OMRON

EJ1G
Modular Temperature Controllers
for Gradient Temperature Control

User's Manual

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User's Manual

Produced October 2006

Preface

This manual describes the EJ1G Modular Temperature Controllers for Gradient Temperature Control, including information on functions, performances, and application methods.

Observe the following precautions when using an EJ1G Modular Temperature Controllers for Gradient Temperature Control.

- Do not allow the Temperature Controller to be handled by anyone except a specialist with sufficient knowledge of electrical systems.
- Read this manual thoroughly and be sure you understand it before attempting to use the Temperature Controller and use the Temperature Controller correctly according to the information provided.
- Keep this manual in a safe place for easy reference.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3...   1. Indicates lists of one sort or another, such as procedures, checklists, etc.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY
OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.
OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY
OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.
In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.
IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE
OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.
At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.
The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:
- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.
Please know and observe all prohibitions of use applicable to the products.
NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS
OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

■ Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the product.

The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.

The following notation is used.

⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, is likely to result in minor or moderate injury or in property damage.

■ Symbols

Symbol		Meaning
Caution	⚠	**General Caution** Indicates non-specific general cautions, warnings, and dangers.
	⚡	**Electrical Shock Caution** Indicates possibility of electric shock under specific conditions.
Prohibition	🚫	**General Prohibition** Indicates non-specific general prohibitions.
Mandatory Caution	❗	**General Caution** Indicates non-specific general cautions, warnings, and dangers.

■ Safety Precautions

⚠ CAUTION

Do not touch the terminals while power is being supplied. Doing so may occasionally result in minor injury due to electric shock.	
Use a power supply that complies with the reinforced insulation specified in IEC 60664 for the EJ1 external power supply or the power supply connected to the EJ1. If non-compliant power supplies are used, electric shock may occasionally result in minor injury.	
Do not allow pieces of metal, wire clippings, or fine metallic shavings or filings from installation to enter the product. Doing so may occasionally result in electric shock, fire, or malfunction.	
Do not use the product where subject to flammable or explosive gas. Otherwise, minor injury from explosion may occasionally occur.	
Never disassemble, modify, or repair the product or touch any of the internal parts. Minor electric shock, fire, or malfunction may occasionally occur.	
Tighten the terminal screws to between 0.40 and 0.56 N·m. Loose screws may occasionally result in fire.	
Set the parameters of the product so that they are suitable for the system being controlled. If they are not suitable, unexpected operation may occasionally result in property damage or accidents.	
A malfunction in the product may occasionally make control operations impossible or prevent alarm outputs, resulting in property damage. To maintain safety in the event of malfunction of the product, take appropriate safety measures, such as installing a monitoring device on a separate line.	
Gradient temperature control controls the average temperature for more than one channel. If a heater burnout occurs during gradient temperature control and the temperature of that channel decreases, physical damage may occasionally occur because the temperature of the other channels will increase. When using gradient temperature control, implement suitable safety measures for the entire system using heater burnout alarms or temperature information for individual channels.	

Precautions for Safe Use

Be sure to observe the following precautions to prevent operation failure, malfunction, or adverse affects on the performance and functions of the product. Not doing so may occasionally result in unexpected events.

1) The product is designed for indoor use only. Do not use the product outdoors or in any of the following locations.
   - Places directly subject to heat radiated from heating equipment
   - Places subject to splashing liquid or oil atmosphere
   - Places subject to direct sunlight
   - Places subject to dust or corrosive gas (in particular, sulfide gas or ammonia gas)
   - Places subject to intense temperature change
   - Places subject to icing or condensation
   - Places subject to vibration or strong shocks

2) Use and store the product within the rated ambient temperature and humidity ranges.
   Mounting two or more Temperature Controllers side by side, or mounting Temperature Controllers above each other may cause heat to build up inside the Temperature Controllers, which will shorten their service life. If the Temperature Controllers are mounted above each other or side by side, use forced cooling by fans or other means of air ventilation to cool down the Temperature Controllers.

3) To allow heat to escape, do not block the area around the product. Do not block the ventilation holes on the product.

4) Be sure to wire properly with correct polarity of terminals.

5) Use specified size (M3, width 5.8 mm or less) crimped terminals for wiring. Use a gage of AWG22 to AWG14 (equal to cross-sectional area of 0.326 to 2.081 mm^2) for power supply lines and a gage of AWG28 to AWG16 (equal to cross-sectional area of 0.081 to 1.309 mm^2) for all other lines. (The stripping length is 6 to 8 mm.) Up to two wires of same size and type, or two crimped terminals can be inserted into a single terminal.

6) Do not wire terminals that do not have an identified use.

7) To reduce inductive noise, keep the wiring for the product's terminal block away from power cables carrying high voltages or large currents. Also, do not wire power lines together with or parallel to product wiring. Using shielded cables and using separate conduits or ducts is recommended.
   Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular, motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component).
   When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the product.
   Allow as much space as possible between the product and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.

8) Use the product within the rated load and power supply.

9) Make sure that the rated voltage is attained within two seconds of turning ON the power using a switch or relay contact. If the voltage is applied gradually, the power may not be reset or output malfunctions may occur.

10) Make sure that the product has 30 minutes or more to warm up after turning ON the power before starting actual control operations to ensure the correct temperature display.

11) The switch or circuit breaker must be within easy reach of the operator, and must be marked as a disconnecting means for this unit.

12) Do not use paint thinner or similar chemical to clean with. Use standard grade alcohol.

13) Design the system (e.g., the control panel) allowing leeway for the delay required before product outputs are valid after turning ON power to the product.

14) Never touch the electronic components, connectors, or patterns on product boards with your bare hands. Always hold the product by the case. Inappropriately handling the product may occasionally damage internal components due to static electricity.

15) Use a switch, relay, or other device with contacts to turn OFF the power supply quickly. Gradually lowering the voltage of the power supply may result in incorrect outputs or memory errors.

16) Do not touch the electronic components with your hands or subject them to shock when removing the terminal block.

17) Connect only the specified number of products in only a specified configuration.

18) Mount the product to a DIN Rail mounted vertically to the ground.

19) Always turn OFF the power supply before wiring the product, replacing the product, or changing the product configuration.

20) Attach the enclosed cover seal to the connector opening on the left end Unit during installation.

21) Do not use port B on the End Unit when using port C on the HFU.

Precautions for Correct Use

● **Installation**

1) Do not connect an End Unit directly to an HFU.
2) Always connect an End Unit to the right side of the Basic Units.
3) Always connect the HFU to the left side of the Basic Units.
4) The EJ1 cannot be used linked to a CJ-series PLC.
5) Use the EJ1G-□□ for gradient temperature control. Use the EJ1N-□□ for any other type of temperature control.
6) When removing the terminal block to replace the Unit, be sure to confirm that the new Unit is the same as the Unit that is being replaced.

● **Service Life**

1) Use the product within the following temperature and humidity ranges.
   Temperature: −10 to 55°C (with no icing or condensation)
   Humidity: 25% to 85%
   When the Temperature Controller is incorporated in a control panel, make sure that the controller's ambient temperature and not the panel's ambient temperature does not exceed 55°C.
2) The service life of electronic devices like the Temperature Controller is determined by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature, the shorter the service life and the lower the temperature, the longer the service life. Therefore, the service life can be extended by lowering the temperature of the Temperature Controller.
3) Mounting two or more Temperature Controllers side by side, or mounting Temperature Controllers above each other may cause heat to build up inside the Temperature Controllers, which will shorten their service life. If the Temperature Controllers are mounted above each other or side by side, use forced cooling by fans or other means of air ventilation to cool down the Temperature Controllers. However, be sure not to cool only the terminals. Doing so will result in measurement errors.

● **Ensuring Measurement Accuracy**

1) When extending or connecting the thermocouple lead wire, be sure to use compensating wires that match the thermocouple types.
2) When extending or connecting the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance and keep the resistance of the three lead wires the same.
3) Mount the Temperature Controller so that it is horizontally level.
4) If the measurement accuracy is low, check to see if input shift has been set correctly.

● **Precautions for Operation**

1) It takes a certain amount of time for the outputs to turn ON from after the power supply is turned ON. Due consideration must be given to this time when designing control panels, etc.
2) It takes 30 minutes from the time the product is turned ON until the correct temperature is indicated. Always turn ON the power supply at least 30 minutes before starting temperature control.
3) Avoid using the Temperature Controller near a radio, television set, or other wireless device. Its use would result in reception disturbance.

Preparations for Use

Be sure to thoroughly read and understand the manual provided with the product, and check the following points.

Timing	Check point	Details
Purchasing the product	Product appearance	After purchase, check that the product and packaging are not dented or otherwise damaged. Damaged internal parts may prevent optimum control.
	Product model and specifications	Make sure that the purchased product meets the required specifications.
Setting the Unit	Product installation location	Provide sufficient space around the product for heat dissipation. Do not block the vents on the product.
Wiring	Terminal wiring	Do not subject the terminal screws to excessive stress (force) when tightening them. Make sure that there are no loose screws after tightening terminal screws to the specified torque of 0.40 to 0.56 N·m.
		Be sure to confirm the polarity for each terminal before wiring the terminal block and connectors.
	Power supply inputs	Wire the power supply inputs correctly. Incorrect wiring will result in damage to the internal circuits.
Operating environment	Ambient temperature	The ambient operating temperature for the product is −10 to 55°C (with no condensation or icing). To extend the service life of the product, install it in a location with an ambient temperature as low as possible. In locations exposed to high temperatures, if necessary, cool the products using a fan or other cooling method.
	Vibration and shock	Check whether the standards related to shock and vibration are satisfied at the installation environment. (Install the product in locations where the conductors will not be subject to vibration or shock.)
	Foreign particles	Install the product in a location that is not subject to liquid or foreign particles entering the product. If sulfide, chlorine, or other corrosive gases are present, remove the source of the gas, install a fan, or use other countermeasures to protect the product.

Related Manuals

The manuals related to the EJ1G are configured as shown in the following tables. Refer to these manuals as required.

■ EJ1G

Name	Cat. No.	Contents
EJ1G EJ1G-TC2A-QNHB EJ1G-TC4A-QQ EJ1G-HFUA-NFLK EJ1C-EDUA-NFLK Modular Temperature Controllers for Gradient Temperature Control User's Manual	H143 (This manual)	Describes the following information on the EJ1G. • Overview and features • Basic specifications • System design • System configuration • Mounting and wiring • Maintenance • Troubleshooting
CX-Thermo Ver. 3.□ (online help) EST2-2C-MV3	--- (Available only as online help.)	Describes how to set parameters and adjust devices (i.e., components such as Temperature Controllers) using the CX-Thermo.

■ CS/CJ-series PLC Manuals

Name	Cat. No.	Contents
SYSMAC CS Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H Programmable Controllers Operation Manual	W339	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CS-series PLCs.
SYSMAC CJ Series CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Operation Manual	W393	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CJ-series PLCs.
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Programming Manual	W394	Describes programming and other methods to use the functions of the CS/CJ-series PLCs.
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Instructions Reference Manual	W340	Describes the ladder diagram programming instructions supported by CS/CJ-series PLCs.
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CJ1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, CS1W-SCB21-V1/41-V1, CS1W-SCU21-V1, CJ1W-SCU21-V1/41-V1 Communications Commands Reference Manual	W342	Describes the C-series (Host Link) and FINS communications commands used with CS/CJ-series PLCs.
SYSMAC CS/CJ Series CS1W-SCB21-V1/41-V1, CS1W-SCU21-V1, CJ1W-SCU21-V1/41-V1 Serial Communications Boards/Units Operation Manual	W336	Describes the use of Serial Communications Unit and Boards to perform serial communications with external devices, including the usage of standard system protocols for OMRON products.

■ Programmable Terminal (PT) Manuals

Name	Cat. No.	Contents
NS-Series NS5-SQ0□(B)-V1/V2, NS5-TQ0□(B)-V2, NS5-MQ0□(B)-V2, NS8-TV□□(B)-V1/V2, NS10-TV0□(B)-V1/V2, NS12-TS0□(B)-V1/V2 Programmable Terminals Setup Manual	V083	Provides an outline of, and describes the design, installation, maintenance, and other basic operations for the NS-series PTs. Information is also included on connecting to hosts and peripheral devices, and settings required for communications and PT operation.
NS-Series NS5-SQ0□(B)-V1/V2, NS5-TQ0□(B)-V2, NS5-MQ0□(B)-V2, NS8-TV□□(B)-V1/V2, NS10-TV0□(B)-V1/V2, NS12-TS0□(B)-V1/V2 Programmable Terminals Programming Manual	V073	Describes the functions of NS-series PTs, including screen configurations, object functions, and host communications for the PT.
SYSMAC One NSJ Series NSJ5-TQ□□(B)-G5D, NSJ5-SQ□□(B)-G5D, NSJ8-TV□□(B)-G5D, NSJ10-TV□□(B)-G5D, NSJ12-TS□□(B)-G5D, NSJW-ETN21, NSJW-CLK21-V1, NSJW-IC101 NSJ Controllers Operation Manual	W452	Provides an outline of, and describes the design, installation, maintenance, and other basic operations for the NSJ-series NSJ Controllers. Information is also included on features, system configuration, wiring, I/O memory allocations, and troubleshooting. Use together with the CJ-series *Programmable Controllers Operation Manual* (W393), CS/CJ-series *Programmable Controllers Programming Manual* (W394), and *NS-Series Programmable Terminals Setup Manual* (V083).
NSH Series NSH5-SQR00B-V2 Hand-held Programmable Terminal Operation Manual	W452	Provides an outline of, and describes the design, installation, maintenance, and other basic operations for the NSH-series NSH5 Hand-held Programmable Terminal. Information is also included on features, system configuration, wiring, I/O memory allocations, and troubleshooting.
NS Series NS-CA002 Programmable Terminals RGB and Video Input Unit Operation Manual	V086 (PDF only)	Describes how to display external video images or analog RGB imagines on NS-series PTs using a NS-series RGB and Video Input Unit, including the following information. • Features, system configuration, and specifications • Functions, setting methods, and adjustment methods
Smart Active Parts Reference Manual	V087 (PDF only)	Describes the Smart Active Parts (SAP) functionality and the settings required to use the SAP library. This document does not describe application restrictions for specific Units or Components or restrictions in combinations. Always refer to the operation manual for the products involved before using the SAP library.

■ Support Software Manuals

Name	Cat. No.	Contents
CX-One CXONE-AL□□C-E Setup Manual	W444 (PDF only)	Describes installation and provides an overview of the CX-One FA Integrated Tool Package.
CX-Integrator CXONE-AL□□C-E Operation Manual	W445	Describes CX-Integrator operating methods, e.g., for setting up and monitoring networks.
CX-Programmer Ver. 6.1 WS02-CXPC1-E-V60 Operation Manual	W446	Describes CX-Programmer operations except those related to function blocks.
CX-Programmer Ver. 6.1 WS02-CXPC1-E-V60 CS1G-CPU□□H CS1H-CPU□□H CJ1G-CPU□□H CJ1H-CPU□□H CJ1M-CPU□□ CP1H-X□□□□-□ CP1H-XA□□□□-□ Operation Manual: Function Blocks	W447	Describes function blocks for CS/CJ-series CPU Units unit version 3.0 or later and CP-series CPU Units, and CX-Programmer operations related to function blocks. Refer to the W447 manual above for other CX-Programmer operations.
SYSMAC CX-Designer Ver. 1.0 NS-CXDC1-V1 Operation Manual	V088	Describes how to install and use the CX-Designer, including screen data creation methods, screen data transfer methods, and system settings.
NS-Series NS5-SQ0□(B)-V1/V2 NS5-TQ0□(B)-V2 NS5-MQ0□(B)-V2 NS8-TV□□(B)-V1/V2 NS10-TV0□(B)-V1/V2 NS12-TS0□(B)-V1/V2 NSJ5-TQ□□(B)-G5D NSJ5-SQ□□(B)-G5D NSJ8-TV□□(B)-G5D NSJ10-TV□□(B)-G5D NSJ12-TS□□(B)-G5D Ladder Monitor Operation Manual (Ladder Monitor/I/O Comment Extracting Tool)	V082	Describes the NS-series PT monitoring function for CS/CJ-series PLC ladder programs, including the following information. • Overview and features • Setup methods • Basic operations • Troubleshooting

Conventions Used in This Manual

Meanings of Abbreviations

The following abbreviations are used in parameter names, figures and in text explanations. These abbreviations mean the following:

Symbol	Term
TC4/TC2	Four-channel and Two-channel Basic Units
CH	Channel
HFU	Advanced Unit
EDU	End Unit
PV	Process value
SP	Set point
HB	Heater burnout
HS	Heater short
GT	Gradient tuning
GTC	Gradient temperature control
OC	Heater overcurrent
AT	Autotuning
EU	Engineering unit (See note 1.)
Expand Unit	Expansion Unit (See note 2.)

Note: (1) "EU" stands for Engineering Unit. EU is used as the minimum unit for engineering units such as °C, m, and g. The size of EU varies according to the input type.
For example, when the input temperature setting range is –200 to +1300°C, 1 EU is 1°C, and when the input temperature setting range is –20.0 to +500.0°C, 1 EU is 0.1°C.
For analog inputs, the size of EU varies according to the decimal point position of the scaling setting, and 1 EU becomes the minimum scaling unit.

    (2) "Expand Unit" in parameter and status names that appear in this manual means "Expansion Unit," which is a Unit, such as the G3ZA Multi-channel Power Controller, connected to a Basic Unit.

TABLE OF CONTENTS

TABLE OF CONTENTS

About this Manual:

This manual describes the EJ1G Modular Temperature Controllers and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to set up or operate an EJ1G Modular Temperature Controller.

• Overview

Section 1 Outline describes the features, nomenclature, and functions of the EJ1G.

• Setup

Section 2 Preparations describes the preparations required to use the EJ1G, including installation, wiring, and switch settings.

• Gradient Temperature Control Setup

Section 3 Gradient Temperature Control Setup describes how to set up and adjust gradient temperature control and how to change the SPs during operation.

• Functions of EJ1G Basic Units (TC4/TC2)

Section 4 Basic Units (TC4/TC2) describes the functions of EJ1G Basic Units.

• Functions of EJ1G Advanced Unit (HFU)

Section 5 Advanced Unit (HFU) Functions describes the functions of EJ1G Advanced Unit.

• Operation Using Communications

Section 6 Communications (CompoWay/F) describes how to use communications based on communications commands.

• Troubleshooting

Section 7 Troubleshooting describes methods for checking possible problems in operation depending on classifications of Temperature Controller status.

• Specifications and Parameter Lists

Appendix provides specifications, parameter lists, status lists, and other reference information.

⚠ **WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

This section describes the features, nomenclature, and functions of the EJ1G.

1-1   Names of Parts

1-1-1   Appearance

TC4, TC2, or HFU
Screw Terminals

TC4, TC2, or HFU
Screw-Less Clamp Terminals

EDU
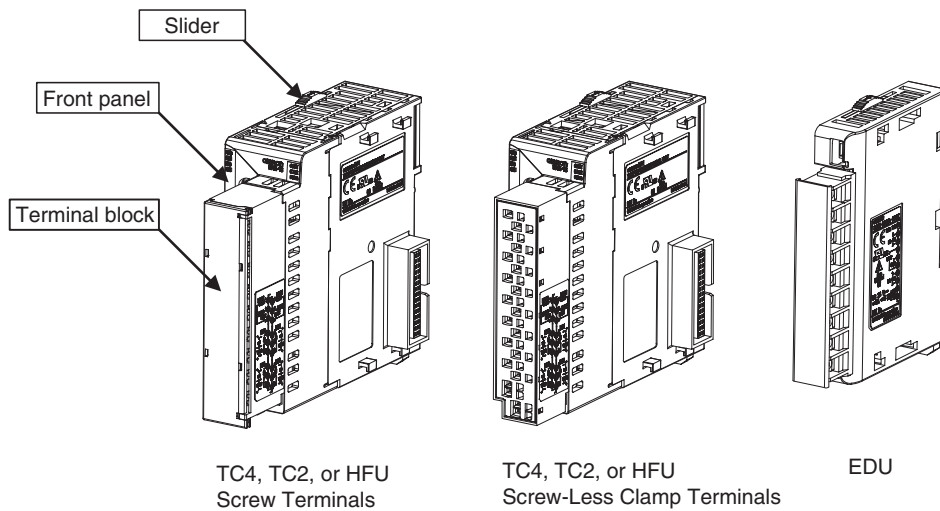
1-1-2   Names of Parts on Front Panel

TC4, TC2, or HFU

EDU
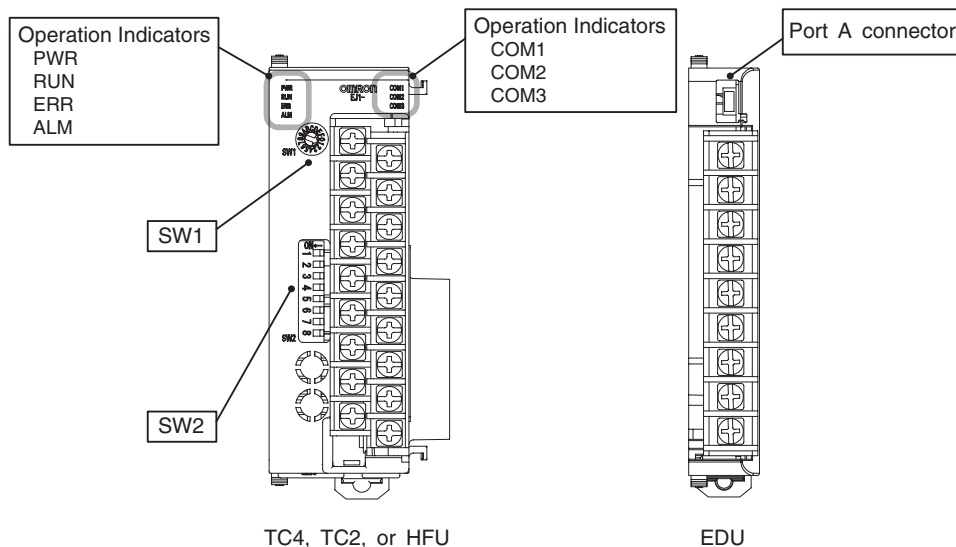
1-1-3   Meanings of Indicators

Operation Indicators

TC4 and TC2

Name	Color	Meaning
PWR	Green	Lights when the power is ON.
ERR	Red	Flashes or lights when an error occurs.
ALM	Red	Lights when an alarm is activated.
COM1	Orange	Flashes during communications via port A on the End Unit.
COM2	Orange	Flashes when the EJ1G system is in operation.
COM3	Orange	Flashes during communications with the G3ZA.

HFU

Name	Color	Meaning
PWR	Green	Lights when the power is ON. (See note.)
RUN	Green	Lights during operation.
ERR	Red	Flashes or lights when an error occurs.
ALM	Red	Lights when an alarm is activated.
COM1	Orange	Flashes during communications via port A on the End Unit.
COM2	Orange	Flashes when the EJ1G system is in operation.
COM3	Orange	Flashes during communications via port C.

Note Some time is required for the indicators to light after the power is turned ON.

1-1-4 Using Setting Switches

- Check that the EJ1G is turned OFF before operating the switches. The settings are enabled when the power is turned ON.
- Set the switches with a small flat-blade screwdriver. Do not set the switches midway between settings.

Setting the Unit Number

SW1 and SW2 are used together to set the unit number to between 00 and 31.

Note The factory setting is unit number 01.
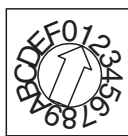
SW1   SW2

Unit Number Settings

SW2		SW1															
1	2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
OFF	OFF	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ON	OFF	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Setting Switch 2 (SW2) Settings

EJ1G-TC Basic Units

SW2	Meaning
2 to 6	Not used (OFF)
7	ON: G3ZA Multi-channel Power Controller in operation
8	Use when an HFU is used and Units are distributed. (See note.)

Note To use an HFU with distributed positioning, turn ON pin number 8 on SW2 on the TC Unit connected at the left end of the Block.
Refer to *SECTION 2 Preparations* for information on wiring.
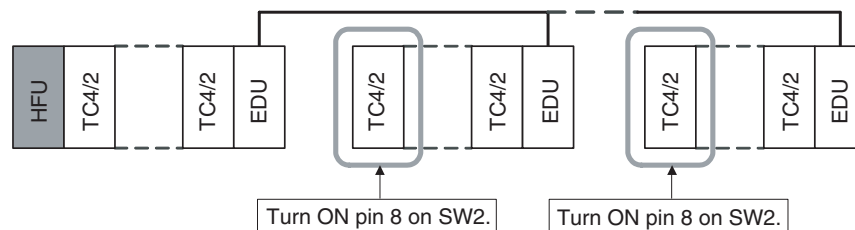
EJ1G-HFU (Advanced Unit)

SW2	Meaning
2 to 7	Not used (OFF)
8	• EJ1G-HFU□-NFLK OFF: RS-485 is selected. ON: RS-232C is selected. • EJ1G-HFU□-NFL2 Not used (OFF).

1-2 I/O Configuration and Main Functions

1-2-1 I/O Configuration

TC4: Four-channel Basic Unit
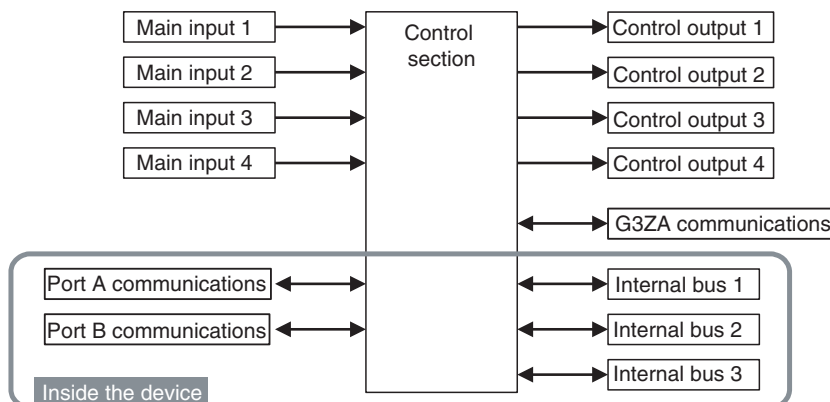
• Internal device I/O are connected via a connector to the adjacent Unit.

TC2: Two-channel Basic Unit
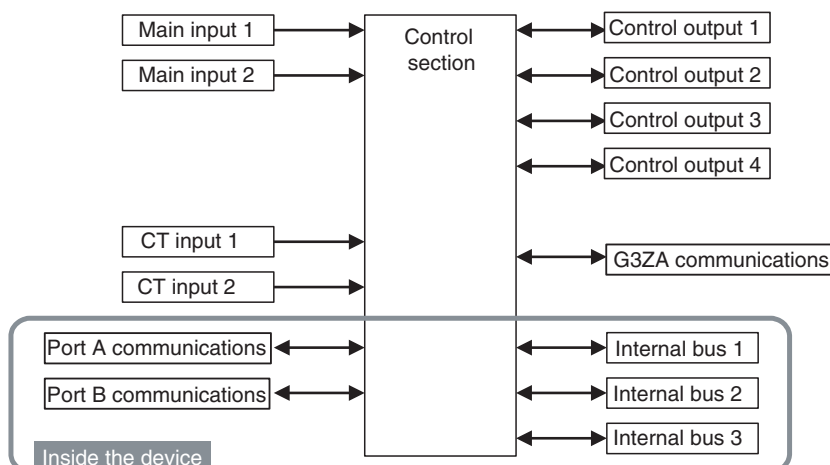
• Internal device I/O are connected via a connector to the adjacent Unit.

HFU (Advanced Unit)
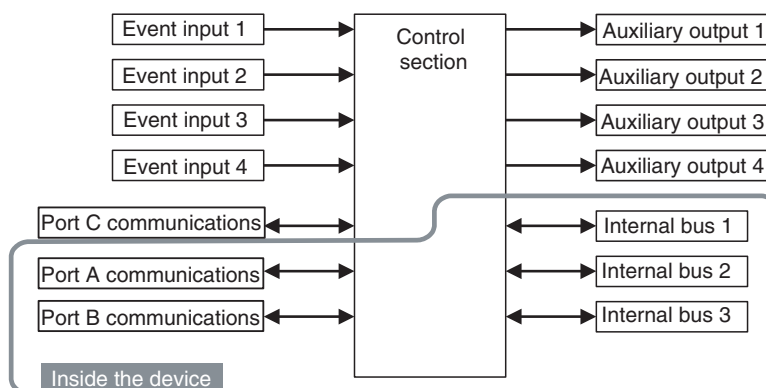
• Internal device I/O are connected via a connector to the adjacent Unit.

EDU: End Unit

Adjacent Unit	←→	Port A communications
	←→	Port B communications
	→	Auxiliary output 1 (See note.)
	→	Auxiliary output 2 (See note.)
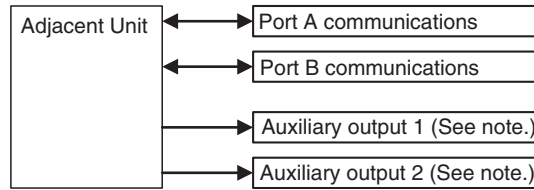
Note   Auxiliary outputs are output via an internal bus.

1-2-2   What Is Gradient Temperature Control?

Gradient temperature control is a control method that achieves a uniform temperature or preset temperature profile over a 2D surface. An example application would be multi-point control of surface temperature using multiple heaters. The gradient temperature control algorithm directly controls the average temperature of all points as well as the temperature difference between each pair of points. The algorithm also includes methods to eliminate the interference of each control output on the other control points.
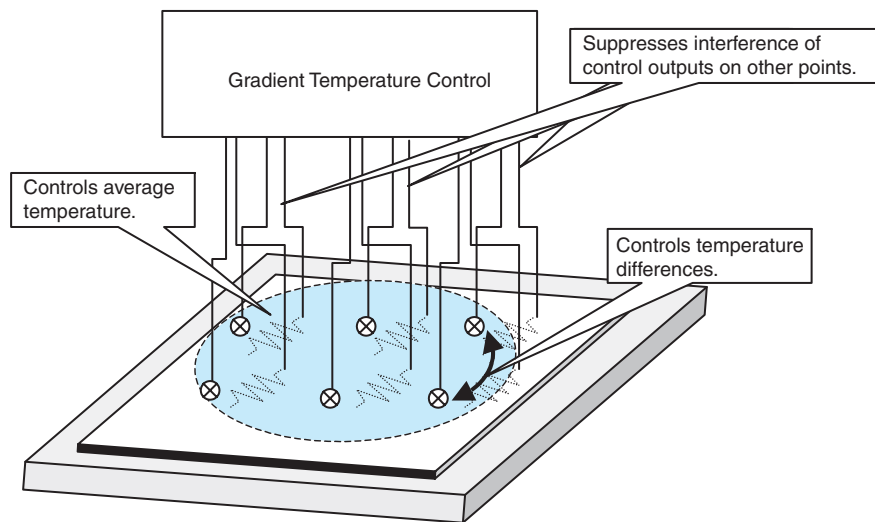
When temperature inputs are received, the average temperature of all points and the temperature differences between each pair of points are calculated. PID control is performed for the present value (PV) of each of these control points.

In addition, PID output values are distributed to prevent them from affecting PID control performance at other points, thus eliminating interference. This means that the interference of heaters on other control points is reduced to enable uniform in-plane temperature control.

1-2-3   Main Unit Functions

Basic Units (TC4 and TC2)

- Basic Units are used as the control I/O devices. (The HFU performs control processing.)
- There are two models of Basic Unit: The TC4 with four I/O channels and the TC2 with two I/O channels.
- Universal input supports a thermocouple, platinum resistance thermometer, or analog input.
- The type of input can be set separately for each channel.
- Control outputs are pulse voltage outputs.

- Terminal blocks can be detached and attached. Both screw terminals and screw-less clamp terminals are available.
- Connect a current transformer (CT) to use the heater burnout and heater overcurrent alarms (TC2 Units only).
- Up to eight G3ZA Multi-channel Power Controllers can be connected to one Basic Unit.

Advanced Unit (HFU)
- The HFU performs gradient temperature control or 2-PID control (set for each group).
- Gradient temperature control can be performed for from 2 to 32 channels. (2-PID control can also be set by group for from 2 to 32 channels.)
- Two-channel gradient temperature control can be performed for up to 16 groups (when TC4 and TC2 Units are used) or 32-channel gradient temperature control can be performed for up to 2 groups (when TC4 Units are used).
- Up to sixteen Basic Units can be connected to one HFU.
- Data can be exchanged between the EJ1G and PLCs using programless communications.
- Up to 300 data items can be read from a PLC to the EJ1G and up to 300 data items can be written from the EJ1G to a PLC.
- OMRON CS/CJ-series PLCs and Mitsubishi Q/QnAS-series PLCs can be connected.

End Unit (EDU)
- The End Unit supplies power to connected Basic Units and HFUs.
- An End Unit is always required when using the EJ1G.
- A total of up to 16 HFUs and Basic Units can be connected to one End Unit.
- Port A is split into both a connector and a terminal block. The connector is used with the Support Software and the terminal block is used for EJ1G distributed placement. (Port B is also used for distributed placement.)
- When using port A, be sure to consider the write life of the EEPROM.

1-2-4   Model Number Legend

TC4 and TC2

Options	None	
	H	2 CT inputs
	B	2 event inputs
Outputs	Q	2 pulse voltage outputs
	N	2 transistor outputs
Terminal type	A	Screw terminals
	B	Screw-less clamp terminals
Unit name	T C 4	Four-channel Temperature Control Unit
	T C 2	Two-channel Temperature Control Unit
Type	G	Gradient Temperature Control

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	G	-	T	C	4	A	-	Q	Q		
E	J	1	G	-	T	C	4	B	-	Q	Q		
E	J	1	G	-	T	C	2	A	-	Q	N	H	B
E	J	1	G	-	T	C	2	B	-	Q	N	H	B

7

HFU

Communications	FLK	CompoWay/F (RS-485/RS-232C)
	FL2	CompoWay/F (RS-422)
Outputs	N	4 transistor outputs
Terminal type	A	Screw terminals
	B	Screw-less clamp terminals
Unit name	HFU	Advanced Unit
Type	G	Gradient Temperature Control

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	G	-	H	F	U	A	-	N	F	L	K
E	J	1	G	-	H	F	U	A	-	N	F	L	2
E	J	1	G	-	H	F	U	B	-	N	F	L	K
E	J	1	G	-	H	F	U	B	-	N	F	L	2

EDU

Communications	FLK	CompoWay/F
Outputs	N	2 transistor outputs
Terminal type	A	Screw terminals
Unit name	EDU	End Unit
Type	C	Common model

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	C	-	E	D	U	A	-	N	F	L	K

1-3 Internal Block Diagrams

TC4
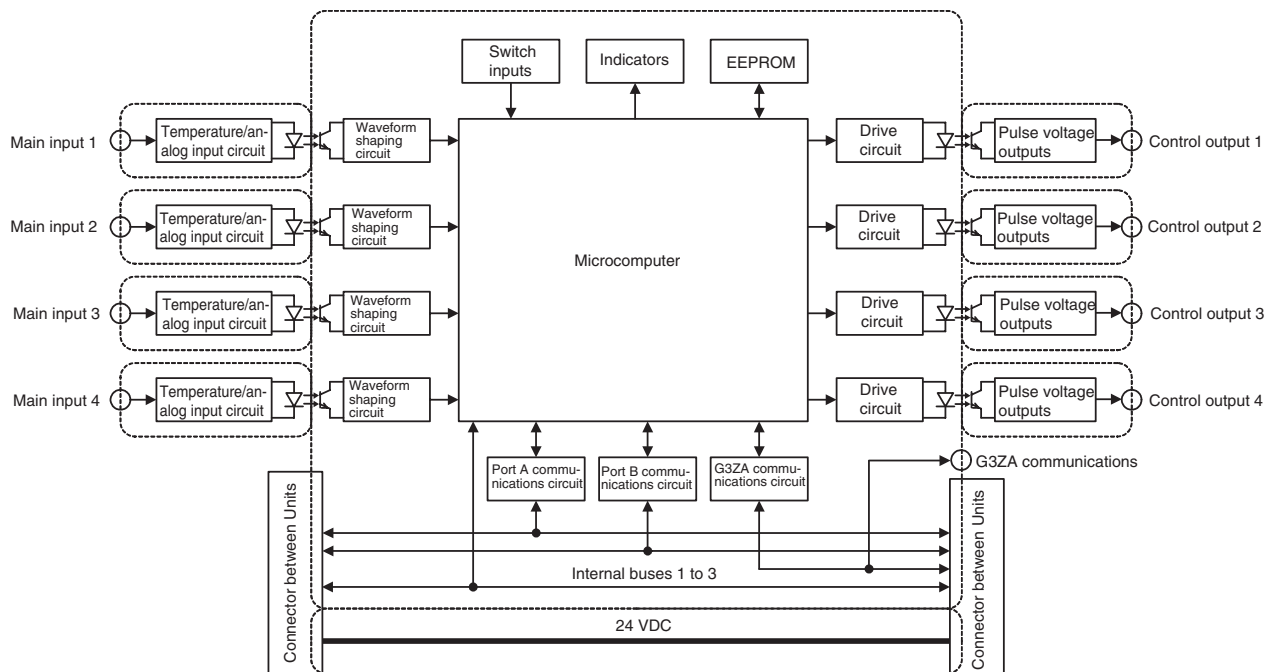
TC2
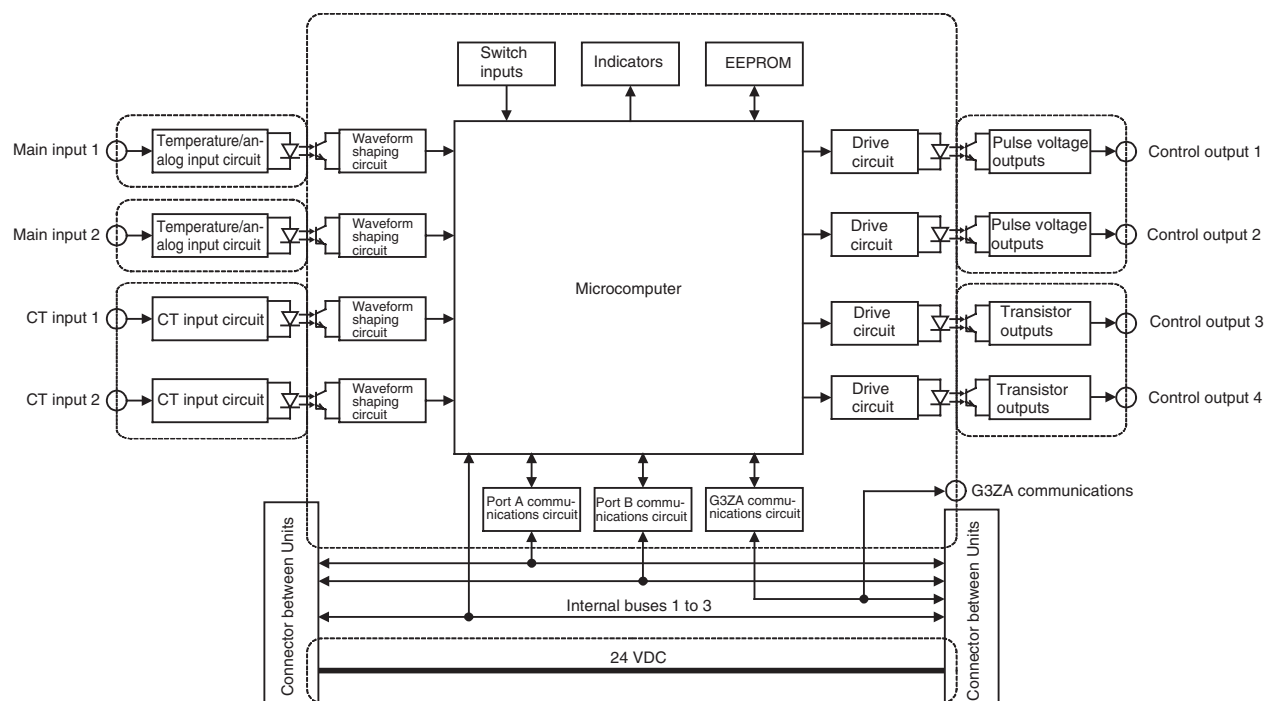
HFU
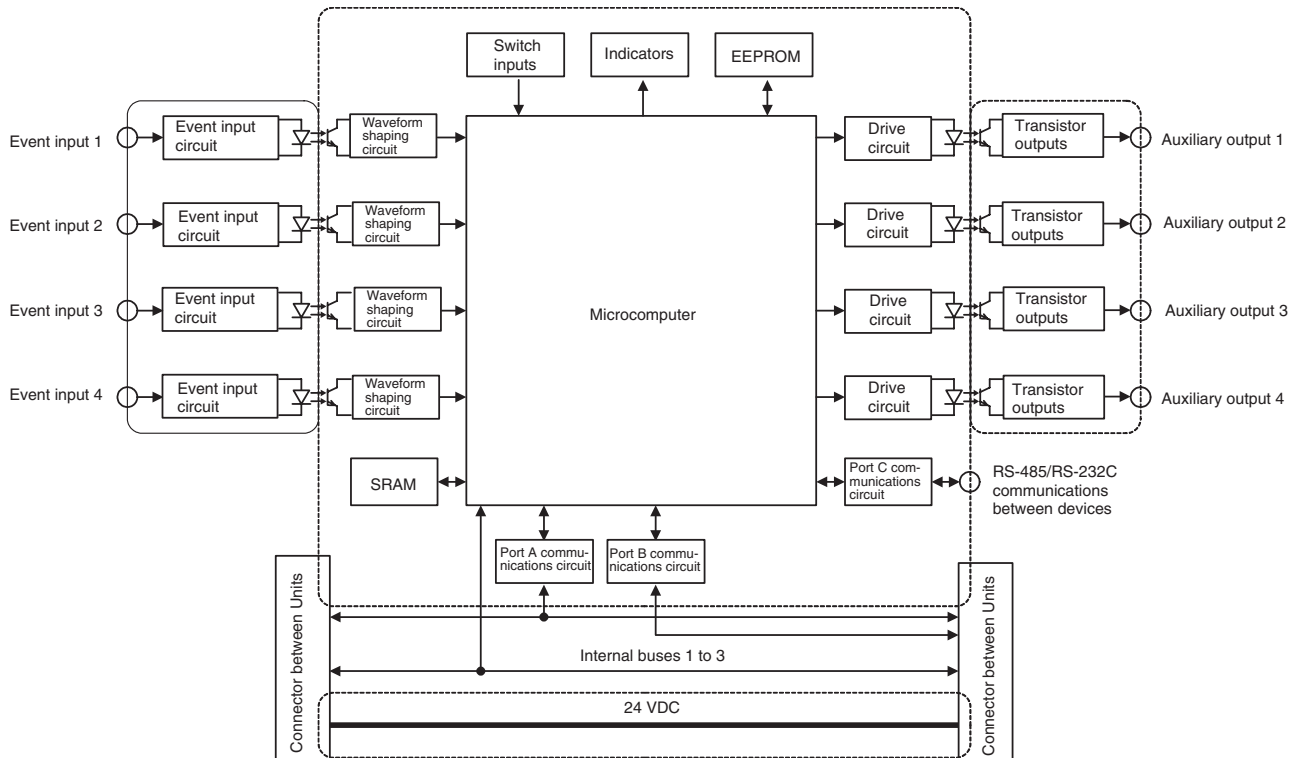
EDU
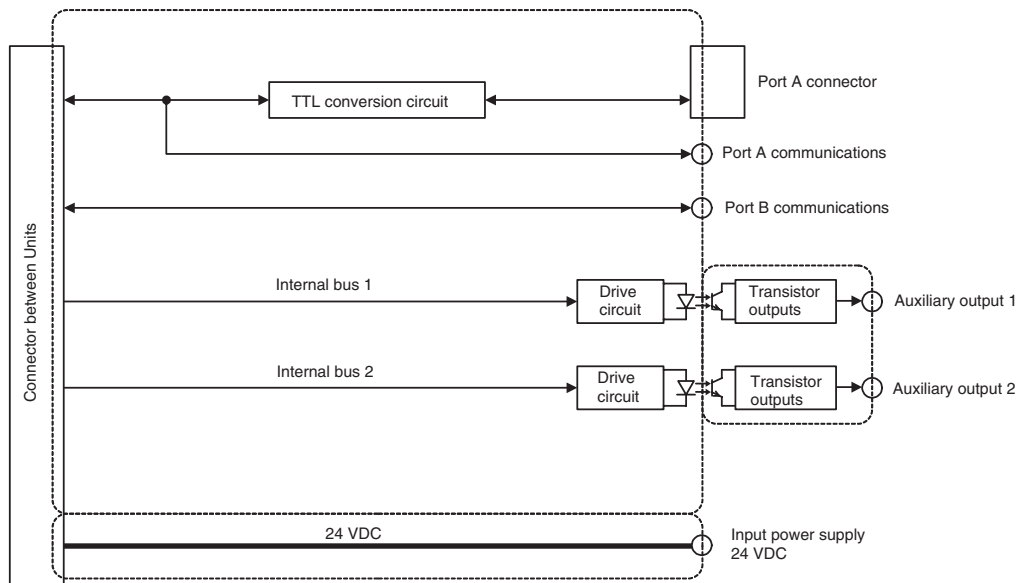
: Functional isolation

SECTION 2
Preparations

This section describes the preparations required to use the EJ1G, including installation, wiring, and switch settings.

2-1 Installation

2-1-1 Dimensions (Unit: mm)

TC4, TC2, and HFU

Models with Screw Terminals: 109
Models with Screw-less Clamp Terminals: 104.85

Models with Screw
Terminals

Models with Screw-less
Clamp Terminals
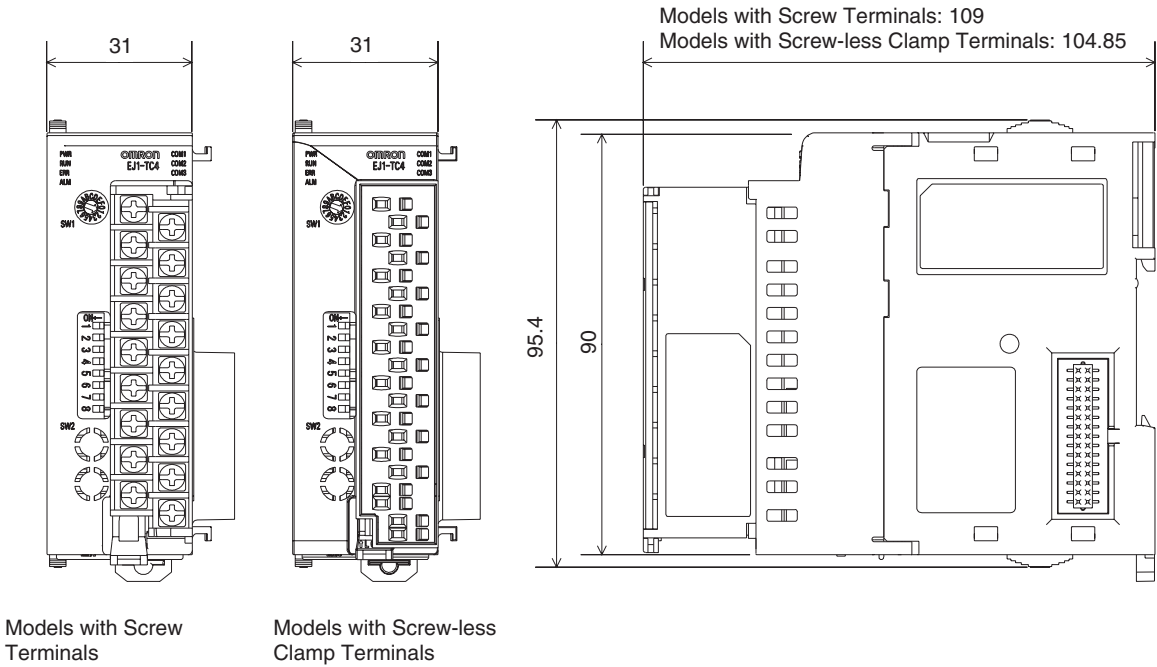
EDU
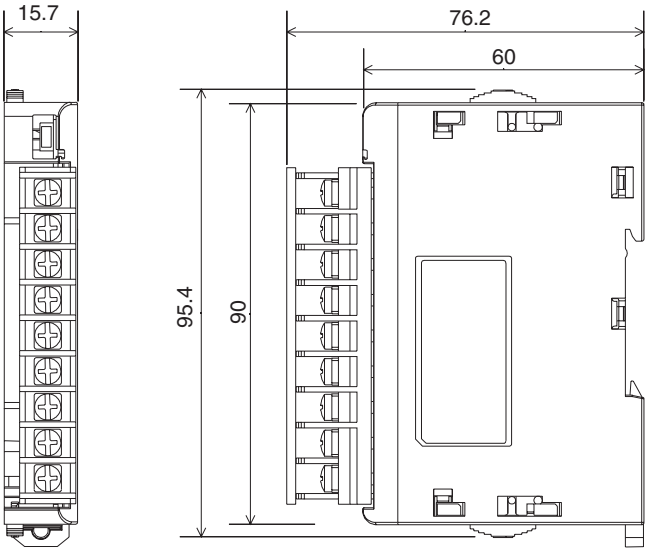
2-1-2 Mounting and Removing Terminal Blocks

Connecting Units

1,2,3...   1. Align the connectors and connect the Units to each other.
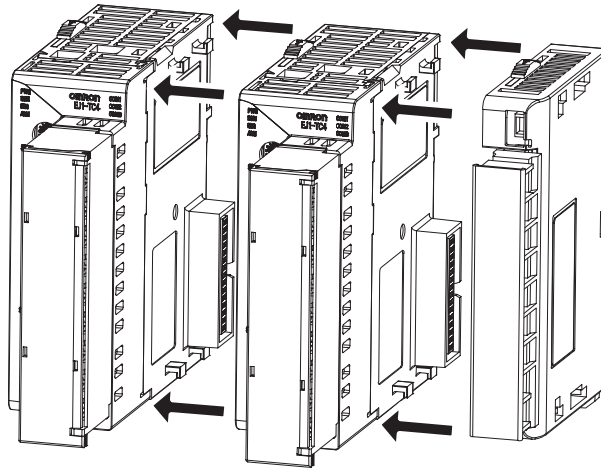
Note   Connect the EDU on the right end of the EJ1G and the HFU on the left end.

2. Slide the yellow sliders on the top and bottom of the Units until they click into place.
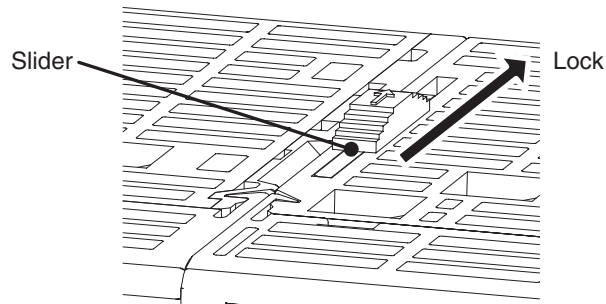
3. Attach the cover seal to the connector on the Unit on the left end of the EJ1G.
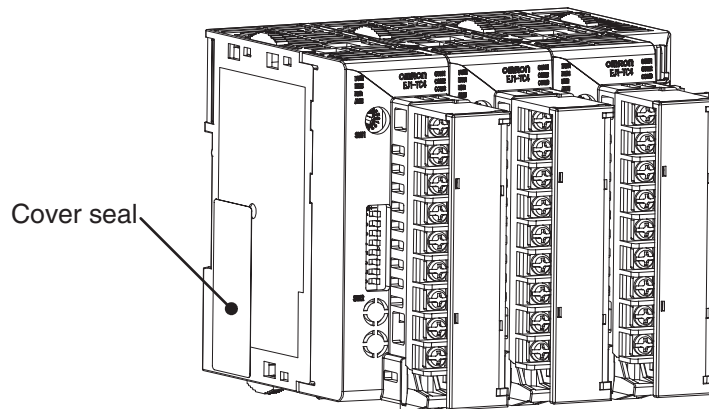
Mounting to DIN Rail

• Mount the EJ1G to DIN Rail.

• Use screws to secure the DIN Rail in at least 3 locations.
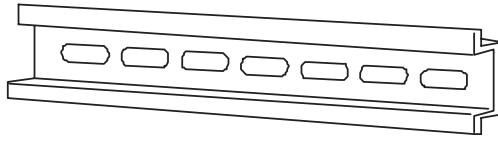
DIN Rail: PFP-50N (50 cm) or PFP-100N (100 cm)

• Install the DIN Rail vertically to the ground.
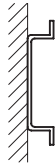
Vertical: OK   Horizontal: NG

Installation Method

Pull down the hooks on the bottoms of the Units, and then catch the hooks on the tops of the Units onto the DIN Rail and press the Units onto the DIN Rail until they lock into place.

2. Catch the upper hooks onto the DIN Rail.

3. Press in on the Units.

1. Pull down the hooks.

4. Make sure the Units are locked into place.
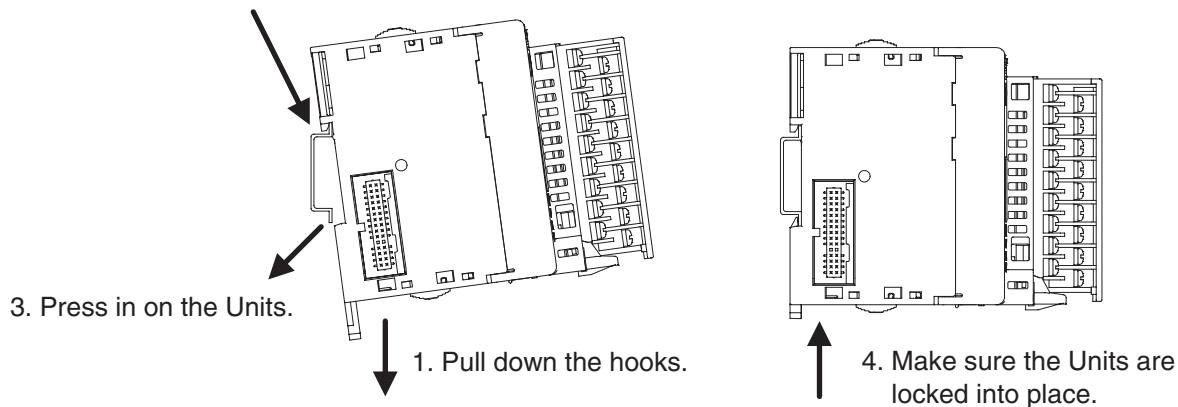
Removal Method

Pull down on the hooks with a flat-blade screwdriver and lift up on the Units.

Flat-blade screwdriver (unit: mm)

0.4

2.5

Flat-blade screwdriver
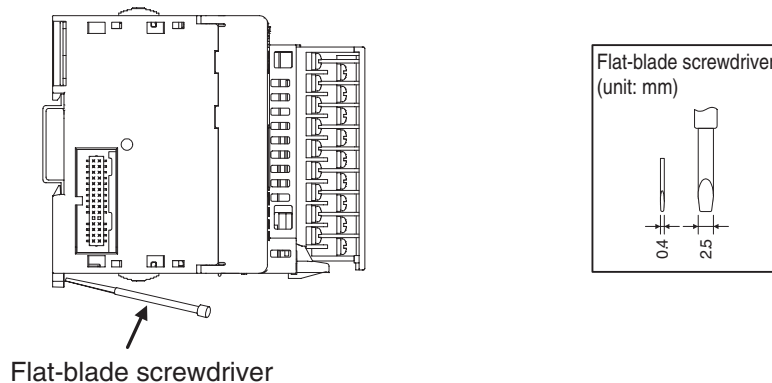
End Plate Installation　　　Always mount an End Plate on each side of the EJ1G.

PFP-M End Plates (2)

PFP-M
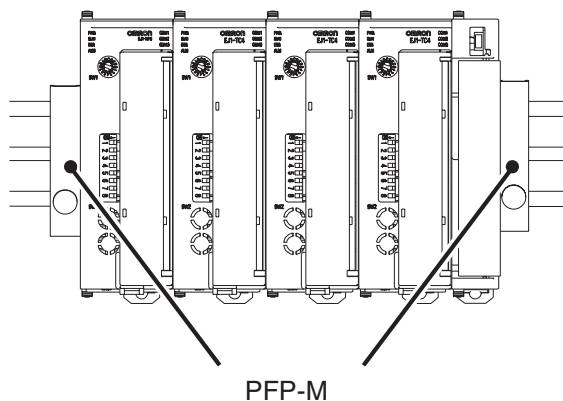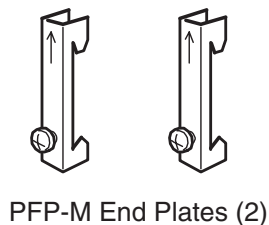
Removing Terminal Blocks

1,2,3...　　1.　Pull down the terminal block lever.

Pull down the lever.

2.　Pull off the terminal block.
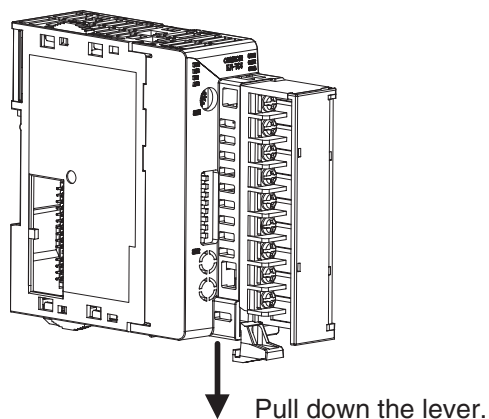
Pull off the terminal block.
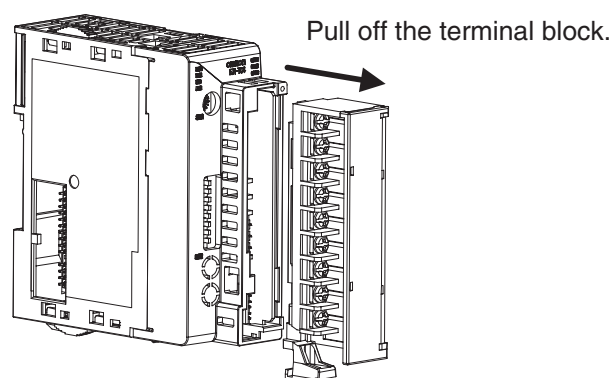
Note　　M3 screw and screw-less terminal blocks cannot be exchanged. Use the type of terminal block supplied with the TC Unit.

2-2 Wiring Terminals

2-2-1 Terminal Arrangement

TC4
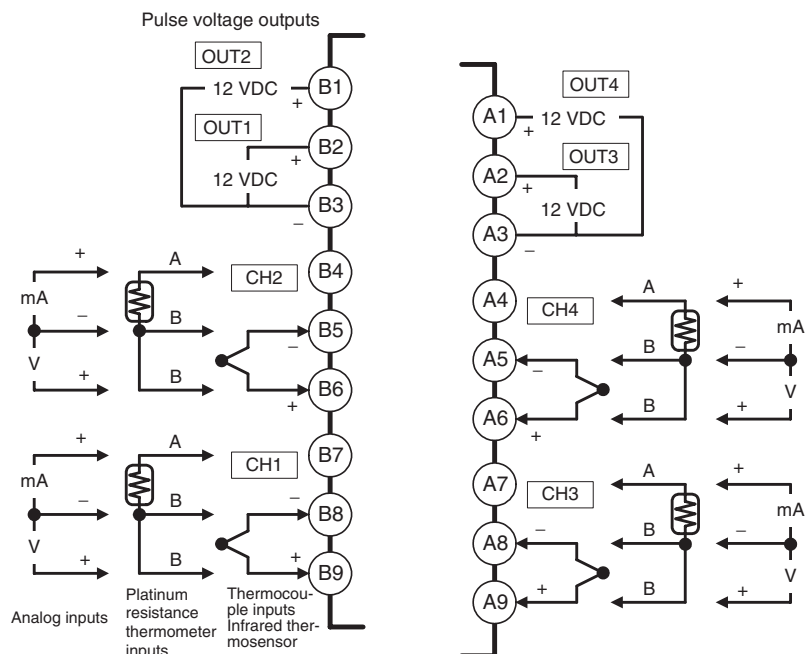
- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.
- A G3ZA connector is located on the bottom of the Unit.
- When wiring voltage inputs, be sure to wire the correct terminals. Incorrect wiring may cause the EJ1G to fail.

TC2
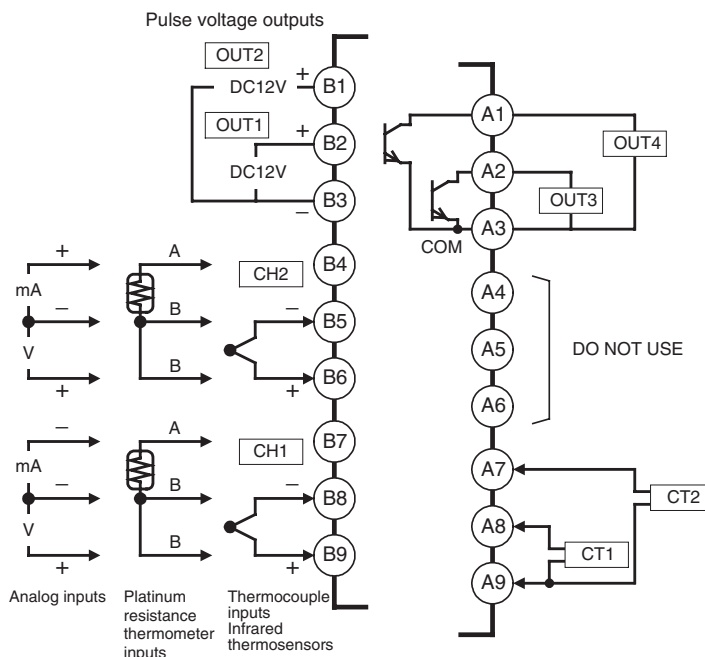
Pulse voltage outputs

- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.
- A G3ZA connector is located on the bottom of the Unit.
- When wiring voltage inputs, be sure to wire the correct terminals. Incorrect wiring may cause the EJ1G to fail.

HFU
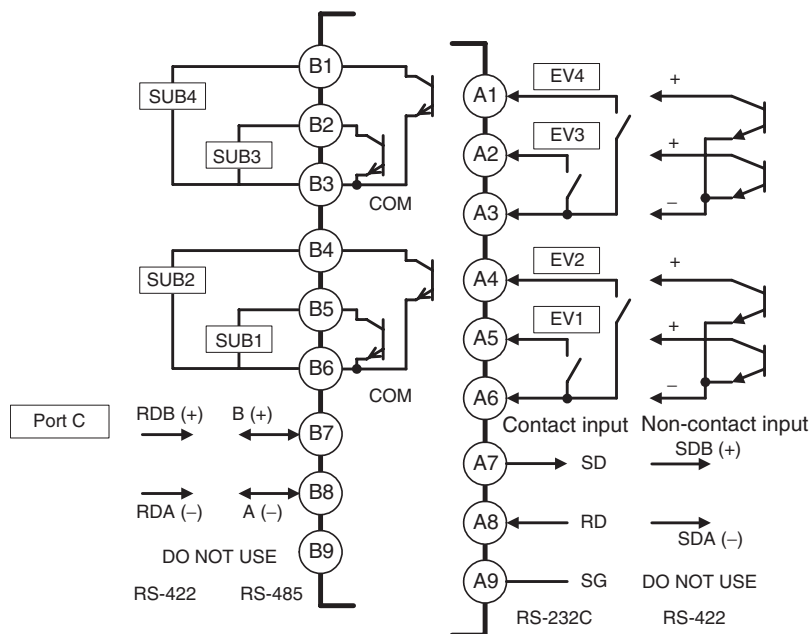
- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.

EDU
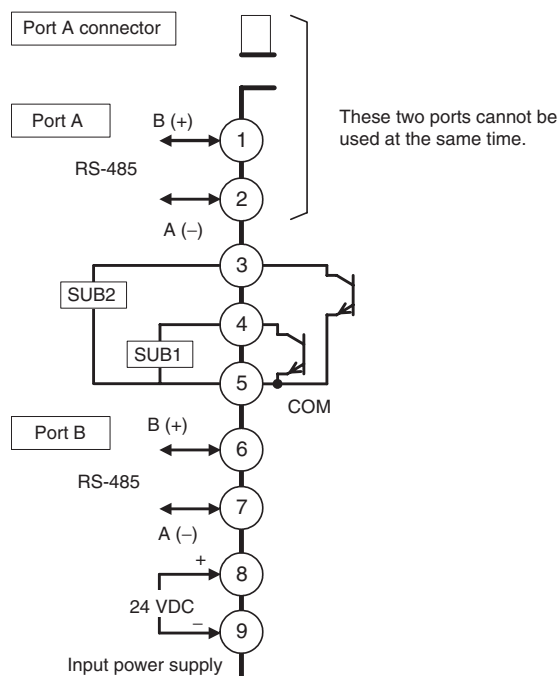
2-2-2 Wiring Precautions

- Separate input leads and power lines to protect the EJ1G from external noise.
- Use AWG22 (cross-sectional area: 0.326 mm^2) to AWG14 (cross-sectional area: 2.081 mm^2) twisted-pair cable for power supply and AWG28 (cross-sectional area: 0.081 mm^2) to AWG16 (cross-sectional area: 1.309 mm^2) for all other cables. The stripping length is 6 to 8 mm.
- Use crimp terminals when wiring the terminals.
- Tighten the terminal screws to a torque of 0.40 to 0.56 N·m.
- Up to two wires of the same size and same type or two crimp terminals can be inserted into a single terminal.
- Use the following types of crimp terminals for M3 screws.
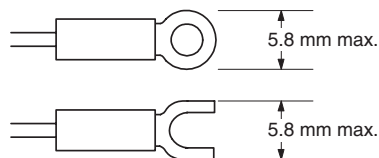
Wiring Procedure for Screw-Less Clamp Terminals
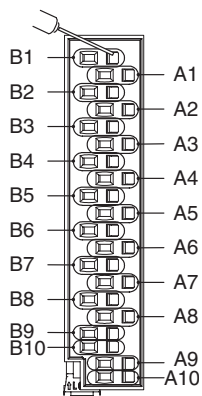
There are two holes for each terminal. The hole on the right is the operating hole; the hole on the left is the wire hole.

Insert a flat-blade screwdriver with a width of 2.5 mm into the operating hole and then insert the wiring into the wire hole.

The wire will be clamped when the screwdriver is removed.

Use crimp terminals for wiring that match the cross-sectional area of the wiring material.

We recommend the following crimp terminals:
Weidmuller H-sleeve Series

2-2-3 Wiring

Power Supply Voltage

Connect the power supply to EDU terminals 8 and 9 as shown below.
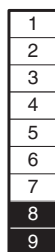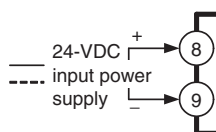
- If reinforced insulation is required, connect the input and output terminals to a device without any exposed current-carrying parts or to a device with standard insulation suitable for the maximum operating voltage of the power supply I/O section.

- Conforming to Safety Standards
  The power supply terminals must be supplied from a SELV, limited-current source. A SELV (separated extra-low voltage) source is a power supply having double or reinforced insulation between the primary and the secondary circuits and having an output voltage of 30 V r.m.s. max. and 42.4 V peak max. or 60 VDC max.
  Recommended power supply: S8VM Series or S8VS Series (both manufactured by OMRON)

  Note Select a power supply that suits the operating environment.

- To comply with the standards for noise terminal voltage for class A in EN 61326, install a noise filter (Densei Lambda MXB-1206-33 or the equivalent) to the DC line as close as possible to the EJ1G.

Inputs

Connect inputs according to the input type as shown below.

Thermocouple inputs
Infrared thermosensor

Platinum resistance
thermometer inputs

Analog inputs
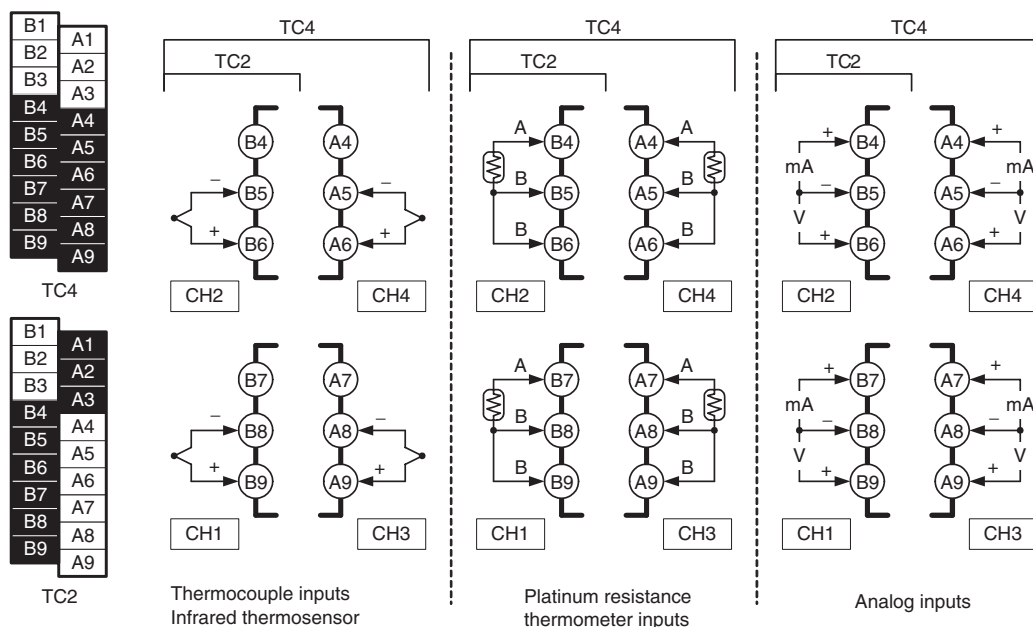
Control Outputs

Terminals B1 to B3 and A1 to A3 on the TC4/TC2 are for control outputs.

TC4

TC2
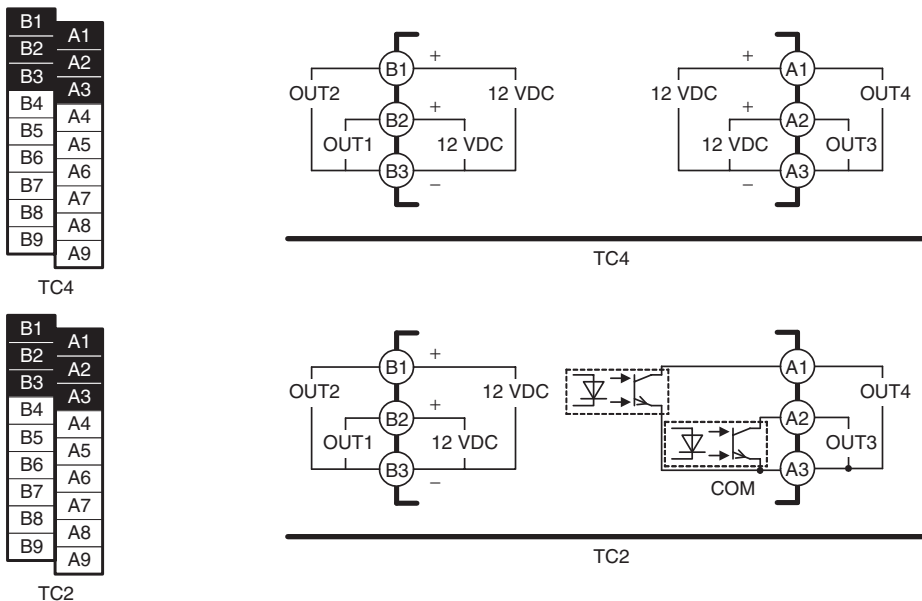
Output type	Specifications	
Pulse voltage outputs	Output voltage:	12 VDC ±15% (PNP)
	Max. load current:	21 mA, with short circuit protection circuit.
Transistor outputs	Max. applicable voltage:	30 VDC
	Max. load current:	100 mA
	Residual voltage:	1.5 V max., Leakage current: 0.4 mA max.

Auxiliary Outputs

Auxiliary outputs are sent from pins B1 to B6 with the HFU, and from pins 3 to 5 with the EDU.
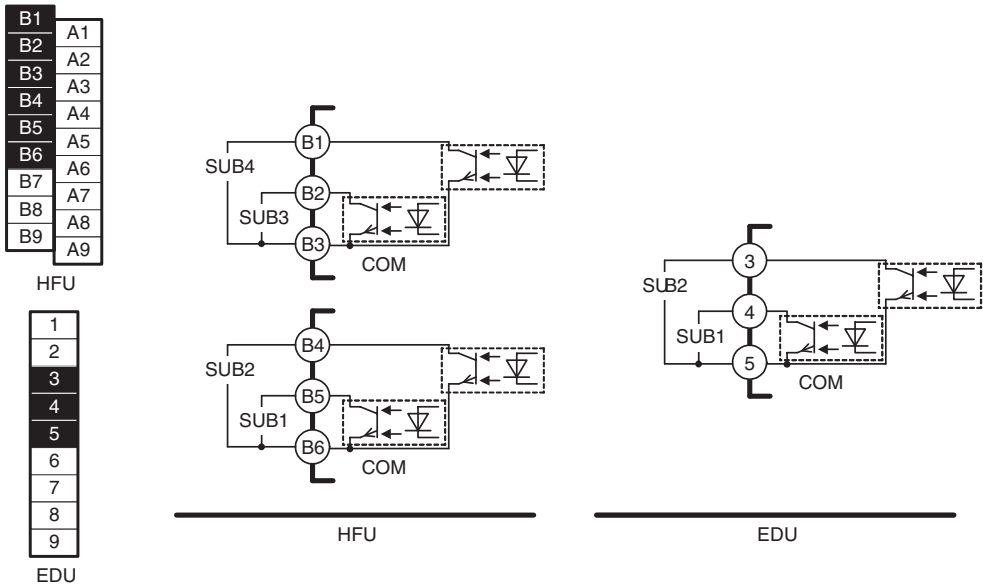
Output type	Specifications	
Transistor outputs	Max. operating voltage:	30 VDC
	Max. load current:	50 mA
	Residual voltage:	1.5 V max., leakage current: 0.4 mA max.

CT Inputs

When the heater burnout (HB) or heater short (HS) alarm is to be used, connect a Current Transformer (CT) across terminals A8 and A9 or terminals A7 and A9 (no polarity) on the TC2.
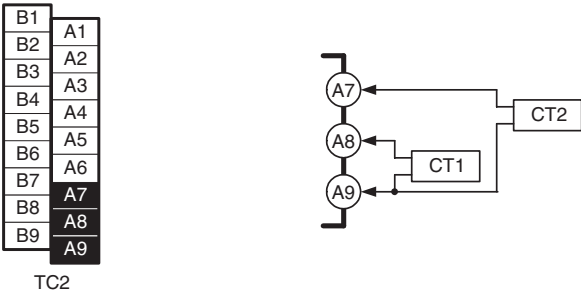
• Use a E54-CT1 or E54-CT3 Current Transformer.

Event Inputs   Connect event inputs across terminals A4 and A6 for the HFU.
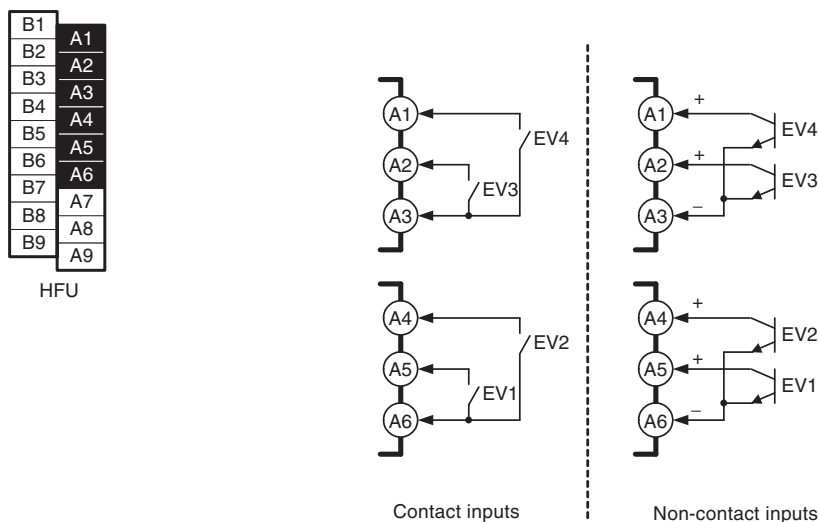
• The inflow current is approximately 4 mA.

• Use event inputs under the following conditions:

Contact inputs	ON: 1 kΩ max., OFF: 100 kΩ min.
Non-contact inputs	ON: Residual voltage: 1.5 V max., OFF: Leakage current: 0.1 mA max.

Communications   • For communications with the host, connect communications across termi-
                                   nals B7 and B8 or terminals A7 to A9 on the HFU or connect across ter-
                                   minals 1 and 2 on the EDU.
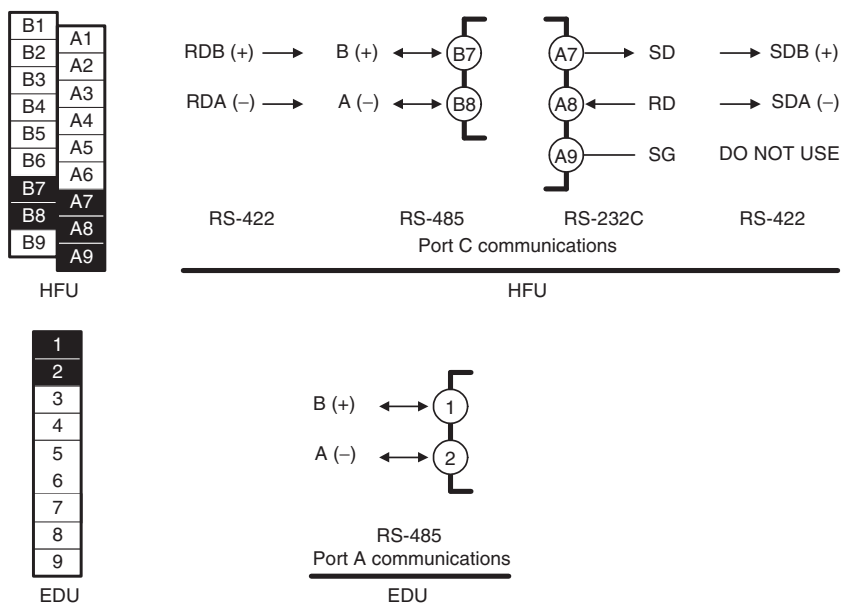
Note   • If there are problems with communications noise performance when using
                  the port A connector, connect 110 to 125 Ω of terminating resistance
                  across terminals 1 and 2 of port A on the EDU.

                  • Specify both ends of the transmission path, including the host computer,
                  as end nodes (i.e., connect terminators to both end). The minimum termi-
                  nating resistance is 54 Ω.

■ <u>**Connection Example**</u>
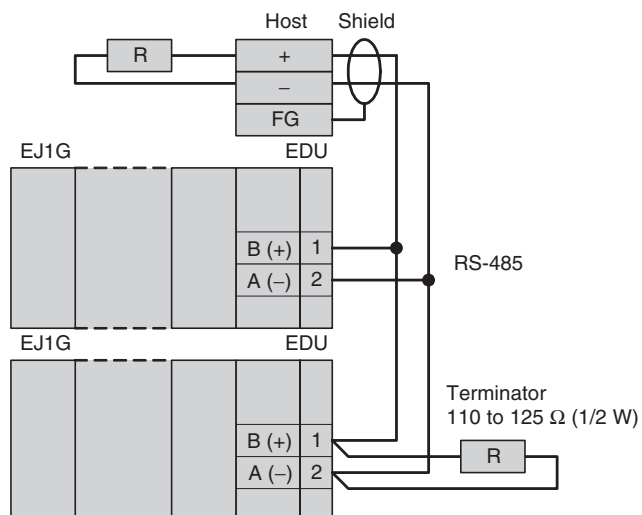
- The RS-485 connection can be either 1:1 or 1:N. RS-232C connections can only be 1:1. A maximum of 32 Units (including the host) can be connected in 1:N systems. The maximum total cable length is 500 m. Use AWG28 (cross-sectional area: 0.081 mm^2) to AWG16 (cross-sectional area: 1.309 mm^2) shielded twisted-pair cable.

Cross-sectional area of conductor
AWG28: 0.081 mm^2
AWG16: 1.309 mm^2
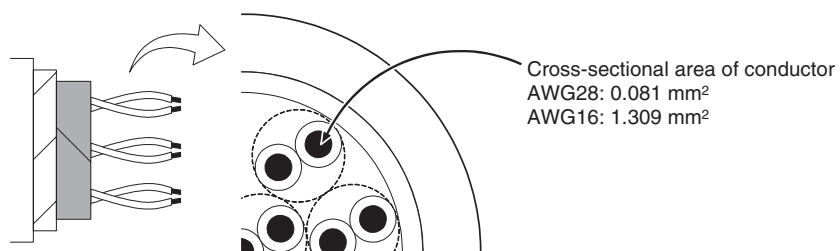
Connecting to the G3ZA Multi-channel Power Controller

CN1
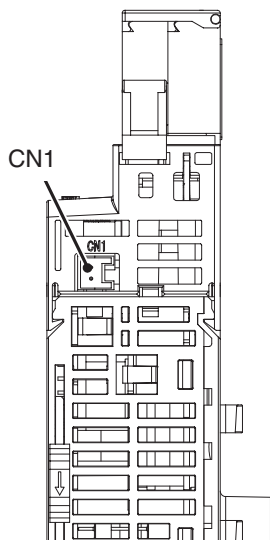
Connect the G3ZA Connecting Cable to the CN1 connector on the bottom of the TC Unit.
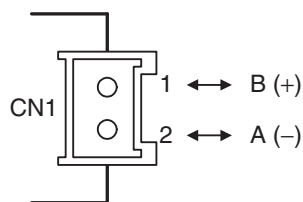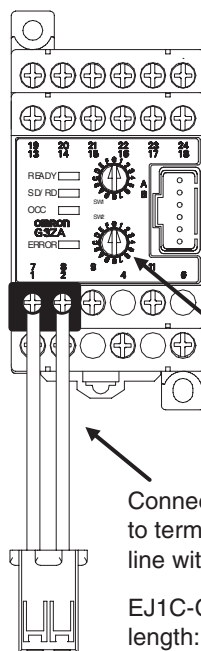
Set SW2 to 3 (57.6 kbps).

Connect the black line with a white stripe to terminal 7 on the G3ZA and the black line with no stripe to terminal 8.

EJ1C-CBLA050 (order separately) (cable length: 5 m)

CN1

1 ⟷ B (+)

2 ⟷ A (−)

TC4/TC2

Use a JST Mfg. Co. Ltd. PA connector.
 Housings
  Model: PAP-02V-S
 Crimp Terminals
  Model: SPHD-001T-P0.5
Use an EJ1C-CBLA050 Cable (manufactured by OMRON).

2-3 Using Tool Ports

Tool ports are used to make EJ1G settings using the EST2-2C-MV3 CX-Thermo Support Software.

The E58-CIFQ1 USB-Serial Conversion Cable is required to make the connection.

2-3-1 Procedure

1,2,3...   1. Turn ON the power supply to the EJ1G.

   Note   Do not connect the E58-CIFQ1 while the power supply to the EJ1G is OFF. If the Cable is connected when the power to the EJ1G is OFF, power will be supplied from the computer and impose a load on the internal circuits of the EJ1G.

2. Connect the Cable.
   Connect the computer's USB port with the port A connector on the EJ1G using the Cable.

Port A connector

E58-CIFQ1

Computer

EDU Front View
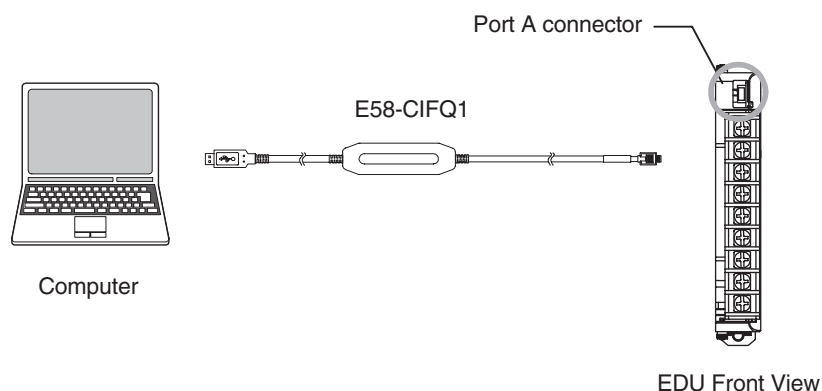
3. Install the driver.
   A driver must be installed to use the Cable.

   • When the Cable is connected with the computer, the OS will detect a new device.
     Follow the installation wizard instructions and install the driver.

   Note   For details on installation methods, refer to the user's manual for the E58-CIFQ1 USB-Serial Conversion Cable.

4. Make the communications port settings.
   The USB-Serial Conversion Cable is used to communicate with the COM port of the computer.
   Set the communications port (COM port) number to be used for the CX-Thermo software to the COM port assigned to the Cable.

2-4   Unit Configuration Examples

EJ1G-HFU

EJ1G-TC4
or
EJ1G-TC2

EJ1C-EDU

PLC

Port A (connector): USB connection
can be made using the E58-CIFQ1
(sold separately).

CX-Thermo for setting

PC

Port B is used for distributed placement.

G3ZA   G3ZA   G3ZA
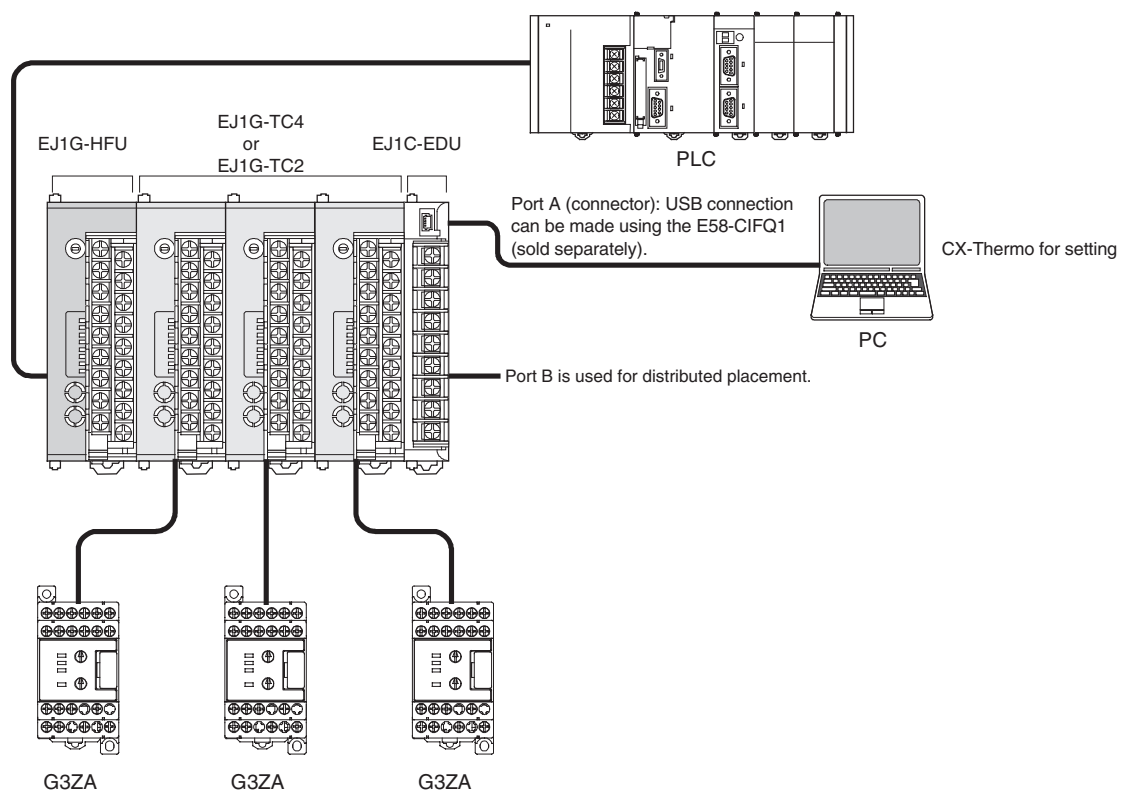
2-4-1   Connection Precautions

Restrictions on the Number of Units that Can Be Connected

- Unit numbers 0 to 31 can be used for EJ1G-HFU and EJ1G-TC4/TC2 Units.

- Up to 16 Units, including the HFU, can be connected side by side. (EDU Units are not counted in the number of Units that can be connected.)

Precautions When Using an HFU

- One HFU can control up to 16 TC4/TC2 Units.

- The unit numbers of the TC4/TC2 Units can be set to between 0 and 31.

- To connect 16 TC4/TC2 Units, Communications Cables must be used to distribute Unit positioning because the maximum number of Units that can be connected horizontally will be exceeded.

- When using Communications Cables to distribute TC4/TC2 Unit positioning, connect the cables to port B on the End Units.

- If distributed positioning is used for an EJ1G, power must be supplied separately to the terminal block on the End Units.

Note   When using distributed positioning, turn ON power to the distributed Units first or turn ON power to the HFU and distributed Units simultaneously. Even if this is done, there may still be problems with the startup timing depending on the EJ1G configuration and power supply capacity. If problems occur at startup, increase the delay between turning ON the power to the distributed Units and the HFU.

One HFU can manage up to 16 TC Units (4 channels × 16 Units = 64 channels)
EDU Units are not included in the number of Units that can be managed.

Turn ON pin 8 on SW2.

EJ1G-HFU   EJ1G-TC4 or EJ1G-TC2   EJ1C-EDU   EJ1G-TC4 or EJ1G-TC2   EJ1C-EDU

Up to 16 Units can be connected side by side.
EDU Units are not counted in the number of Units that can be connected.
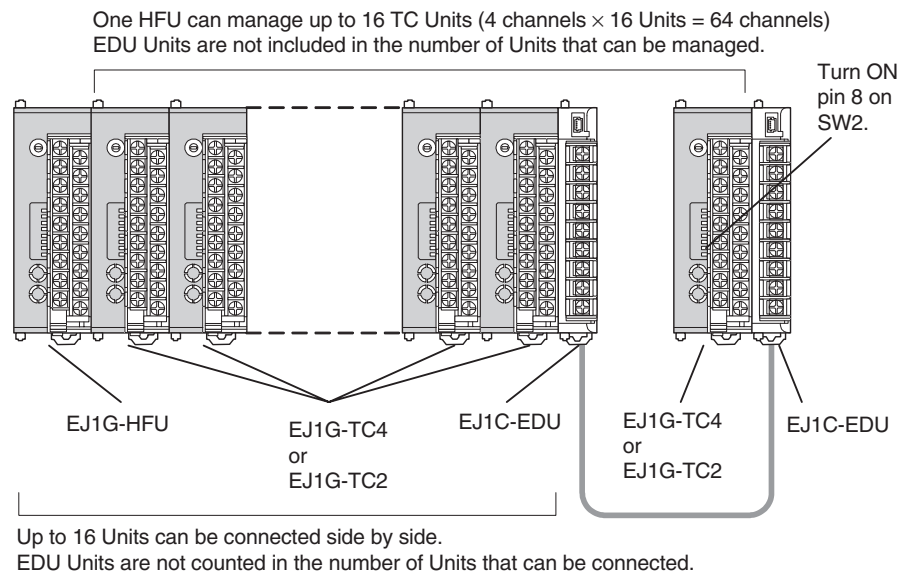
Maximum Number of Connectable Units

The maximum number of Units that can be connected is sometimes limited to 16 or less, depending on the maximum number of channels per group and the types of Basic Unit used. Refer to the following table for information on the maximum number of connectable Units.

Maximum number of channels per group	TC2		TC4	
	Maximum number of groups	Maximum number of connectable Units	Maximum number of groups	Maximum number of connectable Units
2	16	16	16	8
3	10	15	16	12
4	8	16	16	16
5	6	15	8	10
6	5	15	8	12
7	4	14	8	14
8	4	16	8	16
9	3	14	4	9
10	3	15	4	10
11	2	11	4	11
12	2	12	4	12
13	2	13	4	13
14	2	14	4	14
15	2	15	4	15
16	2	16	4	16
17	1	9	2	9
18	1	9	2	9
19	1	10	2	10
20	1	10	2	10
21	1	11	2	11
22	1	11	2	11
23	1	12	2	12
24	1	12	2	12
25	1	13	2	13
26	1	13	2	13
27	1	14	2	14
28	1	14	2	14
29	1	15	2	15
30	1	15	2	15
31	1	16	2	16
32	1	16	2	16

Example: Performing 6-channel Gradient Temperature Control with TC2 Units

The maximum number of groups is 5, and the maximum number of Units that can be connected is 15.

Wiring for Distributed Placement
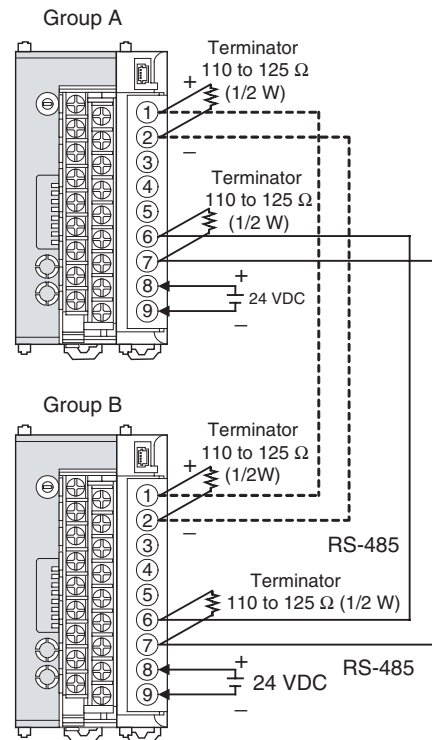
Note Wire the connections indicated with dotted lines when settings for all EJ1G Controllers are being made from one port A connector. If the connections indicated with dotted lines are not wired, the settings for group A can be made only using the port A connector for group A and the settings for group B can be made only using the port A connector for group B.

Connecting the G3ZA and EJ1G

• Up to 8 G3ZA Power Controllers can be connected to one TC4/TC2 Unit.

Note Either turn ON power to the G3ZA first, or turn ON power to the G3ZA and EJ1G simultaneously.

EJ1G-TC4
or
EJ1G-TC2

EJ1C-EDU

G3ZA

Up to 8 G3ZA Power Controllers can be
connected to one TC Unit.
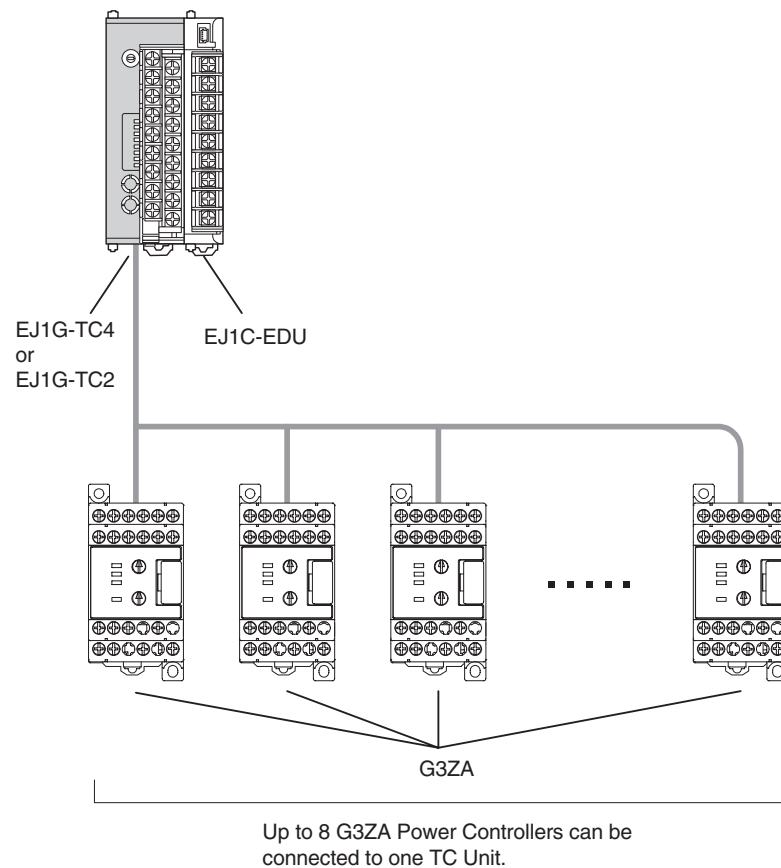
**Restrictions on
Connections and
Placement**

• Always connect the HFU on the left side of the TC4/TC2 Units.

Incorrect

Correct

EJ1G-TC4   EJ1G-HFU
or
EJ1G-TC2

EJ1G-HFU   EJ1G-TC4
or
EJ1G-TC2
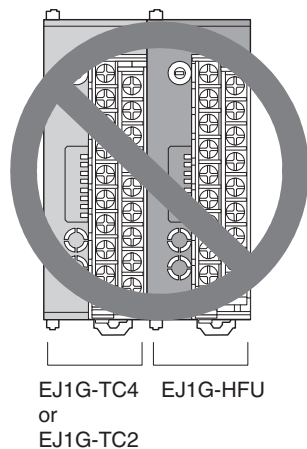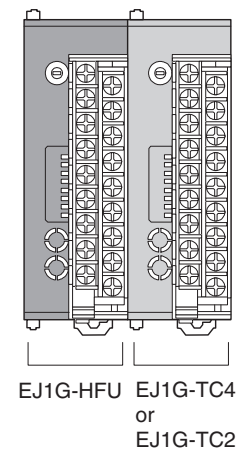
- Do not connect an EDU directly to an HFU. Always connect the EDU to a TC4/TC2.

Incorrect   **Correct**

EJ1G-HFU EJ1C-EDU

EJ1G-HFU EJ1G-TC4 EJ1C-EDU
              or
          EJ1G-TC2
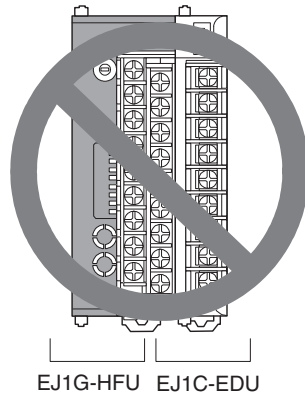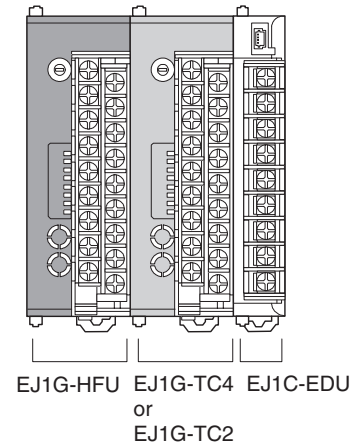
SECTION 3
Gradient Temperature Control Setup

This section describes how to set up and adjust gradient temperature control and how to change the SPs during operation.

3-1 Setup Procedure

Use the following procedure to perform gradient temperature control.

1. Select the models.
2. Set the Communications unit numbers.
3. Make the I/O settings.
4. Make the gradient group settings.
5. Arrange the Sensors.
6. Register the configuration.
7. Set decimal point position B.
8. Make the SP and alarm settings.
9. Perform tuning for gradient temperature control.
10. Start control.
11. Perform tuning for 2-PID control.
12. Check the heater burnout alarm status.

Example: Performing 3-channel Gradient Temperature Control

- Gradient temperature control is performed for 3 groups.
- Also, 2-PID control is performed for three channels in addition to gradient temperature control.
- Heater burnout is detected for all channels.

Upper heater
(2-PID control)

Lower heater
(Gradient temperature control performed for three heaters)
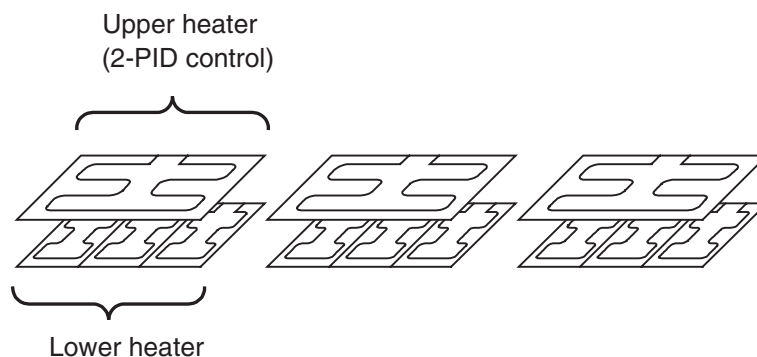
1. Select the models.

    TC2 Basic Units are used because heater burnout detection is performed.

    - Select TC2 Units to detect heater burnout.
    - Select TC4 Units when not detecting heater burnout.

        Note A mixture of TC2 and TC4 Units can be used.

    Here, a total of 12 channels are required, so 6 TC2 Units are needed.
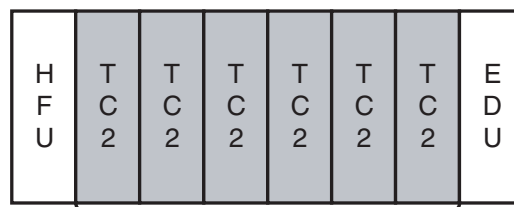
6 Units (x TC2 = 12 channels)

Three-channel gradient control for 3 groups + 3 channels of PID control = 12 channels

2. Set the Communications Unit numbers.

   Set the Communications unit numbers as shown below.
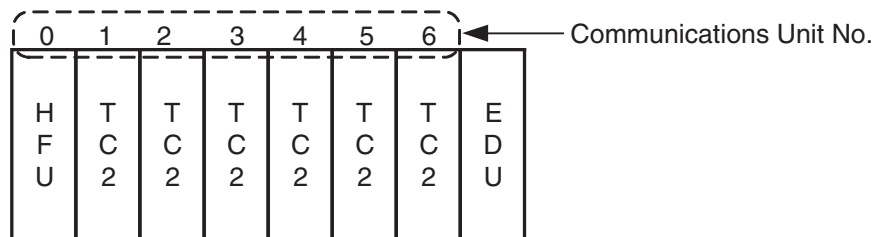
   Note (a) The Communications unit numbers can be set between 0 and 31. Set a number in this range.

   (b) When connecting to an OMRON PLC, set the HFU unit number to between 0 and 7.

3. Make the I/O settings.

   The I/O settings are made for each Basic Unit.
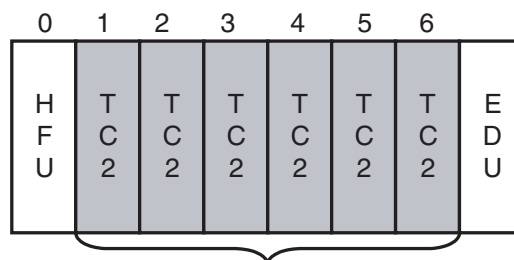
   Set the I/O for each Basic Unit.

   The following table shows the input type and control period for each TC2 Unit in this example.

Parameter			Communications Unit No.					
Variable type	**Address**	**Name**	**1**	**2**	**3**	**4**	**5**	**6**
E0 (A0)	0100	Input Type - CH1	5 (K: −200 to 1300°C)					
	0200	Input Type - CH2	5 (K: −200 to 1300°C)					
E1 (A1)	0101	Control Period 1	2 s					
	0201	Control Period 2	2 s					

4. Make the gradient group settings.

   The gradient group settings are made on the HFU.
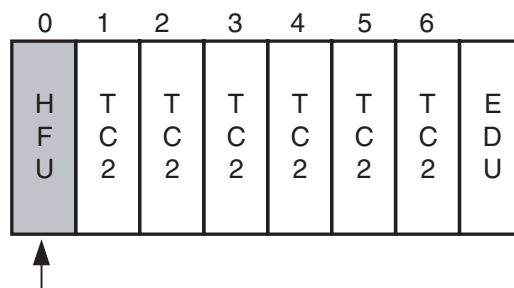
The heaters are first divided into groups and it is decided whether each group will use gradient temperature control or 2-PID control. In this example, there are three groups of gradient temperature control for three channels and one group of 2-PID control for three channels. The groups are divided as shown in the following diagram.
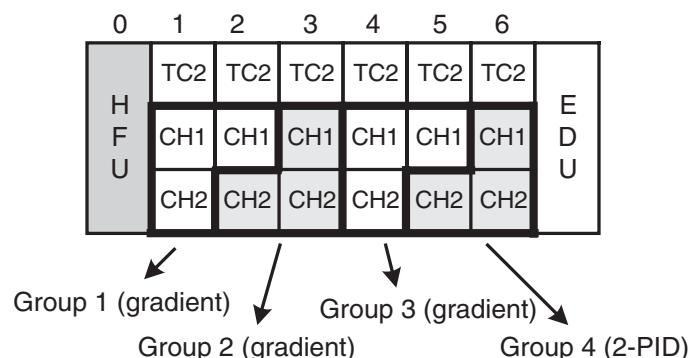
The group settings are made with the following parameters.

Parameter	Description
Number of Enabled Groups	Sets the total number of groups, consisting of those performing gradient temperature control and those performing 2-PID control.
Initial Communications Unit No.	Sets the communications unit number for the group's initial channel.
Initial Channel	Sets the initial channel for the initial communications unit number.
Number of Enabled Channels	Sets the number of channels performing gradient temperature control or 2-PID control.
Control Type	Sets whether the group will perform gradient temperature control or 2-PID control.

Note (a) When the group settings are changed after temperature control has been performed, the control-related parameters are not initialized. To redo the group settings after control has been performed, be sure to initialize the setting parameters before changing the group settings.

(b) The control operation cycle will get longer if there are a lot of channels or groups performing gradient temperature control, which may affect control performance. Refer to *Characteristics* on page 171 for details.

The following table shows the group settings for this example.

Variable type	Address	Parameter		Setting value
F1 (B1)	0000	Number of enabled groups		4
	0100	Group 1	Initial Communications Unit No.	1
	0101		Initial Channel	0
	0102		Number of Enabled Channels	3
	0103		Control Type	0: Gradient temperature control
	0200	Group 2	Initial Communications Unit No.	2
	0201		Initial channel	1
	0202		Number of Enabled Channels	3
	0203		Control type	0: Gradient temperature control
	0300	Group 3	Initial Communications Unit No.	4
	0301		Initial Channel	0
	0302		Number of Enabled Channels	3
	0303		Control Type	0: Gradient temperature control
	0400	Group 4	Initial Communications Unit No.	5
	0401		Initial Channel	1
	0402		Number of Enabled Channels	3
	0403		Control Type	1: 2-PID control

The HFU handles all of the operations for gradient temperature control and 2-PID control. The maximum number of enabled channels that can be controlled is selected at the HFU from 4, 8, 16, or 32 channels, and that number of channels is allocated for the number of groups used.

In this example, the maximum number of enabled channels is three, so the HFU allocates groups in units of four channels each. The HFU recognizes the following channels for the Basic Unit.
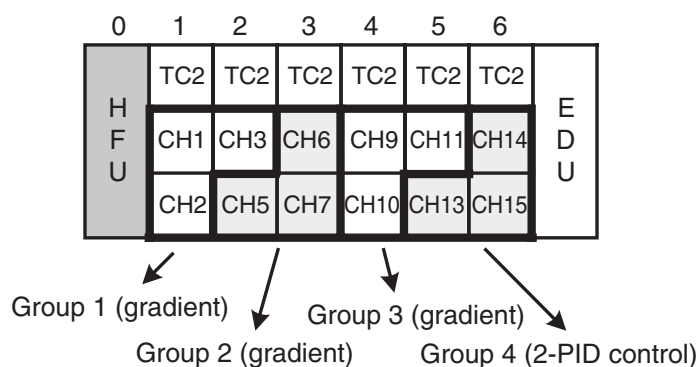
HFU channels	Groups
1	1
2	
3	
4	Not usable
5	2
6	
7	
8	Not usable
9	3
10	
11	
12	Not usable
13	4
14	
15	
16	Not usable

Note (a) The HFU can control up to 64 channels, but when the maximum number of enabled channels is a number other than 4, 8, 16, or 32 channels, non-usable channels result as shown in this example. This limits the number of controllable channels and connectable Units. Refer to *Maximum Number of Connectable Units* on page 28 for details.

(b) If the maximum number of enabled channels is changed in the configuration, the number of channels allocated for each group and the initial channel for each group may change.

5. Arrange the Sensors.

Arrange the sensors sequentially to maximize the control performance within gradient temperature control groups.

Connection Example with Control Object Heaters in a Line
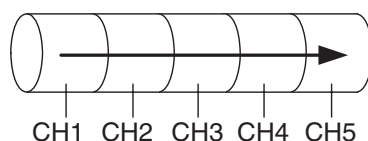
Connection Example with Control Object Heaters in a Plane
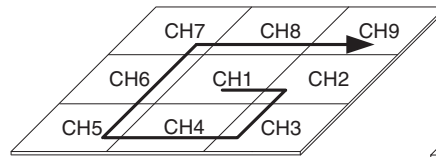
Good example   Bad example
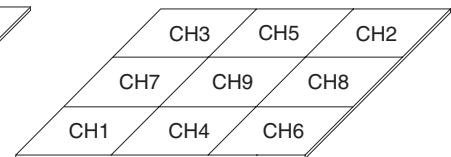
The example used here results in the following sensor arrangement.
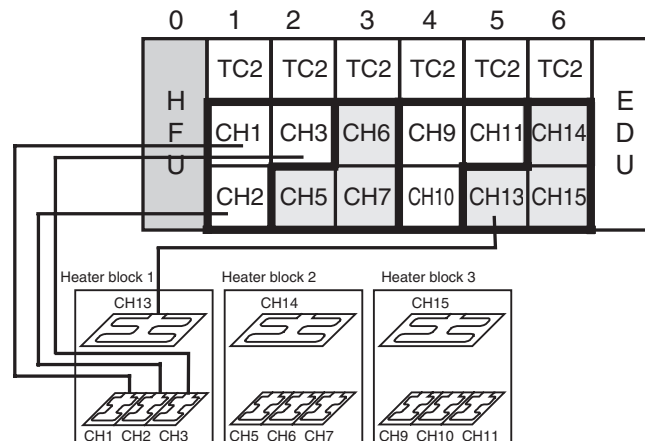
Note: The connections for heater blocks 2 and 3 are omitted above.

Always short-circuit the input for any unused channels in the Basic Unit.

6. Register the configuration.

The configuration is registered in the HFU.
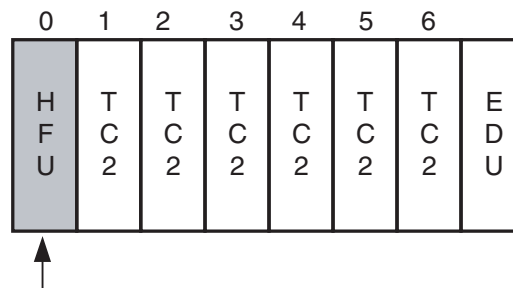
No configuration is registered when the product is shipped. Always register the configuration. If the correct configuration is not registered or if the configuration is not correctly detected, the Basic Unit channels detected by the HFU may be incorrect.

Use the following procedure to register the configuration.

a. Execute the following operation commands.

   • Execute the operation command to set all channels to AUTO mode.

   • Execute the operation command to set all channels to STOP mode.

b. Reset the EJ1G using one of the following methods.

   • Execute a software reset with an operating command to the HFU.

Note All connected Units will be reset when the HFU is reset.

   • Cycle the EJ1G power supply.

c. Check the following after restarting.

- Read the Configuration Error A Status and check that there are no errors.
- Read the Device B Status and check that bit 12 (Configuration Registered) is OFF.

   d. Use the operation command to execute registration of Unit configuration.

   e. Use the method outlined in step b) above to reset the EJ1G system then check the following.

- Read Configuration Error A Status and check that there are no errors.
- Read the Device B Status and check that bit 12 (Configuration Registered) is ON.
- Check that the COM2 indicator is flashing for all Units.

Note Refer to *SECTION 7 Errors and Error Processing* to determine the cause of any errors that occur during when performing the procedure outlined above.

7. Set decimal point position B.
   Decimal point position B is set for the HFU.

The decimal point position for the PV is set using the Decimal Point Position B parameter. Set the same decimal point position as was set for the TC2 Unit or TC4 Unit.

Decimal point position B must be set because it is used as the decimal point position for the SP and alarm values.

In this example, the input type is set to 5 (Thermocouple (K): −200 to 1,300) so the decimal point position must be set to 0.

Variable type	Address	Parameter	Setting value
E0 (A0)	0000	Decimal Point Position B	0

Note The input type can be set separately for each channel, but if different input types are set, input types with the same decimal point position. Temperature control will not be executed correctly if different decimal point input types are used.

8. Make the SP and alarm settings.
   The SP and alarm settings are made for the HFU.

The SP and alarm settings are made for the channels allocated in the group settings. SP and alarm settings made for unusable channels will not be enabled.

The following table shows the Set Point, Alarm Value 1, and Heater Burnout Detection settings for each channel for this example.

Variable type	Address	Parameter	Setting value	
D0 (90)	0100	Bank 0 Set Point - CH1	200	Group 1
	0200	Bank 0 Set Point - CH2	200	
	0300	Bank 0 Set Point - CH3	200	
	0500	Bank 0 Set Point - CH5	200	Group 2
	0600	Bank 0 Set Point - CH6	200	
	0700	Bank 0 Set Point - CH7	200	
	010D	Bank 0 Alarm Value - CH1	230	Group 1
	020D	Bank 0 Alarm Value - CH2	230	
	030D	Bank 0 Alarm Value - CH3	230	
	050D	Bank 0 Alarm Value - CH5	230	Group 2
	060D	Bank 0 Alarm Value - CH6	230	
	070D	Bank 0 Alarm Value - CH7	230	
D6 (96)	0100	Heater Burnout Detection - CH1	5.0 A	Group 1
	0200	Heater Burnout Detection - CH2	5.0 A	
	0300	Heater Burnout Detection - CH3	5.0 A	
	0500	Heater Burnout Detection - CH5	5.0 A	Group 2
	0600	Heater Burnout Detection - CH6	5.0 A	
	0700	Heater Burnout Detection - CH7	5.0 A	

9. Perform tuning for gradient temperature control.

   Tuning for gradient temperature control is called gradient tuning (GT). GT is executed and stopped for the HFU.
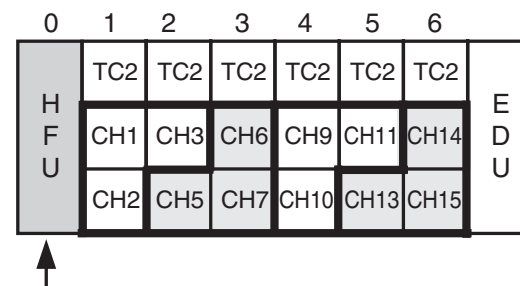
   GT is executed when all groups are in STOP and AUTO modes. GT can also be executed for individual groups.

   a. Check that all groups are in STOP and AUTO modes.
      Read the channel status of the initial channel for each group and check that bit 0 (RUN/STOP) is ON (STOP) and that bit 1 (AUTO/MANUAL) is OFF (AUTO).
      If any group does not satisfy these conditions, execute operation com-

mands for the initial channel in the group and set to STOP and AUTO modes. Groups using 2-PID control also need to be in STOP mode.

Group	Channel status
1	Check the status of channel 1.
2	Check the status of channel 5.
3	Check the status of channel 9.
4	Uses 2-PID control and, therefore, does not need to be checked.

b. Read the PV for all channels in groups for which GT is to be executed and wait for all values to stabilize.

Note Correct tuning results will not be obtained if GT is started before the PV stabilize.

c. GT is executed by executing an operating command for the initial channel in the group for which GT is to be executed.
Channel status bit 2 (GT Execute/Cancel) is ON during GT.

Example: Executing Gradient Tuning for Group 3

An operating command is executed for channel 9 to execute GT.

Note Execute an operating command for the initial channel in the group to cancel GT if an error occurs during GT execution.

Note If any of the following conditions occur, GT will stop and channel status bit 12 (GT Error) will turn ON for the initial channel in the group. In such cases, remove the cause of the error and execute GT again.

• If an input error has occurred.

• If the PV for the channel being output exceeds the SP.
Control may not be possible if the SP is too low, the output remains ON, or the response speed of the control target is too fast.

During GT, the outputs in the group turn ON and OFF in order and the control target characteristics are measured. The following diagram shows the actual operation.

Example: GT for a 3-channel Configuration
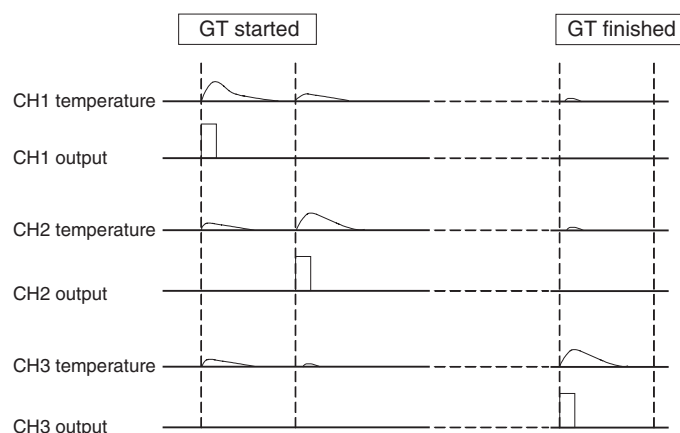
d. Wait until the GT Execute/Cancel bit turns OFF.
GT is completed when this bit turns OFF. Read the PID for each chan-

nel in the group and check that the values are refreshed.

Group 1	CH1	P=□□, I=□□, D=□□
	CH2	P=□□, I=□□, D=□□
	CH3	P=□□, I=□□, D=□□
Group 2	CH5	P=□□, I=□□, D=□□

Note An error will occur if a mixture of gradient temperature control and 2-PID control is used and GT or AT is executed for all channels. Execute GT or AT for individual groups if a mixture of gradient temperature and 2-PID control is used.

10. Start control.
    Control is started and canceled for the HFU.

To start control for gradient temperature control groups, first read the status of the initial channel in the groups and check that bit 13 (GTC Error) is OFF (No error) then execute a RUN operation command.

Note Gradient Temperature Control (GTC) Errors
If the power is interrupted immediately after GT has been completed or while downloading the HFU parameters using the Support Software, the internal parameters for GTC will not be refreshed correctly and control may not be able to be started. Use one of the following methods if this error occurs.
- Re-execute GT.
- Download the parameters again and reset.
- Initialize the setting values and reset.

Example1: Starting Control for Group 2 (Gradient)

Execute a RUN operation command for channel 5.

Example 2: Starting Control for the Initial Channel in Group 4 (2-PID Control)

Execute a RUN operation command for channel 13.

Example 3: Starting Control for All Groups

Execute a RUN command with all channels specified.

Note A RUN command can be executed even for a mixture of gradient temperature and 2-PID control.

11. Perform Tuning for 2-PID Control.
    Tuning for 2-PID control is called autotuning (AT). AT is executed and canceled for the HFU.
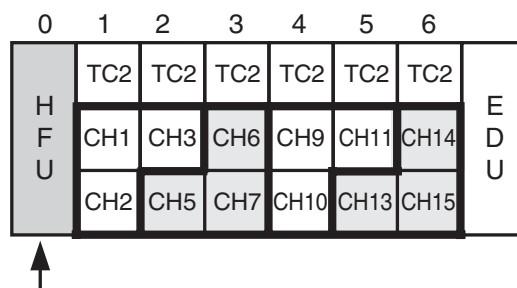
AT is executed when set to RUN and AUTO modes. AT can also be executed for individual channels in a group.

a. Check that the channels for which AT is to be executed are in RUN and AUTO modes.
Read the status of the channels for which AT is to be executed and check that bit 0 (RUN/STOP) is OFF (RUN) and bit 1 (AUTO/MANUAL) is OFF (AUTO).
If these conditions are not met by a channel, execute operation commands for that channel and set to RUN and AUTO modes.

b. Execute an operation command to execute AT for the desired channel. 40% AT Execute and 100% AT Execute options are available. Refer to page 78 for information on the operation differences between the two. Channel status bit 2 (AT Execute/Cancel) will be ON during AT.

Example: Tuning Channel 14 in Group 4 (2-PID Control)

c. Execute an AT Execute operating command for channel 14.
Wait until the AT Execute/Cancel bit turns OFF.
AT has been completed when this bit turns OFF. Read the PID for the corresponding channels and check that the values have been refreshed.

Note An error will occur if a mixture of gradient temperature control and 2-PID control is used and GT or AT is executed for all channels. Execute GT or AT for individual groups if a mixture of gradient temperature and 2-PID control is used.

Note Execute AT for one channel at a time if optimum control performance is required.

12. Check the Heater Burnout Alarm status.
The heater burnout alarm (HB) is checked by checking the status of the Channel Alarm Status bit. The heater current is checked by checking the status of the Heater Current Value Monitor bit.

HB/HS alarm evaluation

Monitors the current and judgment results.
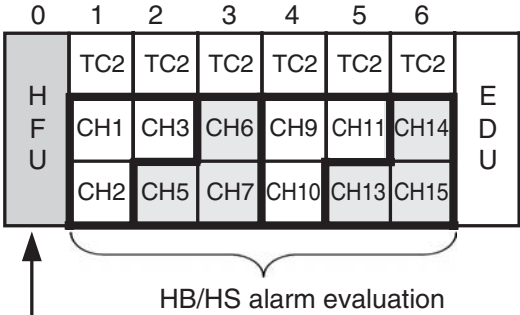
Variable type	Address	Parameter name	
C4 (84)	0102	Channel Alarm Status - CH1	Group 1
	0202	Channel Alarm Status - CH2	
	0302	Channel Alarm Status - CH3	
	0502	Channel Alarm Status - CH5	Group 2
	0602	Channel Alarm Status - CH6	
	0702	Channel Alarm Status - CH7	
C5 (85)	0100	Heater Current Value Monitor - CH1	Group 1
	0200	Heater Current Value Monitor - CH2	
	0300	Heater Current Value Monitor - CH3	
	0500	Heater Current Value Monitor - CH5	Group 2
	0600	Heater Current Value Monitor - CH6	
	0700	Heater Current Value Monitor - CH7	

Heater burnout (HB) and SSR error (HS) alarms are detected by the Basic Unit. Make any fine adjustments to hysteresis and latch settings at the Basic Unit.

3-2   Adjusting Gradient Temperature Control

Sufficient temperature uniformity is sometimes difficult to achieve if the MV is saturated when temperatures increase.
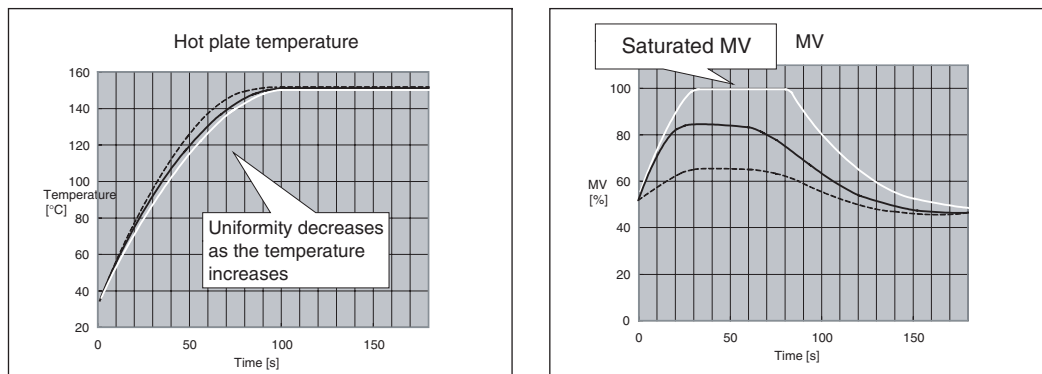
Adjust the control balance coefficient if the temperature uniformity is insufficient and the MV for one of the channels becomes saturated. The control balance coefficient has the characteristics outlined below and must, therefore, be adjusted to a value suitable for the system. The SP cannot be reached, however, if the control balance coefficient is too small. In such cases, return to the default value of 0.8.

Uniformity increases but the speed of the temperature rise drops
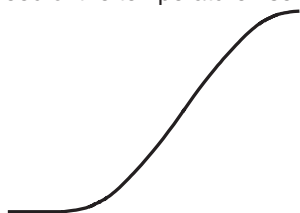
Temperature rise speed increases but uniformity drops

Smaller ◄──────── Control balance coefficient ────────► Larger

Set the control balance coefficient for the initial channel for each group.

Example: Adjust the control balance coefficient for channel 5 if adjusting group 2 when the following group settings apply.

Group	Corresponding channels	Control type
1	CH1 to CH4	Gradient temperature control
2	CH5 to CH8	Gradient temperature control
3	CH9 to CH12	2-PID control

3-3   Changing SPs During Operation

Several channels are grouped together for control when gradient temperature control is used. Therefore, switch banks and change the SP for all channels if changing the SP during operation. Uniformity may be adversely affected if the SP is not changed for all channels in the gradient temperature control groups.
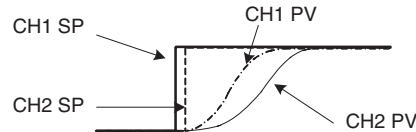
When the SPs are changed at different times
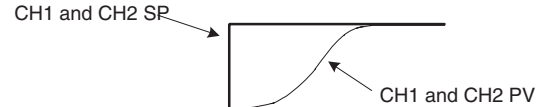
When the SPs are changed at the same time

The following example shows using bank switching to change SPs.

a.   Change the SP for bank 1 during control using bank 0.

BANK	CH1 SP	CH2 SP	CH3 SP	
0	100	100	100	← Control using bank 0
1	150	150	150	← Change bank 1 SP

b.   Switch to bank 1.

All SP for the group are refreshed when the bank is switched.

BANK	CH1 SP	CH2 SP	CH3 SP	
0	100	100	100	
1	150	150	150	← Switch to bank 1

When the initial channel of a gradient group is switched, the bank of channels allocated for that group will be switched. For 2-PID control groups, the bank can be switched for individual channels in a group.

SECTION 4
Basic Units (TC4 and TC2) Functions

This section describes the functions of EJ1G Basic Units.

4-1 Setting Input Specifications

4-1-1 Input Type

Set the input type to match the type of sensor being used.

Variable type	Parameter name	Setting range	Default
E0/A0	Input Type (Channel)	0 to 29	5

Conditions for use	No special conditions

List of Input Types

Input type		Specifica-tion	Set value	Setting range	
				(°C)	(°F)
Tempera-ture input	Platinum resistance thermom-eter	Pt100	0	−200 to 850	−300 to 1500
			1	−199.9 to 500.0	−199.9 to 900.0
			2	0.0 to 100.0	0.0 to 210.0
		JPt100	3	−199.9 to 500.0	−199.9 to 900.0
			4	0.0 to 100.0	0.0 to 210.0
	Thermo-couple inputs	K	5	−200 to 1300	−300 to 2300
			6	−20.0 to 500.0	0.0 to 900.0
		J	7	−100 to 850	−100 to 1500
			8	−20.0 to 400.0	0.0 to 750.0
		T	9	−200 to 400	−300 to 700
			10	−199.9 to 400.0	−199.9 to 700.0
		E	11	0 to 600	0 to 1100
		L	12	−100 to 850	−100 to 1500
		U	13	−200 to 400	−300 to 700
			14	−199.9 to 400.0	−199.9 to 700.0
		N	15	−200 to 1300	−300 to 2300
		R	16	0 to 1700	0 to 3000
		S	17	0 to 1700	0 to 3000
		B	18	100 to 1800	300 to 3200
		W	19	0 to 2300	0 to 4100
		PLII	20	0 to 1300	0 to 2300
	ES1B Infrared Tempera-ture Sensor	10 to 70°C	21	0 to 90	0 to 190
		60 to 120°C	22	0 to 120	0 to 240
		115 to 165°C	23	0 to 165	0 to 320
		140 to 260°C	24	0 to 260	0 to 500
Analog inputs	Current input	4 to 20 mA	25	Any one of the following ranges, by scaling: −1999 to 9999 −199.9 to 999.9 −19.99 to 99.99 −1.999 to 9.999	
		0 to 20 mA	26		
	Voltage input	1 to 5 V	27		
		0 to 5 V	28		
		0 to 10 V	29		

4-1-2   Temperature Inputs

■ <u>**Temperature Unit**</u>

Either °C or °F can be selected.

Variable type	Parameter name	Setting range	Default
E0/A0	Temperature Unit (Channel)	0: °C/1: °F	0

Conditions for use	The input type must be set to temperature input.

■ <u>**Cold Junction Compensation Method**</u>

Specifies whether cold-junction compensation is performed in the Temperature Controller or externally.

Enable external cold-junction compensation when using two thermocouples to measure a temperature difference or using a external cold-junction compensator for even greater precision.

Variable type	Parameter name	Setting range	Default
E0/A0	Cold Junction Compensation Method (Common)	0: External / 1: Internal	1

Conditions for use	The input type must be set to thermocouple or infrared temperature sensor.

4-1-3   Analog Inputs

When an analog input is selected, scaling can be performed as needed by the control application.

- The Scaling Upper Limit, Scaling Lower Limit, and Decimal Point Position parameters are used for scaling. These parameters cannot be used when a temperature input type is selected.

- The Scaling Upper Limit parameter sets the physical quantity to be expressed by the upper limit value of input, and the Scaling Lower Limit parameter sets the physical quantity to be expressed by the lower-limit value of input. The Decimal Point Position parameter specifies the number of digits below the decimal point.

- The following example shows scaling of an analog input (4 to 20 mA). After scaling, the humidity can be read directly. In this case, the decimal point is set for 1 digit below the decimal point.
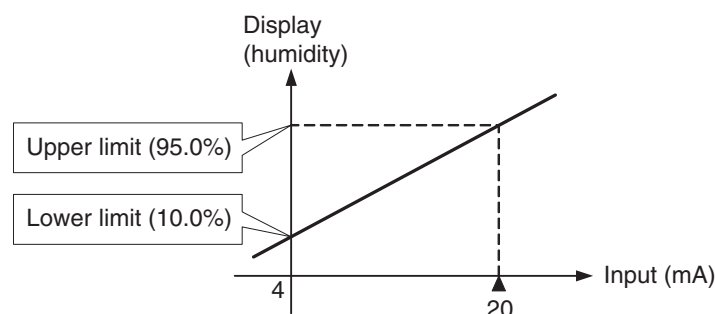
Variable type	Parameter name		Setting range	Default
E0/A0 (See note.)	Scaling Upper Limit	(Channel)	−1999 to 9999	1000
	Scaling Lower Limit	(Channel)	−1999 to 9999	0
	Decimal Point Position	(Channel)	0: **** 1: ***.* 2: **.** 3: *.***	1

Conditions for use	The input type must be set to analog input.

This parameter can be set only when operation is stopped.
Always set the Scaling Upper Limit > Scaling Lower Limit.
If the Scaling Lower Limit > Scaling Upper Limit, the larger value will function as the Scaling Upper Limit.

■ **Setting Example**

In this example, scaling is set to display 0 to 5 V as 10.0% to 95.0%.

Scaling Upper Limit = 950
Scaling Lower Limit = 100
Decimal Point Position = 1

4-1-4   Input Filter

Sets the time constant of the digital input filter.

The following diagram shows the response of the digital filter to a step-wise input of amplitude A.
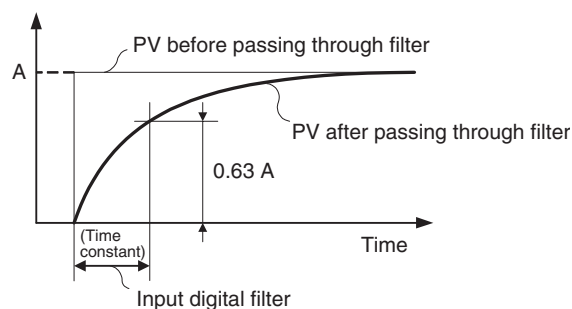
Variable type	Parameter name		Setting range	Default
D5/95	Input Digital Filter	(Channel)	0.0 to 999.9 Second	0.0

Conditions for use	No special conditions

4-2 Setting Output Specifications

4-2-1 Control Output Method

The time-proportional output method is used for the control output.

The MV determines the percentage of time that the output is ON during each control period.
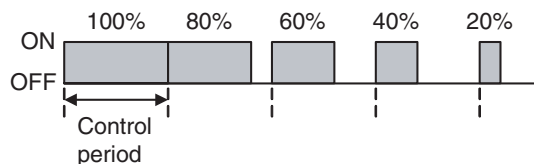
Note Control responsiveness improves as the control period is shortened, but if relays are being used for heater control, the relay lifetime will also be shortened so we recommend using a control period of at least 20 seconds.

Variable type	Parameter name		Setting range	Default
E1/A1	Control Period 1 to 4	(I/O)	0 to 99 s	2

Conditions for use	No special conditions.

Note If the parameter is set to 0, the period will be 0.5 s.

4-2-2 Alarm Outputs (TC2 Units Only)

Output 3 and output 4 from TC2 Units are used to output alarm 1 for the channel assigned to the TC2 Unit.

Example for the Following Groups
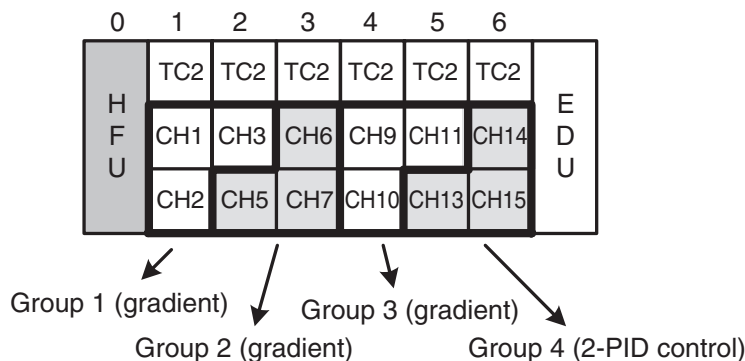
- If alarm 1 for channel 6 turns ON, output 3 from the TC2 Unit with communications unit number 3 turns ON.

- If alarm 1 for channel 10 turns ON, output 4 from the TC2 Unit with communications unit number 4 turns ON.

4-3   Setting Control Specifications

4-3-1   Manipulated Variable (MV)

■ MV at PV Error

The MV will be 0% when an internal communications error (between the HFU and the TC4 or TC2 Unit) occurs.

4-4   Detecting Current Errors

Set the Heater Burnout Hysteresis, Heater Burnout Latch, Heater Short Alarm Hysteresis, and Heater Short Alarm Latch parameters in the TC2 or TC4 Units. Refer to *5-5 Detecting Current Errors* for details.

4-5   Other Functions

4-5-1   Using G3ZA Multi-channel Power Controllers

<u>**Initial Settings**</u>

The following procedure is required in order to use a G3ZA. The G3ZA cannot be used in the condition in which it is shipped.

1,2,3...

1. Connect the G3ZA to a Basic Unit. Up to eight G3ZA Units can be connected to one Basic Unit. If more than eight Units are connected, a configuration error will occur.

2. Turn ON pin 7 of SW2 on the Basic Unit, set SW2 on the G3ZA to 3 (57.6 kbps), and set SW1 on the G3ZA to between 0 and 7 (unit number). The unit number of the G3ZA determines the MV sent from the Basic Unit. For details, refer to *Sending MVs to the G3ZA* on page 57.

3. Turn ON the power supply to the Basic Unit and execute a Register Unit Configuration: Reset operation command. No G3ZA Units are registered in the default Basic Unit settings.

4. Turn OFF the power supply to the Basic Unit and then turn ON the power supply in the following order: G3ZA Units and then the Basic Unit. When the Basic Unit starts, it will automatically scan for connected G3ZA Units.

5. Check the Configuration Error A Status to see if any errors have occurred. If there are no errors, execute a Register Unit Configuration: Register operation command. The next time the Basic Unit is started, it will scan only for the registered G3ZA Units, reducing the startup time.

<u>**Connection Example**</u>

When the EJ1G starts, it scans the connected G3ZA Units and automatically assigns names G3ZA1, G3ZA2, etc., in order starting with the lowest unit number.

Example: In this example, the G3ZA Units have been set to unit numbers 0, 1, 3, and 5.

The following diagram shows how the G3ZA Units are associated with the EJ1G.

Unit 0 $\Rightarrow$ G3ZA1	
Unit 1 $\Rightarrow$ G3ZA2	
Unit 3 $\Rightarrow$ G3ZA3	
Unit 5 $\Rightarrow$ G3ZA4	

G3ZA

Unit No. 0   Unit No. 1   Unit No. 3   Unit No. 5
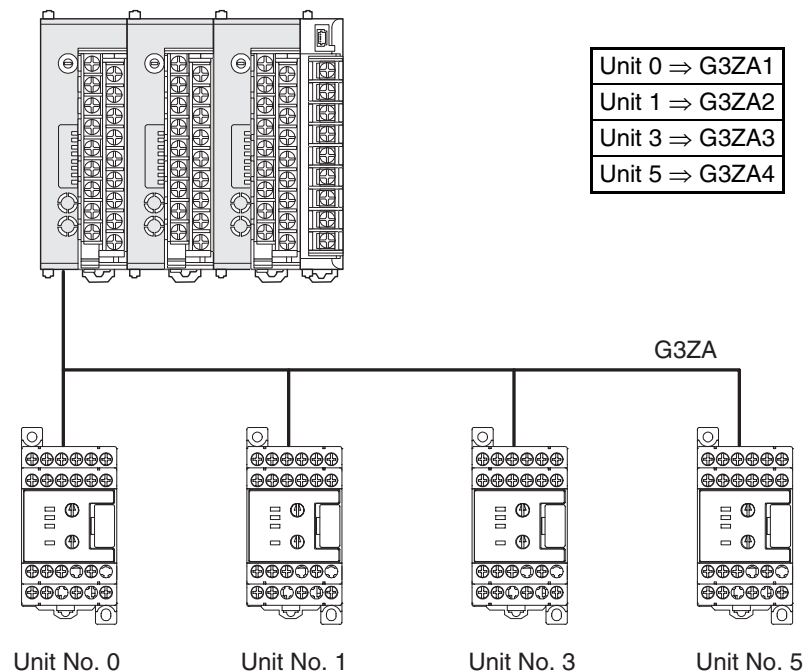
Unit number	Variable type	Parameter name
0	DA/9A	G3ZA1 - CH1 Slope
		G3ZA1 - CH1 2 Slope
		⋮
1		G3ZA2 - CH1 Slope
		G3ZA2 - CH1 2 Slope
		⋮
3		G3ZA3 - CH1 Slope
		G3ZA3 - CH1 2 Slope
		⋮
5		G3ZA4 - CH1 Slope
		G3ZA4 - CH1 2 Slope
		⋮

Settings

The G3ZA settings are read and written through the Basic Unit.

The Basic Unit has addresses allocated in its variable area for use with the G3ZA. The G3ZA set values can be read and written by reading and writing that variable area. Refer to *Parameter List* on page 175 for details on the variable area for the G3ZA. Refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No. Z200) for details on the corresponding functions and settings.

■ **Example**

In this example, G3ZA settings are changed.

Unit No. 1

TC4 | EDU   Host device

Send the following command from the host device to TC4 when setting the Channel 2 Heater Burnout Detection Value to 10 A in the G3ZA with unit number 1.

[STX]0100 01029A0219000001000A [ETX][BCC]

G3ZA   G3ZA

Unit No. 0   Unit No. 1

Sending MVs to the G3ZA
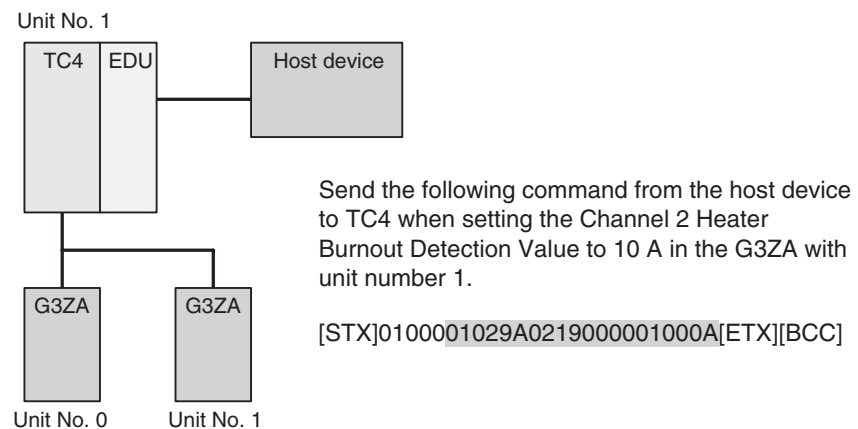
The G3ZA's unit number and model determine which MVs are sent from the EJ1G to the G3ZA.

G3ZA Models with 4 Channels

The EJ1G uses the G3ZA's unit number to determine whether to send heating outputs or cooling outputs.

• G3ZA Units with unit numbers 0 to 7

TC4

CH1 Control Output (Heating)	→
CH2 Control Output (Heating)	→
CH3 Control Output (Heating)	→
CH4 Control Output (Heating)	→

G3ZA

Channel 1 MV
Channel 2 MV
Channel 3 MV
Channel 4 MV
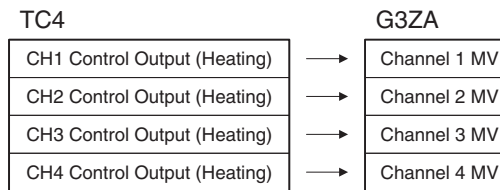
Note With a TC2, the Channel 3 and 4 MVs will be set to 0.0%.

G3ZA Models with 8 Channels

The following outputs will be sent whether the control method is set to standard or heating/cooling control.

TC4

CH1 Control Output (Heating)	→
CH2 Control Output (Heating)	→
CH3 Control Output (Heating)	→
CH4 Control Output (Heating)	→
0.0%	→
0.0%	→
0.0%	→
0.0%	→

G3ZA

Channel 1 MV
Channel 2 MV
Channel 3 MV
Channel 4 MV
Channel 5 MV
Channel 6 MV
Channel 7 MV
Channel 8 MV
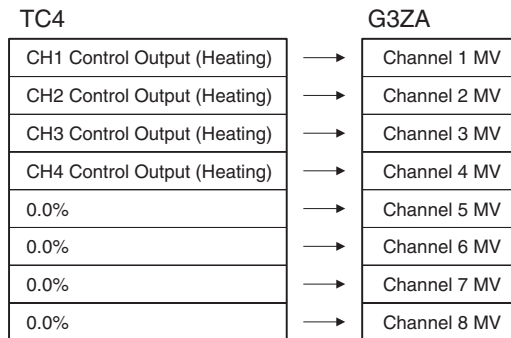
Note With a TC2, the Channel 3 to 8 MVs will be set to 0.0%.

MVs Output from the G3ZA

The outputs of predetermined channels are set in the G3ZA's MV, but any MV can be output to multiple channels by setting the G3ZA's "Source Channel." Arithmetic operations can also be executed on each MV.

⚠**Caution** If the MV is stored or calculated at the G3ZA and the G3ZA is turned ON before the EJ1G, the controlled variable produced at the G3ZA will be output (the output may not be 0.0%) until the EJ1G starts operating. When using MV storage or MV calculation, verify that the controlled variable produced by the G3ZA is appropriate.

■ Example

In this example, the TC4's channel 1 Control output (heating) is output to G3ZA channels 1 to 4.

TC4

CH1 Control Output (Heating)
CH2 Control Output (Heating)
CH3 Control Output (Heating)
CH4 Control Output (Heating)

G3ZA

Channel 1 MV	Operation	Channel 1 controlled variable
Channel 2 MV	Operation	Channel 2 controlled variable
Channel 3 MV	Operation	Channel 3 controlled variable
Channel 4 MV	Operation	Channel 4 controlled variable

Set with the Source Channel parameter.

Set with the Slope and Offset parameters.

G3ZA settings	Set value
CH1 Source Channel	1
CH2 Source Channel	1
CH3 Source Channel	1
CH4 Source Channel	1

Precautions

Always use the G3AZ's current error detection function to detect current errors for G3ZA outputs. The EJ1G current error detection function cannot be used. The G3ZA current error detection function can be used if a 4-channel Basic Unit is used.

This section describes the functions of EJ1G Advanced Unit.

5-1 Setting Input Specifications

5-1-1 Input Type, Temperature Inputs, Analog Inputs, and Input Filter

The input type, temperature inputs, analog inputs, and input filter are set in the TC4 and TC2 Units. Refer to *4-2 Setting Output Specifications* for details.

5-1-2 Decimal Point Position B

The Decimal Point Position B parameter is used to set the decimal point position for the PV. Always set the same decimal point position as the input type set for the TC4 and TC2 Units.

Variable type	Parameter name	Setting range	Default
E0/A0	Decimal Point Position B (Common)	0: **** 1: ***.* 2: **.** 3: *.***	0

Conditions for use	No special conditions.

> **Note** The Decimal Point Position B parameter can be set only when operation is stopped.

Example 1: When the TC4 or TC2 Unit input type is set to 10 (T type thermocouple input, −199.9 to 400.0°C):

Set the Decimal Point Position B parameter to 1 (***.*).

Example 2: When the TC4 or TC2 Unit Input Type parameter is set to 25 (4 to 20 mA current input) and the TC4 or TC2 Unit Decimal Point Position B parameter is set to 2 (**.**):

Set the Decimal Point Position B parameter to 2 (**.**).

5-1-3 Input Shift (Correction)

If there is a significant difference between the temperature at the measurement point and the location where the temperature display is needed so that the display/control performance is unsatisfactory at the present sensor position (measurement point), the temperature difference can be set as an input shift (correction) value.

Variable type	Parameter name	Setting range	Default
D5/95	Input Value 1 for Input Correction (Channel)	−1999 to 9999 EU (See note 1.)	0
	Input Shift 1 (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0
	Input Value 2 for Input Correction (Channel)	−1999 to 9999 EU (See note 1.)	1000
	Input Shift 2 (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0

Conditions for use	No special conditions.

> **Note** (1) The decimal point position will be the value set for the Decimal Point Position B parameter.
>
> (2) The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

Simple Shift:
One-point Shift

The temperature measurements at all points in the sensor range are shifted. For example, make the following settings if you want to increase the temperature by 1.2°C.

- Input Shift 1 = Input Shift 2 = 1.2

Note It is not necessary to set the Input Value 1 for Input Correction or Input Value 2 for Input Correction parameters. Leave these parameters set to their default settings.

When the measured value after the setting is 200°C, the process value will become 201.2°C
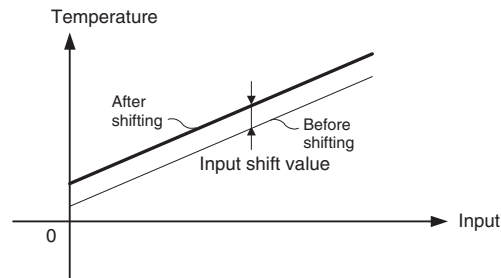
Advanced Shift:
Two-point Shift

A linear compensation can be applied by setting the Input Value 1 for Input Correction in Input Shift 1 and independently setting the Input Value 2 for Input Correction in Input Shift 2. If different shift values are set for Input Shift 1 and Input Shift 2, the slope of the line may be different before and after applying the input shift.
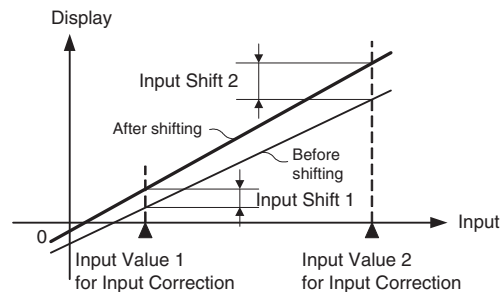
Calculating Input
Shift Values

Measure the temperature at two points: the present value displayed by the EJ1G and the location (control target) that needs to be displayed.

Preparations

1. Set the input type to match the sensor being used.

2. Prepare a thermometer capable of measuring the temperature of the control target as shown in the following diagram so that a 2-point shift can be performed.

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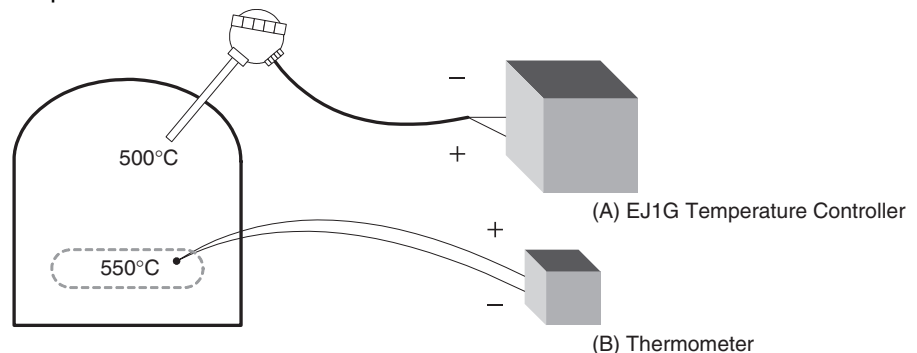
Two-point Shift Method

1,2,3... 1. Shift the controller readout at two reference temperatures, near room temperature and near the value at which the temperature of the control target is to be controlled. Bring the temperature of the control target close to room temperature and close to the set point, and check control target temperature (B) and controller readout (A).

2. Check the temperature of the control target near room temperature (B) and the controller readout (A), and calculate the temperature difference as shown below.

> Object temperature (B) − Controller readout (A)

Set the temperature difference as Input Shift 1 and set the controller readout (A) as Input Value 1 for Input Correction.

3. Check the temperature of the control target near set-point temperature (B) and the controller readout (A), and calculate the temperature difference as shown below.

> Object temperature (B) − Controller readout (A)

Set the temperature difference as Input Shift 2 and set the controller readout (A) as Input Value 2 for Input Correction.

4. After you have set the calculated values, check controller readout (A) and control target temperature (B).

5. In this case, the two-point shift was performed near room temperature and the set-point temperature, but if you want to improve accuracy near the set point, perform the two-point shift at points above and below the set-point temperature. An example shift is shown in the following diagram.
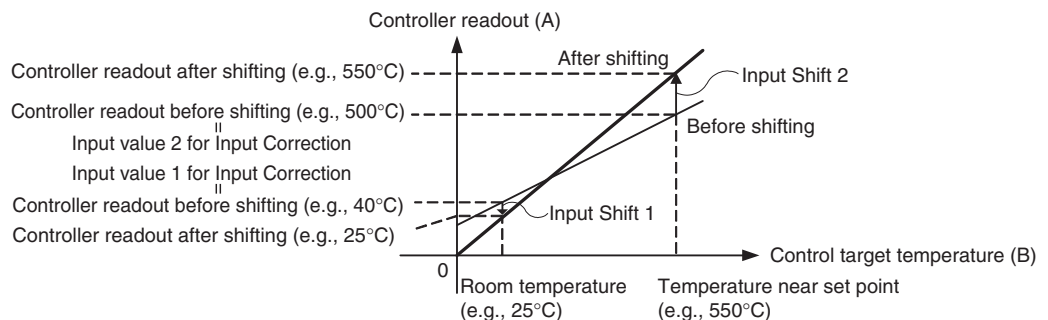
■ **Two-point Shift Example**

In this example, the input type is set to K (5): −200°C to 1,300°C.
Check the temperature of the control target.

When room temperature (B) = 25°C,
the Controller readout (A) = 40°C.

When the temperature near the set point (B) = 550°C,
the Controller readout (A) = 500°C.

In this case, the input shift parameters are calculated as follows:

Input Value 1 for Input Correction = Controller readout (A) = 40°C

Input Shift 1 = Object temperature (B) - Controller readout (A) = 25°C − 40°C = −15.00°C

Input Value 2 for Input Correction = Controller readout (A) = 500°C

Input Shift 2 = Object temperature (B) - Controller readout (A) = 550°C − 500°C = 50.00°C

5-2 Setting Output Specifications

5-2-1 Control Output Method

The control output method is set in the TC4 or TC2 Unit. Refer to *4-2-1 Control Output Method* for details.

5-3 Setting Control Specifications

5-3-1 Starting and Stopping Control

■ Start Control (RUN) and Stop Control (STOP)

The following two methods can be used to start/stop control. For details, refer to the corresponding pages.

1. Starting/stopping control with an operation command: *6-4-11 Operation Commands*

2. Starting/stopping control with an event input: *5-7-2 Event Inputs (TC2)*

■ Operation After Power ON

The operation after power goes ON can be set to Continue, Stop, or Manual mode operation. This setting also applies to operation after a software reset.

Variable type	Parameter name	Setting range	Default
F0/B0	Operation After Power ON (Common)	0: Continue 1: Stop 2: Manual Mode	0

Conditions for use	No special conditions.

Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

Operation After Power ON		Operation
		2-PID control
Continue	RUN/STOP	Retains the status that existed before power went OFF.
	Auto/Manual	Retains the status that existed before power went OFF.
	Manipulated variable	• For Auto mode before power OFF: MV depends on RUN/STOP status. When set to RUN, operation starts from the initial value. When set to STOP, operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.
Stop	RUN/STOP	Stop
	Auto/Manual	Retains the status that existed before power went OFF.
	Manipulated variable	• For Auto mode before power OFF: Operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.
Manual mode	RUN/STOP	Retains the status that existed before power went OFF.
	Auto/Manual	Manual
	Manipulated variable	• For Auto mode before power OFF: Operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.

5-3-2 Selecting the Control Method

Gradient temperature control or 2-PID control can be selected as the control method.

Variable type	Parameter name		Setting range	Default
F1/B1	Control Type	(Group)	0: Gradient temperature control 1: 2-PID control	0

Conditions for use	No special conditions.

Note The control method can be set only while operation is stopped.

If the control method is changed, execute a software reset or cycle the power to enable the setting.

Gradient Temperature Control

Gradient temperature control is set using the Proportional Band (P), Integral Time (I), Derivative Time (D), and Control Balance Coefficient parameters.

■ PID Settings

When using gradient temperature control, use gradient tuning (GT) to set the PID constants.

Gradient tuning will automatically set the optimum PID constants (i.e., the proportional band, integral time, and derivative time).

Note Refer to *5-3-6 Tuning* for information on gradient tuning (GT).

Variable type	Parameter name		Setting range	Default
D0/90	Proportional Band	(Bank)	0.1 to 999.9 EU (See note 2.)	8.0
	Integral Time	(Bank)	0 to 3999 Seconds	233
	Derivative Time	(Bank)	0.0 to 999.9 Seconds	40.0

Conditions for use	No special conditions.

Note (1) Refer to *5-7-1 Bank Function* for information on bank specifications.

(2) The decimal point position is determined by the setting for the Decimal Point Position B parameter. If, however, the Decimal Point Position B parameter is set to 0 (****), it will be treated as setting 1 (***.*).

If the temperature fluctuates even after GT has been executed, adjust using the same PID constants for all channels in the group. The method for adjusting PID is the same as for adjusting PID for 2-PID control. If the performance is still unsatisfactory, use the rules outlined in the following table to adjust the PID for the appropriate channel.

If the temperature is fluctuating for all channels:	Adjust the PID for the initial channel.
If the temperature for the initial channel is fluctuating:	Adjust the PID for the initial channel and channel 1.
If the temperature is fluctuating for the last channel:	Adjust the PID for the last channel.
If the temperature is fluctuating for a channel other than those outlined above:	Adjust the PID for that channel and the next channel.

When Performing 4-channel Gradient Temperature Control

If the temperature is fluctuating for all channels:	Adjust the PID for channel 1.
If the temperature is fluctuating for channel 1 (the initial channel):	Adjust the PID for channel 2.
If the temperature is fluctuating for channel 4 (the last channel):	Adjust the PID for channel 4.
If the temperature is fluctuating for channel 3:	Adjust the PID for channels 3 and 4.

■ **Setting the Control Balance Coefficient**

Refer to *3-2 Adjusting Gradient Temperature Control* for details.

Variable type	Parameter name	Setting range	Default
D5/95	Control Balance Coefficient (Channel)	0.00 to 99.99	0.80

Conditions for use	Gradient temperature control

■ **Setting the Proportional Band x10 Compensation and Alpha Parameters**

The settings are the same as for 2-PID control. Refer to *2-PID Control (Two-degrees-of-freedom PID)* on page 69 for details.

2-PID Control (Two-degrees-of-freedom PID)

The proportional band (P), integral time (I), and derivative time (D) must be set for 2-PID control.

■ **PID Settings**

When the control characteristics are unknown, perform autotuning (AT). When AT is executed, the optimum PID constants for the set point at that time are set automatically.

When the control characteristics are already known, the PID parameters can be set directly to adjust control. The PID parameters are set with the Proportional Band (P), Integral Time (I), and Derivative Time (D) parameters.

Note Refer to *Autotuning (AT)* on page 77 for details on autotuning.

Variable type	Parameter name	Setting range	Default
D0/90	Proportional Band (Bank)	0.1 to 999.9 EU (See note 2.)	8.0
	Integral Time (Bank)	1 to 3999 Seconds	233
	Derivative Time (Bank)	0.0 to 999.9 Seconds	40.0

Conditions for use	No special conditions.
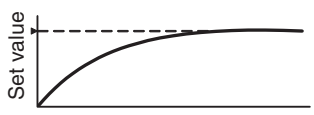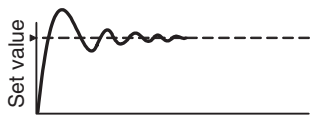
Note (1) Refer to *5-7-1 Bank Function* for details on banks.

(2) The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).
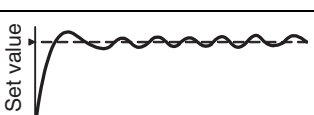
• Proportional action: In proportional action, the MV is proportional to the deviation (control error).

• Integral action: This control action produces an output that is proportional to the time integral of the control error. An offset normally occurs in proportional control, so proportional action is used in combination with integral action. As time passes, this offset disappears and the control temperature (process value) matches the set point.

• Derivative action: This control action produces an output that is proportional to the rate of change of the input. Since proportional control and integral control correct for errors in the control result, the control system will be slow to respond to sudden changes in temperature. The derivative action performs a corrective action by increasing the MV in proportion to the slope of the temperature change.
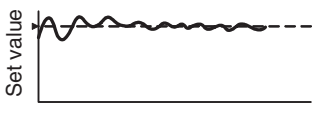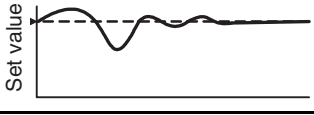
• Effect of Changes to P (Proportional Band)

Increased P		The curve rises gradually and the settling time is long, but overshooting is prevented.
Decreased P		Overshooting and hunting occur, but the set point is reached quickly and the temperature stabilizes.

• Effect of Changes to I (Integral Time)

Increased I		It takes a long time for the process value to reach the set point. It takes time to achieve a stable state, but overshooting, undershooting, and hunting are reduced.
Decreased I		Overshooting and undershooting occur. Hunting occurs. The process value rises quickly.

• Effect of Changes to D (Derivative Time)

Increased D		Overshooting, undershooting, and the settling time are reduced, but fine hunting occurs on the changes themselves.
Decreased D		Overshooting and undershooting are increased and it takes time for the process value to reach the set point.

■ <u>**Proportional Band** × **10 Compensation**</u>

When this parameter is set to *Enabled*, the proportional band is increased by a factor of 10. Use this parameter when the proportional band setting range is insufficient.

Variable type	Parameter name	Setting range	Default
F0/B0	Proportional Band × 10 Compensation (Common)	0: Disabled 1: Enabled	0

Conditions for use	No special conditions.

Note This parameter can be set only while operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

■ <u>**Setting the Alpha**</u>

This parameter sets the 2-PID constant alpha (α).

> **Note** Normally, this parameter is left at its default value.

Variable type	Parameter name	Setting range	Default
D5/95	Alpha (Channel)	0.00 to 1.00	0.65

Conditions for use	No special conditions.

5-3-3 Setting the Set Point

These parameters set the set point.

Variable type	Parameter name	Setting range	Default
D0/90	Set Point (Bank)	−1999 to 9999 EU (See note 2.)	0

Note (1) Refer to *5-7-1 Bank Function* for details on banks.
Set the set point so that it is within the input range as well as the set point limiter range.
If the set point is out-of-range, the internal set point actually used for control will be limited to a value within the input range and set point limiter range.

(2) The decimal point position is the same as set for the Decimal Point Position B parameter.

■ <u>**Set Point Limiter**</u>

These parameters apply a limit to the set point's setting range so that the control subject does not reach an abnormal temperature.

Variable type	Parameter name	Setting range	Default
D5/95	SP Upper Limit (Channel)	−1999 to 9999 EU (See note 3.)	9999
	SP Lower Limit (Channel)	−1999 to 9999 EU (See note 3.)	−1999

Conditions for use	No special conditions.

Note (1) Set the SP Upper and Lower Limits within the input range and also set the SP Upper Limit > SP Lower Limit.
If the SP Lower Limit > SP Upper Limit, the larger value will function as the SP Upper Limit. In addition, if the limit range is set outside of the input range, it will be limited to the input range.

The SP will not be changed automatically, even if the input type or SP Limiter is changed. Although the SP will not be changed automatically, the internal SP used for control will be limited to the input range or SP Limiter (whichever range is narrower).
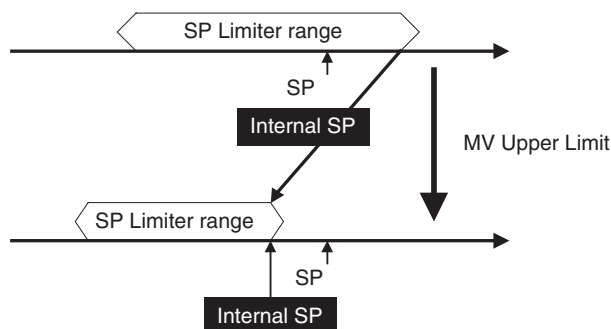
(2) The SP is not changed, but the internal SP used for control is limited by the upper limit of the input range.

(3) The decimal point position is the same as set for the Decimal Point Position B parameter.

5-3-4 Setting the SP Ramp

The SP ramp function restricts the width of changes in the set point as a rate of change. When the SP ramp function is enabled and the change width exceeds the specified rate of change, this function can restrict the set point within an area, as shown in the following diagram.

While the SP ramp function is operating, control will be performed not for the specified set point but rather for the set point restricted by the rate of change set for the SP ramp function.
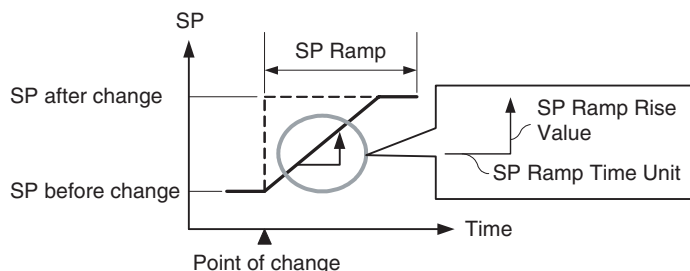
The rate of change during SP ramp operation is specified by the SP Ramp Rise Value, SP Ramp Fall Value, and SP Ramp Time Unit parameters. The SP ramp function will operate when the SP Ramp Rise Value or SP Ramp Fall Value is not set to 0 (disabled).

The Ramp SP can be checked by using the Internal SP parameter.

Variable type	Parameter name		Setting/monitoring range	Default
E5/A5 (See note 1.)	SP Ramp Time Unit	(Channel)	0: Seconds 1: Minutes	1
D0/90	SP Ramp Rise Value	(Bank)	0 to 9999 EU/s or min (See note 2.)	0
	SP Ramp Fall Value	(Bank)	0 to 9999 EU/s or min (See note 2.)	0
C4/84	Internal SP	(Channel)	−1999 to 9999 EU	---

Conditions for use	No special conditions.

Note (1) This parameter can be set only when operation is stopped.

(2) The function is stopped if this parameter is set to 0. The unit is determined by the setting of the SP Ramp Time Unit parameter.
Refer to *5-7-1 Bank Function* for details on banks.
The decimal point position is the same as set for the Decimal Point Position B parameter.

Note Refer to *5-4-7 Alarm SP Selection* for details on alarms during SP ramp operation.

Operation at Startup

If the SP ramp function is enabled when the Controller is turned ON or switched from STOP to RUN mode, the process value may reach the set point using the SP ramp function in the same way as changing the set point. In this case, operation is carried out with the process value regarded as the set point before the change was made.

SP ramp operation at startup depends on the relationship between the process value and the set point, as shown in the following diagrams.
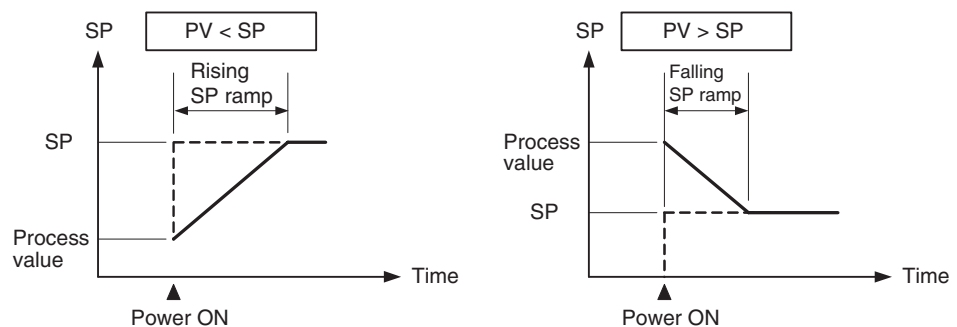
When performing gradient temperature control, the following procedure is used to determine the start point for the SP ramp.

1. The channel in the group with the largest deviation (difference between SP and PV) is found.

2. The PV for the channel with the largest deviation is used as the start point for the SP ramp.

3. For all other channels, the difference is found between that channel's SP and the SP for the channel with the largest deviation. The start point for the SP ramp is the start point for the channel with the largest deviation plus this difference.

Example 1

CH	SP	PS	Deviation	SP set value	SP ramp start point
1	150	25	125	0 (=150-150)	18 (=18+0)
2	150	21	129	0 (=150-150)	18 (=18+0)
3	150	18	132 (max.)	0 (=150-150)	18 (=18+0)

Example 2

CH	SP	PS	Deviation	SP set value	SP ramp start point
1	110	105	5	-5 (=110-115)	95 (=100-5)
2	115	100	15 (max.)	0 (=115-115)	100 (=100-0)
3	120	130	−10	5 (=120-115)	105 (=100+5)

Operation Example using Example 1 Values
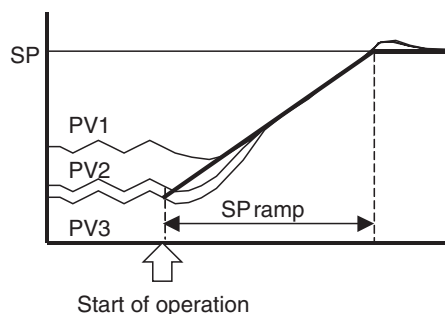
Start of operation

Restrictions during SP Ramp Operation

- Autotuning is started after the SP ramp operation has been completed.
- The SP ramp operation will continue even if operation is switched to manual mode.
- When control is stopped or an error occurs, the SP ramp function will be disabled.

5-3-5 Setting the Manipulated Variable (MV)

■ Manual MV

If control is set to manual mode, the standard control function will stop and the MV set in the Manual MV parameter can be output.

Variable type	Parameter name	Setting range	Default
D5/95	Manual MV (Channel)	–5.0 to 105.0%	0

Conditions for use	The control method must be set to 2-PID control in manual mode.
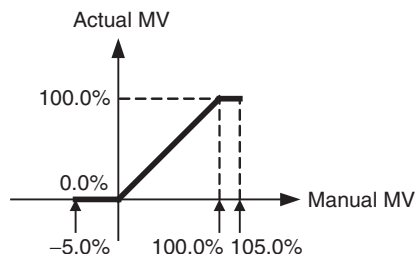
Use an event input or operation command to switch between auto mode (standard control) and manual mode. When using an event input to switch modes, set the Event Input Assignment parameter to Auto (0)/Manual (1). After the event input is set, it will operate as follows:

Event input	Operation
OFF	Auto Mode
ON	Manual Mode

Note Refer to *6-4-11 Operation Commands* for details on using an operation command to switch the mode.
Check the Channel Status parameter (variable type C4/84) to confirm whether the Controller is in auto mode or manual mode.

Operation When Switching between Auto and Manual Modes

The following diagram shows the operation when the mode is switched between auto mode and manual mode.
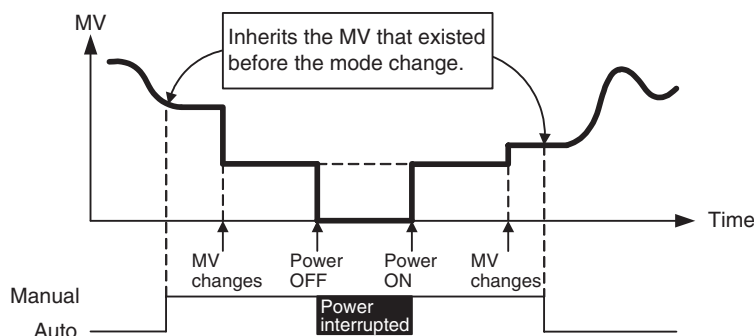
■ **MV at Stop**

This parameter sets the MV when control is stopped.

For heating/cooling control, the MV at Stop parameter applies to the cooling side if the MV is negative and to the heating side if the MV is positive.

The default is 0.0, so an MV will not be output for either standard or heating/cooling control with the default setting.

Variable type	Parameter name	Setting range	Default
D5/95	MV at Stop (Channel)	−5.0 to 105.0%	0

Conditions for use	No special conditions.

The order of priority is as follows: **Manual MV > MV at Stop > MV at PV Error.**

■ **MV at PV Error**

This parameter sets the MV when an input error or remote SP input error occurs.

Variable type	Parameter name	Setting range	Default
D5/95	MV at PV Error (Channel)	−5.0 to 105.0%	0

Conditions for use	No special conditions.

The order of priority is as follows: **Manual MV > MV at Stop > MV at PV Error**.

■ **MV Limiter**

This function limits the MV output by applying upper and lower limits to the calculated MV.

- The following MVs take priority over the MV limits.
  - Manual MV
  - MV at Stop
  - MV at PV Error
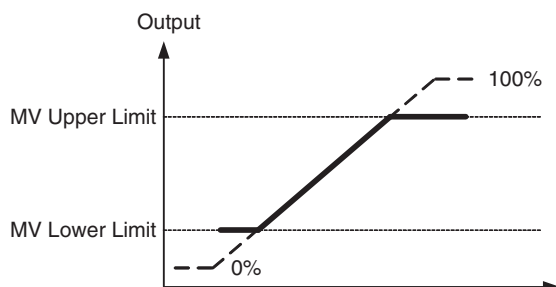
Variable type	Parameter name	Setting range	Default
D5/95	MV Upper Limit (Channel)	−5.0 to 105.0%	105.0
	MV Lower Limit (Channel)	−5.0 to 105.0%	−5.0

Conditions for use	No special conditions.

Note Set the limits so that the MV Upper Limit > MV Lower Limit.
If the MV Lower Limit > MV Upper Limit, the larger value will function as the MV Upper Limit.

5-3-6 Tuning

Gradient Tuning (GT) Gradient temperature control finds the relationship between points with mutual interference and performs control. Gradient tuning (GT) is a series of operations that automatically measure the degree of mutual interference and executes PID tuning at the same time, to adjust the internal parameters that are used to find this relationship.

Always execute GT only when all groups (including 2-PID control groups) are stopped.

- GT cannot be executed in RUN or MANUAL modes.

- An operation command is used to execute and cancel GT. Refer to *6-4-11 Operation Commands* for details.

- GT automatically calculates the differences in characteristics of the different control objects for each channel and finds the relationship between these differences. As a result, the differences in characteristics for each channel does not appear as differences in PID values. The PID values calculated using GT will be the same for all channels in the group.

- GT will stop under the following conditions.

  - If an input error has occurred.

  - If the PV for the channel with outputs ON exceeds the SP.

  - If an operation command is executed for STOP or MANUAL modes or to cancel GT.

  - If the Operation During Error (Selection A/C/D) parameter is set to MV at PV Error or the conditions for stopping control have been occurred

  - If an internal communications error has occurred

  - If the internal parameters cannot be calculated correctly from the GT measurement results

- The following parameters are usually used at the default settings.

Variable type	Parameter name	Setting range	Default
E5/A5	GT Natural Cooling Time (Common)	0 to 9999 s	300
	GT Stabilization Band (Common)	0.0 to 999.9 EU (See note 2.)	1.0

Conditions for use	Gradient temperature control

Note (1) This parameter can be set only while operation is stopped.

(2) The decimal point position is determined by the setting for the Decimal Point Position B parameter. If, however, the Decimal Point Position B parameter is set to 0 (****), it will be treated as being set to 1 (***.*).

■ **GT Natural Cooling Time**

Channel outputs within a group turn ON in order during GT. The time from when one output turns OFF until the next output turns ON can be adjusted using the GT Natural Cooling Time parameter.

If here is a period where the temperature for the previous channel has not returned to room temperature by the time the next output turns ON, increase the setting for the GT Natural Cooling Time. If, on the other hand, channels immediately return to room temperature in all periods, then shorten the GT Natural Cooling Time. This will shorten the execution time for GT.

■ **GT Stabilization Band**

If the temperature of a channel increases by more than the value set for the GT Stabilization Band parameter after the output turns ON, the increase is treated as the effect of interference.

Autotuning (AT)

When autotuning (AT) is executed, the MV is forcibly changed, the control subject's characteristics are observed (with the limit cycle method), and the best PID constants are automatically set for the SP during execution.

- Autotuning cannot be executed while control is stopped, during manual mode operation, or during ON/OFF control.

- Use an operation command to execute autotuning. For details, refer to *6-4-11 Operation Commands*.

- The only parameters that can be received during autotuning are RUN/STOP, Auto/Manual, AT Execute/Cancel, Alarm 1/2/3 Latch Cancel, and Alarm Latch Cancel All. Other parameters cannot be changed.

- If the STOP parameter is set during autotuning, autotuning will be cancelled and operation will stop. Autotuning will not be restarted even if RUN is set again.

- Normally the following parameters are left at their default settings.

Variable type	Parameter name		Setting range	Default
E5/A5	AT Calculated Gain	(Common)	0.1 to 10.0	0.8
	AT Hysteresis	(Channel)	0.1 to 999.9 EU (See note 2.)	0.8
	Limit Cycle MV Amplitude	(Common)	5.0 to 50.0%	20.0
	Temporary AT Execution Judgment Deviation	(Channel)	0.0 to 999.9 EU (See note 2.)	150.0

Conditions for use	The control method must be set to standard control and 2-PID control.

Note (1) This parameter can be set only when operation is stopped.

(2) The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

■ **AT Calculated Gain**

Sets the gain used when calculating the PID constants in autotuning. When emphasizing flexibility, decrease the set value. When emphasizing stability, increase the set value.

■ **AT Hysteresis**

The limit cycle operation during autotuning has a hysteresis when switching ON and OFF. This parameter sets that hysteresis value.

■ **Limit Cycle MV Amplitude**

Sets the MV amplitude during limit cycle operation in autotuning.

> **Note** This parameter is disabled for 100% AT.

■ **Temporary AT Execution Judgment Deviation**

When autotuning has been executed, temporary autotuning will be executed if the deviation specified in this parameter is exceeded.

> **Note** This parameter is disabled for 100% AT.

■ **40% AT**

- The width of MV variation in the limit cycle can be changed with the Limit Cycle MV Amplitude parameter. In this case, autotuning will take longer to execute than it does with 100% AT.

- The timing of the limit cycle's onset depends on whether the deviation at the start of autotuning (DV) is less than the Temporary AT Execution Judgment Deviation.
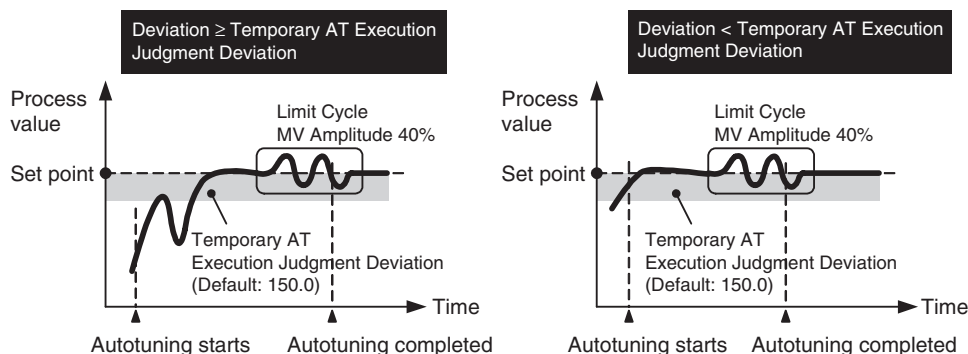
■ **100% AT**

- When autotuning starts, it operates as shown below regardless of the deviation (DV). When you want to shorten the time it takes for autotuning, select 100% AT.

> **Note** The Limit Cycle MV Amplitude and Temporary AT Execution Judgment Deviation parameters are disabled.
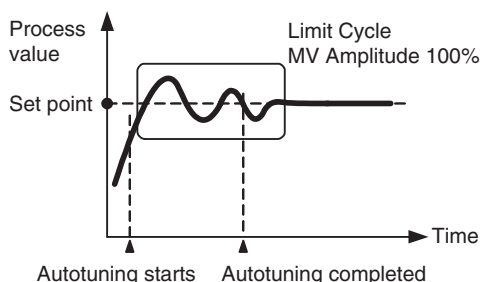
5-3-7 Disturbance Overshoot Adjustment Function

The Disturbance Overshoot Adjustment Function adjusts the control waveform when an external disturbance impacts the system.

- When using this function, set the Disturbance Overshoot Adjustment Function parameter to 1 (Enabled).

- The disturbance response waveform can be adjusted with the Disturbance Gain and Disturbance Time Constant parameters.

Variable type	Parameter name	Setting range	Default
E5/A5 (See note 1.)	Disturbance Overshoot Adjustment Function (Common)	0: Disabled 1: Enabled	0
D5/95	Disturbance Gain (Channel)	−1.00 to 1.00	0.65
	Disturbance Time Constant (Channel)	0.01 to 99.99 s	1.00
	Disturbance Rectification Band (Channel)	0.0 to 999.9 EU (See note 2.)	0.0
	Disturbance Judgment Width (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0

Conditions for use	No special conditions.

Note
(1) This parameter can be set only when operation is stopped.

(2) The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

■ **Disturbance Gain**

- Overshooting due to a disturbance can be suppressed more by increasing the Disturbance Gain.

- Overshooting due to a disturbance can be increased by decreasing the Disturbance Gain.

- If the Disturbance Gain is set to 0, the Disturbance Overshoot Adjustment Function will not operate.
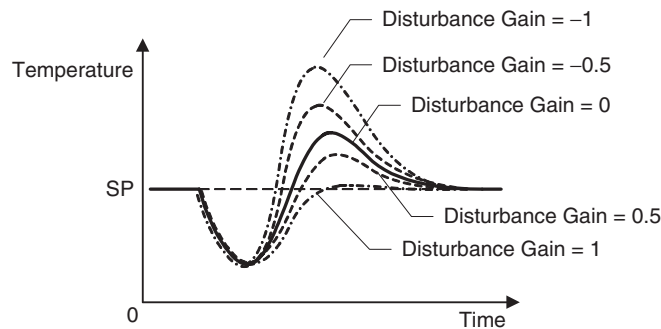
■ **Disturbance Time Constant**

The recovery time from the disturbance can be made longer by increasing the Disturbance Time Constant. The Disturbance Time Constant is normally left at its default setting of 1. Use this parameter for fine-tuning when adjusting the Disturbance Gain alone is not sufficient.
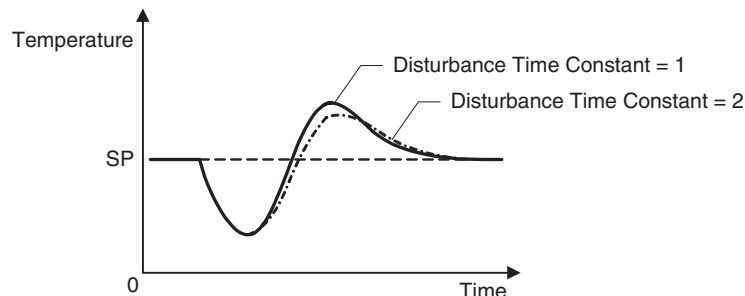
Note The waveform shown in the diagram above will vary depending on the control object's characteristics and the PID constant settings.

Starting Conditions for the Disturbance Overshoot Adjustment Function

The Disturbance Overshoot Adjustment Function will operate after the process value (PV) has stabilized in the Disturbance Rectification Band and the deviation is larger than the Disturbance Judgment Width.

- When the Disturbance Judgment Width is positive, the Disturbance Overshoot Adjustment Function will operate if a disturbance causes the process value (PV) to fall. When the Disturbance Judgement Width is negative, the Disturbance Overshoot Adjustment Function will operate if a disturbance causes the process value (PV) to rise.

- The Disturbance Overshoot Adjustment Function will not operate in the following situations:

  - When the Disturbance Rectification Band or Disturbance Judgment Width parameter is 0

  - When the set point is changed (when the set point change width exceeds the Disturbance Rectification Band)

  - During autotuning
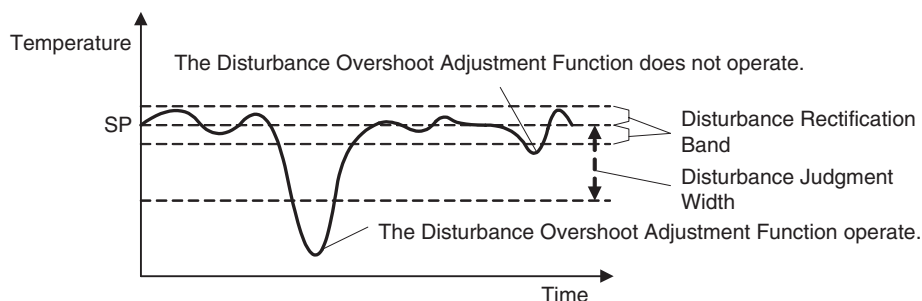
5-3-8 Operation during Errors

This parameter can be used to select the operation when an error occurred.

Variable type	Parameter name	Setting range	Default
F0/B0	Operation During Error (Selection A) (Common)	0: Notification only (continue) 1: MV at PV Error 2: Stop control	0
	Operation During Error (Selection C) (Common)		0
	Operation During Error (Selection D) (Common)		0

Conditions for use	Operation During Error (Selection A): Programless Communications
	Operation During Error (Selection C/D): No special conditions

Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

- The following table lists the errors for which error operation is determined for each parameter

Parameter name	Error for which operation is determined	Operation target
Operation During Error (Selection A)	• Programless link errors	All channels
Operation During Error (Selection C)	• Input errors • G3ZA zero-cross errors • Communications error with G3ZA	Gradient temperature control: Individual groups 2-PID control: Individual channels
Operation During Error (Selection D)	• Heater overcurrent • HB (heater burnout) alarm • HS (SSR failure) alarm	Same as above

- Each setting indicates the operation when the error occurs.

Setting	Operation at error
0: Notification only (Continue)	Control continues. If, however, the Operation During Error (Selection C) parameter is set to 0 (Notification only (Continue)) and an input error occurs, the MV at PV error will be output.
1: MV at error	The value set for the MV at PV Error parameter is output and a normal output is restored when the error has been cleared. The MV at PV error is set using the MV at PV Error (variable type D5/95) parameter. Refer to *MV at PV Error* on page 75 for details.
2: Control stop	Control stops. To start control again, clear the error then execute a RUN operation command. For the Operation During Error (Selection D) parameter, however, the current cannot be recalculated because control is stopped, so the error cannot be cleared. To restart control, first execute a Reset Error operation command then a RUN operation command.

Note The error that has occurred can be checked by reading the status.

Operation examples for the group settings shown in the following diagram are listed below.
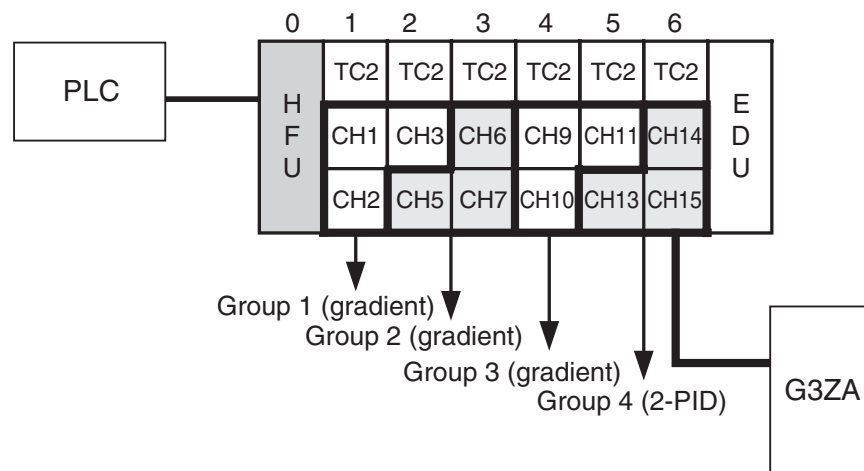
- If a programless link error occurs while the Operation During Error (Selection A) parameter is set to 1 (MV at PV error):

  The value set for the MV at PV Error parameter for each channel is output for each channel.

- If an input error occurs at channel 6 while the Operation During Error (Selection C) parameter is set to 2 (control stopped):
  Group 2 will change to STOP mode (control stopped).

- If a zero-cross error has occurred at the G3ZA while the Operation During Error (Selection C) parameter is set to 2 (control stopped):

  Group 2 will change to STOP mode (control stopped).

  A zero-cross error will occur for all channels at Communications Unit No. 6 connected to the G3ZA and channels 14 and 15 will change to STOP mode (control stopped).

- If a HB alarm occurs at channel 13 while the Operation During Error (Selection D) parameter is set to 0 (Notification only (Continue)).

  Channel 13 will continue control. The HB alarm status for channel 13 can be checked at bit 11 (Basic Unit Alarm) of Channel Alarm Status - CH13 for variable type C4/84, address 0D02.

5-4 Setting Alarm Specifications

5-4-1 Alarm Types

Set the alarm type for each of the alarms in Alarm 1 Type, Alarm 2 Type, and Alarm 3 Type (variable type: E3/A3).

Set value	Alarm type	Alarm Output Function	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1 (See note 1.)	Upper and lower limit		(See note 2.)
2 Default	Upper limit		
3	Lower limit		
4 (See note 1.)	Upper and lower-limit range		(See note 3.)
5 (See note 1.)	Upper and lower-limit alarm with standby sequence	(See note 5.)	(See note 4.)
6	Upper-limit alarm with standby sequence		
7	Lower-limit alarm with standby sequence		
8	Absolute-value upper limit		
9	Absolute-value lower limit		
10	Absolute-value upper limit with standby sequence		
11	Absolute-value lower limit with standby sequence		

Note (1) With set values 1, 4 and 5, the upper and lower limit values can be set independently for each alarm type, and are expressed as "L" and "H."

(2) Set value: 1, Upper and lower-limit alarm
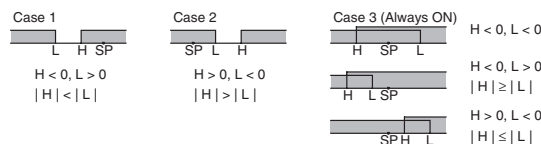
(3) Set value: 4, Upper and lower-limit range
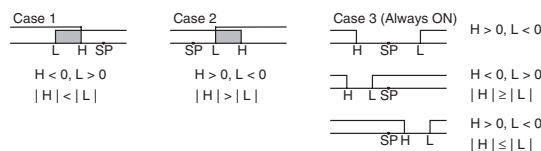
(4) Set value: 5, Upper and lower-limit with standby sequence

   Note   For the above upper and lower-limit alarm:

   • In cases 1 and 2 above, the alarm is always OFF if the hysteresis overlaps the upper and lower limits.

   • In case 3, the alarm is always OFF.

(5) Set value: 5, Upper and lower-limit with standby sequence

   • The alarm is always OFF when the hysteresis overlaps the upper and lower limits.

5-4-2   Alarm Value

Alarm values are indicated by "X" in the table on the previous page. When the upper and lower limits are set independently, "H" is displayed for upper limit values, and "L" is displayed for lower limit values.

Variable type	Parameter name	Setting range	Default
D0/90	Alarm Value 1 to 3 (Bank)	−1999 to 9999 EU (See note 2.)	0

Conditions for use	The alarm type must not be set to an upper and lower limit alarm.

Variable type	Parameter name	Setting range	Default
D0/90	Alarm Upper Limit Value 1 to 3 (Bank)	−1999 to 9999 EU (See note 2.)	0
	Alarm Lower Limit Value 1 to 3 (Bank)	−1999 to 9999 EU (See note 2.)	0

Conditions for use	The alarm type must be set to an upper and lower limit alarm, upper and lower limit range alarm, or upper and lower limit alarm with standby sequence.

   Note   (1) Refer to *5-7-1 Bank Function* for details on banks.

   (2) The decimal point position is the same as set for the Decimal Point Position B parameter.

5-4-3   Alarm Hysteresis

   • The hysteresis of alarm outputs when alarms are switched ON/OFF can be set as follows:
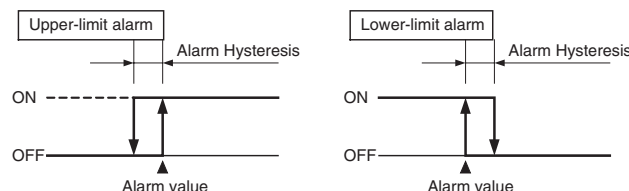
   • Alarm hysteresis can be set separately for each alarm.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Hysteresis (Channel)	0.1 to 999.9 EU	0.2

Conditions for use	The alarm type must not be set to 0.

   Note   This parameter can be set only when operation is stopped.
   The decimal point position is determined by the sensor selection. With analog

inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

5-4-4 Standby Sequence

The standby sequence can be used so that an alarm will not be output until the process value leaves the alarm range once and then enters it again.

For example, with a lower limit alarm, the process value will normally be below the set point, i.e., within the alarm range, when the power supply is turned ON, causing an alarm to be output. If the lower limit alarm with standby sequence is selected, an alarm will not be output until the process value increases above the alarm set value, i.e., until it leaves the alarm range, and then falls back below the alarm value.
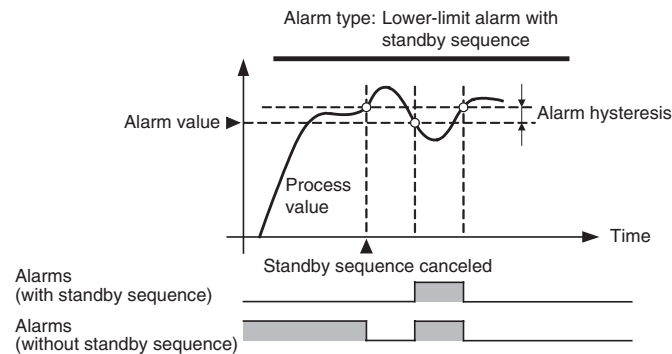
■ **Restarting the Standby Sequence**

- If an alarm is output, the standby sequence is canceled, but the standby sequence will start again after any of the following operations.

Restart conditions	• When control starts (including power ON) or when the alarm value (upper/lower-limit alarm value) or input shift value (upper/lower-limit temperature input shift value) is changed
	• When the set point is changed
	• When the bank is switched
	• When the alarm type is changed
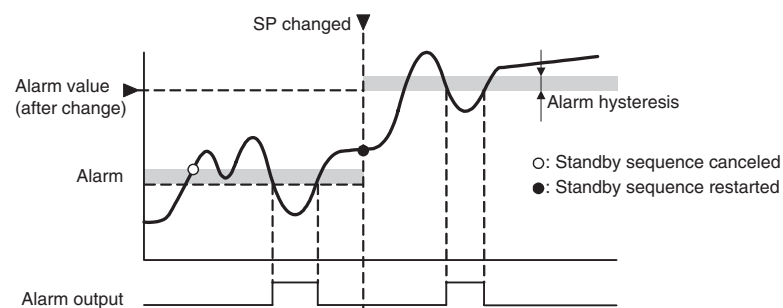
5-4-5   Alarm Latch

The alarm latch can be used to keep an alarm ON once it goes ON.

The latch can be released to turn OFF the alarm by executing an operation command (Latch Cancel or Software Reset). Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Latch (Channel)	0: Disabled 1: Enabled	0

Conditions for use	The alarm type must not be set to 0.

Note   This parameter can be set only when operation is stopped.

5-4-6   Closed in Alarm or Open in Alarm

When Close in Alarm is set, the alarm output function's status will be output as-is. When Open in Alarm is set, the alarm output function's status will be reversed before being output.

	Alarm Output Function	**Alarm Output**
Close in Alarm	ON	ON
	OFF	OFF
Open in Alarm	ON	OFF
	OFF	ON

The alarm output will be OFF (open) when the power is interrupted and for about 3 seconds after the power is turned ON, regardless of the Close in Alarm/Open in Alarm setting.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Open in Alarm (Channel)	0: Closed 1: Open	0

Conditions for use	No special conditions.

Note   This parameter can be set only when operation is stopped.

5-4-7   Alarm SP Selection

During SP ramping, this parameter specifies whether alarm operation is performed on the ramping SP or the SP that will be reached after ramping.
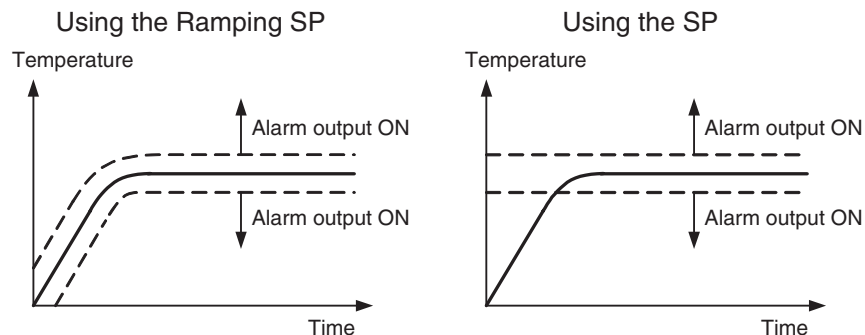
Note The alarm type is set to 1 (Upper and lower limit).

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 SP Selection (Channel)	0: Ramping SP 1: SP	0

Conditions for use	The alarm type must be set to a deviation alarm and the SP Ramp function must be enabled.

Note This parameter can be set only when operation is stopped.

5-4-8 Channel Alarm Status

The alarm status can be monitored.

Variable type	Parameter name	Setting range	Default
C4/84	Channel Alarm Status (Channel)	Refer to *Channel Alarm Status* on page 205.	---

Conditions for use	The alarm type must not be set to 0.

5-5 Detecting Current Errors

5-5-1 Heater Burnout Alarm (HB Alarm)

A heater burnout is detected by measuring the heater current while the control output (heating) is ON. For details, refer to the following table. (Heater burnout detection cannot be used with the control output for cooling.)

Control output (heating)	Power to heater	HB Alarm output
ON	Yes (Normal) (See note 1.)	OFF
	No (Heater burnout)	ON
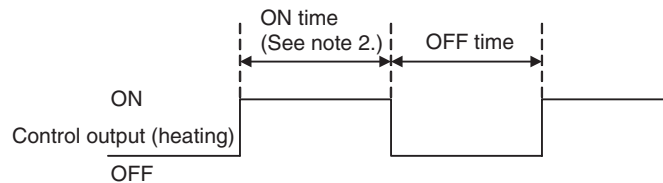
Note (1) In the above diagram, power is considered to be ON (normal) if the heater current is greater than the heater burnout detection current during the ON time. If the heater is burned out, the current measured at the current transformer decreases. When the current falls below the channel's Heater Burnout Detection Value, a heater burnout alarm (HB Alarm) will be output.

(2) Heater burnouts are not detected if the control output (heating) ON time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

Variable type	Parameter name	Setting range	Default
D6/96 (See note 3.)	Heater Burnout 1 or 2 Detection (Channel)	0.0: HB Alarm OFF 0.1 to 99.9 A 100.0: HB Alarm ON	0.0
E4/A4 (See note 4.)	Heater Burnout 1 or 2 Hysteresis (I/O)	0.1 to 100.0 A	0.1
C5/85	Heater Current Value 1 or 2 Monitor (Channel)	0.0 to 110.0 A	---

Conditions for use	There must be a CT input.

(3) The HB Alarm can be forced OFF or ON, regardless of the actual heater current value, by setting the Heater Burnout Detection parameter to 0.0 or 100.0. Use the 0.0 and 100.0 settings to check operation.

(4) The hysteresis setting prevents chattering at the detection point.
Set this parameter in the TC2/4 Unit.

• Turn the heater ON before the EJ1G, or turn both ON simultaneously. If the heater power is turned ON after turning ON the EJ1G, the HB Alarm will be output.

• Control will be continued even when there is an HB Alarm.

• The rated current value may sometimes differ slightly from the actual current flowing to the heater. Check the current value in an actual operating state in the Heater Current Monitor Value 1 or 2 parameter.

- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through once will double the detection current.

Load line

CT
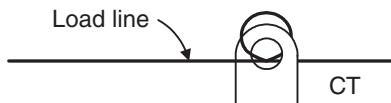
■ Heater Burnout Latch and Latch Cancel

The heater burnout alarm latch can be used to keep the HB Alarm ON once it goes ON.

The latch can be released by executing an operation command (Reset Error or Software Reset), cycling the power, or setting the Heater Burnout Detection Value to 0.0 A. Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name		Setting range	Default
E4/A4	Heater Burnout 1 or 2 Latch	(I/O)	0: Disabled 1: Enabled	0

Note Set this parameter in the TC2/4 Unit.

Installing Current Transformers (CT) (HB Alarm)

Connect the CT in advance to terminals A8 and A9 (CT1) or A7 and A9 (CT2), and pass the heater power line through the CT's hole. Refer to *Current Transformer* on page 172 for details on compatible CT specifications, models, and dimensions.

Single-phase Heaters
Install the CT as shown below.

Load | Load: Heater (example)

AC line

CT

To CT input
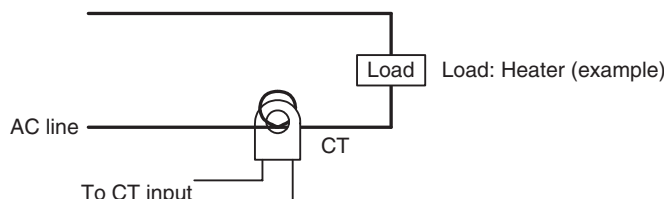
Calculating the Heater Burnout Detection Current Value

Calculate the set value with the following equation:

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

- To set the value of the heater burnout when two or more heaters are connected through the CT, use the current value of the smallest heater connected. (When all of the heaters have the same current value, use the current value when one of the heaters has burned out.)

- Be sure that the following conditions are satisfied:

    Heater with a current of less than 10.0 A:
    Current value at normal operation – Current value at heater burnout ≥ 1 A
    When the difference is less than 1 A, detection is unstable.
    Heater of current 10.0 A or more:
    Current value at normal operation – Current value at heater burnout ≥ 2.5 A
    When the difference is less than 2.5 A, detection is unstable.

- The setting range is 0.1 to 99.9 A. Heater burnout is not detected when the setting is 0.0 or 100.0. When the set value is 0.0, the HB alarm is turned OFF. When the set value is 100.0 the HB alarm is turned ON.
- Set the total current value at normal heater operation to 100 A or less.

■ **Examples**

1. Single-phase Heaters

Example 1   Using a 200-VAC, 1-kW Heater

Normal operation   Heater burnout occurred
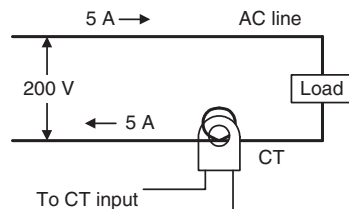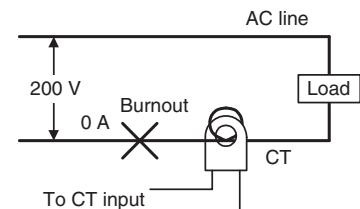
The heater current is 5 A when the current is normal, and 0 A when there is a burnout, so the heater burnout detection current is calculated as follows:

$$\therefore \text{Heater burnout detection current} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

$$= \frac{5 + 0}{2} = 2.5 \text{ A}$$

Example 2   Using Three 200-VAC, 1-kW Heaters

Normal operation   Heater burnout occurred
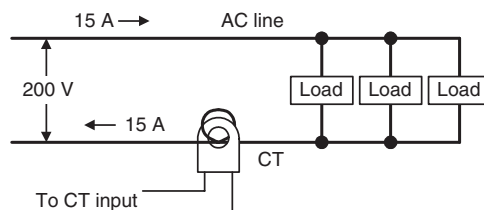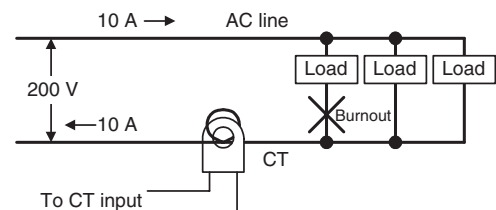
The heater current is 15 A when the current is normal, and 10 A when there is a burnout, so the heater burnout detection current is calculated as follows:

$$\therefore \text{Heater burnout detection current} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

$$= \frac{15 + 10}{2} = 12.5 \text{ A}$$

5-5-2   Heater Short Alarm (HS Alarm)

The HS Alarm detection function measures the heater current when the control output (heating) is OFF. For details, refer to the following table.
(HS Alarm detection cannot be used with the control output for cooling.)

Control output (heating)	Power to heater	HS Alarm output
OFF	Yes (HS alarm occurred)	ON
	No (Normal) (See note 1.)	OFF
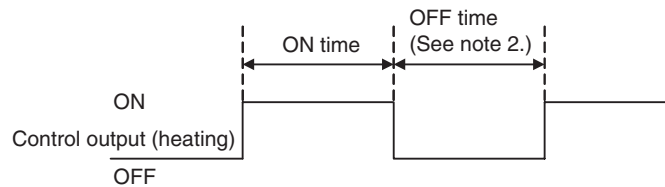
Note   (1) In the above diagram, power is considered to be OFF (normal) if the leakage current is less than the HS alarm current during the OFF time. If the SSR output is short-circuited, the measured current will increase beyond the HS alarm value and an HS Alarm will be output.

       (2) HS alarms are not detected if the control output (heating) OFF time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

Variable type	Parameter name	Setting/monitoring range	Default
D6/96 (See note 3.)	HS Alarm 1 or 2 (Channel)	0.0: HS Alarm ON 0.1 to 99.9 A 100.0: HS Alarm OFF	100.0
E4/A4 (See note 4.)	HS Alarm 1 or 2 Hysteresis (I/O)	0.1 to 100.0 A	0.1
C5/85	Leakage Current Value 1 or 2 Monitor (Channel)	0.0 to 110.0 A	---

Conditions for use	There must be a CT input.

       (3) The HS Alarm can be forced ON or OFF, regardless of the actual leakage current value, by setting the HS Alarm parameter to 0.0 or 100.0. Use the 0.0 and 100.0 settings to check operation.

       (4) This parameter can be set only when operation is stopped.
The hysteresis setting prevents chattering at the detection point.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

- Control will be continued even when there is an HS Alarm.

- The rated current value may sometimes differ slightly from the actual current flowing to the heater. Check the current value in an actual operating state in the Leakage Current Value Monitor parameter.

- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through once will double the detection current.

■ <u>**HS Alarm Latch and Latch Cancel**</u>

The HS alarm latch can be used to keep an HS alarm ON once it goes ON. The latch can be released by executing an operation command (Reset Error or Software Reset), cycling the power, or setting the HS Alarm parameter to 100.0 A. Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name		Setting range	Default
E4/A4	HS Alarm 1 or 2 Latch	(I/O)	0: Disabled 1: Enabled	0

Note Set this parameter in the TC2/4 Unit.

<u>Installing Current Transformers (CT) (HS Alarm)</u>

For details, refer to *Installing Current Transformers (CT) (HB Alarm)* on page 89.

<u>Calculating the Heater Short Detection Current Value</u>

For details, refer to *Calculating the Heater Burnout Detection Current Value* on page 89.

5-6 Programless Communications

Communications with PLCs from OMRON (SYSMAC CS/CJ Series) and Mitsubishi Electric (MELSEC-Q/QnAS Series) can be performed without creating ladder programs.

Using programless communications enables monitoring and changing settings for the EJ1G by simply reading and writing to PLC memory. The EJ1G automatically performs communications with PLCs so no time-consuming communications programming is required.
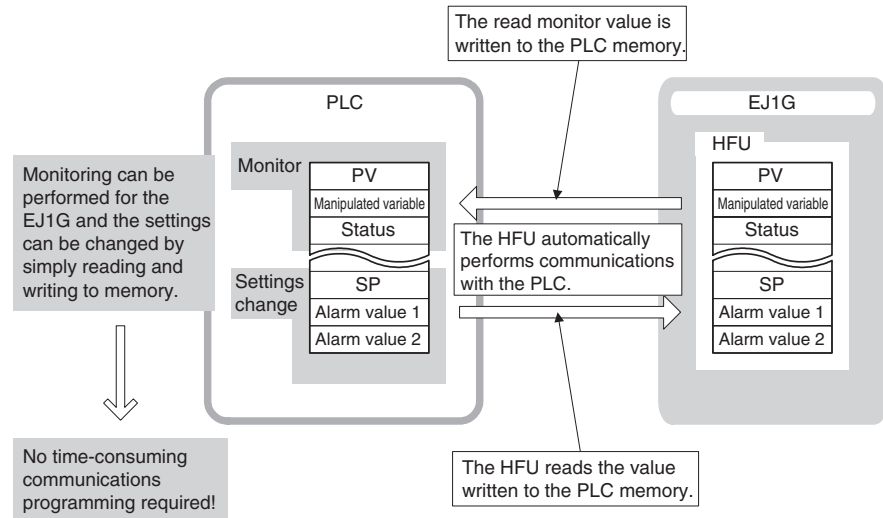
5-6-1 Connectable Devices

SYSMAC CS/CJ Series

Name	Model	Communications port	
		Port 1	**Port 2**
Serial Communications Unit	CJ1W-SCU21-V1	RS-232C	RS-232C
	CJ1W-SCU41-V1	RS-422A/485	RS-232C
	CS1W-SCU21-V1 (See note.)	RS-232C	RS-232C
Serial Communications Board	CS1W-SCB21-V1 (See note.)	RS-232C	RS-232C
	CS1W-SCB41-V1 (See note.)	RS-232C	RS-422A/485
CPU Unit	CS/CJ Series	---	RS-232C

Note (1) Use only products manufactured on or after December 20, 1999.
For details, refer to the *CS/CJ Series Serial Communications Boards/Units* Operation Manual (Cat. No. W336).

(2) Programless communications may stop if a momentary power interruption occurs at the CPU Unit when programless communications are being used for a communications port on the CPU Unit. If they do stop, either cycle the EJ1G power supply or execute a software reset.

MELSEC-Q/QnAS Series

Name	Model	Communications port	
		Channel 1	Channel 2
Q-compatible Serial Communications Unit	QJ71C24N QJ71C24	RS-232C	RS-422/485
	QJ71C24N-R2 QJ71C24-R2	RS-232C	RS-232C
	QJ71C24N-R4	RS-422/485	RS-422/485
QnAS-compatible Serial Communications Unit	A1SJ71QC24N	RS-232C	RS-422/485
	A1SJ71QC24N-R2	RS-232C	RS-232C

Note Direct connections to the EJ1G are possible only with RS-232C or RS-422.

5-6-2 Checking Operation

Checking Operation with SYSMAC CS/CJ Series PLCs

This section describes how to check operation for the configuration shown below.
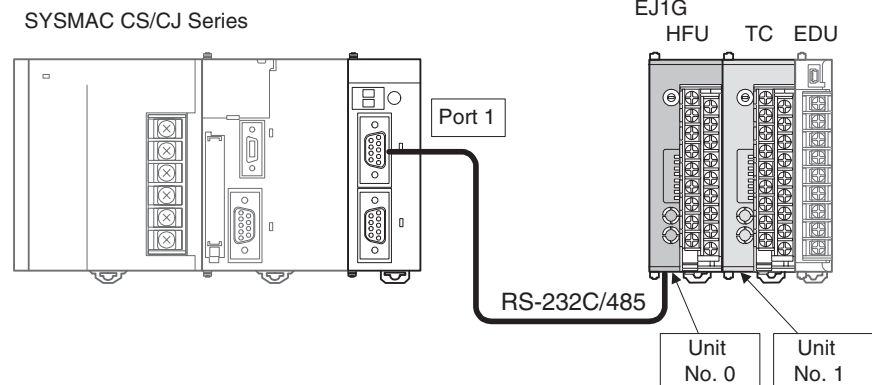
1,2,3... 1. Connect the EJ1G and PLC.

Connect the EJ1G-HFU and Serial Communications Unit as shown in the following diagram.

• RS-232C

SYSMAC
CJ/CS Series
RS-232C

EJ1G-HFU

Pin No.	Signal
2	SD
3	RD
4	RS
5	CS
9	SG
Shell	FG

Shield

A7 SD
A8 RD RS-232C
A9 SG
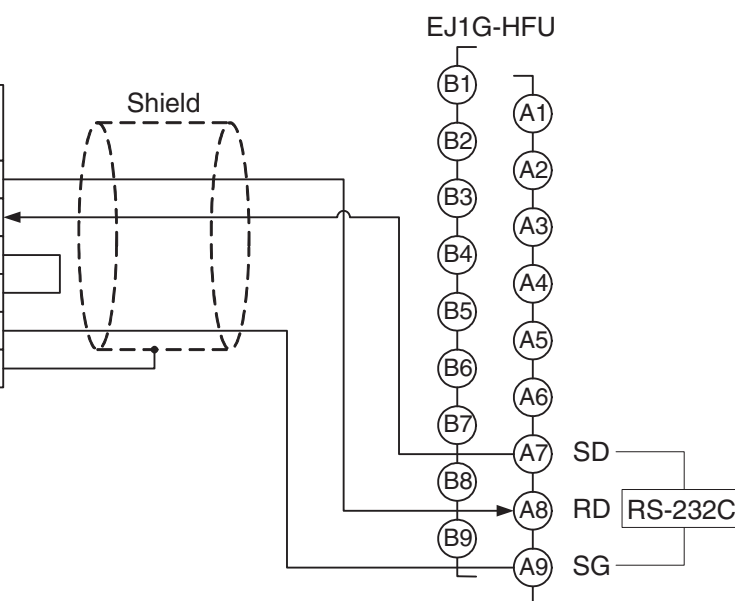
Turn ON pin 8 of SW2
to set RS-232C.

• RS-485

SYSMAC
CJ/CS Series
RS-485

EJ1G-HFU

Pin No.	
1	RDA–
2	RDB+
6	SDA–
8	SDB+
Shell	FG

Shield

B(+) B7
RS-485
A(–) B8
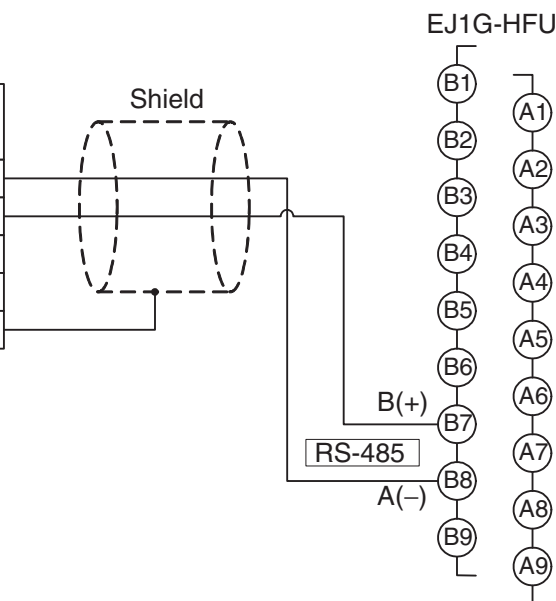
• Attach terminating resistance (110 to 125 Ω) to pins 6 and 7 on the EDU
   port B if there are problems with communications noise resistance.

Note Refer to *Related Manuals* on page xiv for the operating methods for SYSMAC
CS/CJ-series CPU Units and Serial Communications Boards/Units.

2. Make the PLC settings.

   Use the CX-Programmer to make the communications port settings for the Serial Communications Unit. The settings can be easily made using IO Table and Unit Setup. Be sure to transfer the settings to the PLC.

DM Area				Bits	Settings		Set value
Board CS Series only		**Unit CS/CJ Series**					
Port 1	Port 2	Port 1	Port 2				
D32000	D32010	m	m+10	15	Port settings	Setting not required.	0200H
				14 to 12	Reserved	---	
				11 to 08	Serial communications mode	1:N NT Links	
				07 to 05	Reserved	---	
				04	Start bits	Setting not required.	
				03	Data length	Setting not required.	
				02	Stop bits	Setting not required.	
				01	Parity	Setting not required.	
				00	Parity	Setting not required.	
D32001	D32011	m+1	m+11	15 to 04	Reserved	---	000AH
				03 to 00	Baud rate	High-speed NT Link	
D32006	D32016	m+6	m+16	15 to 03	Reserved	---	0000H
				02 to 00	Maximum unit number	0	

Note (1) m = D30000 + 100 × Unit No. (word address)

(2) When using a communications port of the CPU Unit, start the CX-Programmer and set the Host Link port settings in the PLC Settings. Be sure to transfer the settings to the PLC.

(3) The same serial port on the CS/CJ-series Serial Communications Board/Unit cannot be connected to both the EJ1G and an NS-series Programmable Terminal.

The following settings are also required if the models listed below are used.

Model	Terminating resistance ON/OFF switch	2-wire/4-wire switch
CJ1W-SCU41-V1 CS1W-SCB41-V1	ON	2

3. Set the EJ1G parameters.

   No particular EJ1G parameter settings are required when using SYSMAC CS/CJ Series PLCs. Leave the parameters set to their default settings.

   For the default settings, the EJ1G monitor and set values are allocated in the DM Area in the PLC as shown in the following table.

   If the allocated words shown below are already in use, change the words referring to *Programless Communications Upload/Download Data Area (Variable Type: F0/B0)* on page 104 and to *Programless Communications Upload/Download Start Address (Variable Type: F0/B0)* on page 105.

DM Area	Contents (monitor value)
D00000	Read Response Bits
D00001	Setting Change Response Bits
D00002	Operation Command Response Bits
D00003	Communications Status
D00004	Monitor Value A

DM Area	Contents (set value)
D00500	Read Request Bits
D00501	Setting Change Request Bits
D00502	Operation Command Request Bits
D00503	Operation Command Code
D00504	Set Value A

DM Area	Contents (monitor value)
D00005	Monitor Value B
⋮	⋮

DM Area	Contents (set value)
D00505	Set Value B
⋮	⋮

Note When setting programless uploads and downloads, be sure that the words being used in PLC memory are not otherwise used in the program or by other devices.

4. Check operation.

   Turn OFF the power to the EJ1G and PLC and then turn the power back ON. It does not matter which one is turned ON first.
   Refer to the following information and check the operation.

Basic Operations

■ **Monitoring EJ1G Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 process values can be read.

1,2,3... 1. Set the Read Request Bits allocated in PLC memory (D00500) to 0002.

2. Confirm that the Read Response Bits (D00000) are set to 0002.

3. Confirm that D00004 and D00005 are set to the channel 1 and channel 2 process values.
   The EJ1G set value will be continuously read if D00500 is set to 0002. Set D00500 to 0000 to stop reading the set value.

DM Area	Value	Meaning	Procedure step number and confirmation item
D00000	0002	Read Response Bits	Step 2: Set to 0002 by the system.
D00001	0000	Setting Change Response Bits	
D00002	0000	Operation Command Response Bits	
D00003	*000	Communications Status	
D00004	Step 3	Channel 1 Process Value	Step 3: Set to the channel 1 process value by the system.
D00005	Step 3	Channel 2 Process Value	Step 3: Set to channel 2 process value by the system.
⋮	⋮	⋮	⋮
D00500	0002	Read Request Bits	Step 1: Set from PLC user program.
D00501	0000	Setting Change Request Bits	

■ **Changing EJ1G Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 set points change.

1,2,3... 1. Set D00504 and D00505 in PLC memory to 0064.

2. Set the Setting Change Request Bits (D00501) to 0001.

3. Confirm that the Setting Change Response Bits (D00001) have been set to 0001.

4. Use the EST2-2C-MV3 CX-Thermo Support Software to confirm that the EJ1G channel 1 and channel 2 set points have changed to 100. To check operation again, set D00501 to 0000 and once D00001 has changed to 0000 repeat the procedure from step 1.

DM Area	Value	Meaning	Procedure step number and confirmation item
D00000	0000	Read Response Bits	
D00001	0001	Setting Change Response Bits	Step 3: Set to 0001 by the system.
D00500	0000	Read Request Bits	
D00501	0001	Setting Change Request Bits	Step 2: Set from PLC user program.
D00502	0000	Operation Command Request Bits	
D00503	0000	Operation Command Code	
D00504	0064	Channel 1 Set Point	Step 1: Set from PLC user program.
D00505	0064	Channel 2 Set Point	Step 1: Set from PLC user program.

■ If Not Operating Correctly

Check the following items if the operation is incorrect.

- Are the wiring and settings correct?
- Was the power cycled once the EJ1G and PLC settings were completed? (The EJ1G settings are enabled only after the EJ1G is reset.)

Checking Operation with MELSEC-Q/ QnAS Series

This section describes how to check operation for the configuration shown below.
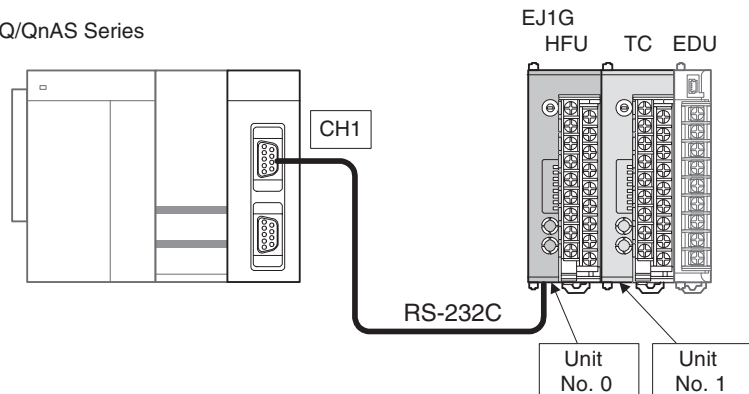
1,2,3... 1. Connect the EJ1G and PLC.

Connect the EJ1G-HFU and Serial Communications Unit as shown in the following diagram.

• RS-232C

MELSEC-Q/QnAS Series
RS-232C   EJ1G-HFU

Pin No.	Signal
1	CD
2	RD
3	SD
4	DTR
5	SG
6	DSR
7	RS
8	CS

Shield

B1
B2
B3
B4
B5
B6
B7
B8
B9

A1
A2
A3
A4
A5
A6
A7 SD
A8 RD RS-232C
A9 SG
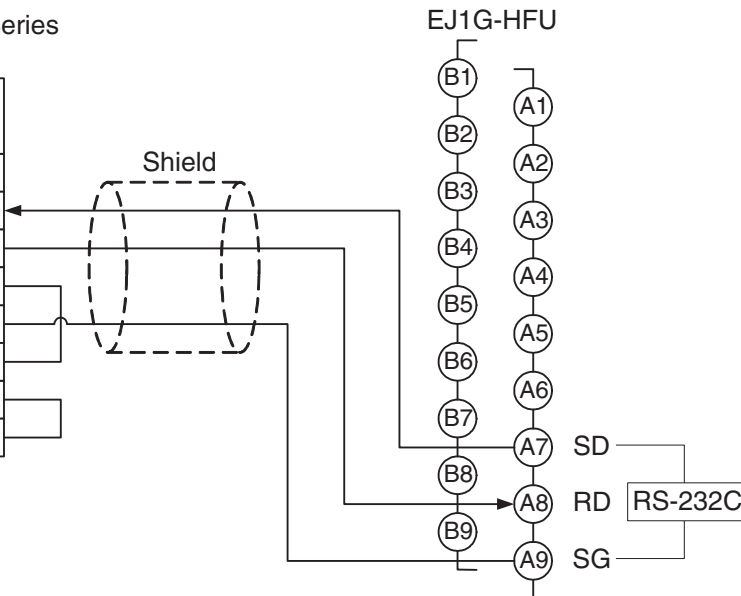
Turn ON pin 8 of SW2
to set RS-232C.

• RS-422

MELSEC-Q/QnAS Series
RS-422   EJ1G-HFU

Signal
SDA
SDB
RDA
RDB
FG

R

Shield

B1
B2
B3
B4
B5
B6
B7 RDB(+)
B8 RDA(−)
B9

A1
A2
A3
A4
A5
A6
A7 SDB(+)
     RS-422
A8
A9 SDA(−)

R
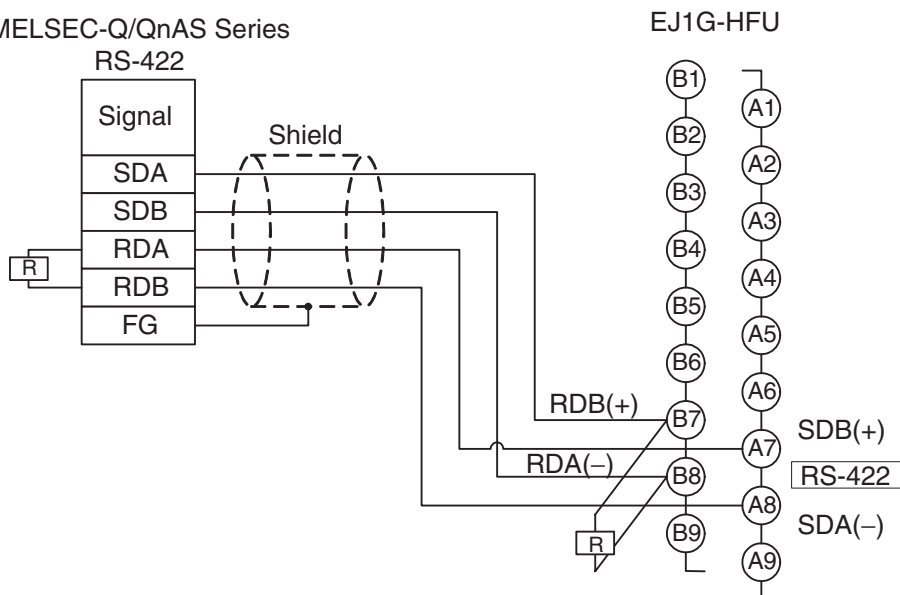
• Refer to the user's manual if using a Communications Module for the QnAS Series.

2. Make the PLC settings.

   Use the GX Developer to make the settings outlined below for the communications port used.

Channel	Switch number.	Bit		Description			Set value
		Position	Setting				
CH1	SW01	b0	OFF	Transmission setting	Operation setting	Independent	0BEEH
		b1	ON		Data bits	8	
		b2	ON		Parity bit	Yes	
		b3	ON		Even/odd parity	Even	
		b4	OFF		Stop bits	1	
		b5	ON		Checksum	Yes	
		b6	ON		Write during RUN	Allowed	
		b7	ON		Setting modifications	Allowed	
		b8 to b15	---		Communications rate setting	115200 bps (0BH)	
	SW02	---		Communications protocol setting		MC protocol format 5	0005H
CH2	SW03	Same settings as SW01.					
	SW04	Same settings as SW02.					
Common for both CH1 and CH2	SW05	---		Station number setting		0	0000H

Note (1) To set a different baud rate from that given above, refer to *Baud Rate Setting* on page 107 and change 0B.

(2) Refer to *MELSEC-QnAS Series* on page 107 if using a Communications Module for the QnAS Series.

3. Make the EJ1G settings.

   When using RS-232C, turn ON pin 8 on SW 2 (to select RS-232C) and make the settings shown in the following table. No other settings are required.

Variable type	Parameter name	Setting/Monitor values
F0/B0	Programless Communications Protocol (Common)	5:MC protocol (format 5)
	Port C Send Wait Time (Common)	1:1 ms

For the default settings, data registers in the PLC are allocated to the EJ1G monitor and set values as shown in the following table. If the allocated words shown below are already in use, change the words referring to *Programless Communications Upload/Download Data Area (Variable Type: F0/B0)* on page 104 and to *Programless Communications Upload/Download Start Address (Variable Type: F0/B0)* on page 105.

Data register	Contents (monitor value)
D0	Read Response Bits
D1	Setting Change Response Bits
D2	Operation Command Response Bits
D3	Communications Status
D4	Monitor Value A
D5	Monitor Value B
⋮	⋮

Data register	Contents (set value)
D500	Read Request Bits
D501	Setting Change Request Bits
D502	Operation Command Request Bits
D503	Operation Command Code
D504	Set Value A
D505	Set Value B
⋮	⋮

4. Check operation.

Turn OFF the power to the EJ1G and PLC and then turn the power back ON. It does not matter which one is turned ON first. Refer to the following information and check the operation.

Basic Operations

■ Monitoring EJ1G Set Values

Use the following procedure to confirm that the channel 1 and channel 2 process values can be read.

1,2,3...
1. Set the Read Request Bits allocated in PLC memory (D500) to 2.
2. Confirm that the Read Response Bits (D0) are set to 2.
3. Confirm that D4 and D5 are set to the channel 1 and channel 2 process values.
   The EJ1G set value will be continuously read if D500 is set to 2. Set D500 to 0 to stop reading the set value.

Data register	Value	Meaning	Procedure step number and confirmation item
D0	2	Read Response Bits	Step 2: Set to 2 by the system.
D1	0	Setting Change Response Bits	
D2	0	Operation Command Response Bits	
D3	*	Communications Status	
D4	Step 3	Channel 1 Process Value	Step 3: Set to channel 1 process value by the system.
D5	Step 3	Channel 2 Process Value	Step 3: Set to channel 2 process value by the system.
D500	2	Read Request Bits	Step 1: Set from PLC user program.
D501	0	Setting Change Request Bits	

■ Changing EJ1G Set Values

Use the following procedure to confirm that the channel 1 and channel 2 set points change.

1,2,3...
1. Set D504 and D505 in PLC memory to 100.
2. Set the Setting Change Request Bits (D501) to 1.
3. Set the Setting Change Response Bits (D1) to 1.
4. Use the EST2-2C-MV3 CX-Thermo Support Software to confirm that the EJ1G channel 1 and channel 2 set points have changed to 100. To check operation again, set D501 to 0 and once D1 has changed to 0 repeat the procedure from step 1.

Data register	Value	Meaning	Procedure step number and confirmation item
D0	0	Read Response Bits	
D1	1	Setting Change Response Bits	Step 3: Set to 1.
D500	0	Read Request Bits	
D501	1	Setting Change Request Bits	Step 2: Set from PLC user program.
D502	0	Operation Command Request Bits	
D503	0	Operation Command Code	
D504	100	Channel 1 Set Point	Step 1: Set from PLC user program.
D505	100	Channel 2 Set Point	Step 1: Set from PLC user program.

■ **If Not Operating Correctly**

Check the following items if the operation is incorrect.

- Are the wiring and settings correct?
- Was the power turned OFF once the EJ1G and PLC settings had been completed? (The EJ1G settings are enabled only after the EJ1G is reset.)
- The Programless Communications Receive Wait Time may be too short. Refer to *Adjusting Communications Time with PLC* on page 105 and change to a longer wait time.

5-6-3 Detailed Settings

Link Data Settings

Link data settings are made to set which EJ1G values to monitor or change.

- Monitor

  The parameters to be monitored are set under Programless Upload Settings.

  The HFU collects monitor values based on these settings for the Units connected to the HFU and transfers the values to PLC memory.

		Variable type
		D7/97
	Address	**Programless Upload Setting**
	0000	Reserved (Read Response Bits)
	0001	Reserved (Setting Change Response Bits)
	0002	Reserved (Operation Command Response Bits)
	0003	Reserved (Communications Status)
	0004	Parameter A to be monitored
	0005	Parameter B to be monitored
		⋮
	012F	

(304, 300)

- Changing Settings

  The parameters to be changed are set under the Programless Download Settings.

  The HFU reads the values in a PLC memory area according to these settings and then refreshes the settings for Units connected to the HFU.

		Variable type
		D8/98
	Address	**Programless Download Setting**
	0000	Reserved (Read Request Bits)
	0001	Reserved (Setting Change Request Bits)
	0002	Reserved (Operation Command Request Bits)
	0003	Reserved (Operation Command Code)
	0004	Parameter A to be changed
	0005	Parameter B to be changed
		⋮
	012F	

(304, 300)

■ **Programless Upload/Download Settings**

- Use the EST2-2C-MV3 CX-Thermo Support Software to make the settings.

- The parameters for the following variable types can be set. Up to 300 settings can be made.

Programless upload settings	Variable types: C4/84, C5/85, D0/90, D1/91, D2/92, D3/93, D4/94, D5/95, and D6/96
Programless download settings	Variable types: D4/94, D5/95, and D6/96

- Parameters can be set to *Not used* to reserve words for future use.

  Note The words set to *Not used* cannot be used for any other purpose except the programless function.

- Only channels 1 and 2 can be set for TC2 Units.

⚠ **Caution**

- There are 304 programless upload and 304 programless download settings, which are linked to data to the PLC memory, from the start address to the end code (00FF). Always set an end code at the end of linked data, because all 304 pieces of data will be linked if there is no end code.
  Each start area contains a reserved area used to control programless communications from the PLC. Information on how to use programless uploading and downloading is provided under *5-6-4 Description of Operation*.

- The communications speed will drop if there is a lot of linked data. Adjust the number of linked data items that are set to suit the system.

- If non-existent settings are set, programless uploading and downloading will not operate correctly. The communications speed may also be affected, so always use valid settings.

The bit corresponding to the unit number will turn ON if an error occurred in communications during programless downloading or programless uploading. The status ON/OFF conditions are listed in the following table.

ON	At least one error occurred.
OFF	Normal communications occurred 22 times in a row.

■ **Examples:**

Bit 15 Turns ON.

This indicates that a communications error has occurred for Unit No. 15.

Communications Protocols and Memory Allocation

For the EJ1G to communicate with the PLC, the Programless Communications Protocol must be set and the area in PLC memory that will be allocated to parameters for the Programless Upload/Download Settings must be set.

- The communications protocol is set under Programless Communications Protocol.

- Select the type of memory area under Programless Communications Upload/Download Data Area and set the start address for the memory allocation in the Programless Communications Upload/Download Start Address.

■ **Programless Communications Protocol (Variable Type: F0/B0)**

Used to set the programless communications protocol.

Variable type	Parameter name	Setting/Monitor values	Default

F0/B0	Programless Communications Protocol (Common)	0: Not used.
		1: Not used.
		2: NT Link (1:N)
		    Connectable PLCs:
		    SYSMAC CS/CJ Series
		3: Not used.
		4: Not used.
		5: MC protocol (format 5)
		    Connectable PLCs:
		    MELSEC-Q/QnAS Series
			2

Conditions for use	No special conditions

Note Reset the EJ1G to enable settings.

■ **Programless Communications Upload/Download Data Area (Variable Type: F0/B0)**

Used to set the area in PLC memory that will be allocated to the parameters set with the Programless Upload/Download Settings. Set this parameter according to the Programless Communications Protocol.

• SYSMAC CS/CJ Series PLCs

Set value	Area	Applicable areas by CPU Unit				
		CJ1H-CPU67H	CJ1H-CPU66H	CJ1H-CPU65H CJ1G-CPU45H	CJ1G-CPU44H -CPU43H -CPU42H	CJ1M
0 (default)	DM	Applicable	Applicable	Applicable	Applicable	Applicable
1	EM0	Applicable	Applicable	Applicable	Applicable	---
2	EM1	Applicable	Applicable	Applicable	---	---
3	EM2	Applicable	Applicable	Applicable	---	---
4	EM3	Applicable	Applicable	---	---	---
5	EM4	Applicable	Applicable	---	---	---
6	EM5	Applicable	Applicable	---	---	---
7	EM6	Applicable	Applicable	---	---	---
8	EM7	Applicable	---	---	---	---
9	EM8	Applicable	---	---	---	---
10	EM9	Applicable	---	---	---	---
11	EMA	Applicable	---	---	---	---
12	EMB	Applicable	---	---	---	---
13	EMC	Applicable	---	---	---	---

• MELSEC-Q/QnAS Series PLCs

Set value	Area
0 (default)	Data registers (D)
1	Link registers (W)
2	File registers (R)

Note (1) Make the programless upload settings in the Programless Communications Upload Data Area and the programless download settings in the Programless Download Data Area.

(2) Reset the EJ1G to enable settings.

■ **Programless Communications Upload/Download Start Address (Variable Type: F0/B0)**

Used to set the start address in the memory area set as the Programless Communications Upload/Download Data Area for the parameters set as the Programless Upload/Download Settings.

• The parameters will occupy the amount of PLC memory set in the Programless Upload/Download Settings from the address set as the Programless Communications Upload/Download Start Address.

• Refer to the following table and set a start address within the accessible range.

Programless Communications Protocol	PLC area	Setting range	Default	
			Programless Communications Upload Start Address	**Programless Communications Download Start Address**
NT Link (1:N)	DM	0000 to 9999	0	500
	EM			
MC protocol (format 5)	Data registers	0000 to 9999		
	Link registers	0000 to 1FFF		
	File registers	0000 to 9999		

Note (1) Make sure the same address is not allocated in both the Programless Upload Settings and Programless Download Settings.

(2) Reset the EJ1G to enable settings.

Communications Settings

The following parameters are used to make the EJ1G communications settings. Set these parameters to the same conditions as the PLC.

Variable type	Parameter name	Setting/Monitor values	Default
F0/B0	Port C Communications Baud Rate (Common)	3: 9.6 kbps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 115.2 kbps	7
	Port C Communications Data Length (Common)	0: 7 bits 1: 8 bits	1
	Port C Communications Parity (Common)	0: None 1: Even 2: Odd	1
	Port C Communications Stop Bits (Common)	0: 1 bit 1: 2 bits	0
	Port C Send Wait Time (Common)	1 to 99 ms	5

Conditions for use	No special conditions.

Note Reset the EJ1G to enable settings.
When using an NT Link, use the default settings.

Adjusting Communications Time with PLC

With programless communications, the time from when the command is sent to the PLC until a response is returned is monitored using the Programless Communications Receive Wait Time.

• This time will differ, depending on the PLC cycle time. Consider the PLC system configuration and allow sufficient margin when setting the response wait time. Communications will not be normal if this setting is too short.

Variable type	Parameter name	Setting range	Default
F0/B0	Programless Communications Receive Wait Time (Common)	10 to 10000 ms	2000

Conditions for use	The Programless Communications Protocol must be set to MC protocol (format 5).

Note Reset the EJ1G to enable settings.
This parameter is not valid when an NT Link is being used.

PLC Settings

SYSMAC CS/CJ Series The settings are the same as made when checking operation. Refer to *Checking Operation with SYSMAC CS/CJ Series PLCs* on page 94.

MELSEC-Q Series The settings are the same as made when checking operation. Make settings based on the following table if the baud rate or transmission settings need to be changed.

Channel	Switch number	Bit position	Description
CH1	SW01	b0 to 7	Transmission settings
		b8 to 15	Baud rate setting
	SW02	---	Communications protocol setting
CH2	SW03	b0 to 7	Transmission settings
		b8 to 15	Baud rate setting
	SW04	---	Communications protocol setting
Common for both CH1 and CH2	SW05	---	Station number setting

■ **Transmission Settings**

Bit	Description	OFF (0)	ON (1)	Setting	
b0	Operation setting	Independent	Linked	0	E
b1	Data bits (See note.)	7	8	1	
b2	Parity bit (See note.)	No	Yes	1	
b3	Even/odd parity (See note.)	Odd	Even	1	
b4	Stop bits (See note.)	1	2	0	E
b5	Checksum	No	Yes	1	
b6	Write during RUN	Prohibited	Allowed	1	
b7	Setting modifications	Prohibited	Allowed	1	

Note Change the settings if required. If changes are made, make the same settings on the EJ1G.

■ <u>Baud Rate Setting</u>

Communications baud rate	Setting (b8 to 15)
9.6 (kbps)	05H
19.2 (kbps)	07H
38.4 (kbps)	09H
57.6 (kbps)	0AH
115.2 (kbps) (See note.)	0BH (recommended)

Note   If both channel 1 and channel 2 are used on the QJ71C24(-R2), make sure that the total baud rate for both channels is 115.2 kbps or less.

> **Note**   Make the same settings on the EJ1G.

■ <u>Communications Protocol Setting</u>

Communications protocol setting	Programless Communications Protocol	Setting
MC Protocol, Format 5	MC Protocol (format 5)	0005H

> **Note**   Make sure this setting is the same as the Programless Communications Protocol parameter.

■ <u>Station Number Setting</u>

Set to 0000H to match the EJ1G setting.
If the station number of the Serial Communications Unit is set to any value except 0, set the programless communications node number in the EJ1G to the same value.

MELSEC-QnAS Series   Make the settings shown in the following table for the channels being used.

Setting switch		Setting
Station number switch		00
Mode switch		Dedicated protocol Binary mode Format 5
Transmission specifications switch	Operation setting	Independent operation
	Data bits	8 bits
	Parity bit enable/disable	Enable
	Even parity/odd parity	Even
	Stop bits	1 bit
	Checksum	Yes
	Write during RUN enable/disable	Enable
	Setting change enable/disable	Enable
	Transmission rate	115.2 kbps (See note.)

Note   If both channel 1 and channel 2 are used, make sure that the total baud rate for both channels is 115.2 kbps or less.

> **Note**   (a) If settings other than those listed above are made, make the same settings on the EJ1G.
>
> (b) Refer to the PLC operation manual for details on setting methods.

5-6-4 Description of Operation

Set values are read and changed and operation commands are executed by setting a value in a Request Bits allocated in a PLC memory area.

DM Area	Meaning
D00000	Read Response Bits
D00001	Setting Change Response Bits
D00002	Operation Command Response Bits
⋮	⋮
D00500	Read Request Bits
D00501	Setting Change Request Bits
D00502	Operation Command Request Bits

The Request Bits are set to the following values.

Bits	Value	Action
Read Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Reads the parameters set in the Programless Upload Setting Area once.
	0002: Multi	Continuously reads the parameters set in the Programless Upload Setting Area.
	0003: Read setting	Reads the parameters set in the Programless Download Setting Area and writes them to the read area.
Setting Change Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Changes only the parameters set in the Programless Download Setting for which values have been changed.
	0002: Multi	Continuously repeats the operation of changing only the parameters set in the Programless Download Setting for which values have been changed.
Operation Command Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Executes the operation command set in the Operation Command Code.
	0002: Multi	Executes the operation command each time the value in the Operation Command Code changes.

Note To change the Request Bits, first set the Request Bits to 0000 then change the setting. The same applies when periodically executing the same operation command.

Example: Changing a Single Action to a Multi Action

1,2,3... 1. For a single action, the Response Bits are set to the single action value, 0001.

  Note The Request Bits cannot be changed directly to 0002 because the setting will not be accepted.

2. Change the Request Bits to 0000, then confirm that the Response Bits have been set to 0000.

3. Then change the Request Bits to the multi action setting of 0002.

  • Each set of Request Bits has a corresponding set of Response Bits. Once the Request Bits have been set, the Response Bits operate in the order shown in the following table.

Type	Order of action
Single	1. The PLC sets the Request Bits. 2. The EJ1G performs a single action. 3. The EJ1G sets the Response Bits to the same value as the Request Bits. 4. The PLC clears the Request Bits. 5. The EJ1G clears the Response Bits.

PLC processing

1. Sets the Request Bits to 0001.

4. Clears the Request Bits.

EJ1G processing

2. Single action

Single action completed

3. Sets the Response Bits to 0001.

5. Clears the Response Bits.
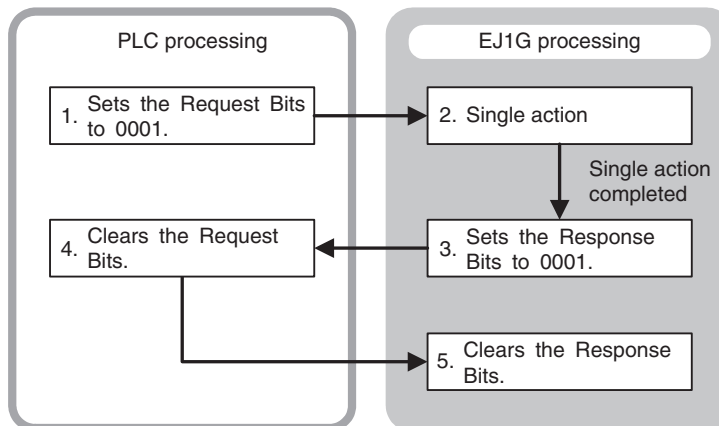
Type	Order of action
Multi	1. The PLC sets the Request Bits. 2. The EJ1G sets the Response Bits to the same value as the Request Bits. 3. The EJ1G performs a multi action.

PLC processing

1. Sets the Request Bits to 0002.

EJ1G processing

Checks the Request Bits.

2. Sets the Response Bits to 0002.

3. Multi action
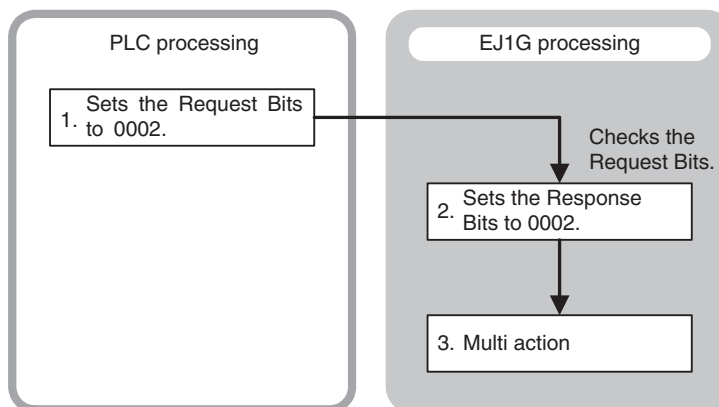
Type	Order of action
Operation stopped	1. The PLC clears the Request Bits. 2. The EJ1G clears the Response Bits.

PLC processing

1. Clears the Request Bits.

EJ1G processing

2. Clears the Response Bits.
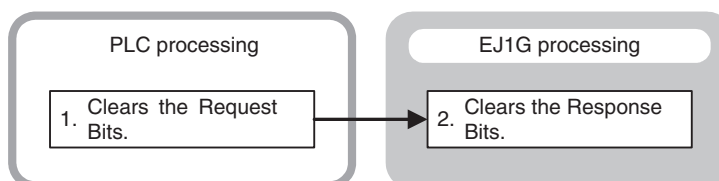
Operation Procedure

Monitor   Once the PLC sets the value of the Read Request Bits, the EJ1G writes the value set under Programless Upload Settings to the PLC memory area.

• Single Read

The parameters set in the Programless Upload Setting are read once.

3. The EJ1G sets the Read Response Bits.

PLC

EJ1G

Upload Area		Download Area		HFU	TC4/TC2
Address	**Value**	**Address**	**Value**		
m+0	0001	n+0	0001		
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits		
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits		
m+3	Communications Status	n+3	Operation Command Code		
m+4	xxxx	n+4	Set value	xxxx	

1. The Read Request Bits are set by the PLC.

2. The EJ1G refreshes the monitor value.

PLC

Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	0000	n+0	0000
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	xxxx	n+4	Set value

4. The Read Request Bits are set by the PLC.

5. The EJ1G clears the Read Response Bits.

- Multi Read

  The parameters set in the Programless Upload Setting are read continuously.

When the Read Request Bits are set (step 1), steps 2 and 3 performed automatically.
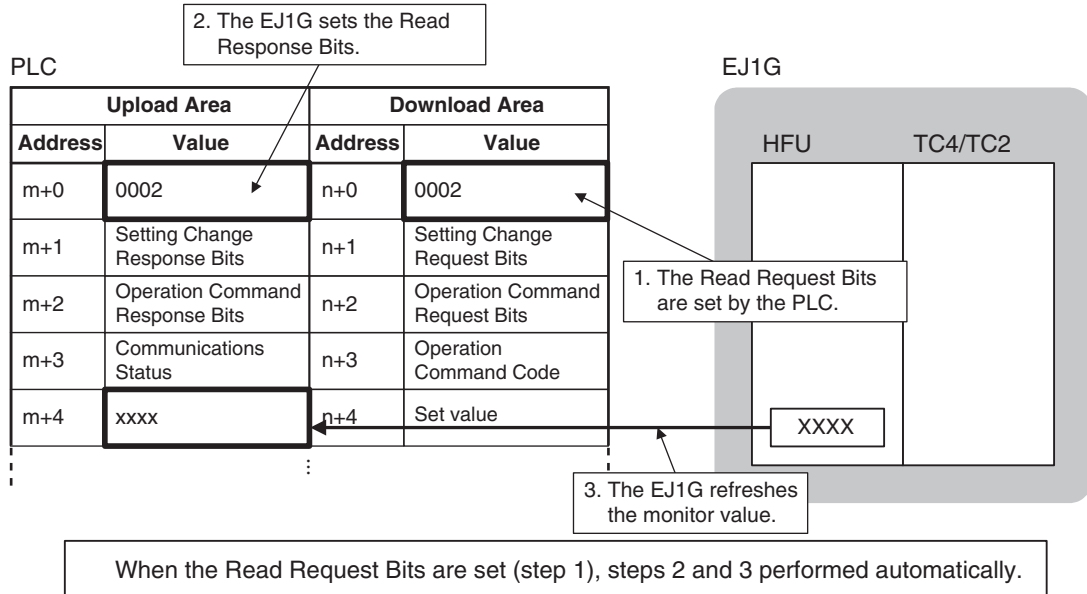
- Read Settings

  With the normal monitor operation, the value set under Programless Upload Setting is read to the upload data area in PLC memory. With the Read Setting operation, the value set under Programless Download Setting is read to the upload data area in PLC memory to confirm that the setting is correct.
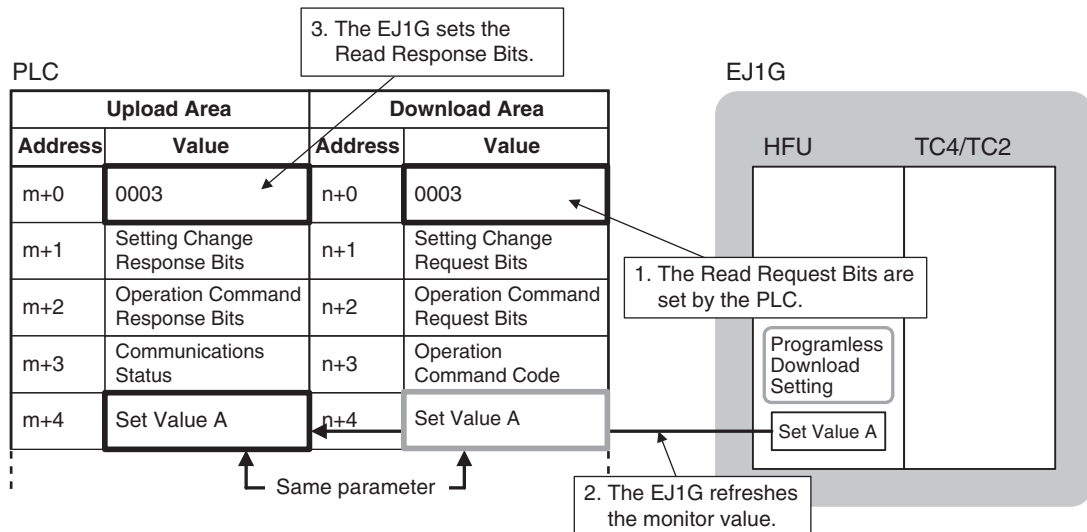
• Stop Operation

Operation is stopped after a series of operations has been completed.

PLC

2. The EJ1G clears the Read Response Bits.

Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	0000	n+0	0000
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	XXXX	n+4	Set value

1. The Read Request Bits are cleared by the PLC.
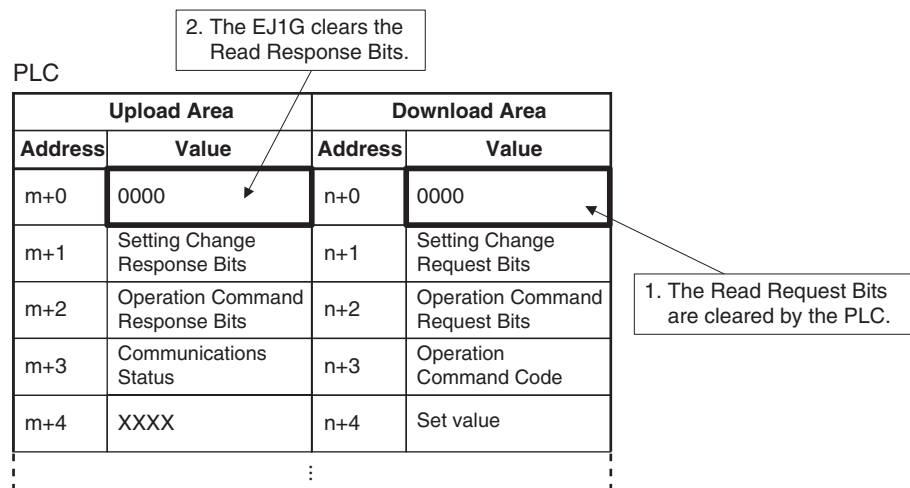
■ **Monitor Values**

If the monitor value has a decimal point, keep the decimal point in mind when handling the monitor value.

Example: monitor value 03E8H or 1000 → 100.0

The set value in the EJ1G will not change even if the monitor value is changed.

■ **Checking Programless Communications Operation from the PLC**

To confirm that programless communications are working from the PLC, confirm that reserved bit 15 of the Communications Status under the Programless Download Settings is changing. Bit 15 repeatedly turns ON/OFF during communications. Bit 15 alternates between ON and OFF, changing at each programless communications.

Example: Multi Read
Each time all the parameters set under Programless Upload Settings are written to the PLC, bit 15 changes between ON and OFF.

Setting Changes

To change EJ1G settings from the PLC, first change the values in the Download Area in the PLC memory and then set the Setting Change Request Bits.

The EJ1G will then read the Download Area in the PLC memory and change the corresponding settings.

- Single Action

  Any parameters in the download area settings that have changed from the previous values are written.
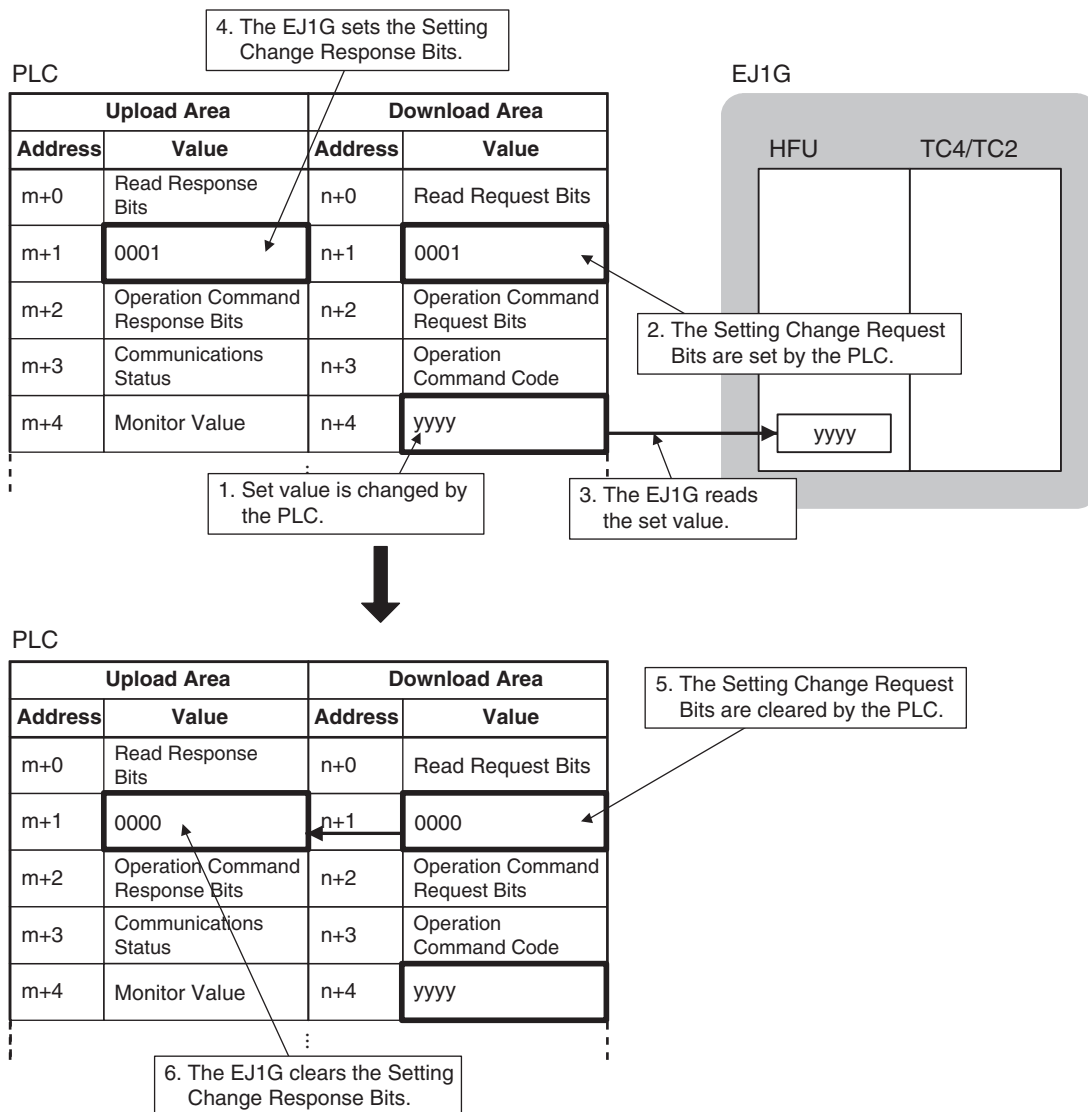
• Multi Action

Operation of writing any parameters in the download area settings that have changed from the previous values is performed continuously.

2. The EJ1G sets the Setting Change Response Bits.

PLC

Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	0002	n+1	0002
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Monitor value	n+3	Operation Command Code
m+4	Communications Status	n+4	YYYY

EJ1G

HFU   TC4/TC2

1. The Setting Change Request Bits are set by the PLC.

YYYY

YYYY

3. The EJ1G repeatedly reads the set values.

• Stop Operation

Operation is stopped after a series of operations has been completed.

PLC

Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	0000	n+1	0000
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	Monitor value	n+4	YYYY

1. The Setting Change Request Bits are cleared by the PLC.

2. The EJ1G clears the Setting Change Response Bits.

Note (1) Always set the Setting Change Request Bits last. If the Setting Change Request Bits are set before the set value is changed, an unexpected value will be written.

(2) All programless download parameters will be updated when the Setting Change Request Bits are set. If set values are not the same in EJ1G and PLC memory, e.g., when the power is turned ON or the bank is changed, always change the values in PLC memory first and then set the Setting Change Request Bits.

■ **Set Values**

- If the set value contains a decimal point, omit the decimal point and set the value.

  Example:100.0 → 1000 or 03E8H: set value

- When changing set values, always set a new value within the setting range. The set value will not be changed if a value outside the range is set.

Operation Commands

When the EJ1G confirms that the Operation Command Request Bits have been set by the PLC, the EJ1G reads the operation command code set in PLC memory and accepts the operation command.

To execute an operation command, set the operation command code in the PLC memory words corresponding to the Programless Download Settings and then set the Operation Command Request Bits.

Note Refer to *5-6-5 Operation Command Codes for Programless Communications* for information on operation command codes.

- Single Operation Command

  Operation commands are accepted only once.

PLC

4. The EJ1G sets the Operation Command Response Bits.

EJ1G

	Upload Area		Download Area	
Address	**Memory**	**Address**	**Memory**	
m+0	Read Response Bits	n+0	Read Request Bits	
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits	
m+2	0001	n+2	0001	
m+3	Communications Status	n+3	zzzz	
m+4	Monitor value	n+4	Set value	

HFU   TC4/TC2

2. The Operation Command Request Bits are set by the PLC.

zzzz

3. The EJ1G reads the operation command code.

1. The Operation Command Code is changed by the PLC.

PLC

	Upload Area		Download Area	
Address	**Memory**	**Address**	**Memory**	
m+0	Read Response Bits	n+0	Read Request Bits	
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits	
m+2	0000	n+2	0000	
m+3	Communications Status	n+3	zzzz	
m+4	Monitor value	n+4	Set value	

5. The Operation Command Request Bits are cleared by the PLC.

6. The EJ1G clears the Operation Command Response Bits.

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- Multi Operation Commands

  Accepts operation commands each time the operation command code changes.

2. The Operation Command Response Bits are set by the PLC.

PLC

EJ1G

Upload Area		Download Area	
Address	**Memory**	**Address**	**Memory**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	0002	n+2	0002
m+3	Communications Status	n+3	ZZZZ
m+4	Monitor value	n+4	Set value

HFU   TC4/TC2

ZZZZ

3. The EJ1G repeatedly reads the operation command code.

1. The EJ1G sets the Operation Command Request Bits.

- Stop Operation

  Operation is stopped after a series of operations has been completed.

PLC

Upload Area		Download Area	
Address	**Memory**	**Address**	**Memory**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	0000	n+2	0000
m+3	Communications Status	n+3	ZZZZ
m+4	Monitor value	n+4	Set value

1. The Operation Command Request Bits are cleared by the PLC.

2. The EJ1G clears the Operation Command Response Bits.

Reducing Communications Time

Try the following measures if communications are slow. Communications time may be reduced depending on the conditions.

Check point	Meaning
Port C Send Wait Time	Reduce the setting to reduce the communications wait time.
Programless Upload/ Download Settings	Reduce the volume of communications data by reducing the number of set values. This may reduce the communications time. Review these settings based on system requirements.

Note The above measures may result in an inability to communicate. It is recommended that a record is kept of the set values when communications are successful, to ensure recovery is possible.

5-6-5 Operation Command Codes for Programless Communications

The following functions are executed using operation commands.

- Write Mode
- Software Reset
- Run
- Stop
- Manual
- Auto
- GT Execute
- GT Cancel
- AT Execute
- AT Cancel
- Bank 0 Change to Bank 3 Change
- Reset Error
- Alarm 1 to Alarm 3 Latch Cancel
- All Alarm Latch Cancel
- Save RAM Data
- Register Unit Configuration

Command codes for programless communications operation commands differ from command codes in CompoWay/F communications because the data length is limited to 16 bits.

Example Calculation of Operation Command Codes for Programless Communications

Unit No.	Channel	Operation command	Operation command code (hexadecimal)
All units	All channels	Run	2808
		Stop	2C08
		Manual	3008
		Auto	3408
		GT Execute	4408
		GT Execute	4808

Any channel between 1 and 64 or all channels can be selected.

Structure of Operation Command Codes for Programless Communications

Bit position	Meaning
0	Not used. (3 bits)
1	Related information (2 bits)
2	
3	All channels specified (1 bit)
4	Unit specification (6 bits)
5	
6	
7	
8	
9	
10	Command code (6 bits)
11	
12	
13	
14	
15	

Details of Operation Command Codes for Programless Communications

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Command code						**Unit specification**		**All Units specified**					**Not used.**		
Write Mode	0	0	0	1	0	0		(See note 1.)					0	0	0	0
Software Reset	0	0	0	1	1	0	0	0	0	0	0	0	0			
Run	0	0	1	0	1	0	(See note 2.)						(See note 4.)			
Stop	0	0	1	0	1	1										
Manual	0	0	1	1	0	0										
Auto	0	0	1	1	0	1										
40% AT Execute	0	0	1	1	1	0										
100% AT Execute	0	0	1	1	1	1										
AT Cancel	0	1	0	0	0	0										
GT Execute	0	1	0	0	0	1										
GT Cancel	0	1	0	0	1	0										
Bank 0 Change	0	1	1	1	1	0										
Bank 1 Change	0	1	1	1	1	1										
Bank 2 Change	1	0	0	0	0	0										
Bank 3 Change	1	0	0	0	0	1										
Reset Error	1	0	1	1	0	1	0	0	0	0	0	0	0			
Alarm 1 Latch Cancel	1	1	0	0	1	0	(See note 2.)						(See note 4.)			
Alarm 2 Latch Cancel	1	1	0	0	1	1										
Alarm 3 Latch Cancel	1	1	0	1	0	0										
All Alarm Latch Cancel	1	1	0	1	0	1										
Save RAM Data	1	1	0	1	1	1	0	0	0	0	0	0	1			
Register Unit Configuration	1	1	1	0	1	1	(See note 3.)						0			

Note

(1) 000000: Backup 000001: RAM

(2) 000000: CH1 000001: CH2 ⋯ 111111: CH64

(3) 000000: Reset 000001: Register

(4) 0: For channels specified in the related information 1: All channels

Example: Operation Command Code to execute Run for channel 1 of Unit No. 1

Command code for Run						**Unit specification: 01**						**Channel 1**			
0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0
H' 2				H'8				H' 1				H' 0			
H' 2810															

Sample Operation Command Codes for Programless Communications

*1: All Units specified.

Command code	Channel	Operation command code	Command code						Unit specification						*1	Not used.		
Run	Channel 1	H' 2800	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
	Channel 2	H' 2810	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0
	Channel 3	H' 2820	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
	Channel 4	H' 2830	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
	All channels	H' 2808	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
Stop	Channel 1	H' 2C00	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	Channel 2	H' 2C10	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0
	Channel 3	H' 2C20	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0
	Channel 4	H' 2C30	0	0	1	0	1	1	0	0	0	0	1	1	0	0	0	0
	All channels	H' 2C08	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0
GT Execute	Channel 1	H' 4400	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Channel 2	H' 4410	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
	Channel 3	H' 4420	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0
	Channel 4	H' 4430	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0
	All channels	H' 4408	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
GT Cancel	Channel 1	H' 4800	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Channel 2	H' 4810	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
	Channel 3	H' 4820	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0
	Channel 4	H' 4830	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0
	All channels	H' 4808	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0

5-6-6 Programless Communications Errors

Possible Causes of Parameter Access Problems

- A value outside the setting range was written.
- A non-existent Unit was accessed.
- An attempt was made to change a setting for which changes are prohibited. Example: An attempt was made to change the SP during autotuning.

In the above cases, the Response Bits will be set to the following error values.

Bits	Operation	Error value
Read Response Bits	Single Read	8001
	Multi Read	8002
Setting Change Response Bits	Single Action	8001
	Multi action	8002
Operation Command Response Bits	Single Operation Commands	8001
	Multi Operation Commands	8002

If an error value is set for Response Bits, check the following items.

- Setting range
- Whether or not the value being changed can be changed.

Use the following procedure to clear the error value.

1. Set the Request Bit corresponding to the Response Bit for which the error value was set to 0000 (Stop operation).
2. Check whether or not the setting range and the value being changed can be changed at the moment then correct the error.
3. Set the Request Bit again.

Errors in Communications with PLCs

If noise or other cause results in a communications error with the PLC, the EJ1G will stop programless communications and set the Operation Command Response Bits to EEEE.

■ Method for Canceling Communications Errors

1,2,3...
1. Set the Operation Command Request Bits to FFFF.
2. The Operation Command Response Bits will be set to FFFF and the programless communications will return to the initial status.

   Note If the Read Request Bits or Setting Change Request Bits are set, restart operation according to the request.

3. Set the Operation Command Request Bits to 0000, then check that the Operation Command Response Bits have been set to 0000.

   Note Operation commands cannot be executed while the Operation Command Response Bits are set to FFFF.

If the communications line is disconnected or the PLC power supply turns OFF during programless communications, a programless communications error will occur after the following times have expired.

Programless communications protocol	Maximum time until programless communications error
1:N NT Link	30 s (See note.)
MC Protocol (Format 5)	Programless Communications Receive Wait Times × 3 (6 s for the default setting)

Note If a programless communications error occurs because the PLC power supply turns OFF when using the 1:N NT Link protocol, the error can be cleared by turn ON the PLC power supply.

5-7 Other HFU Functions

5-7-1 Bank Function

Up to 4 banks can be created with the following parameters registered independently.

- Set Point
- Proportional Band
- Integral Time
- Derivative Time
- SP Ramp Rise Value
- SP Ramp Fall Value
- Alarm Value 1 to 3
- Alarm Upper Limit Value 1 to 3
- Alarm Lower Limit Value 1 to 3

The currently selected bank's parameters can be read or written by reading or writing the "Present Bank" parameters.
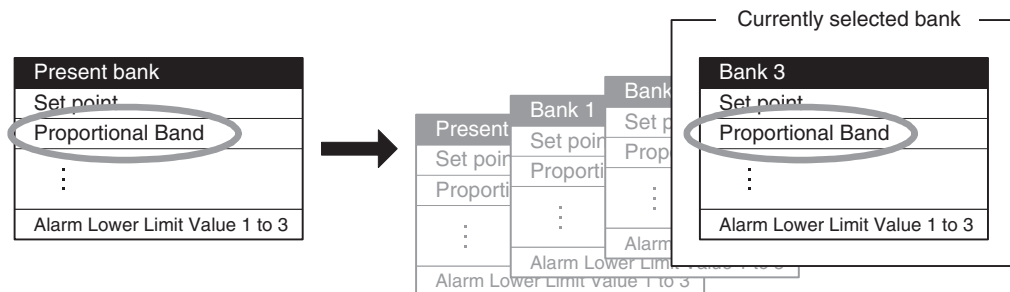
The following table shows the relationship between the banks and variable types.

Variable type	Bank
D0/90	Bank 0
D1/91	Bank 1
D2/92	Bank 2
D3/93	Bank 3
D4/94	Present Bank

Changing the Bank

The bank can be switched with an event input, internal bus, or operation command.

Changing the Bank With an Event Input

The bank can be switched by setting Bank (Bit 0) in the Event Input 1 Assignment and Bank (Bit 1) in the Event Input 2 Assignment, as shown in the following table.

Event input 2	Event input 1	Selected bank
OFF	OFF	Bank 0
OFF	ON	Bank 1
ON	OFF	Bank 2
ON	ON	Bank 3

Note Event input 1 can be used alone to switch between banks 0 and 1.

Operation Commands

For details, refer to *6-4-11 Operation Commands*.

■ **Bank Number**

The presently selected bank number can be checked with the following parameter.

Variable type	Parameter name		Setting range	Default
C4/84	Bank No. Monitor	(Channel)	0 to 3	---

5-7-2 Event Inputs (TC2)

Event Input Assignment

There are two event inputs in the TC2.

The following diagram shows the parameters that can be set in event input 1 or event input 2.

Some of the parameters are for all channels and others are for individual channels.
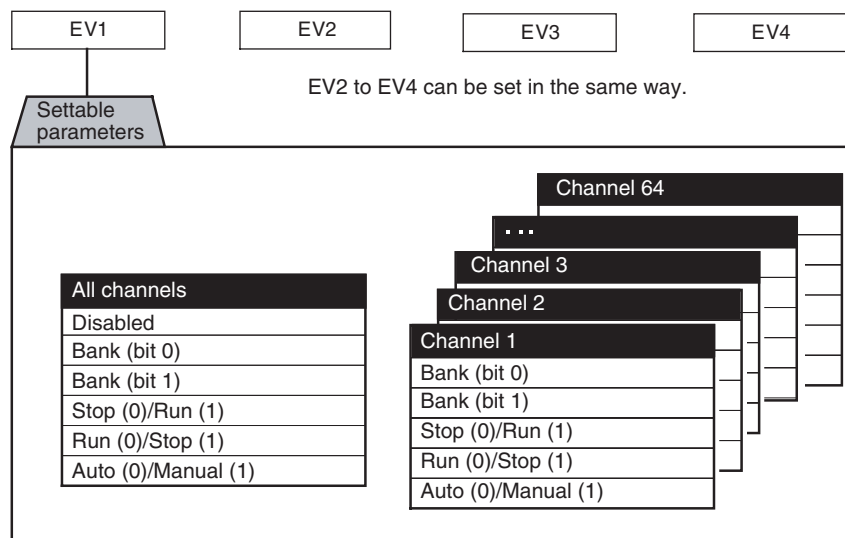
Variable type	Parameter name	Setting range	Default
F2/B2	Event Input 1 to 4 Assignment (Common)	0 to 69	0

Conditions for use	No special conditions.

Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

Controlling Operation with the Event Input's ON/OFF Status

• Operation can be switched by OFF-to-ON or ON-to-OFF event-input transitions.
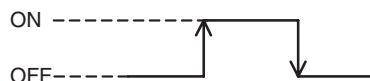
■ **Stop (0)/Run (1), Run (0)/Stop (1), Auto (0)/Manual (1)**

Parameter	Event input	Description
Stop (0)/Run (1)	OFF	Stop
	ON	Run
Run (0)/Stop (1)	OFF	Run
	ON	Stop
Auto (0)/Manual (1)	OFF	Auto
	ON	Manual

5-7-3 Auxiliary Output Allocations

The parameters that can be set for auxiliary outputs 1 to 4 are outlined below.

The settable parameters include those for all channels and those for individual channels.
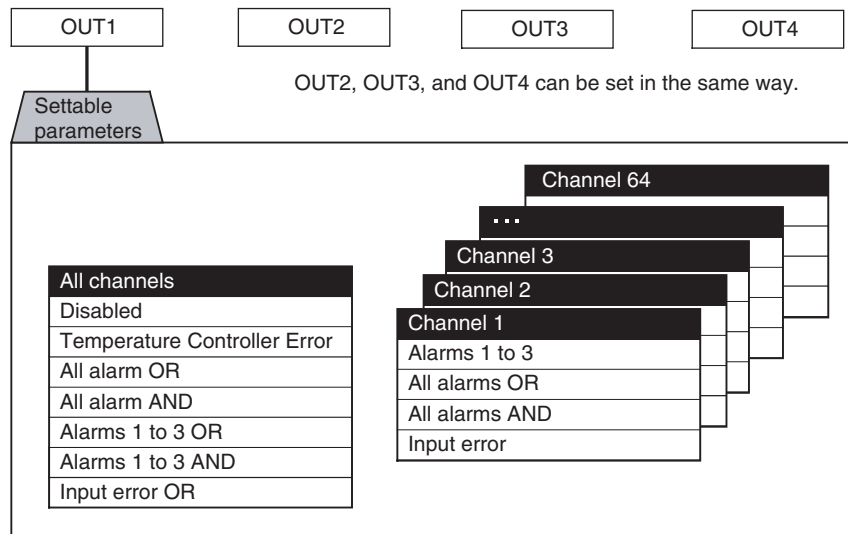
Temperature Controller Error	The Temperature Controller Error output will turn ON when any bit between bit 0 and bit 13 is ON in the Device A Status. It can be used to output EJ1G error status. Refer to *Status Lists* on page 188 for details on Device A Status.
Event inputs 1 to 4	Output the ON/OFF status of event inputs 1 to 4.
Bus inputs 1 to 3	Output the ON/OFF status of bus inputs 1 to 3.

Variable type	Parameter name		Setting range	Default
F2/B2	Auxiliary Output 1 Assignment	(Common)	0 to 2053	4
	Auxiliary Output 2 Assignment	(Common)	0 to 2053	5
	Auxiliary Output 3 Assignment	(Common)	0 to 2053	6
	Auxiliary Output 4 Assignment	(Common)	0 to 2053	10

Conditions for use	No special conditions.

Note (1) This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

(2) Refer to *Parameter List* on page 175 for details on parameter settings.

5-7-4 Using G3ZA Multi-channel Power Controllers

Set the G3ZA settings in the TC4/2 Unit. Refer to *4-5-1 Using G3ZA Multi-channel Power Controllers* for details.

SECTION 6
Communications (CompoWay/F)

This section describes how to use communications based on communications commands.

6-1 Communications Settings

Communications are programmed on the host computer. Descriptions of communications in this manual are therefore written from the viewpoint of the host computer. For example, references to reading and writing mean reading data from the EJ1G to the host computer and writing data from the host computer to the EJ1G.

The EJ1G uses different communications specifications from existing products to improve communications operability.

1. Parameter Validity

   The conditions for parameter validity that depended on the model and setting status no longer apply.

2. Fixed Values for Setting Ranges

   The SP will not change even if the SP Limiter is changed.

   For parameters that set ranges with upper and lower limits, the specifications now allow the upper and lower limits to be reversed.

   Refer to *5-3-3 Setting the Set Point, and MV Limiter* on page 75 *in Section 4 Basic Units (TC4/TC2)* before using the EJ1G.

3. Automatic Offsetting of Setting Values

   Accompanying changes outlined under *Set Values for Setting Ranges*, above, there are no longer any restrictions in operations for the target value limiter or target values for changes in the input type.

   Under the new specifications, there is also no need to change control output assignments when operations, such as selecting heating and cooling, are performed.

   Refer to *5-3-3 Setting the Set Point in Section 4 Basic Units (TC4/TC2)* before using the EJ1G.

6-1-1 Communications Specifications

Parameter name	Settings
	EDU (Port A/Port B)
Transmission Path Connection	Multipoint
Communications	RS-485
Synchronization Method	Start-stop synchronization
Transmission Code	Binary/ASCII
Error Detection	BCC (Block Check Character)
Flow Control	None
Retry Function	None

- The following communications settings are used.
  - EDU (Port A)
    The following settings are fixed.
    - Baud rate: 38.4 kbps
    - Communications data length: 7 (bit)
    - Communications stop bits: 2 (bit)
    - Parity: Even (bit)

6-1-2   Unit Number Setting

The unit number is set first.

The setting is made on SW1 and SW2 on the front of the EJ1G.

For information on the setting method, refer to *1-1-4 Using Setting Switches*.

6-1-3   Other Communications Settings

The communications baud rate, communications data length, communications stop bits, communications parity, and send data wait time are set using communications.

Use communications with the default communications settings to change any of these settings.

Refer to *6-4-2 Write to Variable Area* for information on how to change settings.

When the above settings are changed, the changes will not be enabled until the EJ1G is reset or the power is cycled.

6-1-4   Send Data Wait Time

The send data wait time setting is used to adjust the time the host computer takes to switch from sending to receiving.

Specifically, the send data wait time for the EJ1G is the time from after a response has been created after data has been received until the EJ1G switches to sending.
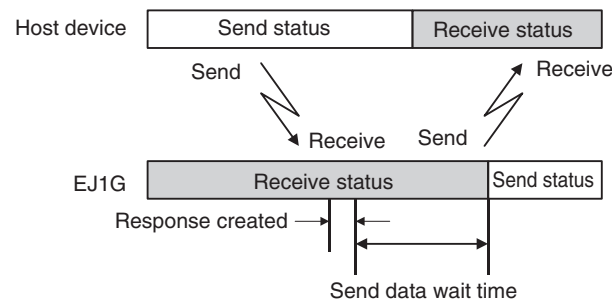
The setting of the Send Wait Time parameter can be shortened to reduce the communications time at the host device as long as there are no problems.

6-2 Frame Configuration

The communications protocol is CompoWay/F.

Commands from the host computer and responses from the EJ1G are contained in data blocks called frames.

The structures of the command and response frames are described below.

In the following explanations, hexadecimal values are expressed by adding the suffix H after the number, e.g., 02H.

All other alphanumeric values in the explanations indicate ASCII characters.

Note CompoWay/F

CompoWay/F is OMRON's standard communications format for general serial communications.

It uses commands compliant with the well-established FINS used extensively with OMRON Programmable Controllers together with a consistent frame format to facilitate communications between more than one component and between personal computers and components.

FINS (Factory Interface Network Service)

The FINS protocol provides message communications between controllers in OMRON FA networks.

Command Frame Format

STX	This code indicates the beginning of the communications frame. Always set to 02H.
Unit No.	• Set the unit number that is set on SW1 and SW2 on the EJ1G. • Specify "XX" for a broadcast transmission. No responses will be returned for broadcast transmissions. • No responses will be returned from unit numbers other than the ones in the above range.
Sub-address	Not used by the EJ1G. Always set to 0.
SID	Not used by the EJ1G. Always set to 0.
FINS-mini command text	This text is the command. For details, refer to *6-3 FINS-mini Text*.
ETX	This code indicates the end of the communications frame. Always set to 03H.
BCC	The BCC calculation result from the unit number to the ETX.

BCC Calculation Example

STX	Unit No.		Sub-address		SID	FINS-mini command text				ETX	BCC
02H	30H	30H	30H	30H	30H	30H	35H	30H	30H	03H	36H

BCC = 30H $\oplus$ 30H $\oplus$ 30H $\oplus$ 30H $\oplus$ 30H $\oplus$ 30H $\oplus$ 35H $\oplus$ 30H $\oplus$ 30H $\oplus$ 03H = 36H

$\oplus$: XOR (exclusive OR) calculation

Note No response will be returned unless the frame contains all elements up to the ETX and BCC.

Response Frame
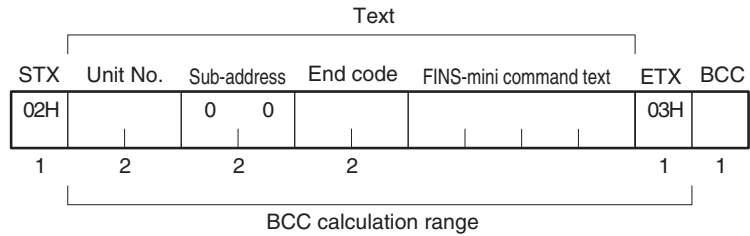
End Codes

End code	Name	Meaning	Error detection priority
0F	FINS command error	The specified FINS command could not be executed.	8
10	Parity error	The OR of 1 bits in received data does not match the setting for the communications parity.	2
11	Framing error	Stop bit is 0.	1
12	Overrun error	The next data was received when the reception data buffer was full.	3
13	BCC error	The calculated BCC value is different from the received BCC value.	5
14	Format error	The FINS-mini command text contains characters other than 0 to 9 and A to F. For details on the echoback test, refer to *6-4-10 Echoback Test*. SID and the FINS-mini command text are not included.	7
16	Sub-address error	The sub-address is not included.	6
18	Frame length error	The received frame exceeds the specified number of bytes.	4
00	Normal completion	Command processing was completed normally.	None

■ **End Code Example**

When the Sub-address, SID, and FINS-mini Command Text Are Not Included

• Command

STX	Unit No.		ETX	BCC
02H	0	1	03H	

• Response

STX	Unit No.		Sub-address		End code		ETX	BCC
02H	0	1	0	0	1	6	03H	

The sub-address is "00" and the end code is "16" (sub-address error).

6-3 FINS-mini Text

The FINS-mini command and response text is the text that form the command and response communications.

6-3-1 PDU Structure

The structure of the FINS-mini command text and FINS-mini response text are described below.

Command Text

An MRC (main request code) and SRC (sub-request code) followed by the various required data is transferred in the command frame.

Service Response PDU
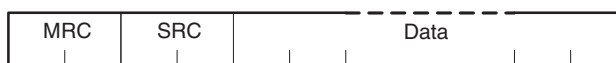
Response Text

The MRES (main response code) and SRES (sub-response code) are transferred in the response frame following the above MRC/SRC. Data is then transferred following the MRES and SRES.

Service Response PDU (Normal Response)
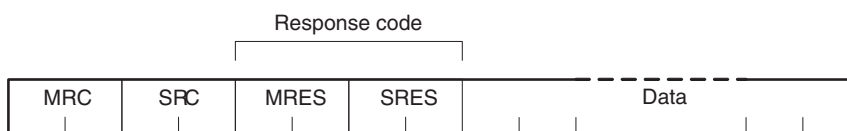
Service Response PDU (FINS-mini Command Text Not Executed)
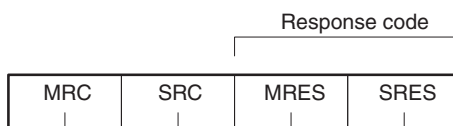
Note   If the specified FINS-mini command text could not be executed, only the MRC/SRC and MRES/SRES are used in the target response PDUs.

The MRES and SRES are used in the response code when processing did not end in a normal completion.

6-3-2 Variable Type and Address

Note   Refer to *Parameter List* on page 175.

6-3-3 Number of Elements

The number of elements is expressed in 2-byte hexadecimal format.

The range for specifying the number of elements differs for each command. Refer to *6-4 Detailed Description of Services*.

6-3-4 Communications Data

Setting (monitor) value	Communications data (See note.)	Negative values	Decimal point
Hexadecimal	Double word (8 digits) Word (4 digits)	2's complement	The decimal point is removed and the result is converted to hexadecimal. Example) 105.0 → 1050 → 0000041A (8 digits) 105.0 → 1050 → 041A (4 digits)

Note Refer to *Parameter List* on page 175.

6-3-5 List of FINS-mini Command Services

For details on each service, refer to *6-4 Detailed Description of Services*.

MRC	SRC	Name of service	Processing	TC4/TC2	HFU
01	01	Read from variable area	Reads a set value.	Supported	Supported
01	02	Write to variable area	Writes a set value.	Supported	Supported
01	04	Composite read from variable area	Reads more than one non-consecutive set value.	Supported	Supported
01	13	Composite write to variable area	Writes more than one non-consecutive set value.	Supported	Supported
01	10	Composite registration read	Reads in order the contents of addresses specified for composite read registration of set values.	Supported	Supported
01	11	Composite read registration	Specifies the addresses to be read for a composite read of set values.	Supported	Supported
01	12	Composite read registration confirmation	Reads the contents of the registration for composite read of set values.	Supported	Supported
05	03	Controller attribute read	Reads the model and communications buffer size.	Supported	Supported
06	01	Controller status read	Reads the operating status.	Supported	Supported
08	01	Echoback test	Performs an echoback test.	Supported	Supported
30	05	Operation commands	Executes RUN/STOP, AT execute/AT cancel, and other operations.	Supported	Supported

Note G3ZA set values can be read from the Basic Unit connected to the G3ZA. The Basic Unit has variables for use with the G3ZA. The G3ZA set values can be read and written by reading and writing these variables.

6-4　Detailed Description of Services

6-4-1　Read from Variable Area

This service reads from a variable area.

■ Command

Service Request PDU

MRC	SRC	Variable type	Read start address	Bit position	No. of elements
0 | 1	0 | 1			0 | 0	
2	2	2	4	2	4

■ Response

Service Response PDU

MRC	SRC	Response code	Read data (for No. of elements)
0 | 1	0 | 1		
2	2	4	No. of elements × 8 or 4

1. Variable Type and Read Start Address

   Refer to *Parameter List* on page 175.

2. Bit Position

   The EJ1G does not support bit access. Fixed to 00.

3. No. of Elements

Read data length	No. of elements
For double-word (8-digit) variable type	40 max. (0028H)
For word (4-digit) variable type	80 max. (0050H)

   Note　The following values apply for the DA/9A variable types.

Read data length	No. of elements
For double-word (8-digit) variable type	25 max. (0019H)
For word (4-digit) variable type	50 max. (0032H)

4. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
110B	Response too long	The number of elements exceeds the maximum.
1100	Parameter error	Bit position is not 00.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

5. Precautions

   • "0" is set when an address with no data set is read.

   • If the start address + number of elements exceeds FFFF, the address returns to 0000.

6-4-2   Write to Variable Area

This service writes to a variable area.

■ Command

Service Request PDU

MRC	SRC	Variable type	Write start address	Bit position	No. of elements	Write data (for No. of elements)
0 1	0 2			0 0		
2	2	2	4	2	4	No. of elements × 8 or 4

■ Response

Service Response PDU

MRC	SRC	Response code
0 1	0 2	
2	2	4

1. Variable Type and Write Start Address

   Refer to *Parameter List* on page 175.

2. Bit Position

   The EJ1G does not support bit access. Fixed to 00.

3. No. of Elements

Write data length	No. of elements
For double-word (8-digit) variable type	39 max. (0027H)
For word (4-digit) variable type	79 max. (004FH)

Note   The following values apply for the DA/9A variable types.

Write data length	No. of elements
For double-word (8-digit) variable type	24 max. (0018H)
For word (4-digit) variable type	48 max. (0030H)

4. Response Codes

Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1003	Number of elements/ data mismatch	The number of data does not match the number of elements.
1100	Parameter error	Bit position is not 00.Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
3003	Read-only error	An attempt was made to write to a read-only variable.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

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6-4-3 Composite Read from Variable Area

This service reads in order the contents of specified addresses in a variable area.

■ **Command**

Service Request PDU

MRC	SRC	Variable type	Read address	Bit position		Variable type	Read address	Bit position
0 1	0 4			0 0				0 0
2	2	2	4	2		2	4	2

■ **Response**

Service Response PDU

MRC	SRC	Response code	Variable type	Read data
0 1	0 4			
2	2	4	2	No. of elements × 8 or 4
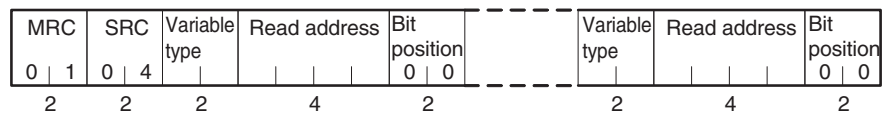
Variable type	Read data
2	No. of elements × 8 or 4

The read data is read together with the variable type, in the order specified in the command.

1. Variable Type and Read Address

    Refer to *Parameter List* on page 175.
    Composite reads cannot be performed for the DA/9A variable types.

2. Bit Position

    The EJ1G does not support bit access. Fixed to 00.

3. Response Codes

Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
110B	Response too long	The number of elements exceeds the maximum.
1100	Parameter error	Bit position is not 00.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

4. No. of Read Data Items (Variable Type + Read Data)

Read data length	No. of read data items
For double-word (8-digit) variable type	32 max. (0020H)
For word (4-digit) variable type	41 max. (0029H)

6-4-4 Composite Write to Variable Area

This service writes in order the contents of specified addresses to a variable area.

■ Command

Service Request PDU
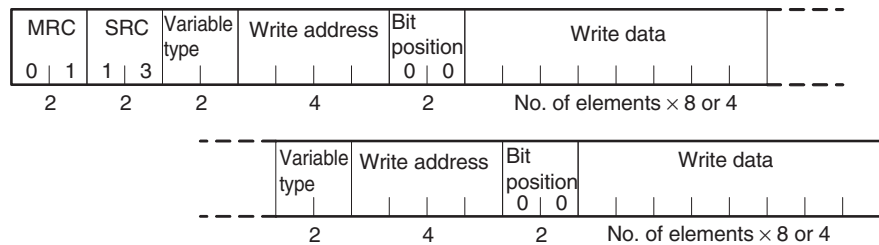
■ Response

Service Response PDU
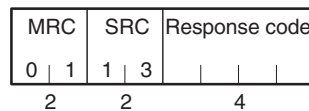
1. Variable Type and Write Address

   Refer to *Parameter List* on page 175.
   Composite writes cannot be performed for the DA/9A variable types.

2. Bit Position

   The EJ1G does not support bit access. Fixed to 00.

3. No. of Write Data Items

Write data length	No. of write data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	27 max. (001BH)

4. Response Codes

Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1100	Parameter error	Bit position is not 00.Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
3003	Read-only error	An attempt was made to write to a read-only variable type.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

6-4-5   Composite Registration Read

This service reads in order the contents of addresses specified in a variable area composite read registration.

■ **Command**

Service Request PDU
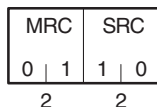
MRC	SRC
0 ¦ 1	1 ¦ 0
2	2

■ **Response**

Service Response PDU

MRC	SRC	Response code	Variable type	Read data
0 ¦ 1	1 ¦ 0			
2	2	4	2	No. of elements × 8 or 4

Variable type	Read data
2	No. of elements × 8 or 4

1.   Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
110B	Response too long	The number of elements exceeds the maximum.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

2.   Variable Type

Refer to *Parameter List* on page 175.

3.   No. of Read Data Items

Read data length	No. of read data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

6-4-6 Composite Read Registration

This service specifies the addresses to be read when using the composite read registration from variable area service.

The registered data is saved in EEPROM.

■ Command

Service Request PDU

MRC	SRC	Variable type	Read address	Bit position		Variable type	Read address	Bit position
0 ¦ 1	1 ¦ 1			0 ¦ 0				0 ¦ 0
2	2	2	4	2		2	4	2

■ Response

Service Response PDU

MRC	SRC	Response code
0 ¦ 1	1 ¦ 1	
2	2	4

1. Variable Type and Read Address

   Refer to *Parameter List* on page 175.
   Composite reads/writes cannot be registered for the DA/9A variable types.

2. Bit Position

   The EJ1G does not support bit access. Fixed to 00.

3. No. of Registered Data Items (Variable Type + Read Address + Bit Position)

Registered data length	No. of registered data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

4. Response Codes

Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1100	Parameter error	Bit position is not 00.Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

6-4-7   Composite Read Registration Confirmation

This service reads the contents of the registration for a composite read from a variable area.
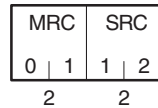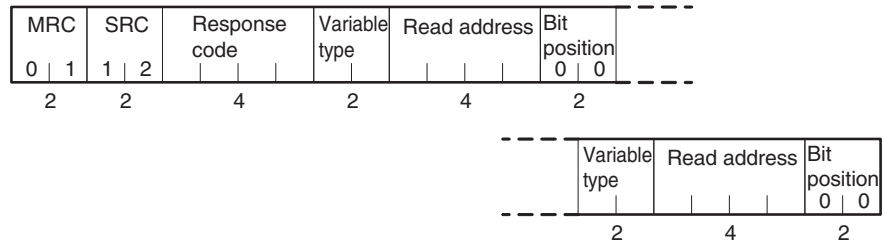
■ Command

Service Request PDU

```
MRC   SRC
0 | 1 | 1 | 2
  2     2
```

■ Response

Service Response PDU

```
MRC   SRC   Response   Variable  Read address  Bit
            code       type                    position
0 | 1 | 1 | 2   |   |     |    |   |  |  |     0 | 0
  2     2      4          2         4           2
```

```
                              Variable  Read address  Bit
                              type                    position
                                  |       |   |   |    0 | 0
                                  2          4          2
```

1.   Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

2.   Variable Type and Read Address

Refer to *Parameter List* on page 175.

3.   Bit Position

The EJ1G does not support bit access. Fixed to 00.

4.   No. of Registered Data Items (Variable Type + Read Address + Bit Position)

Registered data length	No. of registered data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

6-4-8　Controller Attribute Read

This service reads the model number and communications buffer size.

■ Command

Service Request PDU

MRC	SRC
0 | 5	0 | 3
2	2

■ Response

Service Response PDU

MRC	SRC	Response code	Model	Buffer size
0 | 5	0 | 3			
2	2	4	10	4

1. Model

   From 1 to 10 in *1-2-4 Model Number Legend* can be read.

   Example:

   Input range

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	G	-	H	F	U	A	-	N	F	L	K

2. Buffer Size

   The communications buffer size is expressed in 2-byte hexadecimal, and read after being converted to 4-byte ASCII.

   The buffer size is the smaller of the send and receive buffer sizes.

3. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7015	Operation error (7015)	The command cannot be executed while resetting (including during startup).
0000	Normal completion	Processing was completed normally.

6-4-9   Controller Status Read

This service reads the operating status and error status.

■ Command

Service Request PDU

MRC	SRC
0 ¦ 6	0 ¦ 1
2	2

■ Response

Service Response PDU

MRC	SRC	Response code	Operating status	Related Information
0 ¦ 6	0 ¦ 1	¦ ¦ ¦	¦	¦
2	2	4	2	2

1.   Operating Status

   • TC4/TC2

Channel	Bit position	Meaning
CH1	0	00: Operating
	1	01: Error output
CH2	2	10: Stopped
	3	11: In manual operation
CH3	4	
	5	
CH4	6	
	7	

   • HFU
     Fixed to 00.

2.   Related Status

Code	HFU	TC4 and TC2
00	Startup processing	Startup processing
01	Device failure	Device failure
02	Device error	Device error
03	Configuration confirmation	Configuration confirmation
04	Configuration error	Configuration error
05	---	Normal
06	Normal	---

3.   Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
0000	Normal completion	Processing was completed normally.

6-4-10 Echoback Test

This service performs an echoback test.

■ **Command**

Service Request PDU

MRC	SRC	Test data
0 8	0 1	
2	2	0 to 323

■ **Response**

Service Response PDU

MRC	SRC	Response code	Test data
0 8	0 1		
2	2	4	0 to 323
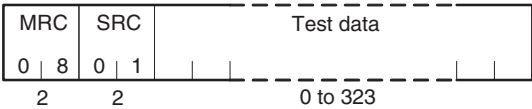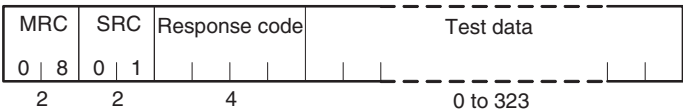
1. Test Data

Up to 323 (0143H).
The test data must be within the following ranges depending on the communications data length.

Communications data length	Test data
8 bits	ASCII H'20 to H'7E and H'A1 to H'FE
7 bits	ASCII H'20 to H'7E

2. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
0000	Normal completion	Processing was completed normally.

6-4-11 Operation Commands

The following functions are executed using operation commands.

• Write Mode	• Software Reset	• Run	• Stop
• Manual	• Auto	• GT Execute	• GT Cancel
• AT Execute	• AT Cancel	• Bank 0 Change to	• Reset Error
		Bank 3 Change	

- Alarm 1 to Alarm 3 Latch Cancel   • All Alarm Latch Cancel
- Save RAM Data   • Parameter Initialization   • Save RAM Data 2
- Register Unit Configuration   • Cancel Configuration Confirmation

■ Command

Service Request PDU

MRC	SRC	Command code	Related information
3 | 0	0 | 5		
2	2	2	2

■ Response

Service Response PDU

MRC	SRC	Response code
3 | 0	0 | 5	| |
2	2	4

1. Command Code by Unit and Related Information

	Command code	HFU related information	TC related information
Write Mode	04	00: Backup 01: RAM	---
Software Reset	06	Always 00.	
Run	0A	00 to 03: Channel FF: All channels (See note 3.)	---
Stop	0B		
Manual	0C		
Auto	0D		
40% AT Execute	0E		
100% AT Execute	0F		
AT Cancel	10		
GT Execute	11		
GT Cancel	12		
Bank 0 Change	1E		
Bank 1 Change	1F		
Bank 2 Change	20		
Bank 3 Change	21		
Reset Error	2D	Always 00.	---
Cancel Configuration Confirmation	2E	Always 00.	
Alarm 1 Latch Cancel	32	00 to 03: Channel FF: All channels	
Alarm 2 Latch Cancel	33		
Alarm 3 Latch Cancel	34		
All Alarm Latch Cancel	35		
Save RAM Data (See note 1.)	37	Always FF.	
Parameter Initialization	38	Always 00.	

	Command code	HFU related information	TC related information
Save RAM Data 2 (See note 2.)	39	Always FF.	
Register Unit Configuration	3B	00: Reset 01: Register	

Note (1) Set values that can be changed during operation are saved to EEPROM.

(2) All set values are saved to EEPROM.

(3) Set the initial channel for gradient temperature control groups.

■ **Description of Operation Commands and Precautions**

• Write Mode
Set either the Port C backup mode or RAM write mode using the related information. (The default is RAM write mode.)
When the mode is switched from RAM write mode to backup mode, the settings for the parameters that can be changed during operation are not written to EEPROM. Execute the Save RAM Data command if required.

Note Settings that are changed from port A are always written to EEPROM. Be sure to consider the limit to the number of writes when using port A.

• Software Reset
Executes a software reset.
A software reset performs the same operation as when the power is cycled.
Execute a software reset only when control operations are stopped for all channels.

• RUN/STOP
Starts or stops operation for the channels specified in the related information.

• Auto/manual Switch
Switches between manual mode and automatic mode for the channels specified in the related information. When switching from automatic to manual mode, the MV will be written to EEPROM.
When switching to manual mode during GT or AT execution, the GT or AT will be stopped before the mode is switched.

• GT Execute/Cancel
Selects executing or canceling GT for the initial channel in the group specified in the related information.
All groups (including 2-PID control groups) must be in STOP mode before GT is executed.
An error will occur in the following instances:

• When the RUN/STOP parameter is set to RUN

• When the AUTO/MANUAL parameter is set to MANUAL

• When GT is executed for a channel other than the initial channel in the group

• When an input error occurs for any channel in the target group

• When GT is executed for a 2-PID control group

• 40% AT Execute/Cancel and 100% AT Execute/Cancel
Selects executing or canceling autotuning for the channels specified in the related information. An "operation error" occurs in the following instances:

• When the Run/Stop parameter is set to "stop"

• When the Auto/Manual parameter is set to "manual"

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- When 100% AT Execute is specified during 40% AT Execute execution
- When 40% AT Execute is specified during 100% AT Execute execution
- When AT Execute/Cancel is specified for a GTC group

- Bank 0 Change to Bank 3 Change
Switches between banks 0 to 3. Refer to *5-7-1 Bank Function* for details on banks.
An operation error will occur if GT or autotuning is already being performed for a specified channel.

- Reset Error
Clears the following errors: heater burnout latch, HS alarm latch, heater overcurrent latch, heater overcurrent, and operation during error (selection D).

- Latch Cancel
Cancels alarm latches. This command is enabled when the alarm latch function is used.

- Save RAM Data
Writes the settings for parameters that can be changed during operation to EEPROM.
Time will be required and control performance may be affected if too many parameters have been changed during operation. Save data to RAM so that control performance will not be affected, e.g., save data while operation is stopped.

- Parameter Initialization
Returns the current set values to their default values. The setting is not saved to EEPROM, however, so Save RAM Data 2 should be executed if required.
Execute Save RAM Data 2 only when control operations are stopped for all channels.
After initializing the parameters, always cycle the power supply or perform a software reset before starting control operations.

- Save RAM Data 2
Writes settings (except read-only settings) to EEPROM.
Execute Save RAM Data 2 only when control operations are stopped for all channels.

- Register Unit Configuration (HFU)
Registers or resets the Basic Unit (TC4/2) configuration. Refer to *Step 6* on page 39 under *3-1 Setup Procedure*.

- Register Unit Configuration (TC4/2)
Registers or resets the G3ZA Unit Configuration. Refer to *4-5-1 Using G3ZA Multi-channel Power Controllers* for details on Unit configuration registration.
Execute Save RAM Data 2 only when control operations are stopped for all channels.

- Cancel Configuration Confirmation
If Units registered in the configuration cannot be detected, the configuration confirmation status will not end. For example, if distributed placement is used and the configuration has been registered, a no-power status will be detected for the distributed Units. Use this operation command to cancel the configuration confirmation status. A configuration error will occur.

Note Operation Commands for Switching Control Operation
An error may occur if Run/Stop, Auto/Manual, GT, Execute/Cancel, or AT Exe-

cute/Cancel are switched too quickly. Allow an interval of at least 1 second when switching control operation continuously.

2. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
1002	Command too short	The command is not long enough.
1100	Parameter error	Bit position is not 00.
0402	Operation error (0402)	The command cannot be executed because the model or version is not the same.
2201	Operation error (2201)	The command cannot be executed during operation.
2202	Operation error (2202)	The command cannot be executed because operation is stopped.
2203	Operation error (2203)	• The command cannot be executed in normal mode. • The command cannot be executed in manufacturer mode.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7012	Operation error (7012)	The command cannot be executed due to a configuration error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received. Execute retries until the 7013 response code is reset.
7014	Operation error (7014)	The command cannot be executed because EEPROM is currently being written. Execute retries until the 7014 response code is reset.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7016	Operation error (7016)	The command cannot be executed during error latch status.
7020	Operation error (7020)	The command cannot be executed in the current control mode.
7021	Operation error (7021)	The command cannot be executed because the control switching conditions have not been established.
7030	Operation error (7030)	The command cannot be executed in the current output mode.
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

SECTION 7
Errors and Error Processing

This section describes methods for checking possible problems in operation depending on classifications of Temperature Controller status.

7-1   Things to Check First

If an error occurs, check the following items and take corrective measures if required.

Check the indicators.	Check the EJ1G operating status by looking at the indicators.

Check the EJ1G operating status by looking at the indicators.

If the ERR indicator is lit, cycle the EJ1G power supply. If the ERR indicator does not light when power comes back ON, check for noise as the cause of the error and take countermeasures.

Check the switches and wiring.

Check the switch settings and wiring.

- Power Supply
    - Is the power turned ON?
    - Is the power supply voltage within the allowable range?

- Switches
    - Are the switch settings correct for the system being used?

- Wiring
    - Is the terminal block correctly wired?
    - Is the polarity correct?
    - Are any wires disconnected?
    - Are any wires or cables broken or touching?

- Communications Conditions
    - Do the communications conditions match those of the host system?

If none of these check items needs correction or the error is not cleared even after performing the above checks, use the communications function to investigate in more detail.

Determine the error from the status.

Check the EJ1G status. Find the cause of the error based on the data read by the EJ1G, then correct the error.

Determine the error from the current situation.

If the cause of the error is still not clear after checking all these items, infer the cause from the current situation and try countermeasures.

7-2 Determining Errors from Indicators

The following table shows indicator status, possible error causes, and coun-
termeasures.

Status			Possible causes	Countermeasure
PWR	▬	Not lit	There is no power supply.	Check to see if the Units are linked properly.
RUN	▬	Not lit	The power supply voltage is out-side the allowable range.	Adjust the voltage to within the range.
ERR	▬	Not lit	The Unit is malfunctioning.	Replace the Unit.
ALM	▬	Not lit		
PWR	◪	Green, flashing 0.5 s	The Unit is malfunctioning.	Cycle the power supply. If the problem persists, replace the Unit.
RUN	—	---		
ERR	▭	Red, lit		
ALM	—	---		
PWR	◪	Green, flashing 1 s	The settings data is corrupted.	Send the Parameter Initialization operation com-mand to initialize the parameters and then set them again.
RUN	▬	Not lit		
ERR	▭	Red, lit	The Unit configuration informa-tion is corrupted (Basic Units only).	Send the Register Unit Configuration: Reset operation command and then cycle the EJ1G power supply.
ALM	—	---	The Unit is malfunctioning.	Replace the Unit.
			A Unit is not connected correctly.	Check Unit models and the order of connection.
PWR	▭	Green, lit	The registered Unit configura-tion does not match the actual Unit configuration (Basic Units only).	Restore the registered Unit configuration or re-register the configuration.
RUN	▬	Not lit		
ERR	▭	Red, lit	The same unit number is set for more than one connected G3ZA (Basic Units only).	Correct the G3ZA unit number settings and then cycle the power supply.
ALM	▬	Not lit	There is an error in a connected G3ZA (Basic Units only).	Refer to the *G3ZA User's Manual* (Cat. No. Z200) and take the required countermeasures.

In addition to the above, the status of the following indicators can be used to
determine the cause of and countermeasures for errors.

TC4/TC2

Status			Possible causes	Countermeasure
ERR	◪	Red, flashing	There is an input error.	Check the wiring for the input to be sure it is wired correctly, not broken, and not shorted. Also check the input type.
ALM	▭	Red, lit	One of the following alarms has occurred: heater burnout alarm, heater short alarm.	Read the Error Channel A Status, the Channel Status, and the Channel Alarm Status to deter-mine the channel with the alarm and the nature of the alarm, and take appropriate measures.
			An error has occurred in commu-nications with a connected G3ZA.	Check the connection to the G3ZA and take appropriate measures.

HFU

Status			Possible causes	Countermeasure
RUN		Green, flashing	There is an error in a channel that is currently running.	Read status to determine the channel that has an error and then determine the cause from the status of the ERR and ALM indicators.
ERR		Red, flashing	There is an input error.	Check the wiring for the input to be sure it is wired correctly, not broken, and not shorted. Also check the input type.
			An error has occurred for which the Operation During Error parameter is set to MV at PV Error or Stop control.	Read status to determine the nature of the error and take appropriate measures.
			An error has occurred in communications with a connected TC4/TC2.	Check the connection to the TC4/TC2 and take appropriate measures.
ALM		Red, lit	One of the following alarms has occurred: heater burnout alarm, heater short alarm, or temperature alarm.	Read the Error Channel A to D and the Channel Alarm Status to determine the channel with the alarm and the nature of the alarm, and take appropriate measures.
			The power supply to the PLC was interrupted after communications were established between the PLC and EJ1G.	Supply power to the PLC. If the Operation Command Response Bits in the Programless Upload Area set in PLC memory are EEEE, write FFFF to the Operation Command Request Bits to restart communications.
			The communications cable was broken after communications were established between the PLC and EJ1G.	Connect the cable. If the Operation Command Response Bits in the Programless Upload Area set in PLC memory are EEEE, write FFFF to the Operation Command Request Bits to restart communications.
			An error has occurred in programless communications.	Check the following and correct any problems, and then restart operation. • Check the communications line lengths (trunk and branch). • Check the communications line for shorts, breaks, or looseness. • Check that terminating resistance is set only on the ends on the trunk line. • Check for excessive noise.

7-3 Determining the Error from the Status

The EJ1G status can be checked by using communications to read the Status.

Status is connected to other status data in a directory tree, so the cause of the error can be checked or the channels for which there are alarms can be investigated by searching through the directory tree for the related status.

■ **Example of Using Status Information for Troubleshooting**

1. Read the Device A Status (C40000) for the HFU Unit.
   C40000: 'H0004 (i.e., bit 2 is ON)
   → A channel error status bit is ON.

2. Read Error Channel A Status (C4000B).

   C4000B: 'H0008 (i.e., bit 3 is ON).

   → An error or alarm has occurred for channel 4.

3. Read the Channel Status (C40401) and Channel Alarm Status (C40402) of channel 4.
   C40401: 'H0001 (i.e., bit 0 is ON)

   → Operation is stopped but there is no input error.

   C40402: 'H0003 (i.e., bits 1 and 2 are ON)
   → Channel 4 alarms 1 and 2 are ON.

C4/84 0000

Device A Status		
Bit 0	Device Error	0
Bit 1	Configuration Error	0
Bit 2	Channel Error	1
Bit 3	External RAM Error at Operation	0
Bit 4	Internal Communications Error	0
Bit 5	Not used.	0
Bit 6	Programless Link Error	0
Bit 7	Not used.	0
Bit 8	Not used.	0
Bit 9	Not used.	0
Bit 10	Not used.	0
Bit 11	Lower-level I/O Error	0
Bit 12	Not used.	0
Bit 13	Lower-level I/O Alarm	0
Bit 14	Not used.	0
Bit 15	Lower-level I/O Notification	0

C4/84 000B

Error Channel A Status		
Bit 0	CH1	0
Bit 1	CH2	0
Bit 2	CH3	0
Bit 3	CH4	1
Bit 4	CH5	0
Bit 5	CH6	0
Bit 6	CH7	0
Bit 7	CH8	0
Bit 8	CH9	0
Bit 9	CH10	0
Bit 10	CH11	0
Bit 11	CH12	0
Bit 12	CH13	0
Bit 13	CH14	0
Bit 14	CH15	0
Bit 15	CH16	0

C4/84 0401

Channel Status		
Bit 0	RUN/STOP	1
Bit 1	Auto/Manual	0
Bit 2	GT or AT Execute/Cancel	0
Bit 3	Not used.	0
Bit 4	Control Type	0
Bit 5	Not used.	0
Bit 6	Not used.	0
Bit 7	Not used.	0
Bit 8	Input Error	0
Bit 9	Not used.	0
Bit 10	Not used.	0
Bit 11	Not used.	0
Bit 12	GT Error	0
Bit 13	Not used.	0
Bit 14	Not used.	0
Bit 15	Not used.	0

C4/84 0402

Channel Alarm Status		
Bit 0	Alarm 1	1
Bit 1	Alarm 2	1
Bit 2	Alarm 3	0
Bit 3	Not used.	0
Bit 4	Not used.	0
Bit 5	Not used.	0
Bit 6	Not used.	0
Bit 7	Not used.	0
Bit 8	Not used.	0
Bit 9	Not used.	0
Bit 10	Basic Unit Error	0
Bit 11	Basic Unit Alarm	0
Bit 12	Set Point Limiter Out of Range	0
Bit 13	Set Value Limiter Reverse Operation	0
Bit 14	MV Limiter Reverse Operation	0
Bit 15	Not used.	0

Status and Addresses

Variable type C4/C84	Parameter name
0000	Device A Status
0001	Device Error Status
0002	Configuration Error A Status
0003	Configuration Error B Status
0004	Internal Communications Error Status
0005	I/O Error Status
0006	I/O Alarm A Status
0007	I/O Alarm B Status
Not used.	
0009	I/O Notification A Status
Not used.	
000B	Error Channel A Status
000C	Error Channel B Status
000D	Error Channel C Status
000E	Error Channel D Status
000F	Basic Unit/Expand Unit Error
0010	Basic Unit/Expand Unit Alarm
Not used.	
0012	Output Status
0013	Device Status B
Not used.	
0020	Version

Variable type C4/C84	Parameter name
Not used.	
0100	Process Value - CH1
0101	Channel Status - CH1
0102	Channel Alarm Status - CH1
0103	Internal Set Point - CH1
	...
0200	Process Value - CH2
0201	Channel Status - CH2
0202	Channel Alarm Status - CH2
0203	Internal Set Point - CH2
	...
0300	Process Value - CH3
0301	Channel Status - CH3
0302	Channel Alarm Status - CH3
0303	Internal Set Point - CH3
	...
4000	Process Value - CH64
4001	Channel Status - CH64
4002	Channel Alarm Status - CH64
4003	Internal Set Point - CH64

Note   Refer to *Status Lists* on page 188 for information on bit data and details for individual statuses.

Status Directory Tree

TC4

Device A Status — C4/84 0000

Bit 0	Device Error	1 ... 0
Bit 1	Configuration Error	1 ... 0
Bit 2	Channel Error	1 ... 0
Bit 3	Not used.	
Bit 4	Expand Communications Error	1 ... 0
Bits 5	Internal Communications Error	
Bits 6 to 7: Not used.		

Device Error Status — C4/84 0001

Bits 0 to 3: Not used.	
Bit 4	EEPROM Error
Bit 5	Calibration Error
Bit 6	Setting Value Error
Bit 7	Not used.
Bit 8	Configured Registration Data Error
Bit 9	Device Information Data Error
Bits 10 to 11: Not used.	
Bit 12	Model Information Mismatching Error
Bits 13 to 15: Not used.	

Configuration Error A Status — C4/84 0002

Bit 0	Undefined Expand Unit
Bit 1	Not used.
Bit 2	Too Many Expand Units
Bit 3	Expand Unit Failure
Bit 4	Expand Unit Connection Fault
Bits 5 to 7: Not used.	
Bits 8 to 9: Not used.	
Bits 10	No HFU
Bit 11: Not used.	
Bits 12 to 15: Not used.	

Configuration Error B Status — C4/84 0003

Bit 0	Expand Unit 1 Error
Bit 1	Expand Unit 2 Error
Bit 2	Expand Unit 3 Error
Bit 3	Expand Unit 4 Error
Bit 4	Expand Unit 5 Error
Bit 5	Expand Unit 6 Error
Bit 6	Expand Unit 7 Error
Bit 7	Expand Unit 8 Error
Bits 8 to 11: Not used.	
Bits 12 to 15: Not used.	

Error Channel A Status — C4/84 000B

Bit 0	Channel 1	1 ... 0
Bit 1	Channel 2	
Bit 2	Channel 3	
Bit 3	Channel 4	
Bits 4 to 7: Not used.		
Bits 8 to 11: Not used.		
Bits 12 to 15: Not used.		

* CH2 to CH4 are the same as CH1.

Channel Status
C4/84 0101 (CH 1)
C4/84 0201 (CH 2)
C4/84 0301 (CH 3)
C4/84 0401 (CH 4)

Bits 0 to 3: Not used.	
Bits 4 to 7: Not used.	
Bit 8	Input Error
Bits 9 to 11: Not used.	
Bits 12 to 15: Not used.	

Internal Communications Error Status — C4/84 0004

Bit 0	Expand Unit 1 Communications Error
Bit 1	Expand Unit 2 Communications Error
Bit 2	Expand Unit 3 Communications Error
Bit 3	Expand Unit 4 Communications Error
Bit 4	Expand Unit 5 Communications Error
Bit 5	Expand Unit 6 Communications Error
Bit 6	Expand Unit 7 Communications Error
Bit 7	Expand Unit 8 Communications Error
Bits 8 to 11: Not used.	
Bits 12 to 15: Not used.	

Channel Alarm Status
C4/84 0102 (CH 1)
C4/84 0202 (CH 2)
C4/84 0302 (CH 3)
C4/84 0402 (CH 4)

Bits 0 to 3: Not used.	
Bit 4	Heater Overcurrent
Bit 5	HB Alarm
Bit 6	HS Alarm
Bit 7: Not used.	
Bits 8 to 11: Not used.	
Bits 12 to 14: Not used.	
Bit 15	Scaling Reverse Operation

Bits 8 to 9: Not used.					
Bit 10	I/O Error	1		I/O Error Status	C4/84 0005
				Bit 0 | Main Input 1 Count Error	
				Bit 1 | Main Input 2 Count Error	
				Bit 2 | Main Input 3 Count Error	
				Bit 3 | Main Input 4 Count Error	
				Bits 4 to 7: Not used.	
				Bits 8 to 11: Not used.	
		0		Bits 12 to 15: Not used.	
Bit 11	Lower-level I/O Error	1		Basic Unit/Expand Unit Error	C4/84 000F
				Bit 0 | Expand Unit 1 Error	
				Bit 1 | Expand Unit 2 Error	
				Bit 2 | Expand Unit 3 Error	
				Bit 3 | Expand Unit 4 Error	
				Bit 4 | Expand Unit 5 Error	
				Bit 5 | Expand Unit 6 Error	
				Bit 6 | Expand Unit 7 Error	
				Bit 7 | Expand Unit 8 Error	
				Bits 8 to 11: Not used.	
				Bits 12 to 15: Not used.	
				Internal Communications Error Status	
		0		Same as Internal Communications Error Status in previous section	
Bit 12	I/O Alarm	1		I/O Alarm A Status	C4/84 0006
				Bit 0 | CT1 Heater Overcurrent	
				Bit 1 | CT2 Heater Overcurrent	
				Bits 2 to 3: Not used.	
				Bits 4 to 7: Not used.	
				Bits 8 to 11: Not used.	
				Bits 12 to 15: Not used.	
				I/O Alarm B Status	C4/84 0007
				Bit 0 | CT1 HB Alarm	
				Bit 1 | CT1 HS Alarm	
				Bit 2 | Not used.	
				Bit 3 | Not used.	
				Bit 4 | CT2 HB Alarm	
				Bit 5 | CT2 HS Alarm	
				Bit 6 | Not used.	
				Bit 7 | Not used.	
				Bits 8 to 11: Not used.	
		0		Bits 12 to 15: Not used.	
Bit 13	Lower-level I/O Alarm	1		Basic Unit/Expand Unit Alarm Status	C4/84 0010
				Bit 0 | Expand Unit 1 Alarm	
				Bit 1 | Expand Unit 2 Alarm	
				Bit 2 | Expand Unit 3 Alarm	
				Bit 3 | Expand Unit 4 Alarm	
				Bit 4 | Expand Unit 5 Alarm	
				Bit 5 | Expand Unit 6 Alarm	
				Bit 6 | Expand Unit 7 Alarm	
				Bit 7 | Expand Unit 8 Alarm	
				Bits 8 to 11: Not used.	
		0		Bits 12 to 15: Not used.	
Bit 14	I/O Notification	1		I/O Notification A Status	C4/84 0009
				Bit 0 | CT1 Heater Current Hold	
				Bits 1 to 3: Not used.	
				Bit 4 | CT2 Heater Current Hold	
		0		Bits 5 to 7: Not used.	
				Bits 8 to 11: Not used.	
Bit 15: Not used.				Bits 12 to 15: Not used.	

Output Status	C4/84 0012
Bit 0	Control Output 1
Bit 1	Control Output 2
Bit 2	Control Output 3
Bit 3	Control Output 4
Bits 4 to 7: Not used.	
Bits 8 to 11: Not used.	
Bits 12 to 15: Not used.	

Device B Status	C4/84 0013
Bit 0	Not used.
Bit 1	Save RAM 2
Bit 2	Not used.
Bit 3	Registration of unit configuration/ Registration of multiple reads
Bits 4 to 7: Not used.	
Bits 8 to 11: Not used.	
Bit 12	Configuration Registered
Bits 13 to 15: Not used.	

HFU

Device A Status			C4/84 0000
Bit 0	Device Error	1	
		0	
Bit 1	Configuration Error	1	
		0	
Bit 2	Channel Error	1	
		0	
Bit 3	External RAM Error at Operation		
Bit 4	Internal Communications Error	1	
		0	
Bit 5	Not Used.		
Bit 6	Programless Link Error		
Bit 7	Not Used.		

Device Error Status — C4/84   0001

Bits 0 to 3: Not used.	
Bit 4	EEPROM Error
Bit 5	Calibration Error
Bit 6	Setting Value Error
Bit 7: Not used.	
Bit 8	Configured Registration Data Error
Bit 9	Model Information Data Error
Bits 10 to 11: Not used.	
Bit 12	Model Information Mismatching Error
Bits 13 to15: Not used.	

Configuration Error A Status — C4/84   0002

Bit 0	Undefind Expand Units
Bit 1	No Basic Units
Bit 2	Too Many Basic Units
Bit 3: Not used.	
Bit 4	Basic Unit Connection Fault
Bit 5	Basic Unit Startup Error
Bits 6 to 7: Not used.	
Bit 8	Illegal Unit Arrangement
Bits 9 to 11: Not used.	
Bit 12	Illegal Restart Error
Bit 13	Invalid Registration Error
Bit 14	Control Group Setting Error
Bit 15: Not used.	

Configuration Error B Status — C4/84   0003

Bit 0 to 15: Basic Unit 1 to 16 Error

Error Channel A Status — C4/84 000B

Bit 0	CH1	1 / 0
Bits 1 to 15 Channels 2 to 16		

Error Channel B Status — C4/84 000C

Bits 0 to 15 Channels 17 to 32

Error Channel C Status — C4/84 000D

Bits 0 to 15 Channels 33 to 48

Error Channel D Status — C4/84 000E

Bits 0 to 15 Channels 49 to 64

Internal Communications Error Status — C4/84 0004

Bits 0 to 15 Basic Unit 1 to 16 Communications Error

Channel Status (bits 4 to 15) — C4/84 0101 (CH1) to 4001 (CH64)

Bit 0	RUN/STOP
Bit 1	Auto/Manual
Bit 2	GT (AT) Execute/Cancel
Bit 3: Not used.	
Bit 4	Control Type
Bits 5 to 7: Not used.	
Bit 8	Input Error
Bits 9 to 11: Not used.	
Bit 12	GT Error
Bits 13 to 15: Not used.	

Note: Even if bits 0 to 4 for Channel Status turn ON, Channel Status A where the error occurred, will not turn ON.

Channel Alarm Status — C4/84 0102 (CH1) to 4002 (CH64)

Bit 0	Alarm 1
Bit 1	Alarm 2
Bit 2	Alarm 3
Bit 3: Not used.	
Bits 4 to 7: Not used.	
Bits 8 to 9: Not used.	
Bit 10	Basic Unit Error
Bit 11	Basic Unit Alarm
Bit 12	SP Limiter Out of Range
Bit 13	Set Point Limiter Reverse Operation
Bit 14	MV Limiter Reverse Operation
Bit 15: Not used.	

Bits 8 to 10: Not used.		
Bit 11	Lower-level I/O Alarm	1
		0
Bit 12: Not used.		
Bit 13	Lower-level I/O Alarm	1
		0
Bit 14: Not used.		
Bit 15	Lower-level I/O Notification	

Basic/Expand Units Error Status	C4/84	000F
Bits 0 to 15: Basic Units 1 to 16 Error		

Basic/Expand Units Alarm Status	C4/84	0010
Bits 0 to 15: Basic Units 1 to 16 Alarm		

Device B Status		C4/84	0013
Bit 0	Save RAM1		
Bit 1	Save RAM2		
Bit 2	Save Control Parameters		
Bit 3	Registration of Unit Configuration/ Registration of Multiple Reads		
Bits 4 to 7: Not used.			
Bit 8	Write Mode		
Bit 9	EEPROM		
Bits 10 to 11: Not used.			
Bit 12	Configuration Registered		
Bits 13 to 15: Not used.			
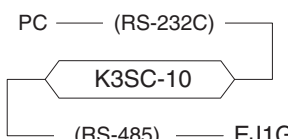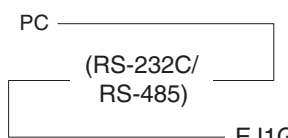
7-4 Determining the Error from the Current Situation for Communications Errors

This section provides troubleshooting information for communications errors.

EST2-2C-MV3 CX-Thermo Support Software
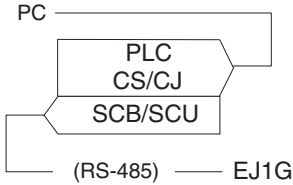
No Communications between the EST2-2C-MV3 CX-Thermo Support Software and the EJ1G.

Status	Possible cause	Countermeasure
Cannot connect online Connection PC ──────┐ └─ E58-CIFQ1 ─┘ └──── EJ1G Connection port 		Connection port
---	---
Computer	USB
EJ1C (EDU)	Port A (Connector)		There is no power supply to the EJ1G.	Supply power from the EDU power supply terminal.
	The USB-Serial Conversion Cable is not connected.	Connect the cable.
	The EST2-2C-MV3 CX-Thermo Support Software settings are incorrect.	Correct the communications settings. Serial port: COM (See note.) (E58-CIFQ1 Serial Port) Baud rate: 38.4 (kbps) Data length: 7 (bit) Stop bit: 2 (bit) Parity: Even (bit) Unit number: (See note.) **Note** Match the serial port and unit number settings to the system used.
	The serial port setting in the EST2-2C-MV3 CX-Thermo Support Software communications settings does not show "E58-CIFQ1".	The driver for the E58-CIFQ1 USB-Serial Conversion Cable is not installed. Install the driver from the CD-ROM included with the product.
	There is no device on the communications path with the specified unit number.	Specify a unit number in the communications settings for a device on the communications path.
	There is a device on the communications path with the same unit number.	Change the unit number in the communications settings so that the unit numbers are not duplicated.
	The Programmable Terminal is connected directly to port A and performing communications.	Both the Support Software and a Programmable Terminal cannot be connected to port A. Either turn OFF the Programmable Terminal or move the Programmable Terminal to the System Screen and stop Programmable Terminal communications.
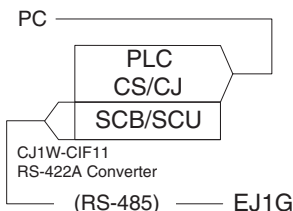
Status	Possible cause	Countermeasure

Cannot connect online
 	
Connection
 	
PC —— (RS-232C) ┐
  └ K3SC-10 ┘
  ┌
  └ (RS-485) —— EJ1G
 	
Connection port
 	
|
		Connection port

Computer	Serial port
EJ1C (EDU)	Port A	 K3SC-10: Interface Converter	There is no power supply to the EJ1G.	Supply power from the EDU power supply terminal.
	There is no power supply to the Interface Converter.	Supply power to the Interface Converter.
	The EST2-2C-MV3 CX-Thermo Support Software settings are incorrect.	Correct the communications settings. Serial port: COM (See note.) Baud rate: 38.4 (kbps) Data length: 7 (bit) Stop bit: 2 (bit) Parity: Even (bit) Unit number: (See note.) **Note** Match the serial port and unit number settings to the system used.
	The Interface Converter communications conditions are different from the EJ1G communications settings.	Refer to the Interface Converter manual and match the communications conditions to the EJ1G communications settings.
	The Interface Converter connection is incorrect.	Refer to the computer, Interface Converter, and EJ1G manuals and wire the connection correctly.
	There is no device on the communications path with the specified unit number.	Specify a unit number in the communications settings for a device on the communications path.
	There is a device on the communications path with the same unit number.	Change the unit number in the communications settings so that the unit numbers are not duplicated.

Cannot connect online
 	
Connection
 	
PC ————┐
  (RS-232C/
   RS-485)
  └─────
  └ EJ1G
 	
Connection port
 	
|
		Connection port

Computer	---
EJ1G (HFU)	Port C		The EJ1G is connected to port C on the HFU.	The EST2-2C-MV3 CX-Thermo Support Software cannot be connected to the HFU. Connect it to port A on the EDU.

Status	Possible cause	Countermeasure
The EJ1G does not appear in the CX-Integrator's Compo-Way/F network. Connection PC —— PLC CS/CJ SCB/SCU (RS-485) —— EJ1G or PC —— PLC CS/CJ SCB/SCU CJ1W-CIF11 RS-422A Converter (RS-485) —— EJ1G Connection port	There is no power supply to the EJ1G.	Supply power from the EDU power supply terminal.
	CX-one is not compatible with the EJ1G.	Use a version of CX-One that is compatible with the EJ1G (Ver.1.12 or later.)
	The Serial Communications Board (SCB)/Unit (SCU) and the EJ1G communications settings do not match.	Correct the communications settings for the Serial Communications Unit. User/default settings: User settings Serial communications mode: Serial Gateway Data length: 7 (bit) Stop bits: 2 (bit) Parity: Even (bit) Baud rate: 38.4 (kbps) Refer to the CX-Integrator Operation Manual (W445). **Note** The Serial Communications Board (SCB)/Unit (SCU) must be unit version 1.2 or later. Refer to *Unit Versions of CS/CJ-series Serial Communications Boards/Units* in the *Serial Communications Board/Unit Operation Manual* (W336) for information on checking unit versions.
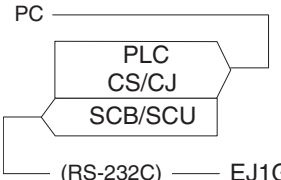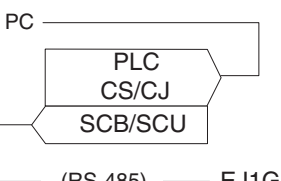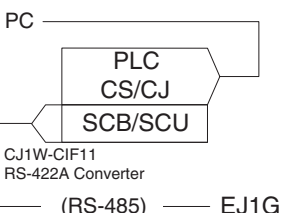
	Connection port
Computer	---
SCU	---
EJ1C (EDU)	Port A

Programless Communications

No Programless Communications between the PLC and the EJ1G

Status	Possible cause	Countermeasure
No communications between the PLC and the EJ1G. Connection PC PLC CS/CJ SCB/SCU (RS-232C) — EJ1G Connection port 	Connection port
SCU	---
EJ1G (HFU)	Port C (RS-232C)		There is no power supply to the EJ1G.	Supply power from the EDU power supply terminal.
	The Serial Communications Board (SCB)/Unit (SCU) wiring is incorrect.	Refer to the respective manuals and wire the connection correctly. See *Related Manuals* on page xiv.
	The port C communications are set to RS-485.	Turn ON pin 8 on the HFU settings switch 2 (SW2) to set to RS-232C.
	The Serial Communications Board (SCB)/Unit (SCU) RS-485 port is connected to the EJ1G RS-232C port.	Connect the SCU RS-232C port to the EJ1G RS-232C port.
	The EJ1G programless communications parameters are incorrect.	Refer to *5-6 Programless Communications* in *SECTION 5 Advanced Unit (HFU) Functions* and check the settings.
	The Serial Communications Board (SCB)/Unit (SCU) communications settings are incorrect.	Same as above.
No communications between the PLC and the EJ1G. Connection PC PLC CS/CJ SCB/SCU (RS-485) — EJ1G or PC PLC CS/CJ SCB/SCU CJ1W-CIF11 RS-422A Converter (RS-485) — EJ1G Connection port 	Connection port
SCU	---
EJ1G (HFU)	Port C (RS-485)		There is no power supply to the EJ1G.	Supply power from the EDU power supply terminal.
	The Serial Communications Board (SCB)/Unit (SCU) wiring is incorrect.	Refer to the respective manuals and wire the connection correctly. See *Related Manuals* on page xiv.
	The port C communications are set to RS-232C.	Turn OFF pin 8 on the HFU settings switch 2 (SW2) to set to RS-485.
	The Serial Communications Board (SCB)/Unit (SCU) RS-232C port is connected to the EJ1G RS-485 port.	Connect the SCU RS-485 port to the EJ1G RS-485 port. Alternatively, connect the RS-422A Converter to the RS-232C port to convert to RS-485, then connect to the EJ1G RS-485 port.
	The EJ1G programless communications parameters are incorrect.	Refer to *5-6 Programless Communications* in *SECTION 5 Advanced Unit (HFU) Functions* and check the settings.
	The Serial Communications Board (SCB)/Unit (SCU) communications settings are incorrect.	Same as above.

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G3ZA

Use the following table when the EJ1G cannot communicate with an G3ZA connected to it.

Status	Possible cause	Countermeasure
Communications are not possible between the G3ZA and EJ1G (the COM3 indicator does not flash).	Power is not supplied to the G3ZA.	Supply power to the G3ZA from the power supply terminals and reset the EJ1G.
	The G3ZA is not connected to the EJ1G.	Connect the G3ZA to the EJ1G using an EJ1C-CBLA050 Connecting Cable.
	Pin 7 on SW2 on the EJ1G is not ON.	Turn ON pin 7 on SW2 on the EJ1G.
	Power was not supplied to the G3ZA when the EJ1G was started.	Supply power to the G3ZA and EJ1G at the same time or to the G3ZA first.
	Different baud rates are set in the G3ZA and EJ1G.	Set SW2 on the G3ZA to 3 and reset the EJ1G.
	The unit configuration was registered when the G3ZA was not connected to the EJ1G (default condition).	Send the Resister Unit Configuration: Reset operation command to the EJ1G Basic Unit to which the G3ZA is connected to clear the Unit configuration. The settings will be valid after the EJ1G is reset.
	The same unit number is set for more than one G3ZA.	Set the G3ZA unit numbers so that the same number is not used more than once for the same EJ1G Basic Unit.
	The registered G3ZA Unit configuration is different from the connected G3ZA Unit configuration.	Send the Resister Unit Configuration: Reset operation command to the EJ1G Basic Unit to which the G3ZA is connected to clear the Unit configuration, and then reset the EJ1G. When the EJ1G starts again, send the Register Unit Configuration: Register operation command to register the connected G3ZA Units in the configuration.
		Note Bit 12 of variable type C4/84 0013 in Device B Status can be used to see if the connected G3ZA Unit configuration has been registered.
	The cable connecting the G3ZA and EJ1G is broken.	Replace the Connecting Cable between the G3ZA and EJ1G.

7-5 Determining the Error from the Current Situation for Temperature Measurement Errors

Error in Measured Temperature or Temperature Cannot Be Measured

	Possible cause	Countermeasure
Connection	The thermometer polarity or connected terminals are wrong.	• Rewire correctly.
	A thermometer that cannot be used with the EJ1G has been connected.	• Change to a compatible thermometer.
	The thermometer has burnt out, short-circuited, or deteriorated.	• Replace with a better quality thermometer.
	No thermometer is connected.	• Connect a thermometer.
	A compensating conductor applicable to the thermocouple has not been used.	• Directly connect a thermocouple with a long lead. • Use an applicable compensating conductor.
	A device using metal other than a thermocouple or compensating conductor has been connected between the thermocouple and EJ1G terminals.	• Connect a device specifically for thermocouples.
	The connection terminal screws are loose and the connection is imperfect.	• Tighten the screws securely.
	The thermocouple lead or compensating conductor is too long and is affected by the conductor resistance.	• Use a thicker compensating conductor. • Change the wiring location and shorten the wires.
	The resistance of the 3 conductors between the thermometer and the EJ1G terminals is different.	• Use conductors with the same resistance for all three terminals, A, B, and B terminals.
Installation	Affected by noise emitted by devices near the EJ1G.	• Move the EJ1G away from devices emitting noise. • Connect a surge suppressor or noise filter to devices emitting noise.
	The thermometer lead is too close to the power line and is receiving induction noise from the power line.	• Separate the thermometer lead from the power line. • Run the thermometer lead through a different pipe or duct from the power line. • Do not wire the thermometer lead and the power line in parallel. • Wire a shorter thermometer lead. • Use a shield on the thermometer lead.
	The thermal response is slow because the installation position of the thermometer is too far from the control point.	• Install the thermometer with the end of the protective tube closer to the control point.
	The ambient temperature of the EJ1G exceeds the rating.	• Keep the ambient temperature between the rating range of −10 to 55°C.
	A wireless device is used in the vicinity of the EJ1G.	• Shield the EJ1G.
	The terminal block temperature is inconsistent due to heat radiated from peripheral devices.	• Move the EJ1G to a position where it will not be exposed to heat.
	An air current or draft is striking the EJ1G terminal block.	• Do not let air currents or drafts strike the terminal block.
Settings	The input type settings are incorrect.	• Correct the input type settings.
	The temperature unit settings are incorrect.	• Correct the temperature unit settings.
	The measured temperature seems incorrect due to the input compensation setting.	• Set the input compensation to 0.0.
Procedure	The input terminals for a thermocouple input are shorted.	• Connect a thermocouple.
	The thermometer was changed or the switch settings changed while power was ON.	• Cycle the power.

Easy Method for Checking Thermometers

Platinum resistance thermometers: 1. Connect a 100 Ω resistor between thermometer input terminals A and B and short B and B.

2. The EJ1G is working if the measured temperature is 0.0°C or 32.0°F.

Thermocouples: 1. Short the thermometer input terminals.

2. The EJ1G is working normally if the temperature in the vicinity of the terminal block is measured.

7-6 Determining the Error from the Current Situation for Temperature Control Errors

Temperature Is Not Rising

	Possible cause	**Countermeasure**
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	No load is connected to the control output terminal.	• Connect a load.
	The load polarity or connected terminals are wrong.	• Rewire correctly.
	The connection terminal screws are loose and the connection is imperfect.	• Tighten the screws securely.
	The heater power is not turned ON.	• Turn ON the heater power.
	Heater is burnt out or deteriorated.	• Replace with a better quality heater.
	The heater's heating capacity is insufficient.	• Replace with a heater with a bigger heating capacity. • If more than one heater is used, check for burnt out heaters and replace if necessary.
	An overheating protection device is operating.	• Set the set value for the overheating protection device to higher than the EJ1G set point.
Setting	The normal and reverse operation settings are incorrect.	• Make the correct settings.
	The PID constant is unsuitable.	• Execute gradient tuning (GT) or autotuning (AT). • Set a suitable PID constant.
	RUN/STOP is set to STOP.	• Set to RUN.
	Operation After Power ON is set to STOP status.	• Set RUN/STOP to RUN. • To change to RUN the next time the power is turned ON, set Operation After Power ON to Continue and turn OFF the power while in RUN mode.
	The MV limiter is preventing the MV from increasing.	• Change the MV limiter to a suitable value.
	A cooling fan is operating.	• Stop the cooling fan.

The Measured Temperature Increases Above the Control Temperature

	Possible cause	**Countermeasure**
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	The load is connected to the incorrect channel so the heater is being controlled using control output from another channel.	• Rewire correctly.
	The contacts for the relay driven by control outputs are welded together.	• Replace with a higher quality relay.
	The SSR has short-circuited.	• Replace with a better quality SSR.
	Leakage current from the SSR is flowing to the heater.	• Connect breeder resistance to prevent the action of leakage current.
Settings	The normal and reverse operation settings are incorrect.	• Make the correct settings.
	The PID constant is unsuitable.	• Execute gradient tuning (GT) or autotuning (AT). • Set a suitable PID constant.
	The MV limiter is preventing the MV from decreasing.	• Change the MV limiter to a suitable value.
	The EJ1G is outputting in manual mode.	• Stop manual mode.
Procedure	The control system is radiating heat.	• Execute heating and cooling control.
	The overshoot is too large.	• Use the countermeasures listed in the *Overshooting or Undershooting troubleshooting* table.

Overshooting or Undershooting

	Possible cause	Countermeasure
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	A general-purpose thermometer with slow thermal response has been connected to a control system with fast thermal response.	• Change to a sheathed thermometer.
Setting	The proportional band value is too low.	• Increase the proportional band within a range with an acceptable response delay. • Execute gradient tuning (GT) or autotuning (AT).
	The integral time is too short.	• Increase the integral time within a range with an acceptable response delay. • Execute gradient tuning (GT) or autotuning (AT).
	The derivative time is too short.	• Increase the derivative time within a range that does not adversely affect the stability of stabilization band. • Execute gradient tuning (GT) or autotuning (AT).
	ON/OFF control is operating.	• Execute P control or PID control.
	The control cycle is too long for the control system with its fast thermal response.	• Shorten the control cycle.
	The overlap band in the heating and cooling control is set to a dead band by mistake.	• Set to an overlap band.

Hunting

The troubleshooting items for connection and setting problems are the same as for overshooting and undershooting, above.

	Possible cause	Countermeasure
Procedure	The heater's heating capacity is too large for the heating capacity of the control target.	• Use a heater with a heating capacity suitable for the control target.
	There is periodic disturbance, which changes the heating capacity of the control target.	• Change to an environment with as little periodic disturbance.
	Executing autotuning (AT).	• Hunting will not occur once autotuning has been completed.

7-7 Determining the Error from the Current Situation for Output Errors

No Control Outputs. No Alarm Outputs.

		Possible cause	Countermeasure
Connection		Measured temperature is wrong.	• Perform the action outlined in 7.5.
		The load polarity or connected terminals are wrong.	• Rewire correctly.
		A load exceeding the output rating is connected.	• Reduce the load to within the rating. • Get the Unit repaired if it is malfunctioning.
		No power supply for the load is connected to the transistor outputs.	• Use a power supply suitable for the output rating and load.
		The polarity of the load power supply for transistor outputs is incorrect.	• Rewire correctly.
Setting		Set the Operation After Power ON parameter to *Stop*.	• Execute a RUN (start operation) operation command after the power is turned ON. • Set the Operation After Power ON parameter to *Continue*.
		Control does not start.	• Execute a RUN (start operation) operation command.
		The specified channel is incorrect.	• Set the correct channel number.
		The control output assignments are incorrect.	• Set the correct control output assignments.
		The set point is incorrect.	• Set the correct set point.
		The specified bank is incorrect.	• Set the correct bank.
		A bank specification for all channels has been assigned to an event input, and an unintended bank has been selected.	• Assign the bank of the channel for which the bank is to be changed to an event input.
		Alarm mode is set to 0 (no alarm).	• Set the correct alarm mode.
		Alarm mode is set to an alarm with a standby sequence.	• Set to an alarm without a standby sequence.
		The deviation alarm and absolute-value alarm settings for alarm mode are incorrect.	• Set the correct alarm mode.

7-8 Determining the Error from the Current Situation for Heater Burnout Alarm Errors

HB (Heater Burnout) Alarm or Heater Burnout Not Detected

		Possible cause	Countermeasure
Connection		No current transformer (CT) is connected.	• Connect a CT.
		The CT is connected to the wrong channel.	• Connect the CT to the correct channel.
Setting		Control does not start.	• Start control.
		The ON time for control output is less than 100 ms.	• Set the control output ON time to 100 ms or more. →This will make the HB alarm operate.
		The heater power was turned ON after operation control started.	• Turn ON the heater power then start operation control.
		The heater burnout detection current is set to 0.0 or 100 A.	• Set an appropriate value between 0.1 and 99.9 A.
		The heater burnout detection current is the heater rated current.	• Measure the heater current and set the detection current value.
		The measured heater burnout detection current is not suitable.	• Set the detection current again, taking into consideration the voltage range of the heater power supply and current measurement error.
Procedure		The heater current value exceeds 100 A.	• Reduce the value to 100 A or less.
		The heater current is direct current (DC).	• The HB alarm will not operate under these conditions.
		A pure metal heater is used.	• Measure the heater current and set the detection current value.

Appendix

Specifications

Ratings

		TC4	TC2	HFU	EDU
Power supply voltage		24 VDC			
Operating voltage range		85% to 110% of rated voltage			
Power consumption (at maximum load)		5 W max.	4 W max.	2 W max.	---
Sensor inputs	**Thermocouple**	K, J, T, E, L, U, N, R, S, B, W, PLII		---	---
	Platinum resistance thermometer	Pt100, JPt100		---	---
	Infrared Thermosensor	10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C		---	---
	Analog input **Current input**	4 to 20 mA, 0 to 20 mA		---	
	Voltage input	1 to 5 V, 0 to 5 V, 0 to 10 V		---	
Control outputs	**Voltage output**	Output voltage: 12 VDC Load current: 21 mA with short-circuit protection circuit		---	---
	Transistor output	---	Max. operating voltage: 30 VDC, max. load current: 100 mA, residual voltage: 1.5 V max., leakage current: 0.4 mA max.	---	---
Auxiliary outputs (transistor outputs)		---	---	Max. operating voltage: 30 VDC, max. load current: 50 mA, residual voltage: 1.5 V max., leakage current: 0.4 mA max.	
Event inputs	**Leakage current**	---	---	Approx. 4 mA	---
	Contact input	---	---	ON: 1 kΩ max., OFF: 100 kΩ min.	---
	Non-contact input	---	---	ON: Residual voltage: 1.5 V max., OFF: Leakage current: 0.1 mA max.	---
Control method		---	---	2-PID or ON/OFF control	---
Setting method		Via communications			
Other functions		Depend on the model			
Ambient temperature range		Operating: −10°C to 55°C, Stored: −25°C to 65°C (with no icing or condensation)			
Ambient humidity range		Operating: 25% to 85%, Stored: 25% to 85%			
Altitude		2,000 m max.			
Inrush current (power supply)		Unit: 15 A or less			
Installation environment		Overvoltage Category II, Pollution Class 2 (IEC 61010-1 compliant)			

HB (Heater Burnout) Alarms, HS (Heater Short) Alarms

Maximum heater current	Single Phase 100 A AC
Input current indication accuracy	(±5% FS) ±1 digit max.
Heater burnout (HB) alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater burnout (HB) alarm output turns OFF. 100.0 A: Heater burnout (HB) alarm output turns ON. Min. detection ON time: 100 ms (See note 1.)
Heater short (HS) alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater short (HS) alarm output turns ON. 100.0 A: Heater short alarm (HS) output turns OFF. Min. detection OFF time: 100 ms (See note 2.)

Note (1) Heater burnouts and heater overcurrents are not detected if the control output (heating) ON time is 100 ms or less.
Detection is also sometimes not possible if a contactor is used for the control output.

(2) A heater short is not detected if the control output (heating) OFF time is 100 ms or less.
Detection is also sometimes not possible if a contactor is used for the control output.

Characteristics

		TC4/TC2	HFU	EDU
Indication accuracy	**Thermocouple input/ platinum resistance thermometer input**	(±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max. (See note 3.)	---	---
	Analog input	(±0.5% FS) ±1 digit max.	---	---
	Heater burnout CT input	(±5% FS) ±1 digit max.	---	---
Temperature variation influence (See note 4.)		Thermocouple input (R, S, B): (±1% of indication value (PV) or ±10°C, whichever is greater) ±1 digit max.		
		Other thermocouple input: (±1% of indication value (PV) or ±4°C, whichever is greater) ±1 digit max. K thermocouple at −100°C max: ±10°C max.		
Voltage variation influence (See note 4.)		Platinum resistance thermometer: (±1% of indication value (PV) or ±2°C, whichever is greater) ±1 digit max.		
		Analog input: ±1% FS ±1 digit max.		
Proportional band (P)		---	0.1 to 999.9 EU (in units of 1 EU) (See note 5.)	---
Integral time (I)		---	1 to 3.999 s (in units of 1 s)	---
Derivative time (D)		---	0.0 to 9.999 s (in units of 1 s)	---
Control period		0.5 s, 1 to 99 s (in units of 1 s)	---	---
Alarm output setting range		---	−1,999 to 9,999 (decimal point position depends on input type)	---
Sampling period		250 ms	---	---
Insulation resistance		20 MΩ min. (at 500 VDC)		
Dielectric strength		600 VAC, 50/60 Hz for 1 min between current-carrying terminals of different polarity		
Vibration resistance		10 to 55 Hz, 20 m/s^2 for 2 hours each in X, Y, and Z directions		
Shock resistance		150 m/s^2 max., 3 times each in 6 directions (on X, Y, and Z axes)		
Degree of protection		Rear case: IP20, Terminal section: IP00		Case: IP20
Memory protection		EEPROM (non-volatile memory) (number of writes: 100,000)		---
Weight		180 g	160 g	70 g

Note (3) W: (±0.5% of indication value or ±3°C, whichever is greater) ±1 digit max.

PLII: (±0.5% of indication value or ±2°C, whichever is greater) ±1 digit max.

The indication accuracy of K, T and N thermocouples at a temperature of −100°C or less, and U and L thermocouples at any temperature is ±2°C ±1 digit maximum.

The indication accuracy of B thermocouples at a temperature of 400°C or less is unrestricted.

The indication accuracy of R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit max.

(4) Ambient temperature: −10°C to 23°C to 55°C
Voltage range: −15% to +10% of rated voltage

(5) The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

The following table shows the control operation cycles for gradient temperature control. The control operation cycle may be longer than indicated, depending on the load status.

	Using TC2 Units					Using TC4 Units			
No. of gradient temperature control channels	4	16	32	4	16	4	32	4	32
No. of gradient temperature control groups	1	1	1	8	2	1	1	16	2
No. of Units used	2	8	16	16	16	1	8	16	16
Control operation cycle [ms]	250		500			250		500	

Measurement conditions: Using programless operation with a multiple read command to read 300 points during operation of all channels.

The control operation cycle can be checked at the Control Operation Cycle Monitor parameter (address 0014 of variable type C4/84).

Current Transformer

Specifications

Item	Specifications	
Model	E54-CT1	E54-CT3
Maximum continuous current	50 A	120 A (See note.)
Dielectric strength	1,000 VAC for 1 min	
Vibration resistance	50 Hz, 98 m/s^2	
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	None	Armatures (2), plugs (2)

Note The maximum continuous current of the EJ1G is 100 A.

Dimensions

E54-CT1
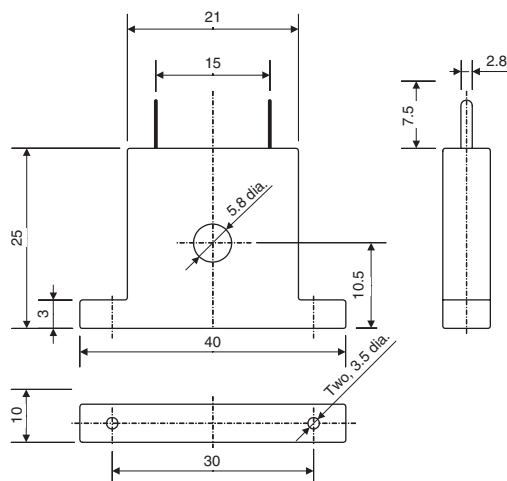
E54-CT3
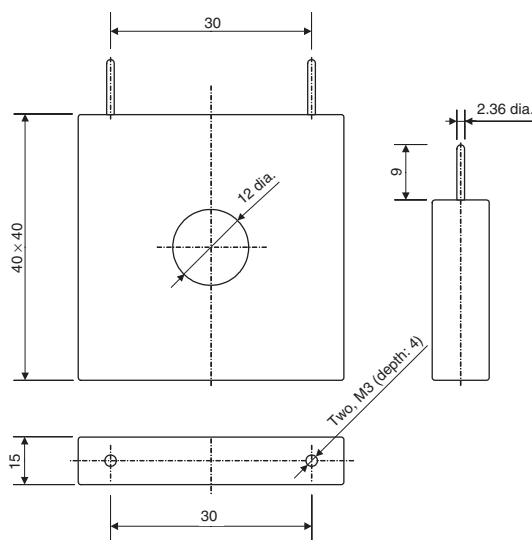
ASCII Table

Leftmost digit Rightmost digit	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	' '	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	¥	l		
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	DEL

Sensor Input Ranges

Input type		Specifica-tion	Set value	Setting range		Indication range	
				°C	°F	°C	°F
Temperature inputs	Platinum resistance thermome-ters	Pt100	0	−200 to 850	−300 to 1500	−220 to 870	−340 to 1540
			1	−199.9 to 500.0	−199.9 to 900.0	−219.9 to 520.0	−239.9 to 940.0
			2	0.0 to 100.0	0.0 to 210.0	−20.0 to 120.0	−40.0 to 250.0
		JPt100	3	−199.9 to 500.0	−199.9 to 900.0	−219.9 to 520.0	−239.9 to 940.0
			4	0.0 to 100.0	0.0 to 210.0	−20.0 to 120.0	−40.0 to 250.0
	Thermocou-ple	K	5	−200 to 1300	−300 to 2300	−220 to 1320	−340 to 2340
			6	−20.0 to 500.0	0.0 to 900.0	−40.0 to 520.0	−40.0 to 940.0
		J	7	−100 to 850	−100 to 1500	−120 to 870	−140 to 1540
			8	−20.0 to 400.0	0.0 to 750.0	−40.0 to 420.0	−40.0 to 790.0
		T	9	−200 to 400	−300 to 700	−220 to 420	−340 to 740
			10	−199.9 to 400.0	−199.9 to 700.0	−219.9 to 420.0	−239.9 to 740.0
		E	11	0 to 600	0 to 1100	−20 to 620	−40 to 1140
		L	12	−100 to 850	−100 to 1500	−120 to 870	−140 to 1540
		U	13	−200 to 400	−300 to 700	−220 to 420	−340 to 740
			14	−199.9 to 400.0	−199.9 to 700.0	−219.9 to 420.0	−239.9 to 740.0
		N	15	−200 to 1300	−300 to 2300	−220 to 1320	−340 to 2340
		R	16	0 to 1700	0 to 3000	−20 to 1720	−40 to 3040
		S	17	0 to 1700	0 to 3000	−20 to 1720	−40 to 3040
		B	18	100 to 1800	300 to 3200	0 to 1820	0 to 3240
		W	19	0 to 2300	0 to 4100	−20 to 2320	−40 to 4140
		PLII	20	0 to 1300	0 to 2300	−20 to 1320	−40 to 2340
	ES1B Infrared Thermosen-sor	10 to 70°C	21	0 to 90	0 to 190	−20 to 130	−40 to 270
		60 to 120°C	22	0 to 120	0 to 240	−20 to 160	−40 to 320
		115 to 165°C	23	0 to 165	0 to 320	−20 to 205	−40 to 400
		140 to 260°C	24	0 to 260	0 to 500	−20 to 300	−40 to 580
Analog inputs	Current input	4 to 20 mA	25	Any of the following ranges, by scaling: −1999 to 9999 −199.9 to 999.9 −19.99 to 99.99 −1.999 to 9.999		−5% to 105% of the setting range 0% to 105% for 0 to 20 mA	
		0 to 20 mA	26				
	Voltage input	1 to 5 V	27				
		0 to 5 V	28				
		0 to 10 V	29				

- Applicable standards by input type are as follows:
  K,J,T,E,N,R,S,B: JIS C1602-1995
  L: Fe-CuNi, DIN43710-1985
  U: Cu-CuNi, DIN43710-1985
  W: W5Re/W26Re, ASTM E988-1990
  PLII: According to Platinel II Electromotive Force Table by Engelhard Corp.
  JPt100:   JIS C1604-1989, JIS C1606-1989
  Pt100:   JIS C1604-1997, IEC751

Parameter List

If variables without parentheses are used in communications, the set values will be eight-digit (double-word) data. If variables with parentheses are used in communications, the set values will be four-digit (word) data.

Example: Variable type C4: Double word (8 digits)

                  Variable type 84: Word (4 digits)

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
C0 (80)	Monitor	0000	Process Value - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	●	●
		0001	Status - CH1	See *Status Lists* on page 188.	---	---	CH	●	●
		0002	Internal SP - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		Not used.							
		0004	MV Monitor (Heating) - CH1	H' FFFFFFFB to H' 00000069 (−5.0 to 105.0)	---	%	CH	---	●
		Not used.							
		0100	Process Value - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		3F00	Process Value - CH64						
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
C1 (81) (See note.)	Monitor	Not used.							
		0003	Set Point - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0004	Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0005	Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0006	Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0007	Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0008	Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		0009	Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		Not used.							
		0103	Set Point - CH2	The rest are the same as channel 1.					
		⋮							
		⋮							
		3F03	Set Point - CH64						
		⋮							

Note The values in the current bank will be used for all set values.

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
C4 (84)	Monitor	0000	Device A Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0001	Device Error Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0002	Configuration Error A Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0003	Configuration Error B Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0004	Internal Communications Error Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0005	I/O Error Status	See *Status Lists* on page 188.	---	---	Common	●	---
		0006	I/O Alarm A Status	See *Status Lists* on page 188.	---	---	Common	●	---
		0007	I/O Alarm B Status	See *Status Lists* on page 188.	---	---	Common	●	---
		Not used.							
		0009	I/O Notification A Status	See *Status Lists* on page 188.	---	---	Common	●	---
		Not used.							
		000B	Error Channel A Status	See *Status Lists* on page 188.	---	---	Common	●	●
		000C	Error Channel B Status	See *Status Lists* on page 188.	---	---	Common	---	●
		000D	Error Channel C Status	See *Status Lists* on page 188.	---	---	Common	---	●
		000E	Error Channel D Status	See *Status Lists* on page 188.	---	---	Common	---	●
		000F	Basic Unit/Expand Unit Error	See *Status Lists* on page 188.	---	---	Common	●	●
		0010	Basic Unit/Expand Unit Alarm	See *Status Lists* on page 188.	---	---	Common	●	●
		0011	Decimal Point Monitor	H' 00000000 to H' 00000003 (0 to 3)	---	---	Common	●	●
		0012	Output Status	See *Status Lists* on page 188.	---	---	Common	●	---
		0013	Device B Status	See *Status Lists* on page 188.	---	---	Common	●	●
		0014	Control Operation Cycle Monitor	H' 000000FA to H' 00001388 (250 to 5000)	2	---	Common	---	●
		0015	Number of Gradient Channels Monitor	H' 00000002 to H' 00000020 (2 to 32)	---	---	Common	---	●
		Not used.							
		0020	Version	H' 00000000 to H' 0000FFFF	---	---	Common	●	●
		Not used.							
		0100	Process Value - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	●	●
		0101	Channel Status - CH1	See *Status Lists* on page 188.	---	---	CH	●	●
		0102	Channel Alarm Status - CH1	See *Status Lists* on page 188.	---	---	CH	●	●
		0103	Internal SP - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	---	EU	CH	---	●
		Not used.							
		0106	Bank No. Monitor - CH1	H' 00000000 to H' 00000003 (0 to 3)	---	---	CH	---	●
		0107	MV Monitor (Heating) - CH1	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0)	---	%	CH	●	●
		Not used.							
		010B	Decimal Point Monitor - CH1	H' 00000000 to H' 00000003 (0 to 3)	---	---	CH	●	---
		Not used.							
		0200	Process Value - CH2	The rest are the same as channel 1.					
		⋮	⋮	Note: The Remote SP Monitor - CH2 parameter is supported only by the TC4.					
		⋮	⋮						
		4000	Process Value - CH64						
		⋮	⋮						

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
C5 (85)	Monitor	0100	Heater Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	CH	---	●
		0101	Leakage Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	CH	---	●
		Not used.							
		0200	Heater Current Value 2 Monitor	The rest are the same as Heater Current Value 1 Monitor.					
		⋮	⋮						
		⋮	⋮						
		4000	Heater Current Value 64 Monitor						
		⋮	⋮						

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Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
C9 (89)	Monitor	0100	G3ZA1 - CH1 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0101	G3ZA1 - CH2 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0102	G3ZA1 - CH3 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0103	G3ZA1 - CH4 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0104	G3ZA1 - CH5 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0105	G3ZA1 - CH6 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0106	G3ZA1 - CH7 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0107	G3ZA1 - CH8 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0108	G3ZA1 - CH1 Status	---	---	---	NUM	●	---
		0109	G3ZA1 - CH2 Status	---	---	---	NUM	●	---
		010A	G3ZA1 - CH3 Status	---	---	---	NUM	●	---
		010B	G3ZA1 - CH4 Status	---	---	---	NUM	●	---
		010C	G3ZA1 - CH5 Status	---	---	---	NUM	●	---
		010D	G3ZA1 - CH6 Status	---	---	---	NUM	●	---
		010E	G3ZA1 - CH7 Status	---	---	---	NUM	●	---
		010F	G3ZA1 - CH8 Status	---	---	---	NUM	●	---
		0110	G3ZA1 - CH1 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0111	G3ZA1 - CH2 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0112	G3ZA1 - CH3 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0113	G3ZA1 - CH4 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0114	G3ZA1 - CH1 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0115	G3ZA1 - CH2 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0116	G3ZA1 - CH3 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
		0117	G3ZA1 - CH4 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
	Not used.								
		0200	G3ZA2 - CH1 Control Variable Monitor	The rest are the same as the G3ZA1.					
		⋮	⋮						
		0300	G3ZA3 - CH1 Control Variable Monitor						
		⋮	⋮						
		0400	G3ZA4 - CH1 Control Variable Monitor						
		⋮	⋮						
		0500	G3ZA5 - CH1 Control Variable Monitor						
		⋮	⋮						
		0600	G3ZA6 - CH1 Control Variable Monitor						
		⋮	⋮						
		0700	G3ZA7 - CH1 Control Variable Monitor						
		⋮	⋮						
		0800	G3ZA8 - CH1 Control Variable Monitor						
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit	
								TC4/TC2	HFU
D0 (90)	Can be changed during operation.	0100	Bank 0 Set Point - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0101	Bank 0 Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999)	80	EU (See note.)	BANK	---	●
		0102	Bank 0 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	Seconds	BANK	---	●
		0103	Bank 0 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	Seconds	BANK	---	●
		0104	Bank 0 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		0105	Bank 0 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		Not used.							
		010D	Bank 0 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		010E	Bank 0 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		010F	Bank 0 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0110	Bank 0 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0111	Bank 0 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0112	Bank 0 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0113	Bank 0 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0114	Bank 0 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		0115	Bank 0 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	BANK	---	●
		Not used.							
		0200	Bank 0 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Bank 0 Set Point - CH64						
		⋮	⋮						

Note The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position B parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit	
								TC4/TC2	HFU
D1 (91)	Can be changed during operation.	0100	Bank 1 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0101	Bank 1 Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999)	80	EU (See note.)	BANK	---	●
		0102	Bank 1 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	Seconds	BANK	---	●
		0103	Bank 1 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	Seconds	BANK	---	●
		0104	Bank 1 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		0105	Bank 1 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		Not used.							
		010D	Bank 1 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010E	Bank 1 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010F	Bank 1 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0110	Bank 1 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0111	Bank 1 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0112	Bank 1 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0113	Bank 1 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0114	Bank 1 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0115	Bank 1 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		Not used.							
		0200	Bank 1 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Bank 1 Set Point - CH64						
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit	
								TC4/TC2	HFU
D2 (92)	Can be changed during operation.	0100	Bank 2 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0101	Bank 2 Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999)	80	EU (See note.)	BANK	---	●
		0102	Bank 2 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	Seconds	BANK	---	●
		0103	Bank 2 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	Seconds	BANK	---	●
		0104	Bank 2 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		0105	Bank 2 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		Not used.							
		010D	Bank 2 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010E	Bank 2 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010F	Bank 2 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0110	Bank 2 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0111	Bank 2 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0112	Bank 2 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0113	Bank 2 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0114	Bank 2 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0115	Bank 2 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		Not used.							
		0200	Bank 2 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Bank 2 Set Point - CH64						
		⋮	⋮						

Note The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position B parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	Target Unit HFU
D3 (93)	Can be changed during operation.	0100	Bank 3 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0101	Bank 3 Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999)	80	EU (See note.)	BANK	---	●
		0102	Bank 3 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	Seconds	BANK	---	●
		0103	Bank 3 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	Seconds	BANK	---	●
		0104	Bank 3 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		0105	Bank 3 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		Not used.							
		010D	Bank 3 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010E	Bank 3 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010F	Bank 3 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0110	Bank 3 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0111	Bank 3 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0112	Bank 3 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0113	Bank 3 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0114	Bank 3 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0115	Bank 3 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		Not used.							
		0200	Bank 3 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Bank 3 Set Point - CH64						
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	Target Unit HFU
D4 (94)	Can be changed during operation.	0100	Present Bank Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0101	Present Bank Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999)	80	EU (See note.)	BANK	---	●
		0102	Present Bank Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	Seconds	BANK	---	●
		0103	Present Bank Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	Seconds	BANK	---	●
		0104	Present Bank SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
							BANK		●
		0105	Present Bank SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	---	●
		Not used.							
		010D	Present Bank Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010E	Present Bank Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		010F	Present Bank Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0110	Present Bank Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0111	Present Bank Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0112	Present Bank Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0113	Present Bank Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0114	Present Bank Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		0115	Present Bank Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	EU	BANK	---	●
		Not used.							
		0200	Present Bank Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Present Bank Set Point - CH64						
		⋮	⋮						

Note The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position B parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	HFU
D5 (95)	Can be changed during operation.	0100	Input Digital Filter - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	0.0	Seconds	CH	●	---
		0101	Input Value 1 for Input Correction - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU	CH	---	●
		0102	Input Shift 1 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU (See note.)	CH	---	●
		0103	Input Value 2 for Input Correction - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	1000	EU	CH	---	●
		0104	Input Shift 2 - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU (See note.)	CH	---	●
		0105	MV at PV Error - CH1 Standard Control: Heating and Cooling Control:	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (−105.0 to 105.0)	0	%	CH	---	●
		0106	MV at Stop - CH1	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (−105.0 to 105.0)	0	%	CH	---	●
			Not used.						
		0109	MV Upper Limit - CH1	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0) H' 00000000 to H' 0000041A (−0.0 to 105.0)	105.0	%	CH	---	●
		010A	MV Lower Limit - CH1	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0) H' FFFFFBE6 to H' 00000000 (−105.0 to 0.0)	−105.0	%	CH	---	●
		010D	Alpha - CH1	H' 00000000 to H' 00000064 (0.00 to 1.00)	0.65	---	CH	---	●
		010E	Manual MV - CH1	H' FFFFFFCE to H' 0000041A (−5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (−105.0 to 105.0)	0	%	CH	---	●
		010F	SP Upper Limit - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	9999	EU	CH	---	●
		0110	SP Lower Limit - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	−1999	EU	CH	---	●
		0111	Disturbance Gain - CH1	H' FFFFFF9C to H' 00000064 (−1.00 to 1.00)	0.65	---	CH	---	●
		0112	Disturbance Time Constant - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	Seconds	CH	---	●
		0113	Disturbance Rectification Band - CH1	H' 00000000 to H' 0000270F (0 to 9999)	0	EU (See note.)	CH	---	●
		0114	Disturbance Judgment Width - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	EU (See note.)	CH	---	●
		0115	Control Balance Coefficient - CH1	H' 00000000 to H' 00000063 (0.00 to 99.99)	0.80	---	CH	---	●
			Not used.						
		0200	Input Digital Filter - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		0400	Input Digital Filter - CH64						
		⋮	⋮						

Note The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position B parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	HFU
D6 (96)	Can be changed during operation.	0100	Heater Burnout 1 Detection - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	A	IO	---	●
		0101	HS Alarm - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	100.0	A	IO	---	●
			Not used.						
		0200	Heater Burnout Detection - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Heater Burnout Detection - CH64						
		⋮	⋮						

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	HFU
D7 (97)	Can be changed during operation.	0004	Programless Upload Settings 4		0900	---	NUM	---	●
		0005	Programless Upload Settings 5		0B00	---	NUM	---	●
		0006	Programless Upload Settings 6		00FF	---	NUM	---	●
		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
		012F	Programless Upload Settings 303		00FF	---	NUM	---	●

Variable type	Category	Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	HFU
D8 (98)	Can be changed during operation.	0004	Programless Download Settings 4		0940	---	NUM	---	●
		0005	Programless Download Settings 5		0B40	---	NUM	---	●
		0006	Programless Download Settings 6		00FF	---	NUM	---	●
		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
		012F	Programless Download Settings 303		00FF	---	NUM	---	●

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	Target Unit HFU
DA (9A)	Can be changed during operation.	0100	G3ZA1 - CH1 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0101	G3ZA1 - CH2 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0102	G3ZA1 - CH3 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0103	G3ZA1 - CH4 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0104	G3ZA1 - CH5 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0105	G3ZA1 - CH6 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0106	G3ZA1 - CH7 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0107	G3ZA1 - CH8 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0108	G3ZA1 - CH1 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		0109	G3ZA1 - CH2 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010A	G3ZA1 - CH3 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010B	G3ZA1 - CH4 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010C	G3ZA1 - CH5 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010D	G3ZA1 - CH6 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010E	G3ZA1 - CH7 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		010F	G3ZA1 - CH8 Offset	H' FFFFF060 to H' 00000FA0 (−400.0 to 400.0)	0.0	%	NUM	●	---
		0110	G3ZA1 - CH1 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	1	---	NUM	●	---
		0111	G3ZA1 - CH2 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	2	---	NUM	●	---
		0112	G3ZA1 - CH3 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	3	---	NUM	●	---
		0113	G3ZA1 - CH4 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	4	---	NUM	●	---
		0114	G3ZA1 - CH5 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	5	---	NUM	●	---
		0115	G3ZA1 - CH6 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	6	---	NUM	●	---
		0116	G3ZA1 - CH7 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	7	---	NUM	●	---
		0117	G3ZA1 - CH8 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	8	---	NUM	●	---
		0118	G3ZA1 - CH1 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
		0119	G3ZA1 - CH2 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
		011A	G3ZA1 - CH3 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
		011B	G3ZA1 - CH4 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
		011C	G3ZA1 - CH1 SSR Short-circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		011D	G3ZA1 - CH2 SSR Short-circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		011E	G3ZA1 - CH3 SSR Short-circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		011F	G3ZA1 - CH4 SSR Short-circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		0120	G3ZA1 - CH1 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		0121	G3ZA1 - CH2 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		0122	G3ZA1 - CH3 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		0123	G3ZA1 - CH4 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
		0124	G3ZA1 - Offset Control	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	1	---	NUM	●	---
		0180	G3ZA1 - Send Standby Time (See note.)	H' 00000000 to H' 00000063 (0 to 99)	20	ms	NUM	●	---
		0181	G3ZA1 - Communications Timeout Time (See note.)	H' 00000000 to H' 0000003C (0 to 60) (Function stops when set to 0.)	0	min	NUM	●	---
		0182	G3ZA1 - Setting Operation for Errors	H' 00000000: Continue with error clear (0) H' 00000001: Continue without error clear (1) H' 00000002: Stop (2)	0	---	NUM	●	---
		0183	G3ZA1 - Offset Value	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		0184	G3ZA1 - Hysteresis	H' 00000001 to H' 0000000A (1 to 10)	1	A	NUM	●	---
	Not used.								
		0200	G3ZA2 - CH1 Slope	The rest are the same as the G3ZA1.					
		⋮	⋮						
		0300	G3ZA3 - CH1 Slope						
		⋮	⋮						
		0400	G3ZA4 - CH1 Slope						
		⋮	⋮						
		0500	G3ZA5 - CH1 Slope						
		⋮	⋮						
		0600	G3ZA6 - CH1 Slope						
		⋮	⋮						
		0700	G3ZA7 - CH1 Slope						
		⋮	⋮						
		0800	G3ZA8 - CH1 Slope						
		⋮	⋮						

Note Valid after a Software Reset operation command or after power is turned ON. Refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No. Z200).

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
E0 (A0)	Can be changed while stopped.	0000	Decimal Point Position B	H' 00000000: **** (No decimal point) (0) H' 00000001: ***.* (1) H' 00000002: **.** (2) H' 00000003: *.*** (3)	0	---	Common	---	●
		0001	Cold Junction Compensation Method	H' 00000000: Externally (0) H' 00000001: Internally (1)	1	---	Common	●	---
		Not used.							
		0100	Input Type - CH1	H' 00000000: Pt100 (0) H' 00000001: Pt100 (1) H' 00000002: Pt100 (2) H' 00000003: JPt100 (3) H' 00000004: JPt100 (4) H' 00000005: K (5) H' 00000006: K (6) H' 00000007: J (7) H' 00000008: J (8) H' 00000009: T (9) H' 0000000A: T (10) H' 0000000B: E (11) H' 0000000C: L (12) H' 0000000D: U (13) H' 0000000E: U (14) H' 0000000F: N (15) H' 00000010: R (16) H' 00000011: S (17) H' 00000012: B (18) H' 00000013: W (19) H' 00000014: PLII (20) H' 00000015: 10 to 70°C (21) H' 00000016: 60 to 120°C (22) H' 00000017: 115 to 165°C (23) H' 00000018: 140 to 260°C (24) H' 00000019: 4 to 20 mA (25) H' 0000001A: 0 to 20 mA (26) H' 0000001B: 1 to 5 V (27) H' 0000001C: 0 to 5 V (28) H' 0000001D: 0 to 10 V (29)	5	---	CH	●	---
		0101	Temperature Unit - CH1	H' 00000000: °C (0) H' 00000001: °F (1)	0	---	CH	●	---
		0102	Scaling Upper Limit - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	1000	---	CH	●	---
		0103	Scaling Lower Limit - CH1	H' FFFFF831 to H' 0000270F (−1999 to 9999)	0	---	CH	●	---
		0104	Decimal Point Position - CH1	H' 00000000: **** (No decimal point) (0) H' 00000001: ***.* (1) H' 00000002: **.** (2) H' 00000003: *.*** (3)	1	---	CH	●	---
		Not used.							
		0200	Input Type - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		0300	Input Type - CH3					TC4	---
		⋮	⋮						
		0400	Input Type - CH4					TC4	---
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
E1 (A1)	Can be changed while stopped.	Not used.							
		0101	Control Period 1	H' 00000000 to H' 00000063 (0 to 99) (0.5 s period when set to 0.)	2	s	IO	●	---
		Not used.							
		0201	Control Period 2	H' 00000000 to H' 00000063 (0 to 99) (0.5 s period when set to 0.)	2	---	IO	●	---
		Not used.							
		0301	Control Period 3	H' 00000000 to H' 00000063 (0 to 99) (0.5 s period when set to 0.)	2	---	IO	TC4	---
		Not used.							
		0401	Control Period 4	H' 00000000 to H' 00000063 (0 to 99) (0.5 s period when set to 0.)	2	---	IO	TC4	---

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
E3 (A3)	Can be changed while stopped.		Not used.						
		0100	Alarm 1 Type - CH1	H' 00000000: Alarm function OFF (0) H' 00000001: Upper and lower limit alarm (1) H' 00000002: Upper limit alarm (2) H' 00000003: Lower limit alarm (3) H' 00000004: Upper and lower limit range alarm (4) H' 00000005: Upper and lower limit alarm with standby sequence (5) H' 00000006: Upper limit alarm with standby sequence (6) H' 00000007: Lower limit alarm with standby sequence (7) H' 00000008: Absolute value upper limit alarm (8) H' 00000009: Absolute value lower limit alarm (9) H' 0000000A: Absolute value upper limit alarm with standby sequence (10) H' 0000000B: Absolute value lower limit alarm with standby sequence (11)	2	---	CH	---	●
		0101	Alarm 1 Latch - CH1	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	CH	---	●
		0102	Alarm 1 Hysteresis - CH1	H' 00000001 to H' 0000270F (1 to 9999)	2	EU (See note.)	CH	---	●
		0103	Alarm 1 Open in Alarm - CH1	H' 00000000: Close in alarm (0) H' 00000001: Open in alarm (1)	0	---	CH	---	●
		0106	Alarm 1 SP Selection - CH1	H' 00000000: Ramp SP (0) H' 00000001: Target SP (1)	0	---	CH	---	●
		0107	Alarm 2 Type - CH1	The rest are the same as Alarm 1.					
		⋮	⋮						
		010E	Alarm 3 Type - CH1						
		⋮	⋮						
			Not used.						
		0200	Alarm 1 Type - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4000	Alarm 1 Type - CH64					TC4	---
		⋮	⋮						

Note The decimal point position is determined by the sensor selection. With analog inputs, the decimal point position is determined by the Decimal Point Position B parameter setting. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
E4 (A4)	Can be changed while stopped.		Not used.						
		0101	Heater Burnout 1 Latch	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	IO	TC2	---
		0102	Heater Burnout 1 Hysteresis	H' 00000001 to H' 000003E8 (0.1 to 100.0)	0.1	A	IO	TC2	---
		0103	HS Alarm 1 Latch	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	IO	TC2	---
		0104	HS Alarm 1 Hysteresis	H' 00000001 to H' 000003E8 (0.1 to 100.0)	0.1	A	IO	TC2	---
			Not used.						
		0201	Heater Burnout 2 Latch	The rest are the same as from Heater Burnout 1 Latch to HS Alarm 1 Hysteresis.					
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit	
								TC4/ TC2	HFU
E5 (A5)	Can be changed while stopped.	0000	AT Calculated Gain	H' 00000001 to H' 00000064 (0.1 to 10.0)	0.8	---	Common	---	●
		0001	Limit Cycle MV Amplitude	H' 00000032 to H' 000001F4 (5.0 to 50.0)	20.0	%	Common	---	●
		0002	Disturbance Overshoot Adjustment Function	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	Common	---	●
		Not used.							
		0004	GT Natural Cooling Time	H' 00000000 to H' 0000270F (0 to 9999)	300	Seconds	Common	---	●
		0005	GT Stabilization Band	H' 00000000 to H' 000003E7 (0.0 to 999.9)	1.0	EU (See note.)	Common	---	●
		0101	SP Ramp Time Unit - CH1	H' 00000000: Seconds (0) H' 00000001: Minutes (1)	1	---	CH	---	●
		0102	AT Hysteresis - CH1	H' 00000001 to H' 0000270F (1 to 9999)	8	EU (See note.)	CH	---	●
		0103	Temporary AT Execution Judgement Deviation - CH1	H' 00000000 to H' 0000270F (0 to 9999)	1500	EU (See note.)	CH	---	●
		Not used.							
		0201	SP Ramp Time Unit - CH2	The rest are the same as channel 1.					
		⋮	⋮						
		⋮	⋮						
		4001	SP Ramp Time Unit - CH64						
		⋮	⋮						

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit	
								TC4/TC2	HFU
F0 (B0)	Enabled after resetting.	Not used.							
		0001	Operation After Power ON	H' 00000000: Continue (0) H' 00000001: Stop (1) H' 00000002: Manual mode (2)	0	---	Common	---	●
		0002	Operation During Error (Selection A)	H' 00000000: Notification only (Continue) (0) H' 00000001: MV at PV error (1) H' 00000002: Control Stop (2)	0	---	Common	---	●
		Not used.							
		0004	Operation During Error (Selection C)	The rest are the same as Operation During Error (Selection A).					
		0005	Operation During Error (Selection D)	The rest are the same as Operation During Error (Selection A).					
		Not used.							
		0021	Port C Communications Baud Rate	Not used.	7	---	Common	---	●
				H' 00000003: 9.6 (3) H' 00000004: 19.2 (4) H' 00000005: 38.4 (5) H' 00000006: 57.6 (6) H' 00000007: 115.2 (7) (kbps)					
		0022	Port C Communications Data Length	H' 00000000: 7 (0) H' 00000001: 8 (1) (bit)	1	---	Common	---	●
		0023	Port C Communications Parity	H' 00000000: None (0) H' 00000001: Even (1) H' 00000002: Odd (2)	1	---	Common	---	●
		0024	Port C Communications Stop Bits	H' 00000000: 1 (0) H' 00000001: 2 (1) (bit)	0	---	Common	---	●
		0025	Port C Send Wait Time	H' 00000001 to H' 00000063 (1 to 99)	5	ms	Common	---	●
		0026	Port A Communications Send Wait Time	H' 00000001 to H' 00000063 (1 to 99)	1	ms	Common	●	●
		Not used.							
		0029	Proportional Band x10 Compensation	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	Common	●	---
		0030	Programless Communications Protocol	Not used.	2	---	Common	---	●
				H' 00000002: NT Link (1:N) (2)					
				Not used.					
				H' 00000005: MC protocol (format 5) (5)					
		0031	Programless Communications Upload Data Area NT Link (1:N)	H' 00000000: DM (0) H' 00000001: EM0 (1) H' 00000002: EM1 (2) H' 00000003: EM2 (3) H' 00000004: EM3 (4) H' 00000005: EM4 (5) H' 00000006: EM5 (6) H' 00000007: EM6 (7) H' 00000008: EM7 (8) H' 00000009: EM8 (9) H' 0000000A: EM9 (10) H' 0000000B: EMA (11) H' 0000000C: EMB (12) H' 0000000D: EMC (13)	0	---	Common	---	●
			MC protocol (format 5)	H' 00000000: Data register (D) (0) H' 00000001: Link register (W) (1) H' 00000002: File register (R) (2)	0				
		0032	Programless Communications Download Data Area NT Link (1:N)	H' 00000000: DM (0) H' 00000001: EM0 (1) H' 00000002: EM1 (2) H' 00000003: EM2 (3) H' 00000004: EM3 (4) H' 00000005: EM4 (5) H' 00000006: EM5 (6) H' 00000007: EM6 (7) H' 00000008: EM7 (8) H' 00000009: EM8 (9) H' 0000000A: EM9 (10) H' 0000000B: EMA (11) H' 0000000C: EMB (12) H' 0000000D: EMC (13)	0	---	Common	---	●
			MC protocol (format 5)	H' 00000000: Data register (D) (0) H' 00000001: Link register (W) (1) H' 00000002: File register (R) (2)	0				
		0033	Programless Communications Upload Start Address	H' 00000000 to H' 00007FFF (0 to 32767)	0	---	Common	---	●
		0034	Programless Communications Download Start Address	H' 00000000 to H' 00007FFF (0 to 32767)	500	---	Common	---	●
		0035	Programless Communications Receive Wait Time (See note.)	H' 0000000A to H' 00002710 (10 to 10000)	2000	ms	Common	---	●
		0036	Programless Communications Node Address (See note.)	H' 00000000 to H' 00000063 (0 to 99)	0	---	Common	---	●

Note Not valid when an NT Link is being used.

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
F1 (B1)	Enabled after resetting.	0000	Number of Enabled Groups	H' 00000001 to H' 00000010 (1 to 16)	1	---	Common	---	●
		0100	Starting Communications Unit Number	H' 00000000 to H' 0000001F (0 to 31)	1	---	GRP	---	●
		0101	Starting Channel	H' 00000000 to H' 00000003 (0 to 3)	0	---	GRP	---	●
		0102	Number of Enabled Channels	H' 00000002 to H' 00000020 (2 to 32)	2	---	GRP	---	●
		0103	Control Type	H' 00000000: Gradient temperature control (0) H' 00000001: 2-PID control (1)	0	---	GRP	---	●

Variable type	Category	Add-ress	Parameter name	Setting (monitor) range	Defau-lt	Unit	Attribut-es	Target Unit TC4/TC2	HFU
F2 (B2)	Enabled after resetting.	0000	Event Input 1 Assignment	H' 00000000: Disabled (0) H' 00000001: All channels Bank (bit0) (1) H' 00000002: All channels Bank (bit1) (2) H' 00000003: All channels Stop (0)/Run (1) (3) H' 00000004: All channels Run (0)/Stop (1) (4) H' 00000005: All channels Auto (0)/Manual (1) (5)	0	---	Common	---	●
				Not used.					
				H' 00000020: CH1 Bank (bit0) (32) H' 00000021: CH1 Bank (bit1) (33) H' 00000022: CH1 Stop (0)/Run (1) (34) H' 00000023: CH1 Run (0)/Stop (1) (35) H' 00000024: CH1 Auto (0)/Manual (1) (36)					
				Not used.					
				H' 00000040: CH2 Bank (bit0) (64)					
				⋮ The rest are the same as channel 1.					
				H' 00000800: CH64 Bank (bit0) (2048)					
				⋮ The rest are the same as channel 1.					
		0001	Event Input 2 Assignment	The rest are the same as Event Input 1 Assignment.					
		0002	Event Input 3 Assignment	The rest are the same as Event Input 1 Assignment.					
		0003	Event Input 4 Assignment	The rest are the same as Event Input 1 Assignment.					
			Not used.						
		0010	Auxiliary Output 1 Assignment	H' 00000000: Disabled (0) H' 00000001: Temperature Controller error (1)	4	---	Common	---	●
				H' 00000002: All channels All alarm OR (2) H' 00000003: All channels All alarm AND (3) H' 00000004: All channels Alarm 1 OR (4) H' 00000005: All channels Alarm 2 OR (5) H' 00000006: All channels Alarm 3 OR (6) H' 00000007: All channels Alarm 1 AND (7) H' 00000008: All channels Alarm 2 AND (8) H' 00000009: All channels Alarm 3 AND (9) H' 0000000A: All channels Input error OR (10)					
				Not used.					
				H' 00000020: CH1 Alarm 1 (32) H' 00000021: CH1 Alarm 2 (33) H' 00000022: CH1 Alarm 3 (34) H' 00000023: CH1 All alarm OR (35) H' 00000024: CH1 All alarm AND (36) H' 00000025: CH1 Input error (37)					
				Not used.					
				H' 00000040: Channel 2: The same as channel 1. (64)					
				⋮					
				⋮					
				H' 00000800: Channel 64: The same as channel 1. (2048)					
				⋮					
		0011	Auxiliary Output 2 Assignment	The rest are the same as Auxiliary Output 1 Assignment.	21				
		0012	Auxiliary Output 3 Assignment		22				
		0013	Auxiliary Output 4 Assignment		0				

Status Lists

Use the Status listed in the following tables to check EJ1G status.

TC4/TC2

C0 Status   C0/80 0001

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Input error	No error	Error	An input error has occurred.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			
Bit 16	Not used.			
Bit 17	Not used.			
Bit 18	Not used.			
Bit 19	Not used.			
Bit 20	Not used.			
Bit 21	Not used.			
Bit 22	Not used.			
Bit 23	Not used.			
Bit 24	Not used.			
Bit 25	Communications Writing	---	ON (enabled)	Communications Writing is always ON (enabled).
Bit 26	Not used.			
Bit 27	Not used.			
Bit 28	Not used.			
Bit 29	Not used.			
Bit 30	Not used.			
Bit 31	Not used.			

Device A Status   C4/84 0000

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Device Error	No error	Error	There is a memory error. Refer to *Device Error Status*.
Bit 1	Configuration Error	No error	Error	There is an error in the device configuration. Refer to *Configuration Error A Status*, and *Configuration Error B Status*.
Bit 2	Channel Error	No error	Error	There is an error in one of the channels. Refer to *Error Channel A Status*.
Bit 3	Not used.			
Bit 4	Expand Communications Error	No error	Error	There is an error in communications with the connected G3ZA. Refer to *Internal Communications Error Status*.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	I/O Error	No error	Error	There is an I/O error. Refer to *I/O Error Status*.
Bit 11	Lower-level I/O Error	No error	Error	There is an error in the connected G3ZA. Refer to *Basic Unit/Expand Unit Error Status*.
Bit 12	I/O Alarm	No error	Error	There is an I/O alarm. Refer to *I/O Alarm A Status* and *I/O Alarm B Status*.
Bit 13	Lower-level I/O Alarm	No error	Error	An alarm has occurred in the connected G3ZA. Refer to *Basic Unit/Expand Unit Alarm Status*.
Bit 14	I/O Notification	No error	Error	There is an I/O notification. Refer to *I/O Notification A Status*.
Bit 15	Not used.			

Device Error Status   C4/84 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	EEPROM Error	No error	Error	There is a memory error.
Bit 5	Calibration Error	No error	Error	There is a memory error.
Bit 6	Setting Value Error	No error	Error	There is a memory error.
Bit 7	Not used.			
Bit 8	Configured Registration Data Error	No error	Error	There is a memory error.
Bit 9	Model Information Data Error	No error	Error	There is a memory error.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Model Information Mismatching Error	No error	Error	There is a memory error.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Configuration Error A Status C4/84 0002

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Undefined Expand Units	No error	Error	A Unit that is not recognized is connected.
Bit 1	Not used.			
Bit 2	Too Many Expand units	No error	Error	More than 9 G3ZA Units are connected.
Bit 3	Expand Unit Failure	No error	Error	There is an error in communications with the G3ZA.
Bit 4	Expand Unit Connection Fault	No error	Error	A communications response has not been received from a G3ZA after it was registered in the configuration.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	No HFU	No error	Error	There is no HFU.
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Configuration Error B Status C4/84 0003

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Error	No error	Error	There is an error in communications with the G3ZA1.
Bit 1	Expand Unit 2 Error	No error	Error	There is an error in communications with the G3ZA2.
Bit 2	Expand Unit 3 Error	No error	Error	There is an error in communications with the G3ZA3.
Bit 3	Expand Unit 4 Error	No error	Error	There is an error in communications with the G3ZA4.
Bit 4	Expand Unit 5 Error	No error	Error	There is an error in communications with the G3ZA5.
Bit 5	Expand Unit 6 Error	No error	Error	There is an error in communications with the G3ZA6.
Bit 6	Expand Unit 7 Error	No error	Error	There is an error in communications with the G3ZA7.
Bit 7	Expand Unit 8 Error	No error	Error	There is an error in communications with the G3ZA8.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Internal Communications Error Status C4/84 0004

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Communications Error	No error	Error	There is an error in communications with the G3ZA1.
Bit 1	Expand Unit 2 Communications Error	No error	Error	There is an error in communications with the G3ZA2.
Bit 2	Expand Unit 3 Communications Error	No error	Error	There is an error in communications with the G3ZA3.
Bit 3	Expand Unit 4 Communications Error	No error	Error	There is an error in communications with the G3ZA4.
Bit 4	Expand Unit 5 Communications Error	No error	Error	There is an error in communications with the G3ZA5.
Bit 5	Expand Unit 6 Communications Error	No error	Error	There is an error in communications with the G3ZA6.
Bit 6	Expand Unit 7 Communications Error	No error	Error	There is an error in communications with the G3ZA7.
Bit 7	Expand Unit 8 Communications Error	No error	Error	There is an error in communications with the G3ZA8.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Error Status C4/84 0005

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Main Input 1 Count Error	No error	Error	There is a channel 1 input error.
Bit 1	Main Input 2 Count Error	No error	Error	There is a channel 2 input error.
Bit 2	Main Input 3 Count Error	No error	Error	There is a channel 3 input error.
Bit 3	Main Input 4 Count Error	No error	Error	There is a channel 4 input error.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Alarm A Status C4/84 0006

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CT1 Heater Overcurrent	No error	Error	The heater current 1 value exceeds 110.0 A.
Bit 1	CT2 Heater Overcurrent	No error	Error	The heater current 2 value exceeds 110.0 A.
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Alarm B Status C4/84 0007

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CT1 HB Alarm	OFF	ON	An HB alarm has occurred for CT1 input.
Bit 1	CT1 HS Alarm	OFF	ON	An HS alarm has occurred for CT1 input.
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	CT2 HB Alarm	OFF	ON	An HB alarm has occurred for CT2 input.
Bit 5	CT2 HS Alarm	OFF	ON	An HS alarm has occurred for CT2 input.
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Notification A Status

C4/84 0009

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CT1 Heater Current Hold	Updated	Hold	The heater current monitor has not been updated because the control output ON time is less than 100 ms.
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	CT2 Heater Current Hold	Updated	Hold	The heater current monitor has not been updated because the control output ON time is less than 100 ms.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Error Channel A Status

C4/84 000B

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CH1	No error	Error	Channel 1 has an error.
Bit 1	CH2	No error	Error	Channel 2 has an error.
Bit 2	CH3	No error	Error	Channel 3 has an error.
Bit 3	CH4	No error	Error	Channel 4 has an error.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Basic Unit/Expand Unit Error Status C4/84 000F

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Error	No error	Error	The G3ZA1 has generated a zero-cross error.
Bit 1	Expand Unit 2 Error	No error	Error	The G3ZA2 has generated a zero-cross error.
Bit 2	Expand Unit 3 Error	No error	Error	The G3ZA3 has generated a zero-cross error.
Bit 3	Expand Unit 4 Error	No error	Error	The G3ZA4 has generated a zero-cross error.
Bit 4	Expand Unit 5 Error	No error	Error	The G3ZA5 has generated a zero-cross error.
Bit 5	Expand Unit 6 Error	No error	Error	The G3ZA6 has generated a zero-cross error.
Bit 6	Expand Unit 7 Error	No error	Error	The G3ZA7 has generated a zero-cross error.
Bit 7	Expand Unit 8 Error	No error	Error	The G3ZA8 has generated a zero-cross error.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Basic Unit/Expand Unit Alarm Status C4/84 0010

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Alarm	OFF	ON	The G3ZA1 has a heater burnout, overcurrent, or SSR short circuit.
Bit 1	Expand Unit 2 Alarm	OFF	ON	The G3ZA2 has a heater burnout, overcurrent, or SSR short circuit.
Bit 2	Expand Unit 3 Alarm	OFF	ON	The G3ZA3 has a heater burnout, overcurrent, or SSR short circuit.
Bit 3	Expand Unit 4 Alarm	OFF	ON	The G3ZA4 has a heater burnout, overcurrent, or SSR short circuit.
Bit 4	Expand Unit 5 Alarm	OFF	ON	The G3ZA5 has a heater burnout, overcurrent, or SSR short circuit.
Bit 5	Expand Unit 6 Alarm	OFF	ON	The G3ZA6 has a heater burnout, overcurrent, or SSR short circuit.
Bit 6	Expand Unit 7 Alarm	OFF	ON	The G3ZA7 has a heater burnout, overcurrent, or SSR short circuit.
Bit 7	Expand Unit 8 Alarm	OFF	ON	The G3ZA8 has a heater burnout, overcurrent, or SSR short circuit.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Output Status

C4/84 0012

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Control Output 1	OFF	ON	The control output 1 status can be checked.
Bit 1	Control Output 2	OFF	ON	The control output 2 status can be checked.
Bit 2	Control Output 3	OFF	ON	The control output 3 status can be checked.
Bit 3	Control Output 4	OFF	ON	The control output 4 status can be checked.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Device B Status

C4/84 0013

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Save RAM 2	No error	Error	Power was turned OFF while saving RAM2 and not all data was registered.
Bit 2	Not used.			
Bit 3	Registration of unit configuration/Registration of multiple reads	No error	Error	Power was turned OFF during Unit configuration registration or composite read registration and not all data was registered.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Configuration Registered	Not registered	Registered	Configuration registration status can be confirmed.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Channel Status C4/84 0101 (CH1)·0201 (CH2)·0301 (CH3)·0401 (CH4)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Input Error	No error	Error	An input error has occurred.
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Channel Alarm Status C4/84 0102 (CH1)·0202 (CH2)·0302 (CH3)·0402 (CH4)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Heater Overcurrent	No error	Error	A heater overcurrent has occurred.
Bit 5	HB Alarm	OFF	ON	An HB alarm has occurred.
Bit 6	HS Alarm	OFF	ON	An HS alarm has occurred.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Scaling Reverse Operation	No error	Error	The upper and lower scaling limits are reversed.

HFU

C0 Status   C0/80 0001

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Input Error	No Error	Error	An input error has occurred.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Alarm Output 1	OFF	ON	An alarm 1 error has occurred.
Bit 13	Alarm Output 2	OFF	ON	An alarm 2 error has occurred.
Bit 14	Alarm Output 3	OFF	ON	An alarm 3 error has occurred.
Bit 15	Not used.			
Bit 16	Not used.			
Bit 17	Not used.			
Bit 18	Not used.			
Bit 19	Not used.			
Bit 20	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 21	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 22	Not used.			
Bit 23	AT Execute/Cancel	AT is stopped.	AT execution in progress	AT Execute/Cancel can be confirmed.
Bit 24	Run/Stop	Run	Stop	Run/Stop can be confirmed.
Bit 25	Communications Writing	---	ON (enabled)	Communications Writing is always ON (enabled).
Bit26	Auto/Manual	Auto	Manual	Auto/Manual can be confirmed.
Bit 27	Not used.			
Bit 28	Not used.			
Bit 29	Not used.			
Bit 30	Not used.			
Bit 31	Not used.			

Device A Status

C4/84 0000

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Device Error	No error	Error	There is a memory error. Refer to *Device Error Status*.
Bit 1	Configuration Error	No error	Error	There is an error in the device configuration. Refer to *Configuration Error A Status*.
Bit 2	Channel Error	No error	Error	There is an error in one of the channels. Refer to *Error Channel A to D Status*.
Bit 3	External RAM Error at Operation	No error	Error	There is a memory error.
Bit 4	Internal Communications Error	No error	Error	There is a programless communications error. Set when one of the programless error status bits turns ON. The internal communications error status, however, is not set.
Bit 5	Not used.			
Bit 6	Programless Link Error	No error	Error	There is a programless communications error.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Lower-level I/O Error	No error	Error	There is an error in the connected TC4/TC2. Refer to *Basic Unit/Expand Unit Error Status*.
Bit 12	Not used.			
Bit 13	Lower-level I/O Alarm	No error	Error	An alarm has occurred in the connected TC4/2. Refer to *Basic Unit/Expand Unit Alarm Status*.
Bit 14	Not used.			
Bit 15	Lower-level I/O Notification	No error	Error	The peak current monitor for connected TC4/2 Units has not been updated. Refer to the *I/O Notification A Status* for the TC4/2 Unit.

Device Error Status

C4/84 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	EEPROM Error	No error	Error	There is a memory error.
Bit 5	Not used.			
Bit 6	Setting Value Error	No error	Error	There is a memory error.
Bit 7	Not used.			
Bit 8	Configured Registration Data Error	No error	Error	There is a memory error.
Bit 9	Model Information Data Error	No error	Error	There is a memory error.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Model Information Mismatching Error	No error	Error	There is a memory error.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Configuration Error A Status C4/84 0002

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Undefined Expand Units.	No error	Error	A Unit that is not recognized is connected.
Bit 1	No Basic Unit	No error	Error	No Basic Units are registered and no TC4/TC2 Units are connected.
Bit 2	Too Many Basic Units	No error	Error	More than 16 TC4/TC2 Units are connected.
Bit 3	Not used.			
Bit 4	Basic Unit Connection Fault	No error	Error	The configuration has been registered, but the registered TC4/TC2 Units cannot recognized.
Bit 5	Basic Unit Startup Error	No error	Error	A configuration error has occurred for the TC4/TC2 Units.
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Illegal Unit Arrangement	No error	Error	A Unit is connected to the left of the HFU.
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Illegal Restart Error	No error	Error	Only the HFU was reset during operation.
Bit 13	Invalid Registration Error	No error	Error	The configuration registered without any TC4/TC2 Units.
Bit 14	Control Group Setting Error	No error	Error	There is an error in the group settings.
Bit 15	Not used.			

Configuration Error B Status C4/84 0003

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Basic Unit 1 Error	No error	Error	An error occurred in a TC2 or TC4 Unit after the configuration was registered.
Bit 1	Basic Unit 2 Error	No error	Error	
Bit 2	Basic Unit 3 Error	No error	Error	
Bit 3	Basic Unit 4 Error	No error	Error	
Bit 4	Basic Unit 5 Error	No error	Error	
Bit 5	Basic Unit 6 Error	No error	Error	
Bit 6	Basic Unit 7 Error	No error	Error	
Bit 7	Basic Unit 8 Error	No error	Error	
Bit 8	Basic Unit 9 Error	No error	Error	
Bit 9	Basic Unit 10 Error	No error	Error	
Bit 10	Basic Unit 11 Error	No error	Error	
Bit 11	Basic Unit 12 Error	No error	Error	
Bit 12	Basic Unit 13 Error	No error	Error	
Bit 13	Basic Unit 14 Error	No error	Error	
Bit 14	Basic Unit 15 Error	No error	Error	
Bit 15	Basic Unit 16 Error	No error	Error	

Internal Communications Error Status C4/84 0004

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Basic Unit 1 Communications Error	No error	Error	An error occurred in communications with the specified Basic Unit.
Bit 1	Basic Unit 2 Communications Error	No error	Error	
Bit 2	Basic Unit 3 Communications Error	No error	Error	
Bit 3	Basic Unit 4 Communications Error	No error	Error	
Bit 4	Basic Unit 5 Communications Error	No error	Error	
Bit 5	Basic Unit 6 Communications Error	No error	Error	
Bit 6	Basic Unit 7 Communications Error	No error	Error	
Bit 7	Basic Unit 8 Communications Error	No error	Error	
Bit 8	Basic Unit 9 Communications Error	No error	Error	
Bit 9	Basic Unit 10 Communications Error	No error	Error	
Bit 10	Basic Unit 11 Communications Error	No error	Error	
Bit 11	Basic Unit 12 Communications Error	No error	Error	
Bit 12	Basic Unit 13 Communications Error	No error	Error	
Bit 13	Basic Unit 14 Communications Error	No error	Error	
Bit 14	Basic Unit 15 Communications Error	No error	Error	
Bit 15	Basic Unit 16 Communications Error	No error	Error	

Error Channel A Status C4/84 000B

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CH1	No error	Error	An error occurred for the specified channel.
Bit 1	CH2	No error	Error	
Bit 2	CH3	No error	Error	
Bit 3	CH4	No error	Error	
Bit 4	CH5	No error	Error	
Bit 5	CH6	No error	Error	
Bit 6	CH7	No error	Error	
Bit 7	CH8	No error	Error	
Bit 8	CH9	No error	Error	
Bit 9	CH10	No error	Error	
Bit 10	CH11	No error	Error	
Bit 11	CH12	No error	Error	
Bit 12	CH13	No error	Error	
Bit 13	CH14	No error	Error	
Bit 14	CH15	No error	Error	
Bit 15	CH16	No error	Error	

Error Channel B Status C4/84 000C

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CH17	No error	Error	An error occurred for the specified channel.
Bit 1	CH18	No error	Error	
Bit 2	CH19	No error	Error	
Bit 3	CH20	No error	Error	
Bit 4	CH21	No error	Error	
Bit 5	CH22	No error	Error	
Bit 6	CH23	No error	Error	
Bit 7	CH24	No error	Error	
Bit 8	CH25	No error	Error	
Bit 9	CH26	No error	Error	
Bit 10	CH27	No error	Error	
Bit 11	CH28	No error	Error	
Bit 12	CH29	No error	Error	
Bit 13	CH30	No error	Error	
Bit 14	CH31	No error	Error	
Bit 15	CH32	No error	Error	

Error Channel C Status   C4/84 000D

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CH33	No error	Error	An error occurred for the specified channel.
Bit 1	CH34	No error	Error	
Bit 2	CH35	No error	Error	
Bit 3	CH36	No error	Error	
Bit 4	CH37	No error	Error	
Bit 5	CH38	No error	Error	
Bit 6	CH39	No error	Error	
Bit 7	CH40	No error	Error	
Bit 8	CH41	No error	Error	
Bit 9	CH42	No error	Error	
Bit 10	CH43	No error	Error	
Bit 11	CH44	No error	Error	
Bit 12	CH45	No error	Error	
Bit 13	CH46	No error	Error	
Bit 14	CH47	No error	Error	
Bit 15	CH48	No error	Error	

Error Channel D Status   C4/84 000E

Bit position	Status	Bit description		Meaning
		0	**1**	
Bit 0	CH49	No error	Error	An error occurred for the specified channel.
Bit 1	CH50	No error	Error	
Bit 2	CH51	No error	Error	
Bit 3	CH52	No error	Error	
Bit 4	CH53	No error	Error	
Bit 5	CH54	No error	Error	
Bit 6	CH55	No error	Error	
Bit 7	CH56	No error	Error	
Bit 8	CH57	No error	Error	
Bit 9	CH58	No error	Error	
Bit 10	CH59	No error	Error	
Bit 11	CH60	No error	Error	
Bit 12	CH61	No error	Error	
Bit 13	CH62	No error	Error	
Bit 14	CH63	No error	Error	
Bit 15	CH64	No error	Error	

Basic Unit/Expand Unit Error Status   C4/84 000F

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Basic Unit 1 Error	No error	Error	An input error occurred in the specified Basic Unit, or a communications error or zero-cross error occurred in the connected G3ZA.
Bit 1	Basic Unit 2 Error	No error	Error	
Bit 2	Basic Unit 3 Error	No error	Error	
Bit 3	Basic Unit 4 Error	No error	Error	
Bit 4	Basic Unit 5 Error	No error	Error	
Bit 5	Basic Unit 6 Error	No error	Error	
Bit 6	Basic Unit 7 Error	No error	Error	
Bit 7	Basic Unit 8 Error	No error	Error	
Bit 8	Basic Unit 9 Error	No error	Error	
Bit 9	Basic Unit 10 Error	No error	Error	
Bit 10	Basic Unit 11 Error	No error	Error	
Bit 11	Basic Unit 12 Error	No error	Error	
Bit 12	Basic Unit 13 Error	No error	Error	
Bit 13	Basic Unit 14 Error	No error	Error	
Bit 14	Basic Unit 15 Error	No error	Error	
Bit 15	Basic Unit 16 Error	No error	Error	

Basic Unit/Expand Unit Alarm Status   C4/84 0010

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Basic Unit 1 Alarm	OFF	ON	A heater overcurrent occurred in the specified Basic Unit, or an HB/HS error occurred. An HB, HS, or OC error occurred in the G3ZA.
Bit 1	Basic Unit 2 Alarm	OFF	ON	
Bit 2	Basic Unit 3 Alarm	OFF	ON	
Bit 3	Basic Unit 4 Alarm	OFF	ON	
Bit 4	Basic Unit 5 Alarm	OFF	ON	
Bit 5	Basic Unit 6 Alarm	OFF	ON	
Bit 6	Basic Unit 7 Alarm	OFF	ON	
Bit 7	Basic Unit 8 Alarm	OFF	ON	
Bit 8	Basic Unit 9 Alarm	OFF	ON	
Bit 9	Basic Unit 10 Alarm	OFF	ON	
Bit 10	Basic Unit 11 Alarm	OFF	ON	
Bit 11	Basic Unit 12 Alarm	OFF	ON	
Bit 12	Basic Unit 13 Alarm	OFF	ON	
Bit 13	Basic Unit 14 Alarm	OFF	ON	
Bit 14	Basic Unit 15 Alarm	OFF	ON	
Bit 15	Basic Unit 16 Alarm	OFF	ON	

Device B Status   C4/84 0013

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Save RAM 1	No Error	Error	Power was turned OFF while saving RAM1 and not all data was registered.
Bit 1	Save RAM 2	OFF	ON	Power was turned OFF while saving RAM2 and not all data was registered.
Bit 2	Save Control Parameters	No Error	Error	Power was turned OFF during parameter registration after autotuning or GT was completed, and not all data was registered.
Bit 3	Registration of unit configuration/Registration of multiple reads	OFF	ON	Power was turned OFF during Unit configuration registration or composite read registration and not all data was registered.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 9	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Configuration Registered	Not registered	Registered	Configuration registration status can be confirmed.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Channel Status   C4/84   0101 (CH1)·0201 (CH2) to 4001 (CH64)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	RUN/STOP	Run	Stop	Run/Stop can be confirmed.
Bit 1	Auto/Manual	Auto	Manual	Auto/Manual can be confirmed.
Bit 2	AT(GT) Execute/Cancel	AT(GT) is stopped.	AT(GT) execution in progress.	Can confirm AT(GT) Execute/Cancel.
Bit 3	Not used.			
Bit 4	Control Type	Gradient	2-PID	Can confirm the control type.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Input Error	No error	Error	An input error has occurred.
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	GT Error	No error	Error	An error occurred while executing GT.
Bit 13	GTC Error	No error	Error	There is an error in internal parameters for GTC.
Bit 14	Not used.			
Bit 15	Not used.			

Channel Alarm Status   C4/84   0102 (CH1)·0201 (CH2) to 4002 (CH64)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Alarm 1	OFF	ON	An alarm 1 error has occurred.
Bit 1	Alarm 2	OFF	ON	An alarm 2 error has occurred.
Bit 2	Alarm 3	OFF	ON	An alarm 3 error has occurred.
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Basic Unit Error	No Error	Error	An input error has occurred or a communications error or zero-cross error has occurred in the G3ZA connected to the Basic Unit with the relevant channel.
Bit 11	Basic Unit Alarm	No Error	Error	A peak current overflow has occurred for the relevant channel or an HB or HS alarm has occurred.
Bit 12	Set Point Limiter Out of Range	No Error	Error	The set point is outside the set point limiter.
Bit 13	Set Value Limiter Reverse Operation	No Error	Error	The upper and lower set point limits are reversed.
Bit 14	MV Limiter Reverse Operation	No Error	Error	The upper and MV limits are reversed.
Bit 15	Not used.			

Parameters That Can Be Allocated for Programless Communications

The following table lists the parameters that can be allocated to programless communications.

Function	Parameter	Attribute	Upload	Download	Remarks
Status	Device A Status	Common	●	--- (See note.)	Monitoring only
	Device Error Status	Common	●	--- (See note.)	Monitoring only
	Configuration Error A Status	Common	●	--- (See note.)	Monitoring only
	Configuration Error B Status	Common	●	--- (See note.)	Monitoring only
	Internal Communications Error Status	Common	●	--- (See note.)	Monitoring only
	Error Channel A Status	Common	●	--- (See note.)	Monitoring only
	Error Channel B Status	Common	●	--- (See note.)	Monitoring only
	Error Channel C Status	Common	●	--- (See note.)	Monitoring only
	Error Channel D Status	Common	●	--- (See note.)	Monitoring only
	Basic Unit/Expand Unit Error	Common	●	--- (See note.)	Monitoring only
	Basic Unit/Expand Unit Alarm	Common	●	--- (See note.)	Monitoring only
	Decimal Point Monitor	Common	●	--- (See note.)	Monitoring only
	Device B Status	Common	●	--- (See note.)	Monitoring only
	Number of Gradient Channels Monitor	Common	●	--- (See note.)	Monitoring only
HB Alarm	Heater Current Value Monitor	CH	●	--- (See note.)	Monitoring only
	Leakage Current Value Monitor	CH	●	--- (See note.)	Monitoring only
	Heater Burnout Detection	CH	●	●	
	HS Alarm	CH	●	●	
Monitoring	Process Value	CH	●	--- (See note.)	Monitoring only
	Channel Status	CH	●	--- (See note.)	Monitoring only
	Channel Alarm Status	CH	●	--- (See note.)	Monitoring only
	Internal SP	CH	●	--- (See note.)	Monitoring only
	Bank No. Monitor	CH	●	--- (See note.)	Monitoring only
	MV Monitor (Heating)	CH	●	--- (See note.)	Monitoring only
Target value	Bank 0 to 3 Present Bank Set Point	BANK	●	●	
	Bank 0 to 3 Present Bank SP Ramp Rise Value	BANK	●	●	
	Bank 0 to 3 Present Bank SP Ramp Fall Value	BANK	●	●	
	SP Upper Limit	CH	●	●	
	SP Lower Limit	CH	●	●	
Alarms	Bank 0 to 3 Present Bank Alarm Value 1	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Upper Limit Value 1	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Lower Limit Value 1	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Value 2	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Upper Limit Value 2	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Lower Limit Value 2	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Value 3	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Upper Limit Value 3	BANK	●	●	
	Bank 0 to 3 Present Bank Alarm Lower Limit Value 3	BANK	●	●	
Inputs	Input Value 1 for Input Correction	CH	●	●	
	Input Shift 1	CH	●	●	
	Input Value 2 for Input Correction	CH	●	●	
	Input Shift 2	CH	●	●	

Function	Parameter	Attribute	Upload	Download	Remarks
Control	Bank 0 to 3 Present Bank Proportional Band	BANK	●	●	
	Bank 0 to 3 Present Bank Integral Time	BANK	●	●	
	Bank 0 to 3 Present Bank Derivative Time	BANK	●	●	
	MV at PV Error	CH	●	●	
	MV at Stop	CH	●	●	
	MV Upper Limit	CH	●	●	
	MV Lower Limit	CH	●	●	
	Alpha	CH	●	●	
	Manual MV	CH	●	●	
	Disturbance Gain	CH	●	●	
	Disturbance Time Constant	CH	●	●	
	Disturbance Rectification Band	CH	●	●	
	Disturbance Judgment Width	CH	●	●	
	Control Balance Coefficient	CH	●	●	
Other	Not used.	Common	●	●	For address adjustment
	End code	Common	●	●	

Note ●: Can be allocated.　　---: Cannot be allocated.

Index

Numerics

A

B

C

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

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Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	October 2006	Original production

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