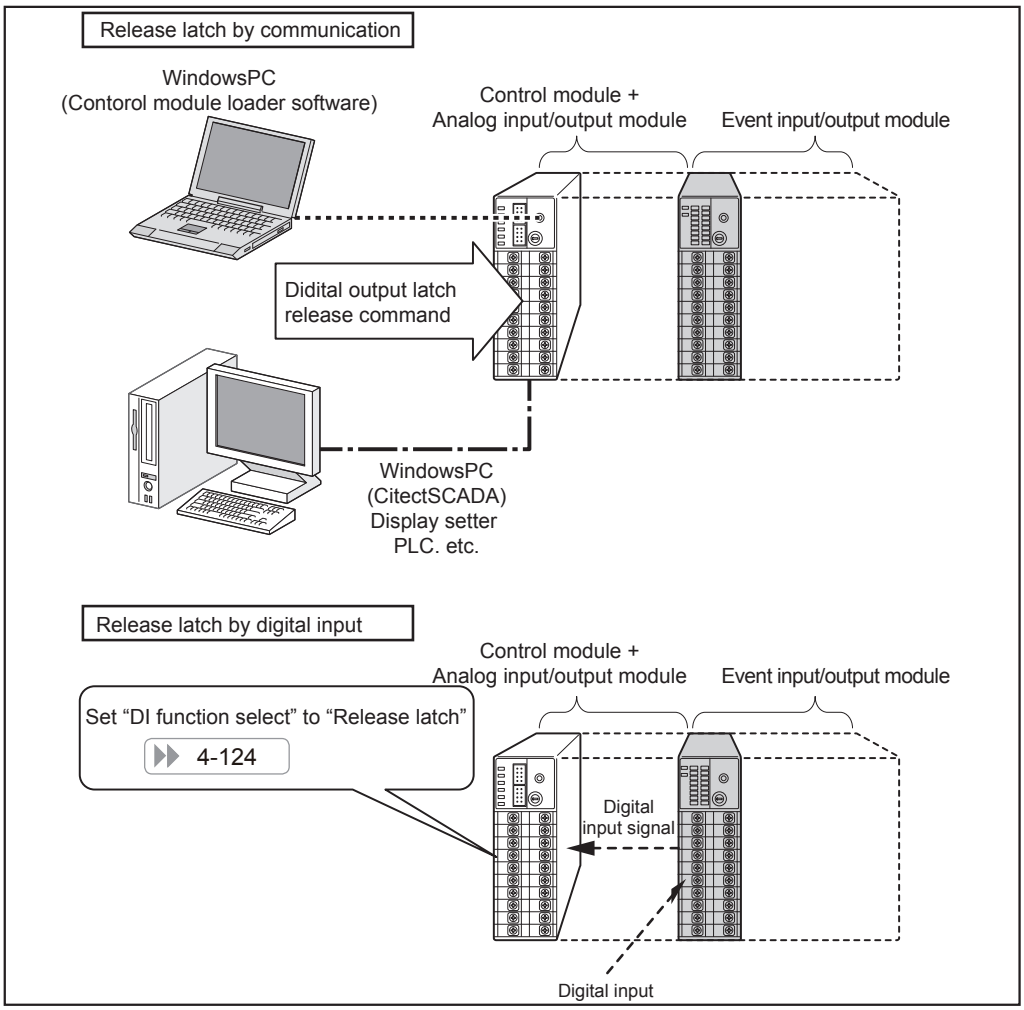
When both hold reset and digital output latch functions are set, digital output latch function is applied prior to hold reset.

### Relative parameters

- ALM set value1 / ALM set value2 ▶▶ 4-96
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101

## Digital Output Latch Release

There are two ways of releasing event latch as shown below.




**Point**

- To enable digital output latch function, set “DO option functions”. 4-102
- When “DI function select” is set to “Release latch”, digital output latch can be released by digital input from an event input/output module. 4-124

To release latch by communication, set the parameter below to “1: Release latch”.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| Digital output latch release command | 0: OFF<br>1: Release latch | None | 0 | R/W | Ch1 | 41031 (0406h) |
| | | | | | Ch2 | 42031 (07EEh) |
| | | | | | Ch3 | 43031 (0BD6h) |
| | | | | | Ch4 | 44031 (0FBEh) |

## SV Alarm

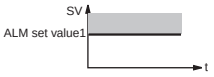
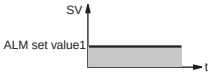
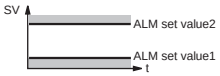
Sets an alarm for inappropriate SV values. This function gives an alarm for setting mistakes of SV or Remote SV values.

**Note**

In remote mode, remote SV values are monitored. ▶▶ 4-24

– Event No.

To set SV alarms, assign the following event numbers when configuring “DO event types” setting. ▶▶ 4-91

| Event No. | Event type | Behavior diagram |
|---|---|---|
| 32 | SV upper limit |  |
| 33 | SV lower limit |  |
| 34 | SV upper/lower limit |  |

– Other settings

Settings of the relative parameters shown below are the same as other alarm events.

### Relative parameters

- ALM set value1 / ALM set value2 ▶▶ 4-96
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101
- DO option functions ▶▶ 4-102

## MV Alarm

Sets an alarm for inappropriate MV1 (heating output) and MV2 (cooling output). MV1(heating output) and MV2(cooling output) are set separately.

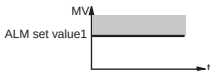
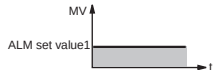
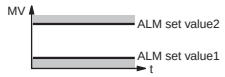
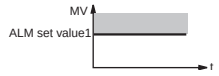
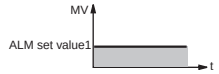
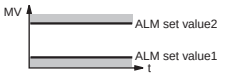
**Point**

– In operation modes shown below, MV monitoring and alarm output are performed.

- Manual mode 4-5
- Standby mode 4-85
- Soft start mode 4-86
- Input error status 4-87

– Event No.

To set MV alarms, assign the following event numbers when configuring “DO event types” setting 4-91

| Event No. | Event type | Behavior diagram |
|---|---|---|
| 35 | MV upper limit (heating output) |   |
| 36 | MV lower limit (heating output) |   |
| 37 | MV upper/lower limit (heating output) |   |
| 38 | MV upper limit (cooling output) |   |
| 39 | MV lower limit (cooling output) |   |
| 40 | MV upper/lower limit (cooling output) |   |

– Other settings

Settings of the relative parameters shown below are the same as other alarm events.

### Relative parameters

- ALM set value1 / ALM set value2 4-96
- ALM delay time 4-99
- ALM delay time units 4-100
- ALM hysteresis 4-101
- DO option functions 4-102

## Interchannel Deviation Alarm

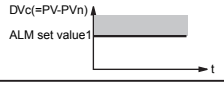
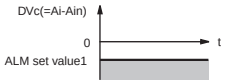
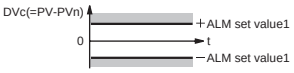
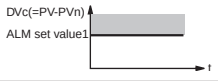
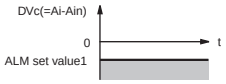
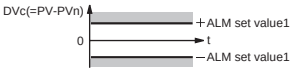
Monitors deviation of PV between channels 1 to 4.

**Note**

When using interchannel deviation ALM, PV input range setting should be the same on the object two channels of which PV values are to be compared. 4-15

– Event No.

To set interchannel deviation ALM functions, assign the following event numbers when configuring “DO event types” setting 4-91

| Event No. | Event type | Behavior diagram |
|---|---|---|
| 41 | Interchannel upper limit deviation |   |
| 42 | Interchannel lower limit deviation |   |
| 43 | Interchannel upper/lower limit deviation |   |
| 44 | Interchannel upper limit deviation with hold |   |
| 45 | Interchannel lower limit deviation with hold |   |
| 46 | Interchannel upper/lower limit deviation with hold |   |

– Object Ch No. for interchannel ALM

Set “Object Ch No. for interchannel ALM1 to 5” to the desired object channel numbers of which PV values are to be compared. Values set to ALM1 to 5 are object Ch No. for interchannel ALM which are applied to DO1 to DO5 respectively.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| Object Ch No. for interchannel ALM1 | 1 to 4 (Ch No.) | None | 1 | R/W | Ch1 | 41039 (040Eh) |
| | | | | | Ch2 | 42039 (07F6h) |
| | | | | | Ch3 | 43039 (0BDEh) |
| | | | | | Ch4 | 44039 (0FC6h) |
| Object Ch No. for interchannel ALM2 | 1 to 4 (Ch No.) | None | 1 | R/W | Ch1 | 41047 (0416h) |
| | | | | | Ch2 | 42047 (07FEh) |
| | | | | | Ch3 | 43047 (0BE6h) |
| | | | | | Ch4 | 44047 (0FCEh) |

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| Object Ch No. for interchannel ALM3 | 1 to 4 (Ch No.) | None | 1 | R/W | Ch1 | 41055 (041Eh) |
| | | | | | Ch2 | 42055 (0806h) |
| | | | | | Ch3 | 43055 (0BEEh) |
| | | | | | Ch4 | 44055 (0FD6h) |
| Object Ch No. for interchannel ALM4 | 1 to 4 (Ch No.) | None | 1 | R/W | Ch1 | 41063 (0426h) |
| | | | | | Ch2 | 42063 (080Eh) |
| | | | | | Ch3 | 43063 (0BF6h) |
| | | | | | Ch4 | 44063 (0FDEh) |
| Object Ch No. for interchannel ALM5 | 1 to 4 (Ch No.) | None | 1 | R/W | Ch1 | 41071 (042Eh) |
| | | | | | Ch2 | 42071 (0816h) |
| | | | | | Ch3 | 43071 (0BFEh) |
| | | | | | Ch4 | 44071 (0FE6h) |

_ Other settings

Settings of the relative parameters shown below are the same as other alarm events.

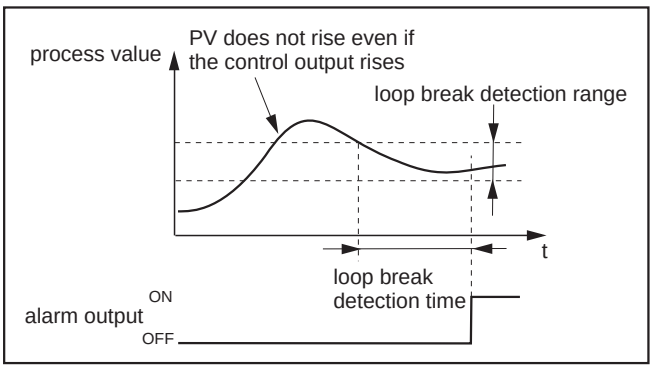
## Relative parameters

- ALM set value1 / ALM set value2 ▶▶ 4-96
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101
- DO option functions ▶▶ 4-102

## Loop Break Alarm

Detects loop break by monitoring process value (PV) change according to control output (MV). Starts to monitor when MV is 0 or 100% and checks PV change in regular intervals (“Loop break detection time”). If PV does not change beyond the range of specified band (“Loop break detection band”), loop break alarm will occur.

Loop break detection time and width are related as follows.




**Note**

- Please do not use this function when “Direct/Reverse setting” is set to dual control mode. 4-55
- When there is an input error or setting error, a loop break alarm event will be output even before the loop break detection time passes.

– Event No.

To set loop break alarm function, assign the following event number when configuring “DO event types” setting 4-91

| Event No. | Event type | Behavior diagram |
|---|---|---|
| 61 | Loop break alarm | — |

– Loop break detection time

Specifies how much time must pass before the loop is determined to be broken.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| Loop break detection time | 0 to 9999 | sec. | 0 | R/W | Ch1 | 41080 (0437h) |
| | | | | | Ch2 | 42080 (081Fh) |
| | | | | | Ch3 | 43080 (0C07h) |
| | | | | | Ch4 | 44080 (0FEFh) |

– Loop break detection band

Sets the temperature range of PV which must be achieved within a specified detection time.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| Loop break detection band | 0 to 100%FS | %FS | 2.5 | R/W | Ch1 | 41081 (0438h) |
| | | | | | Ch2 | 42081 (0820h) |
| | | | | | Ch3 | 43081 (0C08h) |
| | | | | | Ch4 | 44081 (0FF0h) |

* FS represents PV input range (full scale).

– Other settings

Settings of the relative parameters shown below are the same as other alarm events.

**Relative parameters**

- ALM set value1 / ALM set value2 ▶▶ 4-96
- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- ALM hysteresis ▶▶ 4-101
- DO option functions ▶▶ 4-102

## HB (Heater Break) Alarm

Detects heater break when the value of current through CT is below the specified value (HB alarm set value) during control output is ON.

**Note**

- This function is used only for relay output and SSR output types. This function cannot be used when the heater is controlled by thyristor phase angle control.
- It requires 400ms (0.4 sec) or more until control output is switched ON.

- Event No.

To set heater break alarm function, assign the following event number when configuring “DO event types” setting 4-91

| Event No. | Event type |
|---|---|
| 64 | CT[A] HB alarm |
| 65 | CT[B] HB alarm |
| 66 | CT[A] HB alarm OR CT[B] HB alarm |

**Point**

Select “CT[A] HB alarm” or “CT[B] HB alarm” for single phase power supply. In case of three phase power supply, select “CT[A] HB alarm OR CT[B] HB alarm”.

- HB alarm set value

The electric current set value at which an alarm occurs.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| CT[A] HB alarm set value | 0.0 to 50.0 | A (digit) | 0 | R/W | Ch1 | 41072 (042Fh) |
| | | | | | Ch2 | 42072 (0817h) |
| | | | | | Ch3 | 43072 (0BFFh) |
| | | | | | Ch4 | 44072 (0FE7h) |
| CT[B] HB alarm set value | 0.0 to 50.0 | A (digit) | 0 | R/W | Ch1 | 41076 (0433h) |
| | | | | | Ch2 | 42076 (081Bh) |
| | | | | | Ch3 | 43076 (0C03h) |
| | | | | | Ch4 | 44076 (0FEBh) |

**Point**

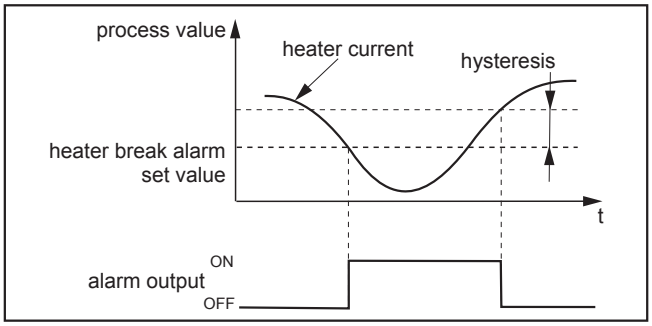
In case of three phase power supply, determine the HB alarm set value considering voltage fluctuations of the heater.

_ HB alarm hysteresis

Specifies the value which the input current value through CT terminal should recover from the HB alarm set value and to be judged normal.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| CT[A] HB alarm hysteresis | 0.0 to 50.0 | A (digit) | 0.5 | R/W | Ch1 | 41073 (0430h) |
| | | | | | Ch2 | 42073 (0818h) |
| | | | | | Ch3 | 43073 (0200h) |
| | | | | | Ch4 | 44073 (0FE8h) |
| CT[B] HB alarm hysteresis | 0.0 to 50.0 | A (digit) | 0.5 | R/W | Ch1 | 41077 (0434h) |
| | | | | | Ch2 | 42077 (0812h) |
| | | | | | Ch3 | 43077 (0C04h) |
| | | | | | Ch4 | 44077 (0FE2h) |

The relationship between the heater break alarm set value and hysteresis is as shown below.



## CT Input Terminal Arrangement RST

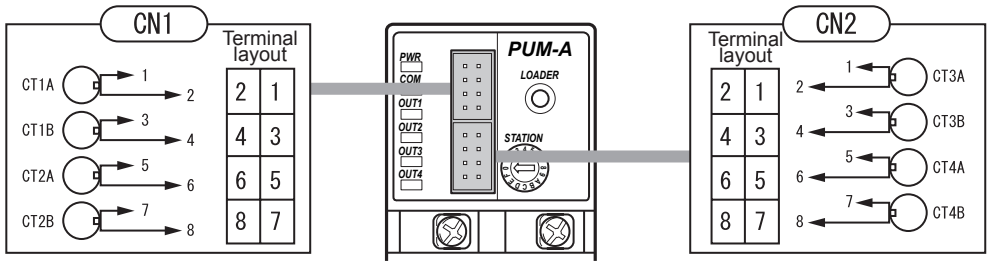
Changeover the arrangement of CT input terminals

Each module has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Changeover the arrangement of CT input terminal | 0: AB arrangement<br>1: AA arrangement | N/A | 0 | R/W | 40202 (00CAh) |

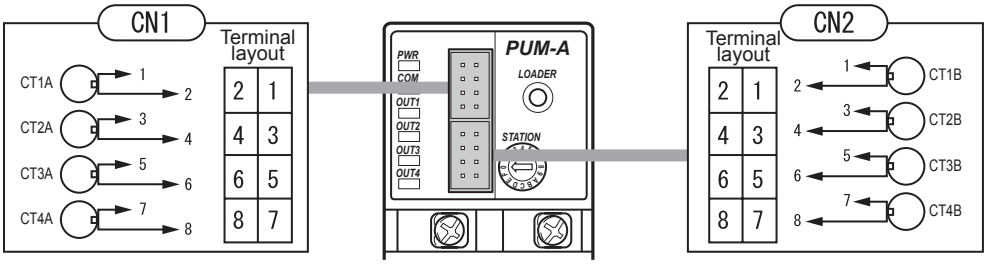
| Setting value | Operation mode |
|---|---|
| AB arrangement | Standard arrangement (following Fig.1) |
| AA arrangement | Four terminals of CT on the top side are A terminal. Four terminals of CT on the bottom side are B terminal. (Following Fig.2) |

### Fig1. CT input terminal of AB arrangement




*Pins No.2, 4, 6, and 8 of CN1 and CN2 are connected internally.
*CN2 cannot be used on PUMB.

### Fig2. CT input terminal of AA arrangement




*Number 2, 4, 6 and 8 pins of CN1 and CN2 are connected inside.

**Note**

– After setting is changed, make sure to turned ON the power supply again.

– Other settings

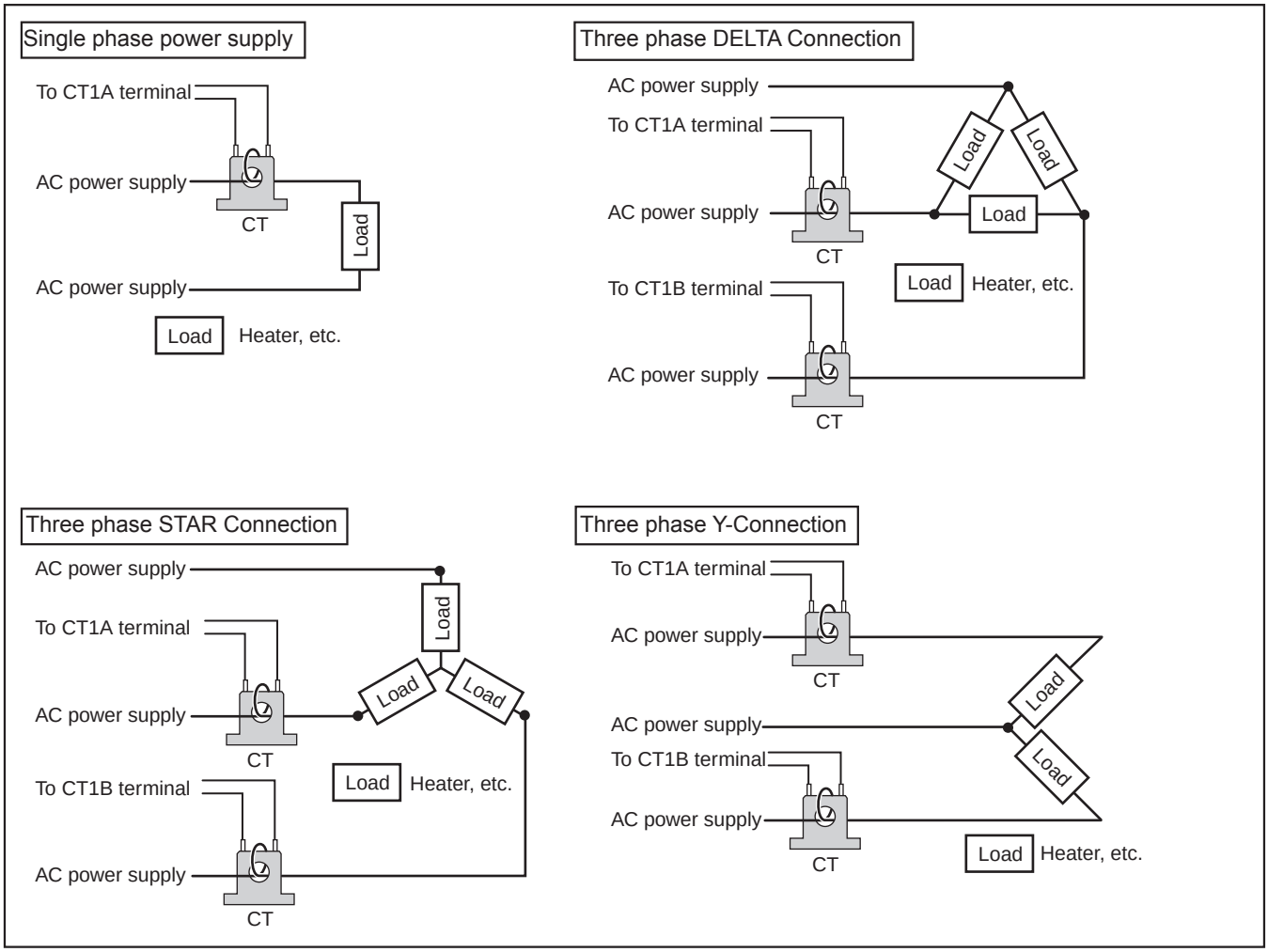
Relevant parameter settings as shown below are the same as other alarm event setting.

**Relative parameters**

- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- DO option functions ▶▶ 4-102

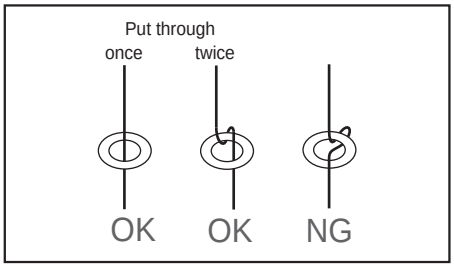
## CT terminal connection method

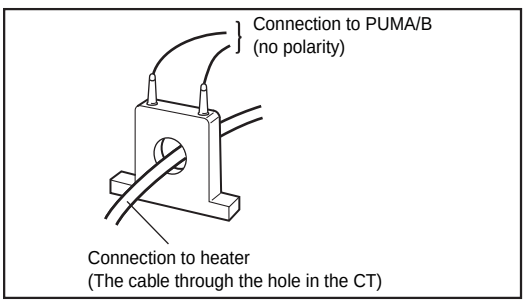
Before setting HB break alarm, complete wiring between the CT and CT (current transformer) terminals of this equipment. Examples are shown below.




Point

- When the margin of detection error is large due to low heater capacity, thread the cable into the hole of CT twice to double the current so that the sensitivity increases. Be sure to double the HB alarm set value in such cases.
- When threading the cable into the hole of CT, be sure to do so from the same direction.
- CT is connected as shown below.



## Load Short-circuit Alarm

Detects short-circuiting of the SSR or magnet conductor when the value of current through CT is above the specified value (Load short-circuit alarm set value) during control output is OFF.

Before setting Load short-circuit alarm, complete wiring between CT and CT terminals of this equipment in the same manner as HB alarm. ▶▶ 4-111

**Note**

- This function is used only for relay or SSR output types. This is not used when the heater is controlled by thyristor phase angle control.
- It requires 2 or more seconds until output is switched OFF.

– Event number

To set load short-circuit alarm function, assign the following event number when configuring “DO event types” setting ▶▶ 4-91

| Event No. | Event type |
|---|---|
| 67 | CT[A] load short-circuit alarm |
| 68 | CT[B] load short-circuit alarm |
| 69 | CT[A] load short-circuit alarm OR CT[B] load short-circuit alarm |

**Point**

Select “CT[A] load shirt-circuit alarm” or “CT[B] load short-circuit alarm” for single phase power supply. In case of three phase power supply, select “CT[A] load short-circuit alarm OR CT[B] load short-circuit alarm”

– Load short-circuit alarm set value

Sets the electric current set value at which an alarm occurs. Decide the value depending on the size of CT.

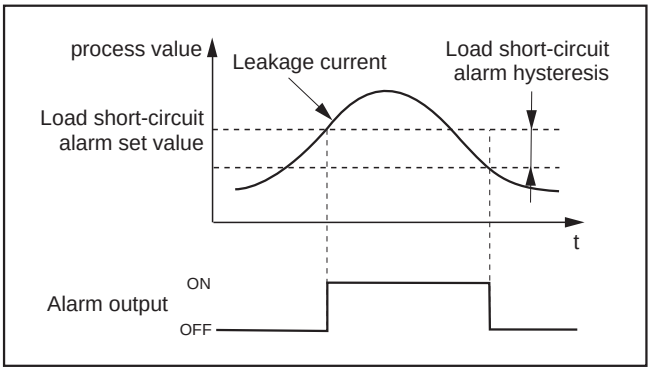
| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| CT[A] load short-circuit alarm set value | 0.0 to 50.0 | A (digit) | 0 | R/W | Ch1 | 41074 (0431h) |
| | | | | | Ch2 | 42074 (0819h) |
| | | | | | Ch3 | 43074 (0C01h) |
| | | | | | Ch4 | 44074 (0FE9h) |
| CT[B] load short-circuit alarm set value | 0.0 to 50.0 | A (digit) | 0 | R/W | Ch1 | 41078 (0435h) |
| | | | | | Ch2 | 42078 (081Dh) |
| | | | | | Ch3 | 43078 (0C05h) |
| | | | | | Ch4 | 44078 (0FEDh) |

– Load short-circuit alarm hysteresis

Specifies the value which the input current value through CT terminal should decrease from the load short-circuit alarm set value and to be judged normal.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) | |
|---|---|---|---|---|---|---|
| CT[A] load short-circuit alarm hysteresis | 0.0 to 50.0 | A (digit) | 0.5 | R/W | Ch1 | 41075 (0432h) |
| | | | | | Ch2 | 42075 (081Ah) |
| | | | | | Ch3 | 43075 (0C02h) |
| | | | | | Ch4 | 44075 (0FEAh) |
| CT[B] load short-circuit alarm hysteresis | 0.0 to 50.0 | A (digit) | 0.5 | R/W | Ch1 | 41079 (0436h) |
| | | | | | Ch2 | 42079 (081Eh) |
| | | | | | Ch3 | 43079 (0C06h) |
| | | | | | Ch4 | 44079 (0FEEh) |

The relationship between the load short-circuit alarm set value and hysteresis is as shown below.




– Other settings

Settings of the relative parameters shown below are the same as other alarm events.

**Relative parameters**

- ALM delay time ▶▶ 4-99
- ALM delay time units ▶▶ 4-100
- DO option functions ▶▶ 4-102

# 4.6 Communication Setting

## Communication Setting

The following communication settings can be performed on this module.

- RS-485 Communication speed setting and RS-485 parity setting ▶▶ 4-120
- RS-485 Communication permission setting ▶▶ 4-121
- Enhanced Communication module (PUMC) connection permission ▶▶ 4-121
- Master/slave setting in connected modules ▶▶ 4-122
- RS-485 Response interval time setting ▶▶ 4-123

The parameters reset the main unit is necessary when change the setting are marked (RST) in each setting explanation or parameter.

## RS-485 Communication Speed Setting and RS-485 Parity Setting (RST)

It is for setting transmission speeds and parity checks of external communication using RS-485.

Each module has the parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| RS-485 Communication speed | 0: 9.6kbps<br>1: 19.2kbps<br>2: 38.4kbps<br>3: No Setting<br>4: 115.2kbps | None | 1 | R/W | 40115(0072h) |
| RS-485 Parity setting | 0: None<br>1: Odd<br>2: Even | None | 0 | R/W | 40111(006Eh) |

**Note**

The communication speed and parity settings of the master and all slaves on the same communication system should be the same. If these settings are not the same, communication can not be performed.

## RS-485 Communication Permission Setting

It is for setting Read/Write permission of external communication using RS-485/loader communication.

Each module has the parameter shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| RS-485 Communication permission | 0: Read only<br>1: Read/Write | None | 1 | R/W | 40114(0071h) |

**Note**

- When connecting an enhanced communication module (CC-Link, etc.), “RS-485 Communication permission” is set to “1: Read/Write” on all module.
- Once “0: Read only” is set, parameters except for “RS-485 Communication permission” can not be changed (to Write). A response will be returned to Write, however, actual Write will not be performed.

## Enhanced Communication Module (PUMC) Connection Permission RST

It is for setting permission of inter-module communication when the enhanced communication module (PUMC) is connected.

Each module has the parameter shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Enhanced communication module (PUMC) connection | 0: PUMC not connected (RS-485 Enable)<br>1: PUMC connected (RS-485 Disable) | None | 0 | R/W | 40116(0073h) |

**Note**

- Even if “0: PUMC not connected (RS-485 Enable)” is set to one of the multiple modules, this communication setting does not influence the settings of the modules after this module. The permission setting is valid only for the module to which the permission setting is given.
- When this parameter is set to "PUMC connected (RS-485 Disable)", RS-485 communication alarm is invalid.

## Master/Slave Setting in Connected Modules

RST

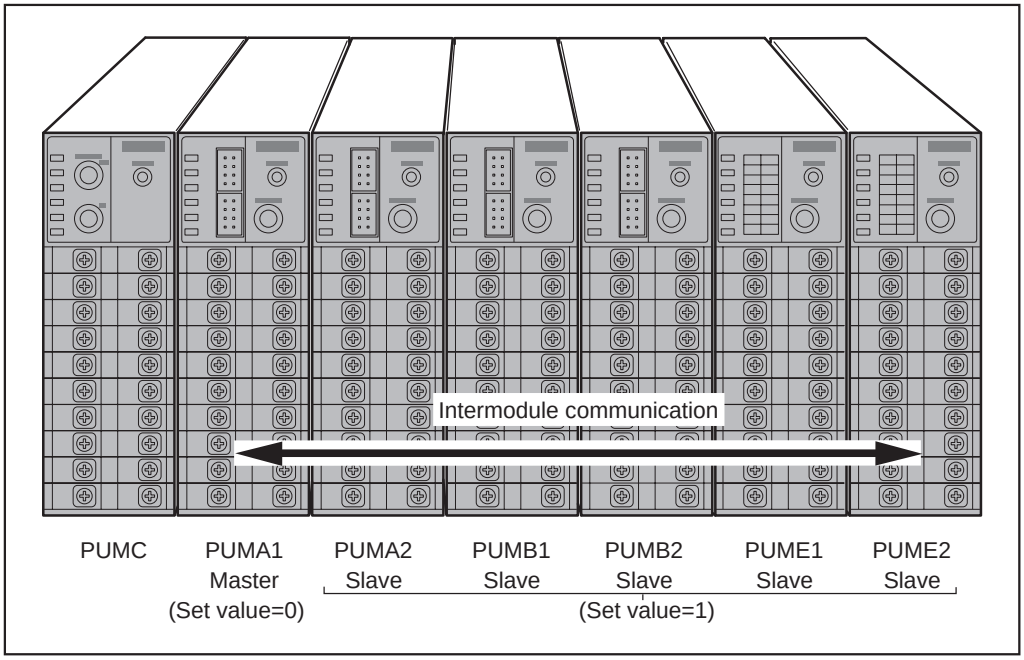
Specifies whether each of connected modules is master or slave.

Each module has the parameter shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Master/slave setting in connected modules | 0: Master<br>1: Slave | None | 1 | R/W | 40117(0074h) |

By setting one of connected control module controllers (4Ch type PUMA / 2Ch type PUMB) as the master (“0: Master”), intermodule communication between all connected module.

### Example of system configuration




**Note**

– Only 1 unit can be set as the maser (“0: Master”).

– Setting change is valid only after resetting the main unit.

## RS-485 Response Interval Time Setting

It is for setting response interval time of RS-485 communication.

**Point**

In RS-485 communication, transmitting and receiving are performed only on a single transmission line, therefore, switching between transmitting and receiving must be performed with precise timing. For this reason, response interval time must be set to secure the time after transmission of a host, that is a communication partner, is completed until the transmission line is switched to receiving.
The length of interval time should be set to suit a host that is a communication partner.

Each module has the parameter shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| RS-485 Response interval time | 0 to 25 | 20ms/1digit | 1 | R/W | 40113(0070h) |

**Note**

- Note that the response interval time is 20ms for every set value 1. The response interval time up to 500 ms can be set.
- The response interval time setting for the master and all slaves on the same communication system must be the same.

# 4.7 Optional Functions Setting

## Optional Functions Setting

The following functions can be added to this module.

The parameters reset the main unit is necessary when change the setting are marked (RST) in each setting explanation or parameter.

### DI function

- Digital input function setting ▶▶ 4-124
- Linkage operation setting ▶▶ 4-128

### Monitoring function for this module

- Input/output monitor setting ▶▶ 4-132
- LED display setting ▶▶ 4-142

### Other functions

- User address specification communication ▶▶ 4-145
- Reset main unit ▶▶ 4-146

## Digital Input Function Setting

Assigns the function which activates when a digital signal is input from DI1 to DI 8 in cases event input/output module are connected.

**Note**

Each channel can use only one unit of event input/output module.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI master Station No. setting RST | 0 to 32 | None | 0 | R/W | Ch1: 41011 (03F2h) |
| | | | | | Ch2: 42011 (07DAh) |
| | | | | | Ch3: 43011 (0BC2h) |
| | | | | | Ch4: 44011 (0FAAh) |
| DI-1 function select | 0 to 57 | None | 0 | R/W | Ch1: 41013 (03F4h) |
| | | | | | Ch2: 42013 (07DCh) |
| | | | | | Ch3: 43013 (0BC4h) |
| | | | | | Ch4: 44013 (0FACh) |
| DI-2 function select | 0 to 57 | None | 0 | R/W | Ch1: 41014 (03F5h) |
| | | | | | Ch2: 42014 (07DDh) |
| | | | | | Ch3: 43014 (0BC5h) |
| | | | | | Ch4: 44014 (0FADh) |
| DI-3 function select | 0 to 57 | None | 0 | R/W | Ch1: 41015 (03F6h) |
| | | | | | Ch2: 42015 (07DEh) |
| | | | | | Ch3: 43015 (0BC6h) |
| | | | | | Ch4: 44015 (0FAEh) |
| DI-4 function select | 0 to 57 | None | 0 | R/W | Ch1: 41016 (03F7h) |
| | | | | | Ch2: 42016 (07DFh) |
| | | | | | Ch3: 43016 (0BC7h) |
| | | | | | Ch4: 44016 (0FAFh) |
| DI-5 function select | 0 to 57 | None | 0 | R/W | Ch1: 41017 (03F8h) |
| | | | | | Ch2: 42017 (07E0h) |
| | | | | | Ch3: 43017 (0BC8h) |
| | | | | | Ch4: 44017 (0FB0h) |

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI-6 function select | 0 to 57 | None | 0 | R/W | Ch1: 41018 (03F9h) |
| | | | | | Ch2: 42018 (07E1h) |
| | | | | | Ch3: 43018 (0BC9h) |
| | | | | | Ch4: 44018 (0FB1h) |
| DI-7 function select | 0 to 57 | None | 0 | R/W | Ch1: 41019 (03FAh) |
| | | | | | Ch2: 42019 (07E2h) |
| | | | | | Ch3: 43019 (0BCAh) |
| | | | | | Ch4: 44019 (0FB2h) |
| DI-8 function select | 0 to 57 | None | 0 | R/W | Ch1: 41020 (03FBh) |
| | | | | | Ch2: 42020 (07E3h) |
| | | | | | Ch3: 43020 (0BCBh) |
| | | | | | Ch4: 44020 (0FB3h) |

### DI master Station No. Setting

The set value of “DI master Station No. setting” is the number of station number configuration switch of the object event input/output module plus “17”.

For example, when the station number configuration switch is set to “1”;

The set value of “DI master Station No. setting” should be “18”.

### The set value for “DI function select”

See the table below to decide which function to assign DI 1 to DI 5.

| Set value | Function name | Description | ON | OFF | Judgment condition |
|---|---|---|---|---|---|
| 0 | No function | No function | - | - | - |
| 1 | RUN/Standby switch | Switches between Standby ON and OFF(RUN) | Standby | RUN (Standby OFF) | Edge |
| 2 | Auto/Manual switch | Switches between auto and manual control output | Manual | Auto | Edge |
| 3 | Local/Remote switch | Switches between local and remote SV | Remote | Local | Edge |
| 4-5 | No function | Do not set | - | - | - |
| 6 | Start AT (Normal type) | Run standard auto-tuning | Run | Stop | Edge |
| 7 | Start AT (Low PV type) | Run low PV type auto-tuning | Run | Stop | Edge |
| 8-9 | No function | Do not set | - | - | - |
| 10 | Ramp SV ON/OFF | Enables or disables Ramp SV | OFF | ON | Edge |
| 11 | Ramp SV HOLD | Switches between Ramp SV HOLD and HOLD cancel | Hold | Hold cancel | Edge |
| 12 | Ramp soak OFF | Sets the ramp soak OFF | OFF | - | Edge |
| 13 | Ramp soak RUN/HOLD | Sets the ramp soak to RUN/HOLD | RUN | Hold | Edge |
| 14-16 | No function | Do not set | - | - | - |
| 17 | Latch release (all) | Cancels all of the sources currently acting as latches | Release | - | Edge |
| 18 | Latch release (DO1) | Cancels the source currently acting as a latch on DO1 | Release | - | Edge |
| 19 | Latch release (DO2) | Cancels the source currently acting as a latch on DO2 | Release | - | Edge |
| 20 | Latch release (DO3) | Cancels the source currently acting as a latch on DO3 | Release | - | Edge |
| 21 | Latch release (DO4) | Cancels the source currently acting as a latch on DO4 | Release | - | Edge |
| 22 | Latch release (DO5) | Cancels the source currently acting as a latch on DO5 | Release | - | Edge |
| 23-25 | No function | Do not set | - | - | - |
| 26 | Start timer (DO1) | Starts the specified timer for DO1 | Timer ON | Timer OFF | Level |
| 27 | Start timer (DO2) | Starts the specified timer for DO2 | Timer ON | Timer OFF | Level |
| 28 | Start timer (DO3) | Starts the specified timer for DO3 | Timer ON | Timer OFF | Level |
| 29 | Start timer (DO4) | Starts the specified timer for DO4 | Timer ON | Timer OFF | Level |
| 30 | Start timer (DO5) | Starts the specified timer for DO5 | Timer ON | Timer OFF | Level |
| 31-37 | No function | Do not set | - | - | - |
| 38 | Ramp/Soak Pattern No.+1 | When selecting pattern No., increases the Pattern No. by +1 | +1 | - | Level |
| 39 | Ramp/Soak Pattern No.+2 | When selecting pattern No., increases the Pattern No. by +2 | +2 | - | Level |
| 40 | Ramp/Soak Pattern No.+4 | When selecting pattern No., increases the Pattern No. by +4 | +4 | - | Level |
| 41 | Ramp soak RUN | Sets the ramp soak to RUN | RUN | - | Edge |

| Set value | Function name | Description | ON | OFF | Judgment condition |
|---|---|---|---|---|---|
| 42 | Ramp soak HOLD | Sets the ramp soak to HOLD | HOLD | - | Edge |
| 43 | Ramp soak RUN at DO1 startup | When turning on the power and start up the set timer of DO1, enables delay start | - | - | - |
| 44 | Ramp soak RUN at DO2 startup | When turning on the power and start up the set timer of DO2, enables delay start | - | - | - |
| 45 | Ramp soak RUN at DO3 startup | When turning on the power and start up set timer of DO3, enables delay start | - | - | - |
| 46 | Ramp soak RUN at DO4 startup | When turning on the power and start up the set timer of DO4, enables delay start | - | - | - |
| 47 | Ramp soak RUN at DO5 startup | When turning on the power and start up the set timer of DO5, enables delay start | - | - | - |
| 48 | No function | Do not set | - | - | - |
| 49 | Output 1 shutdown | Output 1 is set to 0% | Output 0% | - | Level |
| 50 | Output 2 shutdown | Output 2 is set to 0% | Output 0% | - | Level |
| 51 | Output 3 shutdown | Output 3 is set to 0% | Output 0% | - | Level |
| 52 | Output 4 shutdown | Output 4 is set to 0% | Output 0% | - | Level |
| 53 | - | Do no t set | - | - | - |
| 54 | OPEN | When selecting manual valve control, output the OPEN signal. | OPEN | - | Level |
| 55 | CLOSE | When selecting manual valve control, output theCLOSE signal. | CLOSE | - | Level |
| 56 | Input channel changeover 1 | When selecting the input channel, plus 1 | +1 | 0 | Level |
| 57 | Input channel changeover 2 | When selecting the input channel, plus 2 | +2 | 0 | Level |

**Note**

When the DI function for edge operations is selected, please note the followings.

- The power to the unit is turned on with DI turned on, the ON edge is accepted and the selected function is performed.
- The power to the unit is turned ON with DI turned OFF, the OFF edge is rejected and the selected function is not performed. To perform the selected function, switch DI OFF, ON, and OFF again to put DI into the OFF edge.
- In case Remote input master station No. , output master station No. and linkage operation master station No. have been also set as well as DI master station No., the red lamp of PWR LED will be illuminated (system FAULT) if none of the station numbers exist. PWR LED lamp will not be illuminated if any of the station numbers exists.

## Linkage Operation Setting RST

Switches the operation mode of multiple channels in response to that of the master channel.

Each channel (Ch1 to Ch4) has parameters below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Linkage operation master Station No. | 0 to 16 | None | 0 (own station No.) | R/W | Ch1: 41536 (05FFh) |
| | | | | | Ch2: 42536 (09E7h) |
| | | | | | Ch3: 43536 (0DCFh) |
| | | | | | Ch4: 44536 (11B7h) |
| Linkage operation master Ch No. | 1 to 4 | None | own Ch No. | R/W | Ch1: 41537 (0600h) |
| | | | | | Ch2: 42537 (09E8h) |
| | | | | | Ch3: 43537 (0DD0h) |
| | | | | | Ch4: 44537 (11B8h) |
| DI-9 function select | 0 to 57 | None | 0 | R/W | Ch1: 41021 (03FCh) |
| | | | | | Ch2: 42021 (07E4h) |
| | | | | | Ch3: 43021 (0BCCh) |
| | | | | | Ch4: 44021 (0FB4h) |
| DI-10 function select | 0 to 57 | None | 0 | R/W | Ch1: 41022 (03FDh) |
| | | | | | Ch2: 42022 (07E5h) |
| | | | | | Ch3: 43022 (0BCDh) |
| | | | | | Ch4: 44022 (0FB5h) |
| DI-11 function select | 0 to 57 | None | 0 | R/W | Ch1: 41023 (03FEh) |
| | | | | | Ch2: 42023 (07E6h) |
| | | | | | Ch3: 43023 (0BCEh) |
| | | | | | Ch4: 44023 (0FB6h) |
| DI-12 function select | 0 to 57 | None | 0 | R/W | Ch1: 41024 (03FFh) |
| | | | | | Ch2: 42024 (07E7h) |
| | | | | | Ch3: 43024 (0BCFh) |
| | | | | | Ch4: 44024 (0FB7h) |
| DI-13 function select | 0 to 57 | None | 0 | R/W | Ch1: 41025 (0400h) |
| | | | | | Ch2: 42025 (07E8h) |
| | | | | | Ch3: 43025 (0BD0h) |
| | | | | | Ch4: 44025 (0FB8h) |

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| DI-14 function select | 0 to 57 | None | 0 | R/W | Ch1: 41026 (0401h) |
| | | | | | Ch2: 42026 (07E9h) |
| | | | | | Ch3: 43026 (0BD1h) |
| | | | | | Ch4: 44026 (0FB9h) |
| DI-15 function select | 0 to 57 | None | 0 | R/W | Ch1: 41027 (0402h) |
| | | | | | Ch2: 42027 (07EAh) |
| | | | | | Ch3: 43027 (0BD2h) |
| | | | | | Ch4: 44027 (0FBAh) |
| DI-16 function select | 0 to 57 | None | 0 | R/W | Ch1: 41028 (0403h) |
| | | | | | Ch2: 42028 (07EBh) |
| | | | | | Ch3: 43028 (0BD3h) |
| | | | | | Ch4: 44028 (0FBBh) |

### Master Ch No. setting

Set “Linkage operation master station No.” to the No. of module (station number configuration switch) which acts as a trigger of linkage operation plus 1 and set “Linkage operation Ch No.” to its Ch No.

To perform linkage operation intramodule, set “Linkage operation master station No.” to “0” or to own No. (station number configuration switch plus 1). Please note that if “Linkage operation master Ch No.” is set to own No., linkage operation is not operated.

### How Linkage operation works

Switching the operation mode of the master channel of the master station turns ON the corresponding DI function No. of own channel, which activates the designated DI function.

Operation mode of master Ch and corresponding DI No.

| Operation mode of master channel of master station | Corresponding DI function No. of others |
|---|---|
| Remote | DI-11 |
| Standby | DI-13 |
| Manual | DI-14 |
| Local | DI-15 |
| Error input | DI-16 |

Refer to “The set value for “DI function select”” for types of DI functions to be designated. ▶▶ 4-124

Note

- DI-9, 10, and 12 cannot be used for linkage operation.
- In case Remote input master station No. , DI master station No., and output master station No. have been also set as well as linkage operation master station No., the red lamp of PWR LED will be illuminated (system FAULT) if none of the station numbers exist. PWR LED lamp will not be illuminated if any of the station numbers exists.

## Example of setting

### Ex.1 Switching the all channels of 1 unit control module to Remote SV operation when the master Ch switched to Remote operation.

- Set own Ch 1 as “Linkage operation master Ch No.” (No need to designate DI function when own Ch is the master Ch.)
- Set “Linkage operation master Ch No.” of Ch 2, 3 and 4 to own Ch 1. Assign the DI function, “3: Local/Remote switch” , to the corresponding DI function No. 11.

The setting details are as follows.

| Ch | Parameter name | Set value |
|---|---|---|
| Ch1 | Linkage operation master Station No. | 0 |
| | Linkage operation master Ch No. | 1 |
| Ch2 | Linkage operation master Station No. | 0 |
| | Linkage operation master Ch No. | 1 |
| | DI function No.11 designation | 3 |
| Ch3 | Linkage operation master Station No. | 0 |
| | Linkage operation master Ch No. | 1 |
| | DI function No.11 designation | 3 |
| Ch4 | Linkage operation master Station No. | 0 |
| | Linkage operation master Ch No. | 1 |
| | DI function No.11 designation | 3 |

By this setting, switching Ch1 to Remote mode automatically switches all channels to Remote mode operation.

### Ex.2 Switching all Ch of 2 units control module to Standby mode when the master Ch switched to Standby mode.

- The station numbers are “1” and “3”.
- Set Ch1 of the station No.1 as the master. (No need to designate DI function when own Ch is the master Ch.)
- Set Ch1 of own station as the master for Ch 2, 3 and 4 of the station No.1. Assign the DI function, “1: RUN/Standby switch” , to the corresponding DI function No. 13.
- As for station No.3, set Ch1 of the station No.1 as the master. Assign the DI function, “1: RUN/Standby switch” , to the corresponding DI function No. 13.

The setting details are as follows.

| | Ch | Parameter name | Set value |
|---|---|---|---|
| Station No.1 | | | |
| | Ch1 | Linkage operation master Station No. | 0 |
| | | Linkage operation master Ch No. | 1 |
| | Ch2 | Linkage operation master Station No. | 0 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| | Ch3 | Linkage operation master Station No. | 0 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| | Ch4 | Linkage operation master Station No. | 0 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| Station No.3 | | | |
| | Ch1 | Linkage operation master Station No. | 1 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| | Ch2 | Linkage operation master Station No. | 1 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| | Ch3 | Linkage operation master Station No. | 1 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |
| | Ch4 | Linkage operation master Station No. | 1 |
| | | Linkage operation master Ch No. | 1 |
| | | DI function No.13 designation | 1 |

By this setting, switching Ch1 of the station No.1 to Standby mode automatically switches all channels of the stations No.1 and 3 to Standby mode operation.

## Input/Ouput Monitor Setting

The monitor allows you to verify the current input and output conditions of the module.

The monitor can display the following items.

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Unit | Attribute | Modbus register number (relative address) |
|---|---|---|---|
| Measurement value (PV) | %FS | R | Ch1: 30002 (0001h)<br>31001 (03E8h) |
| | | | Ch2: 30003 (0002h)<br>32001 (07D0h) |
| | | | Ch3: 30004 (0003h)<br>33001 (0BB8h) |
| | | | Ch4: 30005 (0004h)<br>34001 (0FA0h) |
| Set value (SV) | %FS | R | Ch1: 30006 (0005h)<br>31002 (03E9h) |
| | | | Ch2: 30007 (0006h)<br>32002 (07D1h) |
| | | | Ch3: 30008 (0007h)<br>33002 (0BB9h) |
| | | | Ch4: 30009 (0008h)<br>34002 (0FA1h) |
| DV | %FS | R | Ch1: 30010 (0009h)<br>31003 (03EAh) |
| | | | Ch2: 30011 (000Ah)<br>32003 (07D2h) |
| | | | Ch3: 30012 (000Bh)<br>33003 (0BBAh) |
| | | | Ch4: 30013 (000Ch)<br>34003 (0FA2h) |
| Output value (MV1) | % | R | Ch1: 30014 (000Dh)<br>31004 (03EBh) |
| | | | Ch2: 30016 (000Fh)<br>32004 (07D3h) |
| | | | Ch3: 30018 (0011h)<br>33004 (0BBBh) |
| | | | Ch4: 30020 (0013h)<br>34004 (0FA3h) |

| Parameter | Unit | Attribute | Modbus register number (relative address) |
|---|---|---|---|
| Output value (MV2) | % | R | Ch1: 30015 (000Eh)<br>31005 (03ECh) |
| | | | Ch2: 30017 (0010h)<br>32005 (07D4h) |
| | | | Ch3: 30019 (0012h)<br>33005 (0BBCh) |
| | | | Ch4: 30021 (0014h)<br>34005 (0FA4h) |
| Remote SV (RSV) | %FS | R | Ch1: 30022 (0015h)<br>31045 (0414h) |
| | | | Ch2: 30023 (0016h)<br>32045 (07FCh) |
| | | | Ch3: 30024 (0017h)<br>33045 (0BE4h) |
| | | | Ch4: 30025 (0018h)<br>34045 (0FCCh) |
| Cold junction compensation temperature | degree C<br>(0.1 degree C /1digit) | R | Ch1: 30110 (006Dh)<br>31016 (03F7h) |
| | | | Ch2: 30111 (006Eh)<br>32016 (07DFh) |
| | | | Ch3: 30112 (006Fh)<br>33016 (0BC7h) |
| | | | Ch4: 30113 (0070h)<br>34016 (0FAFh) |
| Output value | % | R | Ch1: 30120 (0077h) |
| | | | Ch2: 30121 (0078h) |
| | | | Ch3: 30122 (0079h) |
| | | | Ch4: 30123 (007Ah) |
| Heater current [A] | A(0.1A/1digit) | R | Ch1: 30071 (0046h)<br>31046 (0415h) |
| | | | Ch2: 30073 (0048h)<br>32046 (07FDh) |
| | | | Ch3: 30075 (004Ah)<br>33046 (0BE5h) |
| | | | Ch4: 30077 (004Ch)<br>34046 (0FCDh) |

| Parameter | Unit | Attribute | Modbus register number (relative address) |
|---|---|---|---|
| Heater current [B] | A(0.1A/1digit) | R | Ch1: 30072 (0047h) 31047 (0416h) |
| | | | Ch2: 30074 (0049h) 32047 (07FEh) |
| | | | Ch3: 30076 (004Bh) 33047 (0BE6h) |
| | | | Ch4: 30078 (004Dh) 34047 (0FCEh) |
| Leak current [A] | A(0.1A/1digit) | R | Ch1: 30081 (0050h) 31048 (0417h) |
| | | | Ch2: 30083 (0052h) 32048 (07FFh) |
| | | | Ch3: 30085 (0054h) 33048 (0BE7h) |
| | | | Ch4: 30087 (0056h) 34048 (0FCFh) |
| Leak current [B] | A(0.1A/1digit) | R | Ch1: 30082 (0051h) 31049 (0418h) |
| | | | Ch2: 30084 (0053h) 32049 (0800h) |
| | | | Ch3: 30086 (0055h) 33049 (0BE8h) |
| | | | Ch4: 30088 (0057h) 34049 (0FD0h) |
| Error source display | None | R | Ch1: 31008 (03EFh) |
| | | | Ch2: 32008 (07D7h) |
| | | | Ch3: 33008 (0BBFh) |
| | | | Ch4: 34008 (0FA7h) |
| Alarm 1-5 status | None | R | Ch1: 31007 (03EEh) |
| | | | Ch2: 32007 (07D6h) |
| | | | Ch3: 33007 (0BBEh) |
| | | | Ch4: 34007 (0FA6h) |
| Event input status | None | R | Ch1: 31061 (0424h) |
| | | | Ch2: 32061 (080Ch) |
| | | | Ch3: 33061 (0BF4h) |
| | | | Ch4: 34061 (0FDCh) |

| Parameter | Unit | Attribute | Modbus register number (relative address) |
|---|---|---|---|
| Remaining time on timer 1 | min:sec. / hr:min. | R | Ch1: 31011 (03F2h) |
| | | | Ch2: 32011 (07DAh) |
| | | | Ch3: 33011 (0BC2h) |
| | | | Ch4: 34011 (0FAAh) |
| Remaining time on timer 2 | min:sec. / hr:min. | R | Ch1: 31012 (03F3h) |
| | | | Ch2: 32012 (07DBh) |
| | | | Ch3: 33012 (0BC3h) |
| | | | Ch4: 34012 (0FABh) |
| Remaining time on timer 3 | min:sec. / hr:min. | R | Ch1: 31013 (03F4h) |
| | | | Ch2: 32013 (07DCh) |
| | | | Ch3: 33013 (0BC4h) |
| | | | Ch4: 34013 (0FACh) |
| Remaining time on timer 4 | min:sec. / hr:min. | R | Ch1: 31014 (03F5h) |
| | | | Ch2: 32014 (07DDh) |
| | | | Ch3: 33014 (0BC5h) |
| | | | Ch4: 34014 (0FADh) |
| Remaining time on timer 5 | min:sec. / hr:min. | R | Ch1: 31015 (03F6h) |
| | | | Ch2: 32015 (07DEh) |
| | | | Ch3: 33015 (0BC6h) |
| | | | Ch4: 34015 (0FAEh) |

## Explanation on parameters

- Measurement value (PV)
  The current input value is stored (See “PV input basic setting” ▶▶ 4-15 )

- Set value (SV)
  The currently controlled set value is stored. In Local operation, SV value ▶▶ 4-4 is stored and in Remote operation mode, Remote SV input value ▶▶ 4-24 is stored.

- DV
  The difference between PV and SV is stored. (DV=PV-SV)

- Output value (MV1)
  The current output value is stored. In single control, the PID caluculated result is stored and in heating/cooling control, the output value of the heating output side is stored.

- Output value (MV2)
  in heating/cooling control , the current output value of the cooling output side is stored. In single control, always the output value of MV2 lower limits is stored. ▶▶ 4-83

- Remote SV (RSV)
  The Remote SV input value ▶▶ 4-24 is stored. The Remote SV input value can be monitored in local mode also.

- Cold junction compensation temperature
  When “Cold junction compensation” ▶▶ 4-23 is set to “1:ON” , the compensation value which is added to the input value is stored. In the case of thermocouple input only, the valid value is stored.

- Output value
  Value of output which is currently output from the output terminal is stored.

- Heater current [A/B]
  The current value (when the power is ON) being measured at the CT input terminal is stored.

## CT Input Monitor changeover

Select the monitoring function of CT

When this parameter is set to "ON", CT value is indicated as heater current value all the time with no relation to output state.

Even output type is set to current type, CT value can be indicated as heater current value by setting this parameter to "ON".

Each channel (Ch1 to Ch4) has parameters shown below.

| Parameter | Setting range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| CT A monitor changeover | 0: OFF<br>1: ON | N/A | 0 | R/W | Ch1: 41082 (0439h) |
| | | | | | Ch2: 42082 (0821h) |
| | | | | | CH3: 43082 (0C09h) |
| | | | | | Ch4: 44082 (0FF1h) |
| CT B monitor changeover | 0: OFF<br>1: ON | N/A | 0 | R/W | Ch1: 41083 (043Ah) |
| | | | | | Ch2: 42083 (0822h) |
| | | | | | CH3: 43083 (0C0Ah) |
| | | | | | Ch4: 44083 (0FF2h) |

Select the setting value according to the following table.

| Setting value | Function |
|---|---|
| OFF | When relay/SSR is set to ON, Heater current value is measured.<br>When relay/SSR is set to OFF, Leakage current value is measured.<br>If main unit is a current output type, it can not measure the heater current value. |
| ON | Current value is measured by CT input all the time.<br>Measured current value can be checked by heater current value.<br>Even relay /SSR is set to OFF, current value is measured.<br>(Leakage current value will not be changed)<br>Even if specification of current output is set, current value is measured. |

**Note**

– When this parameter is set to ON, heater break alarm and leak current alarm can not be used.

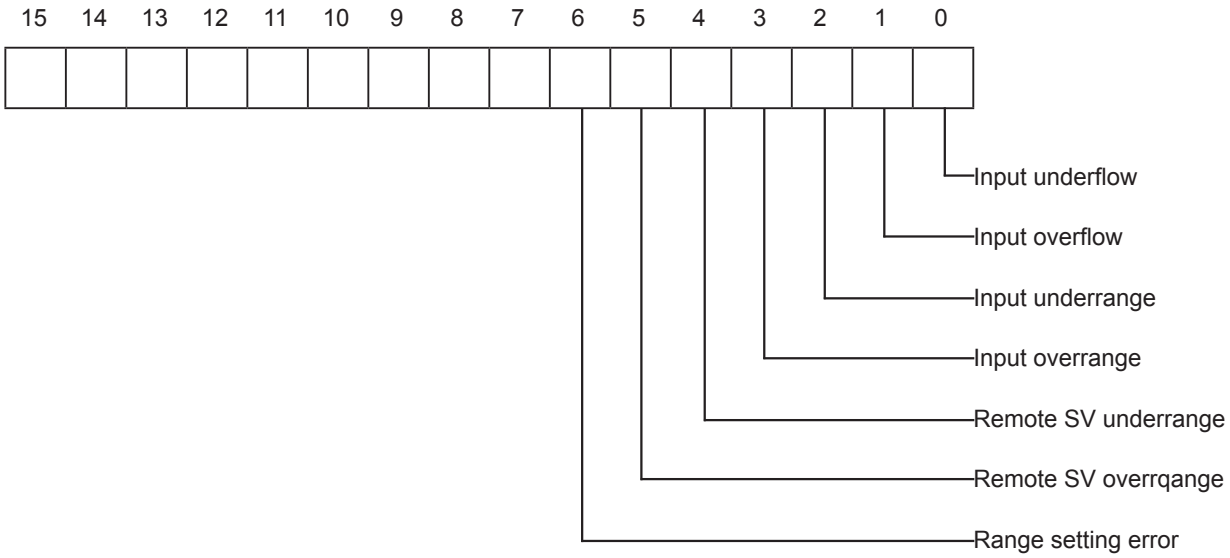
– When specification of current output is set, only a monitor can be used.

- Leak current [A/B]

  The leak current value (when the power is OFF) being measured at the CT input terminal is stored.

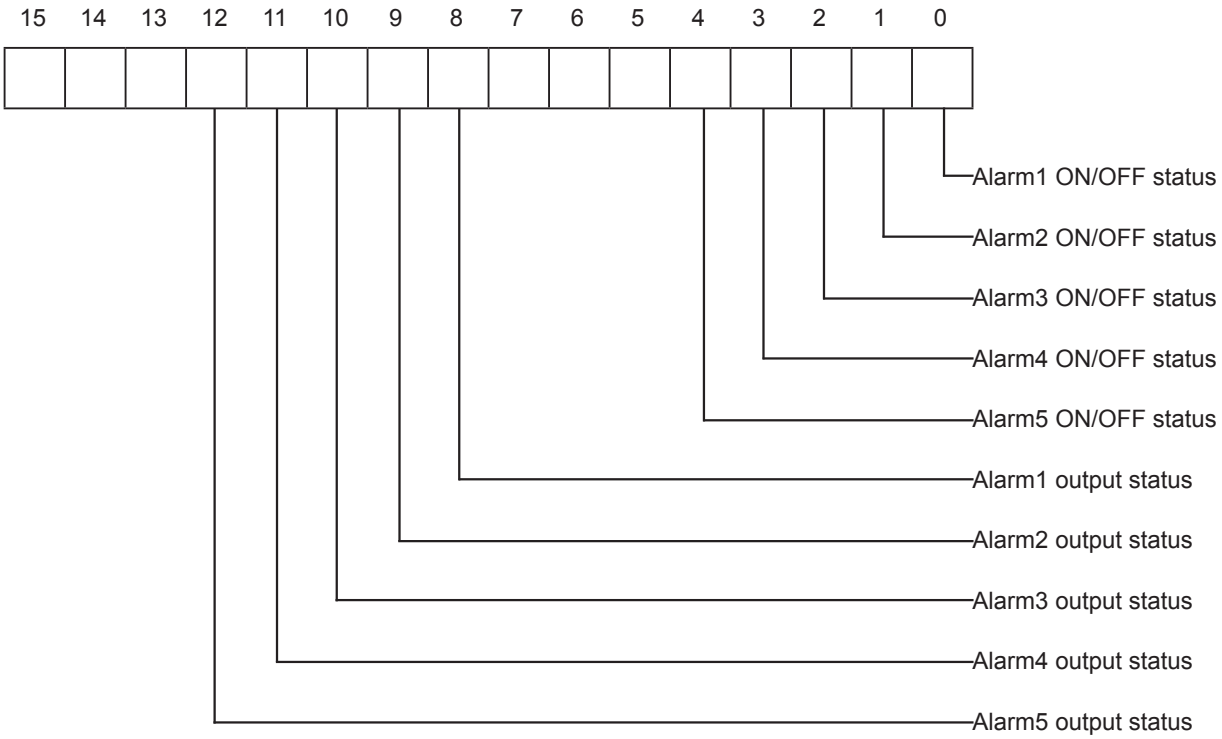
- Error source display

  Input error status of PV or Remote SV is stored in bits. When an input error occurred, the corresponding bit turns ON.



- Alarm 1-5 status

  ON/OFF and the output status of alarms is stored in bits. As for high 8 bits, if an error occurred the corresponding bit turns ON. As for low 8 bits, if an alarm output is ON the corresponding bit turns ON.

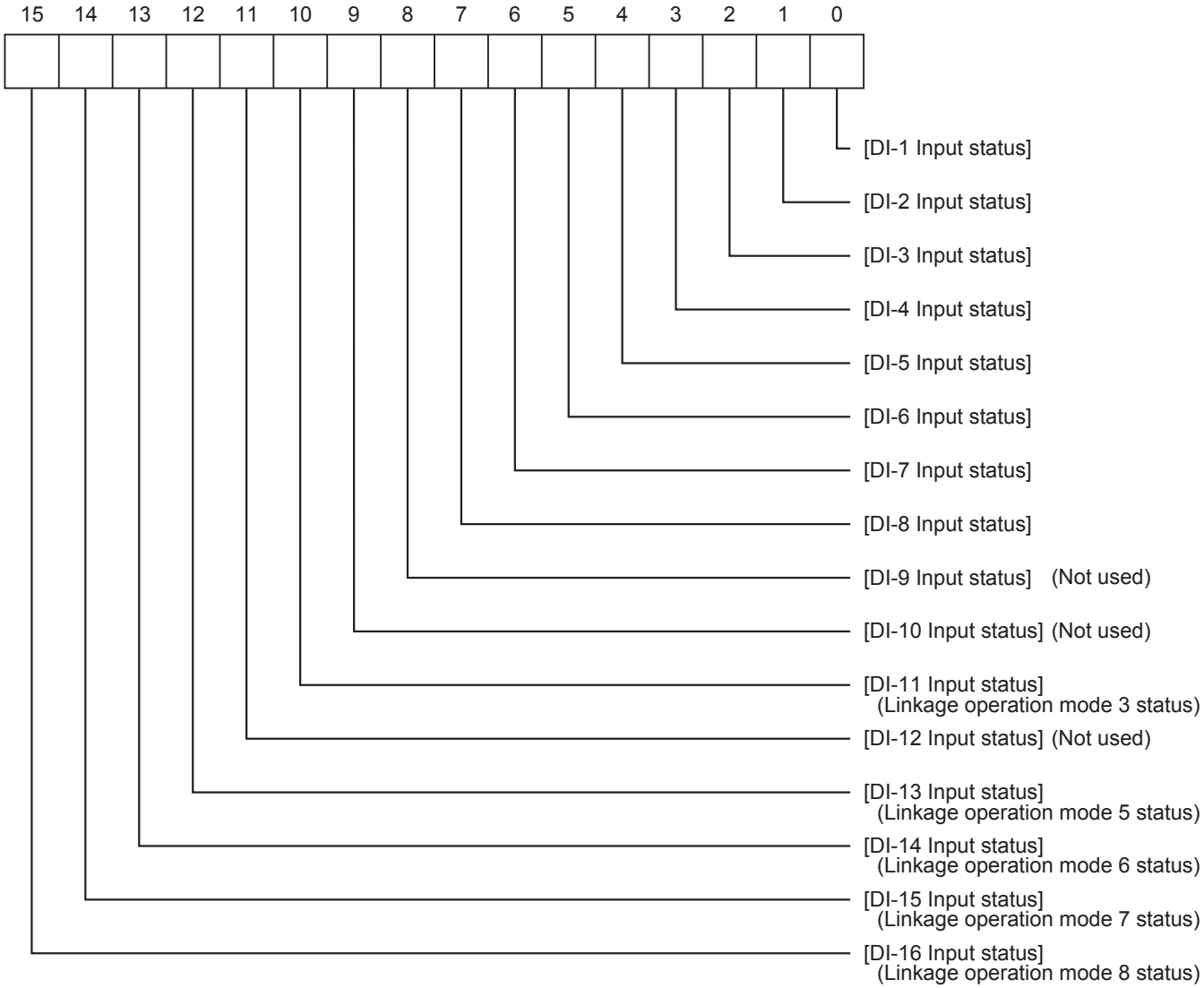



When non-excitation output alarm function is selected for DO option functions setting ▶▶ 4-102, the output status is contrary to Alarm ON/OFF status.

- Event input status display

  DI input status of event input/output module specified when setting digital input functions ▶▶ 4-124 is stored.

  When digital input is ON, the corresponding bit turns ON.



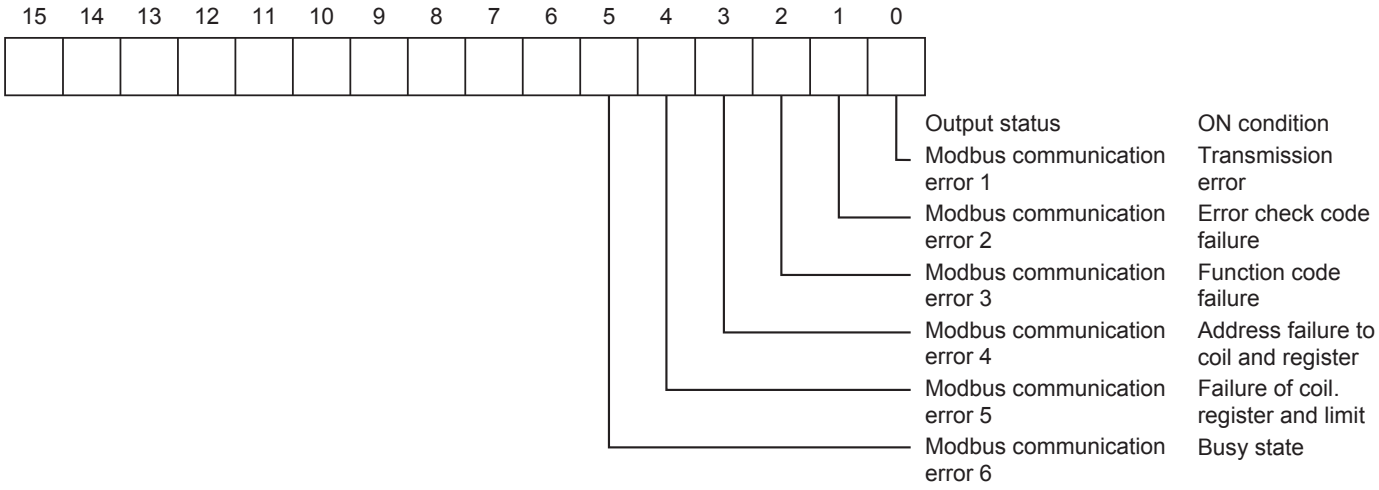

- Remaining time on timer 1/2/3/4/5

  Remaining time of delay timer is stored when “DO event type ▶▶ 4-91 ” is set to “ALM delay time ▶▶ 4-99 .”

## Function of ModBUS communication error alarm monitor

This function is to monitor the status of RS485 communication

When error occurs to read or write the parameter via RS485, Bit will be turned ON corresponding to each error.




**Note**

- When "Enhanced communication module (PUMC) connection" is set to "PUMC connected.", this function is invalid.
- This function provide the alarm function corresponding to message from host device.
  Alarm may occur even if non-responding condition is selected for host device.
- ModBUS communication error 1 to 6 are updated via each RS-485 communication and a value of ModBUS communication error is maintained while communication is not performed.
  When power is turned ON/OFF, it will be reset.

## LED Display Setting RST

Specifies the lighting conditions of the LED lamps on the front terminal block of this module.

Each module has the parameter shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| LED2 Lamp Allocation | 0 to 5 | None | 1 | R/W | 40222 (00DDh) |
| LED3 Lamp Allocation | 0,8,12,16,41 to 46, 50 to 58 | None | 12 | R/W | 40223 (00DEh) |
| LED4 Lamp Allocation | 0,9,13,17,71 to 76, 80 to 88 | None | 13 | R/W | 40224 (00DFh) |
| LED5 Lamp Allocation | 0,10,14,18,101 to 106, 110 to 118 | None | 14 | R/W | 40225 (00E0h) |
| LED6 Lamp Allocation | 0,11,15,19,131 to 136, 140 to 148 | None | 15 | R/W | 40226 (00E1h) |

## LED Lamps

On the front terminal block, there are 6 LED lamps which are from the top; “LED1”, “LED2”, “LED3”, “LED4”, “LED5”, and “LED6” to indicate the operation state of this module. According to the state of this module, the lamps illuminate as shown below.

| Operation State | | LED Lamp | | | | | |
|---|---|---|---|---|---|---|---|
| | | LED1 | LED2 | LED3 | LED4 | LED5 | LED6 |
| Start up | | Green light ON *1 | | | | | |
| After initial processing | | | | | | | |
| | Normal processing | Green light ON *1 | Operates to the designated lighting condition. | | | | |
| | Communication error | Red light ON | Operates to the designated lighting condition. | | | | |
| | Input error (Unit minor failure) | Red light blinking | Operates to the designated lighting condition. | | | | |

*1 If the module is set as the master module for intermodule communication, the green light blinks.

## LED lighting condition setting

Lighting conditions can be set to all of the lamps except “LED1.”

– "LED2" lamp lighting condition setting

| Lighting Condition | | LED Color | Set Value |
|---|---|---|---|
| None | | Light OFF | 0 |
| RS485 Communication state | While receiving | Green | 1 |
| | While transmitting | Orange | |
| All channels Standby *1 | | Green | 2 |
| All channels error input state *1 | | Orange | 3 |
| All channels Auto-tuning *1 | | Green | 4 |
| All channels DO output *1 | | Orange | 5 |

*1 LED lamp will be illuminated if any channel applies to the condition.

– ”LED3” to “LED6” lamp lighting condition setting

| Lighting condition | LED color | Set value | | | |
|---|---|---|---|---|---|
| | | LED3 | LED4 | LED5 | LED6 |
| None | Light OFF | 0 | 0 | 0 | 0 |
| Being output *1 | Green | 8 | 9 | 10 | 11 |
| Being output / Error input | Green/ Red *2 | 12 | 13 | 14 | 15 |
| DO 1 to DO8 output *3 | Red | 16 | 17 | 18 | 19 |
| Error input | Red | 41 | 71 | 101 | 131 |
| Manual mode | Green | 42 | 72 | 102 | 132 |
| Standby | Green | 43 | 73 | 103 | 133 |
| Remote mode | Green | 44 | 74 | 104 | 134 |
| Soft start | Green | 45 | 75 | 105 | 135 |
| Ramp SV | Green | 46 | 76 | 106 | 136 |
| Auto-tuning | Green | 50 | 80 | 110 | 140 |
| DO1 output | Red | 51 | 81 | 111 | 141 |
| DO2 output | Red | 52 | 82 | 112 | 142 |
| DO3 output | Red | 53 | 83 | 113 | 143 |
| DO4 output | Red | 54 | 84 | 114 | 144 |
| DO5 output | Red | 55 | 85 | 115 | 145 |

*1 With relay output or SSR drive output type, LED lamps illuminate when output is switched ON. With current output type, LED lamps remain OFF.

*2 LED lamps will illuminate as shown below according to the status of input error and control output.

| | | Input error status | |
|---|---|---|---|
| | | Abnormal | Normal |
| Control output | ON | Red light ON | Green light ON |
| | OFF | Red light ON | Light OFF |

*3 LED lamps illuminate if any of DO1 to DO5 output has been switched ON.

## User Address Specification Communication RST

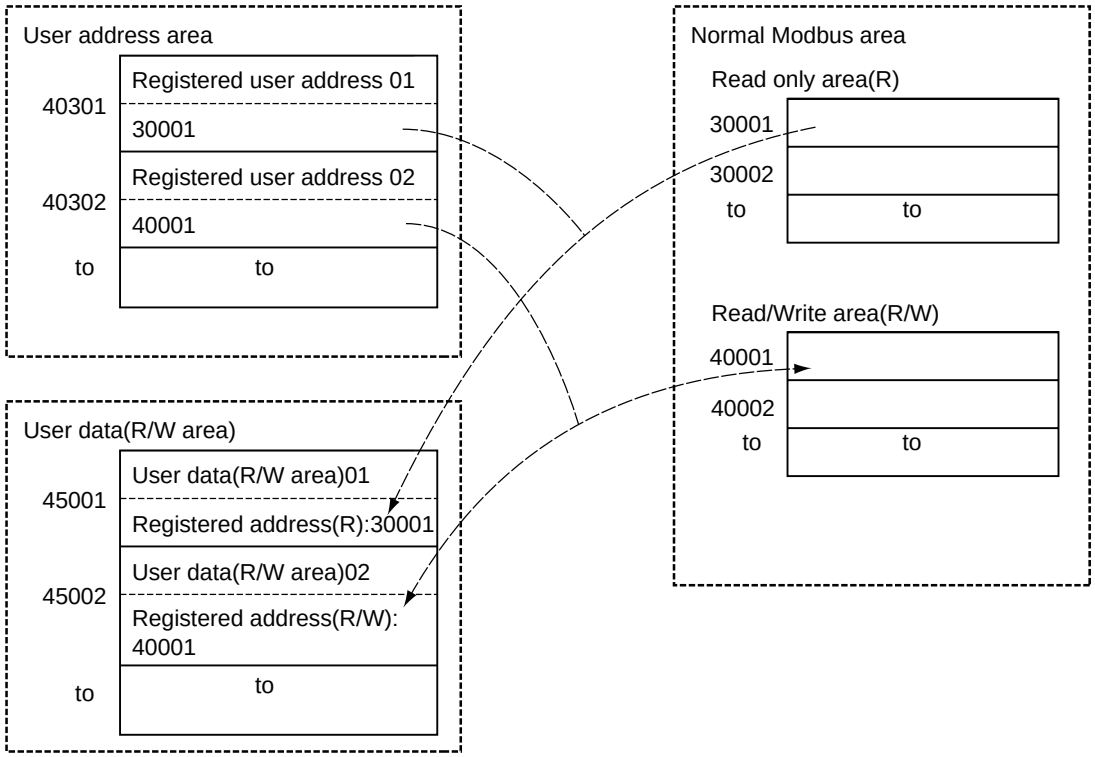
Random addresses can be set to the user address area. Maximum 32 addresses can be registered.

The relative parameters are as shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| User address 01: Register number specification | 30001 to 44999 | None | 30002 | R/W | 40301 (012Ch) |
| to | | | | | |
| User address 32: Register number specification | 30001 to 44999 | None | 30002 | R/W | 40332 (014Bh) |
| User data 01: (R/W area) | Depends on “User address 01” | | | | 45001 (1388h) |
| to | | | | | |
| User data 32: (R/W area) | Depends on “User address 32” | | | | 45032 (13A7h) |

The addresses specified for “User address 01 to 32” can be used for the corresponding “User data 01 to 32.”

Random or nonconsecutive addresses can be treated as successive areas by using “User data 01 to 32” parameters.




**Note**

- If an abnormal Modbus address is set as “User address”, it cannot read or write data using “User data (R/W area).
- If a Modbus address of Read only area is set as “User address”, it cannot write data to the corresponding “User data (R/W area).”

## Reset Main Unit

Resets (restarts) the main unit.

The relative parameter is as shown below.

| Parameter | Range | Unit | Factory default | Attribute | Modbus register number (relative address) |
|---|---|---|---|---|---|
| Reset main unit | 0: Do nothing<br>1: Reset main unit | None | 0 | R/W | 40101 (0064h) |

The main unit is reset if this parameter is set to (“1: Reset main unit”). As “Reset main unit” is the same operation as supplying the power to the main unit, changed parameters which requires restarting of the main unit can be reflected without doing so.

Point

RST mark is on the parameters which requires restarting of the main unit after setting change.

# 5 Communication

# 5.1 Communication Functions

PUM is equipped with communication functions from the RS-485 interface and loader interface, which enables the transmission and reception of data between such devices as the personal computer, programmable controller, and graphic panel.

The communication system is composed of a master and slave relationship. Up to thirty-two slaves (PUMs) may be connected to one master (such as a personal computer) based on a “single master/multiple slave” method.

However, the master can only communicate with one slave at a time. Therefore, each slave is specified by the “Station No.” setting. With loader communication, only one slave can be connected to one master.

Note

- Systems constructed with the PUM as slaves do not respond to messages issued by the master with broadcast queries where the station number is “0”.
- Communication with loader interface should not be attempted during production operation or during RS-485 communication.

In order to have proper communication between master and slave, the transmission data must be in the same format. This document explains how to transmit data using the Modbus RTU protocol format.

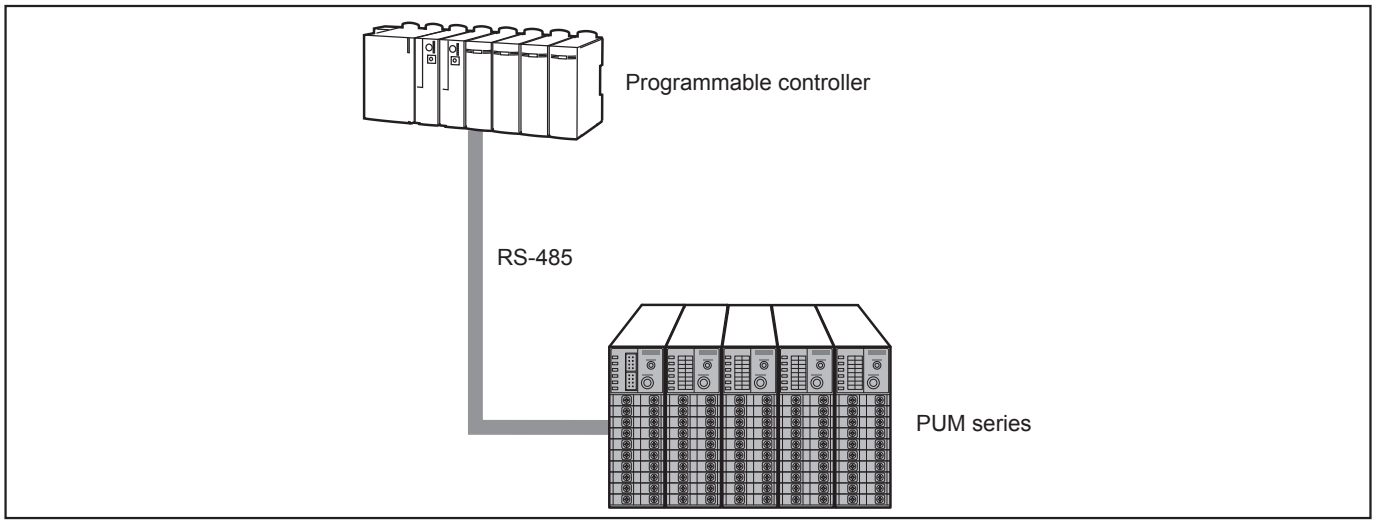
When using equipment with an RS-232C interface, such as a personal computer, as the master, make sure to use an RS-232C to RS-485 converter.

When using loader communication, you can use RS-232C communication with the personal computer by connecting the loader interface located on the main unit front face with the loader communication cable (model: PUMZ*L01, optional).

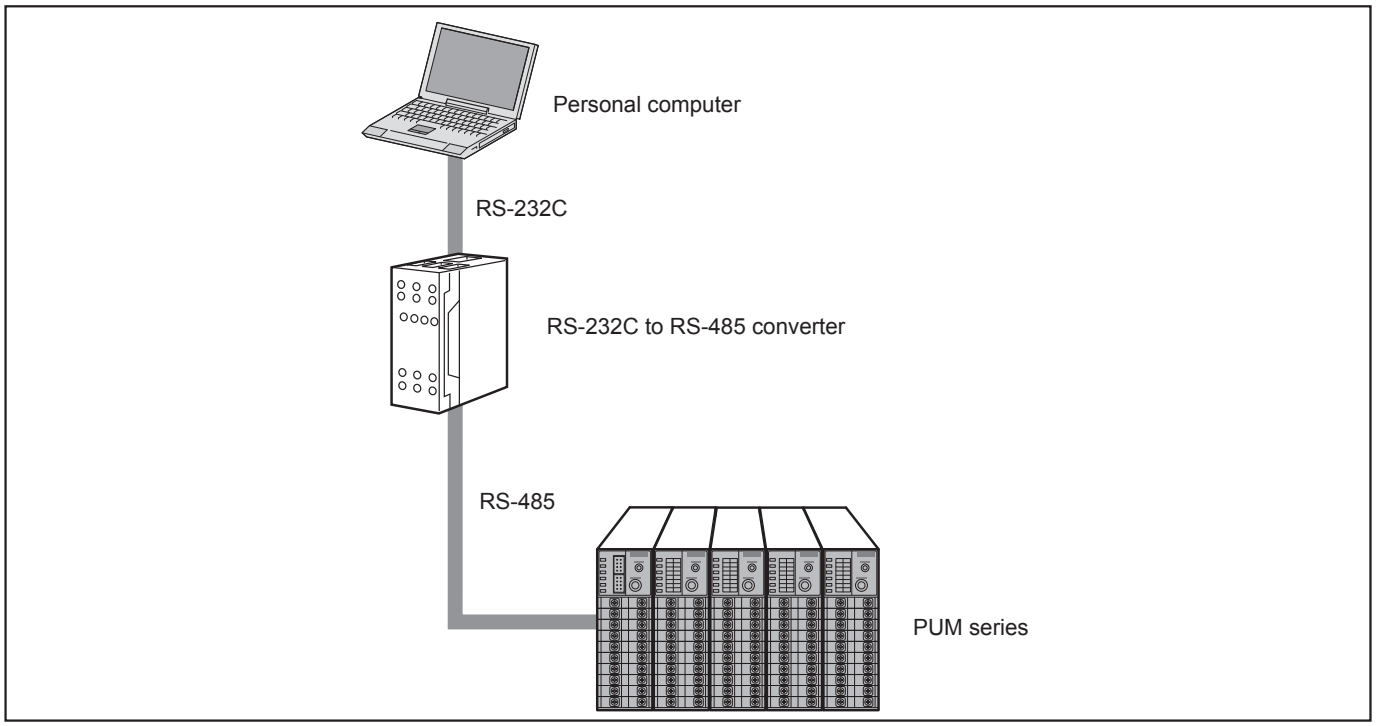
[RS-232C to RS-485 converter] (Recommended)

| Model number/Type | Manufacturer | Max. communication speed | URL |
|---|---|---|---|
| KS3C-10 | Omron | 38.4kbps | http://www.omron.co.jp |
| RC-770X | Sysmex RA | 115.2kbps | http://www.sysmex-ra.co.jp |

## Connecting to a Programmable Controller




## Connecting to a Personal Computer




Note

- When using the RS-232C to RS-485 converter, check to make sure that the cable is properly connected between the converter and master.
  Communication will not work properly if the connection is incorrect.
- Be sure to correctly set the communication settings (such as communication speed and parity) on the RS-232C to RS-485 converter.
  Communication will not work properly if the settings are incorrect.

# 5.2 Communication Specifications

## RS-485

| Item | Specifications | |
|---|---|---|
| Electrical specifications | EIA RS-485 compliant | |
| Communication method | 2-wire system, half duplex, serial | |
| Synchronous method | Asynchronous | |
| Connection status | 1: N | |
| Max. no. of connections | 32 units | |
| Communication distance | Max 1000m (at 38.4kbps or less), Max 250m (at 115.2kbps) | |
| Communication speed | 9.6kbps, 19.2kbps, 38.4kbps, 115.2kbps | |
| Data format | Data length | 8 bits |
| | Stop bit | 1 bit |
| | Parity | None/Even/Odd (Selectable) |
| Transmission code | HEX value (Modbus RTU mode) | |
| Error detection | CRC-16 | |
| Insulation | No insulation with loader communication port, CT input. Functional insulation with any other input/output. | |

## Loader Interface

| Item | Specifications | |
|---|---|---|
| Electrical specifications | EIA RS232C | |
| Communication method | 3-wire system, half duplex, serial | |
| Synchronous method | Asynchronous | |
| Connection status | 1: 1 | |
| Station No. | 1 to 16 | |
| Communication speed | 19.2kbps (Fixed) | |
| Data format | Data length | 8 bits |
| | Stop bit | 1 bit |
| | Parity | None (Fixed) |
| Transmission code | HEX value (Modbus RTU mode) | |
| Error detection | CRC-16 | |
| Insulation | No insulation with RS-485, CT input. Functional insulation with any other input/output. | |

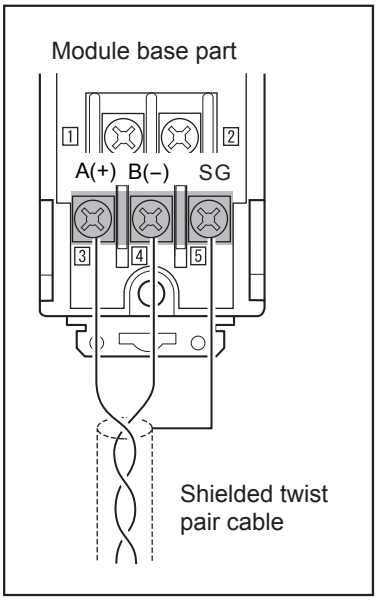
# 5.3 Connection

**⚠ Warning**

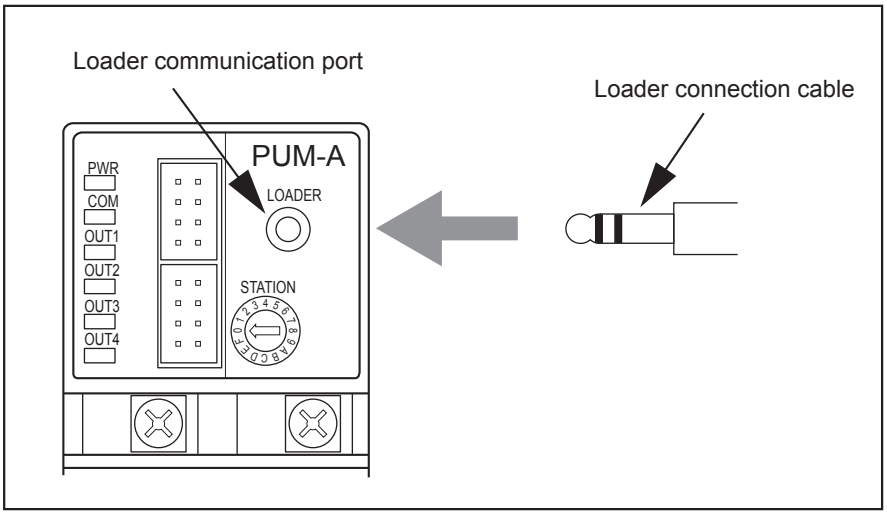
**Do not turn on power until all of the wiring is completely finished.**
**There is a risk of electrical shock or damage.**

## Assignment of Communication Terminals

### RS-485 (terminals on base part)

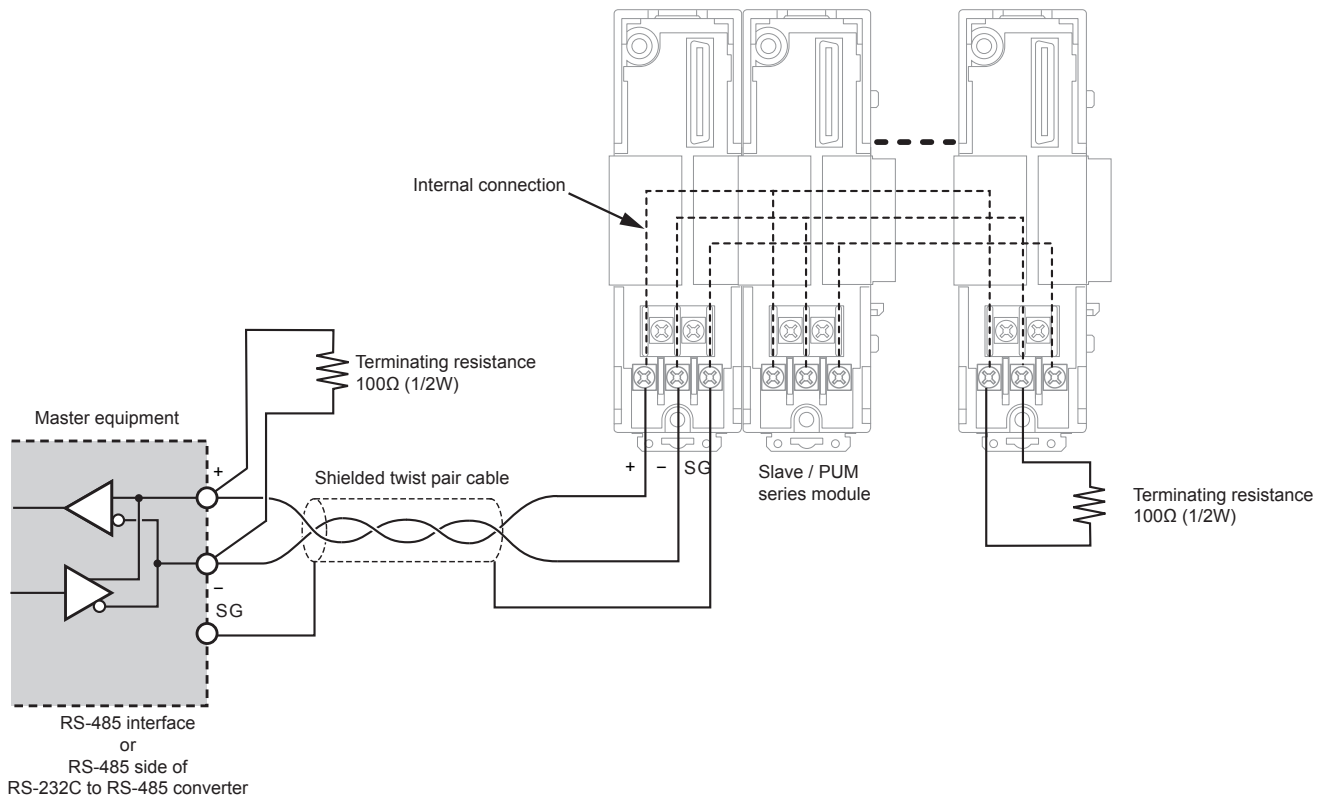



### Loader interface (terminals on front face)



# Connection with RS-485

- Please use a shielded twist pair cable. (Recommended cable: KPEV-SB 0.5sq (made by The Furukawa Electric Co., Ltd.))
- The maximum cable length should be 1000m at 38.4kbps or less, 250m at 115.2kbps. One master and up to thirty-two PUMs (slaves) can be connected per circuit.
- Terminate both ends of the circuit with a terminating resistance of 100Ω (1/2W or more).
- Ground the shielded cable once towards the master side.




- SG does not have to be connected, but it can be used as an effective countermeasure against communication errors due to noise.
- If there are problems with EMC during communication, the noise level can be reduced by using a communication cable with a ferrite core.

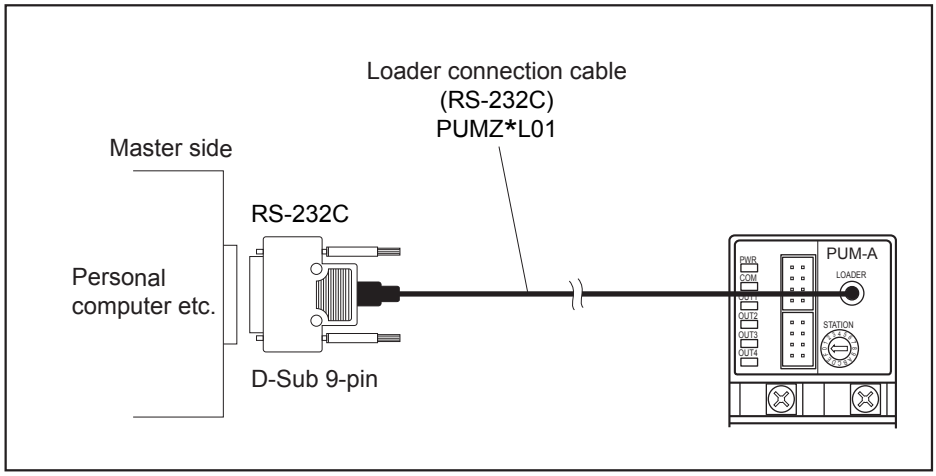
  Ferrite core (recommended):

  For communication cable : H04SR211132 made by Seiwa Electric MFG. or equivalent

  For power cable : E04SR241336A made by Seiwa Electric MFG. or equivalent

# Connection with Loader Interface

• Use the loader communication cable (RS-232C) sold separately.



# 5.4 Setting Communication Parameters

The following settings are required for proper communication between the master and all slaves units (this eqipument).

- The communication parameters for the master and all of the units must be set the same.
- All of the slaves on a circuit must be set with different “Station No.” other than “0 (zero)”. (Multiple PUMs must not have the same “Station No.”.)

## Setup Items for RS-485 (PUM Side)

| Parameter (name) | Setup range | Factory default | Remarks |
|---|---|---|---|
| Station number | 1 to 16 | 1 | Set value: station number configuration switch No. +1 |
| RS-485 Communication speed | 0 (9.6kbps)<br>1 (19.2kbps)<br>2 (38.4kbps)<br>4 (115.2kbps) | 1 | “3” is forbidden. |
| RS-485 Parity setting | 0 (None)<br>1 (Odd)<br>2 (Even) | 0 | |
| Data length | 8 bits | – | Cannot be changed. |
| Stop bit | 1 bit | – | Cannot be changed. |
| RS-485 Communication permittion | 0: Read only<br>1: Read / Write | 1 | |
| RS-485 Response interval time | 0 to 25 | 1 | The response interval time can be set by set value x 20 ms. |
| Enhanced communication module (PUMC) connection | 0: PUMC not connected (RS485 Enable)<br>1: PUMC connected (RS485 Disable) | 0 | Set at “0” for use of RS-485 communication. |

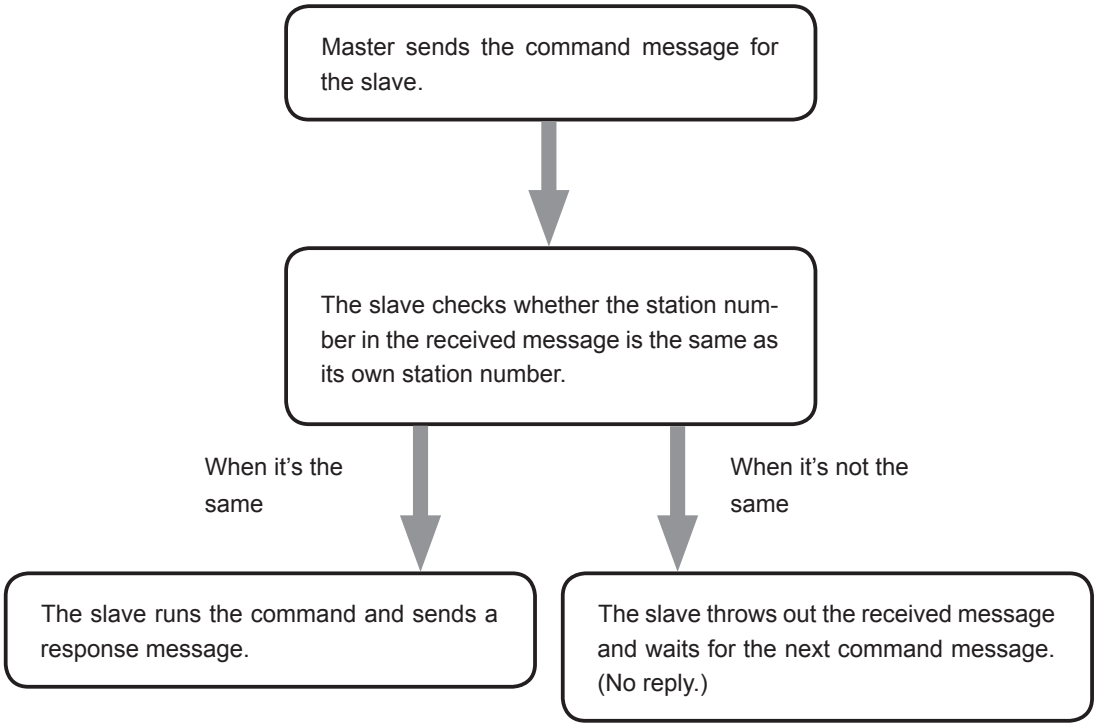
## Setup Items on Loader Interface (PUM Side)

| Parameter (name) | Setup range | Factory default | Remarks |
|---|---|---|---|
| Station number | 0 to Fh (1 to 16) | 1 | Set value: station number configuration switch No. +1 |
| Communication speed | 19.2kbps (fixed) | – | Cannot be changed. |
| Data length | 8 bits | – | Cannot be changed. |
| Parity | None | – | Cannot be changed. |
| Stop bit | 1 bit | – | Cannot be changed. |
| Master/slave setting in connected modules | 0 (Master)<br>1 (Slave) | 1 | Set one as the master and set others as slaves. |

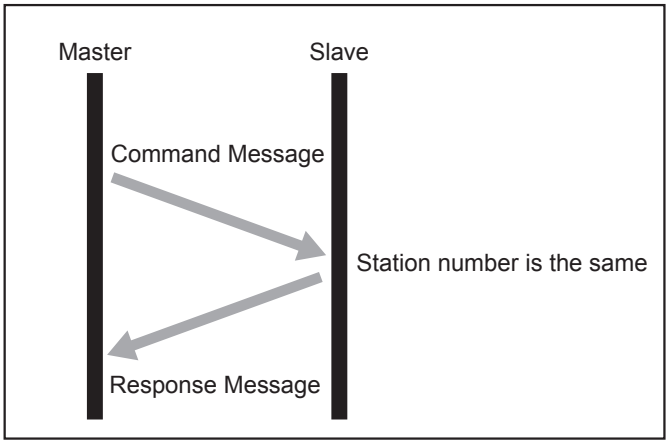
# 5.5 Modbus RTU Communication Protocol

The communication system with the MODBUS protocol always operates using a method where the master first sends a command message and the applicable slave replies with a response message.

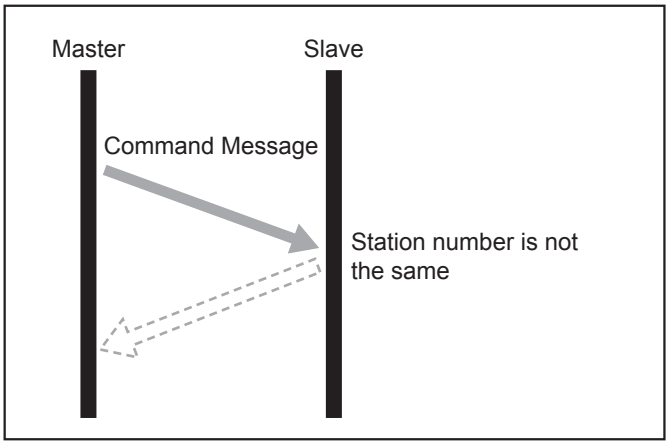
The following describes the communication steps.



When the station number in the command message is the same as the unit's station number




When the station number in the command message is not the same as the unit's station number




Point

The master can communicate with an individual slave when multiple slaves are connected on the same circuit by the station number specified in the master's command message.

# Message Composition

The command message and response message are composed of four parts: the station number, function code, data part, and error check code. These four parts are sent in that order.

| Field name | Number of bytes |
|---|---|
| Station No. | 1 byte |
| Function code | 1 byte |
| Data part | 2 to 64 bytes |
| Error check code (CRC-16) | 2 bytes |

## Station No.

This is the number specifying the slave. Commands can only be processed by slaves that have the same value set with the station number configuration switch (setting position + 1) located on the terminal block on the front face .

## Function Code

This code specifies the function for the slave to perform.

## Data Part

This data is required to run the function code. The composition of the data part is different depending on the function code.

The data in the PUM is assigned a coil number or register number. This coil number or register number is specified when the data is read or written through communication.

The coil number or register number used by the message employs a relative address.

The relative address is calculated using the following formula.

**Relative address = (last 4 digits of the coil number or register number) – 1**

(Ex.) When a function code specifies register number “40003”

**Relative address = (the last four digits of 40003) – 1**

**= 0002**

is used in the message.

## Error Check Code

This code detects whether there are errors (changes in the bits) during the signal transmission processes. MODBUS protocol (RTU mode) uses CRC-16 (Cyclic Redundancy Check).

## Slave Response

- **Normal Slave Response**

  The slave creates and replies with a response message for each command message. The response message has the same format as the command message.

  The contents of the data part are different depending on the function code.

- **Irregular Slave Response**

  If there are problems (such as specification of a nonexistent function code) with the contents of the command message other than transmission error, the slave creates and replies with an error response message without following the command.

  The composition of the error response message uses the value of the function code in the command message plus 80H, as seen below.

| Field name | Number of bytes |
|---|---|
| Station No. | 1 byte |
| Function code + 80H | 1 byte |
| Error Code | 1 byte |
| Error check code (CRC-16) | 2 bytes |

The error code is shown as follows.

| Error Code | Contents | Explanation |
|---|---|---|
| 01H | Faulty function code | A nonexistent function code was specified. Please check the function code. |
| 02H | Faulty address for coil or register | The specified relative address for the coil number or register number cannot be used by the specified function code. |
| 03H | Faulty coil number, register number or data limit. | The specified number is too large and specifies a range that does not contain coil numbers or register numbers. Furthermore, the specified data value is beyond the limit that is set in the specified parameter. |
| 06H | Busy state | Data is being written to the internal memory. Wait 100 msec or more before retrying communication. |

- **No Response**

  In the following situations, the slave will ignore the command message and not send a response message.

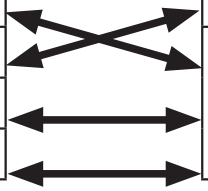
  - The station number specified by the command message is not the same as the slave's specified station number.
  - The error check code does not correspond, or a transmission error (such as parity error) is detected.
  - The interval between the data comprising the message is empty for more than 24 bit time.

## Function Code

For MODBUS protocol, coil numbers or register numbers are assigned by the function code, and each function code only works for the assigned coil number or register number.

The correspondence between the function code and the coil number or register number is as follows.

| Function Code | | | Coil Number, Register number | |
|---|---|---|---|---|
| **Code** | **Function** | **Target** | **Number** | **Contents** |
| 03H | Read (continuous) | Hold register | 3xxxx | Read word data |
| 04H | Read (continuous) | Input register | 4xxxx | Read /write word data |
| 06H | Write | Hold register | | |
| 10H | Write (continuous) | Hold register | | |



The message length for each function is as follows.

| Code | Contents | Assignable Data Number | Command Message | | Response Message | |
|---|---|---|---|---|---|---|
| | | | **Minimum** | **Maximum** | **Minimum** | **Maximum** |
| 03H | Read word data | 32 words * | 8 bytes | 8 bytes | 7 bytes | 69 bytes |
| 04H | Read word data (Read only) | 32 words * | 8 bytes | 8 bytes | 7 bytes | 69 bytes |
| 06H | Write word data | 1 word | 8 bytes | 8 bytes | 8 bytes | 8 bytes |
| 10H | Continuously write word data | 32 words * | 11 bytes | 73 bytes | 8 bytes | 8 bytes |

* : “Assignable Data Number” above is limited by the data number that the PUM assigned to the coil number or register number. (Excluding function code 06H).

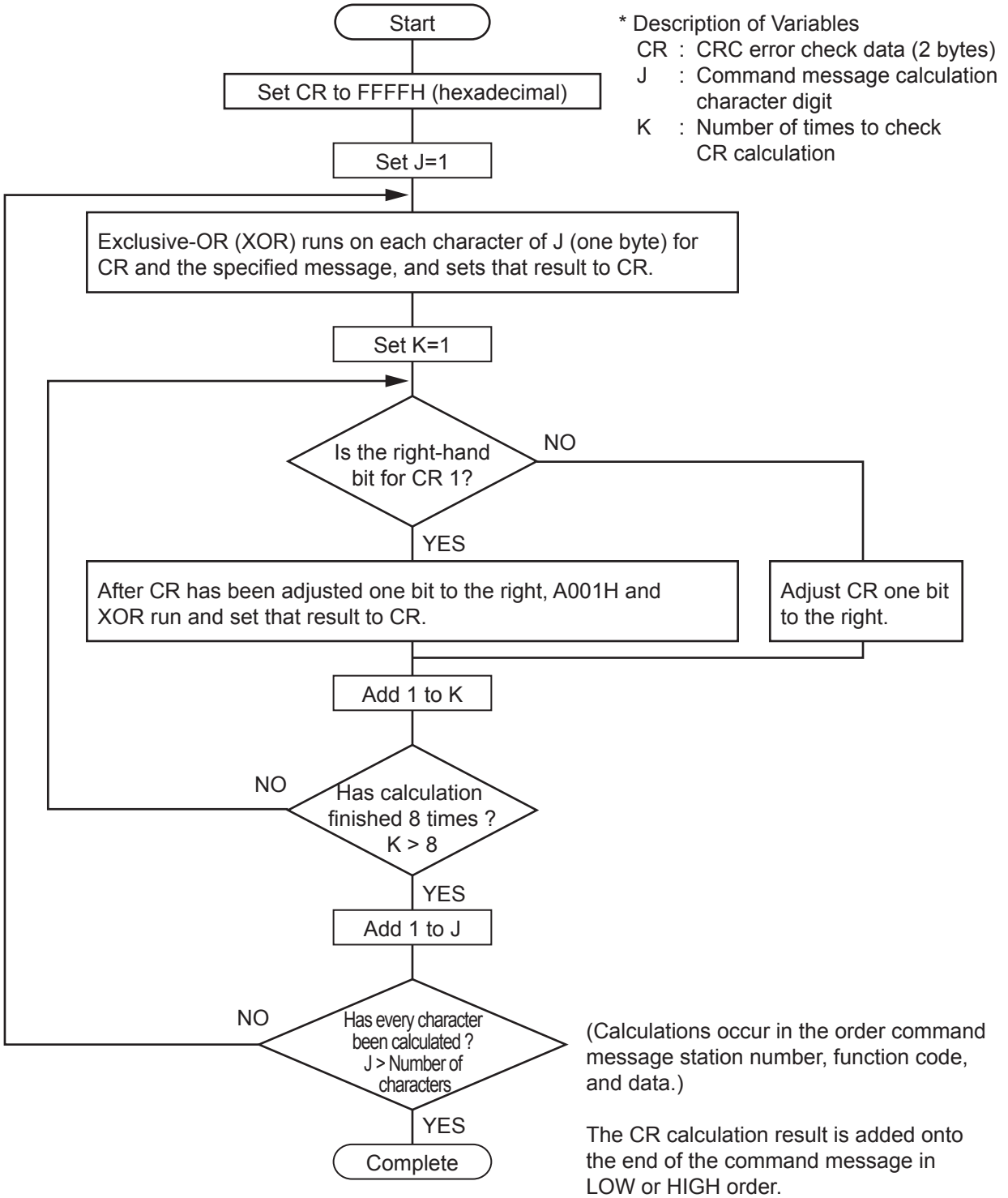
# Calculating Error Check Code (CRC-16)

CRC-16 is a 2-byte (16-bit) error check code.

The calculation range extends from the start of the message (station number) to the end of the data part.

The slave calculates the CRC of the received message and ignores the message if this value is not the same as the received CRC code.

CRC-16 is calculated as follows.



# Transmission Control Steps

## Master Communication Method

Start communication from the master while following the rules below.

1. The command message, must be sent after an empty space of at least 48 bits time.
2. The interval between each byte in a command message should be less than 24 bits time.
3. After sending a command message, for less than 24 bits time the master will enter receiving standby.
4. After receiving the response message, the next command message must be sent after at least 48 bits time. (Similar to 1 above.)
5. For safety reasons, create a framework where the master checks the response message, and if there is no response or an error occurs, retry at least three times.

Note

The definitions written above are for the minimum required value. For safety reasons, we recommend creating a master side program that keeps margins two to three times as large. For a concrete example, with 19.2kbps, we recommend programming a blank state (1 above) of at least 10ms, and the interval between bytes (2 above) and switching time from sending to receiving (3 above) within 1 ms.

## Frame Detection

This communication system uses a two-wire RS-485 interface, and the circuit can therefore enter one of the following two states.

- Empty state (no data on the circuit)
- Communication state (data running on the circuit)

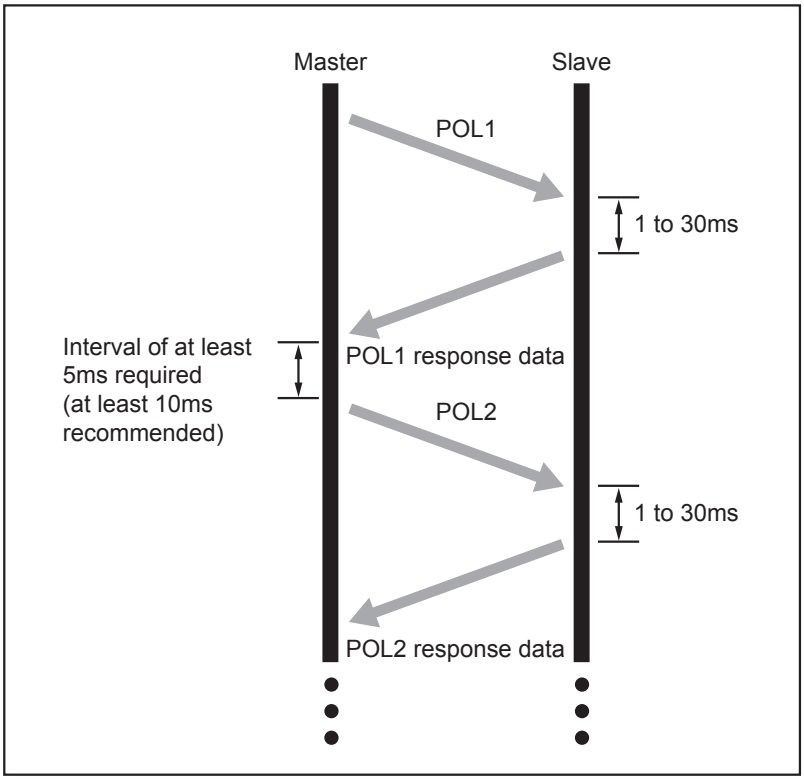
The units connected on the circuit start in receiving state and monitor the circuit. When a blank state appears on the circuit for at least 24 bits time, the unit detects the end of the previous frame, and within the next 24 bits time, enters receiving standby. When data appears on the circuit, the unit begins receiving data, and once another blank state of at least 24 bits time is detected, that frame is ended. In other words, the data on the circuit from the first time that a 24 bits time blank state appears to the second time one appears is loaded as one frame (a bundle of data). Therefore, one frame (command message) must be sent while following the rules below.

- Before sending the command message, leave an empty space of at least 48 bits time.
- The interval between each byte in a command message should be less than 24 bits time.

## PUM Response

After the PUM detects the frame (detects blank states at least 24 bits time long), that frame is used to send a command message. When a command message is sent locally, the response message is returned, but the processing time is about 1 to 30 ms. (The time may change depending on the contents of the command message. ) Therefore, one frame (command message) must be sent while following the rules below.

- After sending a command message, for less than 24 seconds the master will enter receiving standby.



# 5.6 Command and Transmission Frame Details

## Reading Date

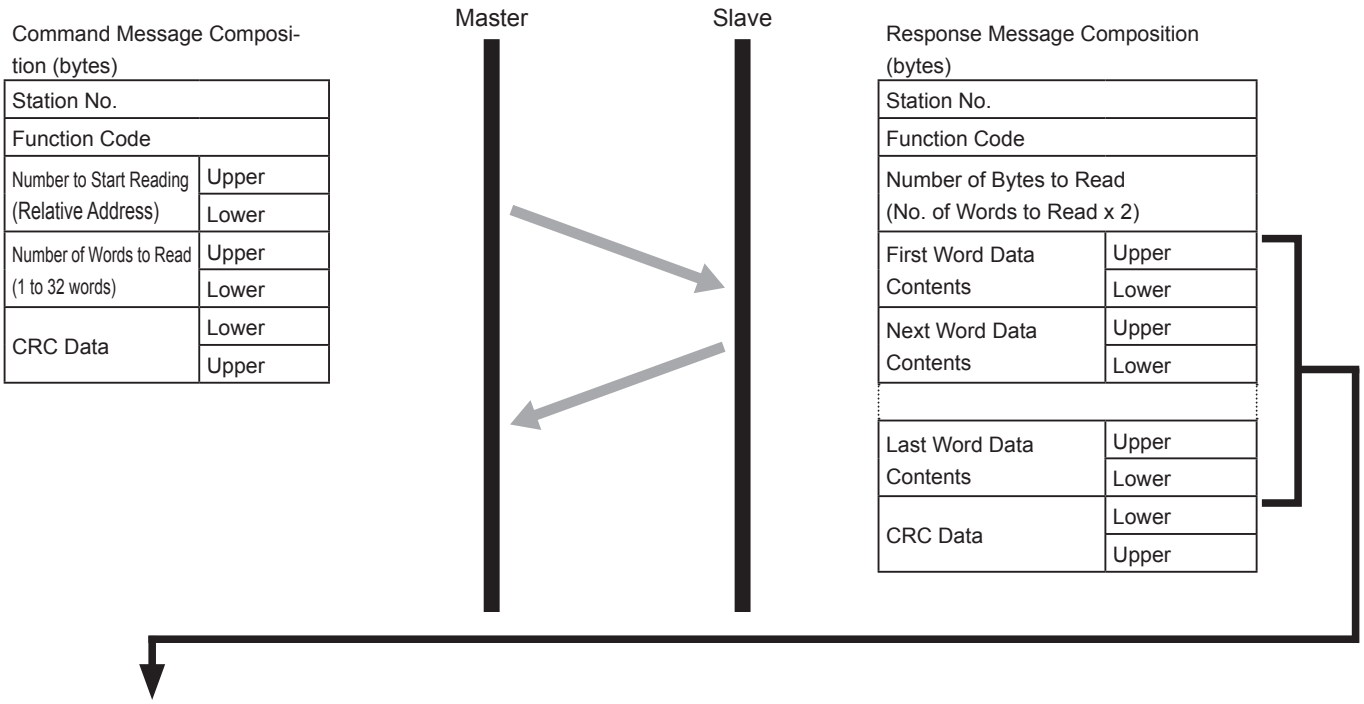
### Reading Word Data (Function Code: 03H)

The unit reads word data continuously for the specified number of words from the first number to start reading from.

The slave forwards the read word data from the upper number of bytes to the lower number.

| | |
|---|---|
| Function Code | 03H |
| Max. No. of Words to Read in One Message | 32 |
| Relative Address | 0000H to 13A7H |
| Register Number | 40001 to 45032 |

- **Message Composition**




Command Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Number to Start Reading (Relative Address) | Upper |
| | Lower |
| Number of Words to Read (1 to 32 words) | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

Response Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Number of Bytes to Read (No. of Words to Read x 2) | |
| First Word Data Contents | Upper |
| | Lower |
| Next Word Data Contents | Upper |
| | Lower |
| | |
| Last Word Data Contents | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

Meaning of Read Word Data

| MSB | LSB |
|---|---|
| First Word Data Contents upper byte | |
| First Word Data Contents lower byte | |
| Next Word Data Contents upper byte | |
| Next Word Data Contents lower byte | |
| | |
| Last Word Data Contents upper byte | |
| Last Word Data Contents lower byte | |

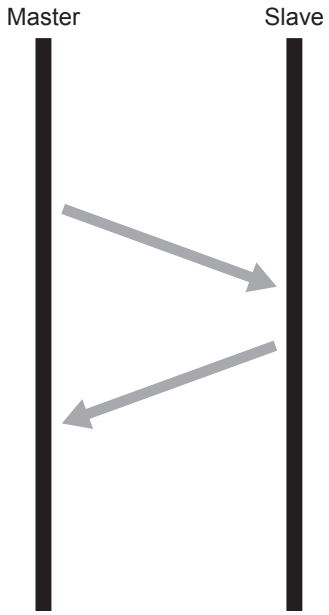
- **Example of Transmitting a Message**

  The message composition is as shown below in case of readout of PV input lower limit and PV input upper limit from Ch1 of station number 2.

  - **Relative Address of "PV Lower Limit Relative Address" : 04BBH**

Command Message (bytes)

| | | |
|---|---|---|
| Station No. | | 02H |
| Function Code | | 03H |
| Number to Start Reading (Relative Address) | Upper | 04H |
| | Lower | BBH |
| Number of Words to Read | Upper | 00H |
| | Lower | 02H |
| CRC Data | Lower | B5H |
| | Upper | 2DH |




Response Message (bytes)

| | | |
|---|---|---|
| Station No. | | 02H |
| Function Code | | 03H |
| Number of Bytes to Read | | 04H |
| First Word Data Contents | Upper | 00H |
| | Lower | 00H |
| Next Word Data Contents | Upper | 0FH |
| | Lower | A0H |
| CRC Data | Lower | CCH |
| | Upper | BBH |

**Meaning of Read Data**

PV Input Lower Limit 0000H = 0

PV Input Upper Limit 0FA0H = 4000

If decimal Point Position = 0, then the PV input upper limit and lower limit are as follows.

PV Input Lower Limit = 0.0 °C

PV Input Upper Limit = 400.0 °C

Point

The decimal point cannot be included in transmission data, so data such as [400.0] is transmitted as [4000].

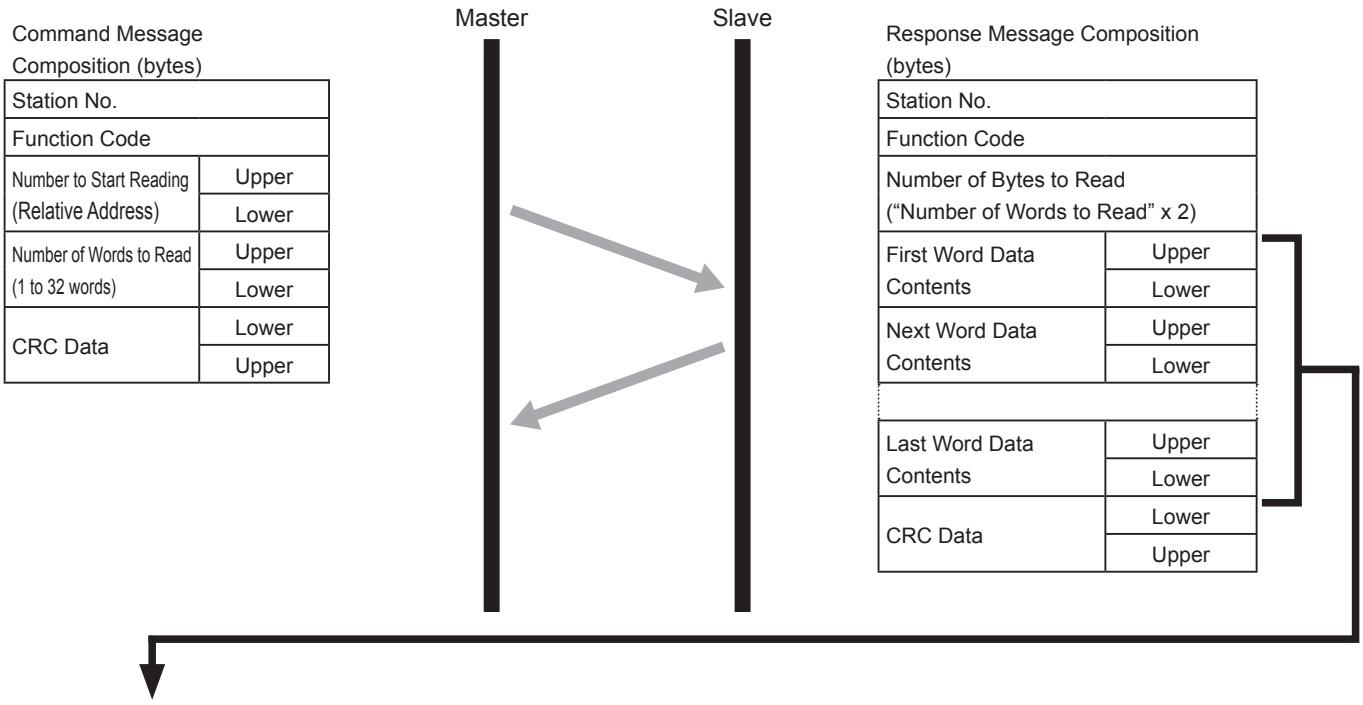
## Reading Read-Only Word Data (Function Code: 04H)

The unit reads word data continuously for the specified number of words from the first number to start reading from.

The slave forwards the read word data from the upper number of bytes to the lower number.

| | |
|---|---|
| Function Code | 04H |
| Max. Number of Words to Read in One Message | 32 |
| Relative Address | 0000H to 0FDGH |
| Register Number | 30001 to 34061 |

- **Message Composition**




Command Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Number to Start Reading (Relative Address) | Upper |
| | Lower |
| Number of Words to Read (1 to 32 words) | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

Response Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Number of Bytes to Read (“Number of Words to Read” x 2) | |
| First Word Data Contents | Upper |
| | Lower |
| Next Word Data Contents | Upper |
| | Lower |
| | |
| Last Word Data Contents | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

Meaning of Read Word Data

| MSB | LSB |
|---|---|
| First Word Data Contents upper byte | |
| First Word Data Contents lower byte | |
| Next Word Data Contents upper byte | |
| Next Word Data Contents lower byte | |
| | |
| Last Word Data Contents upper byte | |
| Last Word Data Contents lower byte | |

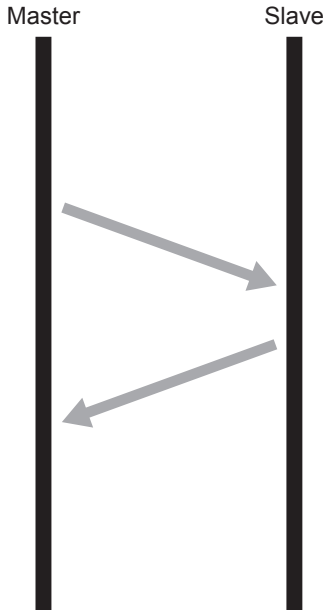
• **Example of Transmitting a Message**

The message composition is as shown below in case of readout of PV value from Ch1 of station number 1.

• **Relative address of "PV value" : 0001H, Number of data:01H**

Command Message (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 04H |
| Number to Start Reading (Relative Address) | Upper | 00H |
| | Lower | 01H |
| Number of Words to Read | Upper | 00H |
| | Lower | 01H |
| CRC Data | Lower | 60H |
| | Upper | 0AH |




Response Message (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 04H |
| Number of Bytes to Read | | 02H |
| First Word Data Contents | Upper | 01H |
| | Lower | 4FH |
| CRC Data | Lower | F9H |
| | Upper | 54H |

**Meaning of Read Data**

Word Data Contents 014FH=335

In case decimal point position = 1;

PV = 33.5 °C

# Writing Data

## Writing word Data (1 word, function code: 06H)

This writes the specified data to the specified number for word data. The master sends the data to be written from the upper number of bytes to the lower number.

| | |
|---|---|
| Function Code | 06H |
| Max. Number of Words to Write in One Message | 1 |
| Relative Address | 0000H to 13A7H |
| Register Number | 40001 to 45032 |

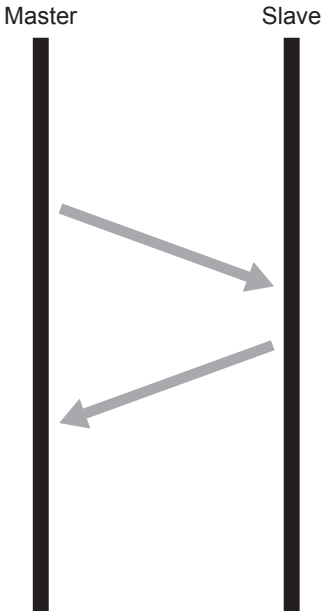
**Caution**

Do not write data to a address (register number) that is not described in MODBUS address map. ( It may cause the malfunction.)

- **Message Composition**

Command Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Specified Write Number (Relative Address) | Upper |
| | Lower |
| Word Date to Write | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |




Response Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Specified Write Number (Relative Address) | Upper |
| | Lower |
| Word Date to Write | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

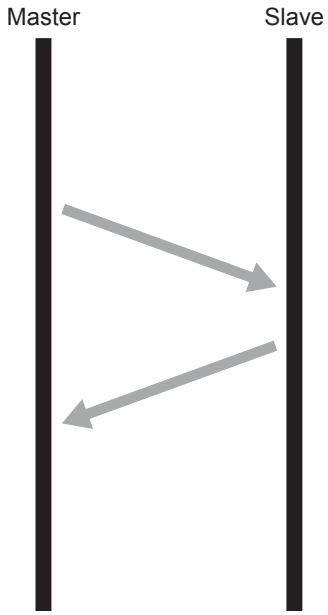
- **Example of Transmitting a Message**

  A case where parameter “proportional band [P]" of Ch1 of station number 1 is set as 100.0 (1000D=03E8H) is described below as an example.

  - **Relative address of “proportional band [P]” : 044DH**

Command Message (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 06H |
| Specified Write Number (Relative Address) | Upper | 04H |
| | Lower | 4DH |
| Word Data to Write | Upper | 03H |
| | Lower | E8H |
| CRC Data | Lower | 18H |
| | Upper | 53H |




Response Message (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 06H |
| Specified Write Number (Relative Address) | Upper | 04H |
| | Lower | 4DH |
| Word Data to Write | Upper | 03H |
| | Lower | E8H |
| CRC Data | Lower | 18H |
| | Upper | 53H |

## Writing Continuous Word Data (function code: 10H)

This writes continuous word information for a number of written words from the first number for writing.

The master sends the data to be written from the upper number of bytes to the lower number.

| | |
|---|---|
| Function Code | 10H |
| Max. Number of Words to Write in One Message | 32 |
| Relative Address | 0000H to 13A7H |
| Register Number | 40001 to 45032 |

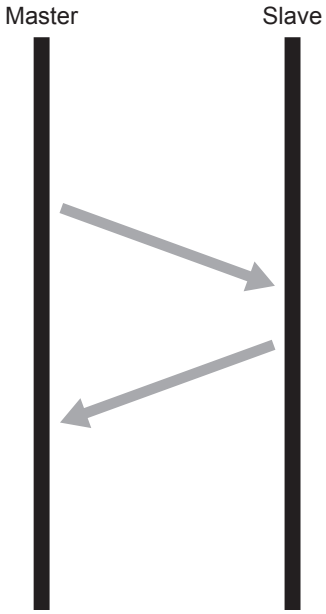
**Caution**

Do not write data to a address (register number) that is not described in MODBUS address map. (It may cause the malfunction.)

- **Message Composition**

Command Message Composition (bytes)

| | | |
|---|---|---|
| Station No. | | |
| Function Code | | |
| Specified Write Number (Relative Address) | Upper | |
| | Lower | |
| Number of words to write | Upper | |
| | Lower | 1 to 32 |
| Number of Bytes to Write | | Number of Words to Write × 2 |
| First Word Data to Write | Upper | |
| | Lower | |
| Next Word Data to Write | Upper | |
| | Lower | |
| | | |
| Last Word Data to Write | Upper | |
| | Lower | |
| CRC Data | Lower | |
| | Upper | |




Response Message Composition (bytes)

| | |
|---|---|
| Station No. | |
| Function Code | |
| Specified Write Number (Relative Address) | Upper |
| | Lower |
| Number of words to write | Upper |
| | Lower |
| CRC Data | Lower |
| | Upper |

- **Example of Transmitting a Message**

  The message composition is as indicated below in case of write of the following PID (Proportional band, Integration time, Derivation time) parameters to Ch1 of station number 1.

  P = 100.0 ( = 1000D = 03E8H )

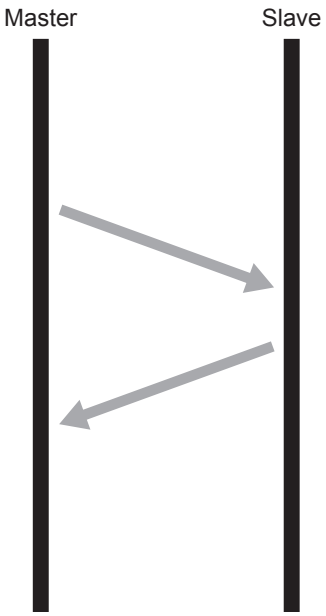
  I = 10 ( = 100D = 0064 H )

  D = 5.0 ( = 50D = 0032H )

  - **Relative address of parameter [proportional band [P]]: 044DH, Number of data: 03H**

Command Message Composition (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 10H |
| Specified Write Number (Relative Address) | Upper | 04H |
| | Lower | 4DH |
| Number of words to write | Upper | 00H |
| | Lower | 03H |
| Number of Bytes to Write | | 06H |
| First Word Data to Write | Upper | 03H |
| | Lower | E8H |
| Next Word Data to Write | Upper | 00H |
| | Lower | 64H |
| Last Word Data to Write | Upper | 00H |
| | Lower | 32H |
| CRC Data | Lower | C0H |
| | Upper | B0H |




Response Message Composition (bytes)

| | | |
|---|---|---|
| Station No. | | 01H |
| Function Code | | 10H |
| Specified Write Number (Relative Address) | Upper | 04H |
| | Lower | 4DH |
| Number of words to write | Upper | 00H |
| | Lower | 03H |
| CRC Data | Lower | 11H |
| | Upper | 2FH |

Point

The decimal point cannot be included in transmission data, so data such as [100.0] is transmitted as [1000].

# 5.7 Address Map and Data Format

**Register numbers of control module readout/write data set values are shown in a table.**

## Operation Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Local SV value | 0 to 100%FS | ○ | 0 | 40001<br>41001 | 40002<br>42001 | 40003<br>43001 | 40004<br>44001 |
| Communication SV value | 0 to 100%FS | ○ | 0 | 40023<br>41100 | 40024<br>42100 | 40025<br>43100 | 40026<br>44100 |
| MV value | –3.0 to 103.0% | | — | 40005<br>41002 | 40006<br>42002 | 40007<br>43002 | 40008<br>44002 |
| Manual mode switch | 0: Auto<br>1: Manual | | 0 (Auto) | 40013<br>41003 | 40014<br>42003 | 40015<br>43003 | 40016<br>44003 |
| RUN/Standby switch | 0: RUN<br>1:Standby | | 0 (RUN) | 40017<br>41004 | 40018<br>42004 | 40019<br>43004 | 40020<br>44004 |
| Remote mode switch | 0: Local<br>1: Remote | | 0 (Local) | 40009<br>41007 | 40010<br>42007 | 40011<br>43007 | 40012<br>44007 |
| Auto-tuning RUN command | 0: Stop/End<br>1: Normal type<br>2: Low PV type | | 0 (Stop/End) | 41005 | 42005 | 43005 | 44005 |
| Digital output latch release command | 0: OFF<br>1: Release latch | | 0 (OFF) | 41031 | 42031 | 43031 | 44031 |
| ALM1 set value 1 | –100 to 100%FS | ○ | 2.5%FS | 41033 | 42033 | 43033 | 44033 |
| ALM1 set value 2 | –100 to 100%FS | ○ | 2.5%FS | 41034 | 42034 | 43034 | 44034 |
| ALM2 set value 1 | –100 to 100%FS | ○ | 2.5%FS | 41041 | 42041 | 43041 | 44041 |
| ALM2 set value 2 | –100 to 100%FS | ○ | 2.5%FS | 41042 | 42042 | 43042 | 44042 |
| ALM3 set value 1 | –100 to 100%FS | ○ | 2.5%FS | 41049 | 42049 | 43049 | 44049 |
| ALM3 set value 2 | –100 to 100%FS | ○ | 2.5%FS | 41050 | 42050 | 43050 | 44050 |
| ALM4 set value 1 | –100 to 100%FS | ○ | 2.5%FS | 41057 | 42057 | 43057 | 44057 |
| ALM4 set value 2 | –100 to 100%FS | ○ | 2.5%FS | 41058 | 42058 | 43058 | 44058 |
| ALM5 set value 1 | –100 to 100%FS | ○ | 2.5%FS | 41065 | 42065 | 43065 | 44065 |
| ALM5 set value 2 | –100 to 100%FS | ○ | 2.5%FS | 41066 | 42066 | 43066 | 44066 |

# Control (PID) Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Proportional band [P] | 0.0 to 999.9% | | 5.0 | 41102 | 42102 | 43102 | 44102 |
| Integration time [I] | 0 to 3200sec | | 240 | 41103 | 42103 | 43103 | 44103 |
| Derivation time [D] | 0.0 to 999.9sec | | 60.0 | 41104 | 42104 | 43104 | 44104 |
| ON/OFF control hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41105 | 42105 | 43105 | 44105 |
| Cooling proportional band coefficient [cool] | 0.0 to 100.0 | | 1.0 | 41106 | 42106 | 43106 | 44106 |
| Dead band | –50.0 to 50.0% | | 0 | 41107 | 42107 | 43107 | 44107 |
| Output convergence value | –100.0 to 100.0% | | 0 | 41108 | 42108 | 43108 | 44108 |
| Anti-reset windup [ARW] | 0 to 100%FS | ○ | 100%FS | 41109 | 42109 | 43109 | 44109 |
| Direct/Reverse action setting [MV1/MV2] | 0 : Reverse/None<br>1 : Direct/None<br>2 : Reverse/Direct<br>3 : Direct/Reverse<br>4 : Reverse/Reverse<br>5 : Direct/Direct | | 0 (Reverse/ None) | 41110 | 42110 | 43110 | 44110 |
| SV Lower Limits | 0 to 100%FS | ○ | 0%FS | 41218 | 42218 | 43218 | 44218 |
| SV Upper Limits | 0 to 100%FS | ○ | 100%FS | 41219 | 42219 | 43219 | 44219 |
| MV1 Lower limits | –3.0 to 103.0% | | –3.0 | 41255 | 42255 | 43255 | 44255 |
| MV1 Upper limits | –3.0 to 103.0% | | 103.0 | 41256 | 42256 | 43256 | 44256 |
| MV2 Lower limits | –3.0 to 103.0% | | –3.0 | 41257 | 42257 | 43257 | 44257 |
| MV2 Upper limits | –3.0 to 103.0% | | 103.0 | 41258 | 42258 | 43258 | 44258 |
| Output limiter type setting | 0: MV1 -3.0%/103.0%<br>MV2 -3.0%/103.0%<br>1: MV1 Limit/103.0%<br>MV2 -3.0%/103.0%<br>2: MV1 -3.0%/Limit<br>MV2 -3.0%/103.0%<br>3: MV1 Limit/ Limit<br>MV2 -3.0%/103.0%<br>4: MV1 -3.0%/103.0%<br>MV2 Limit/103.0%<br>5: MV1 Limit/103.0%<br>MV2 Limit/103.0%<br>6: MV1 -3.0%/Limit<br>MV2 Limit/103.0%<br>7: MV1 Limit/Limit<br>MV2 Limit/103.0%<br>8: MV1 -3.0%/103.0%<br>MV2 -3.0%/Limit<br>9: MV1 Limit/103.0%<br>MV2 -3.0%/Limit<br>10: MV1 -3.0%/Limit<br>MV2 -3.0%/Limit<br>11: MV1 Limit/Limit<br>MV2 -3.0%/Limit<br>12: MV1 -3.0%/103.0%<br>MV2 Limit/Limit<br>13: MV1 Limit/103.0%<br>MV2 Limit/Limit<br>14: MV1 -3.0%/Limit<br>MV2 Limit/Limit<br>15: MV1 Limit/Limit<br>MV2 Limit/Limit | | 0 | 41259 | 42259 | 43259 | 44259 |

# Setup Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| PV input type | 0: Not selectable<br>1: Not selectable<br>2: Pt100 (0 to 150 °C)<br>3: Pt100 (–150 to 300 °C)<br>4: Pt100 (–150 to 850 °C)<br>5: J (0 to 400 °C)<br>6: J (0 to 800 °C)<br>7: K (0 to 400 °C)<br>8: K (0 to 800 °C)<br>9: K (0 to 1200 °C)<br>10: R (0 to 1600 °C)<br>11: B (0 to 1800 °C)<br>12: S (0 to 1600 °C)<br>13: T (–199 to 400 °C)<br>14: E (–199 to 800 °C)<br>18: N (0 to 1300 °C)<br>19: PL-2 (0 to 1300 °C)<br>21: Voltage (0 to 5V)<br>22: Voltage (1 to 5V)<br>23: Voltage (0 to 10V)<br>24: Voltage (2 to 10V)<br>25: Voltage (±5V)<br>26: Voltage (±10V)<br>30: Unused<br>31: Pt100 (-200 to 850°C)<br>32: Pt100 (-200 to 800°C)<br>35: J (-200 to 850°C)<br>36: J (-150 to 850°C)<br>37: J (-200 to 800°C)<br>38: K (-200 to 850°C)<br>39: K (-150 to 850°C)<br>40: K (-200 to 800°C) | | 7 (TC/Pt)<br>22 (VI) | 40151<br>41029 | 40152<br>42029 | 40153<br>43029 | 40154<br>44029 |
| PV input scale lower | –1999 to 9999 | | 0%FS | 41212 | 42212 | 43212 | 44212 |
| PV input scale upper | –1999 to 9999 | | 100%FS | 41213 | 42213 | 43213 | 44213 |
| Input master Ch. | 0 to 4Ch | | 0 | 41535 | 42535 | 43535 | 44535 |
| Destination for inputting PV | 0: PV<br>1: MV1<br>2: PV (DI changeover) | | 0 (PV) | 41539 | 42539 | 43539 | 44539 |
| Decimal place | 0: No decimal point<br>1: One decimal place<br>2: Two decimal places | | 0 (TC/Pt)<br>1 (VI) | 41214 | 42214 | 43214 | 44214 |
| Temperature unit | 0: Degree C<br>1: Degree F | | 0 (degree C) | 41215 | 42215 | 43215 | 44215 |
| PV input shift | –10 to 10%FS | ○ | 0 | 41216 | 42216 | 43216 | 44216 |
| SV value shift | –50 to 50%FS | ○ | 0 | 41217 | 42217 | 43217 | 44217 |
| PV input filter | 0.0 to 120.0sec | | 2.0 | 41220 | 42220 | 43220 | 44220 |
| PV display zero adjustment | –50 to 50%FS | ○ | 0 | 41221 | 42221 | 43221 | 44221 |
| PV display span adjustment | –50 to 50%FS | ○ | 0 | 41222 | 42222 | 43222 | 44222 |
| Cold junction compensation | 0: OFF<br>1: ON | | 1 (ON) | 41223 | 42223 | 43223 | 44223 |
| RSV zero adjustment | –50 to 50%FS | ○ | 0 | 41225 | 42225 | 43225 | 44225 |
| RSV span adjustment | –50 to 50%FS | ○ | 0 | 41226 | 42226 | 43226 | 44226 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Type of SV | 0: PV<br>1: MV | | 0 (PV) | 41531 | 42531 | 43531 | 44531 |
| RSV input master Station No. | 0 to 16 station | | 0 | 41532 | 42532 | 43532 | 44532 |
| RSV input master Ch. No. | 0 / 1 to 4Ch | | Each Ch. | 41533 | 42533 | 43533 | 44533 |
| FAULT MV1 set value | –3.0 to 103.0% | | –3.0 | 41260 | 42260 | 43260 | 44260 |
| FAULT MV2 set value | –3.0 to 103.0% | | –3.0 | 41261 | 42261 | 43261 | 44261 |
| Soft start MV1 value | –3.0 to 103.0% | | 103.0 | 41262 | 42262 | 43262 | 44262 |
| Soft start MV2 value | –3.0 to 103.0% | | 103.0 | 41263 | 42263 | 43263 | 44263 |
| Soft start time | 0 to 99hr.59min. | | 0 | 41264 | 42264 | 43264 | 44264 |
| Standby MV1 value | –3.0 to 103.0% | | –3.0 | 41268 | 42268 | 43268 | 44268 |
| Standby MV2 value | –3.0 to 103.0% | | –3.0 | 41269 | 42269 | 43269 | 44269 |
| Standby mode setting | 0: ALM=OFF<br>1: ALM=ON | | 0 (ALM=OFF) | 41270 | 42270 | 43270 | 44270 |
| Linkage operation master Station No. | 0 to 16 station | | 0 | 41536 | 42536 | 43536 | 44536 |
| Linkage operation master Ch. No. | 1 to 4Ch | | Each Ch. | 41537 | 42537 | 43537 | 44537 |

# System Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Current output range | 4: 0 to 20mA<br>5: 4 to 20mA | | 5 (4-20mA) | 40166<br>41801 | 40167<br>42801 | 40168<br>43801 | 40169<br>44801 |
| Output type | 0: PV of own station<br>1: SV of own station<br>2: DV of own station<br>3: MV1 of own station<br>4: MV2 of own station<br>5: PV of other stations<br>6: SV of other stations<br>7: MV of other stations<br>8: DO1 of own station<br>9: DO2 of own station<br>10: DO3 of own station<br>11: DO4 of own station<br>12: DO5 of own station<br>13: No output | | 3 (MV1 of own station) | 40171<br>41803 | 40177<br>42803 | 40183<br>43803 | 40189<br>44803 |
| Proportional cycle | 1 to 120 sec | | 2 (SSR drive)/30 (relay) | 40176 | 40182 | 40188 | 40194 |
| Output master Station No. | 0 to 16 stations | | 0 | 40172<br>41804 | 40178<br>42804 | 40184<br>43804 | 40190<br>44804 |
| Output master Ch. No. | 1 to 4Ch | | Each Ch. | 40173<br>41805 | 40179<br>42805 | 40185<br>43805 | 40191<br>44805 |
| Output scaling base | –100.0 to 100.0% | | 0.0 | 40175<br>41807 | 40181<br>42807 | 40187<br>43807 | 40193<br>44807 |
| Output scaling span | –100.0 to 1000.0% | | 100.0 | 40174<br>41806 | 40180<br>42806 | 40186<br>43806 | 40192<br>44806 |
| Output shutdown | 0000 to 1111<br>bit0: Output 1 shutdown<br>bit1: Output 2 shutdown<br>bit2: Output 3 shutdown<br>bit3: Output 4 shutdown | | 0000 | 40201 | | | |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| DI-1 function select | O: No function<br>1: Run/Standby switch<br>2: Auto/Manual switch<br>3: Local/Remote switch<br>4: No function<br>5: No function<br>6: Start AT (Normal type)<br>7: Start AT (Low PV type)<br>8: No function<br>9: No function<br>10: Ramp SV ON/OFF<br>11: Ramp SV HOLD<br>12: Ramp/Soak OFF<br>13: Ramp/Soak RUN/HOLD<br>14: No function<br>15: No function<br>16: No function<br>17: Latch release (all)<br>18: Latch release (DO1)<br>19: Latch release (DO2)<br>20: Latch release (DO3)<br>21: Latch release (DO4)<br>22: Latch release (DO5)<br>23: No function<br>24: No function<br>25: No function<br>26: Start timer (DO1)<br>27: Start timer (DO2)<br>28: Start timer (DO3)<br>29: Start timer (DO4)<br>30: Start timer (DO5)<br>31: No function<br>32: No function<br>33: No function<br>34: No function<br>35: No function<br>36: No function<br>37: No function<br>38: Ramp/Soak Pattern No.+1<br>39: Ramp/Soak Pattern No.+2<br>40: Ramp/Soak Pattern No.+4<br>41: Ramp soak RUN<br>42: Ramp soak HOLD<br>43: Ramp soak RUN at DO1 start up<br>44: Ramp soak RUN at DO2 start up<br>45: Ramp soak RUN at DO3 start up<br>46: Ramp soak RUN at DO4 start up<br>47: Ramp soak RUN at DO5 start up<br>48: No function<br>49: Output 1 shutdown<br>50: Output 2 shutdown<br>51: Output 3 shutdown<br>52: Output 4 shutdown<br>53: No function<br>54: Valve OPEN | | 0 (No function) | 41013 | 42013 | 43013 | 44013 |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| DI-1 function select | 55: Valve CLOSE<br>56: Input master Ch. changeover 1<br>57: Input master Ch. changeover 2 | | 0 (No function) | 41013 | 42013 | 43013 | 44013 |
| DI-2 function select | 0 to 57 | | 0 | 41014 | 42014 | 43014 | 44014 |
| DI-3 function select | 0 to 57 | | 0 | 41015 | 42015 | 43015 | 44015 |
| DI-4 function select | 0 to 57 | | 0 | 41016 | 42016 | 43016 | 44016 |
| DI-5 function select | 0 to 57 | | 0 | 41017 | 42017 | 43017 | 44017 |
| DI-6 function select | 0 to 57 | | 0 | 41018 | 42018 | 43018 | 44018 |
| DI-7 function select | 0 to 57 | | 0 | 41019 | 42019 | 43019 | 44019 |
| DI-8 function select | 0 to 57 | | 0 | 41020 | 42020 | 43020 | 44020 |
| DI-9 function select | 0 to 57 | | 0 | 41021 | 42021 | 43021 | 44021 |
| DI-10 function select | 0 to 57 | | 0 | 41022 | 42022 | 43022 | 44022 |
| DI-11 function select | 0 to 57 | | 0 | 41023 | 42023 | 43023 | 44023 |
| DI-12 function select | 0 to 57 | | 0 | 41024 | 42024 | 43024 | 44024 |
| DI-13 function select | 0 to 57 | | 0 | 41025 | 42025 | 43025 | 44025 |
| DI-14 function select | 0 to 57 | | 0 | 41026 | 42026 | 43026 | 44026 |
| DI-15 function select | 0 to 57 | | 0 | 41027 | 42027 | 43027 | 44027 |
| DI-16 function select | 0 to 57 | | 0 | 41028 | 42028 | 43028 | 44028 |
| DI master Station No. setting | 0 to 32 | | 0 | 41011 | 42011 | 43011 | 44011 |
| DO1 output event type setting | 0 to 218 | | 0 | 41032 | 42032 | 43032 | 44032 |
| DO1 option function setting | 0 to 15 (bit data : 0000 to 1111)<br>bit 0: Alarm latch function<br>bit 1: Error input alarm function<br>bit 2: Non-excitation output function<br>bit 3: Hold reset function | | 0000 | 41036 | 42036 | 43036 | 44036 |
| DO2 output event type setting | 0 to 218 | | 0 | 41040 | 42040 | 43040 | 44040 |
| DO2 option function setting | 0 to 15 (bit data : 0000 to 1111)<br>bit 0: Alarm latch function<br>bit 1: Error input alarm function<br>bit 2: Non-excitation output function<br>bit 3: Hold reset function | | 0000 | 41044 | 42044 | 43044 | 44044 |
| DO3 output event type setting | 0 to 218 | | 0 | 41048 | 42048 | 43048 | 44048 |
| DO3 option function setting | 0 to 15 (bit data : 0000 to 1111)<br>bit 0: Alarm latch function<br>bit 1: Error input alarm function<br>bit 2: Non-excitation output function<br>bit 3: Hold reset function | | 0000 | 41052 | 42052 | 43052 | 44052 |
| DO4 output event type setting | 0 to 218 | | 0 | 41056 | 42056 | 43056 | 44056 |
| DO4 option function setting | 0 to 15 (bit data : 0000 to 1111)<br>bit 0: Alarm latch function<br>bit 1: Error input alarm function<br>bit 2: Non-excitation output function<br>bit 3: Hold reset function | | 0000 | 41060 | 42060 | 43060 | 44060 |
| DO5 output event type setting | 0 to 218 | | 0 | 41064 | 42064 | 43064 | 44064 |
| DO5 option function setting | 0 to 15 (bit data : 0000 to 1111)<br>bit 0: Alarm latch function<br>bit 1: Error input alarm function<br>bit 2: Non-excitation output function<br>bit 3: Hold reset function | | 0000 | 41068 | 42068 | 43068 | 44068 |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Ramp SV ON/OFF | 0: OFF<br>1: ON | | 1 (ON) | 41299 | 42299 | 43299 | 44299 |
| Ramp SV - decline | 0 to 100%FS | ○ | 0 | 41300 | 42300 | 43300 | 44300 |
| Ramp SV - incline | 0 to 100%FS | ○ | 0 | 41301 | 42301 | 43301 | 44301 |
| Ramp SV slope time units | 0: Slope deg/hr.<br>1: Slope deg/min. | | 0 (Slope deg/hr.) | 41302 | 42302 | 43302 | 44302 |
| Control algorithm | 0: PID<br>1:FUZZY PID<br>2: PID against open-loop | | 0 (PID) | 41291 | 42291 | 43291 | 44291 |
| ON/OFF hysteresis setting | 0: OFF<br>1: ON | | 1 (ON) | 41292 | 42292 | 43292 | 44292 |
| Mode at startup | 0: Auto mode<br>1: Manual mode<br>2: Remote mode<br>3: Standby mode | | 0 (Auto mode) | 41304 | 42304 | 43304 | 44304 |
| MV transmission type | 0: MV1<br>1: MV2 | | 0 (MV1) | 40195<br>41810 | 40196<br>42810 | 40197<br>43810 | 40198<br>44810 |
| Specified process | 0: 200msec<br>1: 100msec | | 0 (200msec) | 41294 | 42294 | 43294 | 44294 |

# Ramp/Soak Parameter

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Ramp/Soak command | 0: OFF<br>1: RUN<br>2: HOLD | | 0 (OFF) | 41006 | 42006 | 43006 | 44006 |
| Pattern arrangement | 0: Normal pattern<br>1: Special pattern<br>2: 64 STEP | | 0 (Normal pattern) | 41408 | 42408 | 43408 | 44408 |
| Ramp/Soak activation pattern (STEP No.) | 0 to 7 | | 6 | 41431 | 42431 | 43431 | 44431 |
| Ramp/Soak Time Units | 0: hh.MM (hour: min)<br>1: MM.SS (min: sec) | | 0 (hh.MM) | 41432 | 42432 | 43432 | 44432 |
| SV Select (step1) | 0 to 100%FS | ○ | 0%FS | 41451 | 42451 | 43451 | 44451 |
| Ramp Time (step1) | 00: 00 to 99: 59 | | 00: 00 | 41452 | 42452 | 43452 | 44452 |
| Soak Time (step1) | 00: 00 to 99: 59 | | 00: 00 | 41453 | 42453 | 43453 | 44453 |
| SV Select (step2) | 0 to 100%FS | ○ | 0%FS | 41454 | 42454 | 43454 | 44454 |
| Ramp Time (step2) | 00: 00 to 99: 59 | | 00: 00 | 41455 | 42455 | 43455 | 44455 |
| Soak Time (step2) | 00: 00 to 99: 59 | | 00: 00 | 41456 | 42456 | 43456 | 44456 |
| SV Select (step3) | 0 to 100%FS | ○ | 0%FS | 41457 | 42457 | 43457 | 44457 |
| Ramp Time (step3) | 00: 00 to 99: 59 | | 00: 00 | 41458 | 42458 | 43458 | 44458 |
| Soak Time (step3) | 00: 00 to 99: 59 | | 00: 00 | 41459 | 42459 | 43459 | 44459 |
| SV Select (step4) | 0 to 100%FS | ○ | 0%FS | 41460 | 42460 | 43460 | 44460 |
| Ramp Time (step4) | 00: 00 to 99: 59 | | 00: 00 | 41461 | 42461 | 43461 | 44461 |
| Soak Time (step4) | 00: 00 to 99: 59 | | 00: 00 | 41462 | 42462 | 43462 | 44462 |
| SV Select (step5) | 0 to 100%FS | ○ | 0%FS | 41463 | 42463 | 43463 | 44463 |
| Ramp Time (step5) | 00: 00 to 99: 59 | | 00: 00 | 41464 | 42464 | 43464 | 44464 |
| Soak Time (step5) | 00: 00 to 99: 59 | | 00: 00 | 41465 | 42465 | 43465 | 44465 |
| SV Select (step6) | 0 to 100%FS | ○ | 0%FS | 41466 | 42466 | 43466 | 44466 |
| Ramp Time (step6) | 00: 00 to 99: 59 | | 00: 00 | 41467 | 42467 | 43467 | 44467 |
| Soak Time (step6) | 00: 00 to 99: 59 | | 00: 00 | 41468 | 42468 | 43468 | 44468 |
| SV Select (step7) | 0 to 100%FS | ○ | 0%FS | 41469 | 42469 | 43469 | 44469 |
| Ramp Time (step7) | 00: 00 to 99: 59 | | 00: 00 | 41470 | 42470 | 43470 | 44470 |
| Soak Time (step7) | 00: 00 to 99: 59 | | 00: 00 | 41471 | 42471 | 43471 | 44471 |
| SV Select (step8) | 0 to 100%FS | ○ | 0%FS | 41472 | 42472 | 43472 | 44472 |
| Ramp Time (step8) | 00: 00 to 99: 59 | | 00: 00 | 41473 | 42473 | 43473 | 44473 |
| Soak Time (step8) | 00: 00 to 99: 59 | | 00: 00 | 41474 | 42474 | 43474 | 44474 |
| SV Select (step9) | 0 to 100%FS | ○ | 0%FS | 41475 | 42475 | 43475 | 44475 |
| Ramp Time (step9) | 00: 00 to 99: 59 | | 00: 00 | 41476 | 42476 | 43476 | 44476 |
| Soak Time (step9) | 00: 00 to 99: 59 | | 00: 00 | 41477 | 42477 | 43477 | 44477 |
| SV Select (step10) | 0 to 100%FS | ○ | 0%FS | 41478 | 42478 | 43478 | 44478 |
| Ramp Time (step10) | 00: 00 to 99: 59 | | 00: 00 | 41479 | 42479 | 43479 | 44479 |
| Soak Time (step10) | 00: 00 to 99: 59 | | 00: 00 | 41480 | 42480 | 43480 | 44480 |
| SV Select (step11) | 0 to 100%FS | ○ | 0%FS | 41481 | 42481 | 43481 | 44481 |
| Ramp Time (step11) | 00: 00 to 99: 59 | | 00: 00 | 41482 | 42482 | 43482 | 44482 |
| Soak Time (step11) | 00: 00 to 99: 59 | | 00: 00 | 41483 | 42483 | 43483 | 44483 |
| SV Select (step12) | 0 to 100%FS | ○ | 0%FS | 41484 | 42484 | 43484 | 44484 |
| Ramp Time (step12) | 00: 00 to 99: 59 | | 00: 00 | 41485 | 42485 | 43485 | 44485 |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Soak Time (step12) | 00: 00 to 99: 59 | | 00: 00 | 41486 | 42486 | 43486 | 44486 |
| SV Select (step13) | 0 to 100%FS | ○ | 0%FS | 41487 | 42487 | 43487 | 44487 |
| Ramp Time (step13) | 00: 00 to 99: 59 | | 00: 00 | 41488 | 42488 | 43488 | 44488 |
| Soak Time (step13) | 00: 00 to 99: 59 | | 00: 00 | 41489 | 42489 | 43489 | 44489 |
| SV Select (step14) | 0 to 100%FS | ○ | 0%FS | 41490 | 42490 | 43490 | 44490 |
| Ramp Time (step14) | 00: 00 to 99: 59 | | 00: 00 | 41491 | 42491 | 43491 | 44491 |
| Soak Time (step14) | 00: 00 to 99: 59 | | 00: 00 | 41492 | 42492 | 43492 | 44492 |
| SV Select (step15) | 0 to 100%FS | ○ | 0%FS | 41493 | 42493 | 43493 | 44493 |
| Ramp Time (step15) | 00: 00 to 99: 59 | | 00: 00 | 41494 | 42494 | 43494 | 44494 |
| Soak Time (step15) | 00: 00 to 99: 59 | | 00: 00 | 41495 | 42495 | 43495 | 44495 |
| SV Select (step16) | 0 to 100%FS | ○ | 0%FS | 41496 | 42496 | 43496 | 44496 |
| Ramp Time (step16) | 00: 00 to 99: 59 | | 00: 00 | 41497 | 42497 | 43497 | 44497 |
| Soak Time (step16) | 00: 00 to 99: 59 | | 00: 00 | 41498 | 42498 | 43498 | 44498 |
| Ramp/Soak mode | 0 to 15 | | 0 | 41433 | 42433 | 43433 | 44433 |
| Guaranty soak | 0: OFF<br>1: ON | | 0 (OFF) | 41441 | 42441 | 43441 | 44441 |
| Guaranty soak band upper limit | 0 to 50 | ○ | 1.25%FS | 41443 | 42443 | 43443 | 44443 |
| Guaranty soak band lower limit | 0 to 50 | ○ | 1.25%FS | 41442 | 42442 | 43442 | 44442 |
| PV start | 0: OFF<br>1: ON | | 0 (OFF) | 41444 | 42444 | 43444 | 44444 |
| Continue Mode | 0: rSE<br>1: Con<br>2: ini | | 0 (rSE) | 41445 | 42445 | 43445 | 44445 |

## Valve control Parameter

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Valve control | 0: PID control<br>1: SRV 1<br>2: SRV 2 | | 0 (PID control) | 41312 | 42312 | 43312 | 44312 |
| Dead band | 0.0 to 100.0%FS | ○ | 50.0%FS | 41295 | 42295 | 43295 | 44295 |
| Valve stroke time | 5 to 180sec | | 5.0sec | 41296 | 42296 | 43296 | 44296 |

# Alarm Parameter

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| ALM1 hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41035 | 42035 | 43035 | 44035 |
| ALM1 delay time | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | 0 | 41037 | 42037 | 43037 | 44037 |
| ALM1 delay time units | 0: sec.<br>1: min. | | 0 (Second) | 41038 | 42038 | 43038 | 44038 |
| ALM2 hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41043 | 42043 | 43043 | 44043 |
| ALM2 delay time | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | 0 | 41045 | 42045 | 43045 | 44045 |
| ALM2 delay time units | 0: sec.<br>1: min. | | 0 (Second) | 41046 | 42046 | 43046 | 44046 |
| ALM3 hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41051 | 42051 | 43051 | 44051 |
| ALM3 delay time | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | 0 | 41053 | 42053 | 43053 | 44053 |
| ALM3 delay time units | 0: sec.<br>1: min. | | 0 (Second) | 41054 | 42054 | 43054 | 44054 |
| ALM4 hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41059 | 42059 | 43059 | 44059 |
| ALM4 delay time | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | 0 | 41061 | 42061 | 43061 | 44061 |
| ALM4 delay time units | 0: sec.<br>1: min. | | 0 (Second) | 41062 | 42062 | 43062 | 44062 |
| ALM5 hysteresis | 0 to 50%FS | ○ | 0.25%FS | 41067 | 42067 | 43067 | 44067 |
| ALM5 delay time | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | 0 | 41069 | 42069 | 43069 | 44069 |
| ALM5 delay time units | 0: sec.<br>1: min. | | 0 (Second) | 41070 | 42070 | 43070 | 44070 |
| Object Ch. No. for interchannel ALM1 | 1 to 4 | | 1 | 41039 | 42039 | 43039 | 44039 |
| Object Ch. No. for interchannel ALM2 | 1 to 4 | | 1 | 41047 | 42047 | 43047 | 44047 |
| Object Ch. No. for interchannel ALM3 | 1 to 4 | | 1 | 41055 | 42055 | 43055 | 44055 |
| Object Ch. No. for interchannel ALM4 | 1 to 4 | | 1 | 41063 | 42063 | 43063 | 44063 |
| Object Ch. No. for interchannel ALM5 | 1 to 4 | | 1 | 41071 | 42071 | 43071 | 44071 |
| Changeover the arrangement of CT input terminal | 0: AB arrangement<br>1: AA arrangement | | 0 (AB arrange-ment) | 40202 | | | |
| CT A monitor | 0: OFF<br>1: ON | | 0 (OFF) | 41082 | 42082 | 43082 | 44082 |
| CT[A] HB alarm set value | 0.0 to 50.0(A) | | 0 | 41072 | 42072 | 43072 | 44072 |
| CT[A]HB alarm hysteresis | 0.0 to 50.0(A) | | 0.5 | 41073 | 42073 | 43073 | 44073 |
| CT[A] load short-circuit alarm set value | 0.0 to 50.0(A) | | 0 | 41074 | 42074 | 43074 | 44074 |
| CT[A] load short-circuit alarm hysteresis | 0.0 to 50.0(A) | | 0.5 | 41075 | 42075 | 43075 | 44075 |
| CT B monitor | 0: OFF<br>1: ON | | 0 (OFF) | 41083 | 42083 | 43083 | 44083 |
| CT[B] HB alarm set value | 0.0 to 50.0(A) | | 0 | 41076 | 42076 | 43076 | 44076 |
| CT[B]HB alarm hysteresis | 0.0 to 50.0(A) | | 0.5 | 41077 | 42077 | 43077 | 44077 |
| CT[B] load short-circuit alarm set value | 0.0 to 50.0(A) | | 0 | 41078 | 42078 | 43078 | 44078 |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| CT[B] load short-circuit alarm hysteresis | 0.0 to 50.0 (A) | | 0.5 | 41079 | 42079 | 43079 | 44079 |
| Loop break detection time | 0 to 9999sec | | 0 (detection OFF) | 41080 | 42080 | 43080 | 44080 |
| Loop break detection band | 0 to 100%FS | ○ | 2.5%FS | 41081 | 42081 | 43081 | 44081 |

# Communication Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| RS-485 Parity setting | 0: NONE<br>1: ODD<br>2: EVEN | | 0 | 40111 | | | |
| RS-485 Communication speed | 0: 9.6kbps<br>1: 19.2kbps<br>2: 38.4kbps<br>3: Forbidden<br>4: 115.2kbps | | 1 | 40115 | | | |
| RS-485 Communication permission | 0: Read only<br>1: Read/Write | | 1 (R/W) | 40114 | | | |
| RS-485 Response interval time | 0 to 25 (20ms/1digit) | | 0 | 40113 | | | |
| Enhanced communication module (PUMC) connection | 0: PUMC not connected (RS485 Enable)<br>1: PUMC connected (RS485 Disable) | | 0 (RS-485 valid) | 40116 | | | |
| Master/slave setting in connected modules | 0: Master<br>1: Slave | | 1 (Slave) | 40117 | | | |
| User address 01 | 30000 to 49999 | | 30002(PV1) | 40301 | | | |
| User address 02 | 30000 to 49999 | | 30002(PV1) | 40302 | | | |
| User address 03 | 30000 to 49999 | | 30002(PV1) | 40303 | | | |
| User address 04 | 30000 to 49999 | | 30002(PV1) | 40304 | | | |
| User address 05 | 30000 to 49999 | | 30002(PV1) | 40305 | | | |
| User address 06 | 30000 to 49999 | | 30002(PV1) | 40306 | | | |
| User address 07 | 30000 to 49999 | | 30002(PV1) | 40307 | | | |
| User address 08 | 30000 to 49999 | | 30002(PV1) | 40308 | | | |
| User address 09 | 30000 to 49999 | | 30002(PV1) | 40309 | | | |
| User address 10 | 30000 to 49999 | | 30002(PV1) | 40310 | | | |
| User address 11 | 30000 to 49999 | | 30002(PV1) | 40311 | | | |
| User address 12 | 30000 to 49999 | | 30002(PV1) | 40312 | | | |
| User address 13 | 30000 to 49999 | | 30002(PV1) | 40313 | | | |
| User address 14 | 30000 to 49999 | | 30002(PV1) | 40314 | | | |
| User address 15 | 30000 to 49999 | | 30002(PV1) | 40315 | | | |
| User address 16 | 30000 to 49999 | | 30002(PV1) | 40316 | | | |
| User address 17 | 30000 to 49999 | | 30002(PV1) | 40317 | | | |
| User address 18 | 30000 to 49999 | | 30002(PV1) | 40318 | | | |
| User address 19 | 30000 to 49999 | | 30002(PV1) | 40319 | | | |
| User address 20 | 30000 to 49999 | | 30002(PV1) | 40320 | | | |
| User address 21 | 30000 to 49999 | | 30002(PV1) | 40321 | | | |
| User address 22 | 30000 to 49999 | | 30002(PV1) | 40322 | | | |
| User address 23 | 30000 to 49999 | | 30002(PV1) | 40323 | | | |
| User address 24 | 30000 to 49999 | | 30002(PV1) | 40324 | | | |
| User address 25 | 30000 to 49999 | | 30002(PV1) | 40325 | | | |
| User address 26 | 30000 to 49999 | | 30002(PV1) | 40326 | | | |
| User address 27 | 30000 to 49999 | | 30002(PV1) | 40327 | | | |
| User address 28 | 30000 to 49999 | | 30002(PV1) | 40328 | | | |
| User address 29 | 30000 to 49999 | | 30002(PV1) | 40329 | | | |
| User address 30 | 30000 to 49999 | | 30002(PV1) | 40330 | | | |
| User address 31 | 30000 to 49999 | | 30002(PV1) | 40331 | | | |
| User address 32 | 30000 to 49999 | | 30002(PV1) | 40332 | | | |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| User data 01 | Depends on “User address 01” | | — | 45001 | | | |
| User data 02 | Depends on “User address 02” | | — | 45002 | | | |
| User data 03 | Depends on “User address 03” | | — | 45003 | | | |
| User data 04 | Depends on “User address 04” | | — | 45004 | | | |
| User data 05 | Depends on “User address 05” | | — | 45005 | | | |
| User data 06 | Depends on “User address 06” | | — | 45006 | | | |
| User data 07 | Depends on “User address 07” | | — | 45007 | | | |
| User data 08 | Depends on “User address 08” | | — | 45008 | | | |
| User data 09 | Depends on “User address 09” | | — | 45009 | | | |
| User data 10 | Depends on “User address 10” | | — | 45010 | | | |
| User data 11 | Depends on “User address 11” | | — | 45011 | | | |
| User data 12 | Depends on “User address 12” | | — | 45012 | | | |
| User data 13 | Depends on “User address 13” | | — | 45013 | | | |
| User data 14 | Depends on “User address 14” | | — | 45014 | | | |
| User data 15 | Depends on “User address 15” | | — | 45015 | | | |
| User data 16 | Depends on “User address 16” | | — | 45016 | | | |
| User data 17 | Depends on “User address 17” | | — | 45017 | | | |
| User data 18 | Depends on “User address 18” | | — | 45018 | | | |
| User data 19 | Depends on “User address 19” | | — | 45019 | | | |
| User data 20 | Depends on “User address 20” | | — | 45020 | | | |
| User data 21 | Depends on “User address 21” | | — | 45021 | | | |
| User data 22 | Depends on “User address 22” | | — | 45022 | | | |
| User data 23 | Depends on “User address 23” | | — | 45023 | | | |
| User data 24 | Depends on “User address 24” | | — | 45024 | | | |
| User data 25 | Depends on “User address 25” | | — | 45025 | | | |
| User data 26 | Depends on “User address 26” | | — | 45026 | | | |
| User data 27 | Depends on “User address 27” | | — | 45027 | | | |

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| User data 28 | Depends on “User address 28” | | — | 45028 | | | |
| User data 29 | Depends on “User address 29” | | — | 45029 | | | |
| User data 30 | Depends on “User address 30” | | — | 45030 | | | |
| User data 31 | Depends on “User address 31” | | — | 45031 | | | |
| User data 32 | Depends on “User address 32” | | — | 45032 | | | |

## Configuration Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| Control when input burn-out is detected | 0: Stop control<br>1: Continue control | | 0 (Stop control) | 41407 | 42407 | 43407 | 44407 |
| LED2 Lamp Allocation | 0 to 255 | | 1 | 40222 | | | |
| LED3 Lamp Allocation | 0 to 255 | | 12 | 40223 | | | |
| LED4 Lamp Allocation | 0 to 255 | | 13 | 40224 | | | |
| LED5 Lamp Allocation | 0 to 255 | | 14 | 40225 | | | |
| LED6 Lamp Allocation | 0 to 255 | | 15 | 40226 | | | |
| Reset main unit | 0: Do nothing<br>1: Reset main unit | | 0 | 40101 | | | |

# Monitor Parameters

| Content | Readout/write data setting range | Depends on input range | Factory-set value | Register No. 1 (Ch1) | Register No. 2 (Ch2) | Register No. 3 (Ch3) | Register No. 4 (Ch4) |
|---|---|---|---|---|---|---|---|
| SV value | 0 to 100%FS | ○ | — | 30905 | 30906 | 30907 | 30908 |
| Remote mode switch | 0: Local<br>1: Remote | | — | 30030<br>31037 | 30031<br>32037 | 30032<br>33037 | 30033<br>34037 |
| System time | 0 to 65535 | | — | 30001 | | | |
| Measurement value (PV) | –5 to 105%FS | | — | 30002<br>31001 | 30003<br>32001 | 30004<br>33001 | 30005<br>34001 |
| Set value (SV) | 0 to 100%FS | | — | 30006<br>31002 | 30007<br>32002 | 30008<br>33002 | 30009<br>34002 |
| DV | –105 to 105%FS | | — | 30010<br>31003 | 30011<br>32003 | 30012<br>33003 | 30013<br>34003 |
| Output value (MV1) | –3.0 to 103.0% | | — | 30014<br>31004 | 30016<br>32004 | 30018<br>33004 | 30020<br>34004 |
| Output value (MV2) | –3.0 to 103.0% | | — | 30015<br>31005 | 30017<br>32005 | 30019<br>33005 | 30021<br>34005 |
| Remote SV (RSV) | 0.0 to 100.0%FS | | — | 30022<br>31045 | 30023<br>32045 | 30024<br>33045 | 30025<br>34045 |
| RCJ temp | –3276.7 to 3276.7 °C | | — | 30110<br>31016 | 30111<br>32016 | 30112<br>33016 | 30113<br>34016 |
| Heater current [A] | 0.0 to 50.0A | | — | 30071<br>31046 | 30073<br>32046 | 30075<br>33046 | 30077<br>34046 |
| Heater current [B] | 0.0 to 50.0A | | — | 30072<br>31047 | 30074<br>32047 | 30076<br>33047 | 30078<br>34047 |
| Leak current [A] | 0.0 to 50.0A | | — | 30081<br>31048 | 30083<br>32048 | 30085<br>33048 | 30087<br>34048 |
| Leak current [B] | 0.0 to 50.0A | | — | 30082<br>31049 | 30084<br>32049 | 30086<br>33049 | 30088<br>34049 |
| Error source display | 0000 to FFFF | | — | 31008 | 32008 | 33008 | 34008 |
| Alarm 1-5 status | 0000 to 001F | | — | 31007 | 32007 | 33007 | 34007 |
| Event input status | 0000 to FFFF | | — | 31061 | 32061 | 33061 | 34061 |
| Remaining time on timer 1 | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | — | 31011 | 32011 | 33011 | 34011 |
| Remaining time on timer 2 | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | — | 31012 | 32012 | 33012 | 34012 |
| Remaining time on timer 3 | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | — | 31013 | 32013 | 33013 | 34013 |
| Remaining time on timer 4 | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | — | 31014 | 32014 | 33014 | 34014 |
| Remaining time on timer 5 | 0 to 99min.59sec.<br>/0 to 99hr.59min. | | — | 31015 | 32015 | 33015 | 34015 |
| Output value | –3.0 to 103.0% | | — | 30120 | 30121 | 30122 | 30123 |
| RS-485 Communication permission | 0: Read only<br>1: Read/Write | | — | 30062 | | | |
| PWM Output status monitor (ALL) | 0 to 15 | | — | 30066 | | | |
| PWM Output status monitor (each Ch) | 0: OFF<br>1: O N | | — | 31906 | 32906 | 33906 | 34906 |
| Estimated MV value | 0.0 to 100.0% | | — | 30931<br>31907 | 30932<br>32907 | 30933<br>33907 | 30934<br>34907 |
| Ramp/Soak progress | 0 to 129 | | — | 30034<br>31009 | 30035<br>32009 | 30036<br>33009 | 30037<br>34009 |
| Ramp/Soak elapsed time | 00: 00 to<br>99: 59 | hour: min/<br>min: sec | — | 30038<br>31010 | 30039<br>32010 | 30040<br>33010 | 30041<br>34010 |
| COM Monitor (ALM_INFO) | 0000 to FFFF | | — | 30067 | | | |

# Order of Register Numbers

| Content | Register number | Relative address |
|---|---|---|
| Ch1 Local SV value | 40001 | 0000h |
| Ch2 Local SV value | 40002 | 0001h |
| Ch3 Local SV value | 40003 | 0002h |
| Ch4 Local SV value | 40004 | 0003h |
| Ch1 MV value | 40005 | 0004h |
| Ch2 MV value | 40006 | 0005h |
| Ch3 MV value | 40007 | 0006h |
| Ch4 MV value | 40008 | 0007h |
| Ch1 Remote mode switch | 40009 | 0008h |
| Ch2 Remote mode switch | 40010 | 0009h |
| Ch3 Remote mode switch | 40011 | 000Ah |
| Ch4 Remote mode switch | 40012 | 000Bh |
| Ch1 Manual mode switch | 40013 | 000Ch |
| Ch2 Manual mode switch | 40014 | 000Dh |
| Ch3 Manual mode switch | 40015 | 000Eh |
| Ch4 Manual mode switch | 40016 | 000Fh |
| Ch1 RUN/Standby switch | 40017 | 0010h |
| Ch2 RUN/Standby switch | 40018 | 0011h |
| Ch3 RUN/Standby switch | 40019 | 0012h |
| Ch4 RUN/Standby switch | 40020 | 0013h |
| Ch1 Communication SV value | 40023 | 0016h |
| Ch2 Communication SV value | 40024 | 0017h |
| Ch3 Communication SV value | 40025 | 0018h |
| Ch4 Communication SV value | 40026 | 0019h |
| Reset main unit | 40101 | 0064h |
| RS-485 Parity setting | 40111 | 006Eh |
| RS-485 Response interval time | 40113 | 0070h |
| RS-485 Communication permission | 40114 | 0071h |
| RS-485 Communication speed | 40115 | 0072h |
| Enhanced communication module (PUMC) connection | 40116 | 0073h |
| Master/slave setting in connected modules | 40117 | 0074h |
| Ch1 PV input type | 40151 | 0096h |
| Ch2 PV input type | 40152 | 0097h |
| Ch3 PV input type | 40153 | 0098h |
| Ch4 PV input type | 40154 | 0099h |
| OUT1 Current output range | 40166 | 00A5h |
| OUT2 Current output range | 40167 | 00A6h |
| OUT3 Current output range | 40168 | 00A7h |
| OUT4 Current output range | 40169 | 00A8h |
| OUT1 Output type | 40171 | 00AAh |
| OUT1 Output master St. No. | 40172 | 00ABh |
| OUT1 Output master Ch. No. | 40173 | 00ACh |
| OUT1 Output scaling span | 40174 | 00ADh |
| OUT1 Output scaling base | 40175 | 00AEh |
| OUT1 Proportion cycle | 40176 | 00AFh |
| OUT2 Output type | 40177 | 00B0h |
| OUT2 Output master St. No. | 40178 | 00B1h |
| OUT2 Output master Ch. No. | 40179 | 00B2h |
| OUT2 Output scaling span | 40180 | 00B3h |
| OUT2 Output scaling base | 40181 | 00B4h |

| Content | Register number | Relative address |
|---|---|---|
| OUT2 Proportion cycle | 40182 | 00B5h |
| OUT3 Output type | 40183 | 00B6h |
| OUT3 Output master St. No. | 40184 | 00B7h |
| OUT3 Output master Ch. No. | 40185 | 00B8h |
| OUT3 Output scaling span | 40186 | 00B9h |
| OUT3 Output scaling base | 40187 | 00BAh |
| OUT3 Proportion cycle | 40188 | 00BBh |
| OUT4 Output type | 40189 | 00BCh |
| OUT4 Output master St. No. | 40190 | 00BDh |
| OUT4 Output master Ch. No. | 40191 | 00BEh |
| OUT4 Output scaling span | 40192 | 00BFh |
| OUT4 Output scaling base | 40193 | 00C0h |
| OUT4 Proportion cycle | 40194 | 00C1h |
| Ch1 MV transmission type | 40195 | 0C2h |
| Ch2 MV transmission type | 40196 | 0C3h |
| Ch3 MV transmission type | 40197 | 0C4h |
| Ch4 MV transmission type | 40198 | 0C5h |
| Output shutdown | 40201 | 00C8h |
| Changeover the arrangement of CT input terminal | 40202 | 0C9h |
| LED2 Lamp Allocation | 40222 | 00DDh |
| LED3 Lamp Allocation | 40223 | 00DEh |
| LED4 Lamp Allocation | 40224 | 00DFh |
| LED5 Lamp Allocation | 40225 | 00E0h |
| LED6 Lamp Allocation | 40226 | 00E1h |
| User address 01 | 40301 | 012Ch |
| User address 02 | 40302 | 012Dh |
| User address 03 | 40303 | 012Eh |
| User address 04 | 40304 | 012Fh |
| User address 05 | 40305 | 0130h |
| User address 06 | 40306 | 0131h |
| User address 07 | 40307 | 0132h |
| User address 08 | 40308 | 0133h |
| User address 09 | 40309 | 0134h |
| User address 10 | 40310 | 0135h |
| User address 11 | 40311 | 0136h |
| User address 12 | 40312 | 0137h |
| User address 13 | 40313 | 0138h |
| User address 14 | 40314 | 0139h |
| User address 15 | 40315 | 013Ah |
| User address 16 | 40316 | 013Bh |
| User address 17 | 40317 | 013Ch |
| User address 18 | 40318 | 013Dh |
| User address 19 | 40319 | 013Eh |
| User address 20 | 40320 | 013Fh |
| User address 21 | 40321 | 0140h |
| User address 22 | 40322 | 0141h |
| User address 23 | 40323 | 0142h |
| User address 24 | 40324 | 0143h |
| User address 25 | 40325 | 0144h |
| User address 26 | 40326 | 0145h |
| User address 27 | 40327 | 0146h |
| User address 28 | 40328 | 0147h |

| Content | Register number | Relative address |
|---|---|---|
| User address 29 | 40329 | 0148h |
| User address 30 | 40330 | 0149h |
| User address 31 | 40331 | 014Ah |
| User address 32 | 40332 | 014Bh |
| Ch1 Local SV value | 41001 | 03E8h |
| Ch1 MV value | 41002 | 03E9h |
| Ch1 Manual mode switch | 41003 | 03EAh |
| Ch1 RUN/Standby switch | 41004 | 03EBh |
| Ch1 Auto-tuning RUN command | 41005 | 03ECh |
| Ch1 Ramp/Soak command | 41006 | 03EDh |
| Ch1 Remote mode switch | 41007 | 03EEh |
| Ch1 DI master Station No. setting | 41011 | 03F2h |
| Ch1 DI-1 function select | 41013 | 03F4h |
| Ch1 DI-2 function select | 41014 | 03F5h |
| Ch1 DI-3 function select | 41015 | 03F6h |
| Ch1 DI-4 function select | 41016 | 03F7h |
| Ch1 DI-5 function select | 41017 | 03F8h |
| Ch1 DI-6 function select | 41018 | 03F9h |
| Ch1 DI-7 function select | 41019 | 03FAh |
| Ch1 DI-8 function select | 41020 | 03FBh |
| Ch1 DI-9 function select | 41021 | 03FCh |
| Ch1 DI-10 function select | 41022 | 03FDh |
| Ch1 DI-11 function select | 41023 | 03FEh |
| Ch1 DI-12 function select | 41024 | 03FFh |
| Ch1 DI-13 function select | 41025 | 0400h |
| Ch1 DI-14 function select | 41026 | 0401h |
| Ch1 DI-15 function select | 41027 | 0402h |
| Ch1 DI-16 function select | 41028 | 0403h |
| OUT1 PV input type | 41029 | 0404h |
| Ch1 Digital output latch release command | 41031 | 0406h |
| Ch1 DO1 output event type setting | 41032 | 0407h |
| Ch1 ALM1 set value 1 | 41033 | 0408h |
| Ch1 ALM1 set value 2 | 41034 | 0409h |
| Ch1 ALM1 hysteresis | 41035 | 040Ah |
| Ch1 DO1 option function setting | 41036 | 040Bh |
| Ch1 ALM1 delay time | 41037 | 040Ch |
| Ch1 ALM1 delay time units | 41038 | 040Dh |
| Ch1 Object Ch. No. for interchannel ALM1 | 41039 | 040Eh |
| Ch1 DO2 option event type setting | 41040 | 040Fh |
| Ch1 ALM2 set value 1 | 41041 | 0410h |
| Ch1 ALM2 set value 2 | 41042 | 0411h |
| Ch1 ALM2 hysteresis | 41043 | 0412h |
| Ch1 DO2 option function setting | 41044 | 0413h |
| Ch1 ALM2 delay time | 41045 | 0414h |
| Ch1 ALM2 delay time units | 41046 | 0415h |
| Ch1 Object Ch. No. for interchannel ALM2 | 41047 | 0416h |
| Ch1 DO3 option event type setting | 41048 | 0417h |
| Ch1 ALM3 set value 1 | 41049 | 0418h |
| Ch1 ALM3 set value 2 | 41050 | 0419h |

| Content | Register number | Relative address |
|---|---|---|
| Ch1 ALM3 hysteresis | 41051 | 041Ah |
| Ch1 DO3 option function setting | 41052 | 041Bh |
| Ch1 ALM3 delay time | 41053 | 041Ch |
| Ch1 ALM3 delay time units | 41054 | 041Dh |
| Ch1 Object Ch. No. for interchannel ALM3 | 41055 | 041Eh |
| Ch1 DO4 option event type setting | 41056 | 041Fh |
| Ch1 ALM4 set value 1 | 41057 | 0420h |
| Ch1 ALM4 set value 2 | 41058 | 0421h |
| Ch1 ALM4 hysteresis | 41059 | 0422h |
| Ch1 DO4 option function setting | 41060 | 0423h |
| Ch1 ALM4 delay time | 41061 | 0424h |
| Ch1 ALM4 delay time units | 41062 | 0425h |
| Ch1 Object Ch. No. for interchannel ALM4 | 41063 | 0426h |
| Ch1 DO5 option event type setting | 41064 | 0427h |
| Ch1 ALM5 set value 1 | 41065 | 0428h |
| Ch1 ALM5 set value 2 | 41066 | 0429h |
| Ch1 ALM5 hysteresis | 41067 | 042Ah |
| Ch1 DO5 option function setting | 41068 | 042Bh |
| Ch1 ALM5 delay time | 41069 | 042Ch |
| Ch1 ALM5 delay time units | 41070 | 042Dh |
| Ch1 Object Ch. No. for interchannel ALM5 | 41071 | 042Eh |
| Ch1 CT[A] HB alarm set value | 41072 | 042Fh |
| Ch1 CT[A] HB alarm hysteresis | 41073 | 0430h |
| Ch1 CT[A] load short-circuit alarm set value | 41074 | 0431h |
| Ch1 CT[A] load short-circuit alarm hysteresis | 41075 | 0432h |
| Ch1 CT[B] HB alarm set value | 41076 | 0433h |
| Ch1 CT[B] HB alarm hysteresis | 41077 | 0434h |
| Ch1 CT[B] load short-circuit alarm set value | 41078 | 0435h |
| Ch1 CT[B] load short-circuit alarm hysteresis | 41079 | 0436h |
| Ch1 Loop break detection time | 41080 | 0437h |
| Ch1 Loop break detection band | 41081 | 0438h |
| Ch1 CT A monitor | 41082 | 0439h |
| Ch1 CT B monitor | 41083 | 043Ah |
| Ch1 Communication SV value | 41100 | 044Bh |
| Ch1 Local SV value | 41101 | 044Ch |
| Ch1 Proportional band [P] | 41102 | 044Dh |
| Ch1 Integration time [I] | 41103 | 044Eh |
| Ch1 Derivation time [D] | 41104 | 044Fh |
| Ch1 ON/OFF control hysteresis | 41105 | 0450h |
| Ch1 Cooling proportional band coefficient [cool] | 41106 | 0451h |
| Ch1 Dead band | 41107 | 0452h |
| Ch1 Output convergence value | 41108 | 0453h |
| Ch1 Anti-reset windup [ARW] | 41109 | 0454h |
| Ch1 Direct/reverse action setting [MV1/MV2] | 41110 | 0455h |
| Ch1 PV input scale lower | 41212 | 04BBh |

| Content | Register number | Relative address |
|---|---|---|
| Ch1 PV input scale upper | 41213 | 04BCh |
| Ch1 Decimal place | 41214 | 04BDh |
| Ch1 Temperature unit | 41215 | 04BEh |
| Ch1 PV input shift | 41216 | 04BFh |
| Ch1 SV value shift | 41217 | 04C0h |
| Ch1 SV lower limits | 41218 | 04C1h |
| Ch1 SV upper limits | 41219 | 04C2h |
| Ch1 PV input filter | 41220 | 04C3h |
| Ch1 PV display zero adjustment | 41221 | 04C4h |
| Ch1 PV display span adjustment | 41222 | 04C5h |
| Ch1 Cold junction compensation | 41223 | 04C6h |
| Ch1 Remote mode switch | 41224 | 04C7h |
| Ch1 RSV zero adjustment | 41225 | 04C8h |
| Ch1 RSV span adjustment | 41226 | 04C9h |
| Ch1 MV1 lower limits | 41255 | 04E6h |
| Ch1 MV1 upper limits | 41256 | 04E7h |
| Ch1 MV2 lower limits | 41257 | 04E8h |
| Ch1 MV2 upper limits | 41258 | 04E9h |
| Ch1 Output limiter type setting | 41259 | 04EAh |
| Ch1 FAULT MV1 set value | 41260 | 04EBh |
| Ch1 FAULT MV2 set value | 41261 | 04ECh |
| Ch1 Soft start MV1 value | 41262 | 04EDh |
| Ch1 Soft start MV2 value | 41263 | 04EEh |
| Ch1 Soft start time | 41264 | 04EFh |
| Ch1 Standby MV1 value | 41268 | 04F3h |
| Ch1 Standby MV2 value | 41269 | 04F4h |
| Ch1 Standby mode setting | 41270 | 04F5h |
| Ch1 Control algorithm | 41291 | 050Ah |
| Ch1 ON/OFF hysteresis setting | 41292 | 050Bh |
| Ch1 Specified process | 41294 | 050Dh |
| Ch1 Dead band | 41295 | 050Eh |
| Ch1 Valve stroke time | 41296 | 050Fh |
| Ch1 Ramp SV ON/OFF | 41299 | 0512h |
| Ch1 Ramp SV - decline | 41300 | 0513h |
| Ch1 Ramp SV - incline | 41301 | 0514h |
| Ch1 Ramp SV slope time units | 41302 | 0515h |
| Ch1 Mode at startup | 41304 | 0517h |
| Ch1 Valve control | 41312 | 051Fh |
| Ch1 Control when input burnout is detected | 41407 | 057Eh |
| Ch1 Pattern arrangement | 41408 | 057Fh |
| Ch1 Ramp/Soak activation pattern (STEP No.) | 41431 | 0596h |
| Ch1 Ramp/Soak Time Units | 41432 | 0597h |
| Ch1 Ramp/Soak mode | 41433 | 0598h |
| Ch1 Guaranty soak | 41441 | 05A0h |
| Ch1 Guaranty soak band lower limit | 41442 | 05A1h |
| Ch1 Guaranty soak band upper limit | 41443 | 05A2h |
| Ch1 PV start | 41444 | 05A3h |
| Ch1 Continue Mode | 41445 | 05A4h |
| Ch1 SV Select (step1) | 41451 | 05AAh |
| Ch1 Ramp Time (step1) | 41452 | 05ABh |
| Ch1 Soak Time (step1) | 41453 | 05ACh |
| Ch1 SV Select (step2) | 41454 | 05ADh |

| Content | Register number | Relative address |
|---|---|---|
| Ch1 Ramp Time (step2) | 41455 | 05AEh |
| Ch1 Soak Time (step2) | 41456 | 05AFh |
| Ch1 SV Select (step3) | 41457 | 05B0h |
| Ch1 Ramp Time (step3) | 41458 | 05B1h |
| Ch1 Soak Time (step3) | 41459 | 05B2h |
| Ch1 SV Select (step4) | 41460 | 05B3h |
| Ch1 Ramp Time (step4) | 41461 | 05B4h |
| Ch1 Soak Time (step4) | 41462 | 05B5h |
| Ch1 SV Select (step5) | 41463 | 05B6h |
| Ch1 Ramp Time (step5) | 41464 | 05B7h |
| Ch1 Soak Time (step5) | 41465 | 05B8h |
| Ch1 SV Select (step6) | 41466 | 05B9h |
| Ch1 Ramp Time (step6) | 41467 | 05BAh |
| Ch1 Soak Time (step6) | 41468 | 05BBh |
| Ch1 SV Select (step7) | 41469 | 05BCh |
| Ch1 Ramp Time (step7) | 41470 | 05BDh |
| Ch1 Soak Time (step7) | 41471 | 05BEh |
| Ch1 SV Select (step8) | 41472 | 05BFh |
| Ch1 Ramp Time (step8) | 41473 | 05C0h |
| Ch1 Soak Time (step8) | 41474 | 05C1h |
| Ch1 SV Select (step9) | 41475 | 05C2h |
| Ch1 Ramp Time (step9) | 41476 | 05C3h |
| Ch1 Soak Time (step9) | 41477 | 05C4h |
| Ch1 SV Select (step10) | 41478 | 05C5h |
| Ch1 Ramp Time (step10) | 41479 | 05C6h |
| Ch1 Soak Time (step10) | 41480 | 05C7h |
| Ch1 SV Select (step11) | 41481 | 05C8h |
| Ch1 Ramp Time (step11) | 41482 | 05C9h |
| Ch1 Soak Time (step11) | 41483 | 05CAh |
| Ch1 SV Select (step12) | 41484 | 05CBh |
| Ch1 Ramp Time (step12) | 41485 | 05CCh |
| Ch1 Soak Time (step12) | 41486 | 05CDh |
| Ch1 SV Select (step13) | 41487 | 05CEh |
| Ch1 Ramp Time (step13) | 41488 | 05CFh |
| Ch1 Soak Time (step13) | 41489 | 05D0h |
| Ch1 SV Select (step14) | 41490 | 05D1h |
| Ch1 Ramp Time (step14) | 41491 | 05D2h |
| Ch1 Soak Time (step14) | 41492 | 05D3h |
| Ch1 SV Select (step15) | 41493 | 05D4h |
| Ch1 Ramp Time (step15) | 41494 | 05D5h |
| Ch1 Soak Time (step15) | 41495 | 05D6h |
| Ch1 SV Select (step16) | 41496 | 05D7h |
| Ch1 Ramp Time (step16) | 41497 | 05D8h |
| Ch1 Soak Time (step16) | 41498 | 05D9h |
| Ch1 Type of SV | 41531 | 05FAh |
| Ch1 RSV input master Station No. | 41532 | 05FBh |
| Ch1 RSV input master Ch. No. | 41533 | 05FCh |
| Ch1 Input master Ch. | 41535 | 05FEh |
| Ch1 Linkage operation master Station No. | 41536 | 05FFh |
| Ch1 Linkage operation master Ch. No. | 41537 | 0600h |
| Ch1 Destination for inputting PV | 41539 | 0602h |
| Out1 Current output range | 41801 | 0708h |
| Out1 Output type | 41803 | 070Ah |

| Content | Register number | Relative address |
|---|---|---|
| Out1 Output master Station No. | 41804 | 070Bh |
| Out1 Output master Ch. No. | 41805 | 070Ch |
| Out1 Output scaling span | 41806 | 070Dh |
| Out1 Output scaling base | 41807 | 070Eh |
| Ch1 MV transmission type | 41810 | 0711h |
| Ch2 Local SV value | 42001 | 07D0h |
| Ch2 MV value | 42002 | 07D1h |
| Ch2 Manual mode switch | 42003 | 07D2h |
| Ch2 RUN/Standby switch | 42004 | 07D3h |
| Ch2 Auto-tuning RUN command | 42005 | 07D4h |
| Ch2 Ramp/Soak command | 42006 | 07D5h |
| Ch2 Remote mode switch | 42007 | 07D6h |
| Ch2 DI master Station No. setting | 42011 | 07DAh |
| Ch2 DI-1 function select | 42013 | 07DCh |
| Ch2 DI-2 function select | 42014 | 07DDh |
| Ch2 DI-3 function select | 42015 | 07DEh |
| Ch2 DI-4 function select | 42016 | 07DFh |
| Ch2 DI-5 function select | 42017 | 07E0h |
| Ch2 DI-6 function select | 42018 | 07E1h |
| Ch2 DI-7 function select | 42019 | 07E2h |
| Ch2 DI-8 function select | 42020 | 07E3h |
| Ch2 DI-9 function select | 42021 | 07E4h |
| Ch2 DI-10 function select | 42022 | 07E5h |
| Ch2 DI-11 function select | 42023 | 07E6h |
| Ch2 DI-12 function select | 42024 | 07E7h |
| Ch2 DI-13 function select | 42025 | 07E8h |
| Ch2 DI-14 function select | 42026 | 07E9h |
| Ch2 DI-15 function select | 42027 | 07EAh |
| Ch2 DI-16 function select | 42028 | 07EBh |
| OUT2 PV input type | 42029 | 07ECh |
| Ch2 Digital output latch release command | 42031 | 07EEh |
| Ch2 DO1output event type setting | 42032 | 07EFh |
| Ch2 ALM1 set value 1 | 42033 | 07F0h |
| Ch2 ALM1 set value 2 | 42034 | 07F1h |
| Ch2 ALM1 hysteresis | 42035 | 07F2h |
| Ch2 DO1 option function setting | 42036 | 07F3h |
| Ch2 ALM1 delay time | 42037 | 07F4h |
| Ch2 ALM1 delay time units | 42038 | 07F5h |
| Ch2 Object Ch. No. for interchannel ALM1 | 42039 | 07F6h |
| Ch2 DO2 output event type setting | 42040 | 07F7h |
| Ch2 ALM2 set value 1 | 42041 | 07F8h |
| Ch2 ALM2 set value 2 | 42042 | 07F9h |
| Ch2 ALM2 hysteresis | 42043 | 07FAh |
| Ch2 DO2 option function setting | 42044 | 07FBh |
| Ch2 ALM2 delay time | 42045 | 07FCh |
| Ch2 ALM2 delay time units | 42046 | 07FDh |
| Ch2 Object Ch. No. for interchannel ALM2 | 42047 | 07FEh |
| Ch2 DO3 output event type setting | 42048 | 07FFh |
| Ch2 ALM3 set value 1 | 42049 | 0800h |

| Content | Register number | Relative address |
|---|---|---|
| Ch2 ALM3 set value 2 | 42050 | 0801h |
| Ch2 ALM3 hysteresis | 42051 | 0802h |
| Ch2 DO3 option function setting | 42052 | 0803h |
| Ch2 ALM3 delay time | 42053 | 0804h |
| Ch2 ALM3 delay time units | 42054 | 0805h |
| Ch2 Object Ch. No. for interchannel ALM3 | 42055 | 0806h |
| Ch2 DO4 output event type setting | 42056 | 0807h |
| Ch2 ALM4 set value 1 | 42057 | 0808h |
| Ch2 ALM4 set value 2 | 42058 | 0809h |
| Ch2 ALM4 hysteresis | 42059 | 080Ah |
| Ch2 DO4 option function setting | 42060 | 080Bh |
| Ch2 ALM4 delay time | 42061 | 080Ch |
| Ch2 ALM4 delay time units | 42062 | 080Dh |
| Ch2 Object Ch. No. for interchannel ALM4 | 42063 | 080Eh |
| Ch2 DO5 output event type setting | 42064 | 080Fh |
| Ch2 ALM5 set value 1 | 42065 | 0810h |
| Ch2 ALM5 set value 2 | 42066 | 0811h |
| Ch2 ALM5 hysteresis | 42067 | 0812h |
| Ch2 DO5 option function setting | 42068 | 0813h |
| Ch2 ALM5 delay time | 42069 | 0814h |
| Ch2 ALM5 delay time units | 42070 | 0815h |
| Ch2 Object Ch. No. for interchannel ALM5 | 42071 | 0816h |
| Ch2 CT[A] HB alarm set value | 42072 | 0817h |
| Ch2 CT[A] HB alarm hysteresis | 42073 | 0818h |
| Ch2 CT[A] load short-circuit alarm set value | 42074 | 0819h |
| Ch2 CT[A] load short-circuit alarm hysteresis | 42075 | 081Ah |
| Ch2 CT[B] HB alarm set value | 42076 | 081Bh |
| Ch2 CT[B] HB alarm hysteresis | 42077 | 081Ch |
| Ch2 CT[B] load short-circuit alarm set value | 42078 | 081Dh |
| Ch2 CT[B] load short-circuit alarm hysteresis | 42079 | 081Eh |
| Ch2 Loop break detection time | 42080 | 081Fh |
| Ch2 Loop break detection band | 42081 | 0820h |
| Ch2 CT A monitor | 42082 | 0821h |
| Ch2 CT B monitor | 42083 | 0822h |
| Ch2 Communication SV value | 42100 | 0833h |
| Ch2 Local SV value | 42101 | 0834h |
| Ch2 Proportional band [P] | 42102 | 0835h |
| Ch2 Integration time [I] | 42103 | 0836h |
| Ch2 Derivation time [D] | 42104 | 0837h |
| Ch2 ON/OFF control hysteresis | 42105 | 0838h |
| Ch2 Cooling proportional band coefficient [cool] | 42106 | 0839h |
| Ch2 Dead band | 42107 | 083Ah |
| Ch2 Output convergence value | 42108 | 083Bh |
| Ch2 Anti-reset windup [ARW] | 42109 | 083Ch |
| Ch2 Direct/reverse action setting [MV1/MV2] | 42110 | 083Dh |

| Content | Register number | Relative address |
|---|---|---|
| Ch2 PV input scale lower | 42212 | 08A3h |
| Ch2 PV input scale upper | 42213 | 08A4h |
| Ch2 Decimal place | 42214 | 08A5h |
| Ch2 Temperature unit | 42215 | 08A6h |
| Ch2 PV input shift | 42216 | 08A7h |
| Ch2 SV value shift | 42217 | 08A8h |
| Ch2 SV lower limits | 42218 | 08A9h |
| Ch2 SV upper limits | 42219 | 08AAh |
| Ch2 PV input filter | 42220 | 08ABh |
| Ch2 PV display zero adjustment | 42221 | 08ACh |
| Ch2 PV display span adjustment | 42222 | 08ADh |
| Ch2 Cold junction compensation | 42223 | 08AEh |
| Ch2 Remote mode switch | 42224 | 08AFh |
| Ch2 RSV zero adjustment | 42225 | 08B0h |
| Ch2 RSV span adjustment | 42226 | 08B1h |
| Ch2 MV1 lower limits | 42255 | 08CEh |
| Ch2 MV1 upper limits | 42256 | 08CFh |
| Ch2 MV2 lower limits | 42257 | 08D0h |
| Ch2 MV2 upper limits | 42258 | 08D1h |
| Ch2 Output limiter type setting | 42259 | 08D2h |
| Ch2 FAULT MV1 set value | 42260 | 08D3h |
| Ch2 FAULT MV2 set value | 42261 | 08D4h |
| Ch2 Soft start MV1 value | 42262 | 08D5h |
| Ch2 Soft start MV2 value | 42263 | 08D6h |
| Ch2 Soft start time | 42264 | 08D7h |
| Ch2 Standby MV1 value | 42268 | 08DBh |
| Ch2 Standby MV2 value | 42269 | 08DCh |
| Ch2 Standby mode setting | 42270 | 08DDh |
| Ch2 Control algorithm | 42291 | 08F2h |
| Ch2 ON/OFF hysteresis setting | 42292 | 08F3h |
| Ch2 Specified process | 42294 | 08F5h |
| Ch2 Dead band | 42295 | 08F6h |
| Ch2 Valve stroke time | 42296 | 08F7h |
| Ch2 Ramp SV ON/OFF | 42299 | 08FAh |
| Ch2 Ramp SV - decline | 42300 | 08FBh |
| Ch2 Ramp SV - incline | 42301 | 08FCh |
| Ch2 Ramp SV slope time units | 42302 | 08FDh |
| Ch2 Mode at startup | 42304 | 08FFh |
| Ch2 Valve control | 42312 | 0907h |
| Ch2 Control when input burnout is detected | 42407 | 0966h |
| Ch2 Pattern arrangement | 42408 | 0967h |
| Ch2 Ramp/Soak activation pattern (STEP No.) | 42431 | 097Eh |
| Ch2 Ramp/Soak Time Units | 42432 | 097Fh |
| Ch2 Ramp/Soak mode | 42433 | 0980h |
| Ch2 Guaranty soak | 42441 | 0988h |
| Ch2 Guaranty soak band lower limit | 42442 | 0989h |
| Ch2 Guaranty soak band upper limit | 42443 | 098Ah |
| Ch2 PV start | 42444 | 098Bh |
| Ch2 Continue Mode | 42445 | 098Ch |
| Ch2 SV Select (step1) | 42451 | 0992h |
| Ch2 Ramp Time (step1) | 42452 | 0993h |
| Ch2 Soak Time (step1) | 42453 | 0994h |

| Content | Register number | Relative address |
|---|---|---|
| Ch2 SV Select (step2) | 42454 | 0995h |
| Ch2 Ramp Time (step2) | 42455 | 0996h |
| Ch2 Soak Time (step2) | 42456 | 0997h |
| Ch2 SV Select (step3) | 42457 | 0998h |
| Ch2 Ramp Time (step3) | 42458 | 0999h |
| Ch2 Soak Time (step3) | 42459 | 099Ah |
| Ch2 SV Select (step4) | 42460 | 099Bh |
| Ch2 Ramp Time (step4) | 42461 | 099Ch |
| Ch2 Soak Time (step4) | 42462 | 099Dh |
| Ch2 SV Select (step5) | 42463 | 099Eh |
| Ch2 Ramp Time (step5) | 42464 | 099Fh |
| Ch2 Soak Time (step5) | 42465 | 09A0h |
| Ch2 SV Select (step6) | 42466 | 09A1h |
| Ch2 Ramp Time (step6) | 42467 | 09A2h |
| Ch2 Soak Time (step6) | 42468 | 09A3h |
| Ch2 SV Select (step7) | 42469 | 09A4h |
| Ch2 Ramp Time (step7) | 42470 | 09A5h |
| Ch2 Soak Time (step7) | 42471 | 09A6h |
| Ch2 SV Select (step8) | 42472 | 09A7h |
| Ch2 Ramp Time (step8) | 42473 | 09A8h |
| Ch2 Soak Time (step8) | 42474 | 09A9h |
| Ch2 SV Select (step9) | 42475 | 09AAh |
| Ch2 Ramp Time (step9) | 42476 | 09ABh |
| Ch2 Soak Time (step9) | 42477 | 09ACh |
| Ch2 SV Select (step10) | 42478 | 09ADh |
| Ch2 Ramp Time (step10) | 42479 | 09AEh |
| Ch2 Soak Time (step10) | 42480 | 09AFh |
| Ch2 SV Select (step11) | 42481 | 09B0h |
| Ch2 Ramp Time (step11) | 42482 | 09B1h |
| Ch2 Soak Time (step11) | 42483 | 09B2h |
| Ch2 SV Select (step12) | 42484 | 09B3h |
| Ch2 Ramp Time (step12) | 42485 | 09B4h |
| Ch2 Soak Time (step12) | 42486 | 09B5h |
| Ch2 SV Select (step13) | 42487 | 09B6h |
| Ch2 Ramp Time (step13) | 42488 | 09B7h |
| Ch2 Soak Time (step13) | 42489 | 09B8h |
| Ch2 SV Select (step14) | 42490 | 09B9h |
| Ch2 Ramp Time (step14) | 42491 | 09BAh |
| Ch2 Soak Time (step14) | 42492 | 09BBh |
| Ch2 SV Select (step15) | 42493 | 09BCh |
| Ch2 Ramp Time (step15) | 42494 | 09BDh |
| Ch2 Soak Time (step15) | 42495 | 09BEh |
| Ch2 SV Select (step16) | 42496 | 09BFh |
| Ch2 Ramp Time (step16) | 42497 | 09C0h |
| Ch2 Soak Time (step16) | 42498 | 09C1h |
| Ch2 Type of SV | 42531 | 09E2h |
| Ch2 RSV input master Station No. | 42532 | 09E3h |
| Ch2 RSV input master Ch. No. | 42533 | 09E4h |
| Ch2 Input master Ch. | 42535 | 09E6h |
| Ch2 Linkage operation master Station No. | 42536 | 09E7h |
| Ch2 Linkage operation master Ch. No. | 42537 | 09E8h |
| Ch2 Destination for inputting PV | 42539 | 09EAh |
| Out2 Current output range | 42801 | 0AF0h |

| Content | Register number | Relative address |
|---|---|---|
| Out2 Output type | 42803 | 0AF2h |
| Out2 Output master station No. | 42804 | 0AF3h |
| Out2 Output master Ch. No. | 42805 | 0AF4h |
| Out2 Output scaling span | 42806 | 0AF5h |
| Out2 Output scaling base | 42807 | 0AF6h |
| Ch2 MV transmission type | 42810 | 0AF9h |
| Ch3 Local SV value | 43001 | 0BB8h |
| Ch3 MV value | 43002 | 0BB9h |
| Ch3 Manual mode switch | 43003 | 0BBAh |
| Ch3 RUN/Standby switch | 43004 | 0BBBh |
| Ch3 Auto-tuning RUN command | 43005 | 0BBCh |
| Ch3 Ramp/Soak command | 43006 | 0BBDh |
| Ch3 Remote mode switch | 43007 | 0BBEh |
| Ch3 DI master Station No. setting | 43011 | 0BC2h |
| Ch3 DI-1 function select | 43013 | 0BC4h |
| Ch3 DI-2 function select | 43014 | 0BC5h |
| Ch3 DI-3 function select | 43015 | 0BC6h |
| Ch3 DI-4 function select | 43016 | 0BC7h |
| Ch3 DI-5 function select | 43017 | 0BC8h |
| Ch3 DI-6 function select | 43018 | 0BC9h |
| Ch3 DI-7 function select | 43019 | 0BCAh |
| Ch3 DI-8 function select | 43020 | 0BCBh |
| Ch3 DI-9 function select | 43021 | 0BCCh |
| Ch3 DI-10 function select | 43022 | 0BCDh |
| Ch3 DI-11 function select | 43023 | 0BCEh |
| Ch3 DI-12 function select | 43024 | 0BCFh |
| Ch3 DI-13 function select | 43025 | 0BD0h |
| Ch3 DI-14 function select | 43026 | 0BD1h |
| Ch3 DI-15 function select | 43027 | 0BD2h |
| Ch3 DI-16 function select | 43028 | 0BD3h |
| Out3 PV input type | 43029 | 0BD4h |
| Ch3 Digital output latch release command | 43031 | 0BD6h |
| Ch3 DO1 output event type setting | 43032 | 0BD7h |
| Ch3 ALM1 set value 1 | 43033 | 0BD8h |
| Ch3 ALM1 set value 2 | 43034 | 0BD9h |
| Ch3 ALM1 hysteresis | 43035 | 0BDAh |
| Ch3 DO1 option function setting | 43036 | 0BDBh |
| Ch3 ALM1 delay time | 43037 | 0BDCh |
| Ch3 ALM1 delay time units | 43038 | 0BDDh |
| Ch3 Object Ch. No. for interchannel ALM1 | 43039 | 0BDEh |
| Ch3 DO2 output event type setting | 43040 | 0BDFh |
| Ch3 ALM2 set value 1 | 43041 | 0BE0h |
| Ch3 ALM2 set value 2 | 43042 | 0BE1h |
| Ch3 ALM2 hysteresis | 43043 | 0BE2h |
| Ch3 DO2 option function setting | 43044 | 0BE3h |
| Ch3 ALM2 delay time | 43045 | 0BE4h |
| Ch3 ALM2 delay time units | 43046 | 0BE5h |
| Ch3 Object Ch. No. for interchannel ALM2 | 43047 | 0BE6h |
| Ch3 DO3 output event type setting | 43048 | 0BE7h |

| Content | Register number | Relative address |
|---|---|---|
| Ch3 ALM3 set value 1 | 43049 | 0BE8h |
| Ch3 ALM3 set value 2 | 43050 | 0BE9h |
| Ch3 ALM3 hysteresis | 43051 | 0BEAh |
| Ch3 DO3 option function setting | 43052 | 0BEBh |
| Ch3 ALM3 delay time | 43053 | 0BECh |
| Ch3 ALM3 delay time units | 43054 | 0BEDh |
| Ch3 Object Ch. No. for interchannel ALM3 | 43055 | 0BEEh |
| Ch3 DO4 output event type setting | 43056 | 0BEFh |
| Ch3 ALM4 set value 1 | 43057 | 0BF0h |
| Ch3 ALM4 set value 2 | 43058 | 0BF1h |
| Ch3 ALM4 hysteresis | 43059 | 0BF2h |
| Ch3 DO4 option function setting | 43060 | 0BF3h |
| Ch3 ALM4 delay time | 43061 | 0BF4h |
| Ch3 ALM4 delay time units | 43062 | 0BF5h |
| Ch3 Object Ch. No. for interchannel ALM4 | 43063 | 0BF6h |
| Ch3 DO5 output event type setting | 43064 | 0BF7h |
| Ch3 ALM5 set value 1 | 43065 | 0BF8h |
| Ch3 ALM5 set value 2 | 43066 | 0BF9h |
| Ch3 ALM5 hysteresis | 43067 | 0BFAh |
| Ch3 DO5 option function setting | 43068 | 0BFBh |
| Ch3 ALM5 delay time | 43069 | 0BFCh |
| Ch3 ALM5 delay time units | 43070 | 0BFDh |
| Ch3 Object Ch. No. for interchannel ALM5 | 43071 | 0BFEh |
| Ch3 CT[A] HB alarm set value | 43072 | 0BFFh |
| Ch3 CT[A] HB alarm hysteresis | 43073 | 0C00h |
| Ch3 CT[A] load short-circuit alarm set value | 43074 | 0C01h |
| Ch3 CT[A] load short-circuit alarm hysteresis | 43075 | 0C02h |
| Ch3 CT[B] HB alarm set value | 43076 | 0C03h |
| Ch3 CT[B] HB alarm hysteresis | 43077 | 0C04h |
| Ch3 CT[B] load short-circuit alarm set value | 43078 | 0C05h |
| Ch3 CT[B] load short-circuit alarm hysteresis | 43079 | 0C06h |
| Ch3 Loop break detection time | 43080 | 0C07h |
| Ch3 Loop break detection band | 43081 | 0C08h |
| Ch3 CT A monitor | 43082 | 0C09h |
| Ch3 CT B monitor | 43083 | 0C0Ah |
| Ch3 Communication SV value | 43100 | 0C1Bh |
| Ch3 Local SV value | 43101 | 0C1Ch |
| Ch3 Proportional band [P] | 43102 | 0C1Dh |
| Ch3 Integration time [I] | 43103 | 0C1Eh |
| Ch3 Derivation time [D] | 43104 | 0C1Fh |
| Ch3 ON/OFF control hysteresis | 43105 | 0C20h |
| Ch3 Cooling proportional band coefficient [cool] | 43106 | 0C21h |
| Ch3 Dead band | 43107 | 0C22h |
| Ch3 Output convergence value | 43108 | 0C23h |
| Ch3 Anti-reset windup [ARW] | 43109 | 0C24h |

| Content | Register number | Relative address |
|---|---|---|
| Ch3 Direct/reverse action setting [MV1/MV2] | 43110 | 0C25h |
| Ch3 PV input scale lower | 43212 | 0C8Bh |
| Ch3 PV input scale upper | 43213 | 0C8Ch |
| Ch3 Decimal place | 43214 | 0C8Dh |
| Ch3 Temperature unit | 43215 | 0C8Eh |
| Ch3 PV input shift | 43216 | 0C8Fh |
| Ch3 SV value shift | 43217 | 0C90h |
| Ch3 SV lower limits | 43218 | 0C91h |
| Ch3 SV upper limits | 43219 | 0C92h |
| Ch3 PV input filter | 43220 | 0C93h |
| Ch3 PV display zero adjustment | 43221 | 0C94h |
| Ch3 PV display span adjustment | 43222 | 0C95h |
| Ch3 Cold junction compensation | 43223 | 0C96h |
| Ch3 Remote mode switch | 43224 | 0C97h |
| Ch3 RSV zero adjustment | 43225 | 0C98h |
| Ch3 RSV span adjustment | 43226 | 0C99h |
| Ch3 MV1 lower limits | 43255 | 0CB6h |
| Ch3 MV1 upper limits | 43256 | 0CB7h |
| Ch3 MV2 lower limits | 43257 | 0CB8h |
| Ch3 MV2 upper limits | 43258 | 0CB9h |
| Ch3 Output limiter type setting | 43259 | 0CBAh |
| Ch3 FAULT MV1 set value | 43260 | 0CBBh |
| Ch3 FAULT MV2 set value | 43261 | 0CBCh |
| Ch3 Soft start MV1 value | 43262 | 0CBDh |
| Ch3 Soft start MV2 value | 43263 | 0CBEh |
| Ch3 Soft start time | 43264 | 0CBFh |
| Ch3 Standby MV1 value | 43268 | 0CC3h |
| Ch3 Standby MV2 value | 43269 | 0CC4h |
| Ch3 Standby mode setting | 43270 | 0CC5h |
| Ch3 Control algorithm | 43291 | 0CDAh |
| Ch3 ON/OFF hysteresis setting | 43292 | 0CDBh |
| Ch3 Specified process | 43294 | 0CDDh |
| Ch3 Dead band | 43295 | 0CDEh |
| Ch3 Valve stroke time | 43296 | 0CDFh |
| Ch3 Ramp SV ON/OFF | 43299 | 0CE2h |
| Ch3 Ramp SV - decline | 43300 | 0CE3h |
| Ch3 Ramp SV - incline | 43301 | 0CE4h |
| Ch3 Ramp SV slope time units | 43302 | 0CE5h |
| Ch3 Mode at startup | 43304 | 0CE7h |
| Ch3 Valve control | 43312 | 0CEFh |
| Ch3 Control when input burnout is detected | 43407 | 0D4Eh |
| Ch3 Pattern arrangement | 43408 | 0D4Fh |
| Ch3 Ramp/Soak activation pattern (STEP No.) | 43431 | 0D66h |
| Ch3 Ramp/Soak Time Units | 43432 | 0D67h |
| Ch3 Ramp/Soak mode | 43433 | 0D68h |
| Ch3 Guaranty soak | 43441 | 0D70h |
| Ch3 Guaranty soak band lower limit | 43442 | 0D71h |
| Ch3 Guaranty soak band upper limit | 43443 | 0D72h |
| Ch3 PV start | 43444 | 0D73h |
| Ch3 Continue Mode | 43445 | 0D74h |
| Ch3 SV Select (step1) | 43451 | 0D7Ah |

| Content | Register number | Relative address |
|---|---|---|
| Ch3 Ramp Time (step1) | 43452 | 0D7Bh |
| Ch3 Soak Time (step1) | 43453 | 0D7Ch |
| Ch3 SV Select (step2) | 43454 | 0D7Dh |
| Ch3 Ramp Time (step2) | 43455 | 0D7Eh |
| Ch3 Soak Time (step2) | 43456 | 0D7Fh |
| Ch3 SV Select (step3) | 43457 | 0D80h |
| Ch3 Ramp Time (step3) | 43458 | 0D81h |
| Ch3 Soak Time (step3) | 43459 | 0D82h |
| Ch3 SV Select (step4) | 43460 | 0D83h |
| Ch3 Ramp Time (step4) | 43461 | 0D84h |
| Ch3 Soak Time (step4) | 43462 | 0D85h |
| Ch3 SV Select (step5) | 43463 | 0D86h |
| Ch3 Ramp Time (step5) | 43464 | 0D87h |
| Ch3 Soak Time (step5) | 43465 | 0D88h |
| Ch3 SV Select (step6) | 43466 | 0D89h |
| Ch3 Ramp Time (step6) | 43467 | 0D8Ah |
| Ch3 Soak Time (step6) | 43468 | 0D8Bh |
| Ch3 SV Select (step7) | 43469 | 0D8Ch |
| Ch3 Ramp Time (step7) | 43470 | 0D8Dh |
| Ch3 Soak Time (step7) | 43471 | 0D8Eh |
| Ch3 SV Select (step8) | 43472 | 0D8Fh |
| Ch3 Ramp Time (step8) | 43473 | 0D90h |
| Ch3 Soak Time (step8) | 43474 | 0D91h |
| Ch3 SV Select (step9) | 43475 | 0D92h |
| Ch3 Ramp Time (step9) | 43476 | 0D93h |
| Ch3 Soak Time (step9) | 43477 | 0D94h |
| Ch3 SV Select (step10) | 43478 | 0D95h |
| Ch3 Ramp Time (step10) | 43479 | 0D96h |
| Ch3 Soak Time (step10) | 43480 | 0D97h |
| Ch3 SV Select (step11) | 43481 | 0D98h |
| Ch3 Ramp Time (step11) | 43482 | 0D99h |
| Ch3 Soak Time (step11) | 43483 | 0D9Ah |
| Ch3 SV Select (step12) | 43484 | 0D9Bh |
| Ch3 Ramp Time (step12) | 43485 | 0D9Ch |
| Ch3 Soak Time (step12) | 43486 | 0D9Dh |
| Ch3 SV Select (step13) | 43487 | 0D9Eh |
| Ch3 Ramp Time (step13) | 43488 | 0D9Fh |
| Ch3 Soak Time (step13) | 43489 | 0DA0h |
| Ch3 SV Select (step14) | 43490 | 0DA1h |
| Ch3 Ramp Time (step14) | 43491 | 0DA2h |
| Ch3 Soak Time (step14) | 43492 | 0DA3h |
| Ch3 SV Select (step15) | 43493 | 0DA4h |
| Ch3 Ramp Time (step15) | 43494 | 0DA5h |
| Ch3 Soak Time (step15) | 43495 | 0DA6h |
| Ch3 SV Select (step16) | 43496 | 0DA7h |
| Ch3 Ramp Time (step16) | 43497 | 0DA8h |
| Ch3 Soak Time (step16) | 43498 | 0DA9h |
| Ch3 Type of SV | 43531 | 0DCAh |
| Ch3 RSV input master Station No. | 43532 | 0DCBh |
| Ch3 RSV input master Ch. No. | 43533 | 0DCCh |
| Ch3 Input master Ch. | 43535 | 0DCEh |
| Ch3 Linkage operation master Station No. | 43536 | 0DCFh |
| Ch3 Linkage operation master Ch. No. | 43537 | 0DD0h |

| Content | Register number | Relative address |
|---|---|---|
| Ch3 Destination for inputting PV | 43539 | 0DD2h |
| Out3 Current output range | 43801 | 0ED8h |
| Out3 Output type | 43803 | 0EDAh |
| Out3 Output master Station No. | 43804 | 0EDBh |
| Out3 Output master Ch. No. | 43805 | 0EDCh |
| Out3 Output scaling span | 43806 | 0EDDh |
| Out3 Output scaling base | 43807 | 0EDEh |
| Ch3 MV transmission type | 43810 | 0EE1h |
| Ch4 Local SV value | 44001 | 0FA0h |
| Ch4 MV value | 44002 | 0FA1h |
| Ch4 Manual mode switch | 44003 | 0FA2h |
| Ch4 RUN/Standby switch | 44004 | 0FA3h |
| Ch4 Auto-tuning RUN command | 44005 | 0FA4h |
| Ch4 Ramp/Soak command | 44006 | 0FA5h |
| Ch4 Remote mode switch | 44007 | 0FA6h |
| Ch4 DI master Station No. setting | 44011 | 0FAAh |
| Ch4 DI-1 function select | 44013 | 0FACh |
| Ch4 DI-2 function select | 44014 | 0FADh |
| Ch4 DI-3 function select | 44015 | 0FAEh |
| Ch4 DI-4 function select | 44016 | 0FAFh |
| Ch4 DI-5 function select | 44017 | 0FB0h |
| Ch4 DI-6 function select | 44018 | 0FB1h |
| Ch4 DI-7 function select | 44019 | 0FB2h |
| Ch4 DI-8 function select | 44020 | 0FB3h |
| Ch4 DI-9 function select | 44021 | 0FB4h |
| Ch4 DI-10 function select | 44022 | 0FB5h |
| Ch4 DI-11 function select | 44023 | 0FB6h |
| Ch4 DI-12 function select | 44024 | 0FB7h |
| Ch4 DI-13 function select | 44025 | 0FB8h |
| Ch4 DI-14 function select | 44026 | 0FB9h |
| Ch4 DI-15 function select | 44027 | 0FBAh |
| Ch4 DI-16 function select | 44028 | 0FBBh |
| Out4 PV input type | 44029 | 0FBCh |
| Ch4 Digital output latch release command | 44031 | 0FBEh |
| Ch4 DO1 output event type setting | 44032 | 0FBFh |
| Ch4 ALM1 set value 1 | 44033 | 0FC0h |
| Ch4 ALM1 set value 2 | 44034 | 0FC1h |
| Ch4 ALM1 hysteresis | 44035 | 0FC2h |
| Ch4 DO1 option function setting | 44036 | 0FC3h |
| Ch4 ALM1 delay time | 44037 | 0FC4h |
| Ch4 ALM1 delay time units | 44038 | 0FC5h |
| Ch4 Object Ch. No. for interchannel ALM1 | 44039 | 0FC6h |
| Ch4 DO2 output event type setting | 44040 | 0FC7h |
| Ch4 ALM2 set value 1 | 44041 | 0FC8h |
| Ch4 ALM2 set value 2 | 44042 | 0FC9h |
| Ch4 ALM2 hysteresis | 44043 | 0FCAh |
| Ch4 DO2 option function setting | 44044 | 0FCBh |
| Ch4 ALM2 delay time | 44045 | 0FCCh |
| Ch4 ALM2 delay time units | 44046 | 0FCDh |
| Ch4 Object Ch. No. for interchannel ALM2 | 44047 | 0FCEh |

| Content | Register number | Relative address |
|---|---|---|
| Ch4 DO3 output event type setting | 44048 | 0FCFh |
| Ch4 ALM3 set value 1 | 44049 | 0FD0h |
| Ch4 ALM3 set value 2 | 44050 | 0FD1h |
| Ch4 ALM3 hysteresis | 44051 | 0FD2h |
| Ch4 DO3 option function setting | 44052 | 0FD3h |
| Ch4 ALM3 delay time | 44053 | 0FD4h |
| Ch4 ALM3 delay time units | 44054 | 0FD5h |
| Ch4 Object Ch. No. for interchannel ALM3 | 44055 | 0FD6h |
| Ch4 DO4 output event type setting | 44056 | 0FD7h |
| Ch4 ALM4 set value 1 | 44057 | 0FD8h |
| Ch4 ALM4 set value 2 | 44058 | 0FD9h |
| Ch4 ALM4 hysteresis | 44059 | 0FDAh |
| Ch4 DO4 option function setting | 44060 | 0FDBh |
| Ch4 ALM4 delay time | 44061 | 0FDCh |
| Ch4 ALM4 delay time units | 44062 | 0FDDh |
| Ch4 Object Ch. No. for interchannel ALM4 | 44063 | 0FDEh |
| Ch4 DO5 output event type setting | 44064 | 0FDFh |
| Ch4 ALM5 set value 1 | 44065 | 0FE0h |
| Ch4 ALM5 set value 2 | 44066 | 0FE1h |
| Ch4 ALM5 hysteresis | 44067 | 0FE2h |
| Ch4 DO5 option function setting | 44068 | 0FE3h |
| Ch4 ALM5 delay time | 44069 | 0FE4h |
| Ch4 ALM5 delay time units | 44070 | 0FE5h |
| Ch4 Object Ch. No. for interchannel ALM5 | 44071 | 0FE6h |
| Ch4 CT[A] HB alarm set value | 44072 | 0FE7h |
| Ch4 CT[A] HB alarm hysteresis | 44073 | 0FE8h |
| Ch4 CT[A] load short-circuit alarm set value | 44074 | 0FE9h |
| Ch4 CT[A] load short-circuit alarm hysteresis | 44075 | 0FEAh |
| Ch4 CT[B] HB alarm set value | 44076 | 0FEBh |
| Ch4 CT[B] HB alarm hysteresis | 44077 | 0FECh |
| Ch4 CT[B] load short-circuit alarm set value | 44078 | 0FEDh |
| Ch4 CT[B] load short-circuit alarm hysteresis | 44079 | 0FEEh |
| Ch4 Loop break detection time | 44080 | 0FEFh |
| Ch4 Loop break detection band | 44081 | 0FF0h |
| Ch4 CT A monitor | 44082 | 0FF1h |
| Ch4 CT B monitor | 44083 | 0FF2h |
| Ch4 Communication SV value | 44100 | 1003h |
| Ch4 Local SV value | 44101 | 1004h |
| Ch4 Proportional band [P] | 44102 | 1005h |
| Ch4 Integration time [I] | 44103 | 1006h |
| Ch4 Derivation time [D] | 44104 | 1007h |
| Ch4 ON/OFF control hysteresis | 44105 | 1008h |
| Ch4 Cooling proportional band coefficient [cool] | 44106 | 1009h |
| Ch4 Dead band | 44107 | 100Ah |
| Ch4 Output convergence value | 44108 | 100Bh |

| Content | Register number | Relative address |
|---|---|---|
| Ch4 Anti-reset windup [ARW] | 44109 | 100Ch |
| Ch4 Direct/reverse action setting [MV1/MV2] | 44110 | 100Dh |
| Ch4 PV input scale lower | 44212 | 1073h |
| Ch4 PV input scale upper | 44213 | 1074h |
| Ch4 Decimal place | 44214 | 1075h |
| Ch4 Temperature unit | 44215 | 1076h |
| Ch4 PV input shift | 44216 | 1077h |
| Ch4 SV value shift | 44217 | 1078h |
| Ch4 SV lower limits | 44218 | 1079h |
| Ch4 SV upper limits | 44219 | 107Ah |
| Ch4 PV input filter | 44220 | 107Bh |
| Ch4 PV display zero adjustment | 44221 | 107Ch |
| Ch4 PV display span adjustment | 44222 | 107Dh |
| Ch4 Cold junction compensation | 44223 | 107Eh |
| Ch4 Remote mode switch | 44224 | 107Fh |
| Ch4 RSV zero adjustment | 44225 | 1080h |
| Ch4 RSV span adjustment | 44226 | 1081h |
| Ch4 MV1 lower limits | 44255 | 109Eh |
| Ch4 MV1 upper limits | 44256 | 109Fh |
| Ch4 MV2 lower limits | 44257 | 10A0h |
| Ch4 MV2 upper limits | 44258 | 10A1h |
| Ch4 Output limiter type setting | 44259 | 10A2h |
| Ch4 FAULT MV1 set value | 44260 | 10A3h |
| Ch4 FAULT MV2 set value | 44261 | 10A4h |
| Ch4 Soft start MV1 value | 44262 | 10A5h |
| Ch4 Soft start MV2 value | 44263 | 10A6h |
| Ch4 Soft start time | 44264 | 10A7h |
| Ch4 Standby MV1 value | 44268 | 10ABh |
| Ch4 Standby MV2 value | 44269 | 10ACh |
| Ch4 Standby mode setting | 44270 | 10ADh |
| Ch4 Control algorithm | 44291 | 10C2h |
| Ch4 ON/OFF hysteresis setting | 44292 | 10C3h |
| Ch4 Specified process | 44294 | 10C5h |
| Ch4 Dead band | 44295 | 10C6h |
| Ch4 Valve stroke time | 44296 | 10C7h |
| Ch4 Ramp SV ON/OFF | 44299 | 10CAh |
| Ch4 Ramp SV - decline | 44300 | 10CBh |
| Ch4 Ramp SV - incline | 44301 | 10CCh |
| Ch4 Ramp SV slope time units | 44302 | 10CDh |
| Ch4 Mode at startup | 44304 | 10CFh |
| Ch4 Valve control | 44312 | 10D7h |
| Ch4 Control when input burnout is detected | 44407 | 1136h |
| Ch4 Pattern arrangement | 44408 | 1137h |
| Ch4 Ramp/Soak activation pattern (STEP No.) | 44431 | 114Eh |
| Ch4 Ramp/Soak Time Units | 44432 | 114Fh |
| Ch4 Ramp/Soak mode | 44433 | 1150h |
| Ch4 Guaranty soak | 44441 | 1158h |
| Ch4 Guaranty soak band lower limit | 44442 | 1159h |
| Ch4 Guaranty soak band upper limit | 44443 | 115Ah |
| Ch4 PV start | 44444 | 115Bh |
| Ch4 Continue Mode | 44445 | 115Ch |

| Content | Register number | Relative address |
|---|---|---|
| Ch4 SV Select (step1) | 44451 | 1162h |
| Ch4 Ramp Time (step1) | 44452 | 1163h |
| Ch4 Soak Time (step1) | 44453 | 1164h |
| Ch4 SV Select (step2) | 44454 | 1165h |
| Ch4 Ramp Time (step2) | 44455 | 1166h |
| Ch4 Soak Time (step2) | 44456 | 1167h |
| Ch4 SV Select (step3) | 44457 | 1168h |
| Ch4 Ramp Time (step3) | 44458 | 1169h |
| Ch4 Soak Time (step3) | 44459 | 116Ah |
| Ch4 SV Select (step4) | 44460 | 116Bh |
| Ch4 Ramp Time (step4) | 44461 | 116Ch |
| Ch4 Soak Time (step4) | 44462 | 116Dh |
| Ch4 SV Select (step5) | 44463 | 116Eh |
| Ch4 Ramp Time (step5) | 44464 | 116Fh |
| Ch4 Soak Time (step5) | 44465 | 1170h |
| Ch4 SV Select (step6) | 44466 | 1171h |
| Ch4 Ramp Time (step6) | 44467 | 1172h |
| Ch4 Soak Time (step6) | 44468 | 1173h |
| Ch4 SV Select (step7) | 44469 | 1174h |
| Ch4 Ramp Time (step7) | 44470 | 1175h |
| Ch4 Soak Time (step7) | 44471 | 1176h |
| Ch4 SV Select (step8) | 44472 | 1177h |
| Ch4 Ramp Time (step8) | 44473 | 1178h |
| Ch4 Soak Time (step8) | 44474 | 1179h |
| Ch4 SV Select (step9) | 44475 | 117Ah |
| Ch4 Ramp Time (step9) | 44476 | 117Bh |
| Ch4 Soak Time (step9) | 44477 | 117Ch |
| Ch4 SV Select (step10) | 44478 | 117Dh |
| Ch4 Ramp Time (step10) | 44479 | 117Eh |
| Ch4 Soak Time (step10) | 44480 | 117Fh |
| Ch4 SV Select (step11) | 44481 | 1180h |
| Ch4 Ramp Time (step11) | 44482 | 1181h |
| Ch4 Soak Time (step11) | 44483 | 1182h |
| Ch4 SV Select (step12) | 44484 | 1183h |
| Ch4 Ramp Time (step12) | 44485 | 1184h |
| Ch4 Soak Time (step12) | 44486 | 1185h |
| Ch4 SV Select (step13) | 44487 | 1186h |
| Ch4 Ramp Time (step13) | 44488 | 1187h |
| Ch4 Soak Time (step13) | 44489 | 1188h |
| Ch4 SV Select (step14) | 44490 | 1189h |
| Ch4 Ramp Time (step14) | 44491 | 118Ah |
| Ch4 Soak Time (step14) | 44492 | 118Bh |
| Ch4 SV Select (step15) | 44493 | 118Ch |
| Ch4 Ramp Time (step15) | 44494 | 118Dh |
| Ch4 Soak Time (step15) | 44495 | 118Eh |
| Ch4 SV Select (step16) | 44496 | 118Fh |
| Ch4 Ramp Time (step16) | 44497 | 1190h |
| Ch4 Soak Time (step16) | 44498 | 1191h |
| Ch4 Type of SV | 44531 | 11B2h |
| Ch4 RSV input master Station No. | 44532 | 11B3h |
| Ch4 RSV input master Ch. No. | 44533 | 11B4h |
| Ch4 Input master Ch. | 44535 | 11B6h |
| Ch4 Linkage operation master Station No. | 44536 | 11B7h |

| Content | Register number | Relative address |
|---|---|---|
| Ch4 Linkage operation master Ch. No. | 44537 | 11B8h |
| Ch4 Destination for inputting PV | 44539 | 11BAh |
| Out4 Current output range | 44801 | 12C0h |
| Out4 Output type | 44803 | 12C2h |
| Out4 Output master Station No. | 44804 | 12C3h |
| Out4 Output master Ch. No. | 44805 | 12C4h |
| Out4 Output scaling span | 44806 | 12C5h |
| Out4 Output scaling base | 44807 | 12C6h |
| Ch4 MV transmission type | 44810 | 12C9h |
| User data 01 | 45001 | 1388h |
| User data 02 | 45002 | 1389h |
| User data 03 | 45003 | 138Ah |
| User data 04 | 45004 | 138Bh |
| User data 05 | 45005 | 138Ch |
| User data 06 | 45006 | 138Dh |
| User data 07 | 45007 | 138Eh |
| User data 08 | 45008 | 138Fh |
| User data 09 | 45009 | 1390h |
| User data 10 | 45010 | 1391h |
| User data 11 | 45011 | 1392h |
| User data 12 | 45012 | 1393h |
| User data 13 | 45013 | 1394h |
| User data 14 | 45014 | 1395h |
| User data 15 | 45015 | 1396h |
| User data 16 | 45016 | 1397h |
| User data 17 | 45017 | 1398h |
| User data 18 | 45018 | 1399h |
| User data 19 | 45019 | 139Ah |
| User data 20 | 45020 | 139Bh |
| User data 21 | 45021 | 139Ch |
| User data 22 | 45022 | 139Dh |
| User data 23 | 45023 | 139Eh |
| User data 24 | 45024 | 139Fh |
| User data 25 | 45025 | 13A0h |
| User data 26 | 45026 | 13A1h |
| User data 27 | 45027 | 13A2h |
| User data 28 | 45028 | 13A3h |
| User data 29 | 45029 | 13A4h |
| User data 30 | 45030 | 13A5h |
| User data 31 | 45031 | 13A6h |
| User data 32 | 45032 | 13A7h |
| System time | 30001 | 0000h |
| Ch1 Measurement value (PV) | 30002 | 0001h |
| Ch2 Measurement value (PV) | 30003 | 0002h |
| Ch3 Measurement value (PV) | 30004 | 0003h |
| Ch4 Measurement value (PV) | 30005 | 0004h |
| Ch1 Set value (SV) | 30006 | 0005h |
| Ch2 Set value (SV) | 30007 | 0006h |
| Ch3 Set value (SV) | 30008 | 0007h |
| Ch4 Set value (SV) | 30009 | 0008h |
| Ch1 DV | 30010 | 0009h |
| Ch2 DV | 30011 | 000Ah |
| Ch3 DV | 30012 | 000Bh |
| Ch4 DV | 30013 | 000Ch |
| Ch1 Output value (MV1) | 30014 | 000Dh |

| Content | Register number | Relative address |
|---|---|---|
| Ch1 Output value (MV2) | 30015 | 000Eh |
| Ch2 Output value (MV1) | 30016 | 000Fh |
| Ch2 Output value (MV2) | 30017 | 0010h |
| Ch3 Output value (MV1) | 30018 | 0011h |
| Ch3 Output value (MV2) | 30019 | 0012h |
| Ch4 Output value (MV1) | 30020 | 0013h |
| Ch4 Output value (MV2) | 30021 | 0014h |
| Ch1 Remote SV (RSV) | 30022 | 0015h |
| Ch2 Remote SV (RSV) | 30023 | 0016h |
| Ch3 Remote SV (RSV) | 30024 | 0017h |
| Ch4 Remote SV (RSV) | 30025 | 0018h |
| Ch1 Remote mode switch | 30030 | 001Dh |
| Ch2 Remote mode switch | 30031 | 001Eh |
| Ch3 Remote mode switch | 30032 | 001Fh |
| Ch4 Remote mode switch | 30033 | 0020h |
| Ch1 Ramp/Soak progress | 30034 | 0021h |
| Ch2 Ramp/Soak progress | 30035 | 0022h |
| Ch3 Ramp/Soak progress | 30036 | 0023h |
| Ch4 Ramp/Soak progress | 30037 | 0024h |
| Ch1 Ramp/Soak elapsed time | 30038 | 0025h |
| Ch2 Ramp/Soak elapsed time | 30039 | 0026h |
| Ch3 Ramp/Soak elapsed time | 30040 | 0027h |
| Ch4 Ramp/Soak elapsed time | 30041 | 0028h |
| RS-485 Communication permission | 30062 | 003Dh |
| PWM Output status monitor (ALL) | 30066 | 0041h |
| COM Monitor (ALM_INFO) | 30067 | 0042h |
| Ch1 Heater current [A] | 30071 | 0046h |
| Ch1 Heater current [B] | 30072 | 0047h |
| Ch2 Heater current [A] | 30073 | 0048h |
| Ch2 Heater current [B] | 30074 | 0049h |
| Ch3 Heater current [A] | 30075 | 004Ah |
| Ch3 Heater current [B] | 30076 | 004Bh |
| Ch4 Heater current [A] | 30077 | 004Ch |
| Ch4 Heater current [B] | 30078 | 004Dh |
| Ch1 Leak current [A] | 30081 | 0050h |
| Ch1 Leak current [B] | 30082 | 0051h |
| Ch2 Leak current [A] | 30083 | 0052h |
| Ch2 Leak current [B] | 30084 | 0053h |
| Ch3 Leak current [A] | 30085 | 0054h |
| Ch3 Leak current [B] | 30086 | 0055h |
| Ch4 Leak current [A] | 30087 | 0056h |
| Ch4 Leak current [B] | 30088 | 0057h |
| Ch1 RCJtemp | 30110 | 006Dh |
| Ch2 RCJtemp | 30111 | 006Eh |
| Ch3 RCJtemp | 30112 | 006Fh |
| Ch4 RCJtemp | 30113 | 0070h |
| Out1 Output value | 30120 | 0077h |
| Out2 Output value | 30121 | 0078h |
| Out3 Output value | 30122 | 0079h |
| Out4 Output value | 30123 | 007Ah |
| Ch1 SV value | 30905 | 0388h |
| Ch2 SV value | 30906 | 0389h |
| Ch3 SV value | 30907 | 038Ah |
| Ch4 SV value | 30908 | 038Bh |

| Content | Register number | Relative address |
|---|---|---|
| Ch1 Estimated MV value | 30931 | 03A2h |
| Ch2 Estimated MV value | 30932 | 03A3h |
| Ch3 Estimated MV value | 30933 | 03A4h |
| Ch4 Estimated MV value | 30934 | 03A5h |
| Ch1 Measurement value (PV) | 31001 | 03E8h |
| Ch1 Set value (SV) | 31002 | 03E9h |
| Ch1 DV | 31003 | 03EAh |
| Ch1 Output value (MV1) | 31004 | 03EBh |
| Ch1 Output value (MV2) | 31005 | 03ECh |
| Ch1 Alarm 1-5 status | 31007 | 03EEh |
| Ch1 Error source display | 31008 | 03EFh |
| Ch1 Ramp/Soak progress | 31009 | 03F0h |
| Ch1 Ramp/Soak elapsed time | 31010 | 03F1h |
| Ch1 Remaining time on timer 1 | 31011 | 03F2h |
| Ch1 Remaining time on timer 2 | 31012 | 03F3h |
| Ch1 Remaining time on timer 3 | 31013 | 03F4h |
| Ch1 Remaining time on timer 4 | 31014 | 03F5h |
| Ch1 Remaining time on timer 5 | 31015 | 03F6h |
| Ch1 RCJtemp | 31016 | 03F7h |
| Ch1 Remote mode switch | 31037 | 040Ch |
| Ch1 Remote SV (RSV) | 31045 | 0414h |
| Ch1 Heater current [A] | 31046 | 0415h |
| Ch1 Heater current [B] | 31047 | 0416h |
| Ch1 Leak current [A] | 31048 | 0417h |
| Ch1 Leak current [B] | 31049 | 0418h |
| Ch1 Error source display | 31054 | 041Dh |
| Ch1 Alarm 1-5 status | 31060 | 0423h |
| Ch1 Event input status | 31061 | 0424h |
| Ch1 PWM Output status monitor | 31906 | 0771h |
| Ch1 Estimated MV value | 31907 | 0772h |
| Ch2 Measurement value (PV) | 32001 | 07D0h |
| Ch2 Set value (SV) | 32002 | 07D1h |
| Ch2 DV | 32003 | 07D2h |
| Ch2 Output value (MV1) | 32004 | 07D3h |
| Ch2 Output value (MV2) | 32005 | 07D4h |
| Ch2 Alarm 1-5 status | 32007 | 07D6h |
| Ch2 Error source display | 32008 | 07D7h |
| Ch2 Ramp/Soak progress | 32009 | 07D8h |
| Ch2 Ramp/Soak elapsed time | 32010 | 07D9h |
| Ch2 Remaining time on timer 1 | 32011 | 07DAh |
| Ch2 Remaining time on timer 2 | 32012 | 07DBh |
| Ch2 Remaining time on timer 3 | 32013 | 07DCh |
| Ch2 Remaining time on timer 4 | 32014 | 07DDh |
| Ch2 Remaining time on timer 5 | 32015 | 07DEh |
| Ch2 RCJtemp | 32016 | 07DFh |
| Ch2 Remote mode switch | 32037 | 07F4h |
| Ch2 Remote SV (RSV) | 32045 | 07FCh |
| Ch2 Heater current [A] | 32046 | 07FDh |
| Ch2 Heater current [B] | 32047 | 07FEh |
| Ch2 Leak current [A] | 32048 | 07FFh |
| Ch2 Leak current [B] | 32049 | 0800h |
| Ch2 Error source display | 32054 | 0805h |
| Ch2 Alarm 1-5 status | 32060 | 080Bh |
| Ch2 Event input status | 32061 | 080Ch |
| Ch2 PWM Output status monitor | 32906 | 0B59h |
| Ch2 Estimated MV value | 32907 | 0B5Ah |

| Content | Register number | Relative address |
|---|---|---|
| Ch3 Measurement value (PV) | 33001 | 0BB8h |
| Ch3 Set value (SV) | 33002 | 0BB9h |
| Ch3 DV | 33003 | 0BBAh |
| Ch3 Output value (MV1) | 33004 | 0BBBh |
| Ch3 Output value (MV2) | 33005 | 0BBCh |
| Ch3 Alarm 1-5 status | 33007 | 0BBEh |
| Ch3 Error source display | 33008 | 0BBFh |
| Ch3 Ramp/Soak progress | 33009 | 0BC0h |
| Ch3 Ramp/Soak elapsed time | 33010 | 0BC1h |
| Ch3 Remaining time on timer 1 | 33011 | 0BC2h |
| Ch3 Remaining time on timer 2 | 33012 | 0BC3h |
| Ch3 Remaining time on timer 3 | 33013 | 0BC4h |
| Ch3 Remaining time on timer 4 | 33014 | 0BC5h |
| Ch3 Remaining time on timer 5 | 33015 | 0BC6h |
| Ch3 RCJtemp | 33016 | 0BC7h |
| Ch3 Remote mode switch | 33037 | 0BDCh |
| Ch3 Remote SV (RSV) | 33045 | 0BE4h |
| Ch3 Heater current [A] | 33046 | 0BE5h |
| Ch3 Heater current [B] | 33047 | 0BE6h |
| Ch3 Leak current [A] | 33048 | 0BE7h |
| Ch3 Leak current [B] | 33049 | 0BE8h |
| Ch3 Error source display | 33054 | 0BEDh |
| Ch3 Alarm 1-5 status | 33060 | 0BF3h |
| Ch3 Event input status | 33061 | 0BF4h |
| Ch3 PWM Output status monitor | 33906 | 0F41h |
| Ch3 Estimated MV value | 33907 | 0F42h |
| Ch4 Measurement value (PV) | 34001 | 0FA0h |
| Ch4 Set value (SV) | 34002 | 0FA1h |
| Ch4 DV | 34003 | 0FA2h |
| Ch4 Output value (MV1) | 34004 | 0FA3h |
| Ch4 Output value (MV2) | 34005 | 0FA4h |
| Ch4 Alarm 1-5 status | 34007 | 0FA6h |
| Ch4 Error source display | 34008 | 0FA7h |
| Ch4 Ramp/Soak progress | 34009 | 0FA8h |
| Ch4 Ramp/Soak elapsed time | 34010 | 0FA9h |
| Ch4 Remaining time on timer 1 | 34011 | 0FAAh |
| Ch4 Remaining time on timer 2 | 34012 | 0FABh |
| Ch4 Remaining time on timer 3 | 34013 | 0FACh |
| Ch4 Remaining time on timer 4 | 34014 | 0FADh |
| Ch4 Remaining time on timer 5 | 34015 | 0FAEh |
| Ch4 RCJtemp | 34016 | 0FAFh |
| Ch4 Remote mode switch | 34037 | 0FC4h |
| Ch4 Remote SV (RSV) | 34045 | 0FCCh |
| Ch4 Heater current [A] | 34046 | 0FCDh |
| Ch4 Heater current [B] | 34047 | 0FCEh |
| Ch4 Leak current [A] | 34048 | 0FCFh |
| Ch4 Leak current [B] | 34049 | 0FD0h |
| Ch4 Error source display | 34054 | 0FD5h |
| Ch4 Alarm 1-5 status | 34060 | 0FDBh |
| Ch4 Event input status | 34061 | 0FDCh |
| Ch4 PWM Output status monitor | 34906 | 1329h |
| Ch4 Estimated MV value | 34907 | 132Ah |

# 5.8 Sample Program

A sample program for reading and writing data that runs on Microsoft Visual Basic 6.0 (SP6) is distributed in our home page.

**The sample program is meant to be used as a reference for your own program creation, and therefore all its actions are not guaranteed.**

Sample program body can be downloaded from our home page indicated below.

Home page address : http://www.fujielectric.com/products/instruments/ PUM_Sample_program.lzh

Before running the program, check the following summary of points for communication conditions.

- Parity, communication speed to be set in this program. Please match these values with the conditions of the PUM.

**Warning when using an RS-232C to RS-485 converter**

The sent data is sometimes added to the response data from the slave before it is received. In this case, when receiving the data, process the response data only after first getting rid of the number of bytes from the sent data.

Compatible OS
Windows 2000 Professional
Windows XP Professional Edition

Note

- Windows® is a registered trademark of the Microsoft Corporation.
- Visual Basic® is a registered trademark of the Microsoft Corporation.

Fuji Electric Systems Co., Ltd. assumes no responsibility for damages or infringement upon third party rights as a result of using this sample program. Use this program while conforming to the contents of the agreement listed within.

# 6 Troubleshooting

# 6.1 Troubleshooting Procedures

## Troubles that May Occur when the Loader Software is Connected

The following table lists troubles that may occur when module setting is made using a loader software and remedies against such troubles.

Also see the instruction manual of the loader software.

| Trouble | Causes | Solution |
|---|---|---|
| None of the connected modules is capable of communicating with the loader software. | Improper loader software connection | Check that the loader software and the modules are connected properly. |
| | Cables connected to the loader software are defective. | Replace the cables connected to the loader software. |
| | Improper station No. setting | Check station No. of module that connected with loader software. |
| | Incompatible communication conditions | Check that the communication specifications of the loader software and those of the module are compatible. |
| Some of the connected modules only cannot communicate with the loader software. | Improper loader software connection | Check that the loader software is connected to the master of the internal communication between modules. |
| | Improper station No. setting | Check that none of the station Nos. is set duplicated. |
| Parameters cannot be changed. | “RS-485 communication permission setting” is set to “Read only.” | Set “RS-485 communication permission setting” to “Read/Write.” |

# Troubles during Operation

If trouble should occur during operation, check the type of your module and its connection as well as parameter setting for any abnormalities. The following table lists typical trouble and measures to be taken against them.

### At power ON

| Trouble | Causes | Solution |
|---|---|---|
| The PWR indicator does not come on even if the power is turned on. | Power is not supplied to the main unit. | Check that power supply wiring is installed. |
| | Power supply voltage does not fall within the permissible range. | Use a power supply conforming to the module specifications. |
| | Main unit failure | Replace the module. |
| Control is not started properly even if the power is turned on. | “mode at startup” setting is set to Manual or Standby. | Check “mode at startup” setting. |
| An alarm is output on turning on the power. | Setting has been made to allow the alarm range to be entered when operation for production is not performed. | Check the values set as alarm operation points.<br>Change the type of alarms to the one provided with the hold function as required. |

## At start of operation

| Trouble | Causes | Solution |
|---|---|---|
| The PV value exceeds the upper or lower limit. | Improper sensor connection | Check that the sensor is connected to the input terminal, and that the polarity is not reversed. |
| | Sensor failure (break or degradation) | Replace the sensor. |
| | Too long compensating lead wire from the sensor causes conductor resistance to affect the reading. | Use a thick compensating lead wire. Keep wiring as short as possible by changing the sensor position. |
| | Improper input settings | Check input type and input correction. |
| Improper output (control output or retransmission output) | Improper control setting | Check the parameter of PID and “direct/reverse action” setting.<br>Perform Auto tuning as required. |
| | Output is limited | Make output limiter setting and select output limiter type. |
| | Standby or Manual mode is selected. | Check the control mode currently selected. |
| | Improper output setting | Check the Output master station No., Output master Ch, and output type. |
| | Output is shut down. | Check the output shutdown setting. |
| Event input from Event I/O module cannot be made. | Digital input master station No. has not been set. | Check the Digital input master station No. setting. |
| Event output from Event I/O module cannot be made. | Digital output master has not been set. | Check Digital output master station No. and Digital output master Ch. |
| Alarm output is latched. | Alarm latch is enabled by alarm options. | Check alarm options. |
| | Contact melting caused by a unit failure | Replace the module. |

## During operation

| Trouble | Causes | Solution |
|---|---|---|
| Fluctuation of PV value | Effect of external noise | Take measures against noise, or provide an input filter as required. |
| | Inappropriate parameter of PID. | Perform Auto tuning. |
| PV value does not change. | Sensor failure | Check the sensor, and replace it as required. |
| | Main unit failure | Contact us or your dealer. |
| Remote SV cannot be input. | Remote SV master setting error | Check the setting of remote SV master station No. and master Ch. |
| Alarm is output during normal operation. | Setting has been made to allow alarms to be detected during normal operation. | Check the alarm setting. |
| HB alarms cannot be detected. | Too low HB alarm setting | Check the HB alarm setting. |
| HB alarm is output during normal operation. | Too high HB alarm setting | Check the HB alarm setting. |
| Loop break alarm cannot be detected. | Too narrow loop break detection range | Check the Loop break alarm setting. |
| Loop break alarm is output during normal operation | Too wide loop break detection range | Check the Loop break alarm setting. |
| Abnormal LED indicator display | Abnormal internal communication between modules | <About the LED indicator display><br>If either one of the following state is reached, the “RUN” LED indicator may come on in red, indicating that the internal communication error between modules is occurring.<br>• Station No. is duplicated in the connected modules.<br>• There are two or more “Master” station in the connected modules.<br>• There is no master module designated as RSV input master station., DI input master station, output master station, and linkage operation master station. |
| Standby MV value is output. | (1) Operation is made in Standby and not in RUN state.<br>(2) The upper/lower limit range of the PV input scale exceeds 10.000, causing the module to remain in standby mode. | (1) “RUN /Standby” setting is set to “0: RUN”.<br>(2) Set the upper/lower limit range of the PV input scale to less than 10,000. |

# Troubles with RS-485 Communication

The following table lists typical trouble in communication and measures to be taken for the case in which a host equipment is connected via RS-485.

| Trouble | Causes | Solution |
|---|---|---|
| Communication cannot be made from the host equipment. | Improper RS-485 connection | Check the polarity of the wiring and the existence of terminating resistance. |
| | Improper station No. setting | Check that none of the station Nos. is duplicated. |
| | incompatible communication conditions | Check “RS-485 Communication speed” setting, “RS-485 Parity” setting, and “RS-485 Response interval time” setting. |
| Error messages are returned to the host system. | An improper address is accessed. | Check that proper addresses are accessed. |
| Parameters cannot be changed by way of host equipment. | Values that do not fall within the limit range are written. | Check that the values to be written fall within the limit range. |
| | “RS-485 communication permission” is set to “0:Read only.” | Set “RS-485 communication permission” to “1:Rea/Write.” |

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