# OMRON

Modular Temperature Controller for Gradient Temperature Control
EJ1G

Gradient Temperature Control to Achieve Consistent Layer Temperature

- Perform gradient temperature control ranging from 2 to 32 channels.
- Perform 2-channel gradient temperature control for up to 16 groups, or 32-channel gradient temperature control for up to 2 groups.
- Set gradient temperature control or 2-PID control for each group.
- Reduce design work for ladder programming with programless connections to Programmable Controllers. (The same feature as Standard-control EJ1 Models.)
- Connect directly to the G3ZA Multi-channel Power Controller using optimum cycle control for high-accuracy control with minimal noise.

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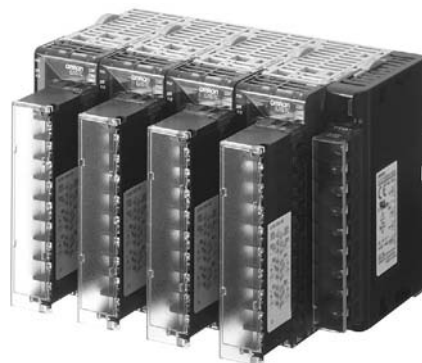
⚠ Refer to the *"Safety Precautions"* on page 18.

Ordering Information

■ Temperature Controllers

Gradient Temperature Control

Name	Power supply voltage	No. of control points	Control outputs 1 and 2	Control outputs 3 and 4	Auxiliary output	Functions		Communications functions	Input type	Terminal	Model
						Heater burnout alarm	Event inputs				
Basic Unit (gradient temperature control) (See note 1.)	24 VDC supplied from the End Unit	2	Voltage output: 2 points (for SSR drive) (See note 2.)	Transistor output: 2 points (sourcing)	None	2 (See note 3.)	None	G3ZA connection port: RS-485 From End Unit: Port A: RS-485	Thermocouple, platinum resistance thermometer, analog voltage, and analog current selectable for each channel.	M3 terminal	EJ1G-TC2A-QNH
										Screw-less clamp	EJ1G-TC2B-QNH
		4		Voltage output: 2 points (for SSR drive) (See note 2.)			None			M3 terminal	EJ1G-TC4A-QQ
										Screw-less clamp	EJ1G-TC4B-QQ
HFU (gradient temperature control) (See note 1.)		None	None	None	Transistor output: 4 points (sourcing)		4	From End Unit: Port A: RS-485 Port C: RS-485 or RS-232C selectable.	No input	M3 terminal	EJ1G-HFUA-NFLK
										Screw-less clamp	EJ1G-HFUB-NFLK
								From End Unit: Port A: RS-485 Port C: RS-422		M3 terminal	EJ1G-HFUA-NFL2
										Screw-less clamp	EJ1G-HFUB-NFL2
End Unit (See note 1.)	24 VDC				Transistor output: 2 points (sourcing)		None	Port A: RS-485 Connector: Port A		M3 terminal	EJ1C-EDUA-NFLK

Note: 1. An End Unit is required to connect an HFU to a Basic Unit. A Gradient Temperature Control HFU and a Gradient Temperature Control Basic Unit must be used together to achieve gradient temperature control. The Gradient Temperature Control HFU and Gradient Temperature Control Basic Unit are used exclusively for gradient temperature control, but the End Unit is the same as that used for the Standard-control EJ1 Models.
The Basic Unit cannot communicate externally by itself.

2. Heating/cooling control is not supported for gradient temperature control.

3. When using the heater burnout alarm, use a Current Transformer (E54-CT1 or E54-CT3) (sold separately).

Refer to the following manual for precautionary information and other information necessary to use the EJ1G:
EJ1G Modular Temperature Controller Operation Manual (Cat. No. H143)

■ Accessories (Order Separately)

Current Transformer (CT)

Diameter	Model
5.8 dia.	E54-CT1
12.0 dia.	E54-CT3

G3ZA Connecting Cable

Cable length	Model
5 m	EJ1C-CBLA050

Rail Mounting Equipment

Name	Model
Mounting Rail	PFP-100N
	PFP-50N

CX-Thermo Support Software Ver. 3.1

Model
EST2-2C-MV3

Note: CX-Thermo Support Software version 3.2 (available soon) is required to set the EJ1G Modular Temperature Controller for Gradient Temperature Control.

USB-Serial Conversion Cable

Model
E58-CIFQ1

Specifications

> Basic Unit/EJ1G-TC

■ Ratings

Item ⟍ Type	EJ1G-TC4	EJ1G-TC2
Power supply voltage	24 VDC	
Operating voltage range	85% to 110% of rated voltage	
Power consumption	5 W max. (at maximum load)	4 W max. (at maximum load)
Input (See note.)	Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII ES1B Infrared Thermosensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C Analog input: 4 to 20 mA, 0 to 20 mA, 1 to 5 V, 0 to 5 V, 0 to 10 V Platinum resistance thermometer: Pt100, JPt100	
Input impedance	Current input: 150 Ω max., voltage input: 1 MΩ min.	
Control outputs — Voltage output	Output voltage: 12 VDC ±15%, max. load current: 21 mA (PNP models with short-circuit protection circuit)	
Control outputs — Transistor output	---	Max. operating voltage: 30 V, max. load current: 100 mA
Number of input and control points	Input points: 4, Control points: 4	Input points: 2, Control points: 2
Setting method	Via communications	
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% (with no condensation)	

Note: Inputs are fully multi-input. Therefore, platinum resistance thermometer, thermocouple, infrared thermosensor, and analog input can be selected.

■ Characteristics

Indication accuracy	Thermocouple input/platinum resistance thermometer input: (±0.5% of indication value (PV) or ±1°C, whichever is greater) ±1 digit max. (See note 1.)	
	Analog input: ±0.5% FS ±1 digit max.	
	CT input: ±5% FS ±1 digit max.	
Temperature variation influence (See note 2.)	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.	
Voltage variation influence (See note 2.)	K thermocouple at −100°C max: ±10°C max.	
	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 0.1 EU) (See note 3.)	
Integral time (I)	1 to 3,999 s (in units of 1 s)	
Derivative time (D)	0.0 to 999.9 s (in units of 0.1 s)	
Control period	0.5 s, 1 to 99 s (in units of 1 s)	
Alarm output setting range	−1,999 to 9,999 (The location of decimal point depends on the setting of decimal point position B.)	
Sampling period	250 ms	
Influence of signal source resistance	Thermocouple: 0.1°C (0.2°F)/Ω max. (100 Ω max per line) (See note 4.)	
	Platinum resistance thermometer: 0.4°C (0.8°F)/Ω max. (10 Ω max per line)	
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/s² for 2 hours each in X, Y, and Z directions	
Shock resistance	150 m/s² max., 3 times each in 6 directions	
Weight	180 g	
Degree of protection	Rear case: IP20, Terminal section: IP00	
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)	
Standards	**Approved standards**	UL61010C-1, CSA C22.2 No.1010-1
	Conformed standards	EN61010-1 (IEC61010-1): Pollution level 2, overvoltage category II
EMC Directive	EMI: EN61326	
	EMI Radiated: EN55011 Group1 class A	
	EMI Conducted: EN55011 Group1 class A	
	EMS: EN61326	
	ESD Immunity: EN61000-4-2	
	Radiated Electromagnetic Field Immunity: EN61000-4-3	
	Burst immunity/Noise Immunity: EN61000-4-4	
	Conducted Disturbance Immunity: EN61000-4-6	
	Surge Immunity: EN61000-4-5	
	Commercial Frequency Immunity: EN61000-4-8	
	Voltage Dip/Interrupting Immunity: EN61000-4-11	

Note: 1. The indication of K thermocouples in the −200 to 1,300°C range, 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 of B thermocouples at a temperature of 400°C or less is unrestricted. The indication of R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit max.
W = (±0.5% of indication value (PV) or ±3°C, whichever is greater) ±1 digit max. PLII = (±0.5% of indication value (PV) or ±2°C, whichever is greater) ±1 digit max.

2. Ambient temperature: −10°C to 23°C to 55°C
Voltage range: −15% to +10% of rated voltage

3. "EU" stands for Engineering Unit. The location of the decimal point depends on the setting of decimal point position B. If the decimal point location is set to 0 (****), however, it will be treated as if it were set to 1 (***.*).

4. B, R, and S sensors: 0.2°C/Ω max. (100 Ω max.)

■ Communications Specifications

Item	Port A Terminal/ Port A Connector (See note 1.)	G3ZA Connection Port (See note 2.)
Transmission path connection	RS-485 (multipoint)	
Communications method	RS-485 (two-wire, half duplex)	
Synchronization method	Start-stop synchronization	
Baud rate	38.4 kbps fixed	57.6 kbps fixed
Transmission code	ASCII	
Data bit length	7 bits	
Stop bit length	2 bits	
Error detection	Vertical parity (even)	
	Block check character (BCC): with CompoWay/F	
Flow control	None	
Interface	RS-485	
Retry function	None	
Communications response wait time	1 to 99 ms (default: 1 ms)	---
Number of Units that can be connected in parallel (See notes 3 and 4.)	16 Units (model numbers with TC4: 64 channels, model numbers with TC2: 32 channels) Communications connection via port A on the End Unit	8 Units (Communications connection via G3ZA port on the Basic Unit)

Note: 1. Connection from the EJ1C-EDU

    2. A special cable (EJ1C-CBLA050) must be purchased separately for the G3ZA connection.

    3. For the number of Units that can be connected, refer to *"Connection Precautions"* on page 9.

    4. When performing gradient temperature control, the number of control channels is limited by the group setting. For details, refer to *"Gradient Group Settings"* on page 11.

■ Current Transformer (CT) Rating

Dielectric strength	1,000 VAC for 1 min
Vibration resistance	50 Hz, 98 m/s^2
Weight	E54-CT1: Approx. 11.5 g, E54-CT3: Approx. 50 g
Accessories (E54-CT3 only)	Armatures (2), plugs (2)

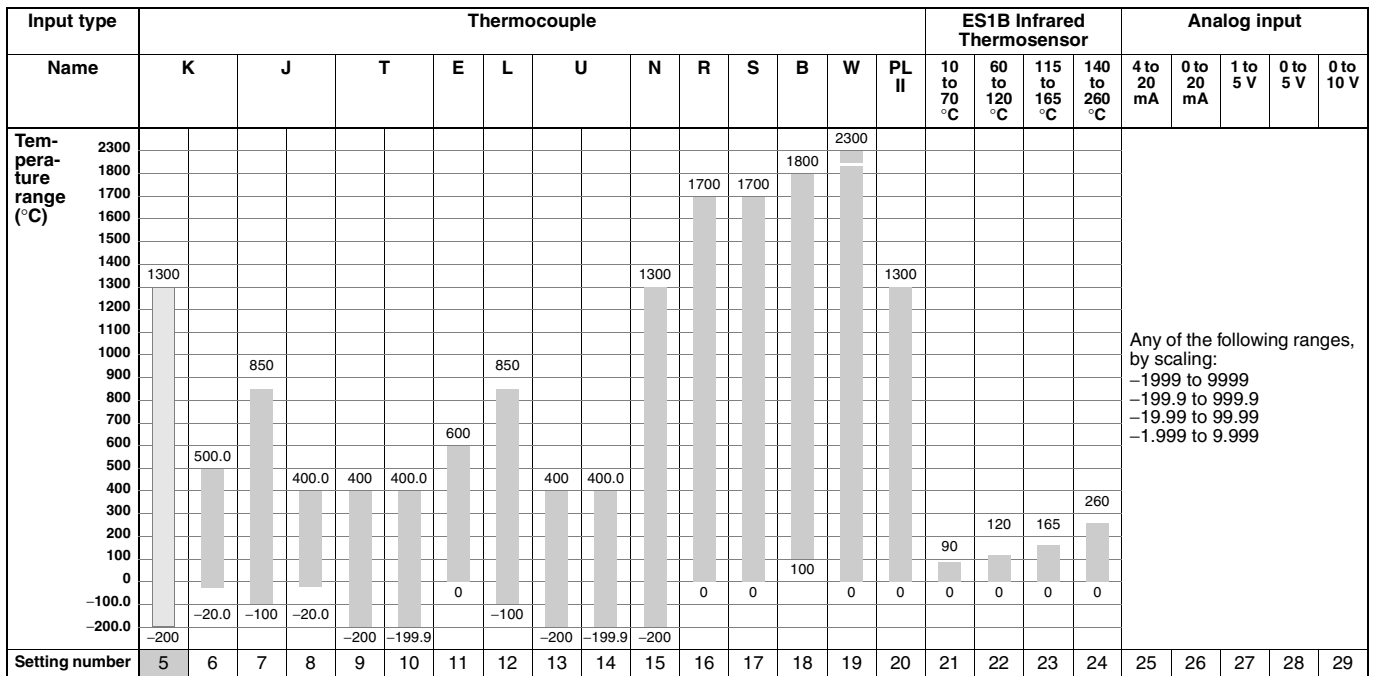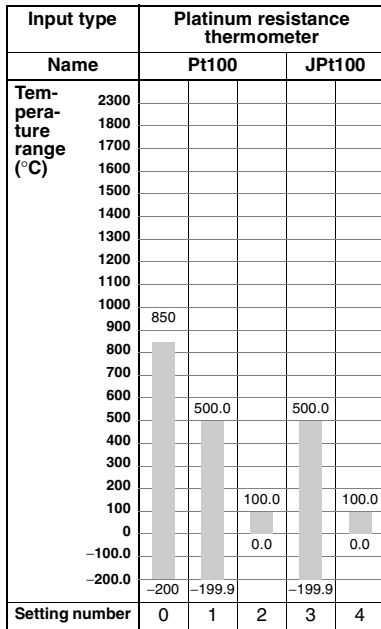# ■ Characteristics of the Heater Burnout Alarm and Heater Short Alarm (TC2 Models Only)

Maximum heater current	100 A AC
Input current indication accuracy	±5%FS ±1 digit max.
Heater burnout alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater burnout alarm output turns OFF. 100.0 A: Heater burnout alarm output turns ON. Min. detection ON time: 100 ms (See note 1.)
Heater short alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater short alarm output turns ON. 100.0 A: Heater short alarm output turns OFF. Min. detection OFF time: 100 ms (See note 2.)

Note: 1. When the control output ON time is 100 ms or less, heater burnout detection and heater current measurement are not performed.

    2. When the control output OFF time is 100 ms or less, heater short alarm and leakage current measurement are not performed.

■ Input Ranges

Sensor inputs are fully multi-input. Therefore, platinum resistance thermometer, thermocouple, infrared thermosensor, and analog input can be selected.
Inputs can be set for each channel using multi-inputs.

Input type	Platinum resistance thermometer				
Name	Pt100	Pt100	Pt100	JPt100	JPt100
Temperature range (°C) – high	850	500.0	100.0	500.0	100.0
Temperature range (°C) – low	−200	−199.9	0.0	−199.9	0.0
Setting number	0	1	2	3	4

Input type	Thermocouple												ES1B Infrared Thermosensor				Analog input				
Name	K	J	T	E	L	U	N	R	S	B	W	PL II	10 to 70 °C	60 to 120 °C	115 to 165 °C	140 to 260 °C	4 to 20 mA / 0 to 20 mA / 1 to 5 V / 0 to 5 V / 0 to 10 V
Temperature range (°C) – high	1300 / 500.0	850 / 400.0	400 / 400.0	600	850	400 / 400.0	1300	1700	1700	1800	2300	1300	90	120	165	260	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
Temperature range (°C) – low	−200 / −20.0	−100 / −20.0	−200 / −199.9	0	−100	−200 / −199.9	−200	0	0	100	0	0	0	0	0	0	
Setting number	5, 6	7, 8	9, 10	11	12	13, 14	15	16	17	18	19	20	21	22	23	24	25, 26, 27, 28, 29

Applicable standards by input type are as follows:
K, J, T, E, N, R, S, B: JIS C1602-1995, IEC584-1
L: Fe-CuNi, DIN 43710-1985
U: Cu-CuNi, DIN 43710-1985

W: W5Re/W26Re, ASTM E988-1990
PL II: According to Platinel II Electromotive Force Table by Engelhard Corp.
JPt100: JIS C 1604-1989, JIS C 1606-1989
Pt100: JIS C 1604-1997 IEC 751

☐ Shaded ranges indicate default settings.

EJ1G-HFU

■ Ratings

Power supply voltage		24 VDC
Operating voltage range		85% to 110% of rated voltage
Power consumption		2 W max. (at maximum load)
Auxiliary outputs (See note 1.)	Outputs	4
	Transistor outputs	Max. operating voltage: 30 VDC, Max. load current: 50 mA
Event inputs (See note 2.)	Inputs	4
	Inputs with contacts	ON: 1 kΩ max., OFF: 100 kΩ min.
	Inputs without contacts	ON: Residual voltage of 1.5 V max., OFF: Leakage current of 0.1 mA max.
		Short-circuit current: Approx. 4 mA (per contact)
Programless connection	Programless downloading (EJ1G writes data to a PLC)	Number of parameters that can be set: 300
	Programless uploading (EJ1G reads data from a PLC)	Number of parameters that can be set: 300
	Applicable PLCs	OMRON: SYSMAC CS/CJ Series, Mitsubishi Electric: MELSEC-Q/QnAS Series
Control method		2-PID control (with autotuning), gradient temperature control (with gradient tuning function)
Other functions		2-point input shift, SP ramp, manual manipulated variable, manipulated variable limiter, interference overshoot adjustment, heater burnout alarm, RUN/STOP, banks, I/O allocations, etc.
Ambient temperature range		Operating: −10°C to 55°C Storage:　−25°C to 65°C (with no icing or condensation)
Ambient humidity range		Operating: 25% to 85% (with no condensation)

Note: 1. Auxiliary outputs can be allocated using auxiliary output allocations.
2. Allocated using the digital input allocation function.

■ Characteristics

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
Weight		160 g
Degree of protection		Rear case: IP20, Terminal section: IP00
Memory protection		EEPROM (non-volatile memory) (number of writes: 100,000)
Standards	Approved standards	UL61010C-1, CSA C22.2 No.1010-1
	Conformed standards	EN61010-1 (IEC61010-1): Pollution level 2, overvoltage category II
EMC Directive		Refer to page 3.

■ Communications Characteristics: Port C

Communications are not possible from port B on the End Unit. A connection is made between ports B when using distributed placement.

Transmission path connection	RS-485/RS-422: Multi-point, RS-232C: Point-to-point (See note 1.)
Communications method	RS-485/RS-422 (two-wire, half duplex), RS-232C
Synchronization method	Start-stop synchronization
Baud rate	9.6, 19.2, 38.4, 57.6, or 115.2 kbps
Transmission code	ASCII
Data bit length	7 or 8 bits
Stop bit length	1 or 2 bits
Error detection	Vertical parity (none, even, or odd)
	Block check character (BCC) with CompoWay/F
Flow control	None
Interface	RS-485, RS-422, RS-232C (See note 1.)
Retry function	None
Communications response wait time	1 to 99 ms (default: 5 ms)
Number of Units that can be connected in parallel (See notes 2 and 3.)	16 Units (model numbers with TC4: 64 channels, model numbers with TC2: 32 channels)

Note: 1. The communications method can be switched between RS-485 and RS-232C. Another model must be used for RS-422 communications.
2. For the number of Units that can be connected, refer to *"Connection Precautions"* on page 9.
3. When performing gradient temperature control, the number of control channels is limited by the group setting. For details, refer to *"Gradient Group Settings"* on page 11.

End Unit/EJ1C-EDU

■ Ratings

Power supply voltage	24 VDC
Operating voltage range	85% to 110% of rated voltage
Auxiliary output	Outputs	2
	Transistor outputs	Max. operating voltage: 30 VDC, Max. load current: 50 mA
Ambient temperature range	Operating: −10°C to 55°C Storage: −25°C to 65°C (with no icing or condensation)
Ambient humidity range	Operating: 25% to 85% (with no condensation)

■ Characteristics

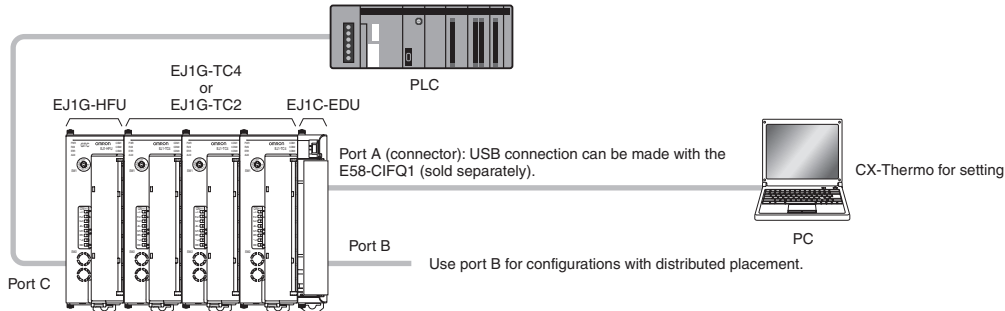|	
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	600 VAC, 50/60 Hz for 1 min between current-carrying terminals of different polarity
Vibration resistance	10 to 55 Hz, 20 m/s^2 for 2 hours each in X, Y, and Z directions
Shock resistance	150 m/s^2 max., 3 times each in 6 directions
Weight	70 g
Degree of protection	End Unit case: IP20, Terminal section: IP00
Standards	Approved standards	UL61010C-1, CSA C22.2 No.1010-1
	Conformed standards	EN61010-1 (IEC61010-1): Pollution level 2, overvoltage category II
EMC Directive	Same as for the Basic Unit. Refer to page 3.

■ Communications

Port A	Basic Unit Communications (Refer to *"Communications Specifications"* on page 4.)
Port A connector (See note.)	E58-CIFQ1

Note: Port A connector communications and port A terminal communications cannot be used at the same time.
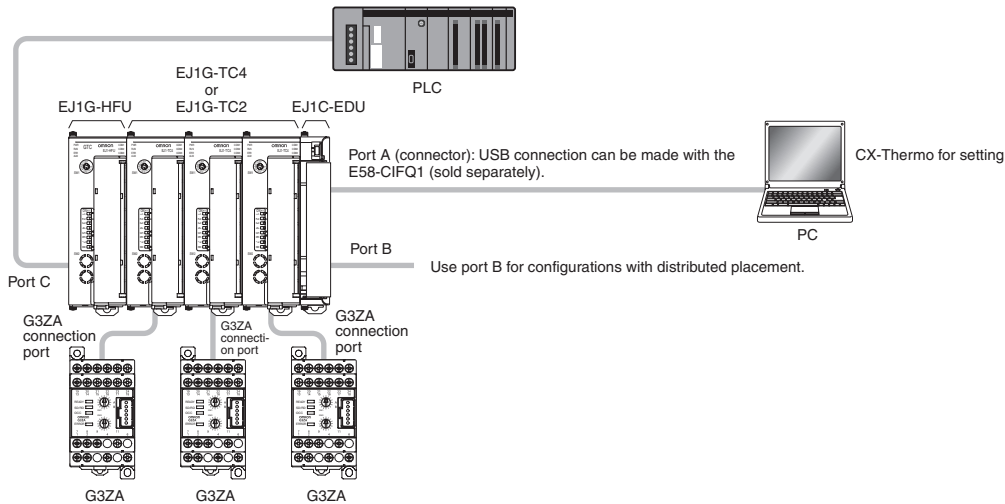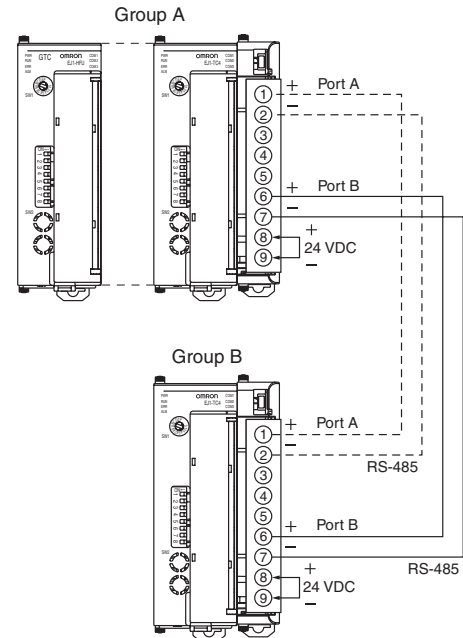
Unit Configuration Example

■ Basic Configuration for Gradient Temperature Control

• Systems can be built with host PLCs using programless communications.
• Distributed placement is possible by using multiple EJ1C-EDU End Units.

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

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

CX-Thermo for setting

PC

Port B

Use port B for configurations with distributed placement.

Port C

■ Basic Configuration for Connection to G3ZA Multi-channel Power Controllers

Up to 8 G3ZA Controllers can be connected to each Basic Unit.

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

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

CX-Thermo for setting

PC

Port B

Use port B for configurations with distributed placement.

Port C

G3ZA connection port   G3ZA connection port   G3ZA connection port

G3ZA   G3ZA   G3ZA

■ Connection Precautions

Node Number Setting

Nodes 0 to 31 can be used for HFUs and Basic Units.

Restrictions on the Number of Units that Can Be Connected

Restrictions for HFUs

• One EJ1G-HFU can manage up to 16 Basic Units (EJ1G-TC4/TC2).

• Up to 16 Units can be connected side by side including the EJ1G-HFU. The End Unit is not included in the 16 Units.

Note: When performing gradient temperature control, the number of control channels is limited by the group setting. For details, refer to *"Gradient Group Settings"* on page 11.

One HFU can manage up to 16 Basic Units
(when using the EJ1G-TC4: 4 channels x 16 Units = 64 channels)

To the host device

Port C

Port B

EJ1G-HFU

EJ1G-TC4
or
EJ1G-TC2

EJ1C-EDU

Up to 16 Units can be connected side by side.
Note: End Units are not included in the number
of Units that can be connected.

Port B

EJ1G-TC4 or
EJ1G-TC2   EJ1C-EDU
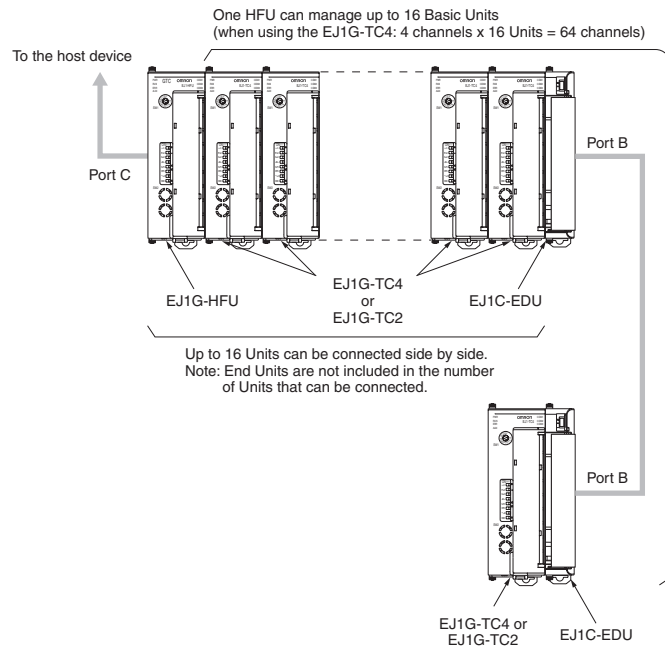
Restrictions When Connecting with the G3ZA

• Up to 8 G3ZA Multi-channel Power Controllers can be connected to one Basic Unit (EJ1G-TC4/TC2).

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

G3ZA connection port

G3ZA

Up to 8 G3ZA Power Controllers can be connected to one Basic Unit.
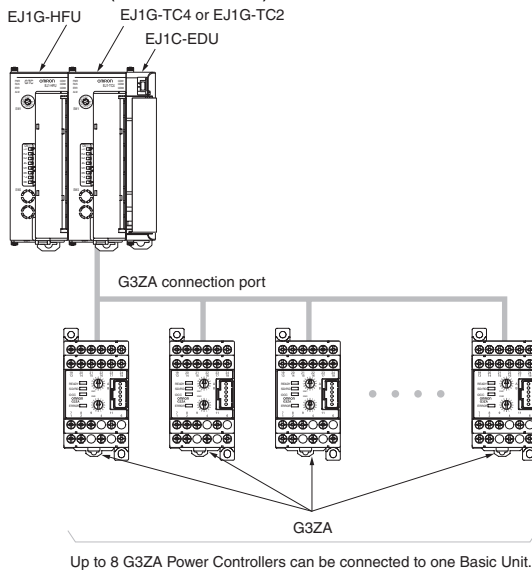
Wiring for Distributed Placement

Group A

Port A
① +
②
③
④
⑤ + Port B
⑥
⑦ −
⑧ +
⑨ 24 VDC

Group B

① + Port A
②
③   RS-485
④
⑤ + Port B
⑥
⑦ −
⑧ +   RS-485
⑨ 24 VDC

Note: Wire the dotted line when settings for all EJ1G are being made from one port A connector.
If the dotted lines are not wired, settings for group A must be made using the port A connector and settings for group B must be made using the port A connector.

Restrictions on Unit Placement

Always connect the HFU on the left side of the Basic Unit.

EJ1G-TC4 or   EJ1G-HFU
EJ1G-TC2
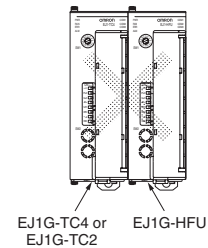
■ Insulation Blocks

Each EJ1G Unit is electrically insulated for each function block as shown in the following figures.
Functional insulation is applied between the power supply, input, output, and communications terminal sections.
If reinforced double insulation is required, use power supplies that comply with IEC60664 for reinforced double insulation for the EJ1G's external power supply and for power supplies connected to the EJ1G.

EJ1G-TC2
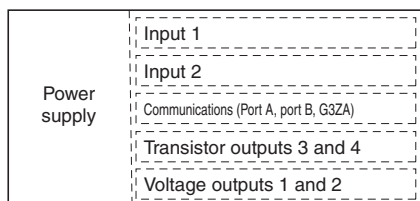
Power supply	Input 1
	Input 2
	Communications (Port A, port B, G3ZA)
	Transistor outputs 3 and 4
	Voltage outputs 1 and 2

☐ Functional isolation

EJ1G-TC4

Power supply	Input 1
	Input 2
	Input 3
	Input 4
	Voltage outputs 1 to 4
	Communications (Port A, Port B, G3ZA)

☐ Functional isolation

EJ1G-HFU

| Power supply | Transistor outputs 1 to 4 |
| | Communications (Port B, port C) |

☐ Functional isolation

EJ1C-EDU

| Power supply | Transistor outputs 1 to 2 |
| | Communications (Port A, port B) |
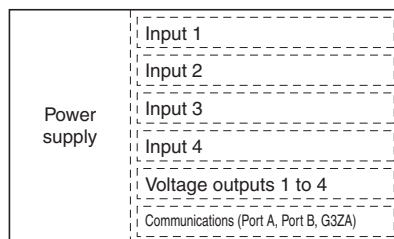
☐ Functional isolation

■ Programless Communications

Communications with PLCs from OMRON (SYSMAC CS/CJ Series) and Mitsubishi Electric (MELSEC-Q/QnAS Series) can be performed without creating ladder programming.
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 the PLC, which reduces work hours spent programming for communications from the PLC to the EJ1G.

Monitoring can be performed for the EJ1G and the settings can be changed by simply reading and writing to memory.

PLC

Monitor: PV / Manipulated variable / Status
Setting: SP / Alarm value 1 / Alarm value 2

The read monitor value is written to the PLC memory.

The EJ1G-HFU automatically performs communications with the PLC.

The EJ1G-HFU reads the value written to the PLC memory.

EJ1G-HFU

PV / Manipulated variable / Status / SP / Alarm value 1 / Alarm value 2

Connectable Devices

SYSMAC CS/CJ Series

Name	Model No.	Communications ports	
		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	**CJ1 Series**	---	RS-232C
	CS1 Series	---	RS-232C

Note: 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).

MELSEC-Q/QnAS Series

Name	Model No.	Communications ports	
		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: 1. Refer to the Mitsubishi Electric manual for the MELSEC.
2. Direct connections to the EJ1G are possible with RS-232C and RS-422.
3. Even when using RS-422, multiple Units cannot be connected to the PLC.
Tests have verified that the EJ1G can be connected to the Mitsubishi Electric models listed above, but design changes and other factors may still prevent connection. Confirm proper connect prior to building the system.

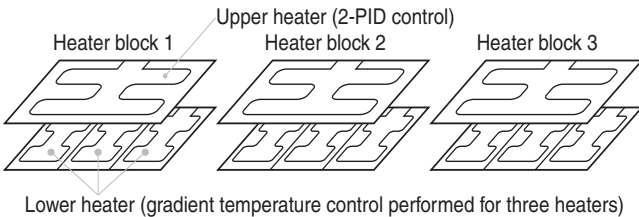# Gradient Temperature Control Settings

■ Gradient Group Settings

The gradient group settings are made on the HFU, as described below.

```
 0   1   2   3   4   5   6
HFU TC2 TC2 TC2 TC2 TC2 TC2 EDU
```

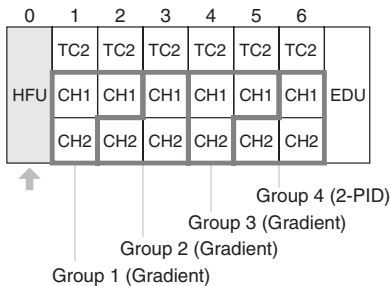HFU: Advanced Unit
TC2: 2-channel Basic Unit
EDU: End Unit
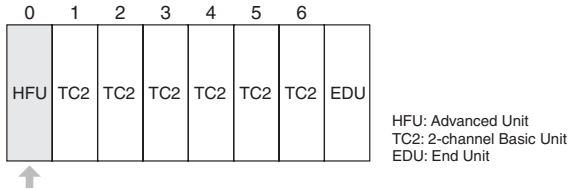
Example: In this example, 3-channel gradient temperature control is performed by heater blocks in three locations.

• Gradient temperature control is divided into three groups.
• One channel of 2-PID control is used for each heater block (making a total of three channels).
• All channels are set to detect heater burnouts.

Upper heater (2-PID control)
Heater block 1   Heater block 2   Heater block 3

Lower heater (gradient temperature control performed for three heaters)

For the group settings, 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 below.

Group Division into Gradient Temperature Control and 2-PID Control

```
  0    1    2    3    4    5    6
     TC2  TC2  TC2  TC2  TC2  TC2
HFU CH1  CH1  CH1  CH1  CH1  CH1  EDU
    CH2  CH2  CH2  CH2  CH2  CH2
```

Group 4 (2-PID)
Group 3 (Gradient)
Group 2 (Gradient)
Group 1 (Gradient)

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: 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.

The group settings for this example are as given here.

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.

Allocation of Channels Inside the HFU

```
  0    1     2     3     4     5     6
     TC2   TC2   TC2   TC2   TC2   TC2
HFU CH1   CH3   CH6   CH9   CH11  CH14  EDU
    CH2   CH5   CH7   CH10  CH13  CH15
```

Group 4 (2-PID)
Group 3 (Gradient)
Group 2 (Gradient)
Group 1 (Gradient)
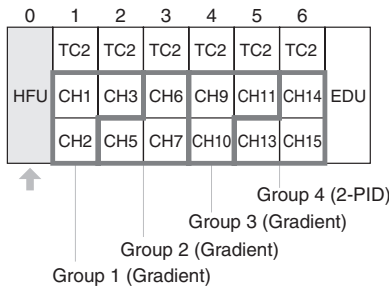
HFU channels	Groups
1	1
2	
3	
4	Not usable
5	2
6	
7	
8	Not usable
9	3
10	
11	
12	Not usable
13	4
14	
15	
16	Not usable

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.

The example used here results in the following group division and heater connection.
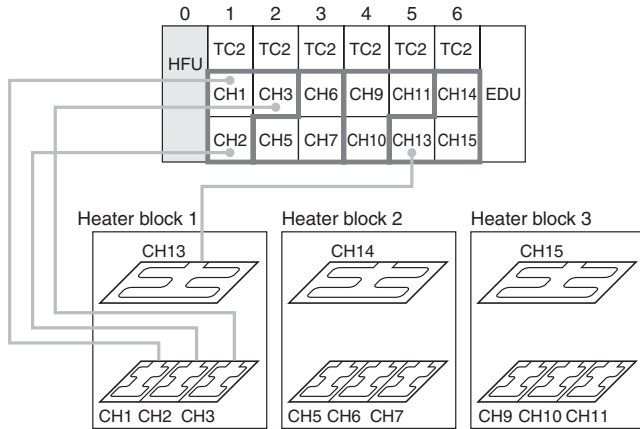
Note: The connections for heater blocks 2 and 3 are omitted above.

■ Gradient Temperature Control Operations

The HFU handles all of the operations for gradient temperature control.
The temperature input is received by the Basic Units (TC2 or TC4), calculated by the HFU, and then output from the Basic Units (TC2 or TC4) as manipulated variables.

General Flow of Gradient Operations
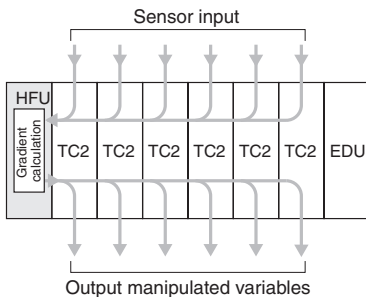
■ Arrangement of Gradient Temperature Control Sensors

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

Examples for linear arrangement of heaters
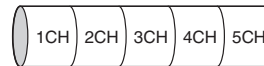
Good example

Bad example

Examples for planar arrangement of heaters
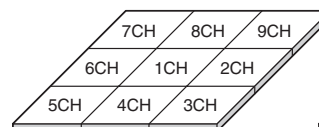
Good example

Bad example
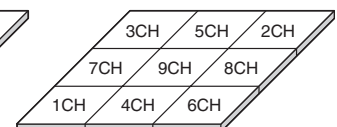
Connection

■ External Connection

- Functional insulation is applied between the power supply and the I/O sections. If reinforced insulation is required, connect the input and output terminals to devices without any exposed current-carrying parts or to devices with reinforced insulation suitable for the maximum operating voltage of the power supply and I/O sections.
- To comply with the standards for noise terminal voltage for class A in EN 61326, install a noise filter (Densei Lamda MXB-1206-33 or the equivalent) to the DC power line as close as possible to the Temperature Controller.
- Use a SELV power supply. An SELV circuit is one separated from the power supply with double insulation or reinforced insulation, that does exceed an output voltage of 30 V r.m.s. and 42.4 V peak or 60 VDC max. The OMROM S8VS Series is recommended for the power supply.

EJ1G-TC4
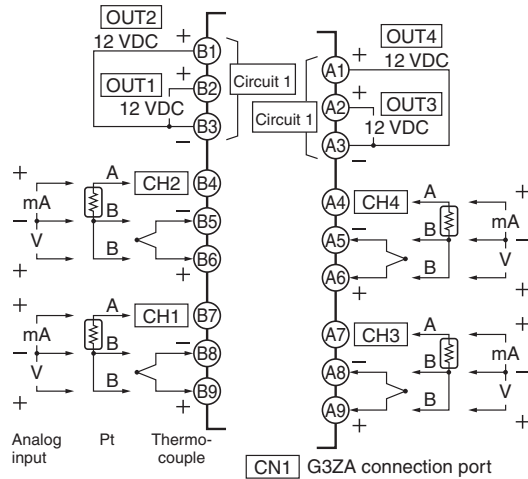
EJ1G-TC2
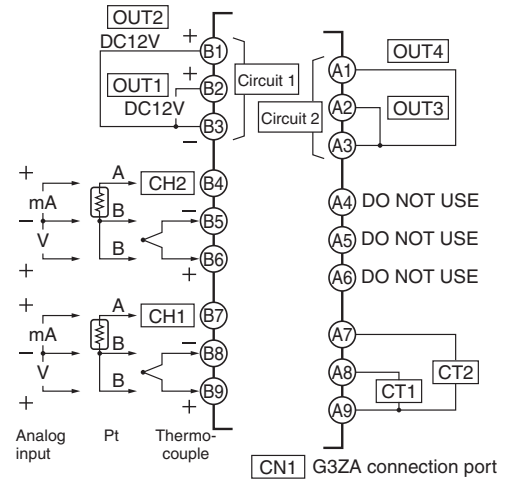
EJ1G-HFU
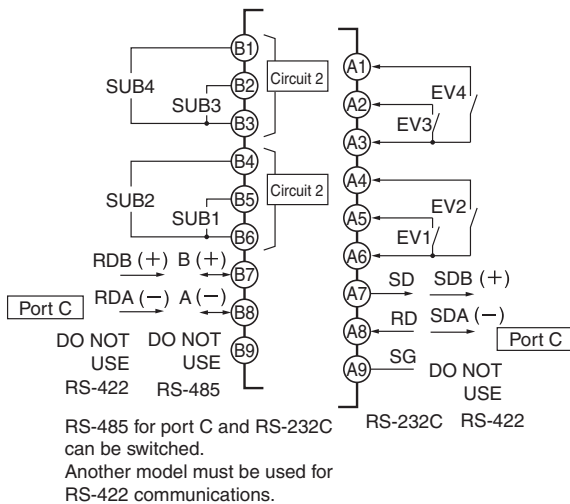
EJ1C-EDU
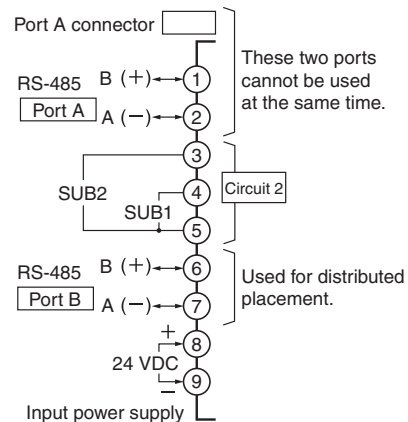
Note: 1. To connect to the G3ZA, connect a G3ZA Connecting Cable (EJ1C-CBLA050, sold separately) to the G3ZA connection port (CN1) on the EJ1.

2. To connect to a computer using the port A connector, use an E58-CIFQ1 USB-Serial Conversion Cable (sold separately). The Temperature Controller can be connected to a computer using USB.

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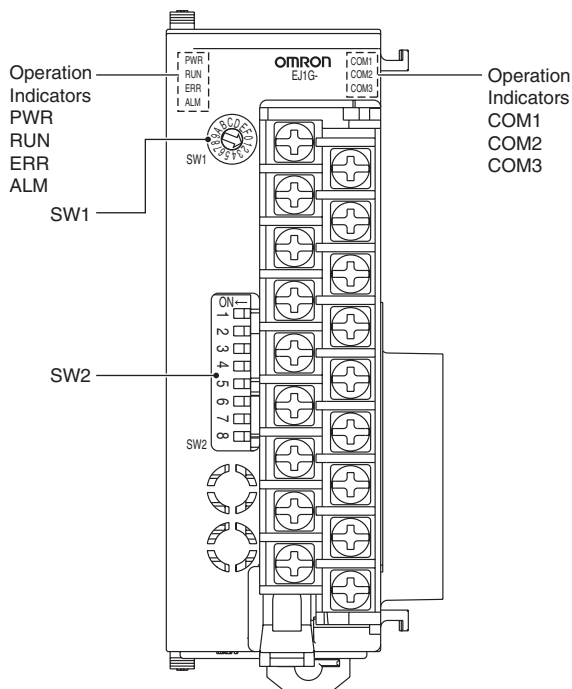
■ Internal Wiring

Circuit 1

| EJ1G
-TC4
B1/B2 | EJ1G-
TC2
B1/B2 | EJ1G-
TC4
A1/A2 |

Circuit 3

| EJ1G
-TC2
A4/A5 | EJ1G
-HFU
A1/A2 | EJ1G
-HFU
A4/A5 |

Circuit 2

| EJ1G
-TC2
A1/A2 | EJ1G
-HFU
B1/B2 | EJ1G
-HFU
B4/B5 | EJ1C
-EDU
3/4 |
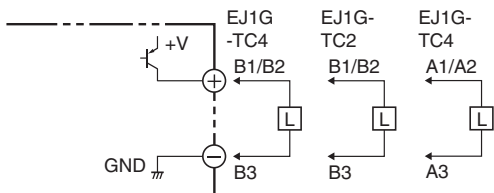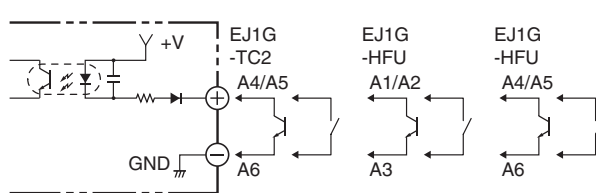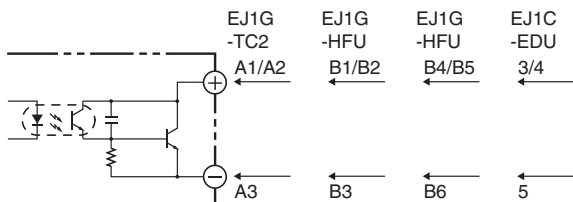
Nomenclature and Specification Settings

■ Nomenclature

Operation
Indicators
PWR
RUN
ERR
ALM

SW1

SW2

SW2

Operation
Indicators
COM1
COM2
COM3

Operation Indicators

EJ1G-TC2/TC4

Operation Indicators	Meaning
PWR (green)	Lights when the power is ON.
RUN	(There is no "RUN" indication printed on the Basic Unit.)
ERR (red)	Flashes or lights when an error occurs.
ALM (red)	Lights when an alarm is activated.
COM 1 (orange)	Flashes during communications via port A on the End Unit.
COM 2 (orange)	Flashes when the EJ1G is in operation.
COM 3 (orange)	Flashes during communications with the G3ZA.

EJ1G-HFU

Operation Indicators	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.
COM 1 (orange)	Flashes during communications via port A on the End Unit.
COM 2 (orange)	Flashes when the EJ1G system is in operation.
COM 3 (orange)	Flashes during communications via port C.

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

■ Specification Settings

Switch Operation

- Check that the EJ1G is turned OFF before operating the switches. Settings are read only when power is turned ON.
- Set the switches with a small flat-blade screwdriver. Do not set the switches midway between settings.
- SW1 is set to 1 and SW2 pins are all set to OFF in the default settings.

SW1 SW2
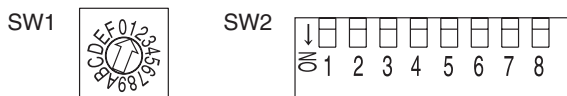
Setting the Unit Number

SW1 and SW2 are used together to set the unit number to between 00 and 31. The factory setting is unit number 01.

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

SW2 Settings

EJ1G-TC2/TC4

SW2	Meaning
2 to 6	Not used (OFF)
7	ON: G3ZA in operation
8	Use when Units are distributed. (Refer to the operation manual for details.)

EJ1G-HFU

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).

Dimensions

Note: All units are in millimeters unless otherwise indicated.

■ Temperature Controller

Basic Units
EJ1G-TC

HFUs
EJ1G-HFU

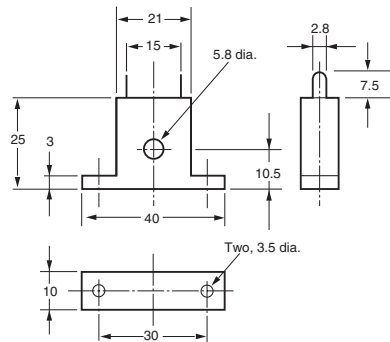(Screws Terminals)　(Screw-less Clamp Terminals)
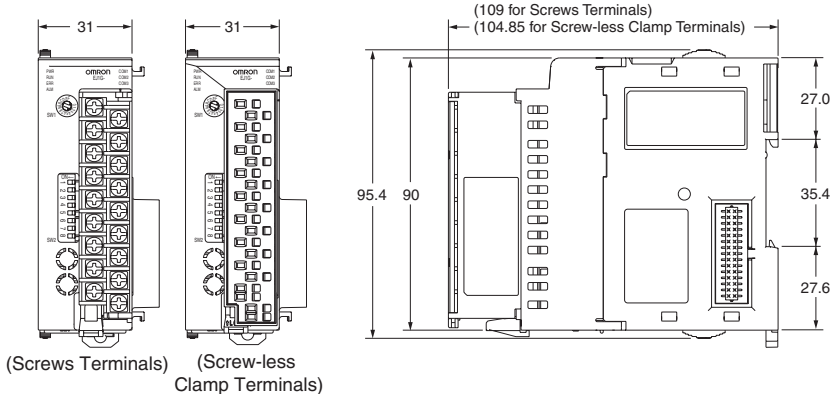
End Units
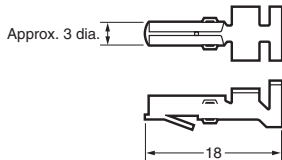**EJ1C-EDU**
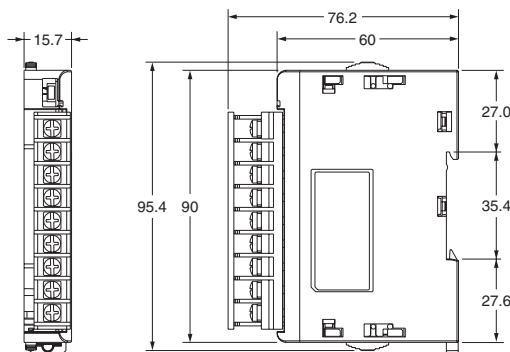
■ Options

Current Transformer (Sold Separately)

E54-CT1

Two, 3.5 dia.

E54-CT3

Two, M3 (depth: 4)
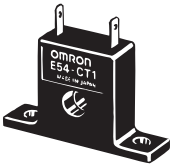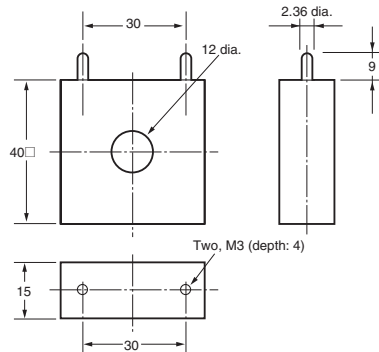
E54-CT3 Accessory
- **Armature**

Connection Example

Approx. 3 dia.

Plug

Armature

Lead

- **Plug**

Approx. 6 dia.

(22)

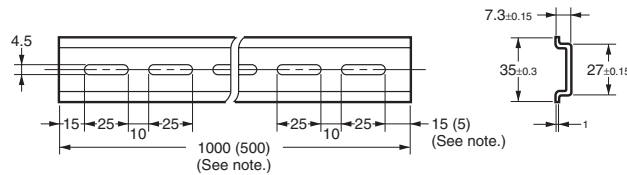## Rail Mounting Equipment (Order Separately)

DIN Rail
PFP-100N
PFP-50N

1000 (500)
(See note.)

15 (5)
(See note.)

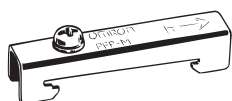**Note:** The figures in parentheses are dimensions for the PFP-50N.

End Plate

PFP-M
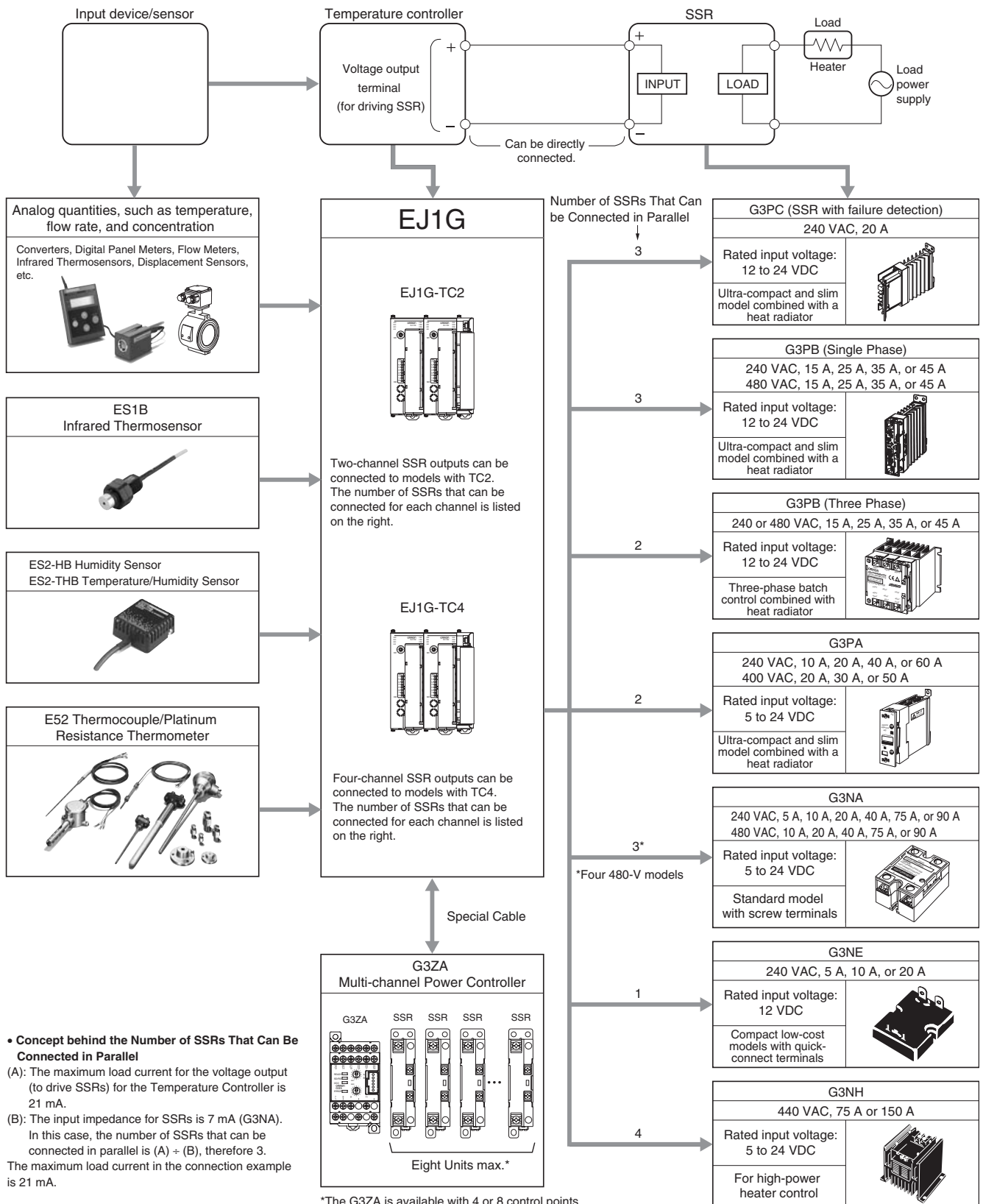
M4 × 8 panhead screw

M4 spring washer

Note: Two screws are included with the EJ1C-EDU for the End Plate. Always attach End Plates to both sides.

OMRON

I/O Devices

■ Examples of EJ1G-series Temperature Controllers Connected with Temperature Sensors and SSRs

Input device/sensor

Temperature controller

SSR

Load

Heater

Load power supply

Voltage output terminal (for driving SSR)

+

−

INPUT

LOAD

+

−

Can be directly connected.

Analog quantities, such as temperature, flow rate, and concentration

Converters, Digital Panel Meters, Flow Meters, Infrared Thermosensors, Displacement Sensors, etc.

ES1B
Infrared Thermosensor

ES2-HB Humidity Sensor
ES2-THB Temperature/Humidity Sensor

E52 Thermocouple/Platinum Resistance Thermometer

EJ1G

EJ1G-TC2

Two-channel SSR outputs can be connected to models with TC2. The number of SSRs that can be connected for each channel is listed on the right.

EJ1G-TC4

Four-channel SSR outputs can be connected to models with TC4. The number of SSRs that can be connected for each channel is listed on the right.

Number of SSRs That Can be Connected in Parallel

3

3

2

2

3*

*Four 480-V models

1

4

G3PC (SSR with failure detection)
240 VAC, 20 A
Rated input voltage: 12 to 24 VDC
Ultra-compact and slim model combined with a heat radiator

G3PB (Single Phase)
240 VAC, 15 A, 25 A, 35 A, or 45 A
480 VAC, 15 A, 25 A, 35 A, or 45 A
Rated input voltage: 12 to 24 VDC
Ultra-compact and slim model combined with a heat radiator

G3PB (Three Phase)
240 or 480 VAC, 15 A, 25 A, 35 A, or 45 A
Rated input voltage: 12 to 24 VDC
Three-phase batch control combined with heat radiator

G3PA
240 VAC, 10 A, 20 A, 40 A, or 60 A
400 VAC, 20 A, 30 A, or 50 A
Rated input voltage: 5 to 24 VDC
Ultra-compact and slim model combined with a heat radiator

G3NA
240 VAC, 5 A, 10 A, 20 A, 40 A, 75 A, or 90 A
480 VAC, 10 A, 20 A, 40 A, 75 A, or 90 A
Rated input voltage: 5 to 24 VDC
Standard model with screw terminals

G3NE
240 VAC, 5 A, 10 A, or 20 A
Rated input voltage: 12 VDC
Compact low-cost models with quick-connect terminals

G3NH
440 VAC, 75 A or 150 A
Rated input voltage: 5 to 24 VDC
For high-power heater control

Special Cable

G3ZA
Multi-channel Power Controller

G3ZA   SSR   SSR   SSR   SSR

Eight Units max.*

*The G3ZA is available with 4 or 8 control points.

- **Concept behind the Number of SSRs That Can Be Connected in Parallel**
(A): The maximum load current for the voltage output (to drive SSRs) for the Temperature Controller is 21 mA.
(B): The input impedance for SSRs is 7 mA (G3NA). In this case, the number of SSRs that can be connected in parallel is (A) ÷ (B), therefore 3.
The maximum load current in the connection example is 21 mA.

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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 EJ1G external power supply or the power supply connected to the EJ1G. 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

Observe the following points to ensure safe operation.

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 temperature and humidity ranges. Provide forced-cooling if required.

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. To connect bare wires to the terminal block, use copper braided or solid wires with 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). (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. Allow as much space as possible between the product and devices that generate a powerful high-frequency or surge. Separate the high-voltage or large-current power lines from other lines, and avoid parallel or common wiring with the power lines when you are wiring to the terminals.

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.

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 product during installation.

21. Do not use port B on the end product when using port C on HFUs.

22. Install the product only after reading the manual provided with the End Unit.

■ Precautions for Correct Use

Service Life

1. Use the product within the following temperature and humidity ranges:

   Temperature: −10°C to 55°C (with no condensation or icing)

   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 Temperature Controllers is determined not only by the number of times the relay is switched but also 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. A certain amount of time is required for the outputs to turn ON from the time the power supply is turned ON. Due consideration must be given to this time when incorporating Temperature Controllers in a sequence circuit.

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.

Installation

Connecting Units

1. Align the connectors and connect the Units to each other. Connect an End Unit to the Unit on the right end. (Up to 16 Units can be connected side by side.)
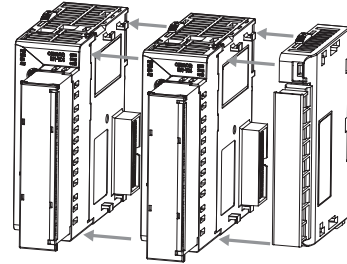
Note: 1. Do not connect an End Unit directly to an HFU.

   2. Always connect an End Unit to the right side of a Basic Unit.

2. Slide the yellow sliders on the top and bottom of the Units until they click into place.
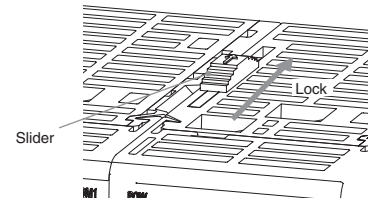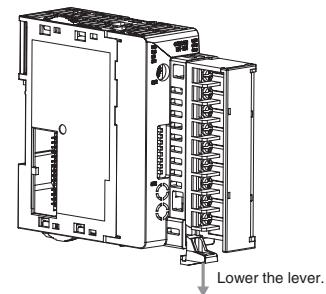

3. Attach the cover seal to the connector on the Unit on the left end of the EJ1G.
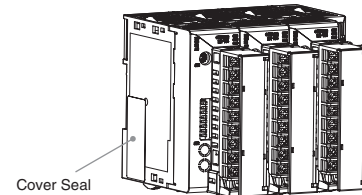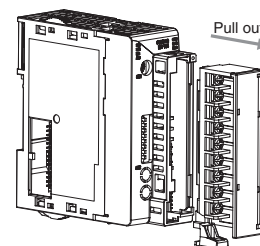

Removing the Terminal Block
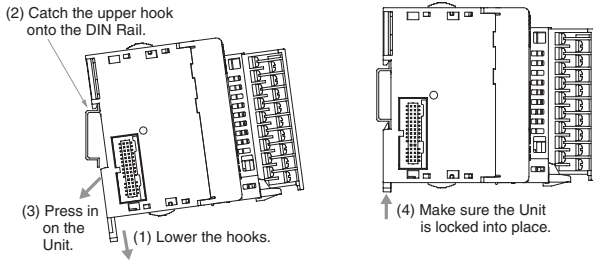
1. Press down the terminal block lever.

2. Pull out the terminal block.

Mounting to the DIN Rail

Mounting

Catch the hook located on the top of the Unit onto the DIN Rail and press the Unit until the Unit locks into place.
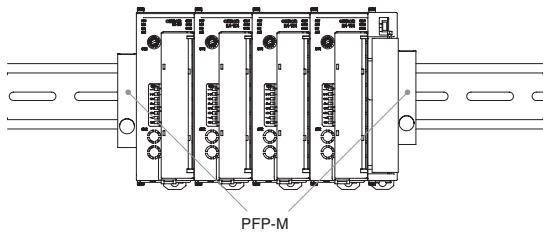
(2) Catch the upper hook onto the DIN Rail.

(3) Press in on the Unit.

(1) Lower the hooks.

(4) Make sure the Unit is locked into place.

Dismounting

Pull down on the hook with a flat-blade screwdriver and lift up on the Unit.

Flat-blade Screwdriver
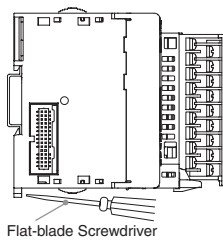
Mount one End Plate to each side of the EJ1C-EDU (PFP-M End Plates are included with the End Unit).

PFP-M

Install the DIN Rail vertically to the ground.

Correct

Incorrect

Vertically

Horizontally
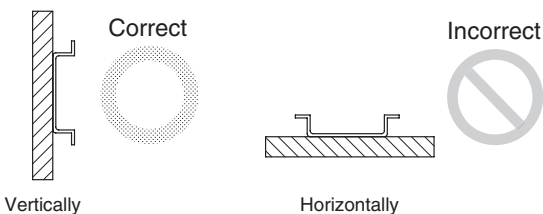
Applicable DIN Rail (sold separately): PFP-100N (100 cm), PFP-50N (50 cm)

## 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 hold 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.
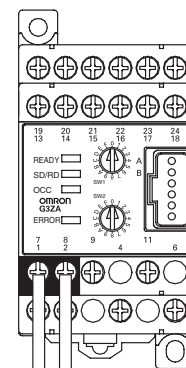We recommend the following crimp terminals:
Weidmuller H-sleeve series

B1 A1
B2 A2
B3 A3
B4 A4
B5 A5
B6 A6
B7 A7
B8 A8
B9
B10 A9
A10
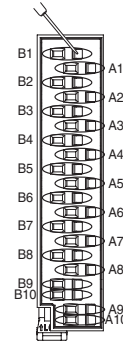
Connecting to the G3ZA (EJ1G-TC)

CN1

CN1

omron
G3ZA
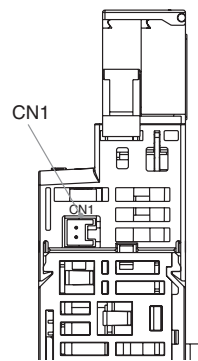
G3ZA

Connect the G3ZA Connecting Cable to the CN1 connector on the bottom of the TC Unit.

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: 5m)
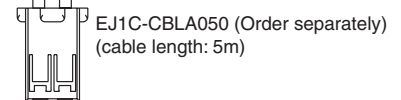
Refer to the *"G3ZA Instruction Manual"* for wiring methods.

Refer to the following manual for precautionary information and other information necessary to use the EJ1G:
EJ1G Modular Temperature Controller Operation Manual (Cat. No. H143)

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