

GENERAL CATALOGUE 2004/2005

Industrial Components



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- Programmable Relays
- Level Controllers
- Limit Switches
- Pushbutton Switches
- Low Voltage Switch Gear
- Temperature Controllers
- Solid State Relays
- Panel Indicators
- Power Supplies

Advanced Industrial Automation

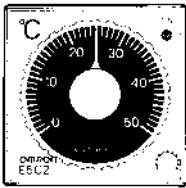

Cat. No. Y202-EN2-02 ICD

OMRON





Temperature Controllers

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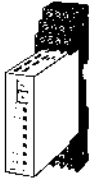

Temperature Controllers

Model type	Analog Temperature Controller	Digital Temperature Controller
Model	E5C2	E5GN/E5CN/E5EN/E5AN
Function	Basic	Standard type
Picture		
Size (BxH) mm	48x48	E5GN: 24x48, E5CN: 48x48, E5EN: 48x96, E5AN: 96x96
Control mode	ON/OFF	Yes
	PID	Only P action
	2-PID (see note)	–
	Position proportional	–
	Advanced	–
Auto-tuning function	–	Yes
Self-tuning function	–	Yes
Hysteresis in ON/OFF control action	0.5% FS fixed	0.1..999.9 EU (in units of 0.1 EU)
Indication accuracy	–	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.
Input	K, L, JPt100, and THE	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Non-contact temperature sensor: 10..70°C, 60..120°C, 115..165°C, 160..260°C Voltage input: 0..50 mV linear
Output	Relay or Voltage output	Relay, voltage, and linear current output (E5GN: Relay, voltage)
Communication	–	RS485 (E5GN -FLK) RS485 or Event IP (E5CN) RS232, RS485 or Event IP
Heater burnout (not used with current output)	–	Yes (E5AN, E5EN, E5CN)
Supply voltage	100/110/120, 200/220/240 VAC at 50/60 Hz	100..240 VAC or 24 VAC/DC
Terminal configuration	Plug-in model	Screw terminals
EMC	Conforms to EN50081-2, EN50082-2	Conforms to EN55011 Group 1 class A, EN55011 Group 1 class A, EN61000-4-2, ENV50140, ENV50141, EN61000-4-4
Approved standards	UL (File No. E68481), CSA (File No, LR59623), conforms to EN61010-1	UL3121-1, CSA22.2 No. 14, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.
Datasheet Cat. No.	H081	H107: E5AN/EN/CN/GN Datasheet
Manual Cat. No.		H100: E5CN User's Manual H101: E5GN User's Manual H111: E5EN User's Manual H112: E5AN User's Manual H102: E5AN/EN/CN/GN Communication Manual
Page No.	I-7	I-13

Note This page provides information on main specifications only. Be sure to read the information on detailed specifications and precautions before using the models listed here.
2-PID is Omron's advanced PID algorithm to achieve both good step- and disturbance response control


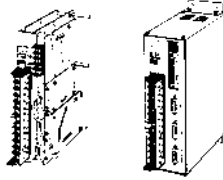
Digital Controller			
E5CK	E5AK/E5EK	E5CK-T	E5EK-T/E5AK-T
Universal type		Universal / Programmer type	
			
48x48	E5AK: 96x96, E5EK: 48x96	E5AK-T: 96x96, E5EK-T: 48x96	48x48
Yes	Yes	Yes	Yes
–	–	–	–
Yes	Yes	Yes	Yes
–	–	–	–
–	Yes	Yes	–
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
0.01%..99.99% FS (in units of 0.01%)	0.01%..99.99% FS (in units of 0.01%)	0.01%..99.99% FS (in units of 0.01%)	0.01%..99.99% FS (in units of 0.01%)
Thermocouple: (±0.3% of indicated value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indicated value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.	Thermocouple: (±0.3% of indicated value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indicated value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.	Thermocouple: (±0.3% of indicated value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indicated value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.	Thermocouple: (±0.3% of indicated value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indicated value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.
K, J, T, L, U, N, R, S, B, W, PLII, JPt100, or PT100 Linear current or voltage input	K, J, T, L, U, N, R, S, B, W, PLII, E JPt100 or PT100 Linear current or voltage input Pot.meter feedback / CT and remote setvalue mA	K, J, T, L, U, N, R, S, B, W, PLII, JPt100 or PT100 Linear current or voltage input Pot.meter feedback / CT	K, J, T, L, U, N, R, S, B, W, PLII, JPt100 or PT100 Linear current or voltage input
Relay, voltage, linear voltage, and linear current output	Relay, SSR, voltage, linear voltage and linear current output	Relay, SSR, voltage, linear voltage and linear current output	Relay, voltage, linear voltage and linear current output
RS232, RS485, Event IP or Transfer OP	RS232, RS485, RS422, Event IP and Transfer OP	RS232, RS485, RS422, Event IP and Transfer OP	RS232, RS485, Event IP and Transfer OP
Loop burnout alarm available	Yes	Yes	Loop burnout alarm available
100..240 VAC or 24 VAC/DC at 50/60 Hz	100..240 VAC or 24 VAC/DC at 50/60 Hz	100..240 VAC or 24 VAC/DC at 50/60 Hz	100..240 VAC or 24 VAC/DC at 50/60 Hz
Screw terminals	Screw terminals	Screw terminals	Screw terminals
Conforms to EN50081-2, EN50082-2	Conforms to EN50081-2, EN50082-2	Conforms to EN50081-2, EN50082-2	Conforms to EN50081-2, EN50082-2
UL (File No. E68481), CSA (File No. LR59623), conforms to EN61010-1	UL (File No. E68481), CSA (File No. LR59623), conforms to EN61010-1	UL (File No. E68481), CSA (File No. LR59623), conforms to EN61010-1	UL (File No. E68481), CSA (File No. LR59623), conforms to EN61010-1
H079: E5CK Digital Controller Cat.	H084: E5AK/EK Digital Controller DS	H087: E5□K-T Digital Controller DS	H087: E5□K-T Digital Controller DS
H078: E5CK User's Manual	H083: E5AK Users Manual H085: E5EK Users Manual H099: E5EK-DRT Manual (Devicenet version)	H088: E5AK User's Manual (Programmable Type) H089: E5EK User's Manual (Programmable Type)	H090: E5CK User's Manual (Programmable Type)
I-65	I-87	I-125	I-127

Temperature Controllers

Model type	Modular Temperature Controller	Digital Process Controller
Model	E5ZN	E5ER/E5AR
Function	In-panel type	Basic
Picture		
Size (BxH) mm	22,5x130	E5ER: 48x96, E5AR: 96x96
Control mode	ON/OFF	Yes
	PID	–
	2-PID (see note)	Yes
	Position proportional	–
	Advanced	–
Auto-tuning function	Yes	Yes
Self-tuning function	–	Yes
Hysteresis in ON/OFF control action	0.1..999.9 EU (in units of 0.1 EU)	0.01 to 99.99% FS (units of 0.01% FS)
Indication accuracy	Thermocouple: ($\pm 0.5\%$ of indicated value or $\pm 1^\circ\text{C}$, whichever greater) ± 1 digit max. Platinum resistance thermometer: ($\pm 0.5\%$ of indicated value or $\pm 1^\circ\text{C}$, whichever greater) ± 1 digit max. Analog input: $\pm 0.5\%$ FS ± 1 digit max.	Thermocouple input: (Larger of 0.1%PV and 1°C) 1 digit max. [Not using internal cold contact compensation] (Smaller of +0.1% FS and 1°C) 1 digit max. Analog input: (0.1% FS) 1 digit max. Platinum resistance temperature sensor input: (Larger of 0.1% PV and 0.5°C) 1 digit max. Position proportional potentiometer input: (5% FS) 1 digit max.
Input	Thermocouple: K, J, T, E, L, U, N, R, S, B Non contact temperature sensor: 10..70°C, 60..120°C, 115..165°C, 160..260°C (ES1A series) Voltage input: 0..50 mV linear Platinum resistance thermometer: Pt100, JPt100	Sensor input: Thermocouples: K, J, T, E, L, U, N, R, S, B, W Platinum resistance temperature input sensors: Pt100 Current input: 4 to 20 mA DC, 0 to 20 mA DC (including remote SP input) Voltage input: 1 to 5 V DC, 0 to 5 V DC, 0 to 10 V DC (including remote SP input) (Input impedance: 150 using current input, approx. 1 M using voltage input)
Output	Voltage, transistor or linear current output	Voltage output: 12 V DC, 40 mA max, with short-circuit protection circuit Current output: 0 to 20 mA DC/4 to 20 mA DC 500 load max. (including transfer output) (Resolution: Approx. 54000 at 0 to 20 mA DC, approx. 43000 at 4 to 20 mA DC) Relay output, Position proportional control type (open, close): 1a 250 V AC 1 A (including inrush current) (inductive load) Auxiliary output: Relay output 1a 250 V AC 1 A (resistive load) Transistor output: Maximum load voltage 30V DC, maximum load current 50 mA Residual voltage 1.5 V max., leakage current 0.4 mA max.
Communication	RS485 and Event IP Transfer OP on E5ZN-C.....types E5ZN-DRT DeviceNet type	RS485: Compoway/F, Modbus; DeviceNet; Profibus via Gateway
Heater burnout (not used with current output)	Yes	Yes
Supply voltage	24 VDC	100 to 240 V AC 50/60 Hz 24 V DC 50/60 Hz/24 V DC
Terminal configuration	Screw terminal (Terminal Unit sold separately)	Screw terminals
EMC	EN61326	EMI: EN61326, Radiated Interference Electromagnetic Field Strength: EN55011 Group 1 class A, Noise Terminal Voltage: EN55011 Group 1 class A, EMS: EN61326, Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2), 8 kV air discharge (level 3) Immunity Electromagnetic: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3), 10 V/m (pulse-modulated, 900 5 MHz) (level 3), Immunity Burst Noise: EN61000-4-4: 2 kV power line (level 3), 2 kV measurement line, I/O signal line (level 4), 1 kV communications line (level 3), Immunity Conducted Disturbance: EN61000-4-6: (0.15 to 80 MHz) (level 3), Immunity Surge: EN61000-4-5: 1 kV line to line (power line, output line (relay output)) (level 2), 2 kV line to ground (power line, output line (relay output)) (level 3), Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 100% (rated voltage)
Approved standards	UL, CSA	UL3121-1, CSA C22.2 No. 1010-1, EN61010-1 (IEC61010-1): Pollution degree 2/overvoltage category 2
Datasheet Cat. No.	H116 and H120 (for E5ZN-DRT)	H122
Manual Cat. No.	H113	N182: user Manual, H124: DeviceNet Communications Manual
Page No.	I-129	I-151

Note This page provides information on main specifications only. Be sure to read the information on detailed specifications and precautions before using the models listed here.

2-PID is Omron's advanced PID algorithm to achieve both good step- and disturbance response control

Digital Temperature Controller	Multipoint Temperature Controller
E5CS-X	E5ZE
Basic	In-panel type
	
48x48	65x253
Yes	Yes
Yes	Yes
–	–
–	Yes
–	–
–	Yes
–	–
0.2% FS fixed	0.0..99.9°C/°F for ON/OFF control only (in units of 0.1°C/°F)
+/-0.5% FS or +/-1°C (whichever greater)	Thermocouple: ±0.3% or ±2°C of indicated value (whichever is larger) ± 1 digit max. Platinum resistance thermometer: ±0.3% or ±0.8°C (whichever is larger) ± 1 digit max.
K, J, JPt100, Pt100	K, J, R, S, T, E, B, N, L, U, W/Re5-26, PT II, Pt100 or JPt100
Relay and Voltage	Linear voltage or current output
–	RS232, RS485, Devicenet
–	Yes
100..240VAC or 24VAC/DC	24 VDC
Screw terminals	Screw terminals
Conforms to EN50081-2, EN50082-2	Conforms to EN50081-2, EN50082-2
UL (File No. E68481), CSA (File No, LR59623), conforms to EN61010-1	–
H032	H075 + H103 for E5ZE devicenet version
–	H104: E5ZE Communications Manual, H076: E5ZE Operation Manual
This product is not shown in the catalogue. For more information please contact your local Omron sales office or download the data from www.eu.omron.com	

Temperature Controllers

Analogue Temperature Controller E5C2

DIN-sized (48 x 48 mm) Temperature Controller with Analog Setting

- Compact, low-cost Temperature Controller.
- Incorporates proportional control and reset adjustment function.
- Consecutive mounting possible using mounting adapter.
- Incorporates a plug-in socket, thus allows to DIN-track and flush mounting.



Model Number Structure

Model Number Legend

E5C2- □ □ □ □
1 2 3 4 5

1. Model name

2. Control output

R: Relay

Q: Voltage

3. Control method

20: ON-OFF control

40: P control

4. Input type

K: K-type thermocouple

L: J-type thermocouple

P: Platinum resistance thermometer (PT100)

G: Thermistor (THE)

5. Special type

Blank: Standard type

D, DIN: Special types

Ordering Information

Temperature Controllers

Setting method	Indication method	Control mode	Output	Model			
				Thermocouple		Platinum resistance thermometer Pt100	Thermistor THE
				K (CA) Chromel vs. alumel	L (IC) Iron vs. constantan		
Analog setting	No indication	ON/OFF	Relay	E5C2-R20K	E5C2-R20L-D	E5C2-R20P-D	E5C2-R20G
		P	Relay	E5C2-R40K	E5C2-R40L-D	E5C2-R40P-D	---

Note: When placing an order, specify the standard temperature range and supply voltage in addition to the model number.
(e.g., E5C2-R20K 0°C to 200°C 100/110 VAC)

Accessories (Order Separately)

Name	Model
Front Connecting Socket	P2CF-08
Back Connecting Socket (for flush mounting)	P3G-08
Front Connecting Socket with Finger Protection	P2CF-08-E
Protective Cover (for finger protection)	Y92A-48G

Temperature Controller

Specifications

■ Ratings

Supply voltage	100/110/120 VAC (common), 200/220/240 VAC (common) (See note.) 50/60 Hz (common)
Operating voltage range	90% to 110% of rated supply voltage
Power consumption	Approx. 2 VA
Input	Thermocouple (with sensor burnout detection circuit), platinum resistance thermometer, or thermistor
Control mode	ON/OFF or P control
Setting method	Analog setting
Indication method	No indication
Control output	Relay output: SPDT, 3 A at 250 VAC, resistive load (switching capacity: 330 VA)

Note: Specify either 100/110/120 VAC or 200/220/240 VAC when ordering.

■ Input Ranges

Input		Thermocouple		Platinum resistance thermometer	Thermistor (see note 2)
		K (CA) Chromel vs. alumel	L (IC) Iron vs. constantan	Pt100	THE
Range	°C	0 to 200 (5), 0 to 300 (10), 0 to 400 (10), 0 to 600 (20), 0 to 800 (20), 0 to 1,000 (25), 0 to 1,200 (25)	0 to 200 (5), 0 to 300 (10), 0 to 400 (10)	-50 to 50 (2), -20 to 80 (2), 0 to 50 (1), 0 to 100 (2), 0 to 200 (5), 0 to 300 (10), 0 to 400 (10)	-50 to 50 (2) (6 kΩ at 0°C), 0 to 100 (2) (6 kΩ at 0°C), 50 to 150 (2) (30 kΩ at 0°C)
	°F	32 to 392 (10), 32 to 572 (20), 32 to 752 (20), 32 to 1,112 (40), 32 to 1,472 (50), 32 to 1,832 (50), 32 to 2,192 (50)	32 to 392 (10), 32 to 572 (20), 32 to 752 (20)	32 to 212 (5), 32 to 392 (10)	---

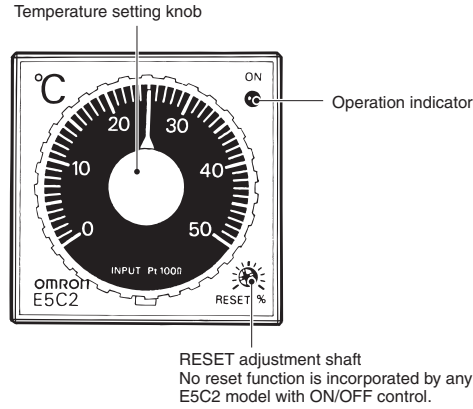
Note: 1. Values in () are the minimum unit.
2. Values in () are the thermistor resistive value.

■ Characteristics

Setting accuracy	±2% FS max.
Hysteresis	Approx. 0.5% FS (fixed)
Proportional band	3% FS (fixed)
Control period	Approx. 20 s
Reset range (see note 1)	5 ±1% FS min.
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between charged terminals and uncharged metallic parts
Vibration resistance	Malfunction: 10 to 55 Hz, 0.15-mm single amplitude for 10 min each in X, Y, and Z directions Destruction: 16.7 Hz, 2-mm double amplitude for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 147 m/s ² , 3 times each in 6 directions Destruction: 294 m/s ² , 3 times each in 6 directions
Life expectancy	Electrical: 100,000 operations min. (3 A at 110 VAC, resistive load)
Ambient temperature	Operating: -10°C to 55°C (with no icing or condensation)
Ambient humidity	Operating: 45% to 85%
Degree of protection	Front panel: IEC standard IP40 (see note 2) Terminals: IEC standard IP00
Weight	Approx. 200 g (with flush-mounting adapter)

Note: 1. No reset function is incorporated by any E5C2 model with ON/OFF control.
2. The model number of the special watertight cover conforming to IP66, NEMA4 is Y92A-48B.

Nomenclature

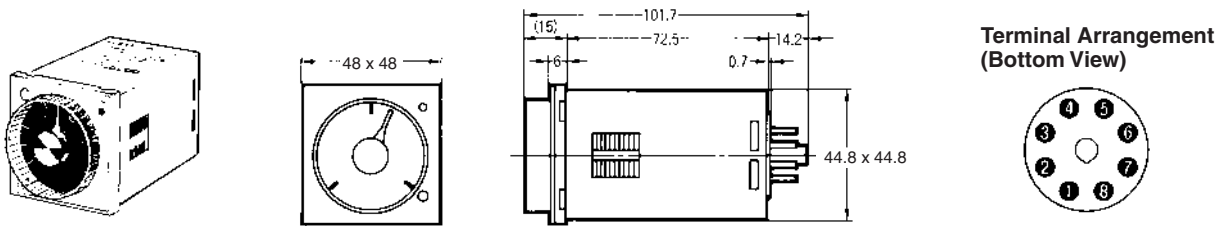


Operation Indicator

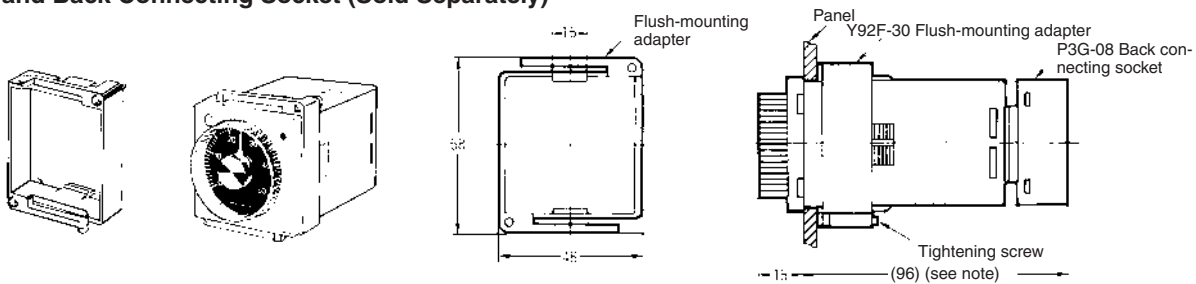
Indicator	Output
Red Lit	ON
Not lit	OFF

Dimensions

Note: All units are in millimeters unless otherwise indicated.

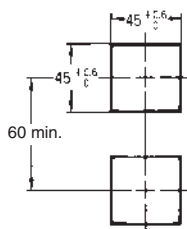


Dimensions with Flush-mounting Adapter (Accessory), and Back Connecting Socket (Sold Separately)

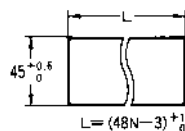


Note: 109 mm for US08 Back Connecting Socket

Panel Cutout



Side-by-side Mounting of N Controllers



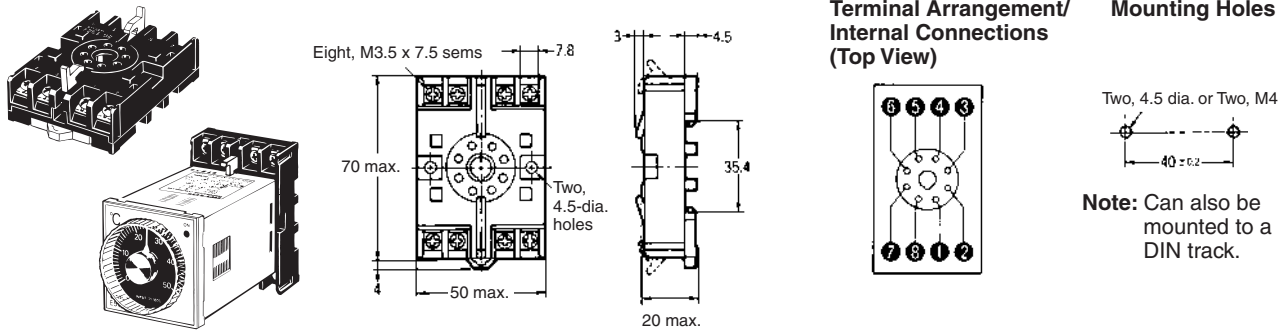
N	2	3	4	5	6
L	93 ± 1	141 ± 1	189 ± 1	237 ± 1	285 ± 1

Note: 1. Recommended panel thickness is 1 to 4 mm.
2. Close side-by-side mounting is possible (in a single direction).

Temperature Controller

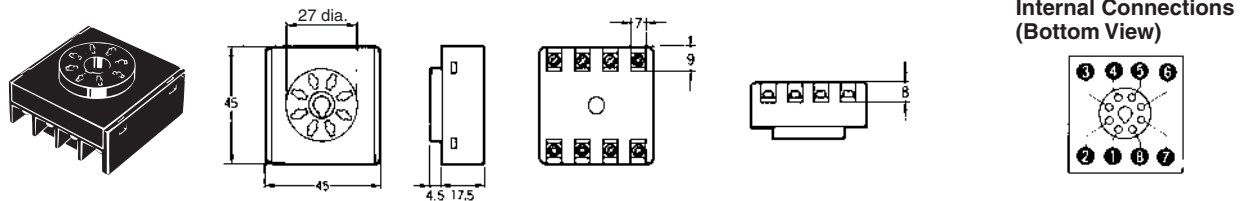
Accessories (Order Separately)

P2CF-08 Front Connecting Socket



Note: A finger-protection model (P2CF-08-E) is also available.

P3G-08 Back Connecting Socket (for Flush Mounting)



Note: A Protective Cover for finger protection (Y92A-48G) is also available.

Protective Cover Y92A-48

The protective cover protects the front panel, particularly the setting section, against dust, dirt, and water drip. It also prevents the set values from being altered due to accidental contact with the setting keys.

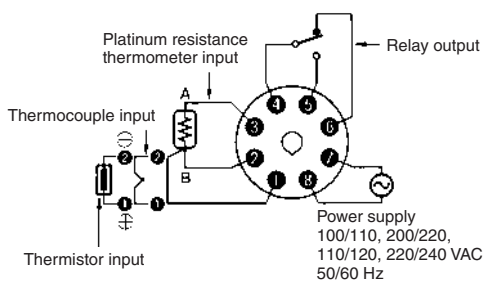
Appearance	
Model	Y92A-48B

Installation

Connections

Input

Connect a thermocouple, the E52-THE□ Thermistor or platinum resistance thermometer to the E5C2 as shown in the following illustration.



Output

If the load circuit is a heating control system, be sure to connect the load to terminals 4 and 5. If the load circuit is a cooling control system, be sure to connect the load to terminals 4 and 6. If the heating control system is connected to terminals 4 and 6 or the cooling control system is connected to terminals 4 and 5, the temperature of the heating control system or cooling control system will be abnormal and a serious accident may result.

If the E5C2 is in frequent operation, such as proportional operation, add an appropriate external relay to the E5C2 by considering the capacity of the load and the life of the relay.

Power Supply

If a single power supply is used for the E5C2 and the load, the supply voltage of the power supply may vary greatly when the load is open or closed if the capacity of the power supply is not large enough. Make sure that the capacity of the power supply is large enough so that the supply voltage range will be always from 90% to 110% of the rated supply voltage.

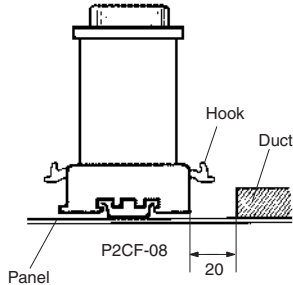
The E5C2 operates at either 50 or 60 Hz.

Precautions

Mounting

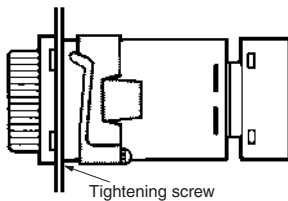
Track Mounting (E5C2 with P2CF-08)

When mounting two or more E5C2 models with track-mounting sockets, leave a space of approximately 20 mm on both sides of the sockets where hooks are located.

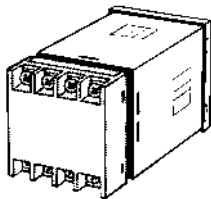


Flush Mounting

Insert E5C2 into the square hole of the panel and insert an adapter from the back so that there will be no space between E5C2 and the panel. Then, secure the E5C2 with a screw.

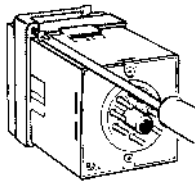


The P3G-08 can be wired in the same way as the P2CF-08.



Dismounting

If flush mounted, loosen the screw of the adapter and disengage the hooks for dismounting.



Temperature Setting

Do not turn the temperature setting knob of the E5C2 with excessive force, otherwise the stopper of the knob may break.

Others

Do not remove the housing of the E5C2, otherwise the housing may break.

To clean the surface of the E5C2, use a soft cloth wet with neutral detergent or alcohol. Do not use any organic solvent, such as paint thinner or benzene, strong acid or strong alkali to clean the surface of the E5C2, otherwise the surface of the E5C2 will become damaged.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H081-E1-02

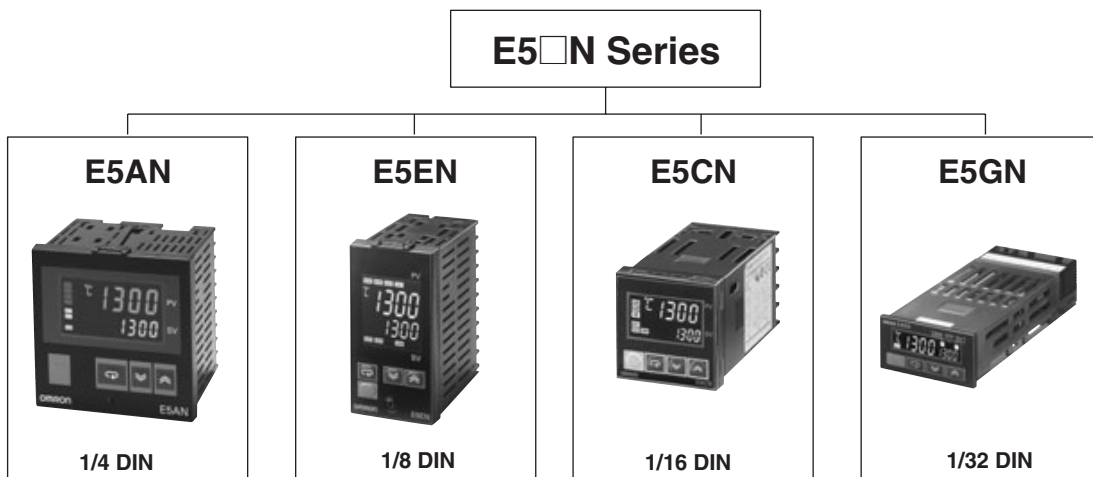
In the interest of product improvement, specifications are subject to change without notice.

Digital Temperature Controllers

E5□N

Compact and Intelligent General-purpose Temperature Controllers

- Various temperature inputs: thermocouple, platinum resistance thermometer, infrared temperature sensor, and analog inputs.
- Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.
- Heating or heating/cooling control is available.
- Event input allows multiple SP selection and run/stop function.
- Water-resistant construction (NEMA4X: equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.



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Temperature Controller

■ E5AN/E5EN/E5CN/E5GN Selection Guide

Item		E5AN	E5EN	E5CN	E5GN
Dimensions (W x H x D (mm))		96 x 96 x 78	48 x 96 x 78	48 x 48 x 78	48 x 24 x 100
Indication accuracy		±0.5% PV±1 digit max.			
Control method		2-PID or ON/OFF			
Alarm	None	No	No	Yes	Yes
	1 point	No	No	No	Yes
	2 points	No	No	Yes	No
	3 points	Yes	Yes	No	No
Input	Thermocouple input Analog input by non-contact temperature sensor	Yes	Yes	Yes	Yes
	Platinum resistance tempera- ture sensor	Yes	Yes	Yes	Yes
Output	Relay output	Yes	Yes	Yes	Yes
	Voltage output	Yes	Yes	Yes	Yes
	Current output	Yes	Yes	Yes	No
RS-232C communication function		Yes	Yes	No	No
RS-485 communication function		Yes	Yes	Yes	Yes
Event input		Yes	Yes	Yes	No
Heater burnout alarm		Yes	Yes	Yes	No
Heating/Cooling control		Yes	Yes	Yes	Yes
Run/Stop		Yes	Yes	Yes	Yes
Multiple SP selection		Yes	Yes	Yes	Yes

■ E5CN Option Units

The E5CN provides communication or event input functionality when mounted with one of the following Option Units.

Name	Function	Model
Communications Unit	RS-485 communication and heater burnout alarm	E53-CNH03 (For relay and voltage output)
	RS-485 communication	E53-CN03 (For current output)
Event Input Unit	Event input and heater burnout alarm	E53-CNHB (For relay and voltage output)
	Event input	E53-CNB (For current output)

Note: The heater burnout alarm is available by mounting the E53-CNH03 or E53-CNHB Option Unit on E5CN.

■ E5AN/E5EN Option Units

The E5AN/E5EN provides communication or event input functionality when mounted with one of the following Option Units.

Name	Function	Model
Communications Unit	RS-232C communication	E53-AK01
	RS-485 communication	E53-AK03
Event Input Unit	Event input	E53-AKB

Digital Temperature Controllers E5GN

Compact and Intelligent Temperature Controllers

1/32 DIN with Communications Function

- Various temperature inputs: Thermocouple, platinum resistance thermometer, infrared temperature sensor, and analog inputs.
- Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.
- Heating or heating/cooling control is available.
- Water-resistant construction (NEMA4X: equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.



48(W) x 24(H) x 100(D) mm



Model Number Structure

Model Number Legend

E5GN- -FLK

1 2 3 4 5

1. Output type

- R: Relay
- Q: Voltage (for driving SSR)

2. Number of alarms

- Blank: No alarm
- 1: One alarm

3. Communications

- Blank: No communications function
- 03: RS-485

4. Input type

- TC: Thermocouple
- P: Platinum resistance thermometer

5. CompoWay/F serial communications

- FLK: CompoWay/F serial communications

Ordering Information

Standard Models

Size	Power supply voltage	No. of alarm points	Control output	Thermocouple model	Platinum resistance thermometer model	
1/32 DIN 48(W) x 24(H) x 100(D) mm	100 to 240 VAC	---	Relay	E5GN-RTC	E5GN-RP	
			Voltage (for driving SSR)	E5GN-QTC	E5GN-QP	
		1 (see note 1)	Relay	E5GN-R1TC	E5GN-R1P	
	24 VAC/VDC	---	1 (see note 1)	Voltage (for driving SSR)	E5GN-Q1TC	E5GN-Q1P
				Relay	E5GN-RTC	E5GN-RP
		1 (see note 1)	---	1 (see note 1)	Voltage (for driving SSR)	E5GN-QTC
Relay	E5GN-R1TC				E5GN-R1P	
			Voltage (for driving SSR)	E5GN-Q1TC	E5GN-Q1P	

Note 1. If the heating/cooling function is used, ALM1 will be used for control output and so alarm output will not be available.

2. Control output 2 for heating/cooling control is relay output.

3. Specify the power supply specifications when ordering.

Temperature Controller

■ Communication Models

Size	Power supply voltage	Communication function	Control output	Thermocouple model	Platinum resistance thermometer model
1/32 DIN 48(W) x 24(H) x 100(D) mm	100 to 240 VAC	RS-485	Relay	E5GN-R03TC-FLK	E5GN-R03P-FLK
			Voltage (for driving SSR)	E5GN-Q03TC-FLK	E5GN-Q03P-FLK
	24 VAC/VDC		Relay	E5GN-R03TC-FLK	E5GN-R03P-FLK
			Voltage (for driving SSR)	E5GN-Q03TC-FLK	E5GN-Q03P-FLK

Note: Specify the power supply specifications when ordering.

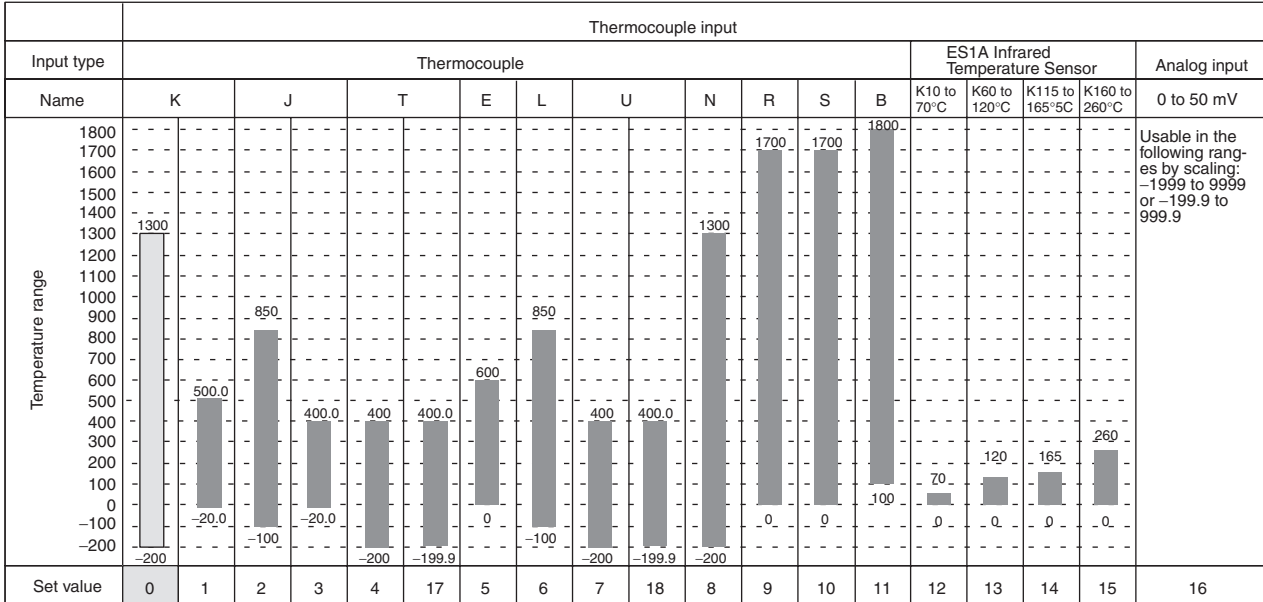
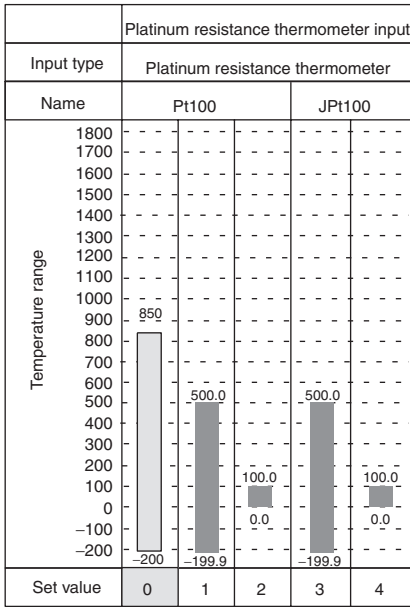
Specifications

■ Ratings

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
Operating voltage range	85% to 110% of rated supply voltage	
Power consumption	7 VA	4 VA/2.5 W
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C Voltage input: 0 to 50 mV	
Control output	Relay output	SPST-NO, 250 VAC, 2 A (resistive load), electrical life: 100,000 operations
	Voltage output	12 VDC (PNP), max. load current: 21 mA, with short-circuit protection circuit
Alarm output	SPST-NO, 250 VAC, 1 A (resistive load), electrical life: 100,000 operations	
Control method	2-PID or ON/OFF control	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and single-lighting indicator Character height: PV: 7.0 mm; SV: 3.5 mm	
Other functions	According to controller model	
Ambient temperature	-10 to 55°C (with no condensation or icing)	
Ambient humidity	25% to 85%	
Storage temperature	-25 to 65°C (with no condensation or icing)	

Input Ranges

Platinum Resistance Thermometer Input/Thermocouple Input



Applicable standards by input type are as follows:

- K, J, T, E, N, R, S, B: JIS C1602-1995
- L: Fe-CuNi, DIN 43710-1985
- U: Cu-CuNi, DIN 43710-1985
- JPt100: JIS C1604-1989, JIS C1606-1989
- Pt100: JIS C1604-1997, IEC751

Shaded ranges indicate default settings.

ES1A models with a temperature range of 160°C to 260°C have been discontinued.

■ Characteristics

Indication accuracy	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.	
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU)	
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU)	
Integral time (I)	0 to 3999 s (in units of 1 s)	
Derivative time (D)	0 to 3999 s (in units of 1 s)	
Control period	1 to 99 s (in units of 1 s)	
Manual reset value	0.0% to 100.0% (in units of 0.1%)	
Alarm setting range	-1999 to 9999 (decimal point position depends on input type)	
Sampling period	500 ms	
Insulation resistance	20 MΩ min. (at 500 VDC megger)	
Dielectric strength	2000 VAC, 50 or 60 Hz for 1 min (between different charging terminals)	
Vibration resistance	10 to 55 Hz, 10 m/s ² for 2 hours each in X, Y and Z directions	
Shock resistance	300 m/s ² , 3 times each in 3 axes, 6 directions (relay: 100 m/s ²)	
Weight	Approx. 90 g	Mounting bracket: approx. 10 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00	
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)	
EMC	Emission Enclosure:	EN55011 Group 1 class A
	Emission AC Mains:	EN55011 Group 1 class A
	Immunity ESD:	EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3)
	Immunity RF-interference:	ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz)
	Immunity Conducted Disturbance:	ENV50141: 10 V (0.15 to 80 MHz) (level 3)
	Immunity Burst:	EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards	UL3121-1, CSA22.2 No. 142, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.	

Note: The indication of K thermocouples in the -200 to 1300°C range, and 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 maximum.

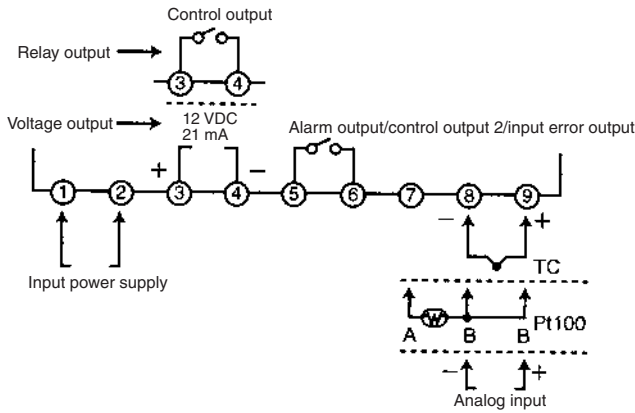
■ Communications Specifications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (see note)	7 or 8 bits
Stop bit length (see note)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSWAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (see note)	RS-485
Retry function	Not available
Communications buffer	40 bytes

Note: The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

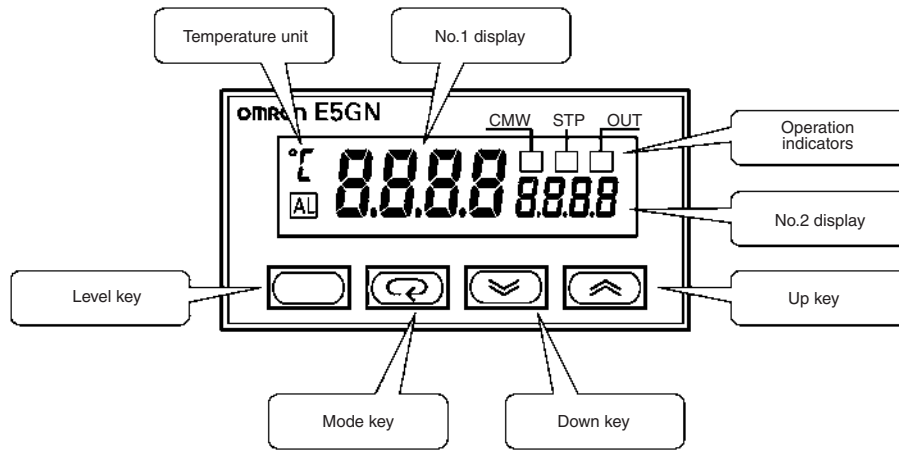
Wiring Terminals

- The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.
- Standard insulation is applied to the power supply I/O sections. 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.



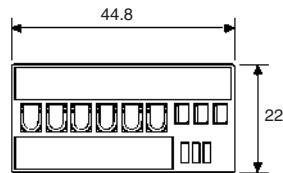
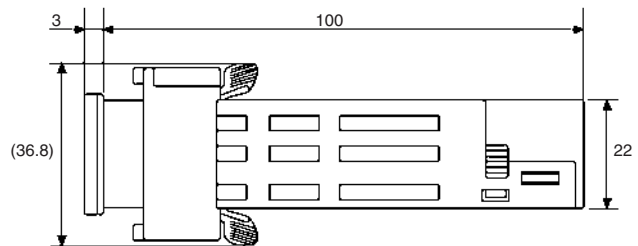
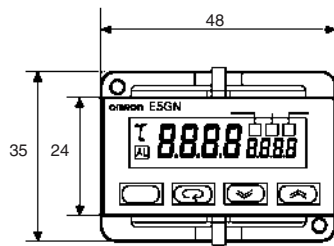
Two input power supplies are available: 100 to 240 VAC or 24 VAC/VDC (no polarity). Recommended power supply for 24VDC; eg. OMRON S8VS.

Nomenclature



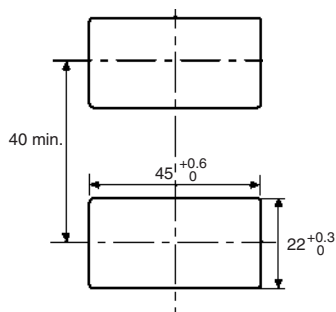
Dimensions

Note: All units are in millimeters unless otherwise indicated.

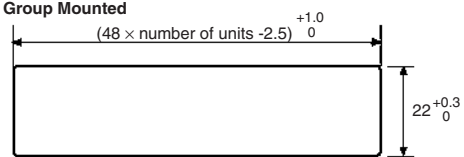


*When carrying out maintenance on the E5GN, only the terminal plate can be drawn out with the terminal leads still attached.

Panel Cutout Mounted Separately



Group Mounted



Mounting separately does not allow waterproofing.

- Insert the Controller through the hole in the panel from the front and push the adapter on from the rear. Push the adapter up to the back of the panel ensuring that the controller is pushed all the way in, removing any gap between the Controller, panel, and adapter. Finally, use the two screws on the adapter to secure the unit in place.
- To mount the E5GN so that it is waterproof, insert the waterproof packing onto the E5GN.
- When two or more E5GN Controllers are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature given in the specifications.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Digital Temperature Controllers E5CN

Compact and Intelligent Temperature Controllers

- Various temperature inputs: thermocouple, platinum resistance thermometer, infrared temperature sensor, and analog inputs.
- Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.
- Heating or heating/cooling control is available.
- Event input allows multiple SP selection and run/stop function.
- The PV display color can be changed according to the application (red or green).
- Water-resistant construction (NEMA4X: equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.



48(W) x 48(H) x 78(D) mm



Model Number Structure

Model Number Legend

E5CN- M -500
 1 2 3 4

1. Output type

- R: Relay
- Q: Voltage (for driving SSR)
- C: Current

2. Number of alarms

- Blank: No alarm
- 2: Two alarms

3. Option Unit

- M: Option Unit can be mounted

4. Input type

- TC: Thermocouple
- P: Platinum resistance thermometer

Note: An Option Unit is required to use heater burnout alarm.

Ordering Information

Standard Models

Size	Power supply voltage	No. of alarm points	Control output	Thermocouple model	Platinum resistance thermometer model
1/16 DIN 48(W) x 48(H) x 78(D) mm	100 to 240 VAC	---	Relay	E5CN-RMTC-500	E5CN-RMP-500
			Voltage (for driving SSR)	E5CN-QMTC-500	E5CN-QMP-500
			Current	E5CN-CMTC-500	E5CN-CMP-500
		2	Relay	E5CN-R2MTC-500	E5CN-R2MP-500
			Voltage (for driving SSR)	E5CN-Q2MTC-500	E5CN-Q2MP-500
			Current	E5CN-C2MTC-500	E5CN-C2MP-500
	24 VAC/VDC	---	Relay	E5CN-RMTC-500	E5CN-RMP-500
			Voltage (for driving SSR)	E5CN-QMTC-500	E5CN-QMP-500
			Current	E5CN-CMTC-500	E5CN-CMP-500
		2	Relay	E5CN-R2MTC-500	E5CN-R2MP-500
			Voltage (for driving SSR)	E5CN-Q2MTC-500	E5CN-Q2MP-500
			Current	E5CN-C2MTC-500	E5CN-C2MP-500

Note 1. A Current Transformer (CT) is not provided with the Unit. Be sure to order one when ordering the E5CN.

2. The heating and cooling function is available for models with two alarm points.

3. Specify the power supply specifications when ordering.

Temperature Controller

■ Option Units

The E5CN provides communications or event input functionality when mounted with one of the following Option Units.

Name	Model	Function
Communications Unit	E53-CNH03 (For relay and voltage output)	RS-485 communication and heater burnout alarm
	E53-CN03 (For current output)	RS-485 communication
Event Input Unit	E53-CNHB (For relay and voltage output)	Event input and heater burnout alarm
	E53-CNB (For current output)	Event input

Note: The heater burnout alarm is available by mounting the E53-CNH03 or E53-CNHB Option Unit on the E5CN.

■ Current Transformer (Sold Separately)

Model	E54-CT1	E54-CT3
Hole diameter	5.8 dia.	12.0 dia.

■ Terminal Cover

Model	E53-COV10
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Note: The Terminal Cover comes with the E5CN and does not have to be purchased separately.

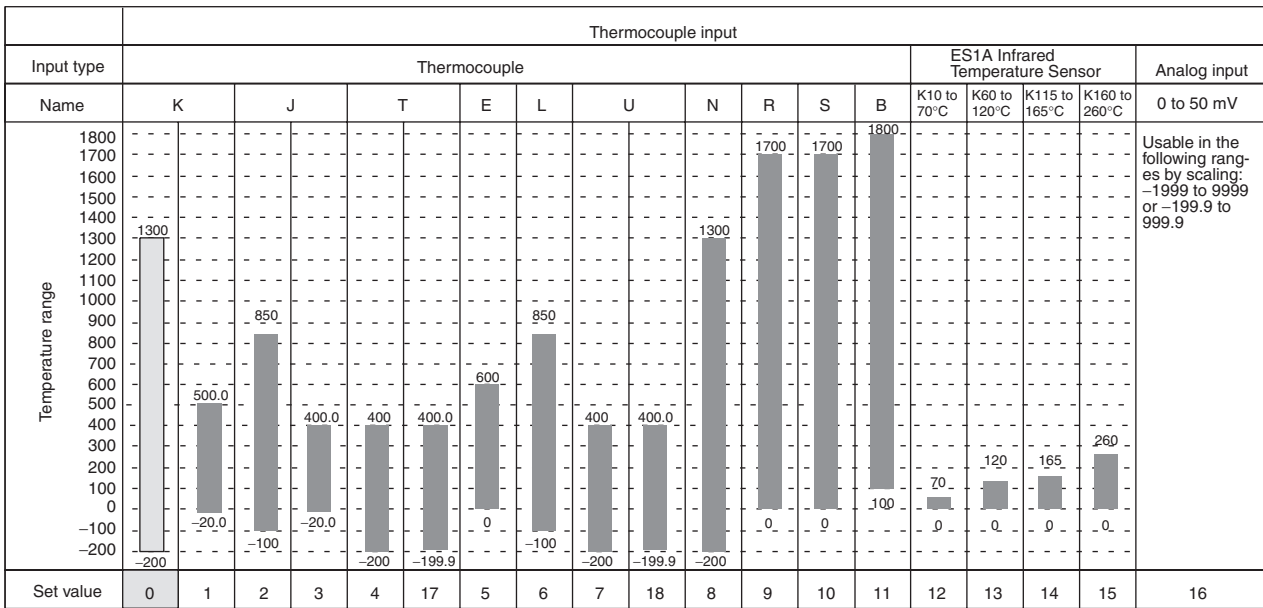
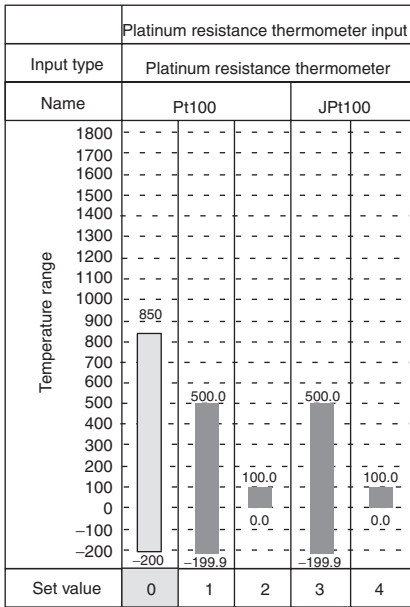
Specifications

■ Ratings

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
Operating voltage range	85% to 110% of rated supply voltage	
Power consumption	7 VA	4 VA/3 W
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C Voltage input: 0 to 50 mV	
Control output	Relay output	SPST-NO, 250 VAC, 3 A (resistive load), electrical life: 100,000 operations
	Voltage output	12 VDC (PNP), max. load current: 21 mA, with short-circuit protection circuit
	Current output	4 to 20 mA DC, load: 600 Ω max., resolution: approx. 2,600
Alarm output	SPST-NO, 250 VAC, 1 A (resistive load), electrical life: 100,000 operations	
Control method	2-PID or ON/OFF control	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and single-lighting indicator Character height: PV: 9.9 mm; SV: 6.4 mm	
Other functions	According to Controller model	
Ambient temperature	-10 to 55°C (with no condensation or icing)	
Ambient humidity	25% to 85%	
Storage temperature	-25 to 65°C (with no condensation or icing)	

Input Ranges

Platinum Resistance Thermometer Input/Thermocouple Input



Applicable standards by input type are as follows:

- K, J, T, E, N, R, S, B: JIS C1602-1995
- L: Fe-CuNi, DIN 43710-1985
- U: Cu-CuNi, DIN 43710-1985
- JPt100: JIS C1604-1989, JIS C1606-1989
- Pt100: JIS C1604-1997, IEC751

Shaded ranges indicate default settings.

ES1A models with a temperature range of 160°C to 260°C have been discontinued.

■ Characteristics

Indication accuracy	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU)
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU)
Integral time (I)	0 to 3999 s (in units of 1 s)
Derivative time (D)	0 to 3999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0% to 100.0% (in units of 0.1%)
Alarm setting range	–1999 to 9999 (decimal point position depends on input type)
Sampling period	500 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2000 VAC, 50 or 60 Hz for 1min (between different charging terminals)
Vibration resistance	10 to 55 Hz, 10 m/s ² for 2 hours each in X, Y and Z directions
Shock resistance	300 m/s ² , 3 times each in 3 axes, 6 directions (relay: 100 m/s ²)
Weight	Approx. 150 g Mounting bracket: Approx. 10 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)
EMC	Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards	UL3121-1, CSA22.2 No. 142, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.

Note: The indication of K thermocouples in the –200 to 1300°C range, and 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 maximum.

■ Communications Specifications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (see note)	7 or 8 bits
Stop bit length (see note)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSWAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (see note)	RS-485
Retry function	Not available
Communications buffer	40 bytes

Note: The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

■ Current Transformer (Sold Separately) Ratings

Dielectric strength	1,000 VAC (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)	Armature (2) Plug (2)

■ Heater Burnout Alarm Specifications

Max. heater current	Single-phase AC: 50 A (see note 1)
Input current readout accuracy	±5%FS±1 digit max.
Heater burnout alarm setting range	0.0 to 50.0 A (0.1 A units) (see note 2)
Min. detection ON time	190 ms (see note 3)

Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

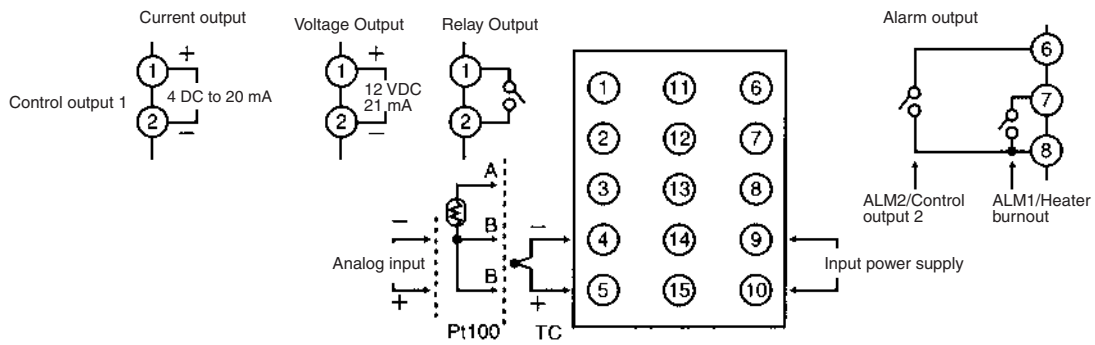
2. When the set value is "00 A," the heater burnout alarm will always be OFF. When the set value is "50.0 A," the heater burnout alarm will always be ON.

3. When the control output ON time is less than 190 ms, heater burnout detection and heater current measurement will not be carried out.

Wiring Terminals

• The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.

• Standard insulation is applied to the power supply I/O sections. 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.

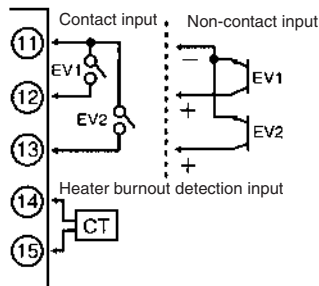


Two input power supplies are available: 100 to 240 VAC or 24 VDC.
Recommended power supply for 24VDC; eg. OMRON S8VS.

■ Option Units

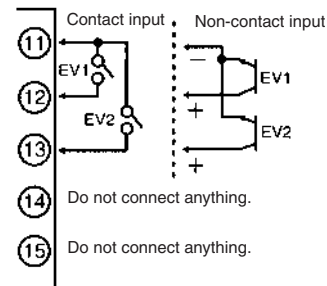
E53-CNHB Event Input/Heater Burnout Alarm Unit

Event Input/Heater Burnout Detection



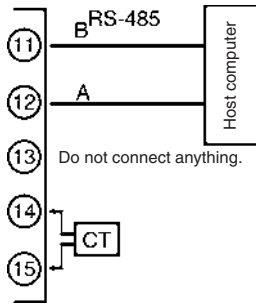
E53-CNB Event Input

Event Input



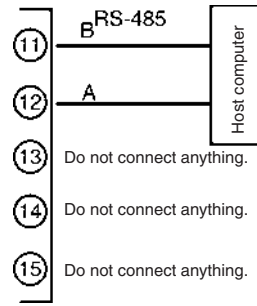
E53-CNH03 Communications/Heater Burnout Alarm Unit

Communications Specification/Heater Burnout Specification

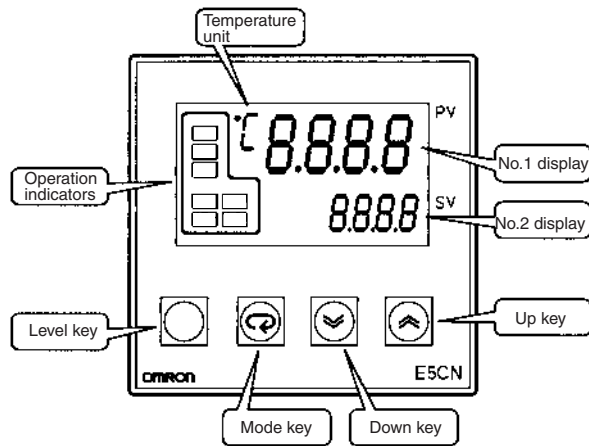


E53-CN03 Communications Unit

Communications Specification

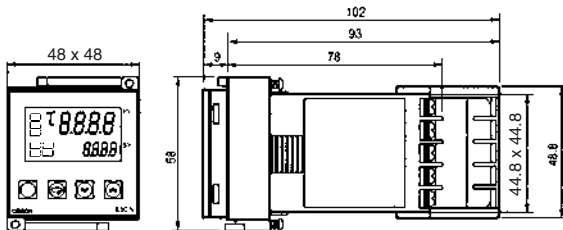
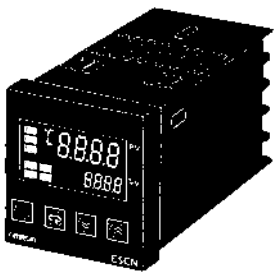


Nomenclature



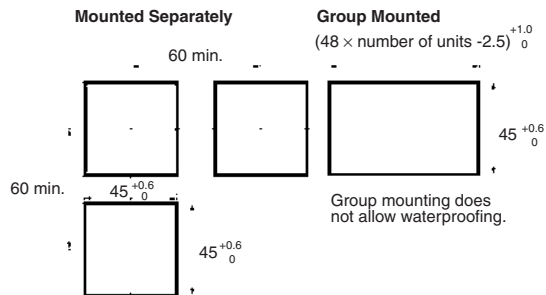
Dimensions

Note: All units are in millimeters unless otherwise indicated.



Note: The suffix "500" is added to the model number of each Controller provided with a E53-COV10 Terminal Cover.

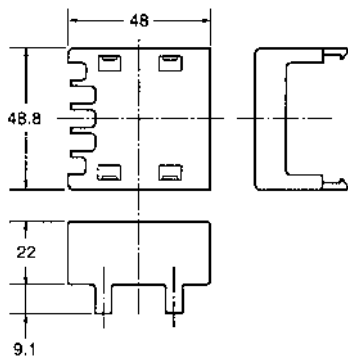
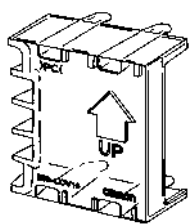
Panel Cutouts



- Recommended panel thickness is 1 to 5 mm.
- Group mounting is not possible in the vertical direction. (Maintain the specified mounting space between Controllers when they are group mounted.)
- To mount the E53CN so that it is waterproof, apply the waterproof packing to the E53CN.
- When two or more E53CNs are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

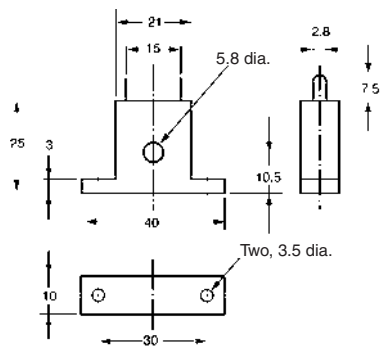
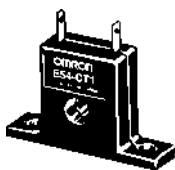
Terminal Cover

E53-COV10

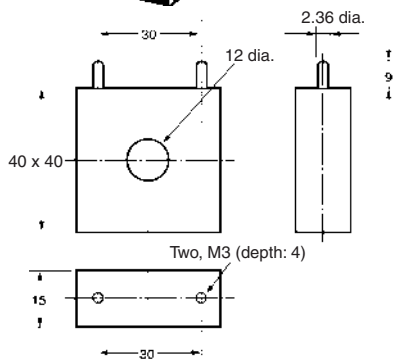


Current Transformer (Sold Separately)

E54-CT1



E54-CT3



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Digital Temperature Controllers E5EN

Compact and Intelligent Temperature Controllers

- Depth of only 78 mm.
- Various temperature inputs: thermocouple, platinum resistance thermometer, infrared temperature sensor, and analog inputs.
- Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.
- Heating or heating/cooling control is available.
- Event input allows multiple SP selection and run/stop function.
- Water-resistant construction (NEMA4X: equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.



48(W) x 96(H) x 78(D) mm



Model Number Structure

Model Number Legend

E5EN- M -500
1 2 3 4 5

1. Output type

- R: Relay
- Q: Voltage (for driving SSR)
- C: Current

2. Number of alarm

- 3: Three alarms

3. Heater burnout alarm

- Blank: Not available
- H: Available

4. Option Unit

- M: Option Unit can be mounted

5. Input type

- TC: Thermocouple
- P: Platinum resistance thermometer

Ordering Information

Standard Models

Size	Power supply voltage	No. of alarm points	Control output	Heater burnout alarm	Thermocouple model	Platinum resistance thermometer model
1/8 DIN 48(W) x 96(H) x 78(D) mm	100 to 240 VAC	3	Relay	No	E5EN-R3MTC-500	E5EN-R3MP-500
				Yes	E5EN-R3HMTC-500	E5EN-R3HMP-500
			Voltage (for driving SSR)	No	E5EN-Q3MTC-500	E5EN-Q3MP-500
				Yes	E5EN-Q3HMTC-500	E5EN-Q3HMP-500
	24 VAC/VDC	3	Relay	No	E5EN-R3MTC-500	E5EN-R3MP-500
				Yes	E5EN-R3HMTC-500	E5EN-R3HMP-500
			Voltage (for driving SSR)	No	E5EN-Q3MTC-500	E5EN-Q3MP-500
				Yes	E5EN-Q3HMTC-500	E5EN-Q3HMP-500
			Current	No	E5EN-C3MTC-500	E5EN-C3MP-500

Note 1. A Current Transformer (CT) is not provided with the Unit. Be sure to order one when ordering the E5EN.

2. When the heating and cooling function or the heater burnout alarm is used, one of the alarm outputs will be disabled for each function used.

3. Specify the power supply specifications when ordering.

Temperature Controller

■ Option Units

The E5EN provides communication or event input functionality when mounted with one of the following Option Units.

Name	Model	Function
Communication Unit	E53-AK01	RS-232C communication
	E53-AK03	RS-485 communication
Event Input Unit	E53-AKB	Event input

■ Current Transformer (Sold Separately)

Model	E54-CT1	E54-CT3
Hole diameter	5.8 dia.	12.0 dia.

■ Terminal Cover

Model	E53-COV11
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Note: The Terminal Cover comes with the E5EN and does not have to be purchased separately.

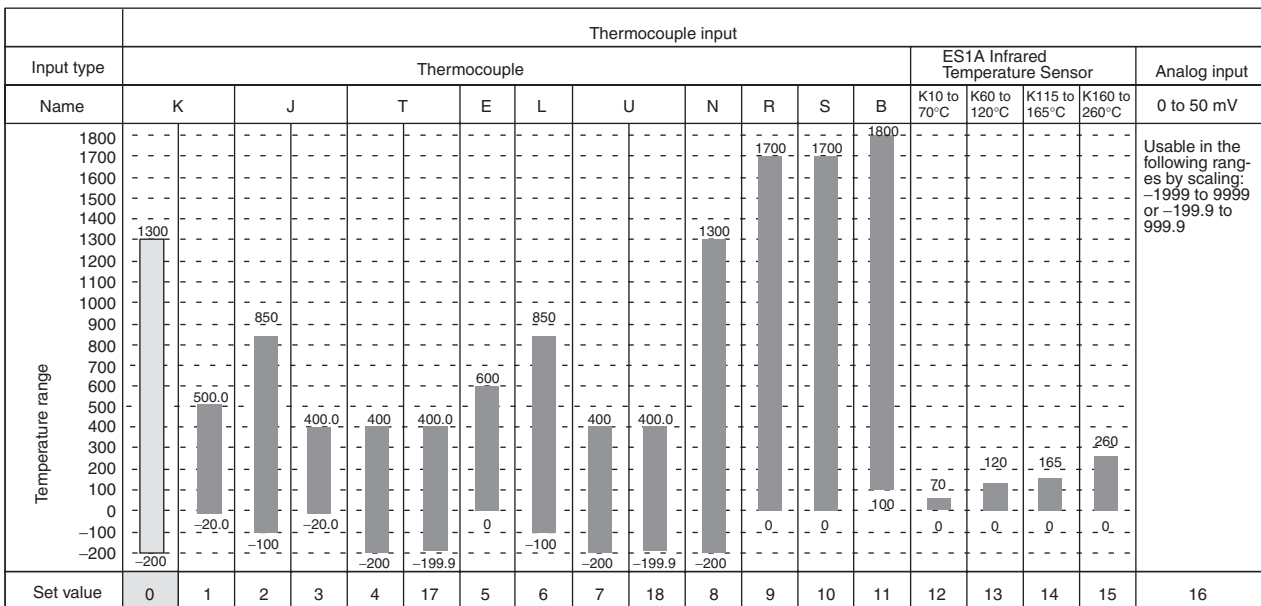
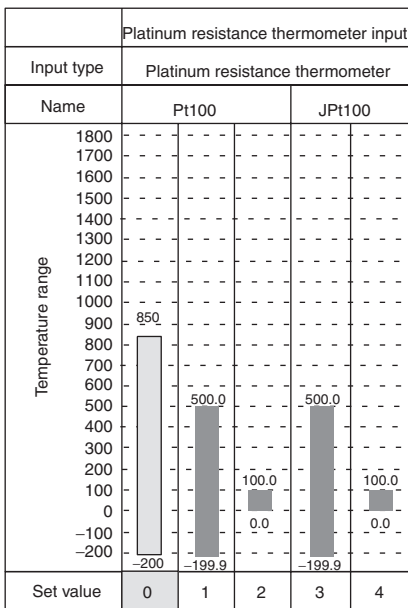
Specifications

■ Ratings

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
Operating voltage range	85% to 110% of rated supply voltage	
Power consumption	9 VA	5 VA/4 W
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C Voltage input: 0 to 50 mV	
Control output	Relay output	SPST-NO, 250 VAC, 5 A (resistive load), electrical life: 100,000 operations
	Voltage output	12 VDC (PNP), max. load current: 40 mA, with short-circuit protection circuit
	Current output	4 to 20 mA DC, load: 600 Ω max., resolution: approx. 2,600
Alarm output	SPST-NO, 250 VAC, 3 A (resistive load), electrical life: 100,000 operations	
Control method	2-PID or ON/OFF control	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and single-lighting indicator Character height: PV: 14.0 mm; SV: 9.5 mm	
Other functions	According to Controller model	
Ambient temperature	-10 to 55°C (with no condensation or icing)	
Ambient humidity	25% to 85%	
Storage temperature	-25 to 65°C (with no condensation or icing)	

Input Ranges

Platinum Resistance Thermometer Input/Thermocouple Input



Applicable standards by input type are as follows:

- K, J, T, E, N, R, S, B: JIS C1602-1995
- L: Fe-CuNi, DIN 43710-1985
- U: Cu-CuNi, DIN 43710-1985
- JPt100: JIS C1604-1989, JIS C1606-1989
- Pt100: JIS C1604-1997, IEC751

Shaded ranges indicate default settings.

ES1A models with a temperature range of 160°C to 260°C have been discontinued.

■ Characteristics

Indication accuracy	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.	
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU)	
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU)	
Integral time (I)	0 to 3999 s (in units of 1 s)	
Derivative time (D)	0 to 3999 s (in units of 1 s)	
Control period	1 to 99 s (in units of 1 s)	
Manual reset value	0.0% to 100.0% (in units of 0.1%)	
Alarm setting range	-1999 to 9999 (decimal point position depends on input type)	
Sampling period	500 ms	
Insulation resistance	20 MΩ min. (at 500 VDC)	
Dielectric strength	2000 VAC, 50 or 60 Hz for 1 min (between different charging terminals)	
Vibration resistance	10 to 55 Hz, 10 m/s ² for 2 hours each in X, Y and Z directions	
Shock resistance	300 m/s ² , 3 times each in 3 axes, 6 directions (relay: 100 m/s ²)	
Weight	Approx. 260 g	Mounting bracket: Approx. 60 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00	
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)	
EMC	Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)	
Approved standards	UL3121-1, CSA22.2 No. 142, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.	

Note: The indication of K thermocouples in the -200 to 1300°C range, and 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 maximum.

■ Communications Specifications

Transmission path connection	RS-485: Multiple points RS-232C: Point-to-point
Communications method (see note 1)	RS-485 (two-wire, half duplex)/RS-232C
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (see note 2)	7 or 8 bits
Stop bit length (see note 2)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSWAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (see note 1)	RS-485/RS-232C
Retry function	Not available
Communications buffer	40 bytes

Note 1. RS-232C communications are only supported for the E5AN and E5EN models.

2. The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

■ Current Transformer (Sold Separately) Ratings

Dielectric strength	1,000 VAC (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)	Armature (2) Plug (2)

■ Heater Burnout Alarm Specifications

Max. heater current	Single-phase AC: 50 A (see note 1)
Input current readout accuracy	±5%FS±1 digit max.
Heater burnout alarm setting range	0.0 to 50.0 A (0.1 A units) (see note 2)
Min. detection ON time	190 ms (see note 3)

Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

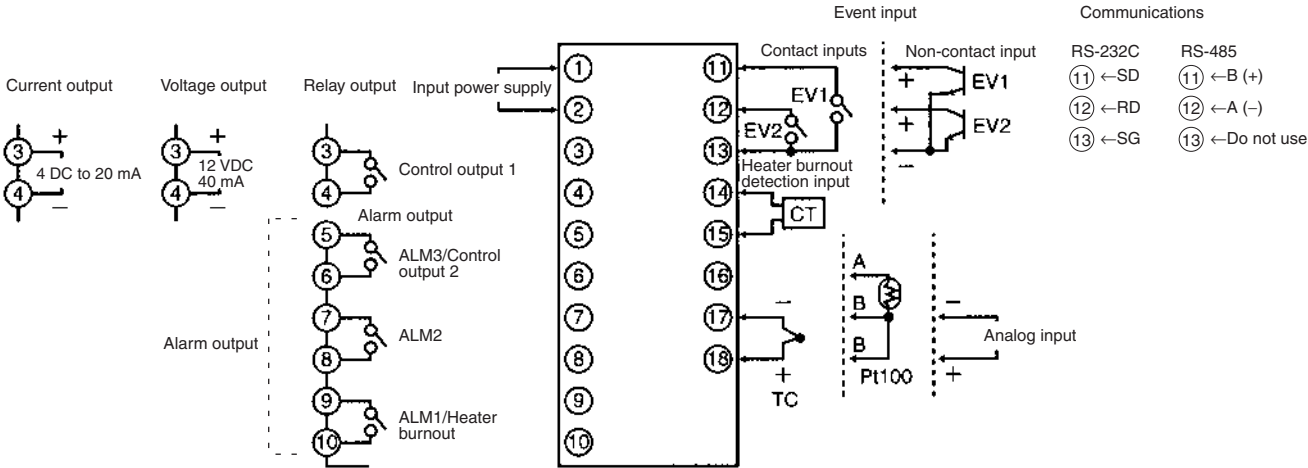
2. When the set value is "00 A," the heater burnout alarm will always be OFF. When the set value is "50.0 A," the heater burnout alarm will always be ON.

3. When the control output ON time is less than 190 ms, heater burnout detection and heater current measurement will not be carried out.

Wiring Terminals

• The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.

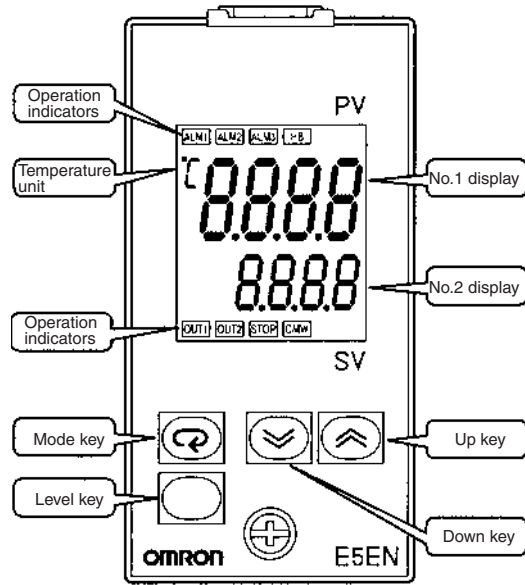
• Standard insulation is applied to the power supply I/O sections. If reinforced insulation is required, connect the input and output terminals to a device without any exposed current-carrying parts or to a device with standard insulation suitable for the maximum operating voltage of the power supply I/O section.



Note: Two input power supplies are available: 100 to 240 VAC or 24 VDC. Recommended power supply for 24VDC; eg. OMRON S8VS.

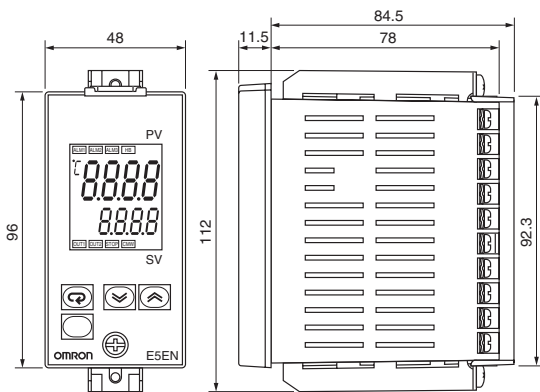
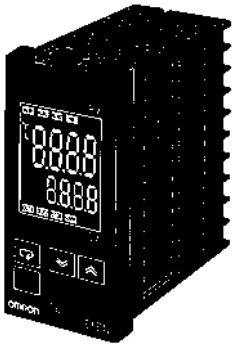
Temperature Controller

Nomenclature



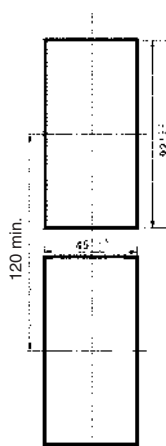
Dimensions

Note: All units are in millimeters unless otherwise indicated.



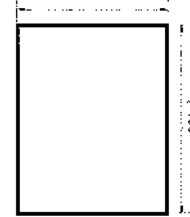
Panel Cutouts

Mounted Separately



Group Mounted

$(48 \times \text{number of units} - 2.5)^{+1.0}_0$

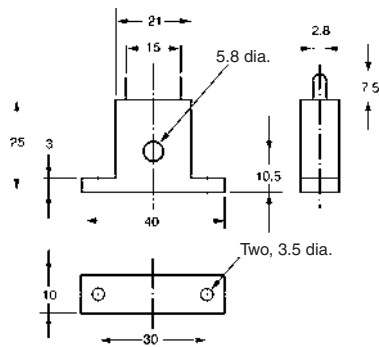
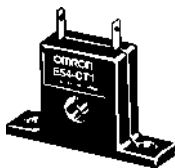


Group mounting does not allow waterproofing.

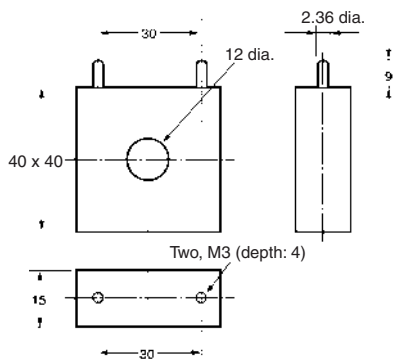
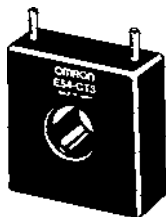
- Recommended panel thickness is 1 to 8 mm.
- Group mounting is not possible in the vertical direction. (Maintain the specified mounting space between Controllers when they are group mounted.)
- To mount the E5EN so that it is waterproof, apply the waterproof packing to the E5EN.
- When two or more E5ENs are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

Current Transformer (Sold Separately)

E54-CT1

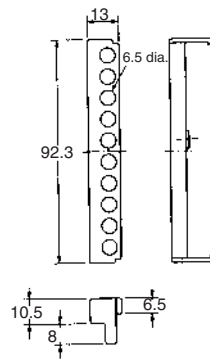
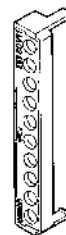


E54-CT3



Terminal Cover

E53-COV11



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Digital Temperature Controllers E5AN

Compact and Intelligent Temperature Controllers

- Depth of only 78 mm.
- Various temperature inputs: thermocouple, platinum resistance thermometer, infrared temperature sensor, and analog inputs.
- Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.
- Heating or heating/cooling control is available.
- Event input allows multiple SP selection and run/stop function.
- Water-resistant construction (NEMA4X: equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.



96(W) x 96(H) x 78(D) mm



Model Number Structure

Model Number Legend

E5AN- M -500
1 2 3 4 5

1. Output type

- R: Relay
- Q: Voltage (for driving SSR)
- C: Current

2. Number of alarms

- 3: Three alarms

3. Heater burnout alarm

- Blank: Not available
- H: Available

4. Option Unit

- M: Option Unit can be mounted

5. Input type

- TC: Thermocouple
- P: Platinum resistance thermometer

Ordering Information

Standard Models

Size	Power supply voltage	No. of alarm points	Control output	Heater burnout alarm	Thermocouple model	Platinum resistance thermometer model
1/4 DIN 96(W) x 96(H) x 78(D) mm	100 to 240 VAC	3	Relay	No	E5AN-R3MTC-500	E5AN-R3MP-500
				Yes	E5AN-R3HMTC-500	E5AN-R3HMP-500
			Voltage (for driving SSR)	No	E5AN-Q3MTC-500	E5AN-Q3MP-500
	Yes	E5AN-Q3HMTC-500		E5AN-Q3HMP-500		
	24 VAC/VDC	3	Relay	No	E5AN-R3MTC-500	E5AN-R3MP-500
				Yes	E5AN-R3HMTC-500	E5AN-R3HMP-500
Voltage (for driving SSR)			No	E5AN-Q3MTC-500	E5AN-Q3MP-500	
	Yes	E5AN-Q3HMTC-500	E5AN-Q3HMP-500			
			Current	No	E5AN-C3MTC-500	E5AN-C3MP-500

- Note 1.** A Current Transformer (CT) is not provided with the Unit. If using a heater burnout alarm, be sure to order one when ordering the E5AN.
2. When the heating and cooling function or the heater burnout alarm is used, one of the alarm outputs will be disabled for each function used.

Temperature Controller

3. Specify the power supply specifications when ordering.

■ Option Units

The E5AN provides communication or event input functionality when mounted with one of the following Option Units.

Name	Model	Function
Communication Unit	E53-AK01	RS-232C communication
	E53-AK03	RS-485 communication
Event Input Unit	E53-AKB	Event input

■ Current Transformer (Sold Separately)

Model	E54-CT1	E54-CT3
Hole diameter	5.8 dia.	12.0 dia.

■ Terminal Cover

Model	E53-COV11
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Note: The Terminal Cover comes with the E5AN and does not have to be purchased separately.

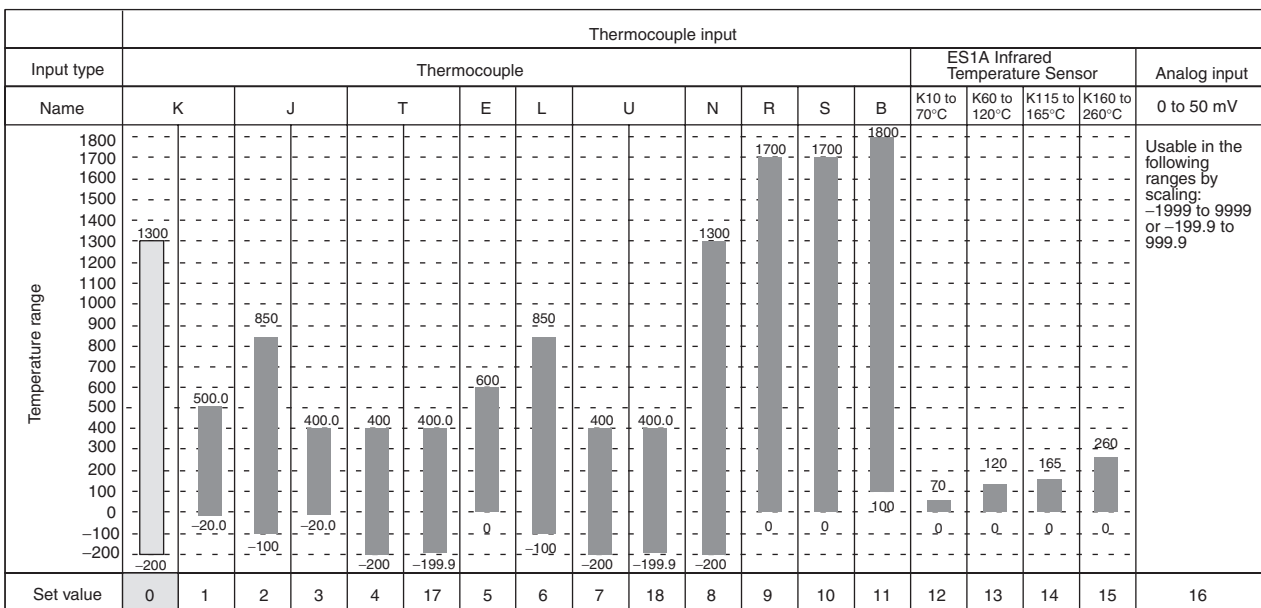
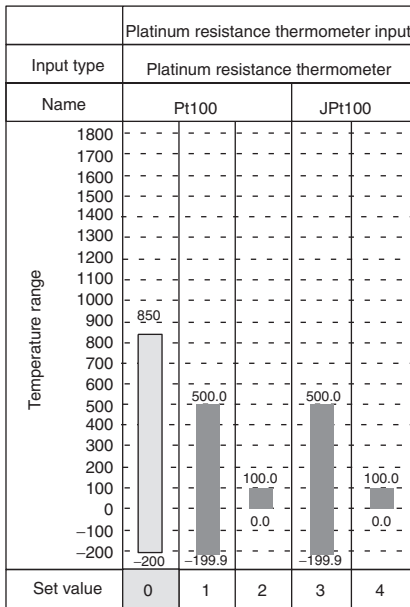
Specifications

■ Ratings

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
Operating voltage range	85% to 110% of rated supply voltage	
Power consumption	9 VA	5 VA/4 W
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C Voltage input: 0 to 50 mV	
Control output	Relay output	SPST-NO, 250 VAC, 5 A (resistive load), electrical life: 100,000 operations
	Voltage output	12 VDC ^{+15%} / _{-20%} (PNP), max. load current: 40 mA, with short-circuit protection circuit
	Current output	4 to 20 mA DC, load: 600 Ω max., resolution: approx. 2,600
Alarm output	SPST-NO, 250 VAC, 3 A (resistive load), electrical life: 100,000 operations	
Control method	2-PID or ON/OFF control	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and single-lighting indicator Character height: PV: 15.0 mm; SV: 9.5 mm	
Other functions	According to Controller model	
Ambient temperature	-10 to 55°C (with no condensation or icing)	
Ambient humidity	25% to 85%	
Storage temperature	-25 to 65°C (with no condensation or icing)	

Input Ranges

Platinum Resistance Thermometer Input/Thermocouple Input



Applicable standards by input type are as follows:

- K, J, T, E, N, R, S, B: JIS C1602-1995
- L: Fe-CuNi, DIN 43710-1985
- U: Cu-CuNi, DIN 43710-1985
- JPt100: JIS C1604-1989, JIS C1606-1989
- Pt100: JIS C1604-1997, IEC751

Shaded ranges indicate default settings.

ES1A models with a temperature range of 160°C to 260°C have been discontinued.

■ Characteristics

Indication accuracy	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU)
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU)
Integral time (I)	0 to 3999 s (in units of 1 s)
Derivative time (D)	0 to 3999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0% to 100.0% (in units of 0.1%)
Alarm setting range	-1999 to 9999 (decimal point position depends on input type)
Sampling period	500 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2000 VAC, 50 or 60 Hz for 1 min (between different charging terminals)
Vibration resistance	10 to 55 Hz, 10 m/s ² for 2 hours each in X, Y and Z directions
Shock resistance	300 m/s ² , 3 times each in 3 axes, 6 directions (relay: 100 m/s ²)
Weight	Approx. 310 g Mounting bracket: Approx. 60 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)
EMC	Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards	UL3121-1, CSA22.2 No. 142, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.

Note: The indication of K thermocouples in the -200 to 1300°C range, and 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 maximum.

■ Communications Specifications

Transmission path connection	RS-485: Multiple points RS-232C: Point-to-point
Communications method (see note 1)	RS-485 (two-wire, half duplex)/RS-232C
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (see note 2)	7 or 8 bits
Stop bit length (see note 2)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSWAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (see note 1)	RS-485/RS-232C
Retry function	Not available
Communications buffer	40 bytes

Note 1. RS-232C communications are only supported for the E5AN and E5EN models.

2. The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

■ Current Transformer (Sold Separately) Ratings

Dielectric strength	1,000 VAC (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)	Armature (2) Plug (2)

■ Heater Burnout Alarm Specifications

Max. heater current	Single-phase AC: 50 A (see note 1)
Input current readout accuracy	±5%FS±1 digit max.
Heater burnout alarm setting range	0.0 to 50.0 A (0.1 A units) (see note 2)
Min. detection ON time	190 ms (see note 3)

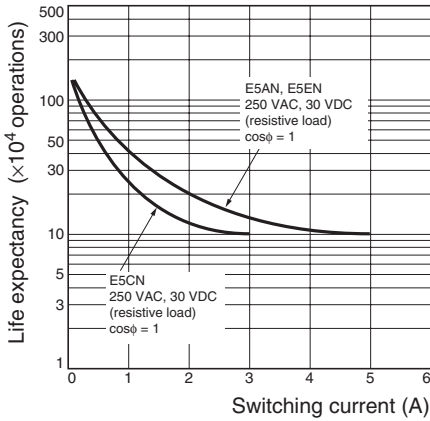
Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

2. When the set value is "00 A," the heater burnout alarm will always be OFF. When the set value is "50.0 A," the heater burnout alarm will always be ON.

3. When the control output ON time is less than 190 ms, heater burnout detection and heater current measurement will not be carried out.

■ Engineering Data

Electrical Life Expectancy Curve for Relays (Reference Values)



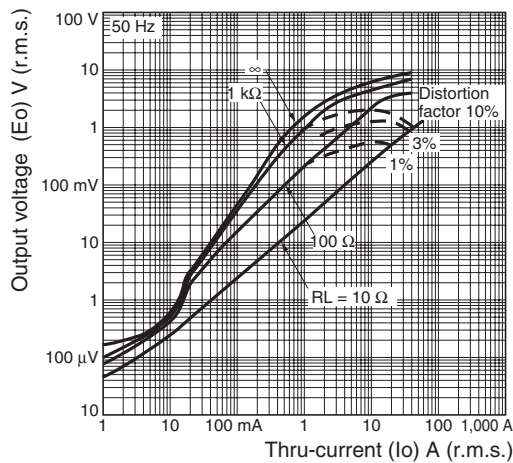
E54-CT1

Thru-current (Io) vs. Output Voltage (Eo) (Reference Values)

Maximum continuous heater current: 50 A (50/60 Hz)

Number of windings: 400±2

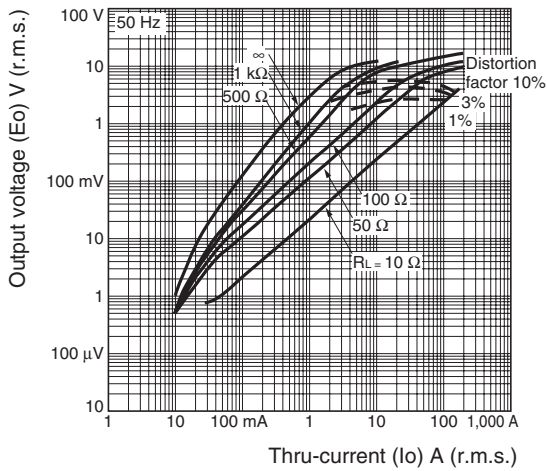
Winding resistance: 18±2 Ω



E54-CT3

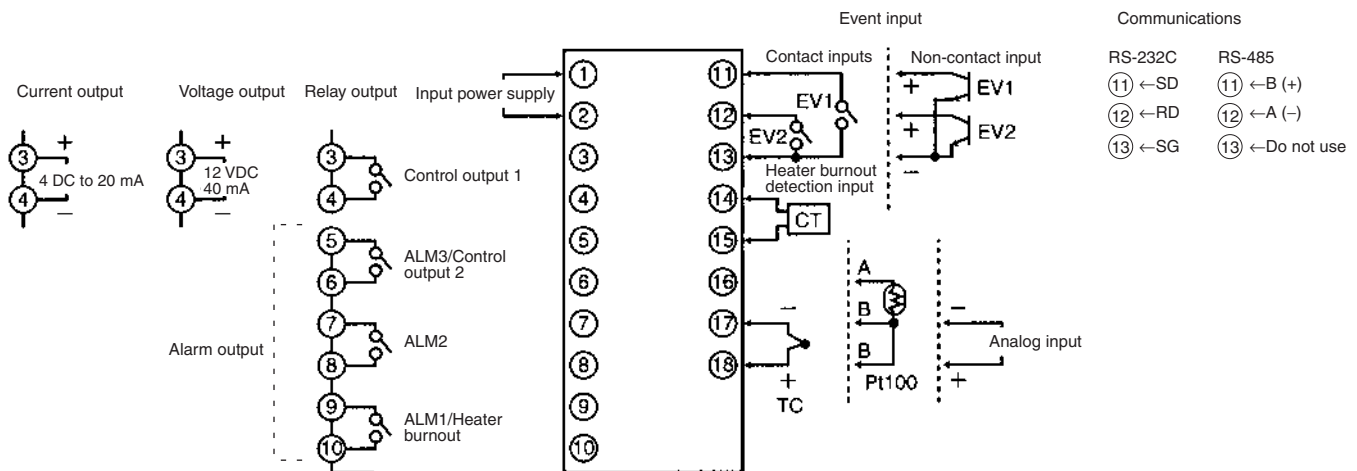
Thru-current (Io) vs. Output Voltage (Eo) (Reference Values)

Maximum continuous heater current: 120 A (50/60 Hz)
 (Maximum continuous heater current for an OMRON Temperature Controller is 50 A.)
 Number of windings: 400±2
 Winding resistance: 8±0.8 Ω



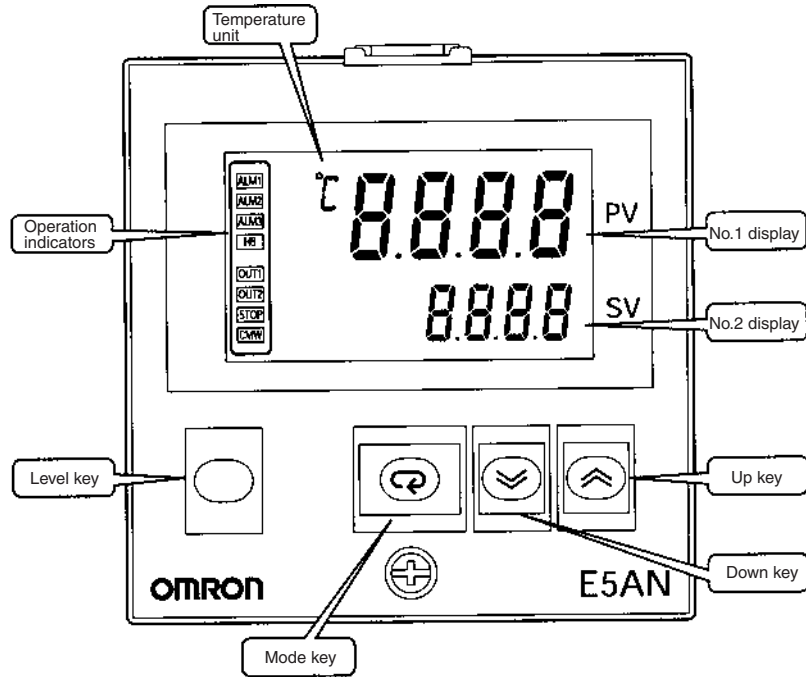
Wiring Terminals

- The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.
- Standard insulation is applied to the power supply I/O sections. 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.



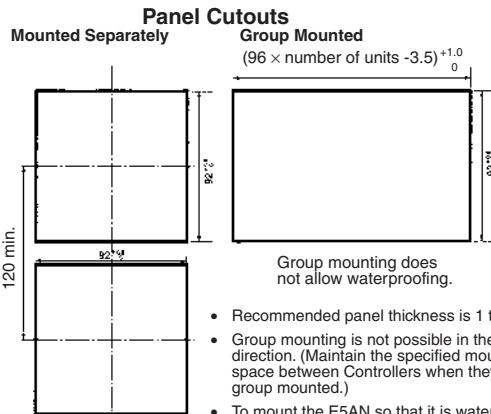
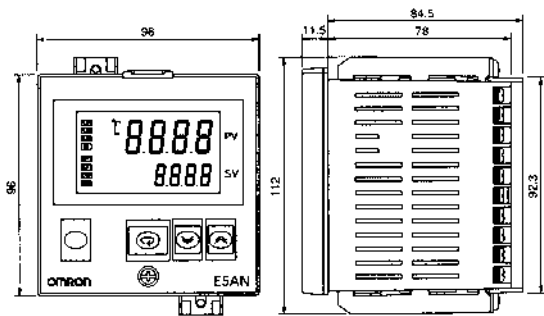
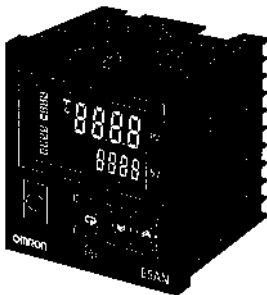
Note: Two input power supplies are available: 100 to 240 VAC or 24 VDC. Recommend power supply for 24VDC; eg. OMRON S8VS.

Nomenclature



Dimensions

Note: All units are in millimeters unless otherwise indicated.



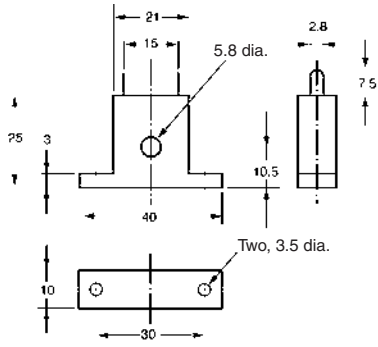
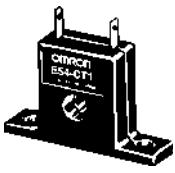
Group mounting does not allow waterproofing.

- Recommended panel thickness is 1 to 8 mm.
- Group mounting is not possible in the vertical direction. (Maintain the specified mounting space between Controllers when they are group mounted.)
- To mount the E5AN so that it is waterproof, apply the waterproof packing to the E5AN.
- When two or more E5ANs are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

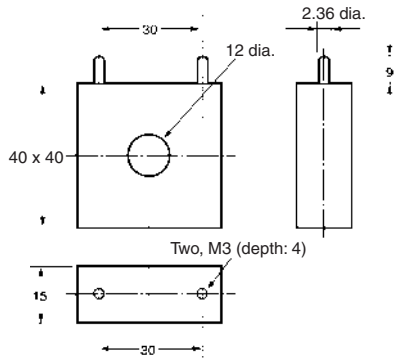
Temperature Controller

Current Transformer (Sold Separately)

E54-CT1

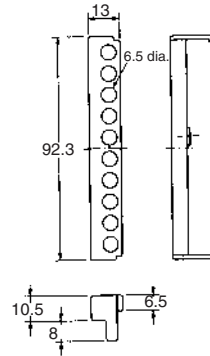
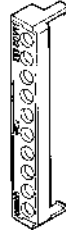


E54-CT3



Terminal Cover

E53-COV11



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Nomenclature

E5AN

Operation Indicators

- ALM1 (alarm 1)
Lights when alarm 1 output is ON.
ALM2 (alarm 2)
Lights when alarm 2 output is ON.
ALM3 (alarm 3)
Lights when alarm 3 output is ON.
- HB (heater burnout alarm display)
Lights when a heater burnout is detected.
The heater burnout alarm remains ON by setting the heater burnout latch. To reset, turn the power supply OFF and then ON or set the heater burnout alarm value to "0.0A."
- OUT1, OUT2 (control output 1, control output 2)
Lights when control output 1 and/or control output 2 (cool) are ON.
However, if control output 1 is current output, OUT1 will always be unlit.
- STOP (stop)
Lights when control of the E5AN has been stopped. During control, this indicator lights when an event or the run/stop function has become stopped. Otherwise, this indicator is out.
- CMW (communications writing control)
Lights when communications writing is enabled and is out when it is disabled.

Temperature Unit

The temperature unit is displayed when the display unit parameter is set to a temperature. Indication is determined by the currently selected "temperature unit" parameter set value. When this parameter is set to "°C," "C" is displayed, and when set to "°F," "F" is displayed.

No. 1 Display

Displays the process value or parameter type.

No. 2 Display

Displays the set point, manipulated variable, or set value (setup) of the parameter.

Up Key

Each press of this key increases values displayed on the No.2 display. Holding down this key continuously increases values.

Down Key

Each press of this key decreases values displayed on the No.2 display. Holding down this key continuously decreases values.

Mode Key

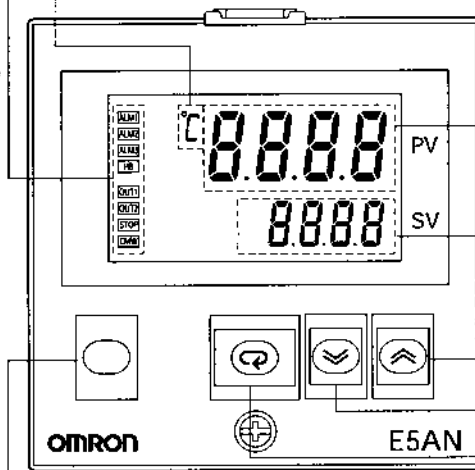
Press this key to select parameters within each level.

Level + Mode Keys

This key combination sets the E5AN to the "protect level."

Level Key

Press this key to select the setup level. The setup level is selected in order "operation level" ↔ "adjustment level," "initial setting level" ↔ "communications setting level."



E5EN

Operation Indicators

- ALM1 (alarm 1)
Lights when alarm 1 output is ON.
ALM2 (alarm 2)
Lights when alarm 2 output is ON.
ALM3 (alarm 3)
Lights when alarm 3 output is ON.
- HB (heater burnout alarm display)
Lights when a heater burnout is detected.
The heater burnout alarm remains ON by setting the heater burnout latch. To reset, turn the power supply OFF and then ON or set the heater burnout alarm value to "0.0A."
- OUT1, OUT2 (control output 1, control output 2)
Lights when control output 1 and/or control output 2 (cool) are ON.
However, if control output 1 is current output, OUT1 will always be unlit.
- STOP (stop)
Lights when control of the E5EN has been stopped. During control, this indicator lights when an event or the run/stop function has become stopped. Otherwise, this indicator is out.
- CMW (communications writing control)
Lights when communications writing is enabled and is out when it is disabled.

Temperature Unit

The temperature unit is displayed when the display unit parameter is set to a temperature. Indication is determined by the currently selected "temperature unit" parameter set value. When this parameter is set to "°C," "C" is displayed, and when set to "°F," "F" is displayed.

No. 1 Display

Displays the process value or parameter type.

No. 2 Display

Displays the set point, manipulated variable, or set value (setup) of the parameter.

Up Key

Each press of this key increases values displayed on the No.2 display. Holding down this key continuously increases values.

Down Key

Each press of this key decreases values displayed on the No.2 display. Holding down this key continuously decreases values.

Level Key

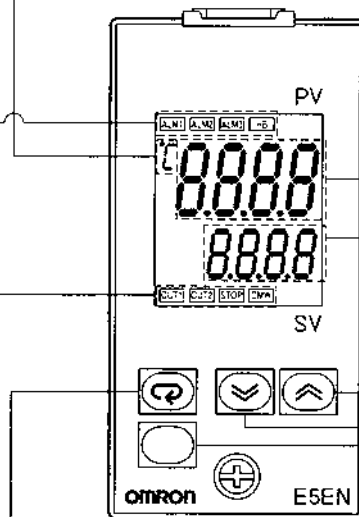
Press this key to select the setup level. The setup level is selected in order "operation level" ↔ "adjustment level," "initial setting level" ↔ "communications setting level."

Level + Mode Keys

This key combination sets the E5EN to the "protect level."

Mode Key

Press this key to select parameters within each level.



E5CN

Operation Indicators

1. AL1 (alarm 1)
Lights when alarm 1 output is ON.
AL2 (alarm 2)
Lights when alarm 2 output is ON.
2. HB (heater burnout alarm display)
Lights when a heater burnout is detected.
The heater burnout alarm remains ON by setting the heater burnout latch. To reset, turn the power supply OFF and then ON or set the heater burnout alarm value to "0.0A."
3. OT1, OT2 (control output 1, control output 2)
Lights when control output 1 and/or control output 2 (cool) are ON.
However, if control output 1 is current output, OT1 will always be unlit.
4. STP (stop)
Lights when control of the E5CN has been stopped.
During control, this indicator lights when an event or the run/stop function has become stopped. Otherwise, this indicator is out.
5. CMW (communications writing control)
Lights when communications writing is enabled and is out when it is disabled.

Temperature Unit

The temperature unit is displayed when the display unit parameter is set to a temperature. Indication is determined by the currently selected "temperature unit" parameter set value. When this parameter is set to "°C," "°C" is displayed, and when set to "°F," "°F" is displayed.

No. 1 Display

Displays the process value or parameter type.

No. 2 Display

Displays the set point, manipulated variable, or set value (setup) of the parameter.

Up Key

Each press of this key increases values displayed on the No.2 display. Holding down this key continuously increases values.

Down Key

Each press of this key decreases values displayed on the No.2 display. Holding down this key continuously decreases values.

Mode Key

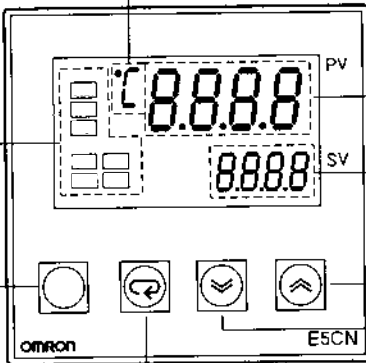
Press this key to select parameters within each level.

Level + Mode Keys

This key combination sets the E5CN to the "protect level."

Level Key

Press this key to select the setup level. The setup level is selected in order "operation level" ↔ "adjustment level," "initial setting level" ↔ "communications setting level."



E5GN

Operation Indicators

1. AL (alarm)
Lights when alarm output is ON.
2. CMW (communications writing control)
Lights when communications writing is enabled and is out when it is disabled.
3. STP (stop)
Lights when control of the E5GN has been stopped.
During control, this indicator lights when an event or the run/stop function has been stopped. Otherwise, this indicator is out.
4. OUT (control output)
Lights when control output is ON.

Temperature Unit

The temperature unit is displayed when the display unit parameter is set to a temperature. Indication is determined by the currently selected "temperature unit" parameter set value. When this parameter is set to "°C," "°C" is displayed, and when set to "°F," "°F" is displayed.

No. 1 Display

Displays the process value or parameter type.

No. 2 Display

Displays the set point, manipulated variable or set value (setup) of the parameter.

Up Key

Each press of this key increases values displayed on the No.2 display. Holding down this key continuously increases values.

Down Key

Each press of this key decreases values displayed on the No.2 display. Holding down this key continuously decreases values.

Level + Mode Key

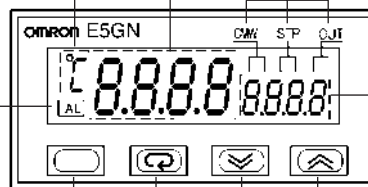
This key combination sets the E5GN to the "protect level."

Level Key

Press this key to select the setup level. The setup level is selected in order "operation level" ↔ "adjustment level," "initial setting level" ↔ "communications setting level."

Mode Key

Press this key to select parameters within each level.



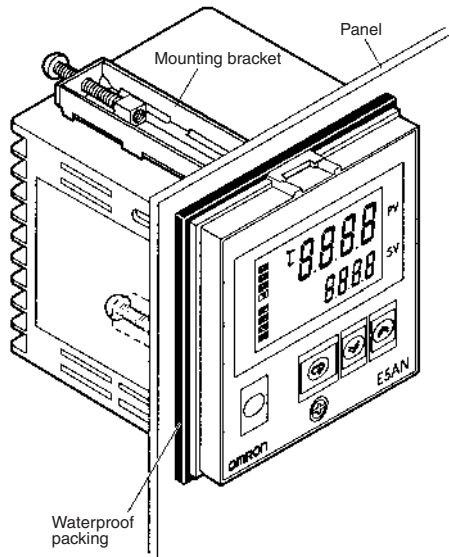
Installation

■ E5AN/E5EN

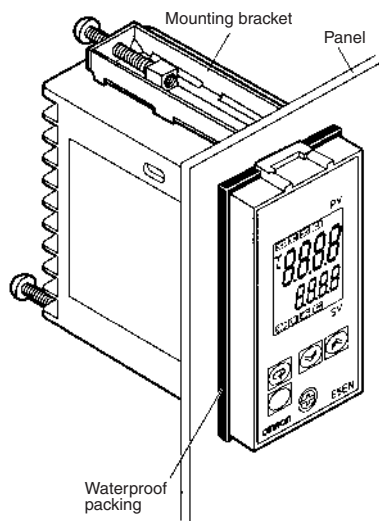
Mounting

1. Insert the E5AN/E5EN into the mounting hole in the panel from the front.
2. Push the mounting bracket along the E5AN/E5EN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the fixing screw on each mounting bracket alternately until the ratchet stops tightening.

E5AN



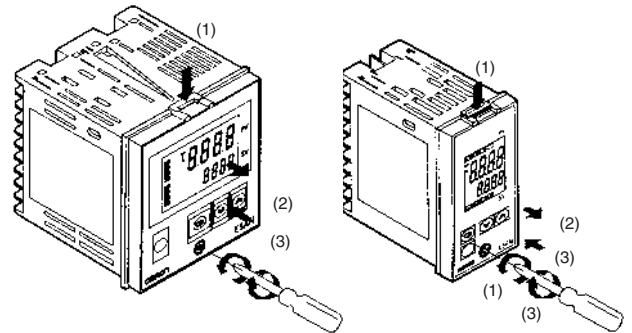
E5EN



Drawing Out

For drawing out the Unit, use a suitable Phillips screwdriver for the screw located at the bottom on the front panel.

1. While pressing down on the hook located at the top of the front panel, turn the screw (located at the bottom on the front panel) counterclockwise using a Phillips screwdriver.
2. Hold both sides of the front panel and draw out the Unit towards you.
3. When inserting the Unit, confirm that the waterproof packing is in place. While pressing down on the hook located at the top of the front panel, turn the screw (located at the bottom on the front panel) clockwise using a Phillips screwdriver and tighten to a torque of 0.3 to 0.5 N·m. Make sure that electronic parts do not come in contact with the case.



■ E5CN

Setting Up Option Units

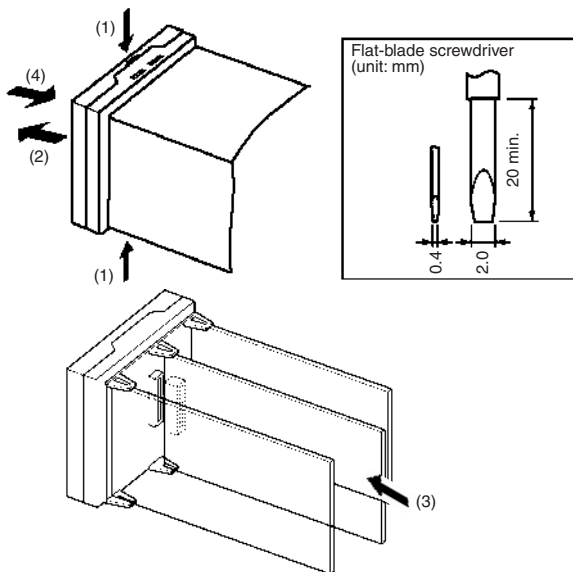
If communications, event input, or heater burnout functions are required, mount the E53-CNH03/E53-CN03 Communications Unit or the E53-CNHB/E53-CNB Event Input Unit. The heater burnout function is supported on either of these two Option Units.

Option Units

Name	Model	Function
Communications Unit	E53-CNH03 E53-CN03	RS-485 communications
Event Input Unit	E53-CNHB E53-CNB	Event inputs

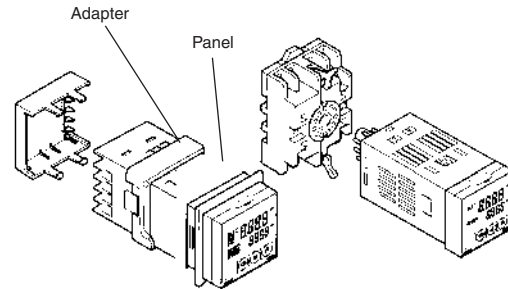
Note: Terminal label: x1

Assembling a Unit



1. Insert the tools (see drawing above) into the slots (one on the top and one on the bottom) and release the hooks.
2. Insert the tool in the space between the front and rear panels and slightly pull out the front panel. Hold the top and bottom of the front panel and pull toward yourself to remove it.
3. Match up the upper and lower claws with the connection points and insert the Option Unit. Mount the Option Unit in the center.
4. Before inserting the Unit, confirm that the waterproof packing is in place. Insert the Unit into the rear case until you hear a click. When inserting the Unit, press down the hooks on the top and bottom of the rear case so that they firmly hook on the inserted Unit. Make sure that electronic parts do not come in contact with the case.

Mounting



Attaching the E5CN to a Panel

1. Insert the E5CN into the mounting hole in the panel.
2. Push the adapter along the E5CN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to between 0.29 and 0.39 N·m (2.9 kgf·cm to 3.9 kgf·cm).

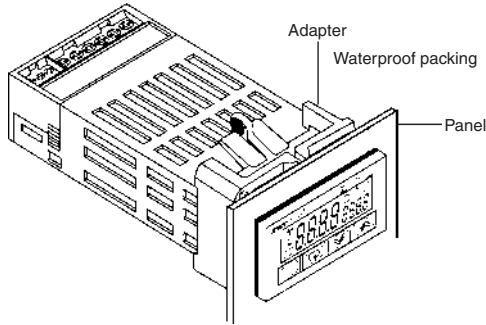
Attaching the Terminal Cover

Make sure that the “UP” mark is facing up, and then fit the Terminal Cover (E53-COV10) into the holes on the top and bottom. A E5CN-□-500 Controller is provided with a Terminal Cover.

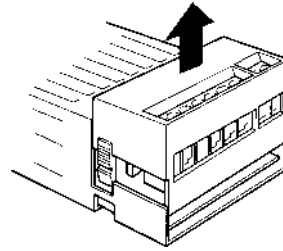
■ E5GN

Mounting

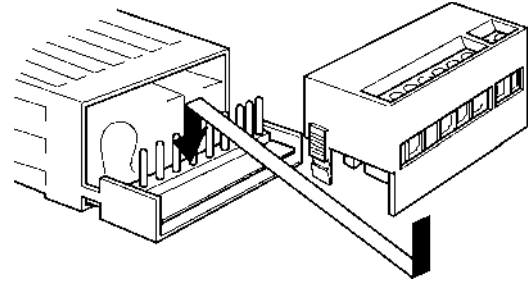
1. Insert the E5GN into the mounting hole in the panel from the front.
2. Push the adapter along the E5GN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to within approximately 0.29 to 0.39 N·m.



2. Draw out the terminal plate as it is.



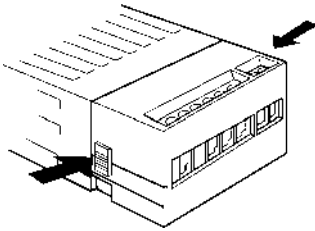
3. Before you insert the terminal plate again, make sure that the pins match the positions of the holes in the terminal plate.



Removing and Attaching the Terminal Plate

The E5GN can be replaced by removing the terminal plate.

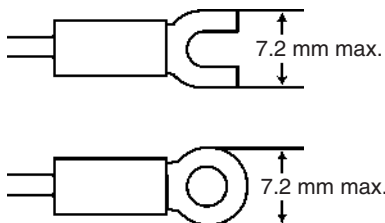
1. Press down hard on the fasteners on both sides of the terminals to unlock the terminal plate and pull upwards.



■ Wiring Precautions

E5AN/E5EN/E5CN

- Separate input leads and power lines to protect the E5AN/E5EN/E5CN and its lines from external noise.
- We recommend using solderless terminals when wiring the E5AN/E5EN/E5CN.
- Tighten the terminal screws using a torque between 0.74 and 0.90 N·m.
- Use the following type of solderless terminals for M3.5 screws.

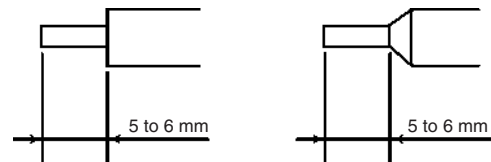


E5GN

- Connect the terminals as specified below.

Terminal No.	Cables	Pin terminals
1 to 6	AWG24 to AWG14	2.1 dia. max.
7 to 9	AWG28 to AWG22	1.3 dia. max.

- The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.







- Tighten the terminal screws to the torque specified below.

Terminal No.	Screw	Maximum tightening torque
1 to 6	M2.6	0.23 to 0.25 N·m
7 to 9	M2	0.12 to 0.14 N·m

Operation

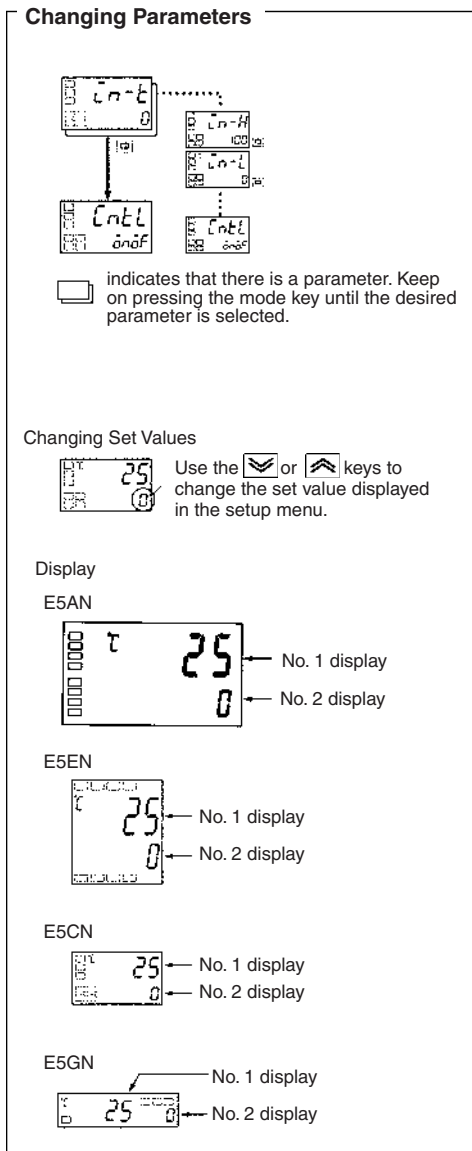
Initial Setup

On previous Controllers, sensor input type, alarm type and control period were set on DIP switches. These hardware settings are now set in parameters in setup menus. The  and  keys are used to switch between setup menus, and the amount of time that you hold the keys down determines which setup menu you move to. This section describes two typical examples.

Note: On the E5EN/E5GN, the  Key is the  Key.

1. ON/OFF Control

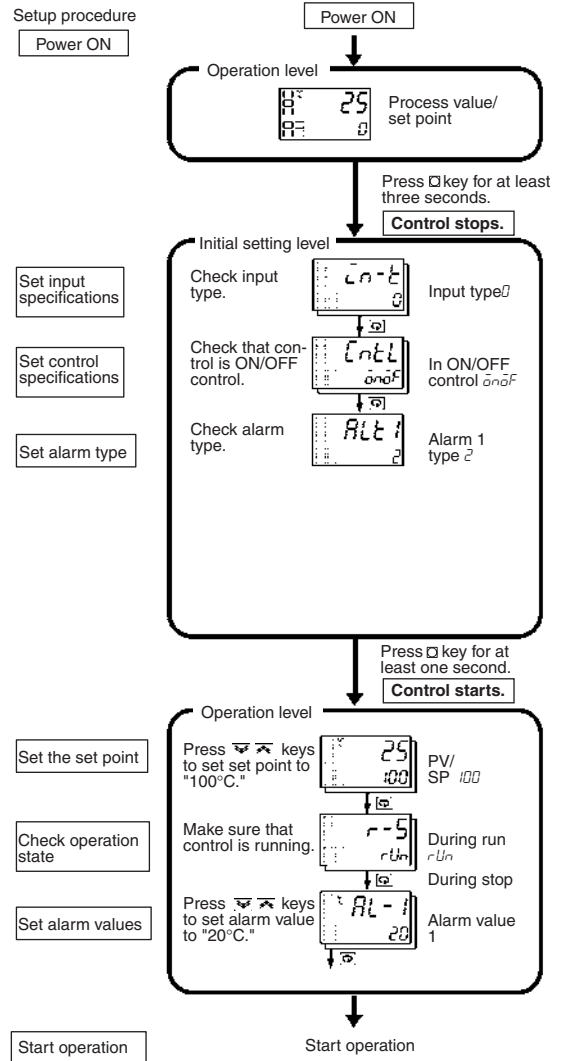
Typical Application Examples



Typical Example

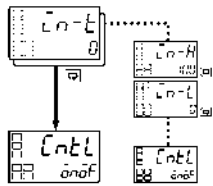
Input type:	0 K thermocouple -200 to 1300°C
Control method:	ON/OFF control
Alarm type:	2 upper limit
Alarm value 1:	20°C (For setting deviation)
Set point:	100°C

Change only the alarm value 1 and set point.
The rest must be left as default settings.



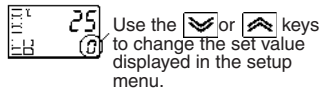
2. PID Control Using Autotuning

Changing Parameters

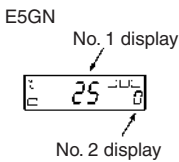
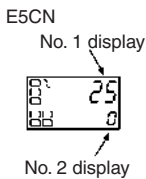
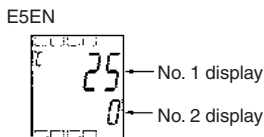
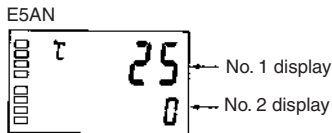


indicates that there is a parameter. Keep on pressing the mode key until the desired parameter is selected.

Changing Set Values



Display



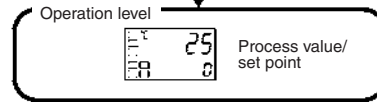
Typical Example

Input type: 4 T thermocouple -200 to 400°C
 Control method: PID control
 ST (self-tuning): OFF
 Calculate PID constants by AT (auto-tuning).
 Alarm type: 2 upper limit
 Alarm value 1: 30°C (For setting deviation)
 Set point: 150°C

Setup procedure

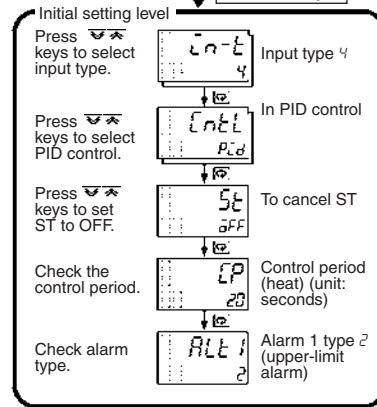
Power ON

Power ON



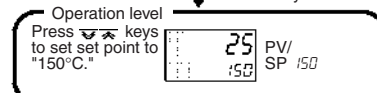
Press key for at least three seconds.

Control stops.



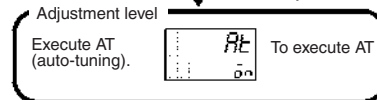
When set to ON, self-tuning operates. Recommended settings: 20 seconds for the relay output and 2 seconds for the SSR output.

Press key for at least one second.



Press keys to set set point to "150°C."

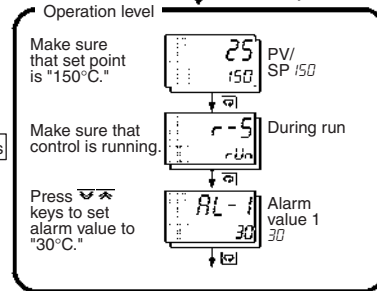
Press key for less than one second.



Execute AT (auto-tuning). To execute AT

Set to for executing AT and to for stopping AT.

Press key for less than one second.



Make sure that set point is "150°C."

Make sure that control is running.

Press keys to set alarm value to "30°C."

Set operation status

Set alarm values

Start operation

Start operation

PV/SP

After AT execution.

Set the set point

During AT execution.

While AT is being executed, SP will flash.

After AT execution.

During AT execution.

Set operation status

Set alarm values

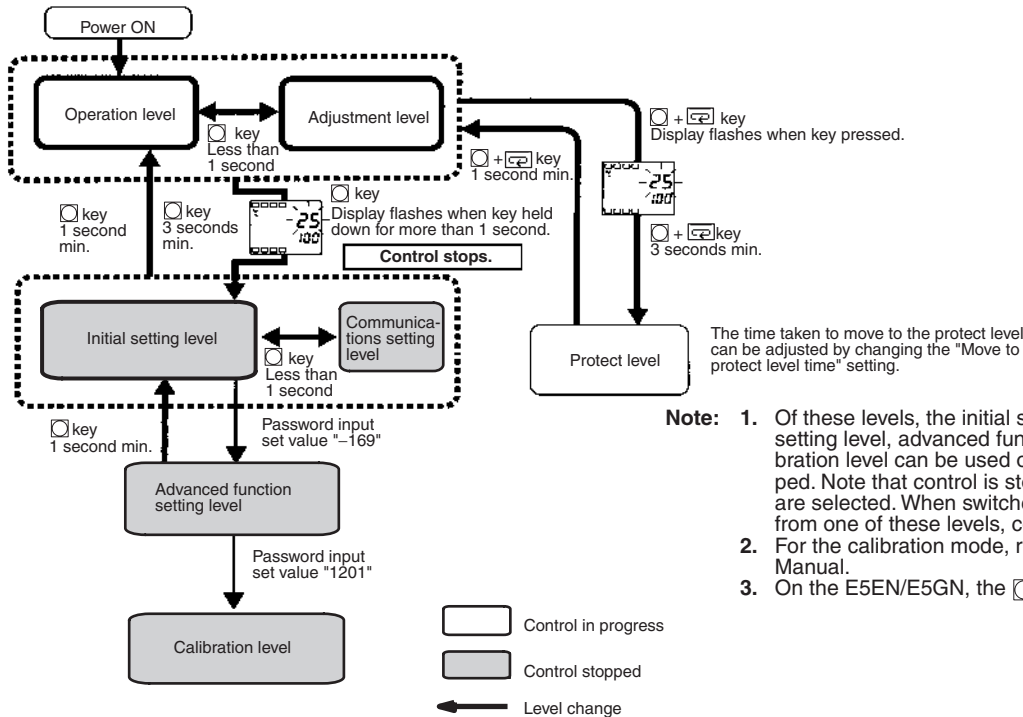
Start operation

■ Specification Setting after Turning ON Power

Outline of Operation Procedures

Key Operation

In the following descriptions, all the parameters are introduced in the display sequence. Some parameters may not be displayed depending on the protect settings and operation conditions.



- Note:**
1. Of these levels, the initial setting level, communications setting level, advanced function setting level and calibration level can be used only when control has stopped. Note that control is stopped when these four levels are selected. When switched back to the operation level from one of these levels, control will start.
 2. For the calibration mode, refer to the relevant User's Manual.
 3. On the E5EN/E5GN, the Key is the Key.

Description of Each Level

Operation Level

This level is displayed when you turn the power ON. You can move to the protect level, initial setting level and adjustment level from this level.

Normally, select this level during operation. During operation, the process value, set point and manipulated variable can be monitored, and the alarm value and upper- and lower-limit alarms can be monitored and modified.

Adjustment Level

To select this level, press the key once for less than one second.

This level is for entering set values and offset values for control. This level contains parameters for setting the set values, AT (auto-tuning), communications writing enable/disable, hysteresis, multi-SP, input shift values, heater burnout alarm (HBA) and PID constants. You can move to the top parameter of the operation level or initial setting level from here.

Initial Setting Level

To select this level, press the key for at least three seconds in the operation level. This level is for specifying the input type, selecting the control method, control period, setting direct/reverse action and alarm type. You can move to the advanced function setting level or communications setting level from this initial setting level. To return to the operation level, press the key for at least one second. To move to the communications setting level, press the key once for less than one second.

Protect Level

To select this level, simultaneously press the and keys for at least 3 seconds. This level is to prevent unwanted or accidental modification of parameters. Protected levels will not be displayed, and so the parameters in that level cannot be modified.

Communications Setting Level

To select this level, press the key once for less than one second in the initial setting level. When the communications function is used, set the communications conditions in this level. Communicating with a personal computer (host computer) allows set points to be read and written, and manipulated variables to be monitored.

Advanced Function Setting Level

To select this level, you must enter the password ("169") in the initial setting level.

You can move only to the calibration level from this level.

This level is for setting the automatic return of display mode, MV limiter, event input assignment, standby sequence, alarm hysteresis, ST (self-tune) and to move to the user calibration level.

Calibration Level

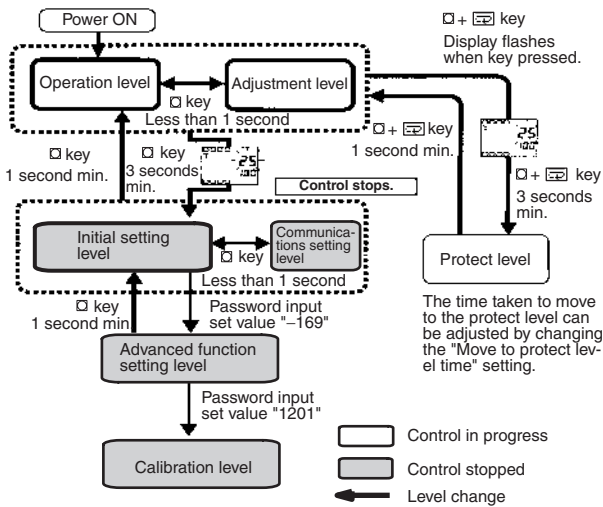
To select this level, you must enter the password ("1201") in the advanced function setting level. This level is for offsetting deviation in the input circuit.

You cannot move to other levels by operating the keys on the front panel from the calibration level. To cancel this level, turn the power OFF then back ON again.

Specification Setting after Turning ON Power

Initial Setting Level

This level is used for setting basic specifications of the Temperature Controller. Using this level, set the input type for selecting the input to be connected such as the thermocouple or platinum resistance thermometer and set the range of set point and the alarm mode.

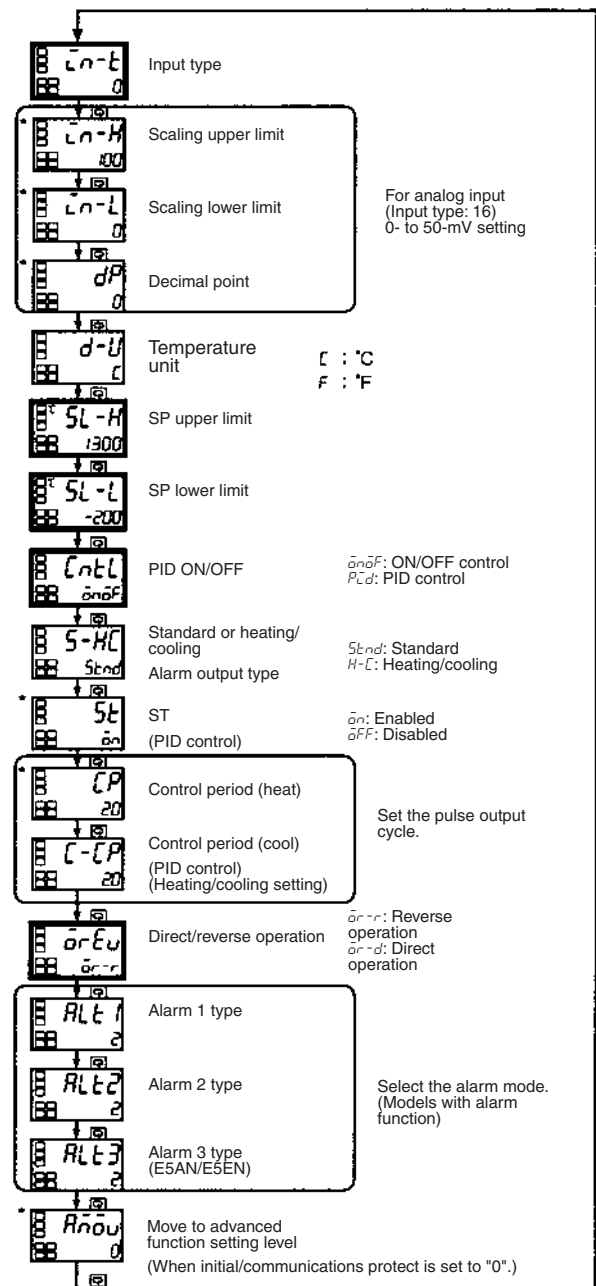


The move from the operation level to the initial setting level, press key for three seconds or more.

The initial setting level is not displayed when "initial/communications protection" is set to "2." This initial setting level can be used when "initial setting/communications protection" is set to "0" or "1."

The "scaling upper limit," "scaling lower limit," and "decimal point" parameters are displayed when an analog voltage input is selected as the input type.

Initial setting level



To return to the operation level, press the key for longer than one second.

* Not displayed as default setting.

Input Type

When using a thermocouple input type, follow the specifications listed in the following table.

	Input Type	Specifications	Set Value	Input Temperature Range	
Thermocouple input type	Thermocouple	K	0	-200 to 1300 (°C) / -300 to 2300 (°F)	
			1	-20.0 to 500.0 (°C) / 0.0 to 900.0 (°F)	
		J	2	-100 to 850 (°C) / -100 to 1500 (°F)	
			3	-20.0 to 400.0 (°C) / 0.0 to 750.0 (°F)	
		T	4	-200 to 400 (°C) / -300 to 700 (°F)	
		E	5	0 to 600 (°C) / 0 to 1100 (°F)	
		U	17	-199.9 to 400.0 (°C) / -199.9 to 700 (°F)	
		L	6	-100 to 850 (°C) / -100 to 1500 (°F)	
		U	7	-200 to 400 (°C) / -300 to 700 (°F)	
		U	18	-199.9 to 400.0 (°C) / -199.9 to 700 (°F)	
		N	8	-200 to 1300 (°C) / -300 to 2300 (°F)	
		R	9	0 to 1700 (°C) / 0 to 3000 (°F)	
	S	10	0 to 1700 (°C) / 0 to 3000 (°F)		
	B	11	100 to 1800 (°C) / 300 to 3200 (°F)		
		Infrared temperature sensor ES1A	K10 to 70°C	12	0 to 90 (°C) / 0 to 190 (°F)
			K60 to 120°C	13	0 to 120 (°C) / 0 to 240 (°F)
	K115 to 165°C		14	0 to 165 (°C) / 0 to 320 (°F)	
	K160 to 260°C		15	0 to 260 (°C) / 0 to 500 (°F)	
	Analog input	0 to 50mV	16	One of following ranges depending on the results of scaling: 1999 to 9999, 199.9 to 999.9	

Note: The initial settings are: 0: -200 to 1300°C/-300 to 2300°F.

When using the platinum resistance thermometer input type, follow the specifications listed in the following table.

	Input Type	Specifications	Set Value	Input Temperature Range
Platinum resistance thermometer input type	Platinum resistance thermometer	Pt100	0	-200 to 850 (°C) / -300 to 1500 (°F)
			1	-199.9 to 500.0 (°C) / -199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C) / 0.0 to 210.0 (°F)
		JPt100	3	-199.9 to 500.0 (°C) / -199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C) / 0.0 to 210.0 (°F)

Note: The initial settings are: 0: Pt100 -200 to 850°C/-300 to 1500°F.

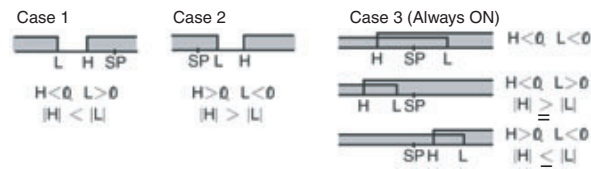
Alarm 1 and Alarm 2

For the alarm 1 and alarm 2, select alarm types out of the 12 alarm types listed in the following table. (The alarm 3 for E5AN/E5EN, which has three alarms, can also be selected from this table.)

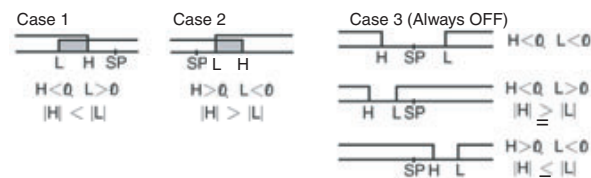
Set Value	Alarm Type	Alarm Output Operation	
		When X is positive	When X is negative
0	Alarm function OFF	Output OFF	
1 ^{*1}	Upper- and lower-limit (deviation)		*2
2	Upper-limit (deviation)		
3	Lower-limit (deviation)		
4 ^{*1}	Upper- and lower-limit range (deviation)		*3
5 ^{*1}	Upper- and lower-limit with standby sequence (deviation)		*4
6	Upper-limit with standby sequence (deviation)		
7	Lower-limit with standby sequence (deviation)		
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		

*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."
Following operations are for cases when an alarm set point is "X" or negative.

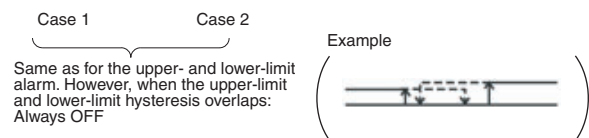
*2: Set value: 1, Upper- and lower-limit alarm



*3: Set value: 4, Upper- and lower-limit range



*4: Set value: 5, Upper- and lower-limit with standby sequence



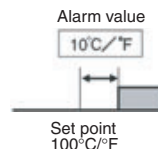
*5: Set value: 5, Upper- and lower-limit with standby sequence alarm. Always OFF when the upper-limit and lower-limit hysteresis overlaps.

Set the alarm types for alarm 1 and alarm 2 independently in the initial setting level. The default setting is 2 (upper limit). With the E5AN/E5EN, perform settings similarly for alarm 3.

Example: When the alarm is set ON at 110°C/°F or higher.

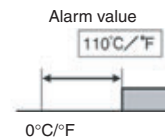
When an alarm type other than the absolute-value alarm is selected

(For alarm types 1 to 7)
The alarm value is set as a deviation from the set point.



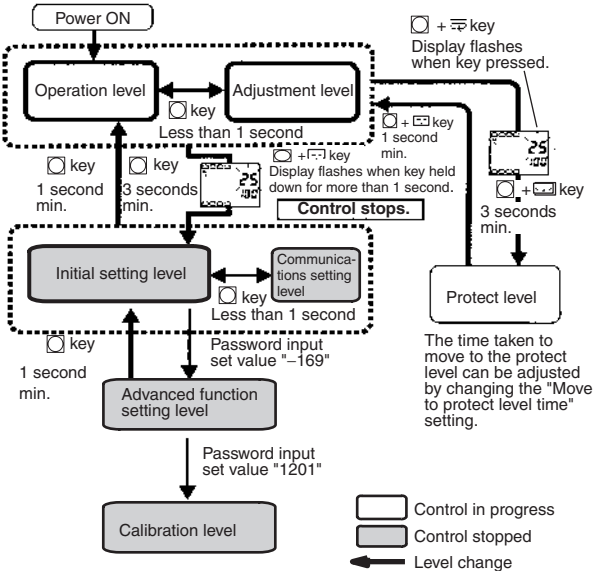
When the absolute-value alarm is selected

(For alarm types 8 to 11)
The alarm value is set as an absolute value from the alarm value of 0°C/F.



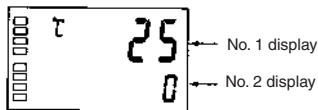
Parameters

Parameters related to setting items for each level are marked in boxes in the flowcharts and brief descriptions are given as required. At the end of each setting item, press the mode key to return to the beginning of each level.

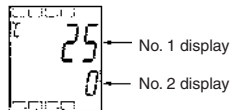


Display

E5AN



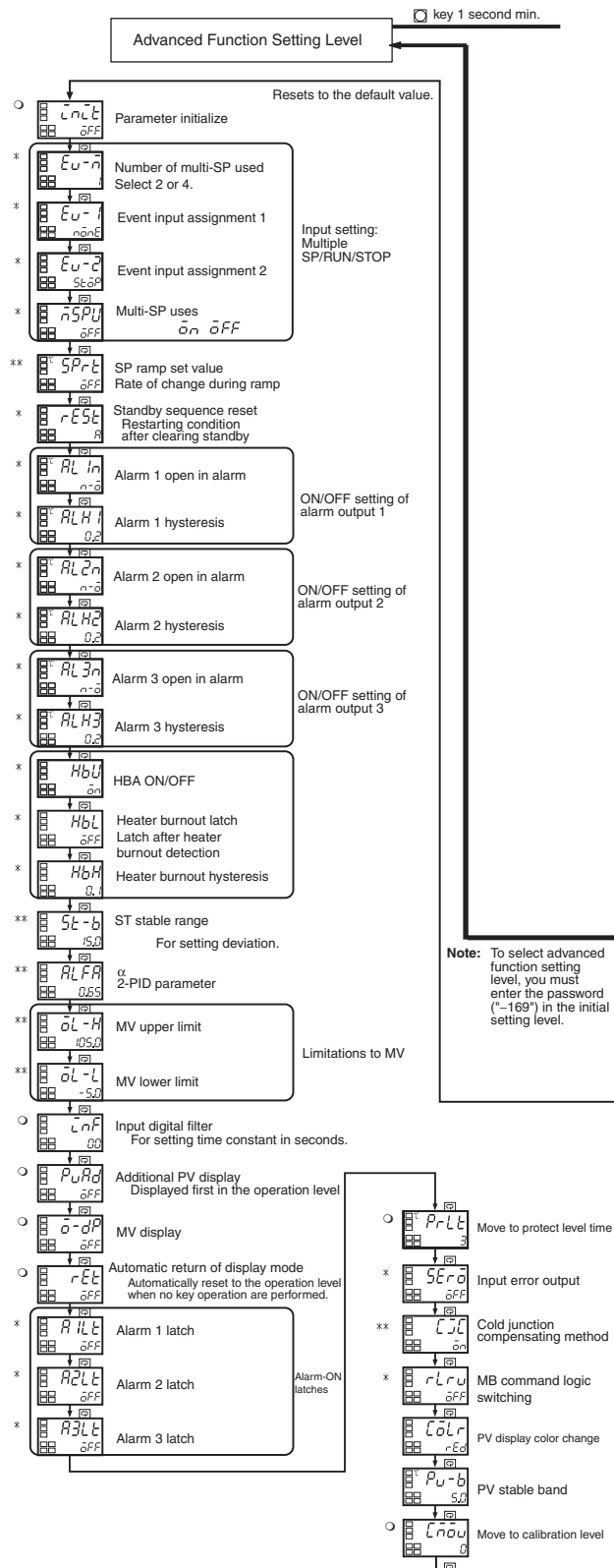
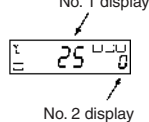
E5EN

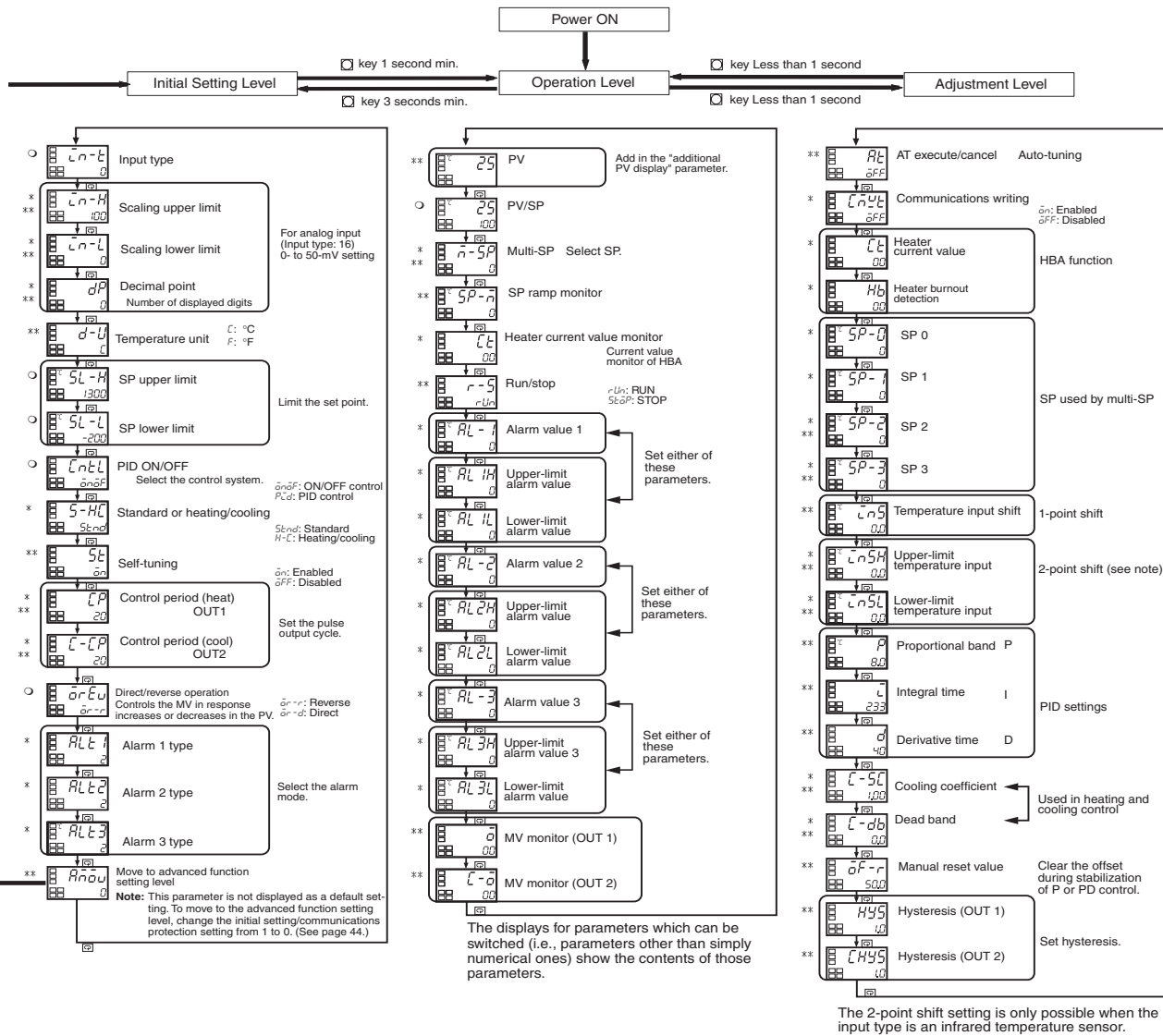


E5CN



E5GN





Note: These diagrams show all the parameters that may be displayed. Depending on the specifications of the model used, there may be some parameters that are not displayed. The following symbols are used to distinguish between these parameters.

- : Displayed for all models regardless of the settings of other parameters.
- x*: Not displayed for some models.
- x*: Depending on the settings of other parameters, may not be displayed.

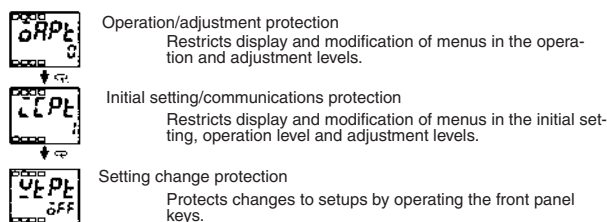
Input Shift

All points in the sensor range are shifted by the value set as the temperature input shift value.

Example

Input shift setting	Temperature measured by sensor	Temperature display
0 (no shift)	100°C	100°C
10 (shifted +10°C)	100°C	110°C
-10 (shifted -10°C)	100°C	90°C

Protect Level



Operation/Adjustment Protection

The following table shows the relationship between set values and the range of protection.

Level		Set value			
		0	1	2	3
Operation level	PV	○	○	○	○
	PV/SP	⊙	⊙	⊙	○
	Other	⊙	⊙	X	X
Adjustment level		⊙	X	X	X

When this parameter is set to “0,” parameters are not protected.

Default setting: 0

⊙: Can be displayed and changed

○: Can be displayed

X: Cannot be displayed and move to other levels not possible

Initial Setting/Communications Protection

This protect level restricts movement to the initial setting level, communications setting level and advanced function setting level.

Set value	Initial setting level	Communication s setting level	Advanced function setting level
0	○	○	○
1	○	○	X
2	X	X	X

Default setting: 1

○: Move to other levels possible

X: Move to other levels not possible

Setting Change Protection

This protect level protects setup from being changed by operating the keys on the front panel.

Set value	Description
OFF	Setup can be changed by key operation.
ON	Setup cannot be changed by key operation. (The protect level, can be changed.)

Default setting: OFF

Communications Setting Level

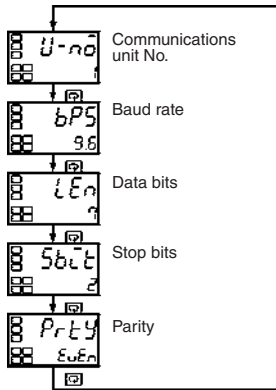
Set the E5AN/E5EN/E5CN/E5GN communications specifications in the communications setting level. For setting communications parameters, use the E5AN/E5EN/E5CN/E5GN panel. The communications parameters and their settings are listed in the following table.

Parameter	Displayed characters	Set (monitor) value	Set value
Communications unit No.	U-nō	0 to 99	0.1 to 99
Baud rate	bP5	1.2/2.4/4.8/9.6/19.2 (kbps)	1.2/2.4/4.8/9.6/19.2
Data bits	LEn	7/8 (bit)	7/8 (bit)
Stop bits	5bLl	1/2	1/2 (bit)
Parity	PrlY	None, even, odd	nōnE/LEnōdd

Note: The highlighted values indicate default settings.

Before executing communications with the E5AN/E5EN/E5CN/E5GN, set the communications unit No., baud rate, etc., through key operations as described below. As for other operations, refer to relevant Operation Manual.

1. Press the key for at least three seconds in the “operation level.” The level moves to the “initial setting level.”
2. Press the key for less than one second. The “initial setting level” moves to the “communications setting level.”
3. Pressing the key advances the parameters as shown in the following figure.
4. Press the or keys to change the parameter setups.



Note: On the E5AN/E5EN/E5GN, the Key is the Key.

Troubleshooting

When an error occurs, an error code will be displayed on the No. 1 display. Check the contents of an error and take appropriate countermeasures.

No.1 display	Contents	Countermeasure	Output status	
			Control output	Alarm output
SErr (S. Err)	Input error (See note.)	Check that the input wiring is correct, that there is no disconnection or short-circuit, and that the input type is correct. (Thermocouple input short-circuits cannot be detected.)	OFF	Handled as abnormally high temperature
	A/D converter error (See note.)	After noting the error, reset the power. If the display does not change, replacement is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
E111 (E111)	Memory error	Reset the power. If the display does not change, replacement is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
HErr (H. Err)	HB error (See note.)	Reset the power. If the display does not change, replacement is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF

Note 1. If the input is within the range for which control is possible but outside the displayable range (–1999 (–199.9) to 9999 (999.9)), will be displayed if the value is less than –1999 (–199.9), and will be displayed if it is greater than 9999 (999.9). Control output and alarm output will operate normally for either of these displays. Refer to the relevant User’s Manual for details on the ranges for which control is possible.

2. These errors are displayed only when the Controller is set to display the present value or the present value and the set value. They are not displayed in other statuses.

Set each communications parameter to match those of the communicating personal computer.

Communications Unit No. (U-nō)

When communicating with the host computer, the unit number must be set in each Temperature Controller so that the host computer can identify each Temperature Controller. The number can be set in a range from 0 to 99 in increments of 1. The default setting is 1. When using more than one Unit, be careful not to use the same number twice. Duplicate settings will cause malfunction. This value becomes valid when the power is turned OFF and ON again.

Baud Rate (bP5)

Use this parameter to set the speed of communications with the host computer. It can be set to one of the following values; 1.2 (1200 bps), 2.4 (2400 bps), 4.8 (4800 bps), 9.6 (9600 bps), and 19.2 (19200 bps). This setting becomes valid when the power is turned OFF and ON again.

Data Bits (LEn)

Use this parameter to change the communications data bit length to 7 bits or 8 bits.

Stop Bits (5bLl)

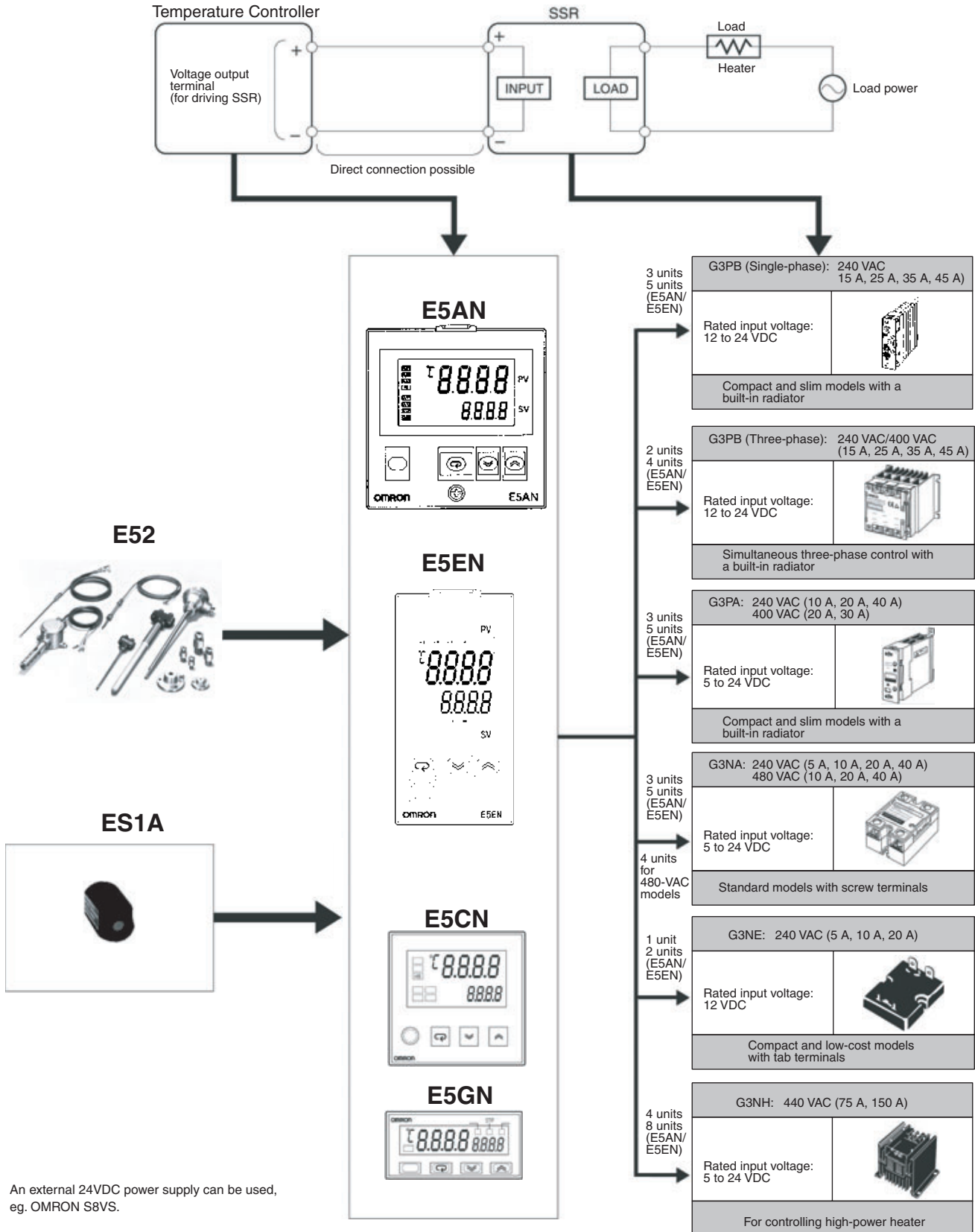
Use this parameter to change the communications stop bit to 1 or 2.

Parity (PrlY)

Use this parameter to set the communications parity to None, Even, or Odd.

Peripheral Devices

Temperature Sensor / SSR Connection Example with SSR



Responding to All Demands for Temperature Control in Wide Application Range

■ ES1A Infrared Temperature Sensor

Replaces the K-type thermocouple with no modification required.



Only One-tenth the Size of OMRON's Conventional Model

The ES1A-A is as compact as 14 x 18.6 x 34 (W x H x D) mm and can be built into machines and equipment with ease.

No Power Supply Required

The ES1A Series has electromotive output that is as high as the output of the thermocouple, thus allowing direct connection to the thermocouple input terminal of the Temperature Controller without requiring any external power supply.

ES1A-A	-25 to 70°C
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■ G3PB SSC for Three-phase Heaters

Compact, low-cost model for three-phase heater control.



Saves 40% on Installation Space

The G3PB is dedicated to three-phase heater control and saves 40% on installation space compared with three single-phase models mounted closely side-by-side. (This comparison is based on the use of three G3PA-240B-VD models and one G3PB-245B-3-VD.)

Note: Refer to the *G3PB Datasheet (J135)* for more details.

■ E52-series Temperature Sensors

Offers a Wide Variety of High-precision Temperature Sensors

- Used as Sensors for Temperature Controllers.
- Ensures easy selection of the most suitable model according to the temperature, place, and environment.
- Offers a wide variety of models that are different in type, appearance, length, and terminal shape.
- Low-cost models and dedicated models, as well as general-purpose models, are available.



Temperature Controller

Precautions

■ General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described here or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

■ Safety Precautions

Definition of Precautionary Information

—⚠ DANGER —

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

—⚠ WARNING —

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

—⚠ Caution —

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Installation Precautions

—⚠ WARNING —

Do not attempt to take any Temperature Controller apart while the power is being supplied. Doing so may result in electric shock.

—⚠ WARNING —

Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

—⚠ WARNING —

Do not allow pieces of metal or wire cuttings to get inside the Temperature Controller. Failure to do so may result in malfunction, electric shock or fire.

—⚠ WARNING —

Do not attempt to disassemble, repair, or modify the Temperature Controller. Any attempt to do so may result in malfunction, fire, or electric shock.

—⚠ Caution —

Do not use the Temperature Controller in locations subject to flammable gases. Doing so may result in an explosion.

—⚠ Caution —

The switching capacity and switching conditions will have a great effect on the longevity of the output relays. Use the Temperature Controller within the rated load and do not use the Temperature Controller beyond the number of operations specified under electrical life. Using the Temperature Controller beyond its electrical life may result in contact welding or burning.

—⚠ Caution —

Do not use the Temperature Controller at loads greater than the rated value. Doing so may result in burning or other damage.

—⚠ Caution —

Use a power supply voltage within the specified range. Failure to do so may result in burning or other damage.

—⚠ Caution —

Tighten the terminal screws to the following torques:

E5AN, E5EN, E5CN: 0.74 to 0.90 N·m

E5GN: Terminals 1 to 6: 0.23 to 0.25 N·m

Terminals 7 to 9: 0.12 to 0.14 N·m

Failure to tighten terminal screws to the correct torque may result in fire or malfunction.

—⚠ Caution —

Make settings for the Temperature Controller that are suitable for the controlled system. Failure to do so may cause unexpected operation resulting in damage to equipment or personal injury.

—⚠ Caution —

Prepare a circuit with an overheating prevention alarm and take other safety measures to ensure safe operation in the event of a malfunction. Loss of operational control due to malfunction may result in a serious accident.

■ Operating Environment Precautions

—⚠ Caution —

In order to ensure the safe operation, observe the following precautions.

- Do not use the Temperature Controller in the following places:
 - Locations exposed to radiated heat from heating devices
 - Locations subject to direct sunlight
 - Locations subject to temperatures or humidity outside the range specified in the specifications
 - Locations subject to condensation as the result of severe changes in temperature
 - Locations subject to corrosive or flammable gases
 - Locations subject to dust (especially iron dust) or salts
 - Locations subject to exposure to water, oil, or chemicals
 - Locations subject to shock or vibration
- Use and store the Temperature Controller within the rated temperature and humidity specified for each model. When two or more Temperature Controllers are mounted horizontally close to each other or vertically next to one another, the internal temperature will increase due to heat radiated by the Temperature Controllers and the service life will decrease. In such a case, forced cooling by fans or other means of air ventilation will be required to cool down the Temperature Controllers. When providing forced cooling, however, be careful not to cool down the terminal sections alone to avoid measurement errors.
- Allow enough space around the Temperature Controller to ensure proper heat dissipation. Do not block the ventilating holes.
- Check polarities and orientation when connecting terminals. Not doing so may result in malfunction.
- When wiring the E5AN, E5EN, or E5CN, use crimp terminals with the specified dimensions (M3.5, width 7.2 mm max.).

- When wiring the E5GN, use cables of a thickness AWG24 (0.205 mm²) to AWG14 (2.081 mm²) for terminals 1 to 6 and use cables of a thickness AWG28 (0.081 mm²) to AWG22 (0.326 mm²) for terminals 7 to 9. The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.
- Do not use empty terminals.
- To avoid inductive noise, keep the wiring for the Temperature Controller's terminal board away from power cables carry high voltages or large currents. Also, do not wire power lines together with or parallel to Temperature Controller wiring. Using shielded lines to separate pipes and ducts is recommended. Attach surge absorbers or noise filters to peripheral devices that may generate noise, such as inductance devices (e.g., motors, transformers, solenoids, magnetic coils etc.). If using a noise filter with the power supply, in addition to confirming the voltage and the current, mount the power supply as near as possible to the Temperature Controller. Set up the Temperature Controller, along with its power supply, as far away as possible from devices that generate strong, high-frequency waves (high-frequency welders, high-frequency machines etc.) and devices that generate surges.
- Set up the power supply so that the voltage will reach the rated voltage within 2 seconds after turning ON.
- Allow at least 30 minutes for the Temperature Controller to warm up.
- When using auto-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature Controller before turning ON power for the load, auto-tuning will not be performed properly and optimum control will not be achieved.
- In order that power can be turned OFF in an emergency by the person operating the Temperature Controller, install the appropriate switches and circuit breakers and label them accordingly.
- With the E5AN, E5EN, or E5CN, when drawing out the Temperature Controller body, do not touch or apply excessive force. After the body is drawn out do not touch the terminals or electronic parts. When inserting, make sure that electronic parts do not come in contact with the case.
- When the terminal block for the E5GN is detached, do not touch or apply excessive force to any electronic parts.
- Use alcohol to clean the Temperature Controller. Do not use thinner or other solvent-based substances.

■ Correct Use

Service Life

Use the Temperature Controller within the following temperature and humidity ranges:

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

Humidity: 25% to 85%

When the Temperature Controller is installed inside a control panel, ensure that the temperature around the Temperature Controller, not the temperature around the control panel, does not exceed 55°C.

The service life of relays used for the control output or alarm output largely varies depending on switching conditions. Be sure to confirm their performance under actual operating conditions and do not use them beyond the allowable number of switchings. If they are used in a deteriorated condition, insulation between circuits may be damaged and, as a result, the Temperature Controller itself may be damaged or burnt.

The service life of electronic devices such as Temperature Controllers is determined not only by the number of switchings of relays but also by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature becomes, the shorter the service life becomes and, the lower the temperature becomes, the longer the service life becomes. Therefore, the service life can be extended by lowering the temperature of the Temperature Controller using fans or other means of air ventilation. When providing forced cooling, however, be careful not to cool down the terminals sections alone to avoid measurement errors.

Measurement Accuracy

When extending or connecting the thermocouple lead wire, be sure to use compensating wires that match the thermocouple types.

When extending or connecting the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance.

When wiring the platinum resistance thermometer to the Temperature Controller, keep the wire route as short as possible. Separate this wiring away from the power supply wiring and load wiring to avoid inductive or other forms of noise.

Mount the Temperature Controller so that it is horizontally level.

If the measurement accuracy is low, check that input shift has been set correctly.

Waterproofing

The degree of protection is as shown below. Sections without any specification on their degree of protection or those with IP□0 have not been waterproofed.

Front panel: NEMA4 indoor use (equivalent to IP 66)

Rear case: IP 20

Terminal section: IP 00

Operating Precautions

It takes approximately four seconds for the outputs to turn ON from the moment the power is turned ON. Due consideration must be given to this time when incorporating Temperature Controllers in a sequence circuit.

When using auto-tuning, supply power to the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature Controller before turning ON power for the load, auto-tuning will not be performed properly and optimum control will not be achieved.

When starting operation after the Temperature Controller has warmed up, turn OFF the power and then turn it ON again at the same time as turning ON power for the load. (Instead of turning the Temperature Controller OFF and ON again, switching from STOP mode to RUN mode can also be used in this case.)

If the Temperature Controller is used close to radios, television sets or wireless devices it may affect reception.

In the case of Temperature Controllers with alarm outputs, alarm output may not be generated properly when an abnormality occurs in the device. It is suggested that a separate alarm device be incorporated in the system.

To ensure proper performance, parameters of the Temperature Controllers are set to default values before they are shipped. Change these parameters depending on actual applications. If left unchanged, the Temperature Controller will operate under the default settings.

Crimp Terminal Connection

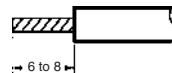
Use crimp terminals that match M3.5 screws. M3.5 x 8 self-rising screws are used.



Be careful not to excessively tighten the terminals screws.

Soldering Connection

The self-rising screws provide easy soldering connection. Strip the lead wire by a length of 6 to 8 mm and properly treat the terminal tip.



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H107-E1-08A

In the interest of product improvement, specifications are subject to change without notice.

Digital Controller E5CK

Advanced, Compact Digital Controllers

- IP66/NEMA4 (indoor use) front face.
- Modular structure, one-stock type.
- Heating/cooling control.
- Serial communications (RS-232C and RS-485).
- Temperature and analog inputs.
- High-accuracy: 100 ms sampling (for analog input).
- Advanced tuning which includes fuzzy self-tuning.
- Conforms to international EMC and safety standards.
- AC/DC24V types are also available.



Ordering Information

List of Models

Description	Model	Specification
Base Unit	E5CK-AA1 AC100-240	Base Unit
	E5CK-AA1-500 AC100-240	Base Unit with terminal cover
	E5CK-AA1 AC/DC24	Base Unit
	E5CK-AA1-500 AC/DC24	Base Unit with terminal cover

Note: A single Output Unit and Option Unit can be mounted to each Base Unit.

Description	Model	Specification
Output Unit	E53-R4R4	Relay/Relay
	E53-Q4R4	Pulse (NPN)/Relay
	E53-Q4HR4	Pulse (PNP)/Relay
	E53-C4R4	Linear (4 to 20 mA)/Relay
	E53-C4DR4	Linear (0 to 20 mA)/Relay
	E53-V44R4	Linear (0 to 10 V)/Relay
	E53-Q4Q4	Pulse (NPN)/Pulse (NPN)
	E53-Q4HQ4H	Pulse (PNP)/Pulse (PNP)

Description	Model	Specification
Option Unit	E53-CK01	RS-232C
	E53-CK03	RS-485
	E53-CKB	Event input: 1 point
	E53-CKF	Transfer output (4 to 20 mA)

Inspection Report

The Digital Controller can be provided together with an inspection report.

Refer to the following legend with the suffix "K" when ordering a model provided together with an inspection report.

E5CK-AA1-K, E53-CKF-K

Accessories (Order Separately)

Name	Model
Terminal Cover	E53-COV07

Temperature Controller

Specifications

■ Ratings

Item	AC100-240V type	AC/DC24V type
Supply voltage	AC100 to 240V, 50/60 Hz	AC/DC24V, 50/60 Hz
Power consumption	15 VA	6 VA, 3.5 W
Operating voltage range	85% to 110% of rated supply voltage	
Input	Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII Platinum resistance thermometer: JPt100, Pt100 Current input: 4 to 20 mA, 0 to 20 mA Voltage input: 1 to 5 V, 0 to 5 V, 1 to 10 V	
Input impedance	Current input: 150 Ω Voltage input: 1 MΩ min.	
Control output	According to Output Unit (see "Output Unit Ratings and Characteristics")	
Auxiliary output	SPST-NO, 1 A at 250 VAC (resistive load)	
Control method	ON/OFF or 2-PID control (with auto-tuning)	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and LEDs	
Other functions	According to Option Unit (see "Option Unit Ratings and Characteristics")	

■ Input Ranges

Platinum Resistance Thermometer

Input (switch selectable)	JPt100	Pt100	
Range	°C	-199.9 to 650.0	-199.9 to 650.0
	°F	-199.9 to 999.9	-199.9 to 999.9
Resolution (°C/°F) (main setting and alarm)	0	1	

Thermocouple

Input (switch selectable) (see note)	K1	K2	J1	J2	T	E	L1	L2	U	N	R	S	B	W	PLII	
Range	°C	-200 to 1,300	0.0 to 500.0	-100 to 850	0.0 to 400.0	-199.9 to 400.0	0 to 600	-100 to 850	0.0 to 400.0	-199.9 to 400.0	-200 to 1,300	0 to 1,700	0 to 1,700	100 to 1,800	0 to 2,300	0 to 1,300
	°F	-300 to 2,300	0.0 to 900.0	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	0 to 1,100	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	-300 to 2,300	0 to 3,000	0 to 3,000	300 to 3,200	0 to 4,100	0 to 2,300
Resolution (°C/°F) (main setting and alarm)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Note: Setting number is factory-set to 2 (K1).
Thermocouple W is W/Re 5-26 (tungsten rhenium 5, tungsten rhenium 26).

Current/Voltage

Input (switch selectable)	Current input		Voltage input		
	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V
Range	One of following ranges depending on results of scaling -1999 to 9999 -199.9 to 999.9 -19.99 to 99.99 -1.999 to 9.999				
Resolution (°C/°F) (main setting and alarm)	17	18	19	20	21

■ Characteristics

Indication accuracy (see note)	Thermocouple: (±0.3% of indication value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indication value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Proportional band (P)	0.1% to 999.9% FS (in units of 0.1% FS)
Integral (reset) time (I)	0 to 3,999 s (in units of 1 s)
Derivative (rate) time (D)	0 to 3,999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0% to 100.0% (in units of 0.1%)
Alarm setting range	-1,999 to 9,999 or -199.9 or 999.9 (decimal point position dependent on input type)
Sampling period	Temperature input: 250 ms Current/voltage input: 100 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between terminals of different polarities
Vibration resistance	Malfunction: 10 to 55 Hz, 10 m/s ² (approx. 1G) for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 20 m/s ² (approx. 2G) for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 200 m/s ² min. (approx. 20G), 3 times each in 6 directions (100 m/s ² (approx. 10G) applied to the relay) Destruction: 300 m/s ² min. (30G), 3 times each in 6 directions
Ambient temperature	Operating: -10°C to 55°C (with no icing)/3-year warranty period: -10°C to 50°C Storage: -25°C to 65°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Degree of protection	Front panel: NEMA4 for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (number of writings: 100,000 operations)
Weight	Approx. 170 g; Adapter: approx. 10 g
EMC	Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards	UL1092, CSA22.2 No. 142, CSA22.2 No. 1010-1 Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC1010-1) Conforms to VDE0106/part 100 (Finger Protection), when the separately-ordered terminal cover is mounted.

Note: The indication accuracy of the K1, T, and N thermocouples at a temperature of -100°C or less is ±2°C ±1 digit maximum. The indication accuracy of the U, L1, and L2 thermocouples at any temperature is ±2°C ±1 digit maximum.
The indication accuracy of the B thermocouple at a temperature of 400°C or less is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.
The indication accuracy of the W thermocouple at any temperature is (±0.3% of the indicated value or ±3°C, whichever is greater) ±1 digit maximum.
The indication accuracy of the PLII thermocouple at any temperature is (±0.3% or ±2°C, whichever is greater) ±1 digit maximum.

■ Output Unit Ratings and Characteristics

Relay output	SPST, 250 VAC, 3 A (resistive load) Mechanical life expectancy: 10,000,000 operations min. Electrical life expectancy: 100,000 operations min.
Voltage output	NPN: 20 mA at 12 VDC (with short-circuit protection) PNP: 20 mA at 12 VDC (with short-circuit protection)
Linear voltage output	0 to 10 VDC: Permissible load impedance: 1 k Ω min. Resolution: approx. 2,600
Linear current output	4 to 20 mA: Permissible load impedance: 500 Ω max. Resolution: approx. 2,600

■ Option Unit Ratings and Characteristics

Event inputs	Contact input: ON: 1 k Ω max., OFF: 100 k Ω min. No-contact input: ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max.
Communications	Interface: RS-232C or RS-485 Transmission method: Half-duplex Synchronization method: Start-stop synchronization (asynchronous method) Baud rate: 1.2/2.4/4.8/9.6/19.2 kbps Transmission code: ASCII
Transfer output	4 to 20 mA: Permissible load impedance: 500 Ω max. Resolution: approx. 2,600

Nomenclature

Operation Indicators

- **OUT1**
Lights when the pulse output function assigned to control output 1 turns ON.
- **OUT2**
Lights when the pulse output function assigned to control output 2 turns ON.
- **SUB1**
Lights when the output function assigned to auxiliary output 1 turns ON.
- **MANU**
Lights when the manual operation mode.
- **STOP**
Lights during operation has stopped.
- **RMT**
Lights during remote operation.
- **AT**
Flashes during auto-tuning.



No. 1 Display

Displays the process value or parameter symbols.

No. 2 Display

Displays the set point, set point during SP ramp, manipulated variable, or parameter settings.

Up Key/Down Key

Press to increase or decrease the value on the No.2 display.

Display Key

Press for less than 1 s to shift the display to the next parameter. When this key is pressed for 1 s or more, the menu screen will be displayed in any case.

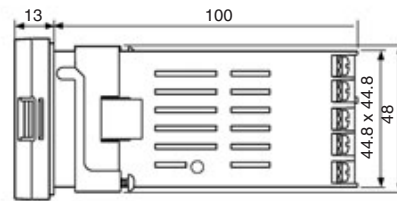
A/M Key

Press to select the auto operation or manual operation.

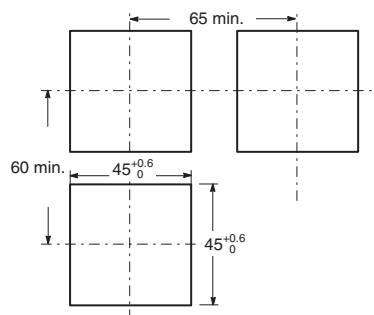
Dimensions

Note: All units are in millimeters unless otherwise indicated.

E5CK



Panel Cutouts

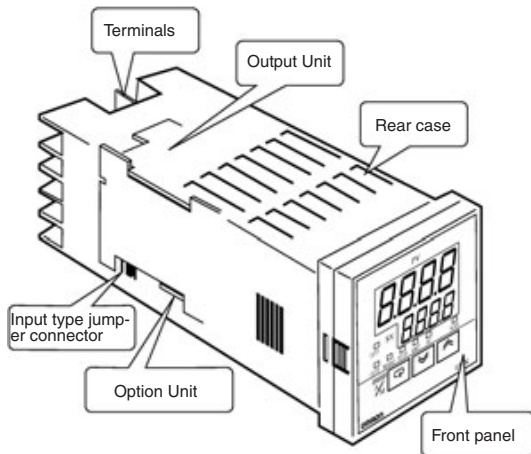


- Note:**
1. Recommended panel thickness is 1 to 5 mm.
 2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

Installation

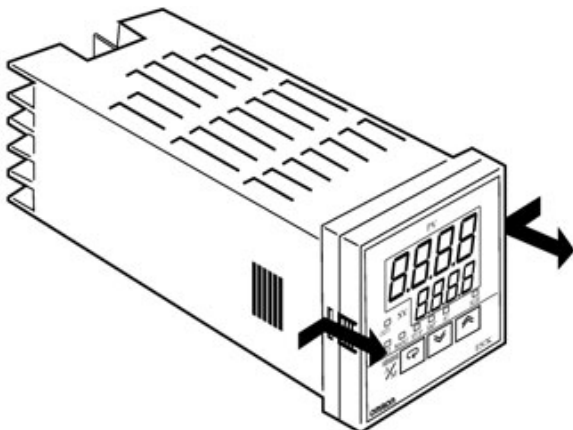
■ Installation

Main Parts



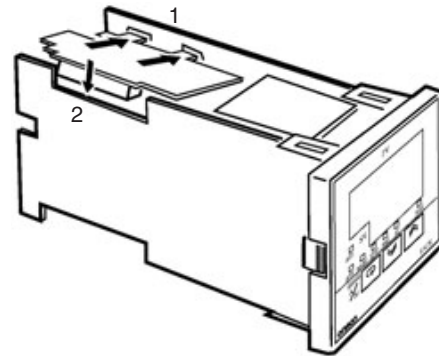
Draw-out

First, draw out the internal mechanism from the housing. Pull out the internal mechanism while pressing the hooks on the left and right sides of the front panel.



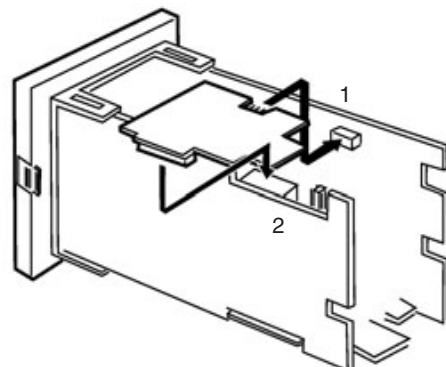
Setting Up the Output Unit

1. Two rectangular holes are provided on the power board (right side of Controller). Fit the two protrusions of the Output Unit into these two holes.
2. With the Output Unit fitted into the power board, fit the Output Unit into the connector on the control board (left side of Controller).



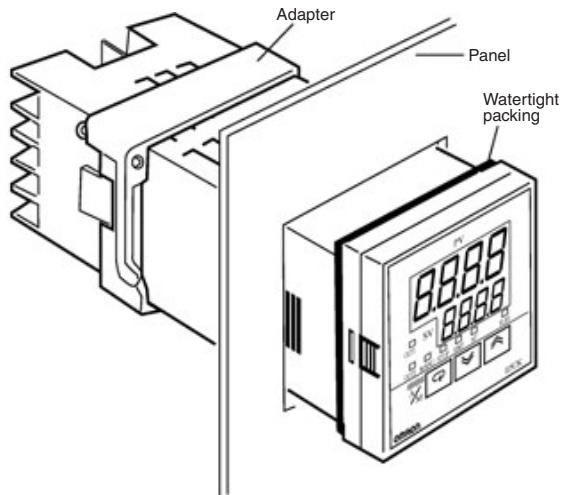
Setting Up the Option Unit

1. Place the Controller with its bottom facing up, and fit the board horizontally into the Connector on the power board (right side of controller).
2. With the power board connected, fit the board vertically into the Connector on the control board (left side of controller).



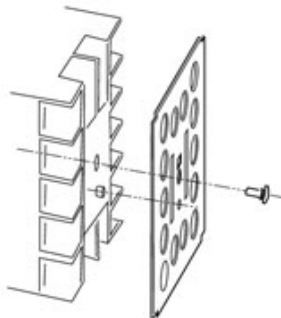
■ Mounting

1. Insert the E5CK Controller into the panel's mounting hole at the position shown in the figure below.
2. Push the adapter along the Controller body from the terminals up to the panel, and fasten temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to approximately 0.29 to 0.39 N·m, or 3 to 4 kgf·cm.



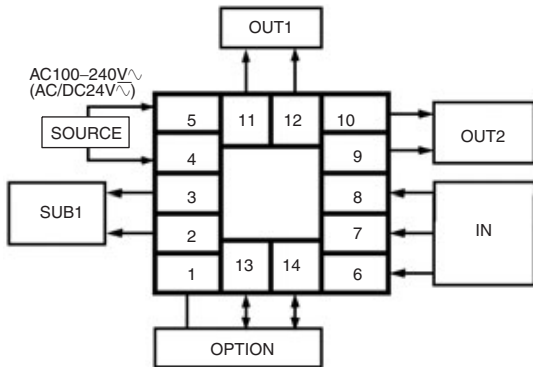
Terminal Cover

The E5CK-AA1-500 Controller is provided with a Terminal Cover (E53-COV07). Fasten the Terminal Cover as follows by using the snap pin.



Wiring

Terminal Arrangement

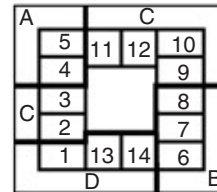


Solderless terminals are recommended when wiring the Controller. Tighten the terminal screws using a torque no greater than 0.78 N·m, or 8 kgf·cm max. Take care not to tighten the terminal screws too tightly.

Power Blocks

The E5CK has independent power supplies for each of the terminal blocks shown below. However, note that the power supplies for blocks C (exclude relay output) and D are shared for the following option unit.

- Option unit: E53-CKB or E53-CKF



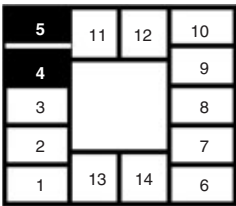
Precautions

Use ducts to separate input leads and power lines in order to protect the Controller and its lines from external noise.

Wiring

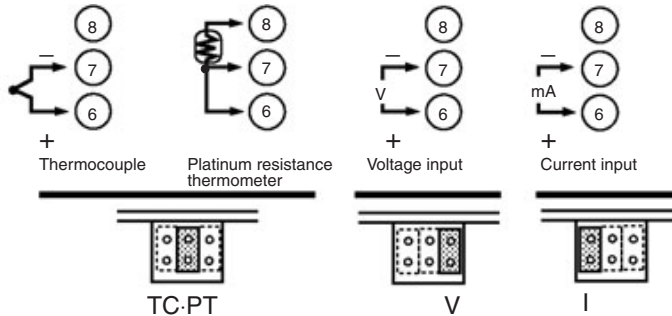
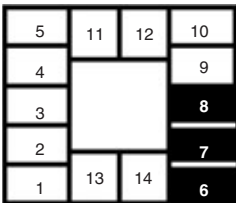
Power Supply

Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 4 and 5 according to the specification. Recommended 24VDC power supply; eg. OMRON S8VS.



Input

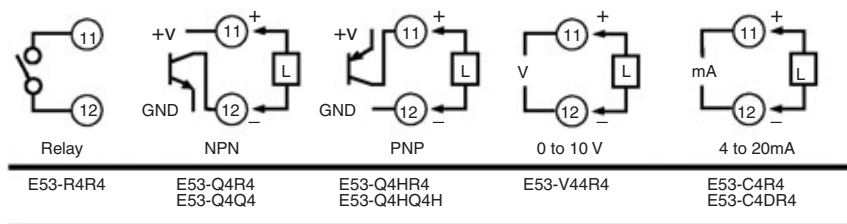
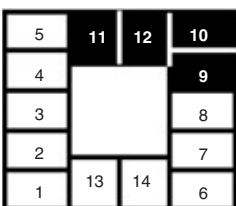
Connect the input to terminal numbers 6 to 8 as follows according to the input type.



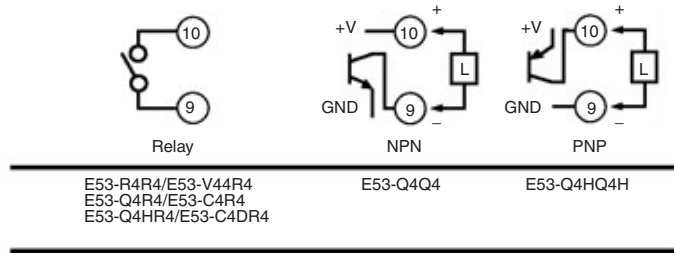
Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the inputs to a common position (TC/PT) as the temperature input.

Control Output

Terminal numbers 11 and 12 are for control output 1 (OUT1). The five output types and internal equalizing circuits are available according to the Output Unit.



Terminal numbers 9 and 10 are for control output 2 (OUT2). The three output types and internal equalizing circuits are available according to the Output Unit.



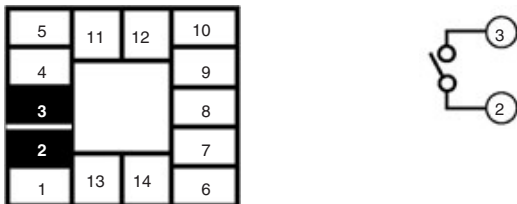
The following table shows the specifications for each output type.

Output type	Specifications
Relay	3 A at 250 VAC
Voltage (NPN)	20 mA at 12 VDC (with short-circuit protection)
Voltage (PNP)	20 mA at 12 VDC (with short-circuit protection)
0 to 10 V 4 to 20 mA	0 to 10 VDC, permissible load impedance: 1 kΩ min., resolution: approx. 2,600 4 to 20 mA, permissible load impedance: 500 Ω max., resolution: approx. 2,600

Auxiliary Output 1

Terminal numbers 2 and 3 are for auxiliary output 1 (SUB1).

The internal equalizing circuit for auxiliary output 1 is as follows:

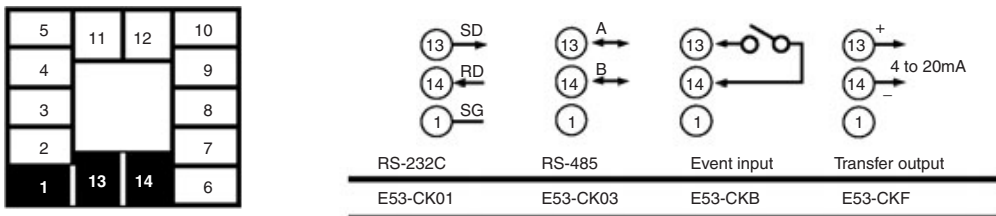


Relay specifications are as follows:
SPST-NO, 250 VAC, 1 A

Option

Terminal numbers 1, 13, and 14 are valid only when the Option Unit is set in the Controller.

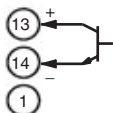
The following four connections are possible depending on the model of the Option Unit.



Use event inputs under the following conditions:

Contact input	ON: 1 kΩ max., OFF: 100 kΩ min.
No-contact input	ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max.

The polarity for no-contact input is as follows:



Transfer output specifications are as follows:

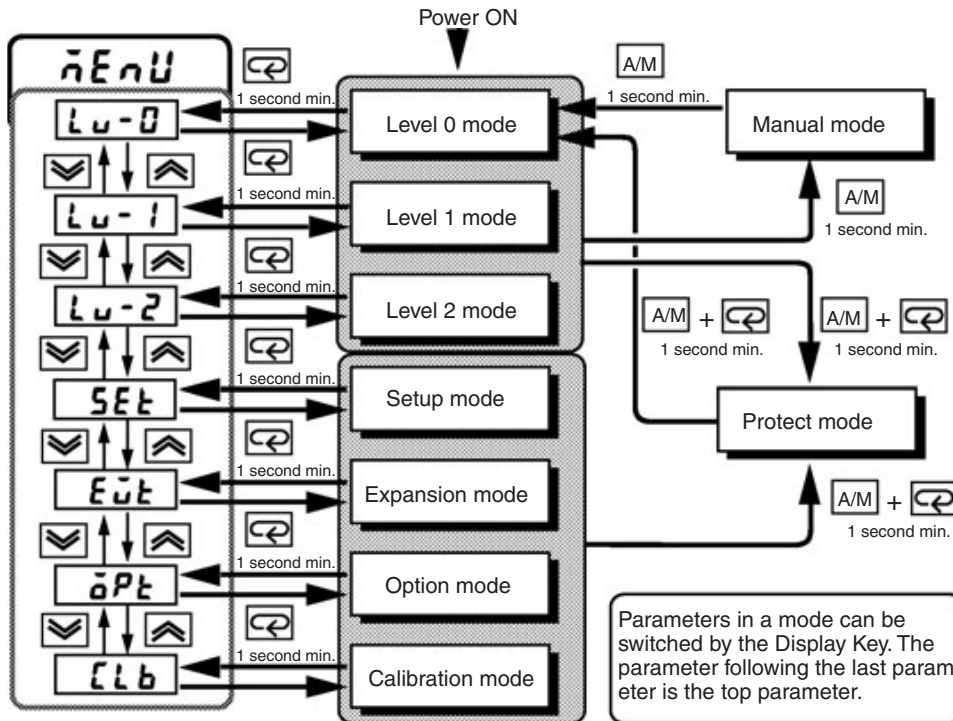
4 to 20 mA, load: 500 Ω max., resolution approx. 2600

Operation

Parameter Operation List

Switching to modes other than manual or protect mode is carried out using mode selection in the menu display.

The figure below shows all parameters in the order that they are displayed. Some parameters are not displayed depending on the protect mode setting and conditions of use.



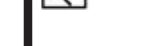
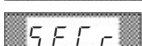
Parameters and Menus

Note: For more details on the functions of each part and display contents, refer to the *E5CK User's Manual (H78)*.

- Protect Mode** Limits use of the menu and A/M Keys. The protect function prevents unwanted modification of parameters and switching between the auto and manual operation.
- Manual Mode** The Controller can be switched to manual operation. The manipulated variable can be manipulated manually only in this mode.
- Level 0 Mode** Set the Controller to this mode during normal operation. In this mode, change the set point during operation, and start or stop Controller operation. The process value, SP ramp, and manipulated variable can only be monitored in this mode.
- Level 1 Mode** The main mode for adjusting control. In this mode, execute AT (auto-tuning), and set alarm values, the control period, and PID parameters.
- Level 2 Mode** The auxiliary mode for adjusting control. In this mode, set the parameters for limiting the manipulated variable and set point, switch between the remote and local modes, and set the loop break alarm (LBA), alarm hysteresis, and the digital filter value of inputs.
- Setup Mode** The mode for setting the basic specifications. In this mode, set parameters that must be checked or set before operation such as the input type, scaling, output assignments and direct/reverse operation.
- Expansion Mode** The mode for setting expanded functions. In this mode, set ST (self-tuning), SP setting limiter, select advanced PID or ON/OFF control, specify the standby sequence resetting method, initialize parameters, and set the time for automatic return to the monitoring display.
- Option Mode** The mode for setting option functions. Select this mode only when the Option Unit is set in the Controller. In this mode, set the communications conditions, transfer output and event input parameters to match the type of Option Unit set in the Controller.
- Calibration Mode** The mode for calibrating inputs and transfer output. When calibrating input, the selected input type is calibrated. Whereas, transfer output can be calibrated only when the Communications Unit (E53-CKF) is set in the Controller.

Parameters Operation

Level 0 Mode



PV/SV

The process value is displayed on the No.1 display and the set point is displayed on the No.2 display. When the multi-SP function is in use, the value of whichever is set, set point 0 or 1, is linked.

Set Point During SP Ramp

Monitors the set point when the SP ramp function is used.

MV Monitor (Heat)

MV Monitor (Cool)

Used when the Unit is in heating and cooling control operation.

Run/Stop

Security

Any mode marked with "X" in the following table is not displayed on the menu when this parameter is set to "0" to "3."

Mode	Set value				
	0	1	2	3	4
Calibration		x	x	x	x
Option			x	x	x
Expansion			x	x	x
Setup			x	x	x
Level 2				x	x
Level 1, 0					x

The Unit will be in only level 0 mode and the menu will not be available when this parameter is set to "4" to "6."

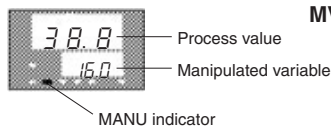
Only the "PV/SP monitor" and "set point" parameter can be used when this parameter is set to "5."

Only the "PV/SP monitor" parameter can be used when this parameter is set to "6."

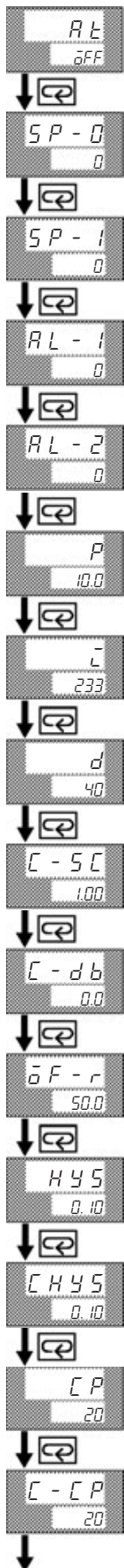
A/M Key Protect

Invalidate the function of the A/M Key.

MV Manual



Level 1 Mode



AT Execute/Cancel

Set Point 0

Used with multi-SP function.

Set Point 1

Used with multi-SP function.

Alarm Value 1

Available only when the alarm output function of the Controller is selected.

Alarm Value 2

Available only when the alarm output function of the Controller is selected.

Proportional Band

Integral Time

Derivative Time

Cooling Coefficient

Used when the Controller is in heating and cooling control.

Dead Band

Used when the Controller is in heating and cooling control.

Manual Reset Value

Available when the integral time parameter of the Controller in standard control is "0."

Hysteresis (Heat)

Available when the Controller is in ON/OFF control.

Hysteresis (Cool)

Available when the Controller is in ON/OFF control in heating and cooling control.

Control Period (Heat)

Available when the Controller has a relay or voltage output, and is in advanced PID control.

Control Period (Cool)

Available when the Controller has a relay or voltage output, and is in advanced PID control in heating and cooling control.

Level 2 Mode



Remote/Local

Used for the communications function.

SP Ramp Time Unit

SP Ramp Set Value

LBA Detection Time

Available only when the LBA (loop break alarm) function of the Controller is selected.

MV at Stop

MV at PV Error

MV Upper Limit

MV Lower Limit

MV Change Rate Limit

Input Digital Filter

Alarm 1 Hysteresis

Available only when the Controller has an alarm output.

Alarm 2 Hysteresis

Available only when the Controller has an alarm output.

Input Shift Upper Limit

Available if the input type connected to the Controller is a thermocouple or platinum resistance thermometer.

Input Shift Lower Limit

Available if the input type connected to the Controller is a thermocouple or platinum resistance thermometer.

Setup Mode



Input Type

Codes are used to determine the input types connected to terminals 6 to 8.

Scaling Upper Limit

Used if the input type connected to the Controller is an analog input (voltage or current input).

Scaling Lower Limit

Used if the input type connected to the Controller is an analog input (voltage or current input).

Decimal Point

Used if the input type connected to the Controller is an analog input (voltage or current input).

°C/°F Selection

Used if the input type connected to the Controller is a temperature input (thermocouple or platinum resistance thermometer).

Parameter Initialize

Control Output 1 Assignment

Enables the Controller to have heating control, cooling control, alarm 1, alarm 2, alarm 3, and LBA (loop break alarm) outputs.

Control Output 2 Assignment

Enables the Controller to have heating control, cooling control, alarm 1, alarm 2, alarm 3, and LBA (loop break alarm) outputs.

Auxiliary Output 1 Assignment

Enables the Controller to have alarm 1, alarm 2, alarm 3, LBA (loop break alarm), error 1, and error 2 outputs.

Alarm 1 Type

Available only when the Controller has an alarm output (see the table on the next page).

Alarm 1 Open in Alarm

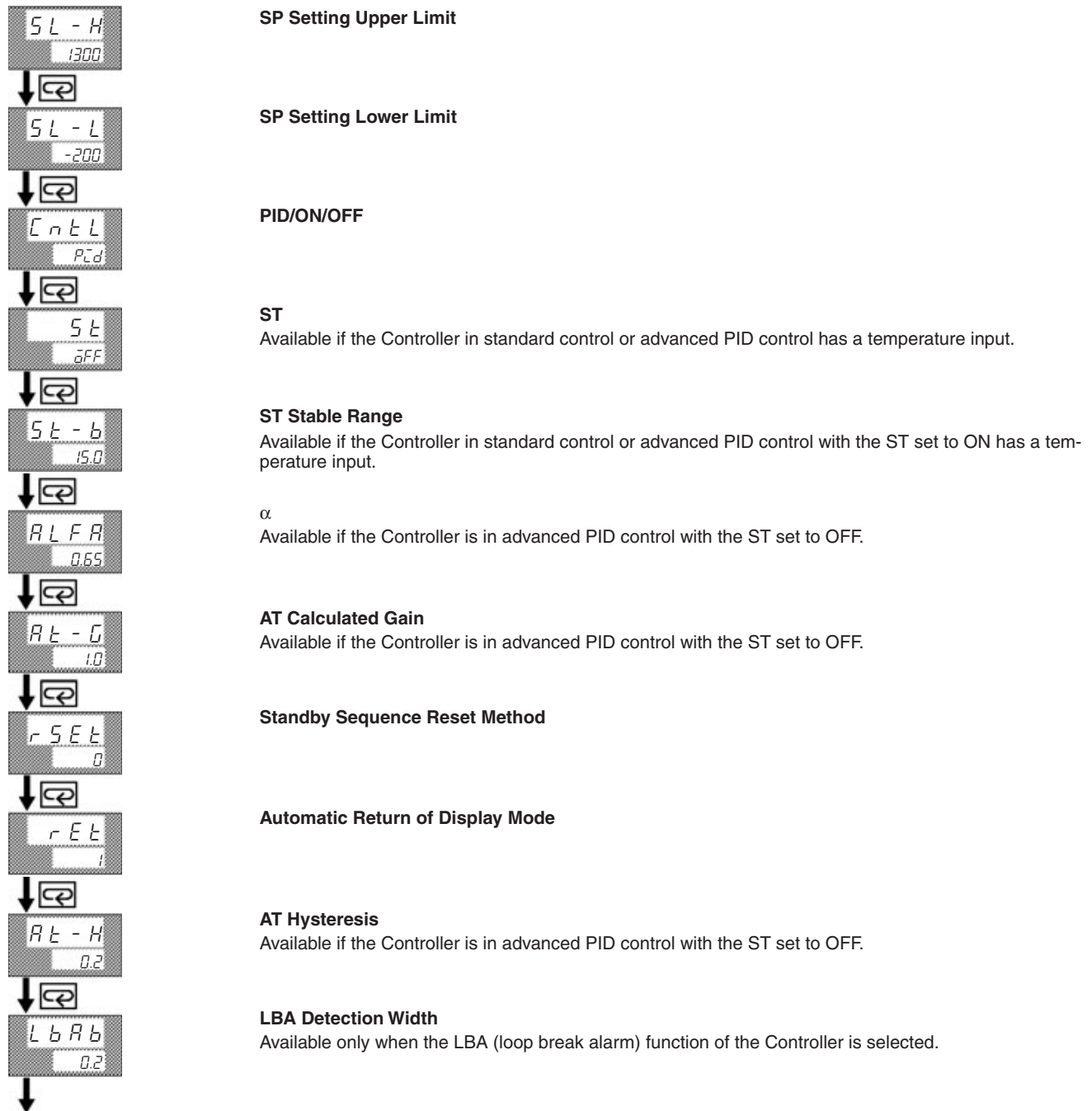
Alarm 2 Type

Alarm 2 Open in Alarm

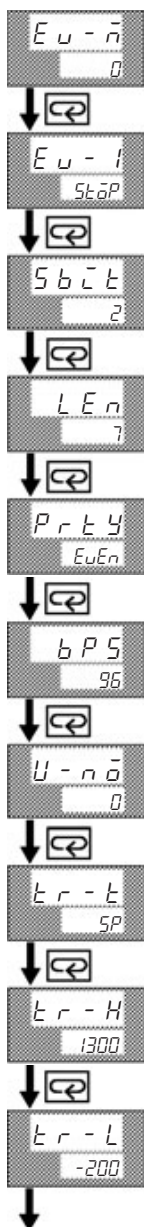
Direct/Reverse Operation

Switch setting	Alarm operation	Alarm output	
		When X is positive	When X is negative
1	Upper- and lower-limit alarm (deviation)		Always ON
2	Upper-limit alarm (deviation)		
3	Lower-limit alarm (deviation)		
4	Upper- and lower-limit range alarm (deviation)		Always OFF
5	Upper- and lower-limit alarm with standby sequence (deviation)		Always OFF
6	Upper-limit alarm with standby sequence (deviation)		
7	Lower-limit alarm with standby sequence (deviation)		
8	Absolute-value upper-limit alarm		
9	Absolute-value lower-limit alarm		
10	Absolute-value upper-limit alarm with standby sequence		
11	Absolute-value lower-limit alarm with standby sequence		

Expansion Mode



Option Mode



Multi-SP Function

Available for the event input function.

Event Input Assignment 1

Available for the event input function.

Communication Stop Bit

Used when the communications function is being used.

Communication Data Length

Used when the communications function is being used.

Communication Parity

Used when the communications function is being used.

Communication Baud Rate

Used when the communications function is being used.

Communication Unit No.

Used when the communications function is being used.

Transfer Output Type

Set when the transfer output function is being used.

Transfer Output Upper Limit

Set when the transfer output function is being used.

Transfer Output Lower Limit

Set when the transfer output function is being used.

■ How to Use the Error Display

When an error has occurred, the No.1 display alternately indicates error codes together with the current display item. This section describes how to check error codes on the display, and the actions that must be taken to remedy the problem.

Input Error

Meaning	Input is in error.
Action	Check the wiring of inputs, disconnections, and shorts, and check the input type and the input type jumper connector.
Operation at Error	For control output functions, output the manipulated variable matched to the setting of the "MV at PV error" parameter (level 2 mode). Alarm output functions are activated when the upper limit is exceeded.

Memory Error

Meaning	Internal memory operation is in error
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5CK Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.

A/D Converter Error

Meaning	Internal circuits are in error.
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5CK Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.

Calibration Data Error

Meaning	This error is output only during temperature input and is displayed for two seconds when the power is turned ON. Calibration data is in error.
Action	Must repair.
Operation at Error	Both control output functions and alarm output functions are active. However, note that the readout accuracy is not assured.

Display Range Over

Meaning	Though not an error, this is displayed when the process value exceeds the display range when the control range (setting range $\pm 10\%$) is larger than the display range (-1999 to 9999). <ul style="list-style-type: none"> When less than "-1999" When greater than "9999"
Operation	Control continues, allowing normal operation.

■ Fuzzy Self-tuning

Fuzzy self-tuning is a function that enables the E5CK to calculate the most suitable PID constants for the controlled object.

Features

- The E5CK determines by itself when to perform fuzzy self-tuning.

Fuzzy Self-tuning Function

The fuzzy self-tuning function has three modes.

In SRT (step response tuning) mode, the PID constants are tuned using a step response method at the time the set point is changed.

In DT (disturbance tuning) mode, the PID constants are amended so that the controlled temperature will be within the target range set in advance when there is external disturbance.

In HT (hunting tuning) mode, when hunting occurs, the PID constants are amended to suppress the hunting.

Note: Be sure to turn on the power supply to the load either before or simultaneously with the start of Temperature Controller operation.

Dead time will be measured from the time the Temperature Controller starts operating. If a load such as a heater is turned on after the Temperature Controller is turned on, dead time longer than the actual value will be measured and inappropriate PID constants will be obtained. If an extremely large amount of dead time is measured, the control amount will be set to 0% for a short period of time before being returned to 100%, and the constants will then be returned. Retuning is performed only for large amounts of dead time, so be sure to follow the precaution given above when starting operation.

Startup Conditions of SRT

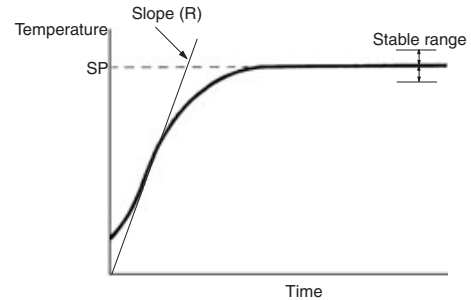
SRT will start if the following conditions are satisfied simultaneously when the E5CK is turned on or the set point is changed.

At the time the E5CK starts operating	At the time set point is changed
<ol style="list-style-type: none"> 1. The set point at the time the E5CK starts operating is different from the set point used at the time SRT was last executed (see note). 2. The process value at the time the E5CK starts operating is smaller than the set point in reverse operation and larger than the set point in normal operation. 	<ol style="list-style-type: none"> 1. The new set point is different from the set point used at the time SRT was last executed (see note). 2. The process value is in stable condition before the set point is changed. 3. A larger set point value is set in reverse operation and a smaller set point is set in normal operation.

Note: The last SRT-executed set point is set to 0 before shipping and when changing from advanced PID control to advanced PID control with fuzzy self-tuning.

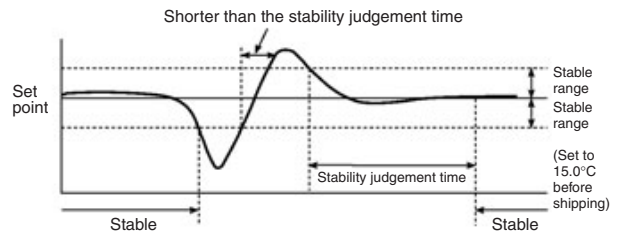
PID Constant Refreshing Conditions

If the step control amount is applied before the maximum temperature slope (R) is obtained, SRT will not renew any PID constant. If the proportional band obtained from the R and L values that were measured before the imposition had been completed is larger than the present proportional band, the PID constants will be renewed because the measured value is in the direction towards the suitable proportional band value, and the set point at that time will be the SRT-executed set point.



Stable Temperature Status

If the temperature is within the stable range for a certain time, it is deemed that the temperature is stable. This time is called stability judgement time. Like PID constants, stability judgement time is adjusted with fuzzy self-tuning according to the characteristics of the object to be controlled. Fuzzy self-tuning will not be activated if the temperature is stable because the Temperature Controller deems that temperature control is smooth.

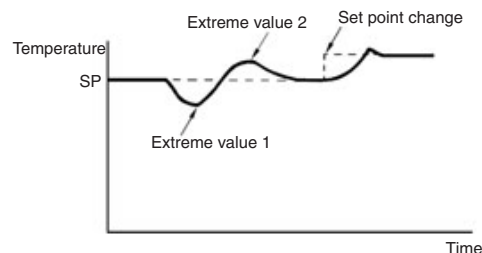


Balanced Status

If the process value is within the stable range for 60 s when there is no output, it is deemed that the temperature is balanced.

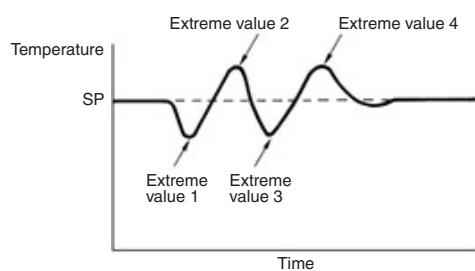
Startup Conditions of DT

1. DT will start if the temperature that has been stable varies due to external disturbance and the deflection of the temperature exceeds the stable range, and then the temperature becomes stable, provided that the number of maximum temperature values is less than four.
2. DT will start if the set point is changed under the condition that SRT does not start and the temperature becomes stable, provided that the number of maximum temperature values is less than four.
If there are four or more maximum temperature values, HT will start.



Startup Conditions of HT

HT will be ON when there is hunting with four or more maximum temperature values (extreme values) while SRT is not being executed.



Note: In specific applications where temperature varies periodically due to disturbance, internal parameters need to be adjusted. For details, refer to the *E5CK User's Manual*.

Precautions

■ Period and Scope of Guarantee

Unit with Standard Specifications

Scope of Guarantee

Should the Unit malfunction during the guarantee period, OMRON shall repair the Unit or replace any parts of the Unit at the expense of OMRON.

The above does not apply in the following cases.

1. Any malfunction of the Unit due to the incorrect use or improper handling of the Unit.
2. Any malfunction of the Unit not originating from the Unit.
3. Any malfunction of the Unit due to a modification of the Unit or repairs to the Unit carried out by any person not authorized by OMRON.
4. Any malfunction of the Unit due to any natural disaster.

OMRON shall not be responsible for any damage or loss induced by any malfunction of the Unit.

Three-year Guarantee

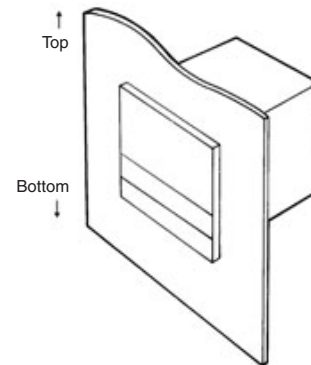
Period of Guarantee

The guarantee period of the Unit is three years starting from the date the Unit is shipped from the factory.

Scope of Guarantee

The Unit is guaranteed under the following operating conditions.

1. Average Operating Temperature (see note): -10°C to 50°C
2. Mounting Method: Standard mounting



Note: Average Operating Temperature

Refer to the process temperature of the Unit mounted to a control panel and connected to peripheral devices on condition that the Unit is in stable operation, sensor input type K is selected for the Unit, the positive and negative thermocouple input terminals of the Unit are short-circuited, and the ambient temperature is stable.

Should the Unit malfunction during the guarantee period, OMRON shall repair the Unit or replace any parts of the Unit at the expense of OMRON.

The above does not apply in the following cases.

1. Any malfunction of the Unit due to the incorrect use or improper handling of the Unit.
2. Any malfunction of the Unit not originating from the Unit.
3. Any malfunction of the Unit due to a modification of the Unit or repairs to the Unit carried out by any person not authorized by OMRON.
4. Any malfunction of the Unit due to any natural disaster.

OMRON shall not be responsible for any damage or loss induced by any malfunction of the Unit.

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 catalog.
- 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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Digital Controller E5AK/E5EK

Advanced Digital Controllers Ideal for Worldwide Use

- Modular structure
- High-accuracy: 100 ms sampling (for analog input)
- Auto-tuning and fuzzy self-tuning
- Conforms to international EMC and safety standards.
- IP66/NEMA4 (indoor use) front face
- Remote set point
- Serial communications (RS-232C, RS-422 and RS-485) and transfer output (4 to 20 mA)
- Position-proportional control model
- Heating/cooling control
- AC/DC24V types are also available.



Model Number Structure

■ Model Number Legend

E5□K- □□□□ -500

1 2 3

1. Size

- A: 96 x 96 mm
- E: 96 x 48 mm

2. Model

- AA: Standard model
- PRR: Position-proportional model

3. Number of alarms

- 2: Three alarms

Ordering Information

■ List of Models

Description	Model	Specification
Base Unit	E5AK-AA2 AC100-240	Standard model
	E5AK-AA2-500 AC100-240	Standard model with terminal cover
	E5AK-AA2 AC/DC24	Standard model
	E5AK-AA2-500 AC/DC24	Standard model with terminal cover
	E5AK-PRR2 AC100-240	Position-proportional model
	E5AK-PRR2-500 AC100-240	Position-proportional model with terminal cover
	E5AK-PRR2 AC/DC24	Position-proportional model
	E5AK-PRR2-500 AC/DC24	Position-proportional model with terminal cover
	E5EK-AA2 AC100-240	Standard model
	E5EK-AA2-500 AC100-240	Standard model with terminal cover
	E5EK-AA2 AC/DC24	Standard model
	E5EK-AA2-500 AC/DC24	Standard model with terminal cover
	E5EK-PRR2 AC100-240	Position-proportional model
	E5EK-PRR2-500 AC100-240	Position-proportional model with terminal cover
	E5EK-PRR2 AC/DC24	Position-proportional model
	E5EK-PRR2-500 AC/DC24	Position-proportional model with terminal cover

- Note:**
1. When using the heater burnout alarm function with a standard model, the Linear Output Unit cannot be used for the control outputs (heat).
 2. Be sure to specify the Current Transformer, Output Unit, and Option Unit when ordering.
 3. The Digital Controller provides transfer outputs at 4 to 20 mA for the PV and other values and control outputs at 4 to 20 mA for the current outputs.

Description	Model	Specification
Output Unit	E53-R	Relay
	E53-S	SSR
	E53-Q	Pulse (NPN) 12 VDC
	E53-Q3	Pulse (NPN) 24 VDC
	E53-Q4	Pulse (PNP) 24 VDC
	E53-C3	Linear (4 to 20 mA)
	E53-C3D	Linear (0 to 20 mA)
	E53-V34	Linear (0 to 10 V)
	E53-V35	Linear (0 to 5 V)

- Note:** The Digital Controller uses a dedicated, high-resolution Output Unit. The E53-C Current Output Unit for the E5□X cannot be used with the Digital Controller.

Description	Model	Specification
Option Unit	E53-AKB	Event input
	E53-AK01	Communication (RS-232C)
	E53-AK02	Communication (RS-422)
	E53-AK03	Communication (RS-485)
	E53-AKF	Transfer output

- Note:**
1. The Option Unit can be used either by the E5AK or E5EK.
 2. The E5AK allows a maximum of three Option Units to be mounted. Refer to page 94 for mounting combinations.
The E5EK allows only one Option Unit to be mounted.

Inspection Report

The Digital Controller can be provided together with an inspection report.

Refer to the following legend with the suffix "K" when ordering a model provided together with an inspection report.

E5□K-AA2-K, E5□K-PRR2-K, E53-AKF-K

■ Accessories (Order Separately)

Name	Model	Hole diameter
Current Transformer	E54-CT1	5.8 mm
	E54-CT3	12.0 mm

Note: No CT is required unless the heater burnout alarm function is used.

Name	Model	Connectable models
Terminal Cover	E53-COV09	E5AK
	E53-COV08	E5EK

Specifications

■ Ratings

Item	AC100-240V type	AC/DC24V type
Supply voltage	AC100 to 240V, 50/60 Hz	AC/DC24V, 50/60 Hz
Power consumption	E5AK: 16 VA E5EK: 15 VA	12 VA, 8 W
Operating voltage range	85% to 110% of rated supply voltage	
Input	Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII Platinum resistance thermometer: JPt100, Pt100 Current input: 4 to 20 mA, 0 to 20 mA Voltage input: 1 to 5 V, 0 to 5 V, 0 to 10 V	
Input impedance	Current input: 150 Ω; Voltage input: 1 MΩ min.	
Control output	<u>Standard Model</u> According to Output Unit (see "Output Unit Ratings and Characteristics") <u>Position-proportional Model</u> 2 Relay outputs: SPST-NO, 1 A at 250 VAC (including inrush current) (see note 1)	
Auxiliary output	SPST-NO, 3 A at 250 VAC (resistive load)	
Control method (see note 2)	ON/OFF or 2-PID control (with auto-tuning)	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and LEDs	
Potentiometer	100 Ω to 2.5 kΩ	
Event input	Contact input: ON: 1 kΩ max., OFF: 100 kΩ min. No-contact input: ON: residual voltage: 1.5 V max., OFF: leakage current: 0.1 mA max.	
Transfer output	4 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2,600	
Remote SP input	Current input: 4 to 20 mA (Input impedance: 150 Ω)	
Current Transformer input	Connect an exclusive Current Transformer (E54-CT1 or E54-CT3)	
Other functions	<u>Standard</u> Manual output, heating/cooling control, SP limiter, loop burnout alarm, SP ramp, MV limiter, MV change rate limiter, input digital filter, input shift, run/stop, protect functions <u>Option</u> Multiple SP, run/stop selection, transfer output functions	
Degree of protection	Conforms to IEC IP66 and NEMA4 (Indoor use)	

- Note: 1. All control outputs are insulated from the input circuit.
2. Fuzzy self-tuning is available when using the Digital Controller in standard control operation with temperature input.

■ Input Ranges

Platinum Resistance Thermometer

Input (switch selectable)		JPt100	Pt100
Range	°C	-199.9 to 650.0	-199.9 to 650.0
	°F	-199.9 to 999.9	-199.9 to 999.9
Setting		0	1

Temperature Controller

Thermocouple

Input (switch selectable) (see note)		K1	K2	J1	J2	T	E	L1	L2	U	N	R	S	B	W	PLII
Range	°C	-200 to 1,300	0.0 to 500.0	-100 to 850	0.0 to 400.0	-199.9 to 400.0	0 to 600	-100 to 850	0.0 to 400.0	-199.9 to 400.0	-200 to 1,300	0 to 1,700	0 to 1,700	100 to 1,800	0 to 2,300	0 to 1,300
	°F	-300 to 2,300	0.0 to 900.0	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	0 to 1,100	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	-300 to 2,300	0 to 3,000	0 to 3,000	300 to 3,200	0 to 4,100	0 to 2,300
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Note: Setting number is factory-set to 2 (K1).
Thermocouple W is W/Re5-26 (tungsten rhenium 5, tungsten rhenium 26).

Current/Voltage

Input (switch selectable)	Current input		Voltage input		
	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V
Range	One of following ranges depending on results of scaling -1999 to 9999 -199.9 to 999.9 -19.99 to 99.99 -1.999 to 9.999				
Setting	17	18	19	20	21

■ Characteristics

Indication accuracy (see note 1)	Thermocouple: (±0.3% of indication value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indication value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Proportional band (P)	0.1% to 999.9% FS (in units of 0.1% FS)
Integral (reset) time (I)	0 to 3,999 s (in units of 1 s)
Derivative (rate) time (D)	0 to 3,999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0% to 100.0% (in units of 0.1%)
Alarm setting range	-1,999 to 9,999 or -199.9 or 999.9 (decimal point position dependent on input type or result of scaling)
Sampling period (see note 2)	Temperature input: 250 ms Current/voltage input: 100 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between terminals of different polarities
Vibration resistance	Malfunction: 10 to 55 Hz, 10 m/s ² (approx. 1G) for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 20 m/s ² (approx. 2G) for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 200 m/s ² min. (approx. 20G), 3 times each in 6 directions (100 m/s ² (approx. 10G) applied to the relay) Destruction: 300 m/s ² min. (approx. 30G), 3 times each in 6 directions
Ambient temperature	Operating: -10°C to 55°C (with no icing)/3-year warranty period: -10°C to 50°C Storage: -25°C to 65°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Degree of protection	Front panel: NEMA4 for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (number of writings: 100,000 operations)
Weight	E5AK: approx. 450 g E5EK: approx. 320 g Mounting bracket: approx. 65 g
EMC	Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards	UL1092, CSA22.2 No. 142, CSA22.2 No. 1010-1 Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC1010-1) Conforms to VDE0106/part 100 (Finger Protection), when the separately-ordered terminal cover is mounted.

- Note: 1.** The indication accuracy of the K1, T, and N thermocouples at a temperature of -100°C or less is ±2°C ±1 digit maximum. The indication accuracy of the U, L1, and L2 thermocouples at any temperature is ±2°C ±1 digit maximum.
The indication accuracy of the B thermocouple at a temperature of 400°C or less is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.
The indication accuracy of the W thermocouple at any temperature is (±0.3% of the indicated value or ±3°C, whichever is greater) ±1 digit maximum.
The indication accuracy of the PLII thermocouple at any temperature is (±0.3% or ±2°C, whichever is greater) ±1 digit maximum.
- 2.** The sampling period of the standard model with CT and remote SP inputs is 250 ms.

■ Output Unit Ratings and Characteristics

Relay output	5 A at 250 VAC (resistive load)
SSR output	1 A at 75 to 250 VAC (resistive load)
Voltage output	NPN: 40 mA at 12 VDC (with short-circuit protection) NPN: 20 mA at 24 VDC (with short-circuit protection) PNP: 20 mA at 24 VDC (with short-circuit protection)
Linear current output	4 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2,600 0 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2,600
Linear voltage output	0 to 10 VDC, permissible load impedance: 1 k Ω max., resolution: approx. 2,600 0 to 5 VDC, permissible load impedance: 1 k Ω max., resolution: approx. 2,600

Note: An output relay (1 A at 250 VAC) is mounted on the position-proportional model. (When replacing, use the E53-R.)

■ Option Unit Ratings and Characteristics

Event inputs	Contact input: ON: 1 k Ω max., OFF: 100 k Ω min. No-contact input: ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max.
Communications	Interface: RS-232C, RS-422 or RS-485 Transmission method: Half-duplex Synchronization method: Start-stop synchronization (asynchronous method) Baud rate: 1.2/2.4/4.8/9.6/19.2 kbps Transmission code: ASCII
Transfer output	4 to 20 mA: Permissible load impedance: 600 Ω max. Resolution: approx. 2,600

■ Current Transformer Ratings

Dielectric strength	1,000 VAC (for 1 min)
Vibration resistance	50 Hz, 98 m/s ² (10G)
Weight	E54-CT1: approx. 11.5 g; E54-CT3: approx. 50 g
Accessories (E54-CT3 only)	Armature: 2; Plug: 2

■ Heater Burnout Alarm

Max. heater current	Single-phase 50 A VAC (see note 1)
Heater current value display accuracy	$\pm 5\%$ FS ± 1 digit max.
Heater burnout alarm setting range	0.1 to 49.9 A (in units of 0.1 A) (see note 2)
Min. detection ON time	190 ms (see note 3)

Note: 1. Use the K2CU-F□□A-□GS (with gate input terminals) for the detection of three-phase heater burnout.

2. The heater burnout alarm is always OFF if the alarm is set to 0.0 A and always ON if the alarm is set to 50.0 A.

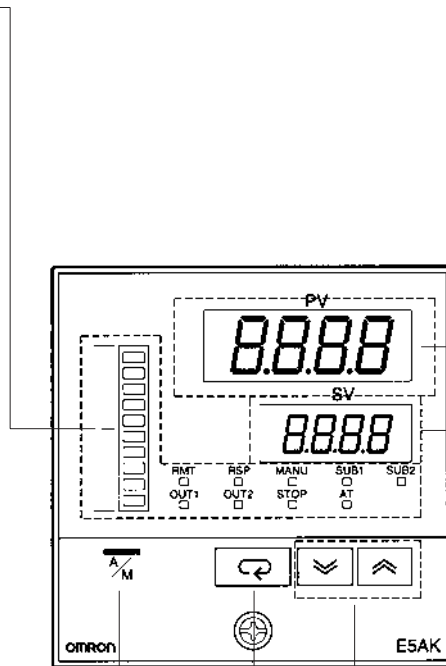
3. No heater burnout detection or heater current value measurement is possible if the control output (heat) is ON for less than 190 ms.

Nomenclature

E5AK

Operation Indicators

- OUT1
Lights when the pulse output function assigned to control output 1 turns ON.
- OUT2
Lights when the pulse output function assigned to control output 2 turns ON.
- SUB1
Lights when the output function assigned to auxiliary output 1 turns ON.
- SUB2
Lights when the output function assigned to auxiliary output 2 turns ON.
- MANU
Lights when the manual operation mode.
- STOP
Lights during operation has stopped.
- RMT
Lights during remote operation.
- AT
Flashes during auto-tuning.
- RSP
Lights during remote SP operation.
- Bar Graph
On a standard model (E5AK-AA2), this bar graph indicates the manipulated variable (heat) in 10% increments per single segment. On a position-proportional model (E5AK-PRR2), this bar graph indicates the valve opening in 10% increments per single segment.



No. 1 Display

Displays the process value or parameter symbols.

No. 2 Display

Displays the set point, manipulated variable, or parameter settings.

Up Key/Down Key

Press to increase or decrease the value on the No.2 display.

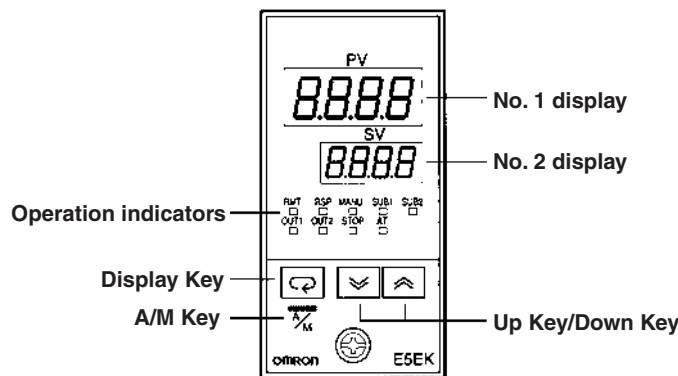
Display Key

Press for less than 1 s to shift the display to the next parameter. When this key is pressed for 1 s or more, the menu screen will be displayed in any case.

A/M Key

Press to select the auto operation or manual operation.

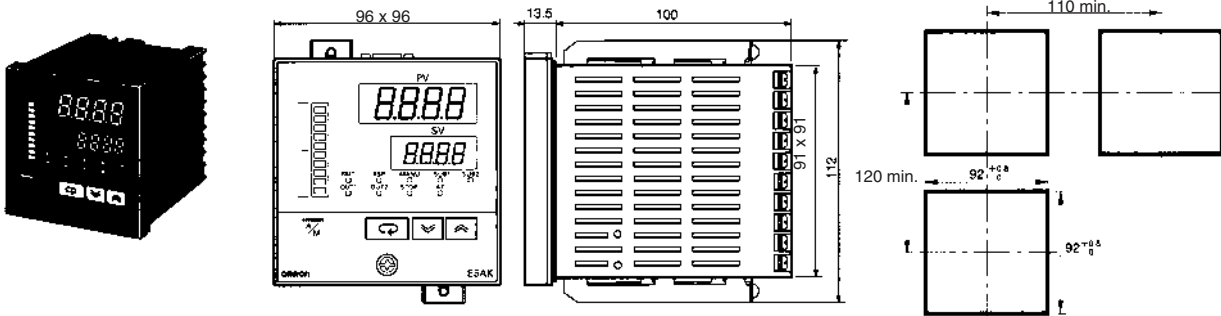
E5EK



Dimensions

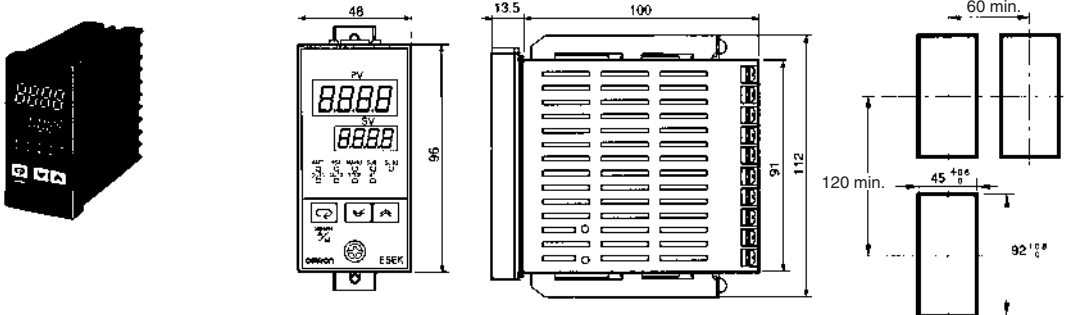
Note: All units are in millimeters unless otherwise indicated.

E5AK



- Note:
1. Recommended panel thickness is 1 to 8 mm.
 2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

E5EK

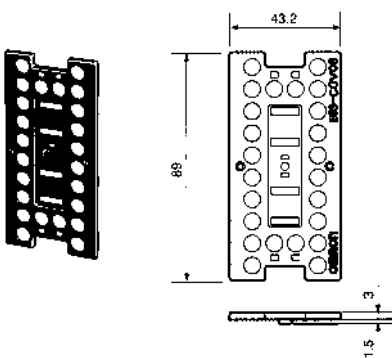


- Note:
1. Recommended panel thickness is 1 to 8 mm.
 2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

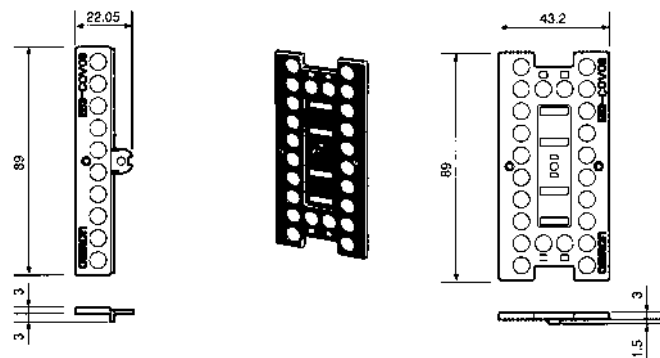
Accessories (Order Separately)

Terminal Cover

E53-COV0809

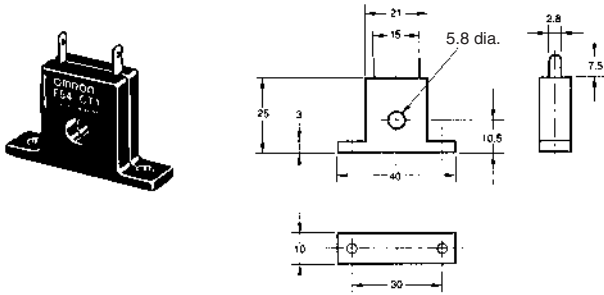


E53-COV08

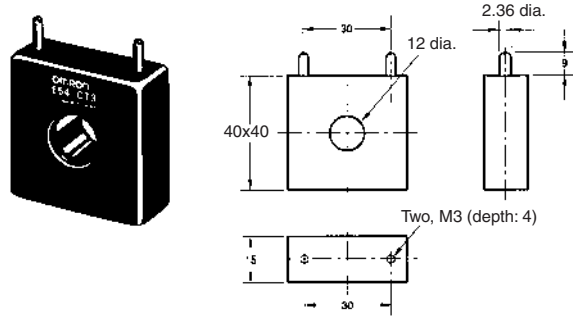


Current Transformer

E54-CT1



E54-CT3



Installation

Note: Always turn off the power supply to the Digital Controller before changing any switch settings.

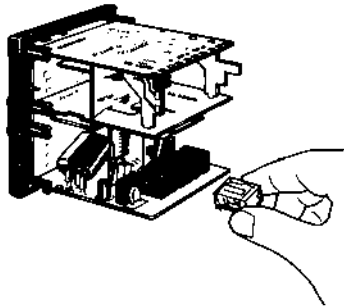
Settings

On a standard model, set up the Output Units for control outputs 1 and 2 before mounting the Controller.

On a position-proportional model, the Relay Output Unit is already set. Therefore, this setup operation is unnecessary. (Do not replace with other Output Units.)

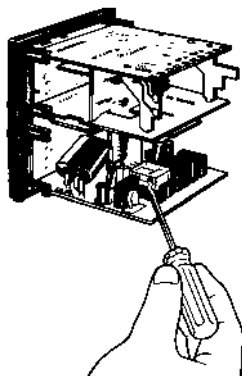
When setting up the Output Units, draw out the internal mechanism from the housing and insert the Output Units into the sockets for control outputs 1 and 2.

Setting Up the Output Unit



Removing the Output Unit

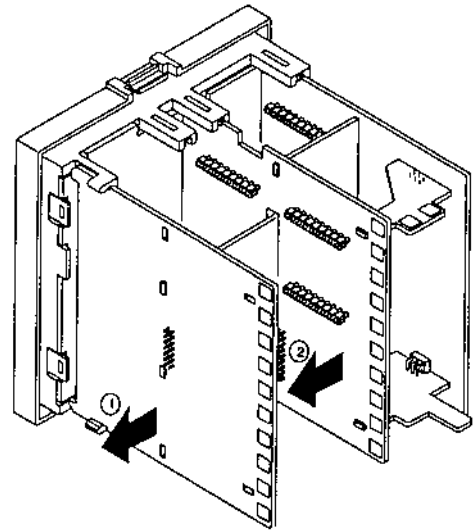
To replace the Output Unit, use a flat-blade screwdriver to push up the Output Unit.



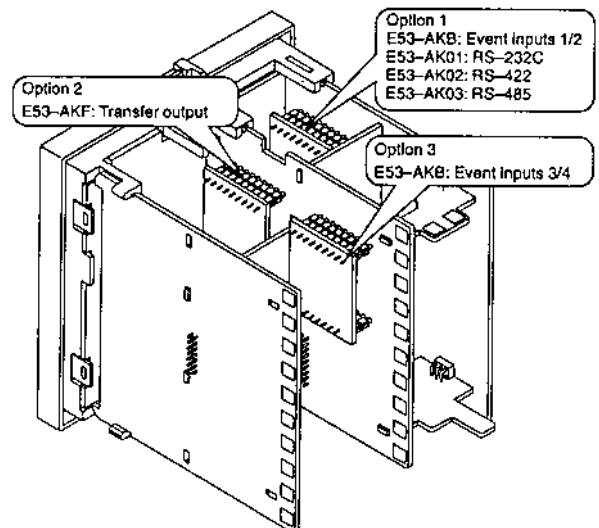
Setting Up the Option Unit

• E5AK

1. Remove the power board and option boards in the order shown in the following diagram.



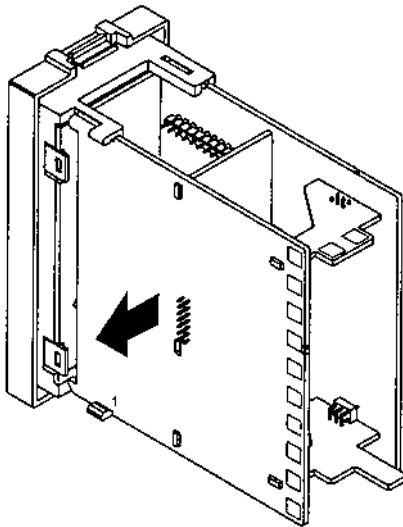
2. Insert the Option Units into the sockets for options 1 to 3. The following diagram shows the relationship between the Option Units and mounting positions.



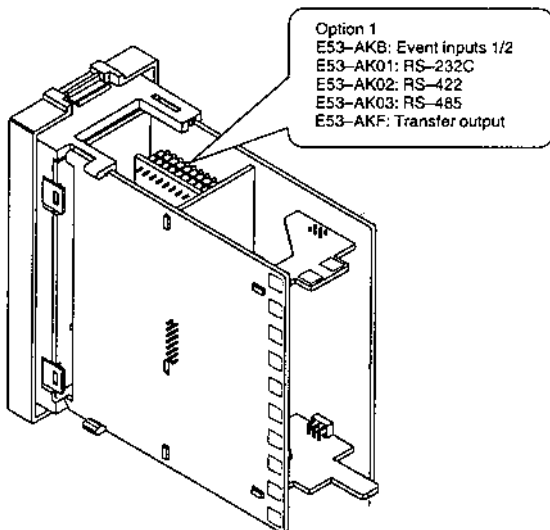
3. Mount the option boards and the power board in the order shown.

• E5EK

1. Remove the power board and option boards in the order shown in the following diagram.



2. Insert the Option Unit into the socket for option 1. The following diagram shows the relationship between the Option Unit and mounting position.

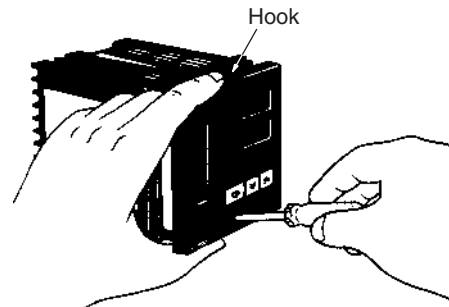


3. Mount the option board and the power board in the order shown.

Draw-out

To draw out the internal mechanism from the housing, use a Phillips screwdriver matching the screw on the lower part of the front panel.

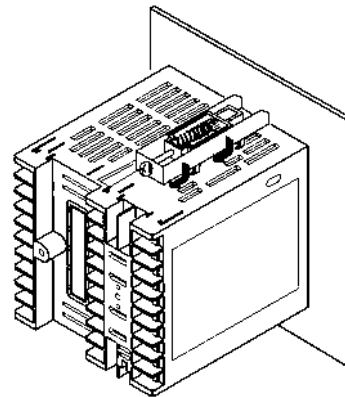
1. Turn the screw counterclockwise while pressing the hook on the upper part of the front panel.



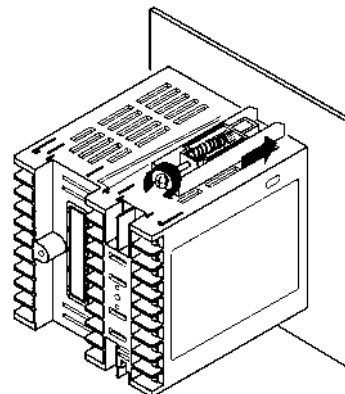
2. Draw out the internal mechanism while holding the left and right sides of the front panel.

Mounting

1. Insert the E5AK Controller into the panel's mounting hole at the position shown in the figure below.
2. Fit the mounting bracket (accessory) into the fixing slots on the top and bottom of the rear case.

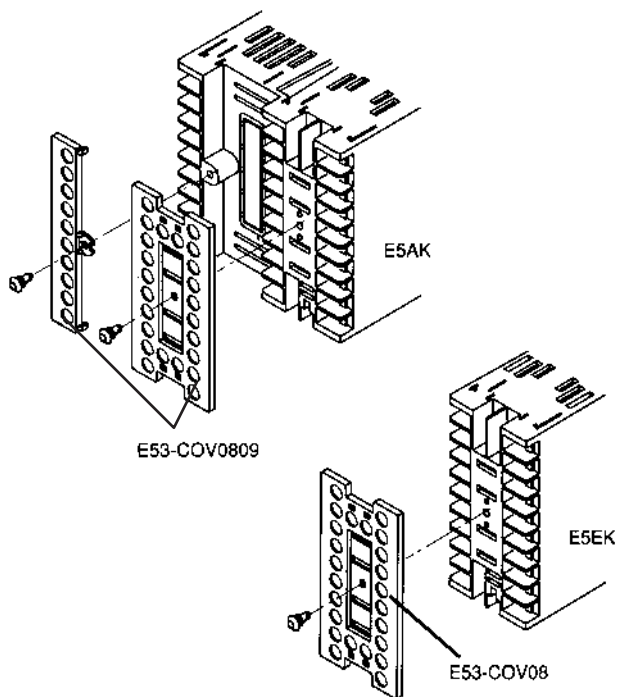


3. Tighten the mounting bracket screws on the upper and lower parts of the E5AK in small increments alternately and equally until the ratchet start to slide.



E53-COV0809, E53-COV08 Terminal Cover (Sold Separately)

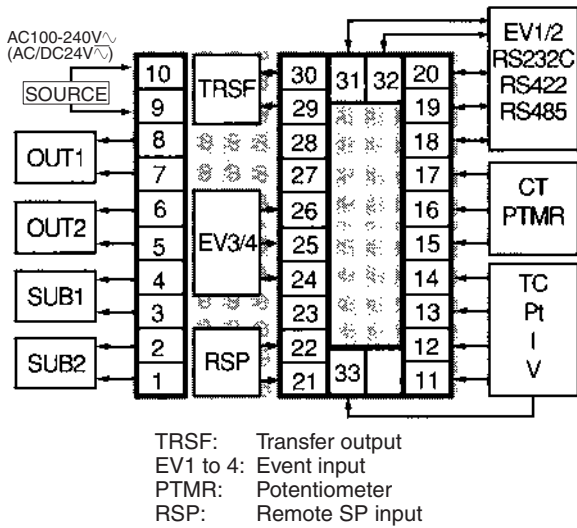
Fasten the terminals covers as follows by using the snap pins. Snap pins are provided with the terminal covers.



Wiring

■ Wiring Terminals for E5AK

Terminal Arrangement

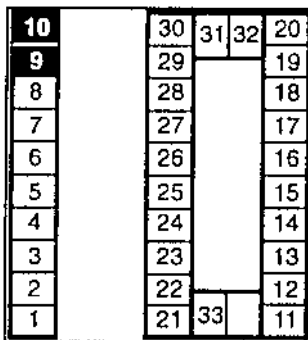


Wiring

In the following wiring diagrams, the left side of the terminal numbers indicate the inside of the Controller.

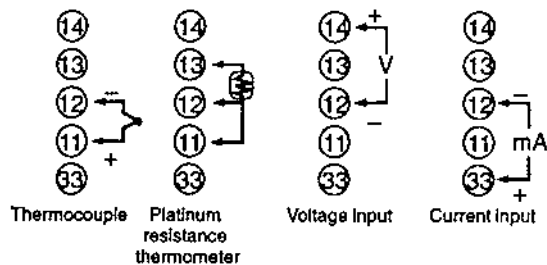
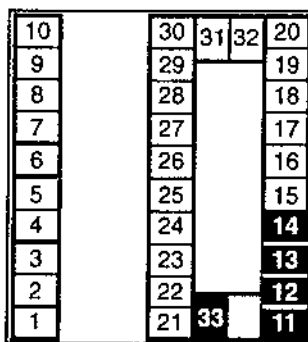
Power Supply: Recommended 24VDC power supply; eg. OMRON S8VS

Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 9 and 10 according to the specifications.



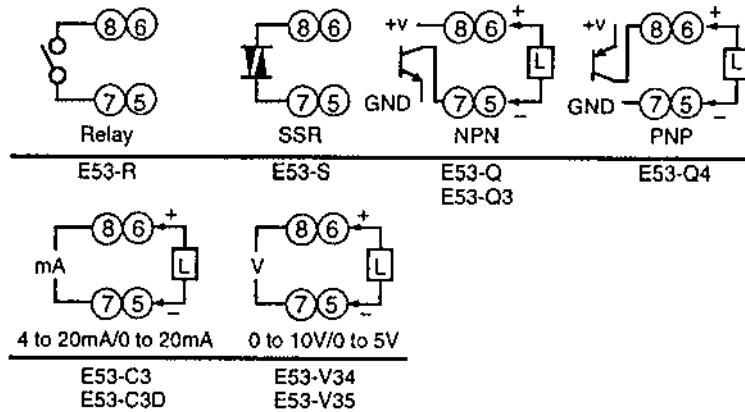
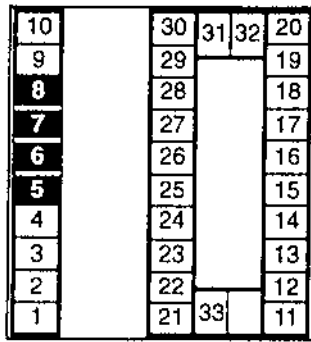
Sensor Input

Connect the sensor input to terminal numbers 11 to 14 and 33 as follows according to the input type.



Control Output

Terminal numbers 7 and 8 are for control output 1 (OUT1), and terminal numbers 5 and 6 are for control output 2 (OUT2). The following diagrams show the available Output Units and their internal equalizing circuits.

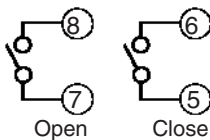


With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted. The following table shows the specifications for each Output Unit.

Model	Output type	Specifications
E53-R	Relay	5 A at 250 VAC
E53-S	SSR	1 A at 75 to 250 VAC
E53-Q	Voltage (NPN)	NPN: 40 mA at 12 VDC (with short-circuit protection)
E53-Q3	Voltage (NPN)	NPN: 20 mA at 24 VDC (with short-circuit protection)
E53-Q4	Voltage (PNP)	PNP: 20 mA at 24 VDC (with short-circuit protection)
E53-C3	4 to 20 mA	4 to 20 mA; permissible load impedance: 600 Ω max.; resolution: approx. 2600
E53-C3D	0 to 20 mA	0 to 20 mA; permissible load impedance: 600 Ω max.; resolution: approx. 2600
E53-V34	0 to 10 V	0 to 10 VDC; permissible load impedance: 1 kΩ min.; resolution: approx. 2600
E53-V35	0 to 5 V	0 to 5 VDC; permissible load impedance: 1 kΩ min.; resolution: approx. 2600

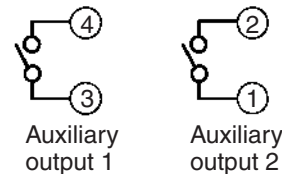
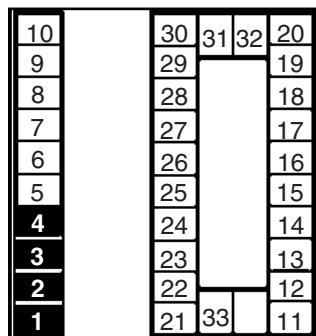
With E5AK-PRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



Auxiliary Output

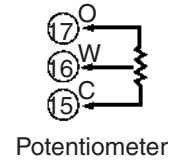
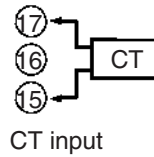
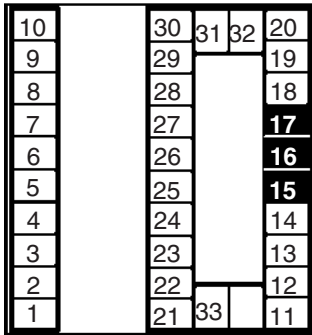
Terminal numbers 3 and 4 are for auxiliary output 1 (SUB1) and terminal numbers 1 and 2 are for auxiliary output 2 (SUB2). The following diagrams show the internal equalizing circuits for the auxiliary outputs:



Output specifications are as follows:
SPST-NO, 3 A at 250 VAC

CT Input/Potentiometer

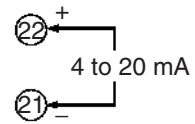
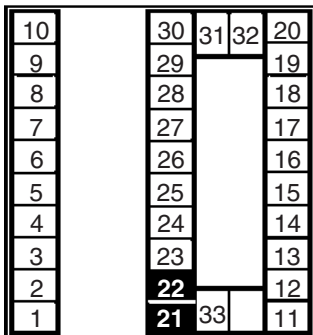
When using the HBA function on the E5AK-AA2 Controller, connect CT input (CT) to terminal numbers 15 to 17. When monitoring the valve opening on the E5AK-PRR2 Controller, connect the potentiometer (PTMR) to terminal numbers 15 to 17. Connect each of these inputs as follows:



For details on CT inputs, refer to *Appendix, About Current Transformer* in the *E5AK/E5EK User's Manual (H83/H85)*. For details on the potentiometer, refer to the *Instruction Manual* for the valve connected to the Controller. The variable resistance range is 100 Ω to 2.5 kΩ.

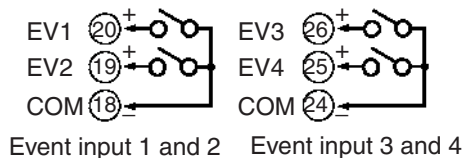
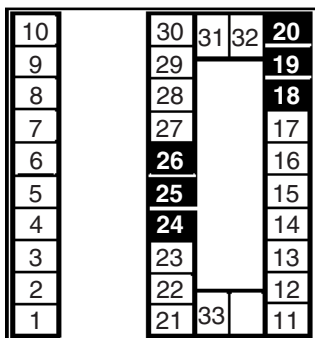
Remote SP Input

Connect the input (RSP) to be used as the remote SP to terminal numbers 21 and 22. Only 4 to 20 mA inputs can be connected. Connect the input as follows:



Event Input

Connect event inputs 1 and 2 (EV1/2) to terminal numbers 18 to 20, and event events 3 and 4 (EV3/4) to terminal numbers 24 to 26. However, note that terminal numbers 18 to 20 cannot be used on Controllers with a communications function. Connect the event inputs as follows:

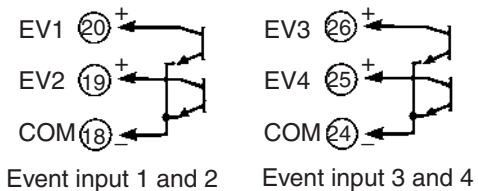


Terminals 18 and 24 (COM) are connected internally.

Use event inputs under the following conditions:

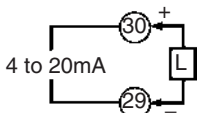
Contact input	ON: 1 kΩ max. OFF: 100 kΩ min.
No-contact input	ON: Residual voltage 1.5 V max., OFF: Leakage current 0.1 mA max.

Polarities during no-contact input are as follows:



Transfer Output

Connect transfer output (TRSF) to terminal numbers 29 and 30. The internal equalizing circuit for transfer output is as follows:



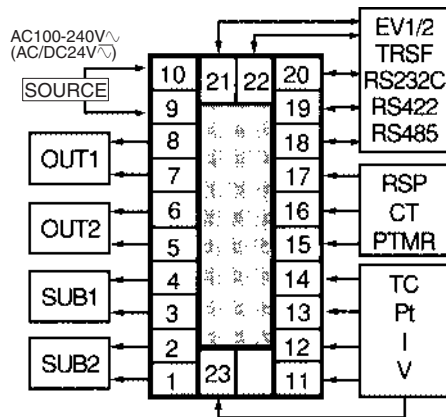
Transfer output specifications are as follows: 4 to 20 mA,
Permissible load impedance: 600 Ω max.,
Resolution: Approx. 2600

Communications

Terminal numbers 18 to 20, 31 and 32 can be used only on Controllers with Communications Units (E53-AK01/02/03). For details on wiring, refer to *Chapter 6, Using the Communications Function* in the *E5AK/E5EK User's Manual (H83/H85)*.

■ Wiring Terminals for E5EK

Terminal Arrangement



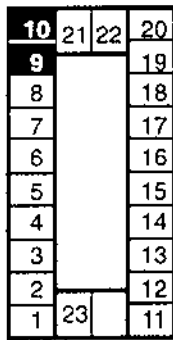
TRSF: Transfer output
 EV1/2: Event input
 PTMR: Potentiometer
 RSP: Remote SP input

Wiring

In the following wiring diagrams, the left side of the terminal numbers indicate the inside of the Controller.

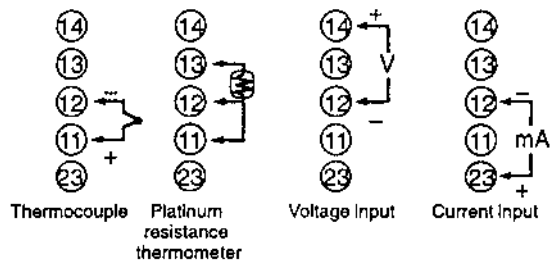
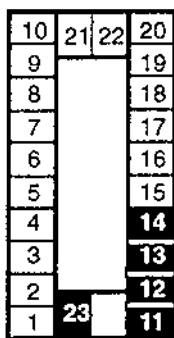
Power Supply: Recommended 24VDC power supply; eg. OMRON S8VS

Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 9 and 10 according to the specifications.



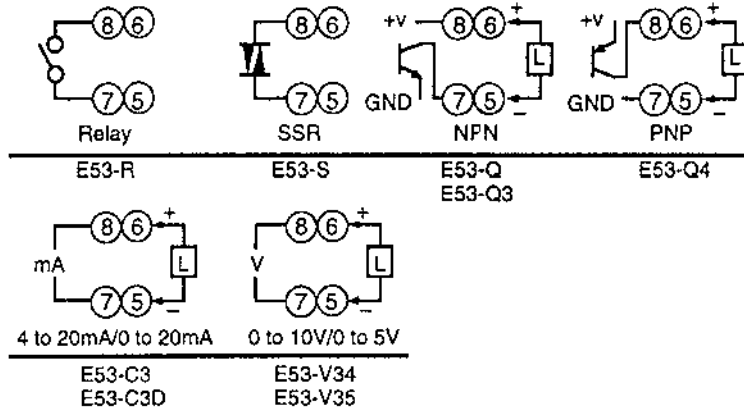
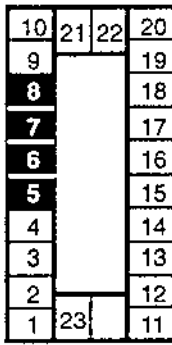
Sensor Input

Connect the sensor input to terminal numbers 11 to 14 and 23 as follows according to the input type.



Control Output

Terminal numbers 7 and 8 are for control output 1 (OUT1), and terminal numbers 5 and 6 are for control output 2 (OUT2). The following diagrams show the available Output Units and their internal equalizing circuits.



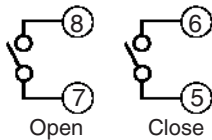
With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted.

The following table shows the specifications for each Output Unit.

Model	Output type	Specifications
E53-R	Relay	5 A at 250 VAC
E53-S	SSR	1 A at 75 to 250 VAC
E53-Q E53-Q3 E53-Q4	Voltage (NPN) Voltage (NPN) Voltage (PNP)	NPN: 40 mA at 12 VDC (with short-circuit protection) NPN: 20 mA at 24 VDC (with short-circuit protection) PNP: 20 mA at 24 VDC (with short-circuit protection)
E53-C3 E53-C3D	4 to 20 mA 0 to 20 mA	4 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2600 0 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2600
E53-V34 E53-V35	0 to 10 V 0 to 5 V	0 to 10 VDC, permissible load impedance: 1 kΩ min., resolution: approx. 2600 0 to 5 VDC, permissible load impedance: 1 kΩ min., resolution: approx. 2600

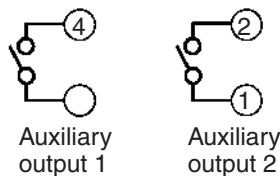
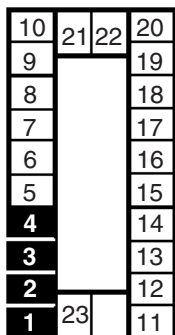
With E5EK-PRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



Auxiliary Output

Terminal numbers 3 and 4 are for auxiliary output 1 (SUB1) and terminal numbers 1 and 2 are for auxiliary output 2 (SUB2). The following diagrams show the internal equalizing circuits for the auxiliary outputs:

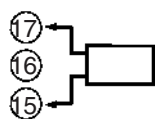


Output specifications are as follows:
SPST-NO, 3A at 250 VAC

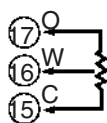
CT Input/Potentiometer

When using the HBA function on the E5EK-AA2 Controller, connect CT input (CT) to terminal numbers 15 to 17. When monitoring the valve opening on the E5EK-PRR2 Controller, connect the potentiometer (PTMR) to terminal numbers 15 to 17. Connect each of these inputs as follows:

10	21	22	20
9			19
8			18
7			17
6			16
5			15
4			14
3			13
2			12
1	23		11



CT input



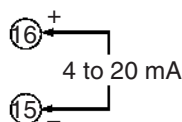
Potentiometer

For details on CT inputs, refer to *Appendix, About Current Transformer* in the *E5AK/E5EK User's Manual (H83/H85)*. For details on the potentiometer, refer to the *Instruction Manual* for the valve connected to the Controller. The variable resistance range is 100 Ω to 2.5 kΩ.

Remote SP Input

Connect the input (RSP) to be used as the remote SP to terminal numbers 15 and 16. However, note that the remote SP cannot be used on the E5EK-PRR2 Controller. Only 4 to 20 mA inputs can be connected. Connect the input as follows:

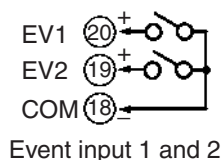
10	21	22	20
9			19
8			18
7			17
6			16
5			15
4			14
3			13
2			12
1	23		11



Event Input

Connect event inputs 1 and 2 (EV1/2) to terminal numbers 18 to 20. However, note that terminal numbers 18 to 20 cannot be used on Controllers with a communications function. Connect the event inputs as follows:

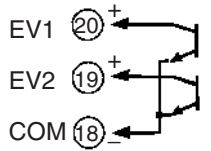
10	21	22	20
9			19
8			18
7			17
6			16
5			15
4			14
3			13
2			12
1	23		11



Use event inputs under the following conditions:

Contact input	ON: 1 kΩ max., OFF: 100 kΩ min.
No-contact input	ON: Residual voltage 1.5 V max., OFF: Leakage current 0.1 mA max.

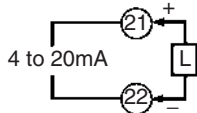
Polarities during no-contact input are as follows:



Event input 1 and 2

Transfer Output

Connect transfer output (TRSF) to terminal numbers 21 and 22. The internal equalizing circuit for transfer output is as follows:



Transfer output specifications are as follows: 4 to 20 mA,
Permissible load impedance: 600 Ω max.,
Resolution: Approx. 2600

Communications

Terminal numbers 18 to 22 can be used only on controllers with Communications Units (E53-AK01/02/03). For details on wiring, refer to *Chapter 6, Using the Communications Function in the E5AK/E5EK User's Manual (H83/H85)*.

■ Precautions when Wiring

Use ducts to separate input leads and power lines in order to protect the Controller and its lines from external noise.

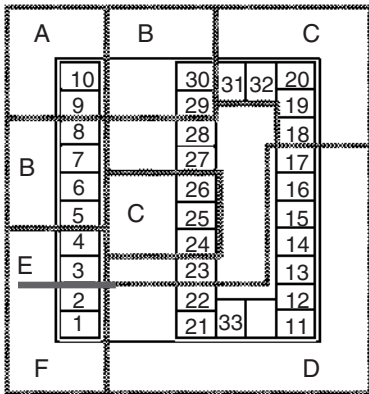
Solderless terminals are recommended when wiring the Controller.

Tighten the terminal screws using a torque no greater than 0.78 N·m, or 8 kgf·cm max. Take care not to tighten the terminal screws too tightly.

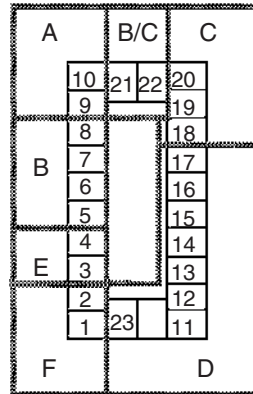
Power Blocks

The E5AK/E5EK has independent power supplies for each of the terminal blocks shown below.

E5AK



E5EK

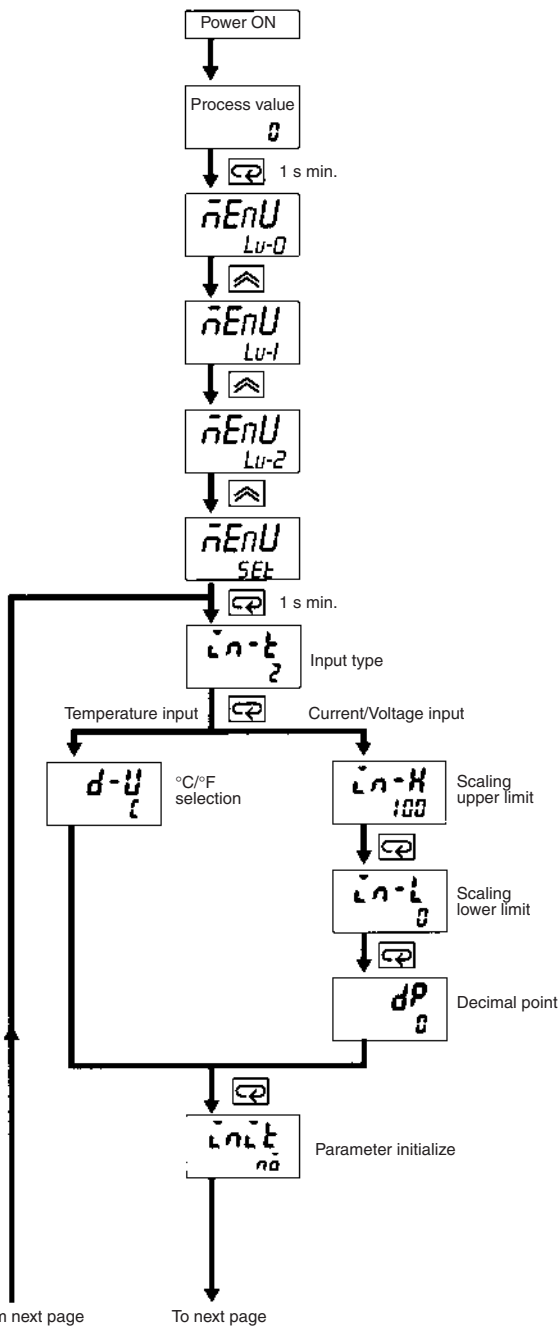


Note: Terminals 21 and 22 of the E5EK belong to the B block when a transfer output is set to option 1 and to the C block for other Option Units.

Operation

■ After Turning ON Power

Determine the I/O specifications of the Digital Controller in setup mode.



■ Input Type

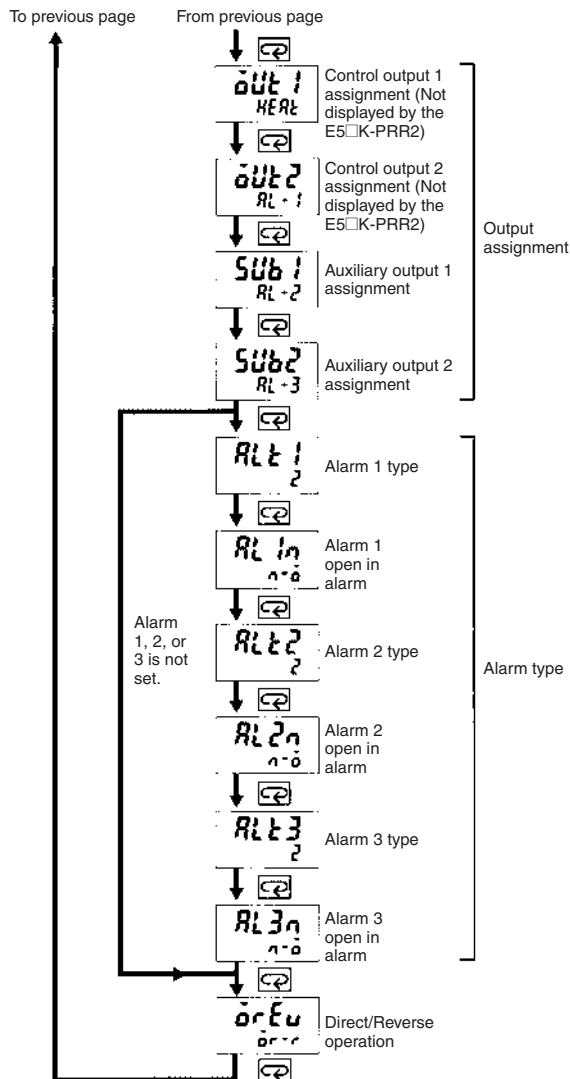
Set the code according to the following table. Default is "2: K1 thermocouple."

Platinum Resistance Thermometer

Set value	Input type		
0	JPt100	-199.9 to 650.0 (°C) /-199.9 to 999.9 (°F)	Platinum resistance thermometer
1	Pt100	-199.9 to 650.0 (°C) /-199.9 to 999.9 (°F)	
2	K1	-200 to 1,300 (°C) /-300 to 2,300 (°F)	Thermocouple
3	K2	0.0 to 500.0 (°C) /0.0 to 900.0 (°F)	
4	J1	-100 to 850 (°C) /-100 to 1,500 (°F)	
5	J2	0.0 to 400.0 (°C) /0.0 to 750.0 (°F)	
6	T	-199.9 to 400.0 (°C) /-199.9 to 700.0 (°F)	
7	E	0 to 600 (°C) /0 to 1,100 (°F)	
8	L1	-100 to 850 (°C) /-100 to 1,500 (°F)	
9	L2	0.0 to 400.0 (°C) /0.0 to 750.0 (°F)	
10	U	-199.9 to 400.0 (°C) /-199.9 to 700.0 (°F)	
11	N	-200 to 1,300 (°C) /-300 to 2,300 (°F)	
12	R	0 to 1,700 (°C) /0 to 3,000 (°F)	Current input
13	S	0 to 1,700 (°C) /0 to 3,000 (°F)	
14	B	100 to 1,800 (°C) /300 to 3,200 (°F)	
15	W	0 to 2,300 (°C) /0 to 4,100 (°F)	
16	PLII	0 to 1,300 (°C) /0 to 2,300 (°F)	Voltage input
17	4 to 20 mA		
18	0 to 20 mA		
19	1 to 5 V		
20	0 to 5 V		
21	0 to 10 V		

Parameter Initialize

Parameter initialization sets all parameters to default values except for the input type, scaling upper limit, scaling lower limit, decimal point, and °C/°F selection parameters.



Output Assignments

Signals available as allocated outputs are the control output (heat), control output (cool), alarm 1, alarm 2, alarm 3, LBA, and HBA. The auxiliary outputs of the Digital Controller cannot be used as control outputs.

Control output (heat), control output (cool), alarm 1, alarm 2, alarm 3, LBA, error 1 (input error), error 2 (A/D converter error), and error 3 (RSP input error) output functions are available. These functions are assigned to control outputs 1 and 2 and auxiliary outputs 1 and 2.

The assignment destination of each output function is may be restricted. Refer to the following table.

Standard Models

Assignment destination \ Output function	Control output		Auxiliary output	
	1	2	1	2
Control output (heat)	Yes	Yes	---	---
Control output (cool)	Yes	Yes	---	---
Alarm 1	Yes	Yes	Yes	Yes
Alarm 2	Yes	Yes	Yes	Yes
Alarm 3	Yes	Yes	Yes	Yes
HBA	Yes	Yes	Yes	Yes
LBA	Yes	Yes	Yes	Yes
Error 1: Input error	---	---	Yes	Yes
Error 2: A/D converter error	---	---	Yes	Yes
Error 3: RSP input error	---	---	Yes	Yes

With control output (cool), the conditions for switching from standard control to heating and cooling control are reached when the output function is assigned at the cooling side during heating and cooling control.

In other words, heating and cooling control is carried out when control output (cool) is assigned, and standard control is carried out when output is not assigned.

Position-proportional Models

Assignment destination \ Output function	Control output		Auxiliary output	
	1	2	1	2
Alarm 1	---	---	Yes	Yes
Alarm 2	---	---	Yes	Yes
Alarm 3	---	---	Yes	Yes
Error 1: Input error	---	---	Yes	Yes
Error 2: A/D converter error	---	---	Yes	Yes
Error 3: RSP input error	---	---	Yes	Yes

LBA

The LBA (loop break alarm) function is available when it is assigned as an output. The LBA function is not available when a memory or A/D converter error results.

LBA is a function for determining that an error has occurred somewhere on the control loop and outputting an alarm when the process value does not change with the manipulated variable at a maximum or minimum state. Accordingly, the LBA function can be used as a means for detecting a malfunctioning control loop.

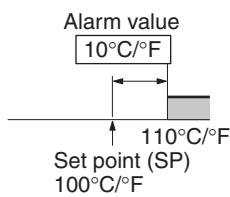
Alarm Mode Selectors

Alarm outputs are available if they are allocated as outputs. Factory setting is "2: Upper-limit alarm (deviation)."

Switch setting	Alarm operation	Alarm output	
		When X is positive	When X is negative
1	Upper- and lower-limit alarm (deviation)		Always ON
2	Upper-limit alarm (deviation)		
3	Lower-limit alarm (deviation)		
4	Upper- and lower-limit range alarm (deviation)		Always OFF
5	Upper- and lower-limit alarm with standby sequence (deviation)		Always OFF
6	Upper-limit alarm with standby sequence (deviation)		
7	Lower-limit alarm with standby sequence (deviation)		
8	Absolute-value upper-limit alarm		
9	Absolute-value lower-limit alarm		
10	Absolute-value upper-limit alarm with standby sequence		
11	Absolute-value lower-limit alarm with standby sequence		

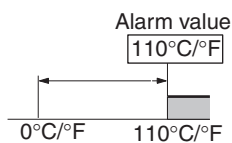
Deviation Alarm

If the alarm mode selector is set to a number between 1 to 7, alarm values are set to the width deviated from the set point as shown in the following illustration.



Absolute Alarm

If the alarm mode selector is set to 8 or 9, alarm values are set to the absolute value based on 0°C/°F as shown in the following illustration.



When selecting a control method, refer to the following table for correct parameter setting.

Control method	Control output 1 assignment	Control output 2 assignment	Operation
Heat	Control output (heat)	---	Reverse
Cool	Control output (heat)	---	Direct
Heat/Cool	Control output (heat)	Control output (cool)	Reverse

Close in Alarm/Open in Alarm

When the Controller is set to “close in alarm,” the status of the alarm output function is output as it is. When set to “open in alarm,” the status of the alarm output function is output inverted.

Condition	Alarm	Output	Output LED
Close in alarm	ON	ON	Lit
	OFF	OFF	Not lit
Open in alarm	ON	OFF	Lit
	OFF	ON	Not lit

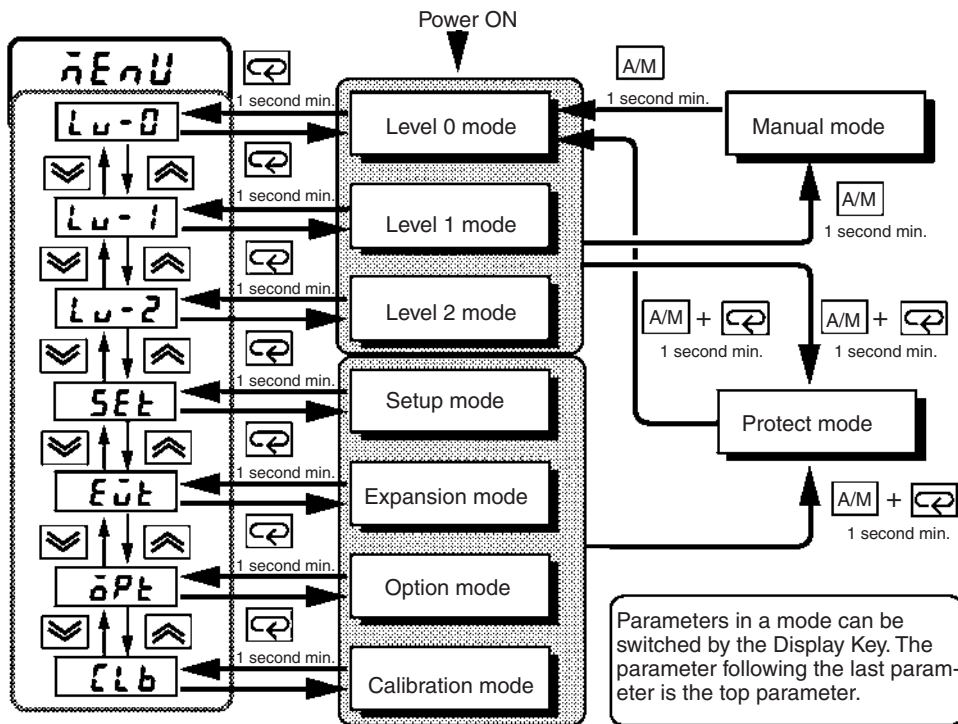
Alarm type and close in alarm (normally open)/open in alarm (normally close) can be set independently from each alarm.

Close in alarm/Open in alarm is set in the “alarm 1 to 3 open in alarm” parameters (setup mode). Factory setting is “close in alarm” [$n-\bar{o}$].

Parameter Operation List

Switching to modes other than manual or protect mode is carried out using the mode selection in the menu display.

The figure below shows all parameters in the order that they are displayed. Some parameters are not displayed depending on the protect mode setting and conditions of use.



Note: The control of the Digital Controller is reset when the Digital Controller is in setup, expansion, option, or calibration mode, in which case the control and auxiliary outputs are OFF. The reset condition will be canceled when the Digital Controller is in any mode other than the above.

Parameters and Menus

Note: For more details on the functions of each part and display contents, refer to the *E5AK/E5EK User's Manual (H83/H85)*.

All functions selected with the Digital Controller in setup or expansion mode or all optional functions of the Digital Controller may not be displayed.

Protect Mode

Limits use of the menu and A/M Keys. The protect function prevents unwanted modification of parameters and switching between the auto and manual operation.

Manual Mode

The Controller can be switched to manual operation. The manipulated variable can be manipulated manually only in this mode.

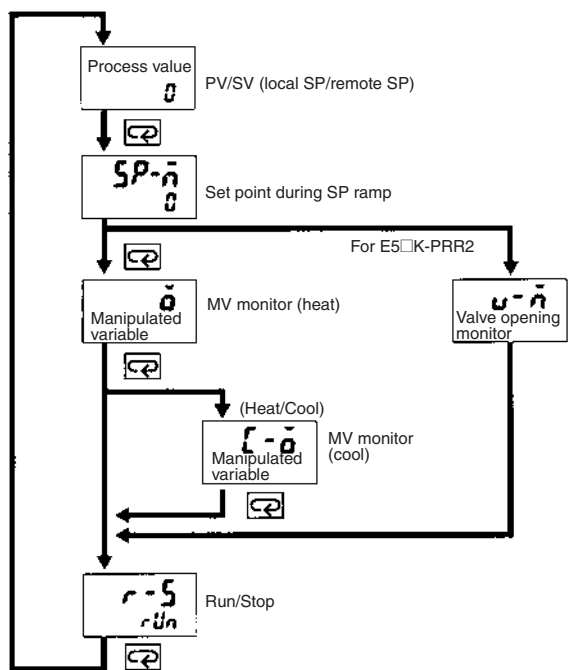
Level 0 Mode	Set the Controller to this mode during normal operation. In this mode, change the set point during operation, and start or stop Controller operation. The process value, ramp SP, and manipulated variable can only be monitored in this mode.
Level 1 Mode	The main mode for adjusting control. In this mode, execute AT (auto-tuning), and set alarm values, the control period, and PID parameters.
Level 2 Mode	The auxiliary mode for adjusting control. In this mode, set the parameters for limiting the manipulated variable and set point, switch between the remote and local modes, switch between the SP mode, and set the loop break alarm (LBA), alarm hysteresis, and the digital filter value of inputs.
Setup Mode	The mode for setting the basic specifications. In this mode, set parameters that must be checked or set before operation such as the input type, scaling, output assignments and direct/reverse operation.
Expansion Mode	The mode for setting expanded functions. In this mode, set ST (self-tuning), SP setting limiter, select advanced PID or ON/OFF control, specify the standby sequence resetting method, and set the time for automatic return to the monitoring display.
Option Mode	The mode for setting option functions. Select this mode only when the Option Unit is set in the Controller. In this mode, set the communications conditions, transfer output and event input parameters to match the type of Option Unit set in the Controller. Heater burnout latch function, position-proportional travel time, and remote SP scaling parameter are also located in this mode.
Calibration Mode	The mode for calibrating inputs and transfer output. When calibrating input, the selected input type is calibrated. Whereas, transfer output can be calibrated only when the Communications Unit (E53-CKF) is set in the Controller.

Parameter Operation

Refer to the *E5AK/E5EK User's Manual (H83/H85)* for each parameter and the calibration mode in detail.

Refer to page 95 for the setting in detail.

Level 0 Mode



PV/SV

The process value is displayed on the No.1 display and the set point is displayed on the No.2 display.

When the multi-SP function is in use, the value of whichever is set, set point 0 or 1, is linked.

Remote SP Monitor

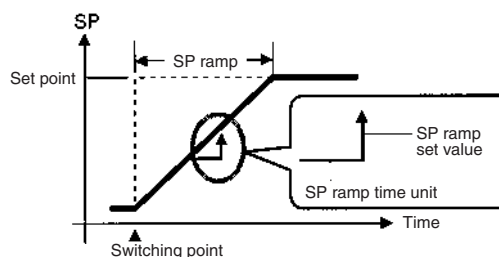
Monitors remote SP in the local SP mode.

Set Point During SP Ramp

Monitors the set point when the SP ramp function is used.

SP Ramp

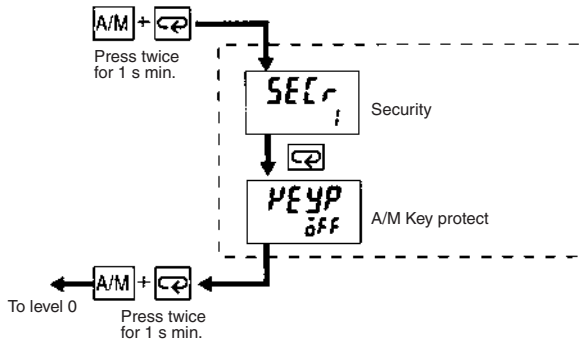
With the SP ramp function, the Controller operates according to the value (set point during SP ramp) limited by a change rate, instead of the changed set point when the set point is changed. The interval in which the set point during SP ramp is limited is referred to as the "SP ramp."



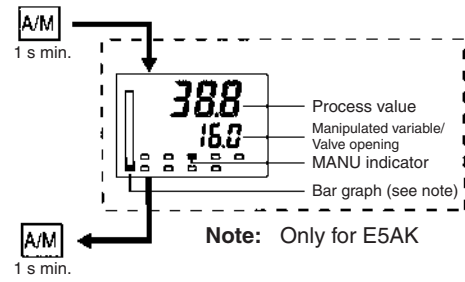
The change rate during the SP ramp is specified by the "SP ramp set value" and "SP ramp time unit" parameters. At the "SP ramp set value" default "0," the SP ramp function is disabled.

The set point changing in SP ramp can be monitored in the "Set point during SP ramp" parameter (level 0 mode).

Protect Mode



Manual Mode



Security

Any mode marked with "X" in the following table is not displayed on the menu when this parameter is set to "0" to "3."

Mode	Set value				
	0	1	2	3	4
Calibration	---	X	X	X	X
Option	---	---	X	X	X
Expansion	---	---	X	X	X
Setup	---	---	X	X	X
Level 2	---	---	---	X	X
Level 1, 0	---	---	---	---	X

The Unit will be in only level 0 mode and the menu will not be available when this parameter is set to "4" to "6."

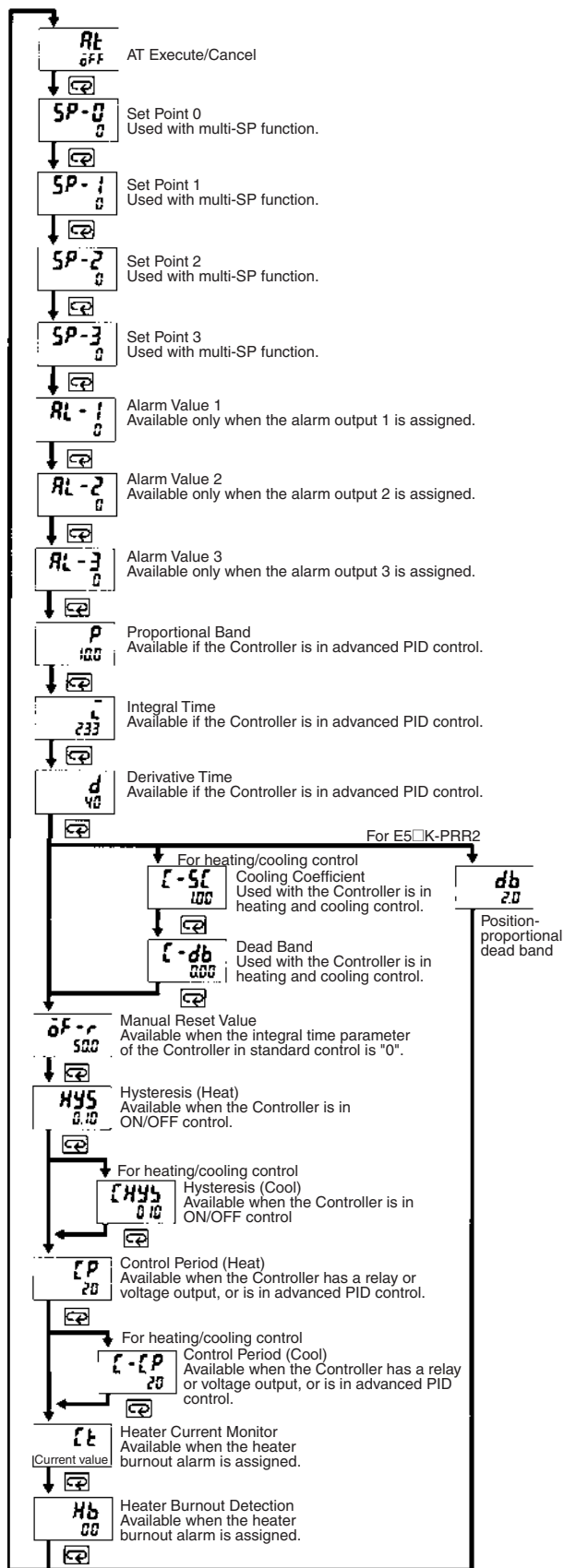
Only the "PV/SP" parameter in the level 0 mode can be used when this parameter is set to "5."

Only the "PV/SP" parameter in the level 0 mode can be used when this parameter is set to "6."

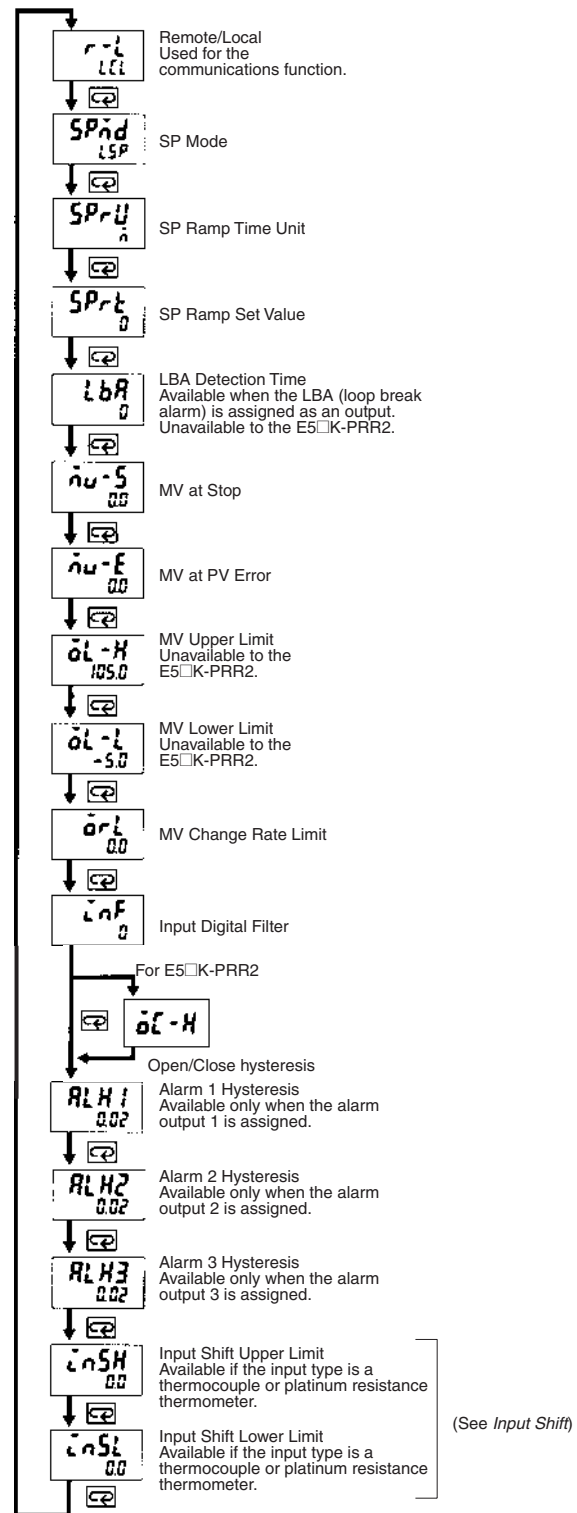
A/M Key Protect

Invalidate the function of the A/M Key.

Level 1 Mode



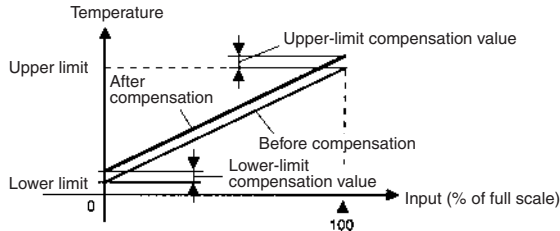
Level 2 Mode



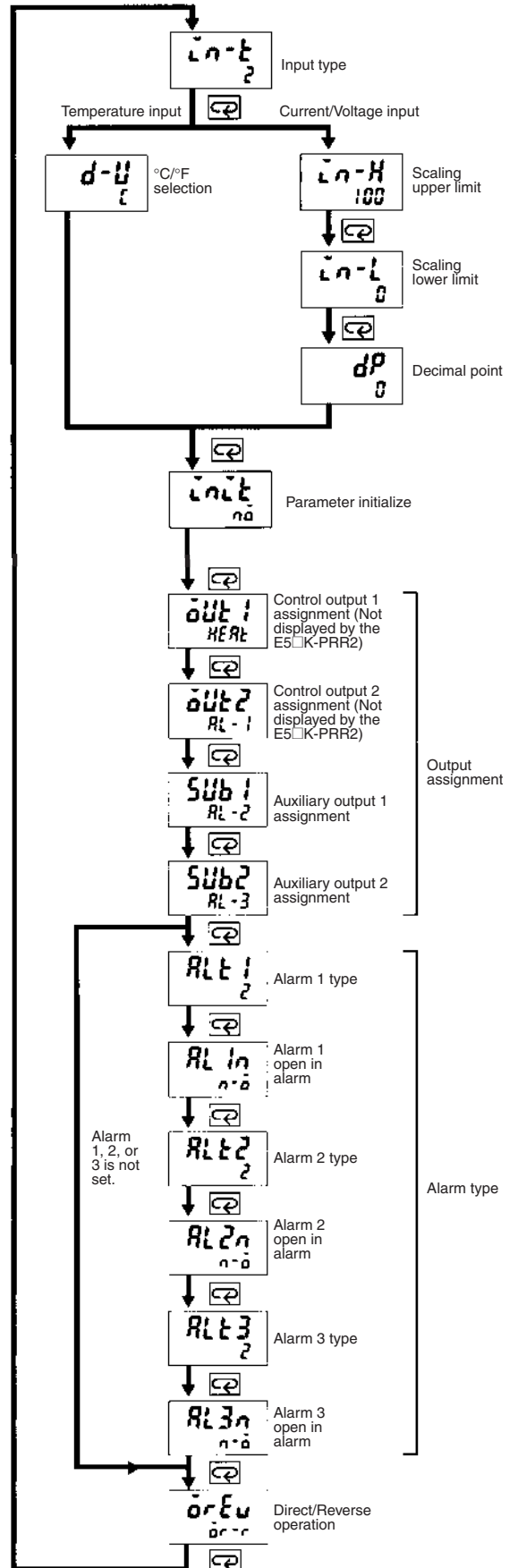
Input Shift

When temperature input is selected, scaling is not required. This is because input is treated as the “temperature” as it is matched to the input type. However, note that the upper- and lower-limit values of the sensor can be shifted. For example, if both the upper- and lower-limit values are shifted by 1.2°C, the process value (before shift) is regarded as 201.2°C after shift when input is 200°C before shift.

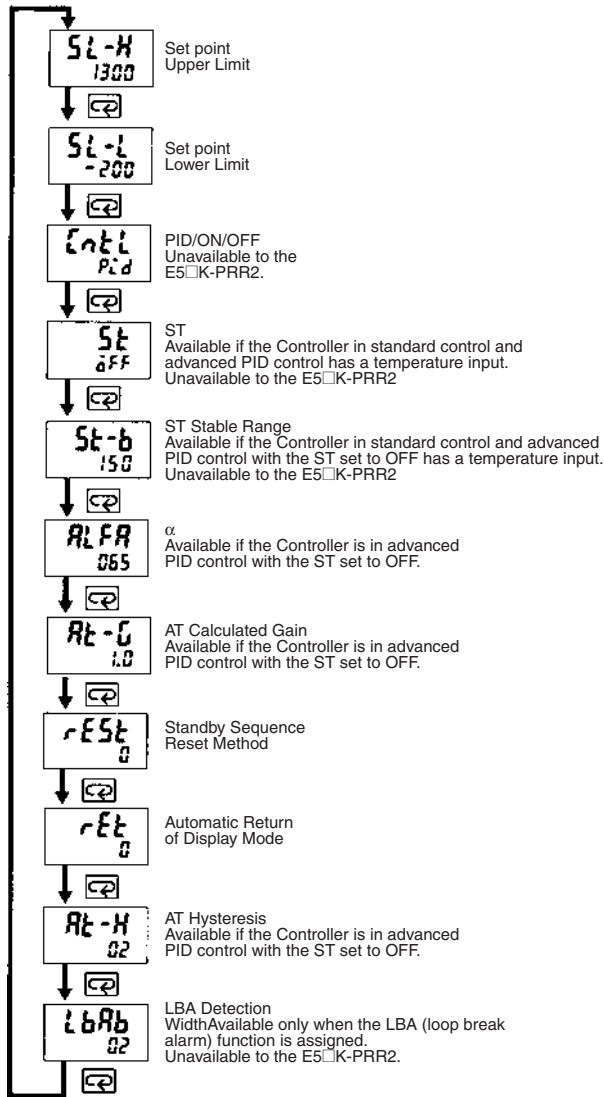
To set the input shift, set shift values in the “input shift upper limit” and “input shift lower limit” parameters (level 2 mode).



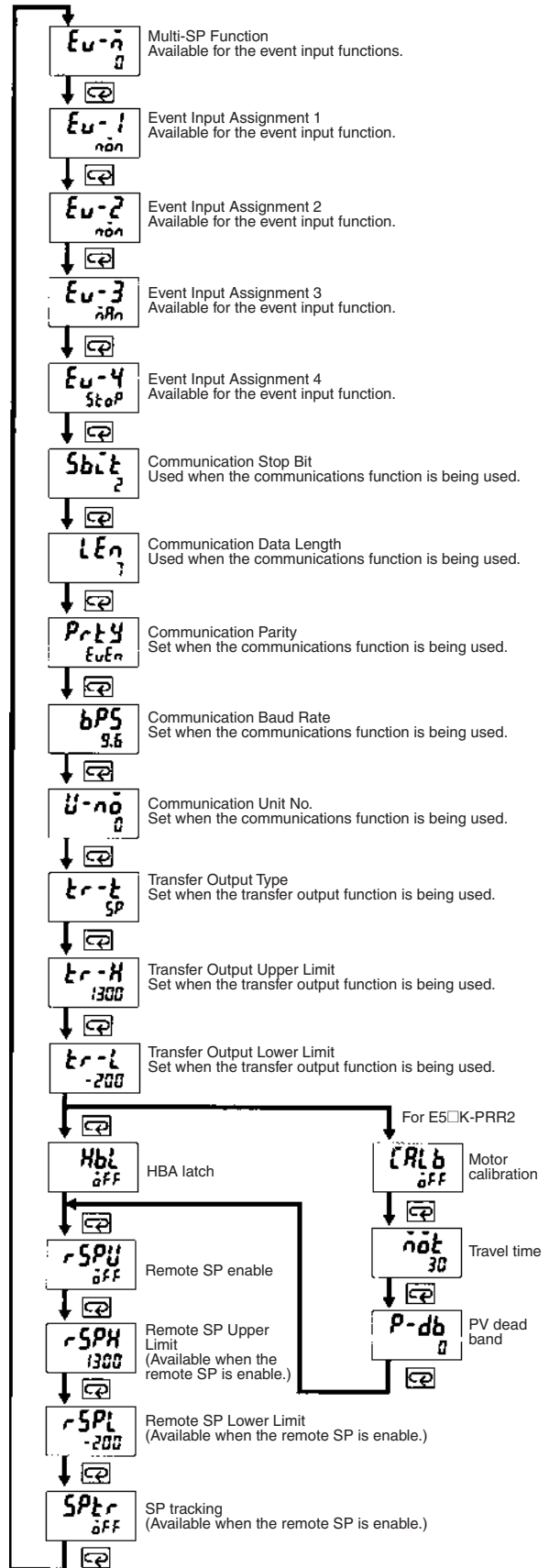
Setup Mode



Expansion Mode



Option Mode



■ How to Use the Error Display

When an error has occurred, the No.1 display alternately indicates error codes together with the current display item. This section describes how to check error codes on the display, and the actions that must be taken to remedy the problem.

5.E r r Input Error	
Meaning	Input is in error.
Action	Check the wiring of inputs, disconnections, and shorts, and check the input type and the input type jumper connector.
Operation at Error	For control output functions, output the manipulated variable matched to the setting of the "MV at PV error" parameter (level 2 mode). Alarm output functions are activated when the upper limit is exceeded.

E 1 1 1 Memory Error	
Meaning	Internal memory operation is in error
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5AK/E5EK Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.

E 3 3 3 A/D Converter Error	
Meaning	Internal circuits are in error.
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5AK/E5EK Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.

R.E r r Calibration Data Error	
Meaning	This error is output only during temperature input and is displayed for two seconds when the power is turned ON. Calibration data is in error.
Action	Must repair.
Operation at Error	Both control output functions and alarm output functions are active. However, note that the readout accuracy is not assured.

C C C C 3 3 3 3 Display Range Over	
Meaning	Though not an error, this is displayed when the process value exceeds the display range when the control range (setting range $\pm 10\%$) is larger than the display range (-1999 to 9999). <ul style="list-style-type: none"> • When less than "-1999" C C C C • When greater than "9999" 3 3 3 3
Operation	Control continues, allowing normal operation.

Err Motor Calibration Error (Displayed on the No. 2 Display)

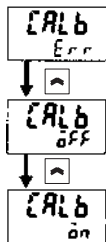
Meaning

Motor calibration has ended with an error.

Action

First, correctly connect the wiring for the potentiometer, open output, and close output. Execute the motor calibration again.

Operation Procedure



Operation at Error

When motor calibration is executed, open output will operate and then close output will operate. However, as the value is incorrect, the result turns out to be an error.

■ Fuzzy Self-tuning

Fuzzy self-tuning is a function that enables the E5AK/E5EK to calculate the most suitable PID constants for the controlled object.

Features

- The E5AK/E5EK determines by itself when to perform fuzzy self-tuning.

Fuzzy Self-tuning Function

The fuzzy self-tuning function has three modes.

In SRT (step response tuning) mode, the PID constants are tuned using a step response method at the time the set point is changed.

In DT (disturbance tuning) mode, the PID constants are amended so that the controlled temperature will be within the target range set in advance when there is external disturbance.

In HT (hunting tuning) mode, when hunting occurs, the PID constants are amended to suppress the hunting.

Note: Be sure to turn on the power supply to the load either before or simultaneously with the start of Temperature Controller operation.

Dead time will be measured from the time the Temperature Controller starts operating. If a load such as a heater is turned on after the Temperature Controller is turned on, dead time longer than the actual value will be measured and inappropriate PID constants will be obtained. If an extremely large amount of dead time is measured, the control amount will be set to 0% for a short period of time before being returned to 100%, and the constants will then be retuned. Retuning is performed only for large amounts of dead time, so be sure to follow the precaution given above when starting operation.

Startup Conditions of SRT

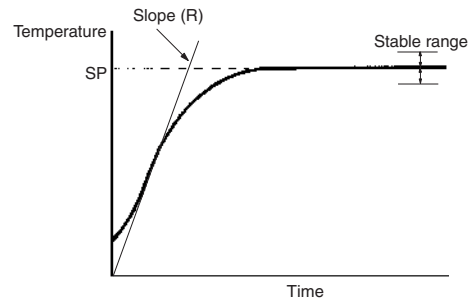
SRT will start if the following conditions are satisfied simultaneously when the E5AK/E5EK is turned on or the set point is changed.

At the time the E5AK/E5EK starts operating	At the time set point is changed
<ol style="list-style-type: none"> 1. The set point at the time the E5AK/E5EK starts operating is different from the set point used at the time SRT was last executed (see note). 2. The process value at the time the E5AK/E5EK starts operating is smaller than the set point in reverse operation and larger than the set point in normal operation. 	<ol style="list-style-type: none"> 1. The new set point is different from the set point used at the time SRT was last executed (see note). 2. The process value is in stable condition before the set point is changed. 3. A larger set point value is set in reverse operation and a smaller set point is set in normal operation.

Note: The last SRT-executed set point is set to 0 before shipping and when changing from advanced PID control to advanced PID control with fuzzy self-tuning.

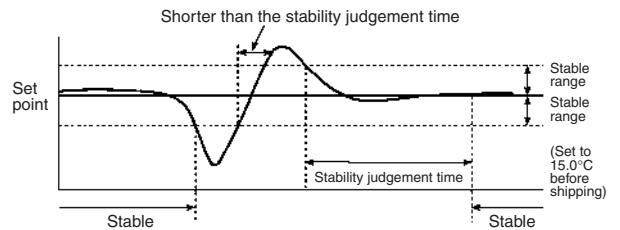
PID Constant Refreshing Conditions

If the step control amount is applied before the maximum temperature slope (R) is obtained, SRT will not renew any PID constant. If the proportional band obtained from the R and L values that were measured before the imposition had been completed is larger than the present proportional band, the PID constants will be renewed because the measured value is in the direction towards the suitable proportional band value, and the set point at that time will be the SRT-executed set point.



Stable Temperature Status

If the temperature is within the stable range for a certain time, it is deemed that the temperature is stable. This time is called stability judgement time. Like PID constants, stability judgement time is adjusted with fuzzy self-tuning according to the characteristics of the object to be controlled. Fuzzy self-tuning will not be activated if the temperature is stable because the Temperature Controller deems that temperature control is smooth.

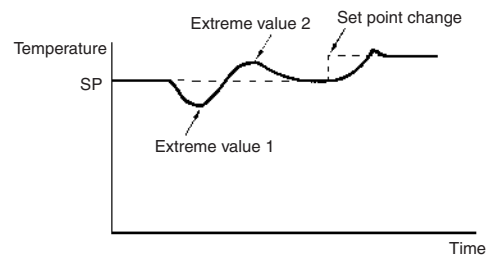


Balanced Status

If the process value is within the stable range for 60 s when there is no output, it is deemed that the temperature is balanced.

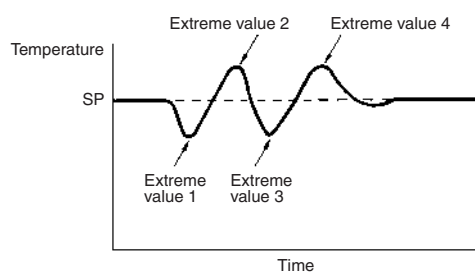
Startup Conditions of DT

1. DT will start if the temperature that has been stable varies due to external disturbance and the deflection of the temperature exceeds the stable range, and then the temperature becomes stable, provided that the number of maximum temperature values is less than four.
2. DT will start if the set point is changed under the condition that SRT does not start and the temperature becomes stable, provided that the number of maximum temperature values is less than four.
If there are four or more maximum temperature values, HT will start.



Startup Conditions of HT

HT will be ON when there is hunting with four or more maximum temperature values (extreme values) while SRT is not being executed.

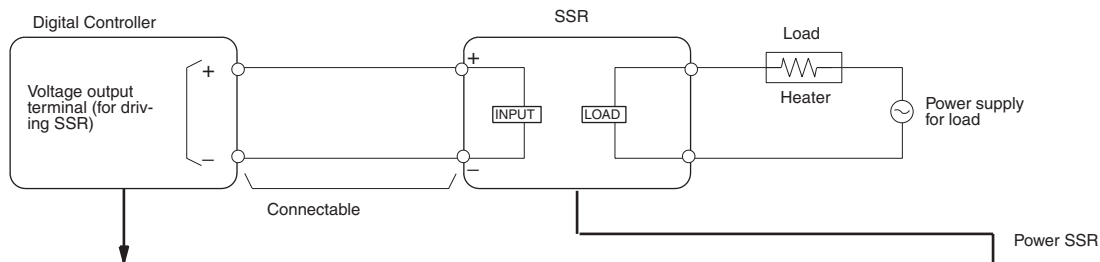


Note: In specific applications where temperature varies periodically due to disturbance, internal parameters need to be adjusted. For details, refer to the *E5AK/E5EK User's Manual (H83/H85)*.

Peripheral Devices

■ SSR

Connection Example of Digital Controller and SSR



E5AK/E5EK

Digital Controller with Voltage Output (12 VDC, 40 mA max.)



E5CK

Digital Controller with Voltage Output (12 VDC, 20 mA max.)



See the following table.

Model	G3PA	G3NH	G3NA	G3NE	G3B
Appearance					
SSRs connected in parallel	E5AK/E5EK: 8 pcs. E5CK: 4 pcs.	E5AK/E5EK: 8 pcs. E5CK: 4 pcs.	E5AK/E5EK: 5 pcs. E5CK: 2 pcs.	E5AK/E5EK: 2 pcs. E5CK: 1 piece	E5AK/E5EK: 5 pcs. E5CK: 2 pcs.
Rated input voltage	5 to 24 VDC	5 to 24 VDC	5 to 24 VDC	12 VDC	5 to 24 VDC
Features	Thin, monoblock construction with heat sink	For high-power heater control	Standard model with screw terminals	Compact, low-cost model with tab terminals	Socket, model with 5-A switching capacity

Temperature Controller

Precautions

General Precautions

Operating Environment

Keep within the rated ambient operating temperature, ambient operating humidity, and storage temperature ranges.

Use the Unit according to the vibration resistance, shock resistance, and degree of protection.

Do not use the Unit in places with corrosive gas or excessive dust.

Do not use the Unit nearby machines generating high-frequency noise.

Correct Use

Mounting

The dimensions of the Digital Controller conform to DIN 43700.

Recommended panel thickness is 1 to 8 mm.

Mount the Unit horizontally.

Connection

To reduce inductive noise influence, the lead wires connecting the input type to the Digital Controller must be separated from the power lines and load lines.

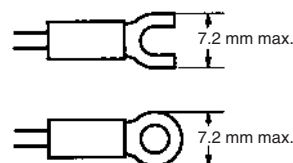
Use the specified compensating conductors for thermocouples. Use lead wires having a small resistance for platinum resistance thermometers.

Connection Example

Wire the terminals of the Unit using solderless terminals.

The tightening torque applied to the terminal screws of the Unit must be approximately 0.78 N·m or 8 kgf·cm.

Use the following type of solderless terminals for M3.5 screws.



Operation

The alarm outputs of a model with an alarm function may not turn ON properly when the model malfunctions. The use of alarm equipment with the model is recommended.

The parameters and internal switch are set before shipping so that the Unit will function normally. Change the settings of the parameters and internal switch according to the application if necessary.

Several seconds are required until the relay is turned ON after power has been supplied to the Digital Controller. Therefore, take this time delay into consideration when designing sequenced circuits which incorporate a Digital Controller.

Do not use excessive force when drawing out the internal mechanism from the housing. Protect the internal connector or electronic parts of the Unit from shock. Protect against static discharge when changing the settings of the internal switch. Changing the settings on a grounded conductive mat is recommended.

When connecting the Control Output Unit to the Temperature Controller or Digital Controller, make sure that the Control Output Unit is a suitable type. The use of an improper type of Control Output Unit may cause the system to malfunction.

The heater burnout alarm will not be available if the Linear Output Unit is used.

■ Period and Scope of Guarantee

Unit with Standard Specifications

Scope of Guarantee

Should the Unit malfunction during the guarantee period, OMRON shall repair the Unit or replace any parts of the Unit at the expense of OMRON.

The above does not apply in the following cases.

1. Any malfunction of the Unit due to the incorrect use or improper handling of the Unit.
2. Any malfunction of the Unit not originating from the Unit.
3. Any malfunction of the Unit due to a modification of the Unit or repairs to the Unit carried out by any person not authorized by OMRON.
4. Any malfunction of the Unit due to any natural disaster.

OMRON shall not be responsible for any damage or loss induced by any malfunction of the Unit.

Three-year Guarantee

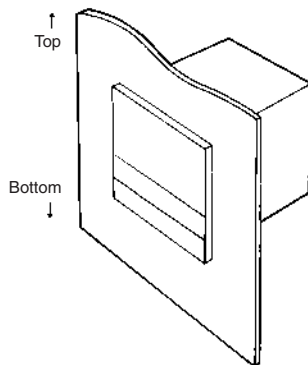
Period of Guarantee

The guarantee period of the Unit is three years starting from the date the Unit is shipped from the factory.

Scope of Guarantee

The Unit is guaranteed under the following operating conditions.

1. Average Operating Temperature (see note): -10°C to 50°C
2. Mounting Method: Standard mounting



Note: Average Operating Temperature

Refer to the process temperature of the Unit mounted to a control panel and connected to peripheral devices on condition that the Unit is in stable operation, sensor input type K is selected for the Unit, the positive and negative thermocouple input terminals of the Unit are short-circuited, and the ambient temperature is stable.

Should the Unit malfunction during the guarantee period, OMRON shall repair the Unit or replace any parts of the Unit at the expense of OMRON.

The above does not apply in the following cases.

1. Any malfunction of the Unit due to the incorrect use or improper handling of the Unit.
2. Any malfunction of the Unit not originating from the Unit.
3. Any malfunction of the Unit due to a modification of the Unit or repairs to the Unit carried out by any person not authorized by OMRON.
4. Any malfunction of the Unit due to any natural disaster.

OMRON shall not be responsible for any damage or loss induced by any malfunction of the Unit.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H084-E1-04

In the interest of product improvement, specifications are subject to change without notice.

Digital Controller E5□K-T

The E5□K-T Programmable Type Digital Controllers Expand the Variety of E5□K Digital Controllers and are Available in Three Sizes (1/4, 1/8, and 1/16 DIN).



E5□K-T Series



Contents

Digital Controllers

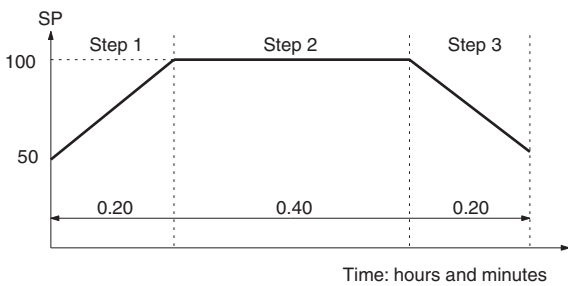
E5AK-T/E5EK-T	I-125
E5CK-T	I-127

Temperature Controller

Compact and Easy-to-use Controllers

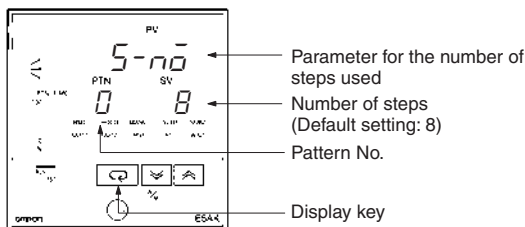
■ Programming is as easy as following the steps below.

Program can be set in pattern 0 according to the following procedure.

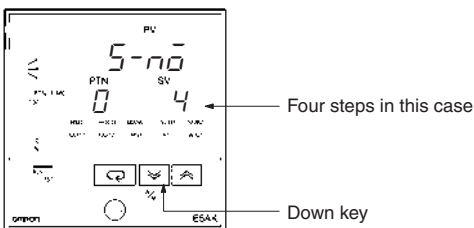


Step No.	Target value	Time (hours.minutes)
0	50	0.00
1	100	0.20
2	100	0.40
3	50	0.20

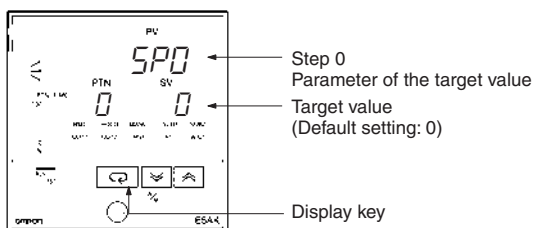
1. Press the Display Key to shift to the display for the number of steps.



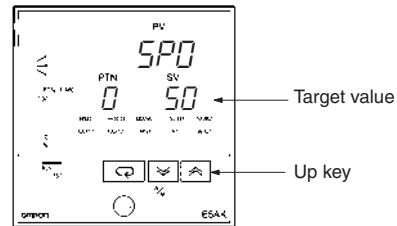
2. Press the Down Key and set the number of steps.



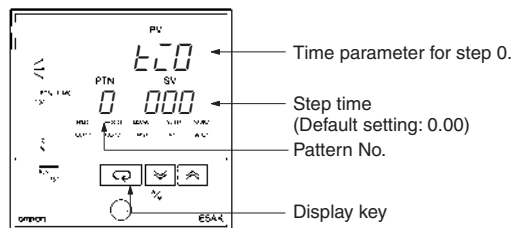
3. Press the Display Key to shift to the display for the target value of step 0.



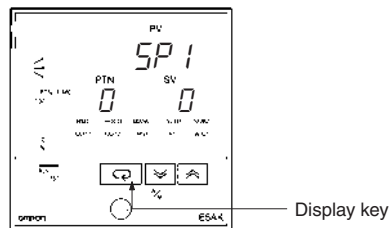
4. Set the target value to "50."



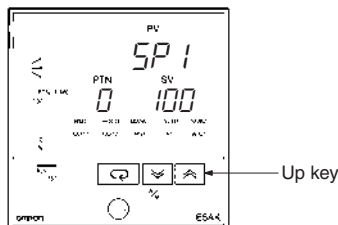
5. Press the Display Key to shift to the display for the time of step 0.



6. Press the Display Key again with the step time set at 0 minutes, and the target value parameter for step 1 will be displayed.



7. Press the Up Key to increment to "100."



In the same manner, set the time for step 1, target value for step 2, time for step 2, etc.

When the target value and time settings are complete, press the Display Key.

Digital Controller

E5AK-T/E5EK-T

Advanced Programmable Digital Controllers Ideal for Worldwide Use

- Offers up to eight patterns of simple programming control (16 steps per pattern).
- Modular structure, one-stock type
- High-accuracy: 100-ms sampling (for analog input)
- Conforms to international EMC and safety standards.
- IP66/NEMA4 (indoor use) front face
- Serial communications (RS-232C, RS-422 and RS-485) and transfer output (4 to 20 mA)
- Position-proportional control model
- Heating/cooling control
- 24VAC/DC types are also available.



Model Number Structure

Model Number Legend

E5□K-T□□□□-500
 1 2 3 4

1. Size

- A: 96 x 96 mm
- E: 96 x 48 mm
- C: 58 x 58 mm

2. Programmable type

- T: Programmable type

3. Model

- AA: Standard model
- PRR: Position-proportional model

4. Number of alarms

- 2: Two alarms

Ordering Information

List of Models

Description	Model	Specification
Base Unit	E5AK-TAA2 AC100-240	Standard model
	E5AK-TAA2-500 AC100-240	Standard model with terminal cover
	E5AK-TAA2 AC/DC24	Standard model
	E5AK-TAA2-500 AC/DC24	Standard model with terminal cover
	E5AK-TPRR2 AC100-240	Position-proportional model
	E5AK-TPRR2-500 AC100-240	Position-proportional model with terminal cover
	E5AK-TPRR2 AC/DC24	Position-proportional model
	E5AK-TPRR2-500 AC/DC24	Position-proportional model with terminal cover
	E5EK-TAA2 AC100-240	Standard model
	E5EK-TAA2-500 AC100-240	Standard model with terminal cover
	E5EK-TAA2 AC/DC24	Standard model
	E5EK-TAA2-500 AC/DC24	Standard model with terminal cover
	E5EK-TPRR2 AC100-240	Position-proportional model
	E5EK-TPRR2-500 AC100-240	Position-proportional model with terminal cover
	E5EK-TPRR2 AC/DC24	Position-proportional model
	E5EK-TPRR2-500 AC/DC24	Position-proportional model with terminal cover

Note: 1. When using the heater burnout alarm function with a standard model, the Linear Output Unit cannot be used for the control outputs (heat).
 2. Be sure to specify the Current Transformer, Output Unit, and Option Unit when ordering.

Temperature Controller

Nomenclature

E5AK

Pattern Number

Indicates the pattern number.

Program Status Indicators

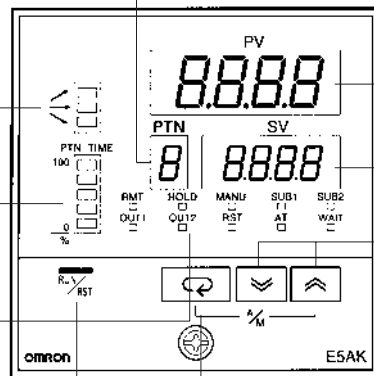
The top indicator indicates the rising step, the middle indicator indicates the constant step, and the bottom indicator indicates the falling step.

Bar Graph

Indicates the rate of pattern elapsing time at the rate of 20% (5 levels) per one segment.

Operation Indicators

- **OUT1**
Lights when the pulse output function assigned to control output 1 turns ON.
- **OUT2**
Lights when the pulse output function assigned to control output 2 turns ON.
- **SUB1**
Lights when the output function assigned to auxiliary output 1 turns ON.
- **SUB2**
Lights when the output function assigned to auxiliary output 2 turns ON.
- **MANU**
Lights when the manual operation mode.
- **RST**
Lights when the operation is reset.
- **RMT**
Lights during remote operation.
- **AT**
Flashes during auto-tuning.
- **HOLD**
Lights when the program is on hold.
- **WAIT**
Lights when the program is waiting.



Display 1

Displays the process value or parameter code.

Display 2

Displays the present SP, manipulated variable, or parameter settings.

Up Key/Down Key

Press to increase or decrease the value on the No.2 display.

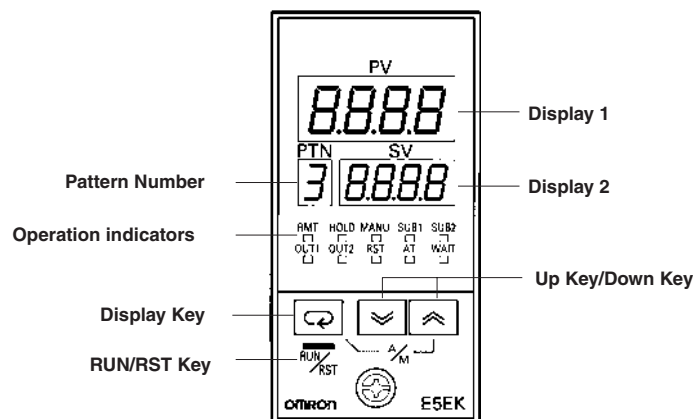
Display Key

Press to shift the display to the next parameter.

RUN/RST Key

Switches between RUN and RESET mode.

E5EK



Display 1

Display 2

Pattern Number

Operation indicators

Up Key/Down Key

Display Key

RUN/RST Key

Digital Controller E5CK-T

Advanced, Compact Programmable Digital Controllers Ideal for Worldwide Use

- Offers up to four patterns of simple programming control (16 steps per pattern).
- IP66/NEMA4 (indoor use) front face.
- Modular structure, one-stock type.
- Heating/cooling control.
- Serial communications (RS-232C and RS-485).
- Temperature and analog inputs.
- High-accuracy: 100-ms sampling (for analog input).
- Conforms to international EMC and safety standards.
- 24 VAC/DC types are also available.



Ordering Information

List of Models

Description	Model	Specification
Base Unit	E5CK-TAA1 AC100-240	Standard model
	E5CK-TAA1-500 AC100-240	Standard model with terminal cover
	E5CK-TAA1 AC/DC24	Standard model
	E5CK-TAA1-500 AC/DC24	Standard model with terminal cover

Note: A single Output Unit and Option Unit can be mounted to each Base Unit.

Description	Model	Specification
Output Unit	E53-R4R4	Relay/Relay
	E53-Q4R4	Pulse (NPN)/Relay
	E53-Q4HR4	Pulse (PNP)/Relay
	E53-C4R4	Linear (4 to 20 mA)/Relay
	E53-C4DR4	Linear (0 to 20 mA)/Relay
	E53-V44R4	Linear (0 to 10 V)/Relay
	E53-Q4Q4	Pulse (NPN)/Pulse (NPN)
	E53-Q4HQ4H	Pulse (PNP)/Pulse (PNP)

Description	Model	Specification
Option Unit	E53-CK01	RS-232C
	E53-CK03	RS-485
	E53-CKB	Event input: 1 point
	E53-CKF	Transfer output (4 to 20 mA)

Inspection Report

The Digital Controller can be provided together with an inspection report.

Refer to the following legend with the suffix "K" when ordering a model provided together with an inspection report.

E5CK-TAA1-K

Accessories (Order Separately)

Name	Model
Terminal Cover	E53-COV07

Temperature Controller

Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied.
Doing so may result in electric shock.

■ General Precautions

Be sure to observe these precautions to ensure safe use.

- Do not use the product in places where explosive or flammable gases may be present.
- Never disassemble, repair or modify the product.
- Tighten the terminal screws properly.
- Use the specified size of solderless terminals for wiring.
- Use the product within the rated supply voltage.
- Use the product within the rated load.
- The life expectancy of the output relay varies considerably according to its switching capacity and operating conditions. Be sure to use the output relay within its rated load and electrical life expectancy. If the output relay is used beyond its life expectancy, its contacts may become fused or burned.

■ Correct Use

If you remove the Controller from its case, never touch nor apply shock to the electronic parts inside.

Do not cover the E5□K-T. (Ensure sufficient space around the Controller to allow heat radiation.)

Do not use the Controller in the following places:

- Places subject to icing, condensation, dust, corrosive gas (especially sulfide gas or ammonia gas).
- Places subject vibration and large shocks.
- Places subject to splashing liquid or oil atmosphere.
- Places subject to intense temperature changes.
- Places subject to heat radiation from a furnace.

Be sure to wire properly with correct polarity of terminals.

When wiring input or output lines to the Controller, keep the following points in mind to reduce the influence from inductive noise:

- Allow adequate space between the high voltage/current power lines and the input/output lines.
- Avoid parallel or common wiring with high voltage sources and power lines carrying large currents.
- Using separating pipes, ducts, and shielded line is also useful in protecting the Controller, and its lines from inductive noise.

Cleaning: Do not use paint thinner or organic solvents. Use standard grade alcohol to clean the product.

Use a voltage (100 to 240 VAC at 50/60 Hz, or 24 VDC). At power ON, the prescribed voltage level must be attained within two seconds.

Allow as much space as possible between the Controller and devices that generate a powerful high frequency (high-frequency welders, high-frequency sewing machines, etc.) or surge. These devices may cause malfunctions.

If there is a large power-generating peripheral device and any of its lines near the Controller, attach a surge suppressor or noise filter to the device to stop the noise affecting the Controller system. In particular, motors, transformers, solenoids and magnetic coils have an inductance component, and therefore can generate very strong noise.

When mounting a noise filter on the power supply to the Controller, be sure to first check the filter's voltage and current capacity, and then mount the filter as close as possible to the Controller.

Use within the following temperature and humidity ranges:

- Temperature: -10°C to 55°C (with no icing or condensation)
Humidity: 35% to 85% (with no icing or condensation)
If the Controller is installed inside a control board, the ambient temperature must be kept to under 55°C , including the temperature around the Controller.
If the Controller is subjected to heat radiation, use a fan to cool the surface of the Controller to under 55°C .

Store within the following temperature and humidity ranges:

- Temperature: -25°C to 65°C (with no icing or condensation)
Humidity: 35% to 85% (with no icing or condensation)

Never place heavy objects on, or apply pressure to the Controller that may cause it to deform and deteriorate during use or storage.

Avoid using the Controller in places near a radio, television set, or wireless installing. These devices can cause radio disturbances which adversely affect the performance of the Controller.

Mounting

The dimensions of the Digital Controller conform to DIN 43700.

Recommended panel thickness is 1 to 8 mm (1 to 5 mm for E5CK).

Mount the Unit horizontally.

Connection

To reduce inductive noise influence, the lead wires connecting the input type to the Digital Controller must be separated from the power lines and load lines.

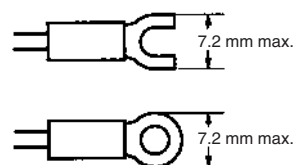
Use the specified compensating conductors for thermocouples. Use lead wires having a small resistance for platinum resistance thermometers.

Connection Example

Wire the terminals of the Unit using solderless terminals.

The tightening torque applied to the terminal screws of the Unit must be approximately 0.78 N·m or 8 kgf·cm.

Use the following type of solderless terminals for M3.5 screws.



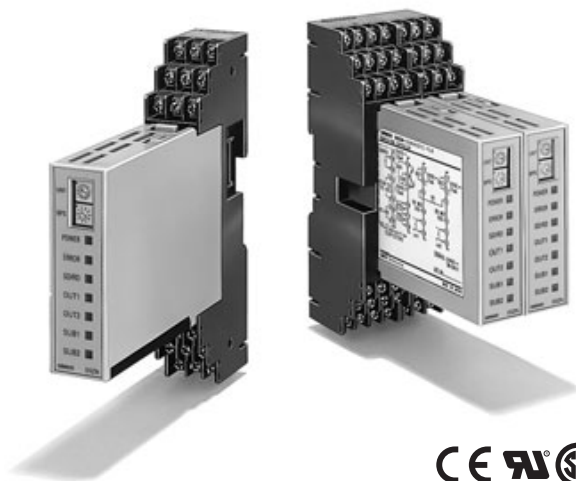
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Modular Temperature Controller E5ZN

New DIN Track Mounting Temperature Controller

- Two channels of temperature control available despite width of only 22.5 mm.
- The Temperature Controller itself can be replaced without changing terminal wiring.
- Use in combination with a compact Setting Display Unit to reduce communications programming requirements.
- A wide variety of operation indicators (single-color LEDs) enable easy operation monitoring.
- Power supply and communications wiring not required between Units when mounted side-by-side.



Model Number Structure

■ Model Number Legend

E5ZN- 2 □ □ □ □ □ -FLK
1 2 3 4 5 6 7

1. Control points

2: Two points

2. Control output

Q: Voltage (for driving SSR)

T: Transistor

C: Current

3. Auxiliary output

P: Transistor (sourcing)

N: Transistor (sinking)

4. Option

H: Heater burnout alarm

F: Transfer output

5. Communications

03: RS-485

6. Input type

TC: Thermocouple

P: Platinum resistance thermometer

7. CompoWay/F serial communications

-FLK: CompoWay/F serial communications

Ordering Information

List of Models

Name	Power supply	No. of control points	Control output	Auxiliary output	Functions	Communications functions	Input type (See note 5.)	Model	
Temperature Controller (See note 1.)	24 VDC	2	Voltage output (for SSRs)	Transistor output: 2 pts (sinking)	Heater burnout alarm (See note 3.)	RS-485	Thermocouple	E5ZN-2QNH03TC-FLK	
				Transistor output: 2 pts (sourcing)			Platinum resistance thermometer	E5ZN-2QNH03P-FLK	
				Transistor output			Transistor output: 2 pts (sinking)	Thermocouple	E5ZN-2QPH03TC-FLK
							Transistor output: 2 pts (sourcing)	Platinum resistance thermometer	E5ZN-2QPH03P-FLK
			Analog output (current output) (See note 2.)	Transfer output (linear voltage output) (See note 2.)	Thermocouple		E5ZN-2TNH03TC-FLK		
					Platinum resistance thermometer		E5ZN-2TNH03P-FLK		
				Transfer output (linear voltage output) (See note 2.)	Thermocouple		E5ZN-2TPH03TC-FLK		
					Platinum resistance thermometer		E5ZN-2TPH03P-FLK		
			Transfer output (linear voltage output) (See note 2.)	Transfer output (linear voltage output) (See note 2.)	Thermocouple		E5ZN-2CNF03TC-FLK		
					Platinum resistance thermometer		E5ZN-2CNF03P-FLK		
					Thermocouple		E5ZN-2CPF03TC-FLK		
					Platinum resistance thermometer		E5ZN-2CPF03P-FLK		

- Note:**
- Terminal Units are required for wiring. Purchase separately.
 - When connecting the load of the controlled system, heat control output or cool control output can be allocated to the control output or auxiliary output. When connecting a recording device or Digital Panel Meter, transfer output can be allocated to control output or auxiliary output 3 or 4 of analog output models.
 - When using the heater burnout alarm, purchase a Current Transformer (CT) separately.
 - When using heating and cooling control functionality, the auxiliary output will be either heating control output or cooling control output.
 - Analog input and infrared temperature sensors (ES1A-A) can also be used with thermocouple models.

Name	No. of terminals	Functions	Model
Terminal Unit (Includes bus system without backplane.)	24	Equipped with communications terminals for power supply, communications, and setting devices.	E5ZN-SCT24S-500
	18 (See note 1.)	Not equipped with communications terminals for power supply, communications, and setting devices.	E5ZN-SCT18S-500

- Note:**
- When using 2 or more E5ZNs mounted side-by-side, use the E5ZN-SCT18S-500 for the second and subsequent Units. When using E5ZNs separately, be sure to use the E5ZN-SCT24S-500.
 - Two End Plates are provided with E5ZN-SCT24S-500 Terminal Units. When mounting to a DIN track, be sure to mount End Plates on both sides.

Current Transformer (CT) (Order Separately)

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

Setting Display Unit (Order Separately)

Name	Power supply	Model
Setting Display Unit (See note.)	24 VDC	E5ZN-SDL

Note: Purchase sockets for wiring (shown on page 130) separately.

Terminal Cover

Model	E53-COV12	E53-COV13
Type	For SCT24S-500 models	For SCT18S-500 models

Note: The Terminal Cover comes with the Terminal Unit and does not have to be purchased separately.

Sockets (for Setting Display Unit - Order Separately)

Model	P2CF-11	P2CF-11-E	P3GA-11	Y92A-48G
Type	Front-connecting socket	Front-connecting socket (with finger protection)	Back-connecting socket	Terminal cover for finger protection

Note: Refer to the following manual for precautionary information and other information necessary to use the E5ZN: E5ZN Temperature Controller Operation Manual (Cat. No. H113).

Specifications

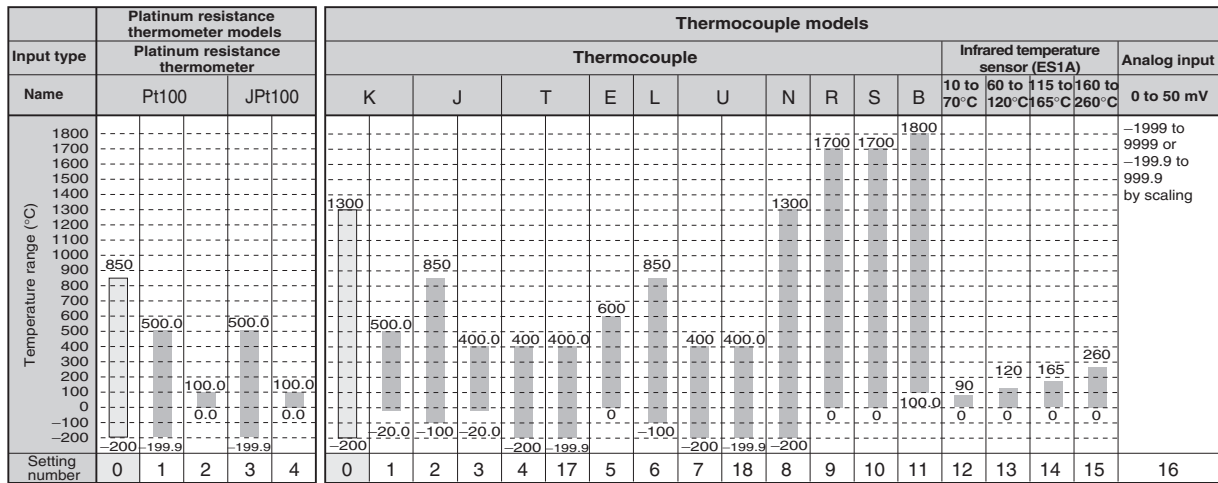
Ratings

Power supply voltage	24 VDC		
Allowable voltage range	85% to 110% of the rated power supply voltage		
Power consumption	Approx. 3 W		
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Infrared temperature sensor (ES1A series): 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C (See note 1.) Voltage input: 0 to 50 mV		
	Platinum resistance thermometer: Pt100, JPt100		
Control output	Voltage output (for driving SSR)	Output voltage: 12 VDC ±15% (PNP); Maximum load current: 21 mA; Equipped with short-circuit protection circuit	
	Transistor output	Maximum operational voltage: 30 VDC; Maximum load current: 100 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.	
	Current output	Current output range: 4 to 20/0 to 20 mA DC; Load: 350 Ω max. (See note 2.)	
Auxiliary output	Transistor output	Sourcing	Maximum operating voltage: 30 VDC; Maximum load current: 50 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.
		Sinking	
	Linear voltage output	Voltage output range: 1 to 5/0 to 5 VDC; Load: 10 kΩ min.	
Event input	Contact output	ON: 1 kΩ max., OFF: 100 kΩ min. Discharge current: Approx. 7 mA	
	Non-contact output	ON: Residual voltage: 1.5 V max., OFF: Leakage current: 0.1 mA max. Discharge current: Approx. 7 mA	
Number of input and control points	Input points: 2, Control points: 2		
Setting method	Via communications or using the Setting Display Unit (E5ZN-SDL)		
Control method	2-PID or ON/OFF control		
Other functions	Heater burnout detection function, transfer output function Multi-SP and RUN/STOP switching using event input		
Ambient operating temperature	-10 to 55°C (with no icing or condensation) For 3 years of assured use: -10 to 50°C		
Ambient operating humidity	25% to 85%		
Storage temperature	-25 to 65°C (with no icing or condensation)		

Note: 1. ES1A models with a temperature range of 160°C to 260°C have been discontinued.
2. OMRON G32A-EA Cycle Controller Unit (load impedance 352 Ω) can be used.

Input Range

Platinum Resistance Thermometer Models and Thermocouple Models



The applicable standards for the input types 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
- JPt100: JIS C 1604-1989, JIS C 1606-1989
- Pt100: JIS C 1604-1997 IEC 751

Shaded parts indicate the settings at the time of purchase.

Note: ES1A models with a temperature range of 160°C to 260°C have been discontinued.

■ Characteristics

Indication accuracy	Thermocouple: (Indicated value $\pm 0.5\%$ or $\pm 1^\circ\text{C}$, whichever is greater) ± 1 digit max. (See note 1.) Platinum resistance thermometer: (Indicated value $\pm 0.5\%$ or $\pm 1^\circ\text{C}$, whichever is greater) ± 1 digit max. (See note 1.) Analog input: $\pm 0.5\%$ or ± 1 digit max. CT input: $\pm 5\%$ FS ± 1 digit max.
Transfer output	Accuracy: $\pm 0.5\%$ FS (See note 2.)
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU) (See note 3.)
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU) (See note 3.)
Integral time (I)	0 to 3,999 s (in units of 1 s)
Derivative time (D)	0 to 3,999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0 to 100.0% (in units of 0.1%)
Alarm setting range	-1,999 to 9,999 (Position of decimal point depends on input type.)
Sampling period	500 ms
Insulation resistance	20 MW min. (at 500 VDC)
Dielectric strength	600 VAC for 1 minute at 50 or 60 Hz (between unlike terminals of charged parts)
Vibration resistance	10 to 55 Hz, 10 m/s ² for 2 hrs each in X, Y, and Z directions
Shock resistance	150 m/s ² max., 3 times each in $\pm X$, $\pm Y$, and $\pm Z$ directions
Enclosure rating	Temperature Controller: IP00 Terminal Unit: IP00
Memory protection	EEPROM (non-volatile memory) (Number of write operations: 100,000)
Weight	Temperature Controller: Approx. 90 g Terminal Unit (18): Approx. 80 g Terminal Unit (24): Approx. 100 g
Approved standards (See note 4.)	UL File No.: E200593 CSA File No.: 203889-1140084 CE EMS: ESD EN61326, EN61000-4-2 (4 kV/contact, 8 kV/air) REM field EN61326, EN61000-4-3 (10 V/m) Fast transient EN61326, EN61000-4-4 (2 kV/DC power, 1 kV/I/O) Surge immunity EN61326, EN61000-4-5 (line to ground: 2 kV/DC power 1 kV/I/O line to line: 1 kV/DC power) Conducted RF EN61326, EN61000-4-6 (10 V) EMI: Radiated EN61326 Class A

- Note:**
1. The indication accuracy for T and N thermocouples at -100°C , and for U and L thermocouples is $\pm 2^\circ\text{C} \pm 1$ digit max. There is no specification for the indication accuracy for the B thermocouple used at 400°C max. The indication accuracy for R and S thermocouples at 200°C max. is $\pm 3^\circ\text{C} \pm 1$ digit max.
 2. The transfer output accuracy for 0 to 4 mA when 0 to 20 mA DC is selected is $\pm 0.5\%$ FS $+0.7$ mA. The transfer output accuracy for 0 to 1 V when 0 to 5 VDC is selected is $\pm 0.5\%$ FS $+0.175$ V.
 3. "EU" stands for "Engineering Unit."
 4. In order to satisfy the EN61326 Class A standard for conducted emissions, install a noise filter (Densei-Lambda MXB-1206-33 or equivalent) in a DC power line as close to the E5ZN as possible.

■ Communications (Host Communications)

Transmission line connection method	RS-485 multipoint
Communications method	RS-485 (2-wire, half-duplex)
Synchronization method	Start-stop synchronization
Baud rate	4,800, 9,600, 19,200, or 38,400 bps
Transmission code	ASCII
Data bit length (See note.)	7 or 8 bits
Stop bit length (See note.)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) BCC (block check character)
Flow control	None
Interface	RS-485
Retry function	None
Number of Units that can be connected in parallel	16 Units max. (32 channels)

Note: The baud rate, data bit length, stop bit length, and vertical parity can all be set independently as host communications settings.

■ Setting Display Unit (Order Separately) Ratings and Characteristics

Power supply voltage	24 VDC
Allowable voltage range	85% to 110% of the rated power supply voltage
Power consumption	Approx. 1 W
Display method	7-segment digital display and single-color display
Ambient operating temperature	-10 to 55°C (with no icing or condensation) For 3 years of assured use: -10 to 50°C
Ambient operating humidity	25% to 85%
Storage temperature	-25 to 65°C (with no icing or condensation)
Communications method	RS-485 (half-duplex)
Communications format	Fixed
Insulation resistance	20 MW min. (at 500 VDC)
Dielectric strength	1,500 VAC for 1 minute at 50 or 60 Hz (between unlike terminals of charged parts)
Vibration resistance	10 to 55 Hz, 20 m/s ² for 2 hrs each in X, Y, and Z directions
Shock resistance	300 m/s ² max., 3 times each in ±X, ±Y, and ±Z directions
Enclosure ratings	Front panel: IP50 Rear case: IP20 Terminal case: IP00
Memory protection	EEPROM (non-volatile memory) (Number of writes: 100,000)
Weight	Approx. 100 g Mounting bracket: Approx. 10 g

■ Current Transformer (CT) Ratings (Order Separately)

Dielectric strength	1,000 VAC (1 minute)
Vibration resistance	50 Hz, 98 m/s ²
Weight	E54-CT1: Approx. 11.5 g E54-CT3: Approx. 50 g
Accessories (E54-CT3 only)	Armature (2) Plug (2)

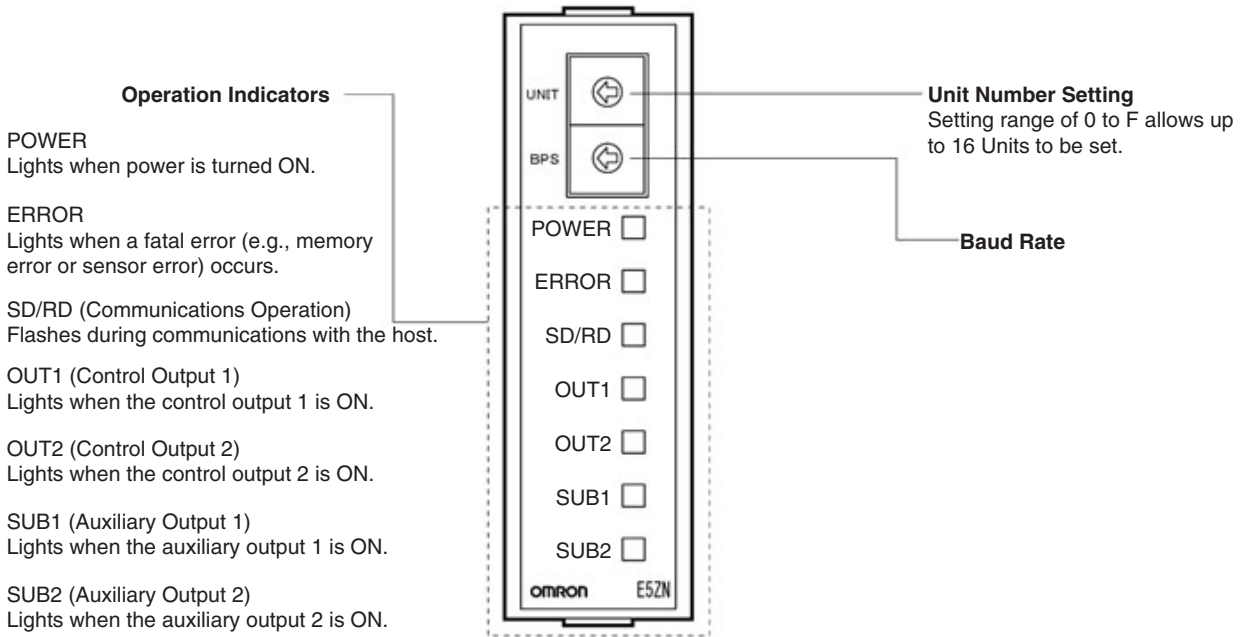
■ Heater Burnout Alarm Characteristics

Maximum heater current	Single-phase, 50 A AC (See note 1.)
Input current readout accuracy	±5% FS ±1 digit max.
Heater burnout alarm setting range	0.0 to 50.0 A (in units of 0.1 A) (See note 2.)
Minimum detection ON time	190 ms (See note 3.)

- Note:**
1. Use the K2CU-F□□A□GS (with GATE input terminal) for burnout detection of 3-phase heaters.
 2. If the heater burnout alarm setting is set to 0.0 A, the alarm is always OFF, and if it is set to 50.0 A the alarm is always ON.
 3. If the ON time for control output is less than 190 ms, heater burnout detection and heater current measurement will not be performed.

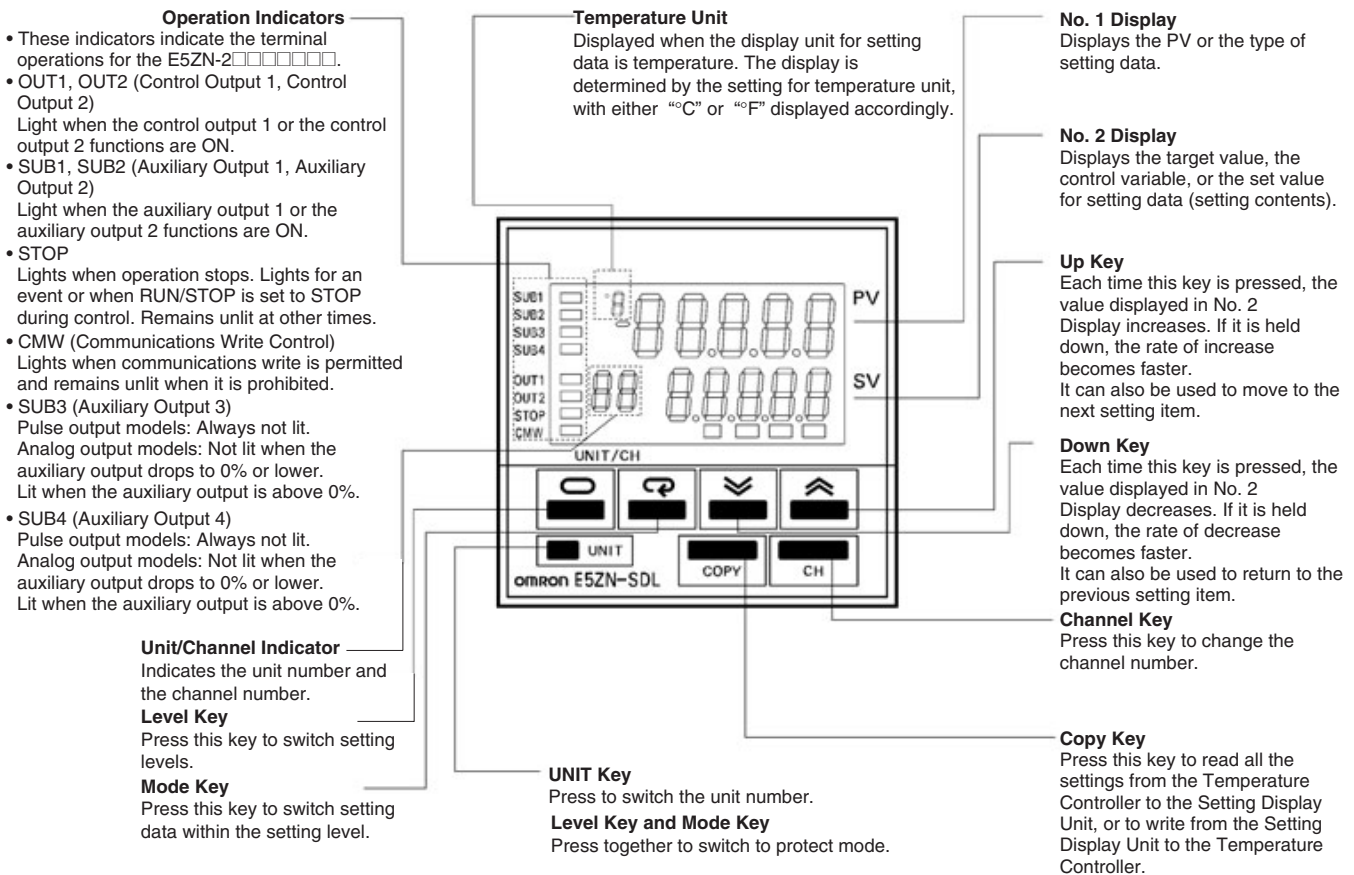
Nomenclature

E5ZN-2



E5ZN-SDL

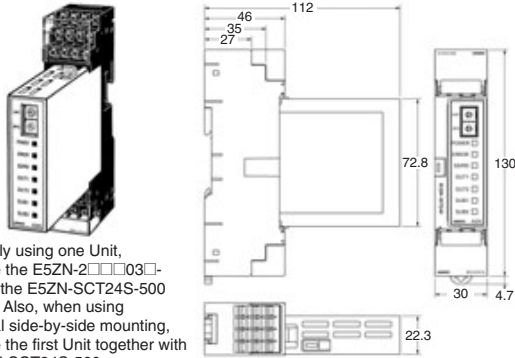
The following diagram shows the names and functions of the E5ZN-SDL parts for when it is connected to the E5ZN-2□□□□□□□□.



Dimensions

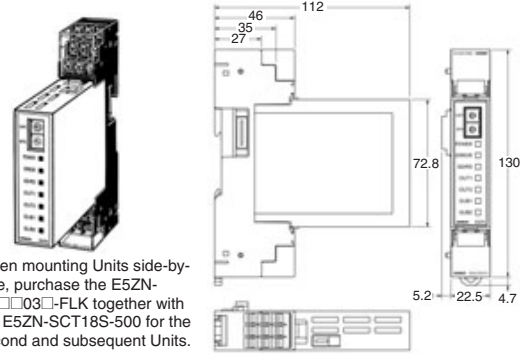
Note: All units are in millimeters unless otherwise indicated.

E5ZN-2□□□03□-FLK Connected to E5ZN-SCT24S-500



When only using one Unit, purchase the E5ZN-2□□□03□-FLK and the E5ZN-SCT24S-500 together. Also, when using horizontal side-by-side mounting, purchase the first Unit together with the E5ZN-SCT24S-500.

E5ZN-2□□□03□-FLK Connected to E5ZN-SCT18S-500

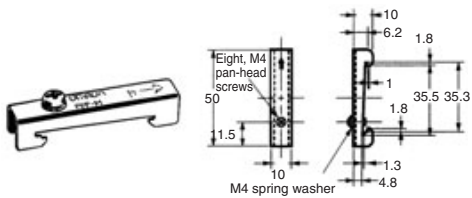


When mounting Units side-by-side, purchase the E5ZN-2□□□03□-FLK together with the E5ZN-SCT18S-500 for the second and subsequent Units.

Note: Refer to the following manual for precautionary information and other information necessary to use the E5ZN: E5ZN Modular Temperature Controller User's Manual (Cat. No. H113).

End Plate

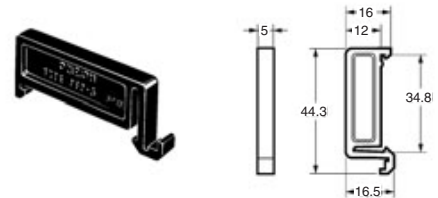
PFP-M



Note: End Plates are provided with the E5ZN-SCT24-500. Be sure to mount End Plates at both ends of Unit blocks.

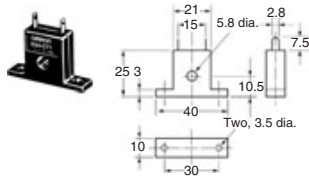
Spacer

PFP-S

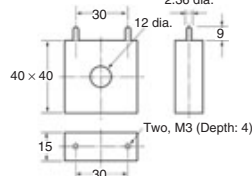


Current Transformer (Order Separately)

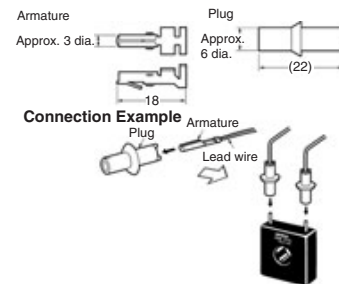
E54-CT1



E54-CT3

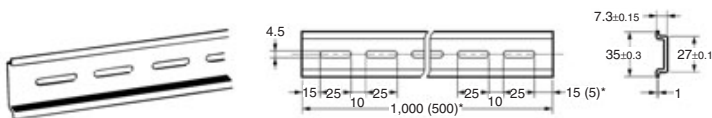


E54-CT3 Accessories



Mounting Track (for DIN Track Mounting - Order Separately)

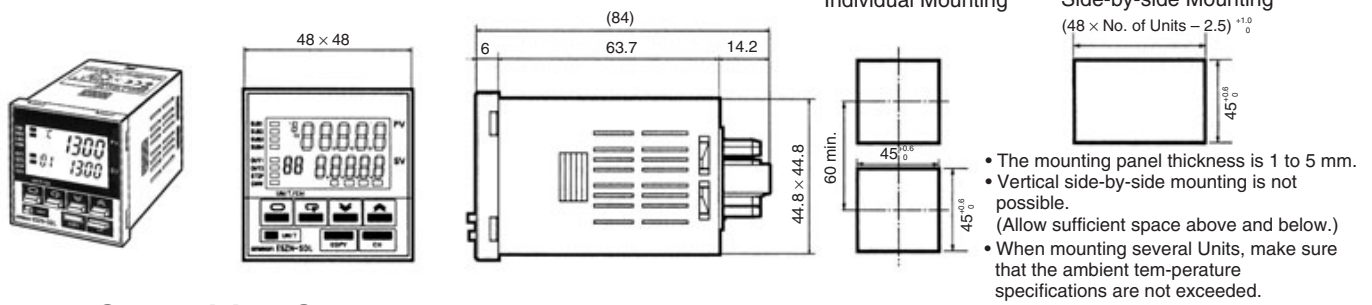
PFP-100N PFP-50N



* Indicates dimensions for the PFP-50N.

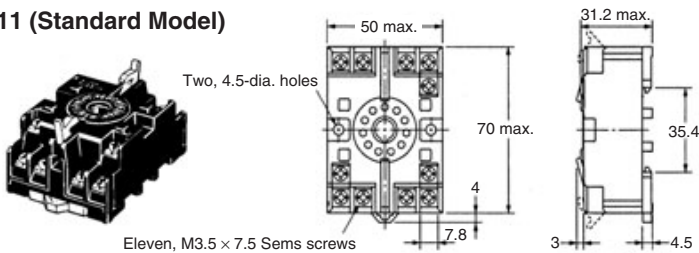
Temperature Controller

Setting Display Unit E5ZN-SDL

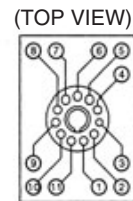


E5ZN-SDL Wiring Sockets Front-connecting Sockets

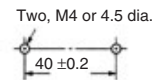
P2F-11 (Standard Model)



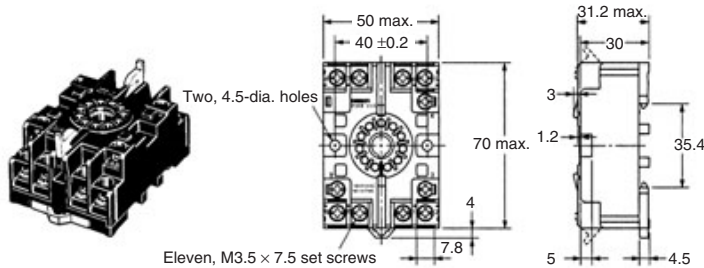
Terminal Arrangement/ Internal Connections



Mounting Hole Cutout Dimensions



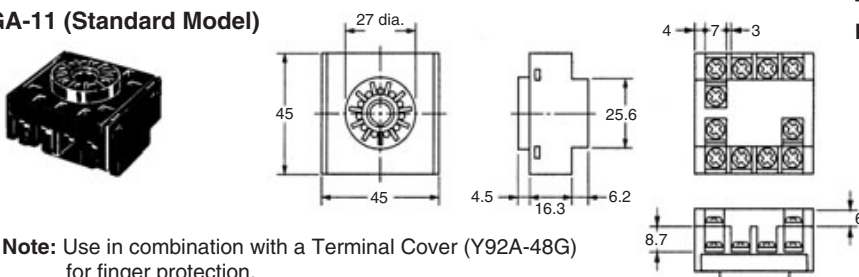
P2F-11-E (with Finger Protection)



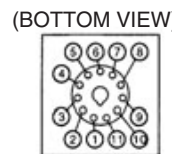
Note: DIN track mounting is also possible.

Back-connecting Sockets

P3GA-11 (Standard Model)



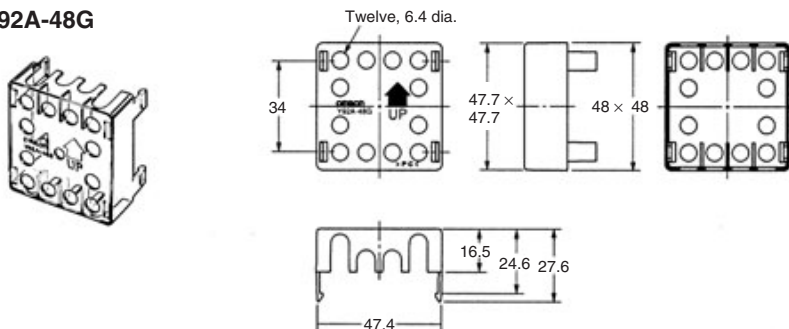
Terminal Arrangement/ Internal Connections



Note: Use in combination with a Terminal Cover (Y92A-48G) for finger protection.

Terminal Cover

Y92A-48G

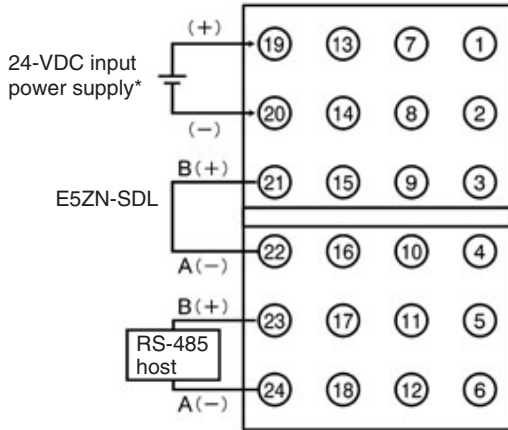


Installation

■ Connection Diagrams

- Voltage output (control output) is not electrically isolated from internal circuitry. Therefore, when using grounded thermocouples, do not ground control output terminals. (Doing so may result in temperature measurement errors due to unwanted current paths.)
- There is basic insulation between the power supply inputs and outputs for this product. If reinforced insulation is required, connect the input and output terminals to equipment without any exposed charge-carrying parts, or to equipment with basic insulation sufficient for the maximum operating voltage of the power supply and the inputs and outputs.

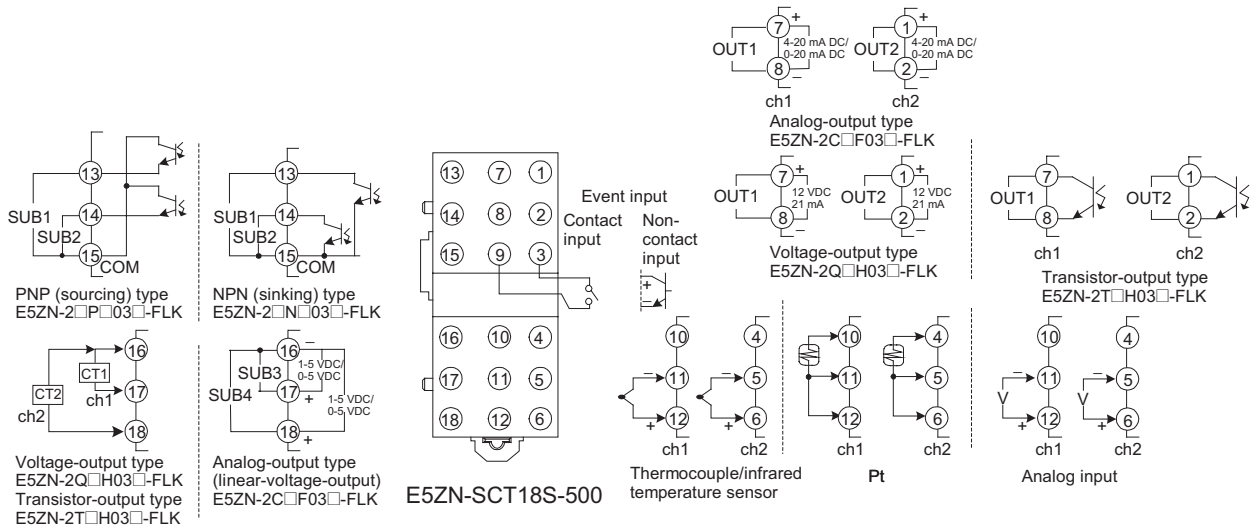
Using with the E5ZN-SCT24S-500



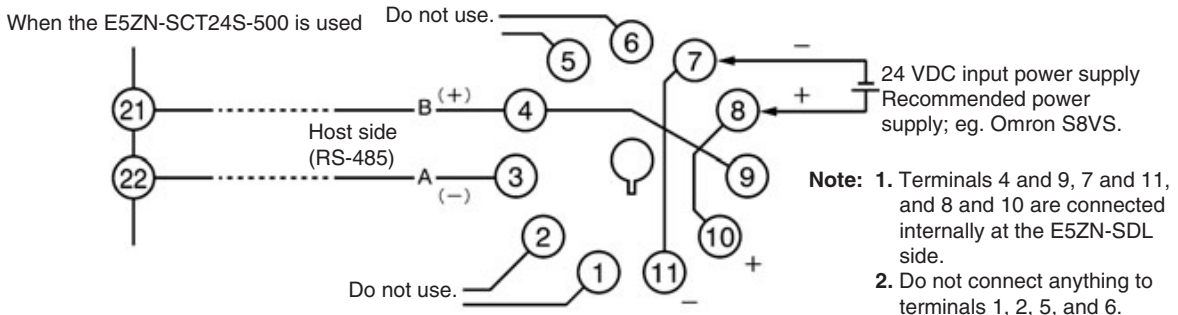
Wiring for terminals 1 to 18 is the same as for the E5ZN-SCT18S-500. See below.

*Power supply: recommended power supply; eg. OMRON S8VS

Using with the E5ZN-SCT18S-500



E5ZN-SDL

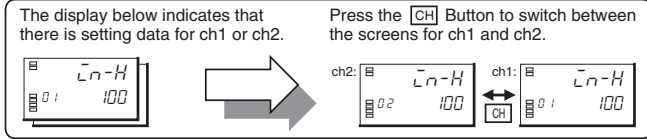


Note: Purchase either a P2CF-11 or a P3GA-11 Socket separately. (Refer to page 136.)

Operation

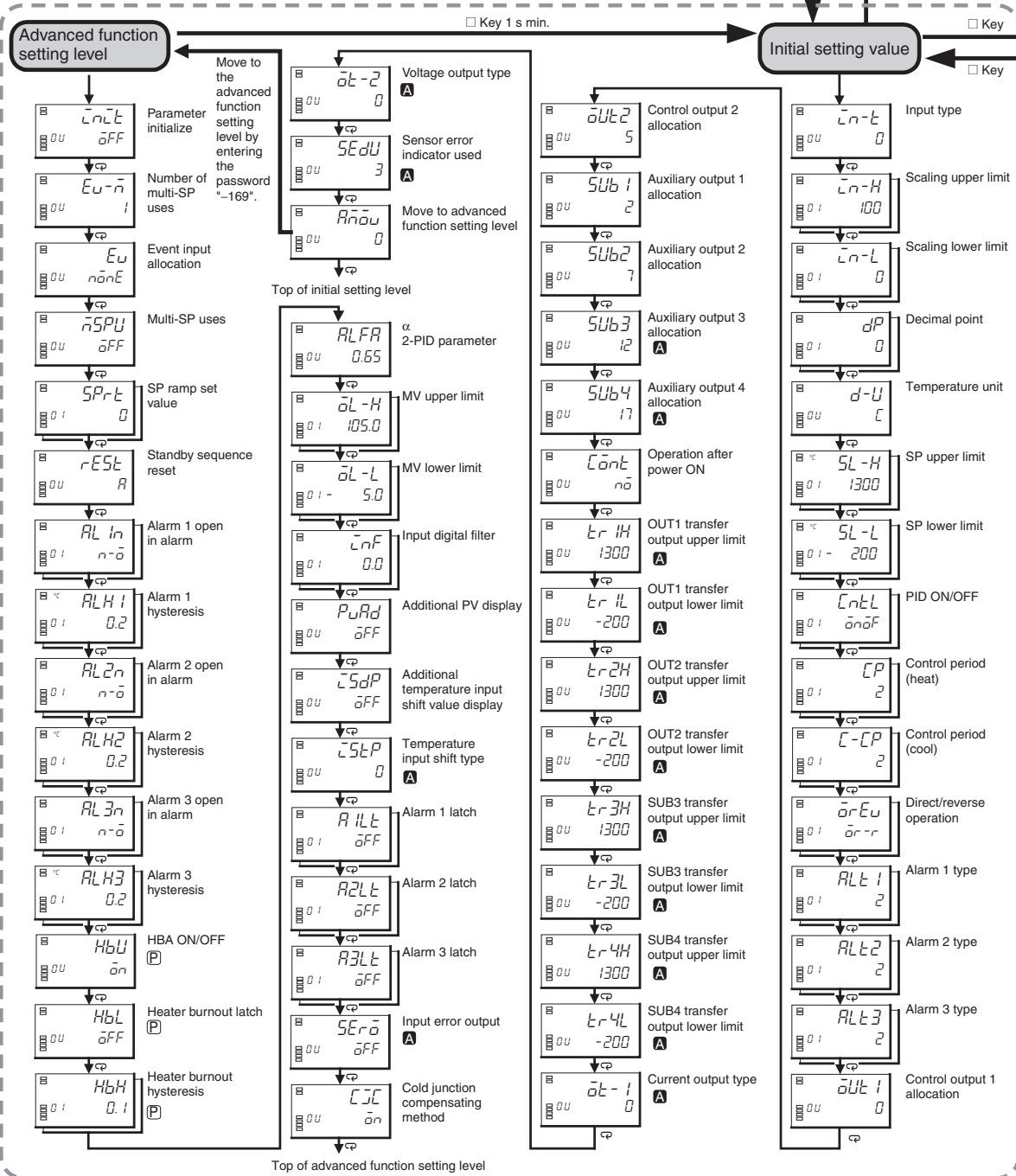
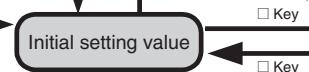
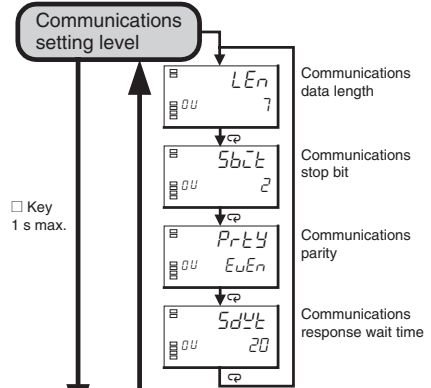
E5ZN-SDL Setting Data

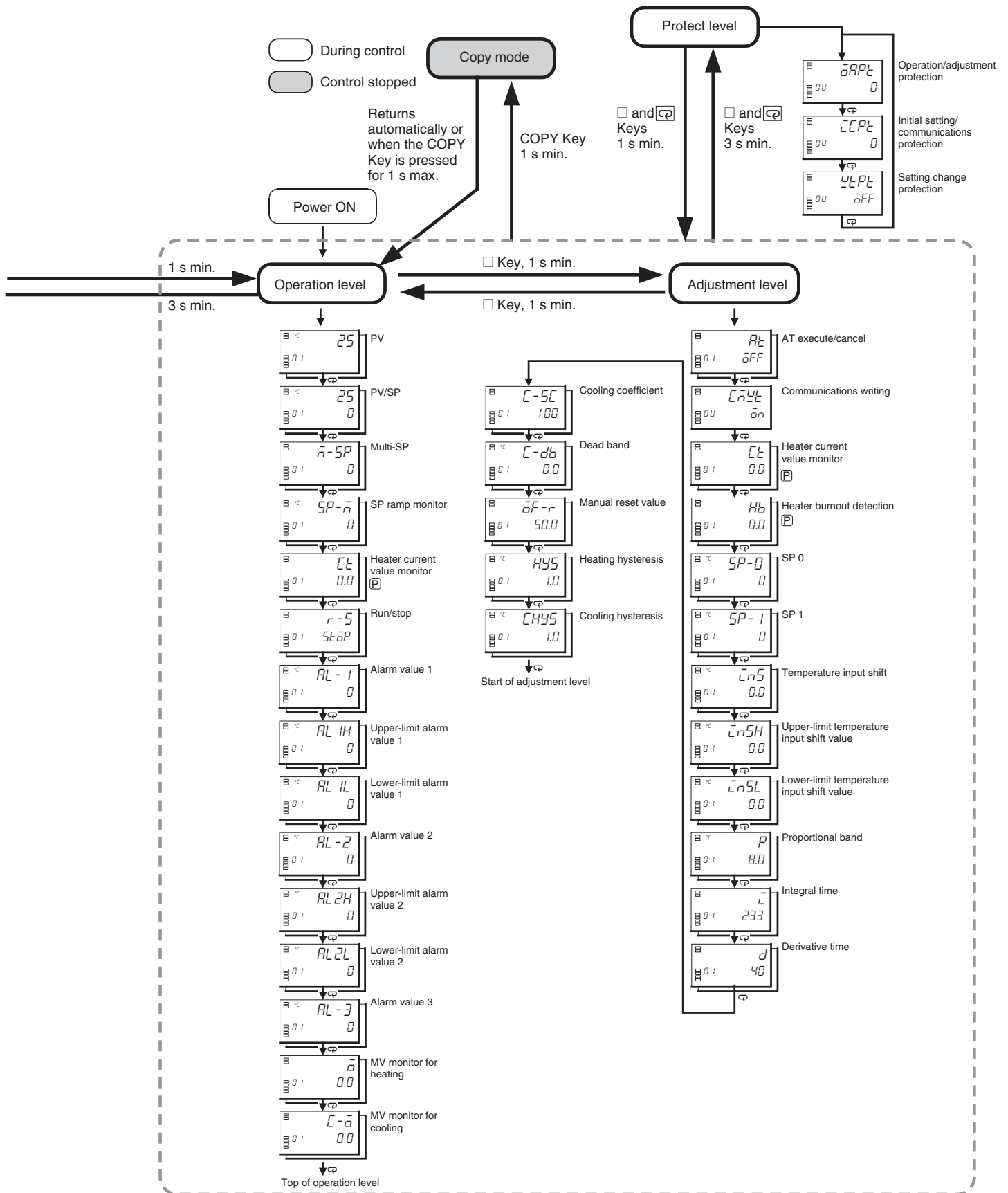
The setting data that can be set from the E5ZN-SDL Setting Display Unit is shown below. Depending on the protection settings and other factors, some settings may not be displayed. A password is required to move to the advanced function setting level.



P: This symbol indicates setting data that is displayed only for models with pulse output. ("Models with pulse output" is used here to indicate models with voltage output or transistor output.)

A: This symbol indicates setting data that is displayed only for models with analog output.





Examples of Functions

Using as a Temperature Input Signal Converter

Transfer Output Types

- The ten types of data shown below can be allocated for transfer output using the control output 1 allocation, control output 2 allocation, auxiliary output 3 allocation, and auxiliary output 4 allocation (initial setting level).
- Transfer output is supported by analog output models only.

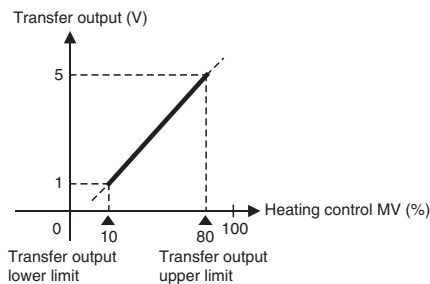
ch1	ch2
Transfer output for ch1 set point	Transfer output for ch2 set point
Transfer output for ch1 ramp set point	Transfer output for ch2 ramp set point
Transfer output for ch1 process value	Transfer output for ch2 process value
Transfer output for ch1 heating control MV	Transfer output for ch2 heating control MV
Transfer output for ch1 cooling control MV	Transfer output for ch2 cooling control MV

Note: Control outputs 1 and 2 use current output and auxiliary outputs 3 and 4 use linear voltage output.

Transfer Output Scaling

- The range set by the transfer output upper limit and transfer output lower limit (initial setting level) can be scaled to the output range for the transfer output (4 to 20 mA DC or 0 to 20 mA DC for control outputs 1 and 2, and to 1 to 5 VDC or 0 to 5 VDC for auxiliary outputs 3 and 4).
- The scale can be expanded by setting a small range between the transfer output upper and lower limits. Reverse scaling can be performed by setting the transfer output upper limit to a value smaller than the transfer output lower limit. The following figure shows a scaling example where the heating control MV transfer output is scaled to 1 to 5 VDC.

Example: Scaling to 1 to 5 VDC



Reading Temperatures for Multiple E5ZN Units

With conventional models, if the present temperature is read from multiple Temperature Controllers using host communications, there are time differences in the process temperatures read from each Temperature Controller, making it difficult to obtain concurrent data.

With the E5ZN, the PV hold function can be used to ensure that the data is concurrent to within 500 ms.

PV Hold

The PV hold function temporarily stores the present temperature for that moment as the PV hold value, when the "PV hold" operation command sent by host communications is received. (See fig. 1.)

Example 2: Displaying the ch2 Process Values on an External Meter Using Transfer Output

Temperature Controller: E5ZN-2C□F03P-FLK (current output, platinum resistance thermometer input)
 Meter: K3MA-J 24 VAC/VDC (Process Meter)

Temperature Controller Settings:

Sensor input type (initial setting level): 2 (platinum resistance thermometer, 0.0°C to 100.0°C)
 Control output allocation 2 (initial setting level): 17 (process value transfer output for ch2)
 OUT2 transfer output upper limit (initial setting level): 100.0 (°C)
 OUT2 transfer output lower limit (initial setting level): 0 (°C)
 Current output type (initial setting level): 0 (4 to 20 mA DC)

Meter Setting Example:

Inputs for 4 to 20 mA DC are scaled to 0.0 to 100.0°C.
 Input type (initial setting level: $\bar{c}n-t$): 4 to 20 mA DC (4-20)
 Scaling input value 1 (initial setting level: $\bar{c}n.P.1$): 4 mA (4.00)
 Scaling display value 1 (initial setting level: $dSP.1$): 0 (00000)
 Scaling input value 2 (initial setting level: $\bar{c}n.P.2$): 20 mA (20.00)
 Scaling display value 2 (initial setting level: $dSP.2$): 100 (0 10000)
 Decimal point (initial setting level: dP): One decimal place (0000.0)

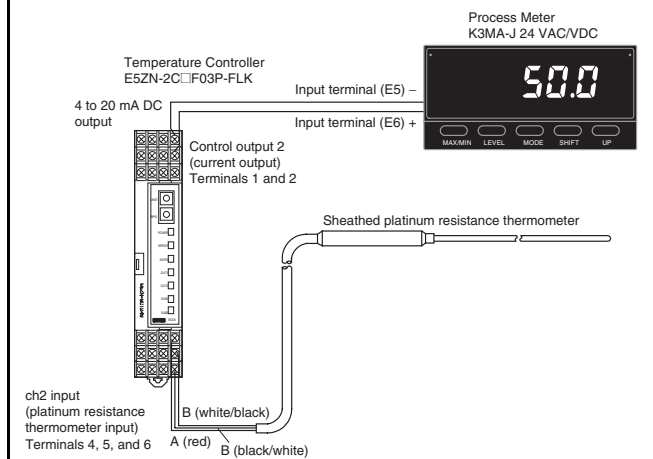
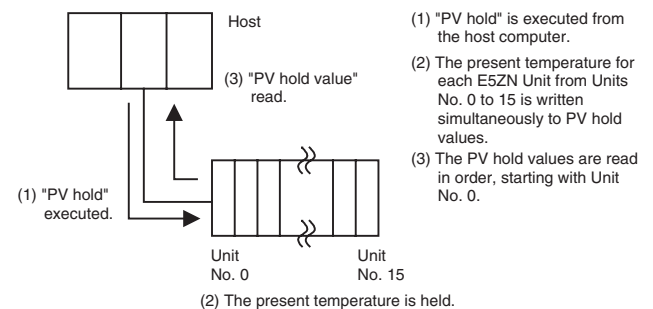


Fig. 1



- Note:**
- PV hold values are overwritten every time the "PV hold" operation command is executed. Once the PV hold values have been read for channels that require simultaneous reading of present temperatures, execute the next "PV hold" operation command.
 - The "PV hold" operation command cannot be executed and the "PV hold value" cannot be read from the E5ZN-SDL Setting Display Unit.
 - When the power is turned OFF, the PV hold values change to 0.

Precautions

■ General Precautions

The user must operate the product according to the performance specifications described in the operation manual. Before using the product under conditions that are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

■ Safety Precautions

Definition of Precautionary Information

⚠ WARNING
The above symbol indicates a situation that may result in injury or property damage.

Warnings

⚠ WARNING
Do not allow metal fragments or lead wire scraps to fall inside this product. These may cause electric shock, fire, or malfunction.

⚠ WARNING
Do not use the product in locations subject to flammable or explosive gases. Doing so may result in explosion.

⚠ WARNING
Do not touch any of the terminals while the power is ON. Doing so may result in electric shock.

⚠ WARNING
Provide at least one power-interruption switch to ensure that the power is OFF before wiring. Not doing so may result in electric shock.

⚠ WARNING
To maintain safety in the event of a product malfunction, always take appropriate safety measures, such as installing an alarm on a separate line to prevent excessive temperature rises. If a malfunction prevents proper control, a major accident may result.

⚠ WARNING
Do not attempt to disassemble, repair, or modify the product. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠ WARNING
Tighten screws to the specified torques given below. Loose screws may result in burning or malfunction.
E5ZN-SCT□S-500: 0.40 to 0.56 N·m
E5ZN-SDL: 0.74 to 0.90 N·m

⚠ WARNING
Set all settings according to the control target of the product. If the settings are not appropriate for the control target, the product may operate in an unexpected manner, resulting in damage to the product or accidents.

■ Application and Operating Environment Precautions

- Observe the following points to ensure safe operation.
1. Use and store the product within the specified temperature and humidity ranges. Cool the product (e.g., using fans) where necessary.
 2. Do not touch the electronic components or pattern of the PCB. Hold the product by the case.
 3. To ensure proper heat dissipation, leave a space around the product. Do not block the product's ventilating holes.
 4. Use at the rated power supply voltage with the rated load.
 5. Be sure to connect terminals with the correct polarity.
 6. Perform wiring using crimp terminals of the specified size. (E5ZN-SCT□S-500: M3.0, width 5.8 mm max.; E5ZN-SDL: M3.5, width 7.2 max.)
 7. Be sure to use wires satisfying the following specifications for connection using bare wires.
Power supply terminals: AWG 22 to 14
Other terminals: AWG 28 to 16
(Length of exposed part: 6 to 8 mm)
 8. Do not connect anything to unused terminals.
 9. Ensure that the rated voltage is reached within 2 seconds of turning power ON.
 10. Allow 30 seconds' warm-up time.
 11. Install the product as far away as possible from devices that generate strong, high-frequency noise and devices that generate surges.
 12. Keep wiring separate from high-voltage power lines or power lines carrying large currents. Do not wire in parallel with or together with power lines.
 13. Install switches or circuit-breakers so that the user can turn the power OFF immediately, and indicate these accordingly.
 14. Do not use the product in the following locations:
 - Locations subject to dust or corrosive gases (in particular, sulfide gas and ammonia gas)
 - Locations subject to freezing or condensation
 - Locations exposed to direct sunlight
 - Locations subject to vibrations or shocks
 - Locations subject to exposure to water or oil
 - Locations subject to heat radiated directly from heating equipment
 - Locations subject to intense temperature changes
 15. When the Terminal Unit is separated from the Temperature Controller, under no circumstances touch the electrical components or apply shock to the Temperature Controller.
 16. Do not use solvents to clean the product. Use commercial alcohol.
 17. After wiring is completed remove the dust-protection label to allow proper heat dissipation.
 18. When mounting the Temperature Controller to the Terminal Unit, make sure that the hook on the side of the Temperature Controller facing the Terminal Unit is inserted properly.
 19. Install the DIN track vertically.

■ Correct Use

Service Life

- Use within the following temperature and humidity ranges:
- Temperature: -10 to 55°C (with no icing or condensation)
 - Humidity: 25% to 85%

If the product is installed inside a control panel, the temperature around the product (and not the temperature around the control panel) must be kept below 55°C.

With electronic devices like the E5ZN, the service life will depend not only on the number of switching operations performed by the relay but also on the service life of the internal electronic components. The service life of these components depends on the ambient temperature; it will be shorter if the ambient temperature is high, and longer if the ambient temperature is low. For this reason, the service life of the product can be lengthened by keeping the inside of the E5ZN at a low temperature.

If several Units are mounted side-by-side or are arranged vertically, the heat generated may cause the internal temperature of the Units to rise, reducing service life. To prevent this, take steps to ensure that the Units are cooled, such as installing fans.

Ensure, however, that the terminals are not also cooled, otherwise correct temperature measurement will not be possible.

Measurement Accuracy

When extending the lead wires for thermocouples, use a compensating conductor appropriate for the type of thermocouple used.

When extending the lead wires for platinum resistance thermometers, use lead wires with a low resistance, and make the resistance in the 3 lead wires equal.

Mount the E5ZN horizontally.

If significant errors occur, check that input compensation has been set correctly.

Waterproofing

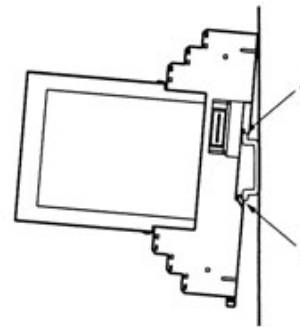
The enclosure ratings are given below. Parts for which the enclosure rating is not clearly indicated, and parts with IP□0 ratings (where □ is not 0) do not have waterproof specifications.

- Temperature Controller: IP00
- Terminal Unit: IP00

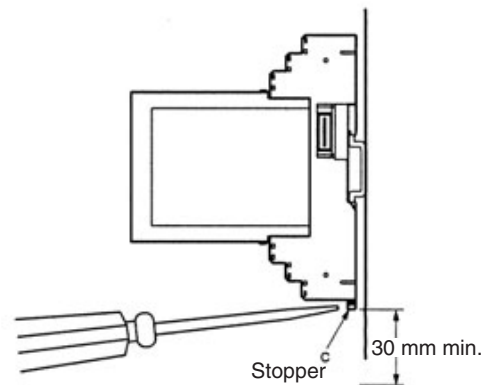
Note: Refer to the following manual for precautionary information and other information necessary to use the E5ZN: E5ZN Temperature Controller Operation Manual (Cat. No. H113).

Mounting and Dismounting

- To mount using a mounting track, first hook part A (see below) onto the track and then push down on part B.



- To dismount, insert a flat-bladed screwdriver into part C, pull the hook down, and then lift the bottom part of the E5ZN upwards.



- Mount the E5ZN at least 30 mm away from other devices to ensure easy mounting and dismounting.

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 catalog.
- 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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

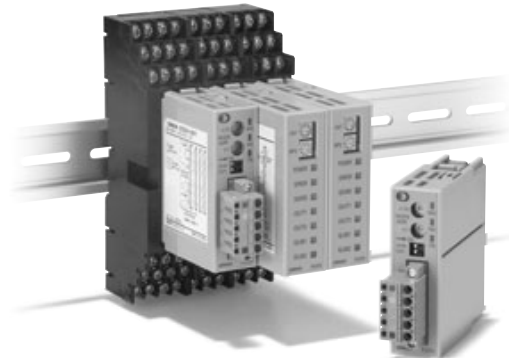
Cat. No. H116-E1-02A

In the interest of product improvement, specifications are subject to change without notice.

DeviceNet Communications Unit E5ZN-DRT

Connect the E5ZN Modular Temperature Controller to DeviceNet

- The I/O link function allows setting and monitoring (e.g., of present values) for the E5ZN Modular Temperature Controller to be performed without communications programming.
- Up to 16 E5ZN Modular Temperature Controllers can be connected to one Unit.
- All the parameters for the E5ZN can be uploaded or downloaded in one operation using DeviceNet Configurator.



Ordering Information

List of Models

Name	External input power supply voltage	Applicable Temperature Controller	Model
DeviceNet Communications Unit	24 VDC	E5ZN	E5ZN-DRT

Note: A DeviceNet Communications Unit and Terminal Unit are required to connect to DeviceNet. (For details on the Terminal Unit, refer to page 148 or to the E5ZN Catalog (H116-E1-02).) Two End Plates are provided with E5ZN-SCT24S Terminal Units. When mounting to a DIN track, be sure to mount End Plates on both sides.

Specifications

Ratings

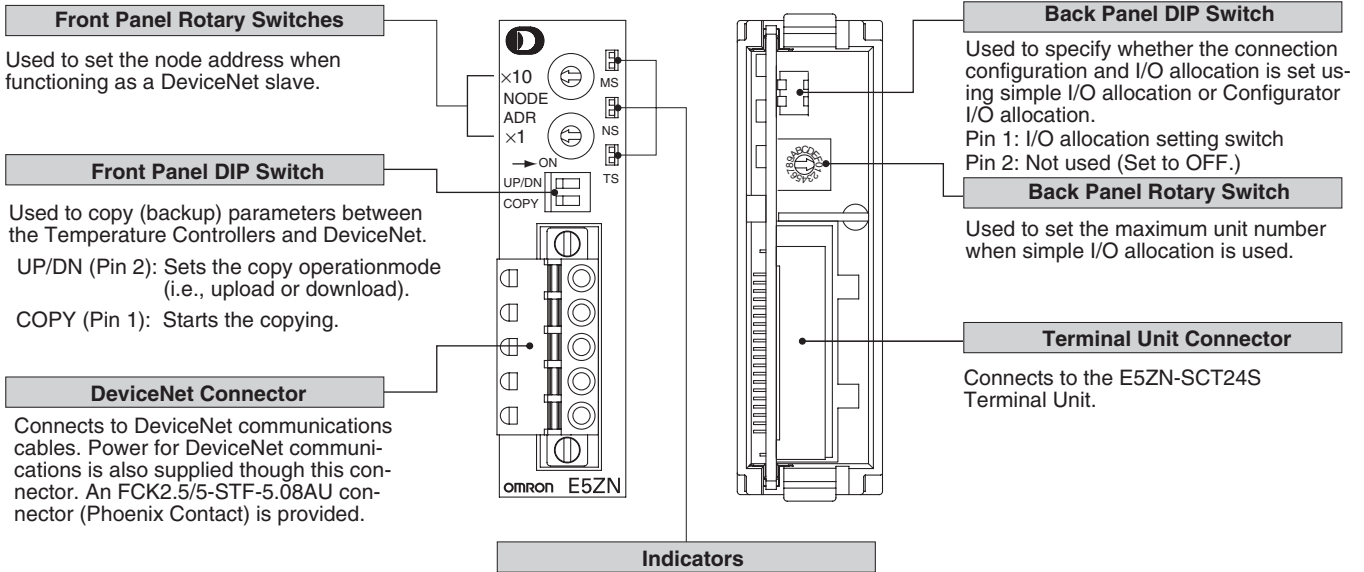
Power supply voltage	DeviceNet	24 VDC (for internal circuits)
	External input power supply	24 VDC (for RS-485 communications circuits and Temperature Controllers)
Allowable voltage range	DeviceNet	11 to 25 VDC
	External input power supply	20.4 to 26.4 VDC
Power consumption (See note.)	DeviceNet	Approx. 1.1 W (for a current of 45 mA at 24 VDC)
	External input power supply	Approx. 0.5 W (for a current of 20 mA at 24 VDC)
Connectable Temperature Controllers	E5ZN Series	
Maximum number of connectable Temperature Controllers	16	
Ambient operating temperature	-10 to 55°C (with no icing or condensation)	
Ambient operating humidity	25% to 85%	
Ambient storage temperature	-25 to 65°C (with no icing or condensation)	

Note: The power consumption for the Temperature Controllers is not included.

Temperature Controller

Nomenclature

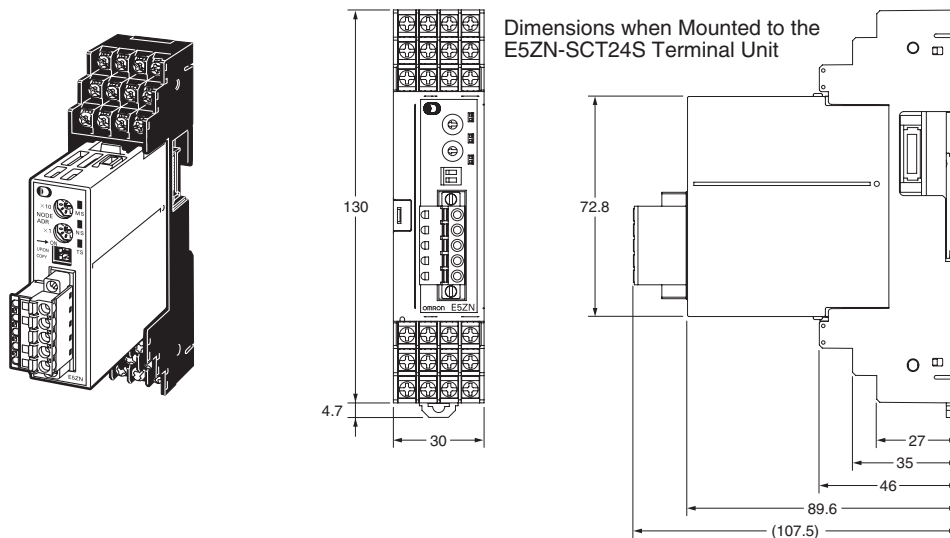
E5ZN-DRT



Dimensions

Note: All units are in millimeters unless otherwise indicated.

E5ZN-DRT



Temperature Controller

E5ZN Modular Temperature Controllers

■ List of Models

Name	Power supply	No. of control points	Control output	Auxiliary output	Functions	Communications functions	Input type (See note 5.)	Model	
Temperature Controller (See note 1.)	24 VDC	2	Voltage output (for SSRs)	Transistor output: 2 pts (sinking)	Heater burnout alarm (See note 3.)	RS-485	Thermocouple	E5ZN-2QNH03TC-FLK	
							Platinum resistance thermometer	E5ZN-2QNH03P-FLK	
				Transistor output: 2 pts (sourcing)			Thermocouple	E5ZN-2QPH03TC-FLK	
							Platinum resistance thermometer	E5ZN-2QPH03P-FLK	
			Transistor output	Transistor output: 2 pts (sinking)	Heating or heat/cool control is selectable (See note 4.)		Thermocouple	E5ZN-2TNH03TC-FLK	
							Platinum resistance thermometer	E5ZN-2TNH03P-FLK	
				Transistor output: 2 pts (sourcing)			Thermocouple	E5ZN-2TPH03TC-FLK	
							Platinum resistance thermometer	E5ZN-2TPH03P-FLK	
			Analog output (current output) (See note 2.)	Transfer output (linear voltage output) (See note 2.)	Event input: 1 point per Unit		Thermocouple	E5ZN-2CNF03TC-FLK	
								Platinum resistance thermometer	E5ZN-2CNF03P-FLK
							Transistor output: 2 pts (sinking)	Thermocouple	E5ZN-2CPF03TC-FLK
								Platinum resistance thermometer	E5ZN-2CPF03P-FLK

Note: 1. Terminal Units are required for wiring. Purchase separately.

2. When connecting the load of the controlled system, heat control output or cool control output can be allocated to the control output or auxiliary output. When connecting a recording device or Digital Panel Meter, transfer output can be allocated to control output or auxiliary output 3 or 4 of analog output models.
3. When using the heater burnout alarm, purchase a Current Transformer (CT) separately.
4. When using heating and cooling control functionality, the auxiliary output will be either heating control output or cooling control output.
5. Analog input and infrared temperature sensors (ES1A-A) can also be used with thermocouple models.

Name	No. of terminals	Functions	Model
Terminal Unit (Includes bus system without backplane.)	24	Equipped with communications terminals for power supply, communications, and setting devices.	E5ZN-SCT24S-500
	18 (See note 1.)	Not equipped with communications terminals for power supply, communications, and setting devices.	E5ZN-SCT18S-500

Note: 1. When using 2 or more E5ZNs mounted side-by-side, use the E5ZN-SCT18S-500 for the second and subsequent Units. When using E5ZNs separately, be sure to use the E5ZN-SCT24S-500.

2. Two End Plates are provided with E5ZN-SCT24S-500 Terminal Units. When mounting to a DIN track, be sure to mount End Plates on both sides.

Setting Display Unit (Order Separately)

Name	Power supply	Model
Setting Display Unit (See note.)	24 VDC	E5ZN-SDL

Note: Purchase sockets for wiring separately.

Warranties, 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 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 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 which apply to the combination of the product in the customer's application or use of the product.

Take all necessary steps to determine the suitability of the product for the systems, machines and equipment with which it will be used.

Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCT 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 PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Precautions

■ Definition of Precautionary Information

—⚠ WARNING —

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

—⚠ Caution —

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

—⚠ WARNING —

Provide safety measures (such as emergency stop circuits, interlock circuits, and limit circuits) in external circuits in order to ensure safety in the system if an abnormality occurs due to malfunction of the PC or another external factor affecting the PC operation. Not doing so may result in serious accidents.

—⚠ Caution —

Tighten screws to the specified torques given below. Loose screws may result in burning or malfunction.
Connector screws: 0.25 to 0.3 N · m; Terminal screws: 0.40 to 0.56 N · m

Confirm safety at the destination node before transferring a program to another node or changing contents of the I/O memory area. Doing either of these without confirming safety may result in injury.

Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

Do not allow metal fragments or lead wire scraps to fall inside this product. These may cause electric shock, fire, or malfunction.

Notice

Observe the following points to ensure safe operation.

- Set the communications distance to within the range specified in the E5ZN-DRT User's Manual (Cat. No. H119).
- Do not place communications cables close to or parallel to high-voltage lines or power lines.
- Use the communications cables specified in the E5ZN-DRT User's Manual (Cat. No. H119).
- Do not attempt to disassemble, repair, or modify the product.
- Do not drop the product or expose it to excessive shocks or vibrations. Doing so may result in malfunctions.
- Always use the power supply voltage within the specified range.
- Do not pull on the cables or bend the cables beyond their natural limit.
- Confirm that the power is OFF before wiring.
- Be sure to perform wiring for communications lines and power supplies correctly. Be sure to wire to terminals with the correct polarity. Incorrect wiring may result in malfunctions.
- Confirm that the power is OFF before mounting or removing connectors. Mounting or removing connectors with the power ON may result in malfunctions.
- Double-check all wiring and switch settings before turning ON the power supply.

Notice

- Do not use the product in the following locations
 - Locations exposed to direct sunlight
 - Locations subject to intense temperature changes
 - Locations subject to freezing or condensation
 - Locations subject to dust or corrosive gases (in particular, sulfide gas and ammonia gas)
 - Locations subject to exposure to water or oil
 - Locations subject to vibrations or shocks
- Take appropriate and sufficient countermeasures when installing systems in the following locations:
 - Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields.
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power lines with high voltage or large current.
- Use the product within the specified temperature and humidity ranges.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.
- Do not use solvents to clean the product.
- Confirm that the power is OFF before replacing the product.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H120-E1-01

In the interest of product improvement, specifications are subject to change without notice.

Digital Controllers

E5□R

New DeviceNet-compatible models offer high-speed and high-precision as general-purpose Digital Controllers with an even broader range of application.



E5□R Series

E5AR



96 × 96 × 95 mm

E5ER



96 × 48 × 95 mm

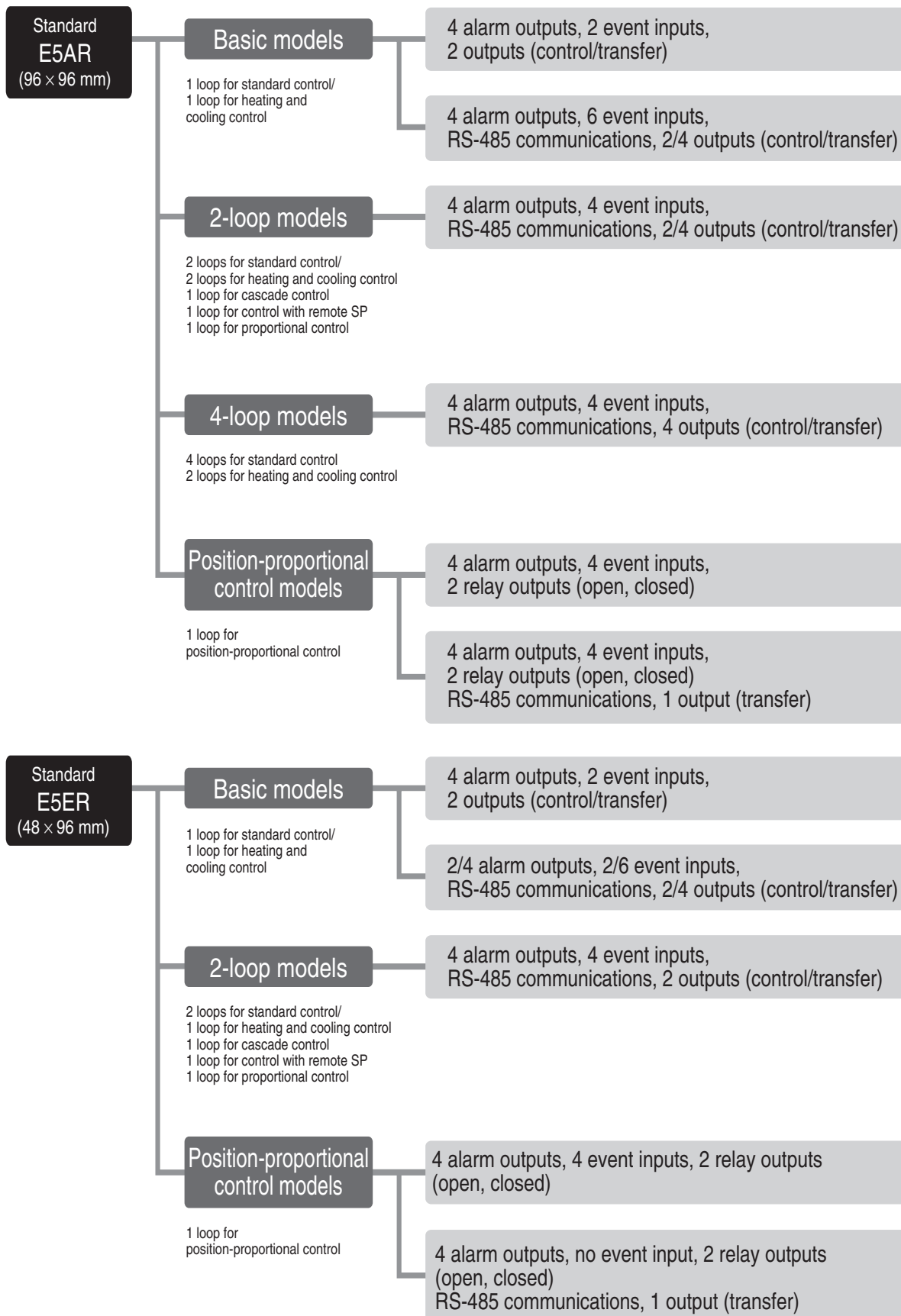
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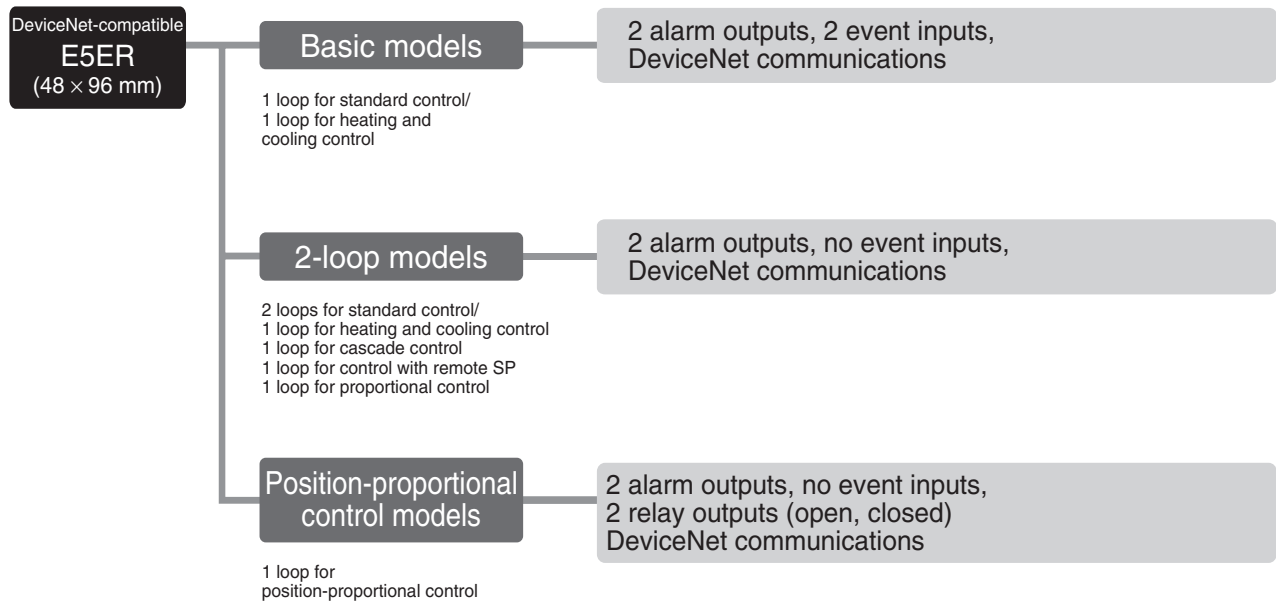
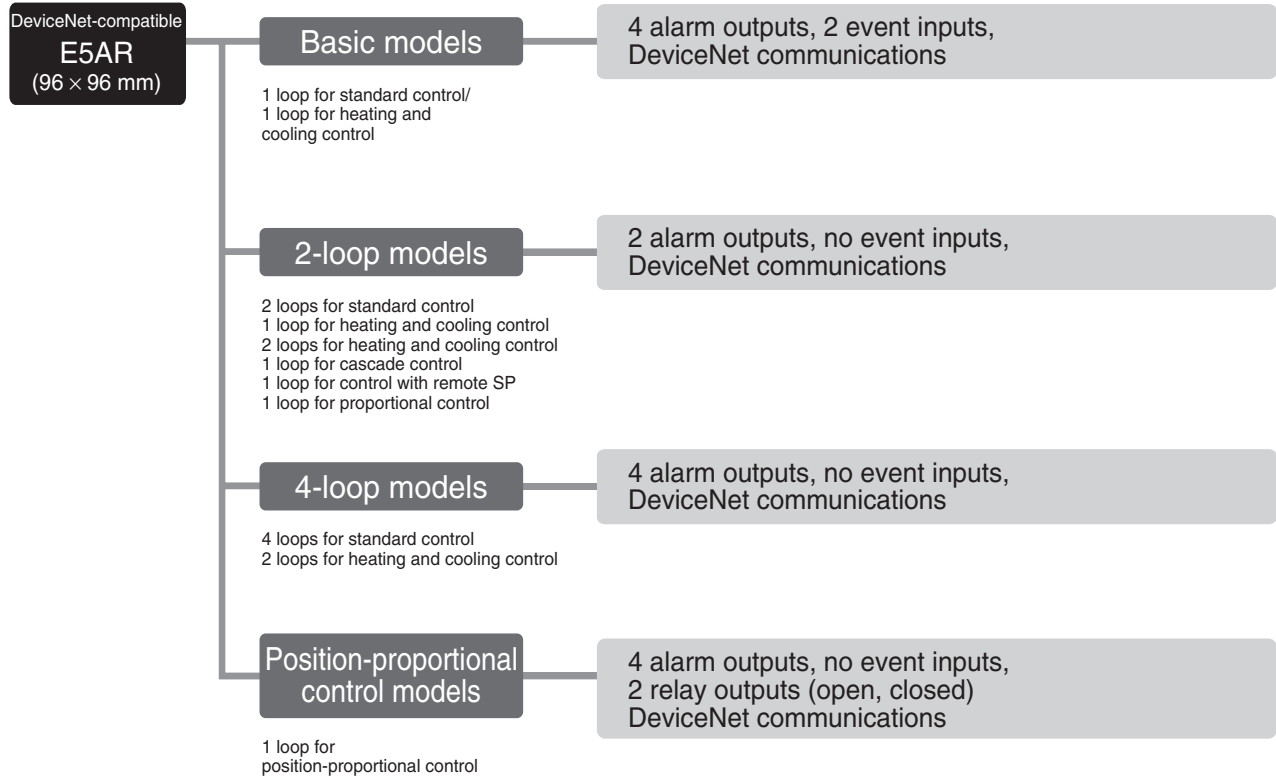
Temperature Controller

■ E5□R Selection Guide

Standard type



DeviceNet type



Temperature Controller

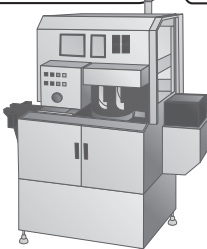

■ Applications

High-speed

Problem Lack of reasonably-priced controller for devices requiring high-speed response (e.g., ceramic heaters) resulting in using expensive machinery with unnecessary functions.

Solution

- Improved control performance with high-speed sampling at 50 ms.
- Moderately priced and easily operated.

Applications

- Bonding equipment
- Evaporation equipment
- Coil winding machinery

High-resolution

Problem Need for high-resolution measuring and monitoring of internal temperatures of devices while handling fluctuations at high-resolution.

Solution Greater input resolution with Pt sensor (0.01°C resolution)




Applications

- Semiconductor production lines (exposure, air-conditioning)
- Environmental testing equipment
- Vacuum heating furnace
- Sterilizing equipment
- Food processing machinery

■ Features

Easily Coordinate Control with PLCs Using Various I/O

• Up to 6 Event Inputs

Externally control bank switching (4/8 banks), RUN/STOP, auto/manual, SP mode, communications write enable/disable, and other operations with event inputs.

• Up to 2 Transfer Outputs

Externally output PVs, SPs, MVs, and ramp SP monitor values for each loop.

• Up to 4 Auxiliary Outputs

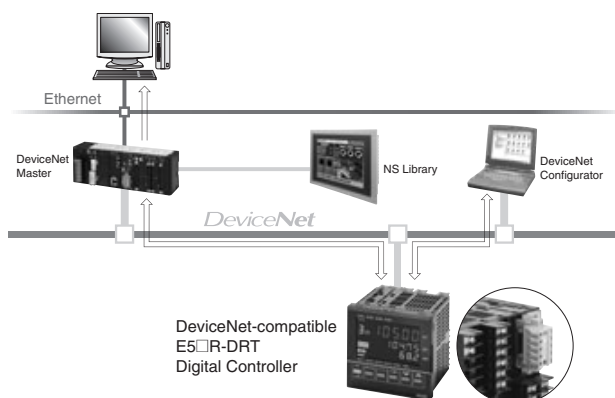
Externally output warnings for 11 alarm modes and input errors.

• RS-485 Serial Communications

Simply share data, such as PVs and SPs, with an OMRON PLC (without requiring special programming). Only settings are required.

• DeviceNet Communications

Perform high-speed data communications with the PLC without requiring special programming. Unified management of communications from a DeviceNet Configurator is also possible.

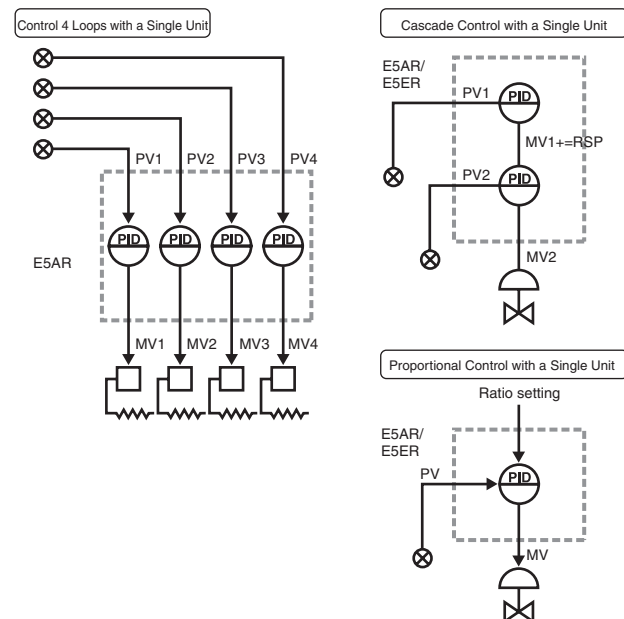


Control Up to 4 Loops with a Single Unit

Models with 1, 2, and 4 analog inputs are available (see note). Various control modes can also be selected in the software settings, including standard control, heating/cooling control, cascade control, position-proportional control, and remote SP control. This allows a single Unit to perform multipoint control (up to 4 loops for the E5AR, and up to 2 loops for the E5ER), cascade control, and proportional control.

Temperature, humidity, and pressure can be controlled simultaneously for up to 4 points from a single Unit, contributing to reduced costs and smaller panels.

Note: Models with 4 analog inputs are 96 x 96 mm (E5AR only).



Digital Controllers E5AR

E5AR Digital Controllers offer high speed, high precision, and multiple I/O and use a 5-digit, 3-row LCD display for high visual clarity.

- A short sampling period of 50 ms enables use in applications requiring high-speed response.
- PV, SP, and MV data is displayed simultaneously in a 3-row, negative LCD display with a backlight.
- Bar graph to show MV (manipulated variable), valve opening, or deviation.
- Multiloop control, cascade control, and proportional control are possible with a single Controller.
- When using models with communications functions, initial settings can be downloaded and settings can be masked using Support Software (Thermo Tools).
- Equipped with calculation functions as a standard (e.g., square root calculation and broken-line approximation).
- DeviceNet Communications
Data setting and monitoring can be performed without special programming.



Model Number Structure

■ Model Number Legend

E5AR-□□□□□□□□□□-□□□□
1 2 3 4 5 6 7 8 9 10

1. Constant values/Program

None: Constant value

2. Control method

Blank: Standard or heating/cooling control

P: Position proportional control

3. Output 1

R: DPST-NO relay outputs

Q: Pulse voltage and pulse voltage/current outputs

C: Current and current outputs

4. Output 2

Blank: None

R: Relay outputs

Q: Pulse voltage and pulse voltage/current outputs

C: Current and current outputs

5. Auxiliary Outputs

Blank: None

4: 4PST-NO relay outputs

T: 2 transistor outputs

6. Optional Function 1

Blank: None

3: RS-485 communications

7. Optional Function 2

Blank: None

D: 4 event inputs

8. Input 1

B: Multi-input and 2 event inputs

F: Multi-input and FB (Potentiometer input)

W: Multi-input and multi-input

9. Input 2

Blank: None

W: Multi-input and multi-input

10. Communications Method

Blank: None

FLK: RS-485 (CompoWay F/MODBUS)

DRT: DeviceNet

Temperature Controller

Ordering Information

■ Digital Controllers

Standard Controllers

Size	Control type	Control mode	Outputs (control/transfer)	Optional functions			Model
				Auxiliary outputs (SUB)	Event inputs	Serial communi- cations	
96 × 96 mm	Basic control (1 loop)	Single-loop standard control Single-loop heating and cooling control	2 points: Pulse voltage and Pulse voltage/current	4	2	No	E5AR-Q4B
			2 points: Current and Current				E5AR-C4B
			2 points: Pulse voltage and Pulse voltage/current				RS-485
			2 points: Current and Current			6	E5AR-C43B-FLK (See note 2.)
			2 points: Pulse voltage and Pulse voltage/current				E5AR-Q43DB-FLK (See note 2.)
			2 points: Current and Current				E5AR-C43DB-FLK (See note 2.)
			4 points: Pulse voltage and Pulse voltage/current and Current (2 points)				E5AR-QC43DB-FLK
2-loop control	2-loop standard control Single-loop heating and cooling control Single-loop cascade control Single-loop control with remote SP Single-loop proportional control	2 points: Pulse voltage and Pulse voltage/current	4	4	RS-485	E5AR-Q43DW-FLK (See note 2.)	
		2 points: Current and Current				E5AR-C43DW-FLK (See note 2.)	
		4 points: Pulse voltage (2 points) and Pulse voltage/current (2 points)				E5AR-QQ43DW-FLK	
4-loop control	4-loop standard control 2-loop heating and cooling control	4 points: Current output (4 points)	4	4	RS-485	E5AR-CC43DWW-FLK	
		4 points: Pulse voltage (2 points) and Pulse voltage/current (2 points)				E5AR-QQ43DWW-FLK (See note 2.)	
Position-proportional control (1 loop)	Single-loop position-proportional control	Relay output (1 open, 1 close)	4	4	No	E5AR-PR4DF	
		Relay output (1 open, 1 close) and 1 current (transfer) output				RS-485	E5AR-PRQ43DF-FLK

Note 1: Specify the power supply specifications when ordering. Model numbers for 100 to 240 VAC are different from those for 24 VAC/VDC.

2: These models are for 100 to 240 VAC only.

DeviceNet-compatible Controllers

Size	Control type	Control mode	Outputs (control/transfer)	Optional functions			Model
				Auxiliary outputs (SUB)	Event inputs	DeviceNet communications	
96 × 96 mm	Basic control (1 loop)	1 loop for standard control Single-loop heating and cooling control	2 points: Pulse voltage and Pulse voltage/current	4	2	Yes	E5AR-Q4B-DRT
			2 points: Current and Current				E5AR-C4B-DRT
			4 points: Pulse voltage and Pulse voltage/current and Current (2 points)				E5AR-QC4B-DRT
	2-loop control	2-loop standard control 2-loop heating and cooling control Single-loop cascade control Single-loop control with remote SP Single-loop proportional control	4 points: Pulse voltage (2 points) and Pulse voltage/current (2 points)	4	None	Yes	E5AR-QQ4W-DRT
	4-loop control	4-loop standard control 2-loop heating and cooling control	4 points: Current (4 points)	4	None	Yes	E5AR-CC4WW-DRT
	Position-proportional control (1 loop)	Single-loop position-proportional control	Relay output (1 open, 1 close)	4	None	Yes	E5AR-PR4F-DRT
			Relay output (1 open, 1 close) and Current (transfer) output (1 point)				E5AR-PRQ4F-DRT

Note: Specify the power supply specifications when ordering. Model numbers for 100 to 240 VAC are different from those for 24 VAC/VDC.

Inspection Results

The Inspection Report can be ordered at the same time as the Digital Controller using the following model number.

Inspection Report (Sold Separately)

Descriptions	Model
Inspection Report for E5AR	E5AR-K

Terminal Cover (Sold Separately)

Descriptions	Model
Terminal Cover for E5AR	E53-COV14

Specifications

■ Ratings

Item	Supply voltage (See note 1.)	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz; 24 VDC
Operating voltage range		85% to 110% of rated supply voltage	
Power consumption		22 VA max. (with maximum load)	15 VA/10 W max. (with maximum load)
Sensor input (See note 2.)		Thermocouple: K, J, T, E, L, U, N, R, S, B, W Platinum resistance thermometer: Pt100 Current input: 4 to 20 mA DC, 0 to 20 mA DC (including remote SP input) Voltage input: 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC (including remote SP input) (Input impedance: 150 Ω for current input, approx. 1 MΩ for voltage input)	
Control output	Voltage (pulse) output	12 VDC, 40 mA max. with short-circuit protection circuit (E5AR-QQ□WW□: 21 mA max.)	
	Current output	0 to 20 mA DC, 4 to 20 mA DC; load: 500 Ω max. (including transfer output) (Resolution: Approx. 54,000 for 0 to 20 mA DC; Approx. 43,000 for 4 to 20 mA DC)	
	Relay output	Position-proportional control type (open, closed) N.O., 250 VAC, 1 A (including inrush current)	
Auxiliary output		<u>Relay Output</u> N.O., 250 VAC, 1 A (resistive load) <u>Transistor Output</u> Maximum load voltage: 30 VDC; Maximum load current: 50 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.	
Potentiometer input		100 Ω to 2.5 kΩ	
Event input	Contact	Input ON: 1 kΩ max.; OFF: 100 kΩ min.	
	No-contact	Input ON: Residual voltage of 1.5 V max.; OFF: Leakage current of 0.1 mA max.	
		Short-circuit: Approx. 4 mA	
Remote SP input		Refer to the information on sensor input.	
Transfer output		Refer to the information on control output.	
Control method		2-PID or ON/OFF control	
Setting method		Digital setting using front panel keys or setting using serial communications	
Indication method		7-segment digital display and single-lighting indicator Character Height No. 1 display: 12.8 mm; No. 2 display: 7.7 mm; No. 3 display: 7.7 mm	
Other functions		Depends on model.	
Ambient operating temperature		-10 to 55°C (with no icing or condensation) For 3 years of assured use: -10 to 50°C (with no icing or condensation)	
Ambient operating humidity		25% to 85%	
Storage temperature		-25 to 65°C (with no icing or condensation)	


Note 1: The supply voltage (i.e., 100 to 240 VAC or 24 VAC/VDC) depends on the model. Be sure to specify the required type when ordering.

2: The Controller is equipped with multiple sensor input. Temperature input or analog input can be selected with the input type setting switch. There is basic insulation between power supply and input terminals, power supply and output terminals, and input and output terminals.


Input Ranges

The E5AR has multi-inputs. The default setting is 2 (K-type thermocouple, -200.0 to 1300.0°C or -300.0 to 2300.0°F).


Platinum Resistance Thermometer Input

Input		Pt100	
Range	°C	-200.0 to 850.0	-150.00 to 150.00
	°F	-300.0 to 1500.0	-199.99 to 300.00
Setting		0	1
Minimum setting unit (SP and alarm)		0.1	0.01
Input type setting switch		Set to TC.PT. 	

Thermocouple Input

Input		K		J		T	E	L	U	N	R	S	B	W
Range	°C	-200.0 to 1300.0	-20.0 to 500.0	-100.0 to 850.0	-20.0 to 400.0	-200.0 to 400.0	0.0 to 600.0	-100.0 to 850.0	-200.0 to 400.0	-200.0 to 1300.0	0.0 to 1700.0	0.0 to 1700.0	100.0 to 1800.0	0.0 to 2300.0
	°F	-300.0 to 2300.0	0.0 to 900.0	-100.0 to 1500.0	0.0 to 750.0	-300.0 to 700.0	0.0 to 1100.0	-100.0 to 1500.0	-300.0 to 700.0	-300.0 to 2300.0	0.0 to 3000.0	0.0 to 3000.0	300.0 to 3200.0	0.0 to 4100.0
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14
Minimum setting unit (SP and alarm)		0.1												
Input type setting switch		Set to TC.PT. 												

Current/Voltage Input

Input	Current		Voltage		
	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V
Range	Depending on the scaling settings, one of the following ranges will be displayed. -19999 to 99999 -1999.9 to 9999.9 -199.99 to 999.99 -19.999 to 99.999 -1.9999 to 9.9999				
Setting	15	16	17	18	19
Input type setting switch	Set to ANALOG. 				

Temperature Controller

■ Characteristics

Indication accuracy	Thermocouple input with cold junction compensation: (±0.1% of PV or ±1°C, whichever is greater) ±1 digit max. (See note 1.) Thermocouple input without cold junction compensation: (±0.1% FS or ±1°C, whichever is smaller) ±1 digit (See note 2.) Analog input: ±0.1% FS ±1 digit max. Platinum resistance thermometer input: (±0.1% of PV or ±0.5°C, whichever is greater) ±1 digit max. Position-proportional potentiometer input: ±5% FS ±1 digit max.
Control mode	Standard control (heating or cooling control), heating/cooling control, standard control with remote SP (2-input models only), heating/cooling control with remote SP (2-input models only), cascade standard control (2-input models only), cascade heating/cooling control (2-input models only), proportional control (2-input models only), position-proportional control (control-valve control models only)
Control period	0.2 to 99.0 s (in units of 0.1 s) for time-proportioning control output
Proportional band (P)	0.00% to 999.99% FS (in units of 0.01% FS)
Integral time (I)	0.0 to 3,999.9 s (in units of 0.1 s)
Derivative time (D)	0.0 to 3,999.9 s (in units of 0.1 s)
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Manual reset value	0.0% to 100.0% (in units of 0.1% FS)
Alarm setting range	-19,999 to 99,999 EU (See note 3.) (The decimal point position depends on the input type and the decimal point position setting.)
Input sampling period	50 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min (between charged terminals of different polarities)
Vibration resistance	10 to 55 Hz, 20 m/s ² for 10 min each in X, Y, and Z directions
Shock resistance	100 m/s ² , 3 times each in X, Y, and Z directions
Inrush current	100 to 240-VAC models: 50 A max. 24 VAC/VDC models: 30 A max.
Weight	E5AR: Controller only: Approx. 450 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 30 g E5ER: Controller only: Approx. 330 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 16 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66); Rear case: IP20; Terminals: IP00
Memory protection	Non-volatile memory (number of writes: 100,000)
Applicable standards	UL3121-1, CSA C22.2 No. 1010-1 EN61010-1 (IEC61010-1): Pollution degree 2/overvoltage category 2
EMC	EMI: EN61326 Radiated Interference Electromagnetic Field Strength: EN55011 Group 1 Class A Noise Terminal Voltage: EN55011 Group 1 Class A EMS: EN61326 ESD Immunity: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Electromagnetic Immunity: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz, 1.4 GHz to 2 GHz) (level 3) Burst Noise Immunity: EN61000-4-4: 2 kV power line (level 3) 2 kV output line (relay output) (level 4) 1 kV measurement line, I/O signal line (level 4) 1 kV communications line (level 3) Conducted Disturbance Immunity: EN61000-4-6: 3 V (0.15 to 80 MHz) (level 3) Surge Immunity: EN61000-4-5: 1 kV line to line (power line, output line (relay output)) (level 2) 2 kV line to ground (power line, output line (relay output)) (level 3) Power Frequency Magnetic Field Immunity: EN61000-4-8: 30 A/m (50 Hz) continuous field Voltage Dip/Interrupting Immunity: EN61000-4-11: 0.5 cycle, 100% (rated voltage)

- Note 1:** K-, T-, or N-type thermocouple at -100°C max.: ±2°C ±1 digit max.
U- or L-type thermocouple: ±2°C ±1 digit max.
B-type thermocouple at 400°C max.: No accuracy specification.
R- or S-type thermocouple at 200°C max.: ±3°C ±1 digit max.
W-type thermocouple: (±0.3% of PV or ±3°C, whichever is greater) ±1 digit max.
- 2:** U- or L-type thermocouple: ±1°C ±1 digit
R- or S-type thermocouple at 200°C max.: ±1.5°C ±1 digit
- 3:** "EU" (Engineering Unit) represents the unit after scaling. If a temperature sensor is used it is either °C or °F.

■ Communications Specifications

RS-485 Serial Communications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	9,600, 19,200, or 384,000 bps
Transmission code	ASCII (CompoWay/F), RTU Remote Terminal Unit (MODBUS)
Data bit length	7 or 8 bits
Stop bit length	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Block check character (BCC) Start-stop synchronization data format
Flow control	None
Interface	RS-485
Retry function	None

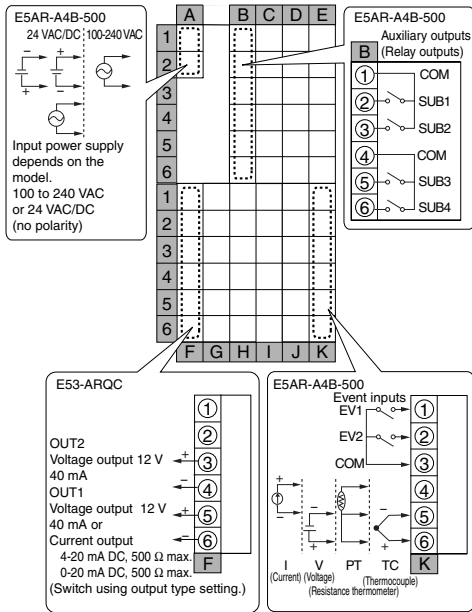
DeviceNet

Item		Specifications			
Communications protocol		Conforms to DeviceNet			
Communications functions	Remote I/O communications	<ul style="list-style-type: none"> • Master-slave connections (polling, bit-strobe, COS, or cyclic) • Conform to DeviceNet specifications. 			
	I/O allocations	<ul style="list-style-type: none"> • Can allocate any I/O data from the Configurator. • Can allocate any data, such as parameters specific to the DeviceNet and the Digital Controller variable area. • Up to 2 blocks for the IN Area, up to a total of 100 words. • One block for the OUT Area, up to 100 words (first word is always allocated to Output Enable Bits). 			
	Message communications	<ul style="list-style-type: none"> • Explicit message communications • CompoWay/F communications commands can be sent (commands are sent in explicit message format). 			
Connection format		Combination of multidrop and T-branch connections (for trunk and drop lines)			
Baud rate		DeviceNet: 500, 250, or 125 kbps, or automatic detection of master baud rate			
Communications media		Special 5-wire cable (2 signal lines, 2 power lines, and 1 shield line)			
Communications distance	Baud rate	Network length	Drop line length	Total drop line length	
	500 kbps	100 m max. (100 m max.)	6 m max.	39 m max.	
	250 kbps	250 m max. (100 m max.)	6 m max.	78 m max.	
	125 kbps	500 m max. (100 m max.)	6 m max.	156 m max.	
	The values in parentheses apply when Thin Cables are used.				
Supply voltage		DeviceNet power supply: 24 VDC			
Allowable voltage range		DeviceNet power supply: 11 to 25 VDC			
Current consumption		50 mA max. (24 VDC)			
Maximum number of nodes that can be connected		64 (includes Configurator when used)			
Maximum number of slaves that can be connected		63			
Error control		CRC error detection			
Power supply		Power supplied from DeviceNet communications connector.			

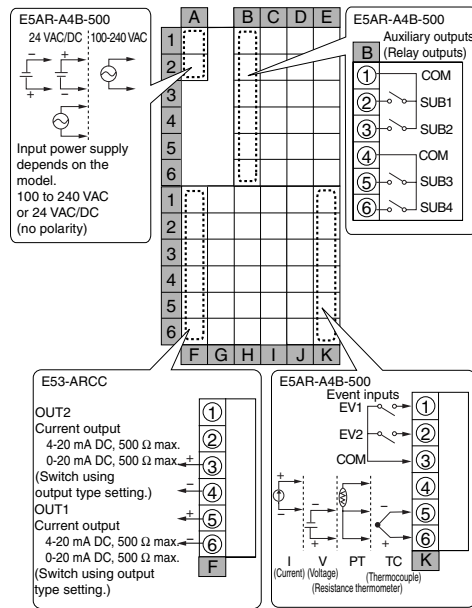
Wiring Terminals

■ E5AR Standard Controller Connections

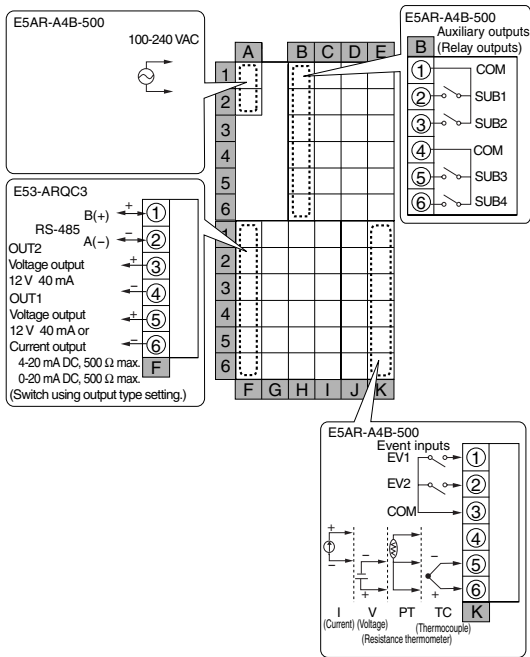
E5AR-Q4B



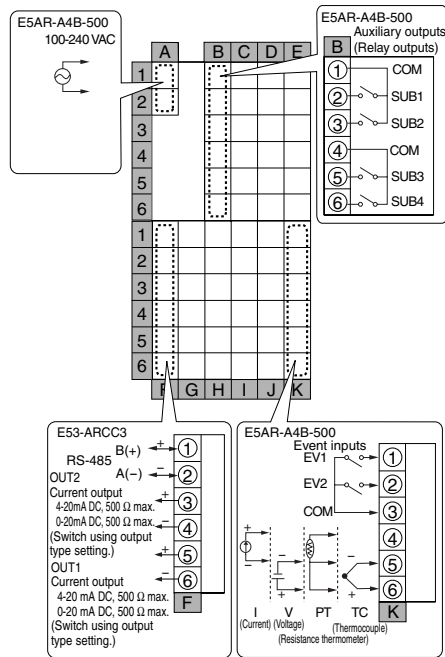
E5AR-C4B



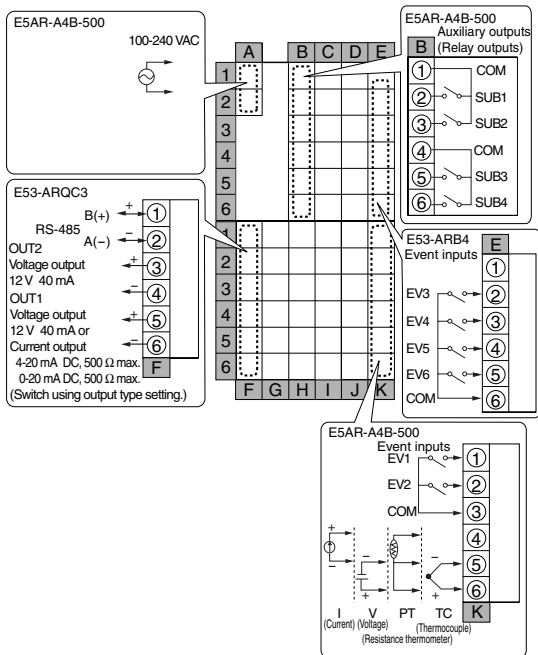
E5AR-Q43B-FLK



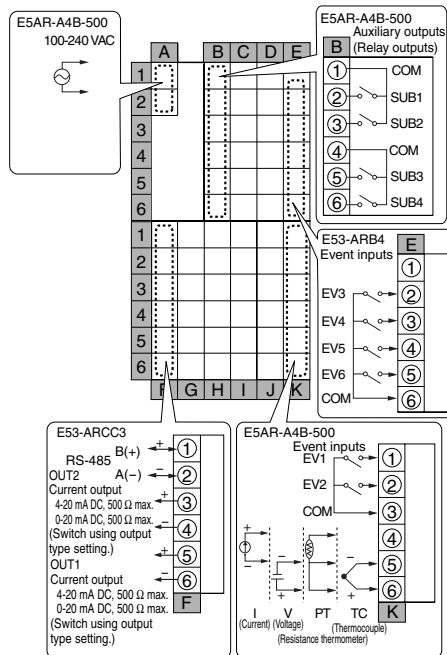
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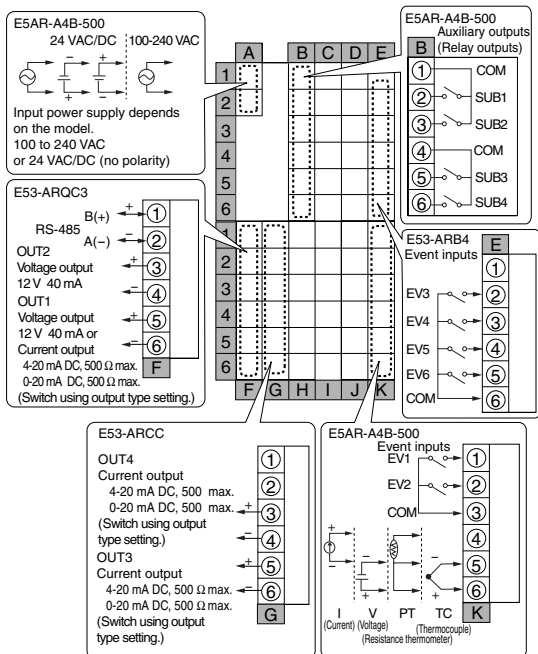
E5AR-Q43DB-FLK



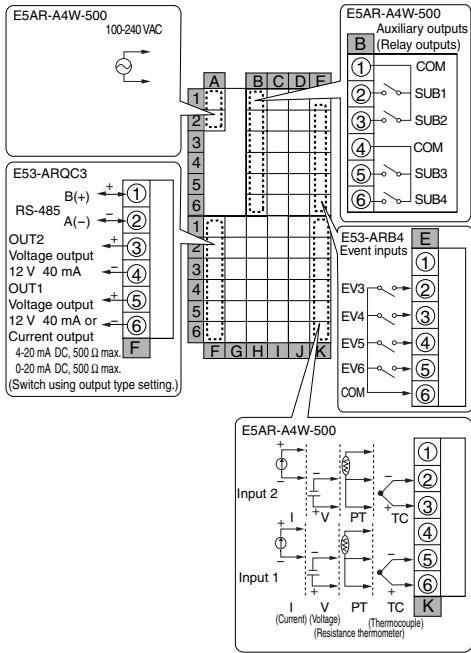
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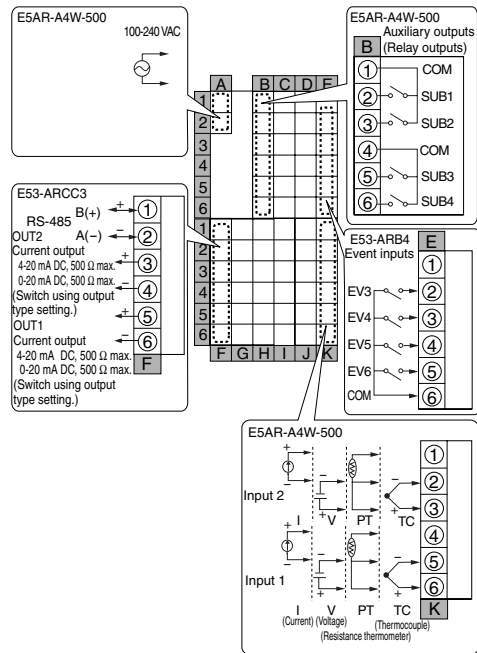
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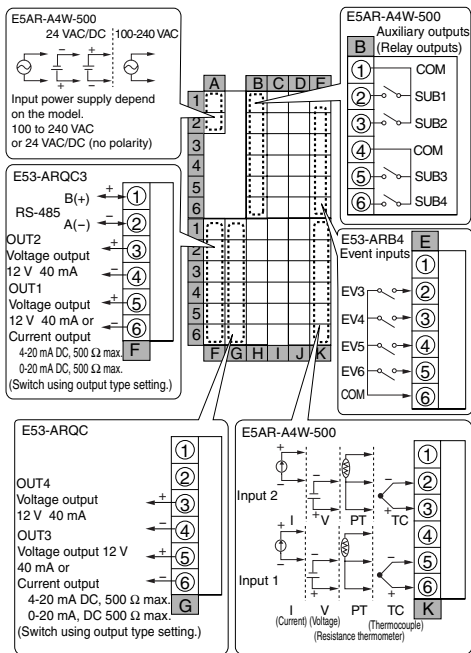
E5AR-Q43DW-FLK (2-loop Control)



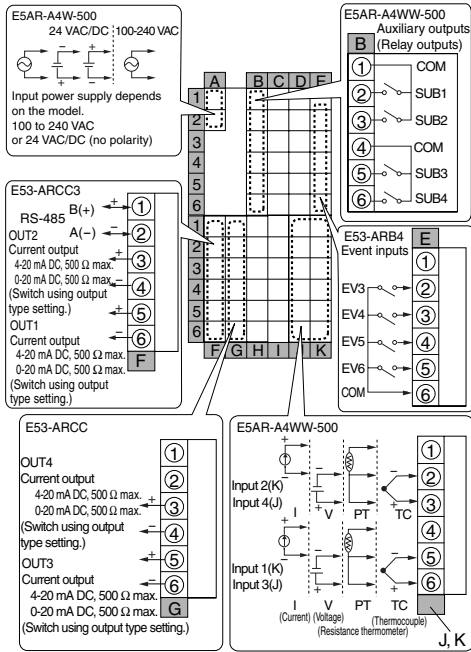
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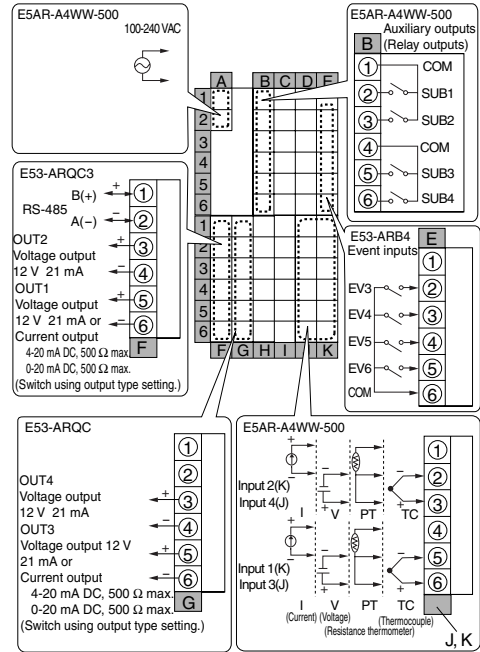
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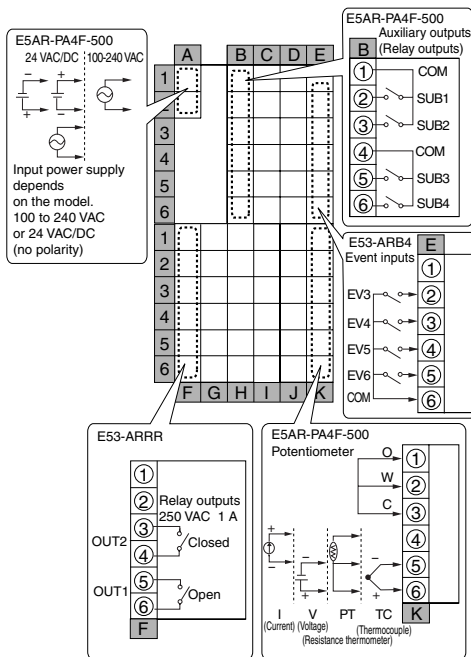
E5AR-CC43DWW-FLK (4-loop Control)



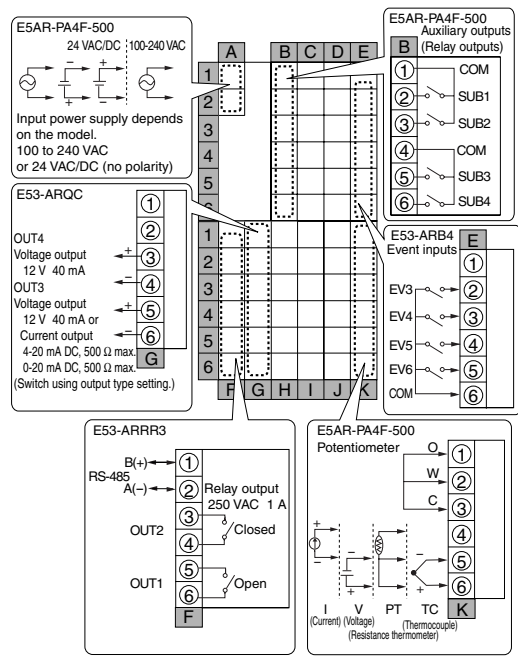
E5AR-QQ43DWW-FLK (4-loop Control)



E5AR-PR4DF

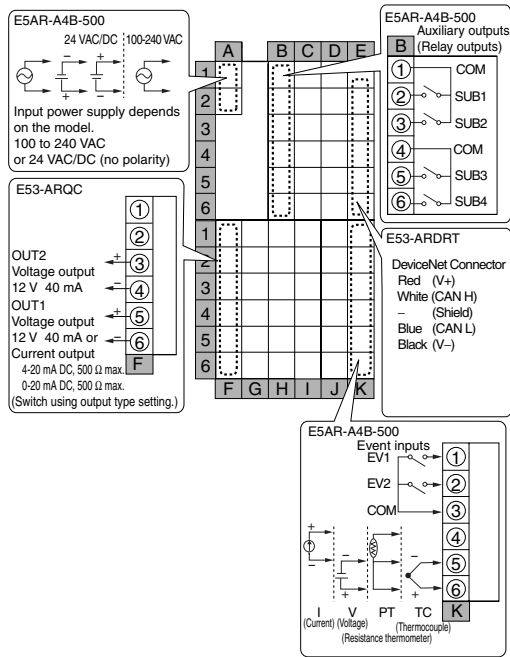


E5AR-PRQ43DF-FLK

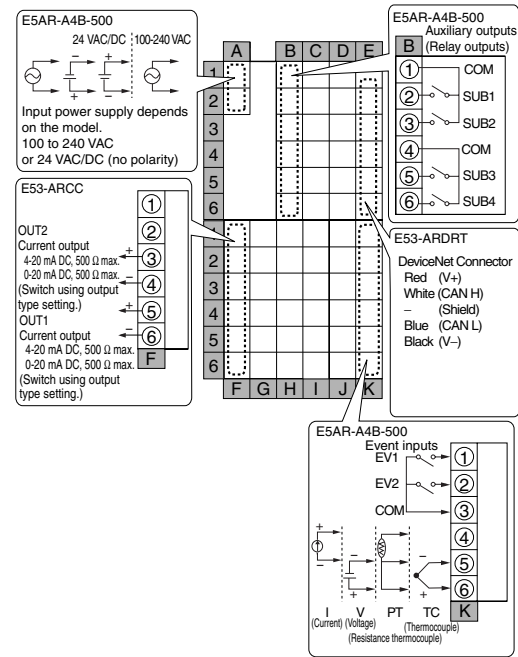


E5AR DeviceNet-compatible Controller Connections

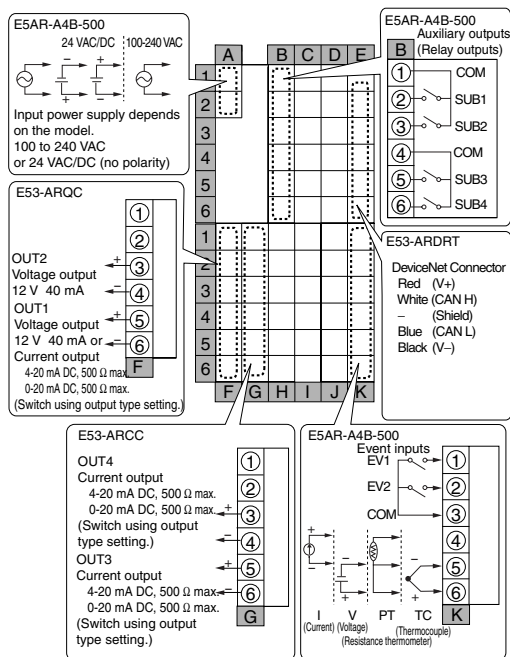
E5AR-Q4B-DRT



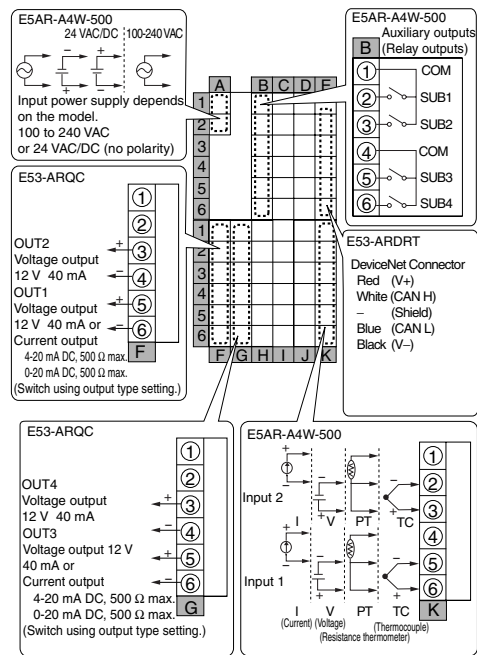
E5AR-C4B-DRT



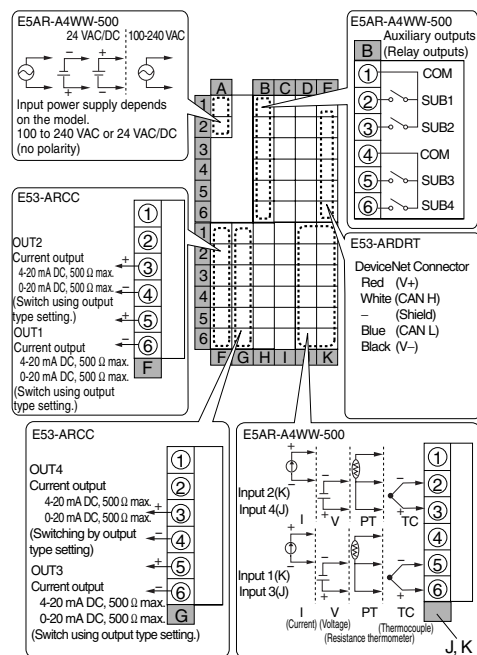
E5AR-QC4B-DRT



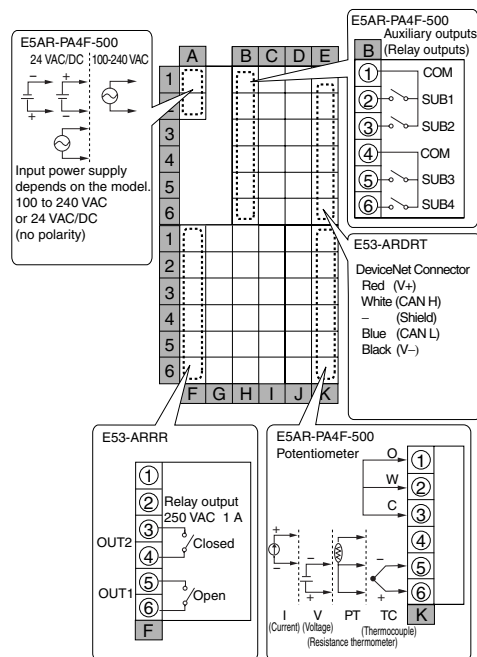
E5AR-QQ4W-DRT (2-loop Control)



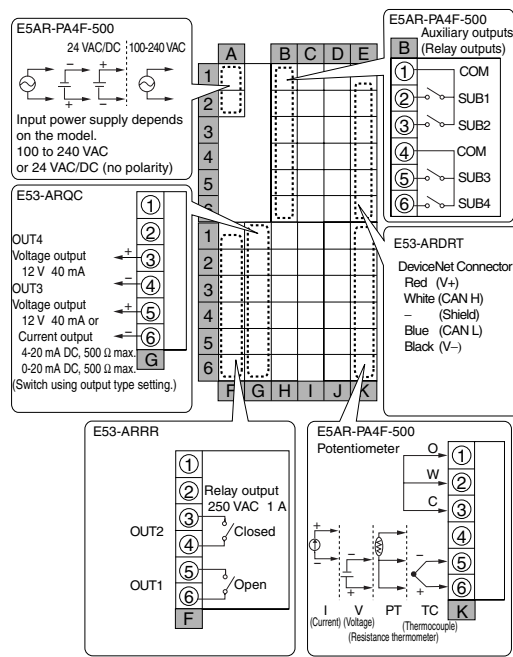
E5AR-CC4WW-DRT (4-loop Control)



E5AR-PR4F-DRT



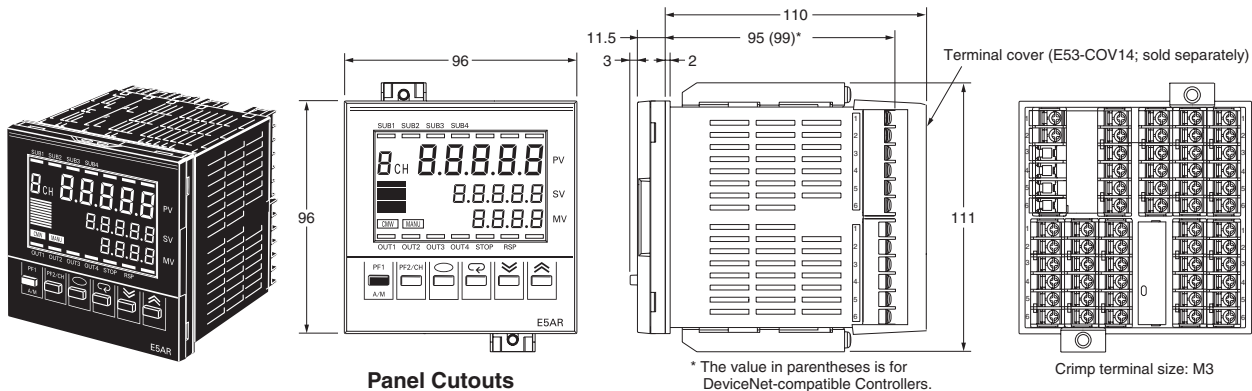
E5AR-PRQ4F-DRT



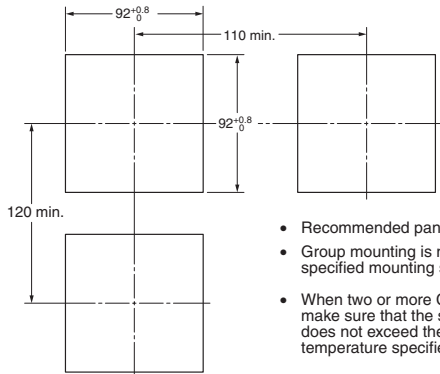
Temperature Controller

Dimensions

Note: All units are in millimeters unless otherwise indicated.

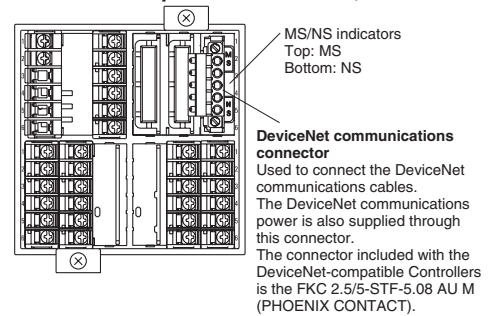


Panel Cutouts



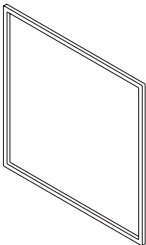
* The value in parentheses is for DeviceNet-compatible Controllers.

DeviceNet-compatible Controllers, Rear Panel



Rubber Packing (Sold Separately)

Y92S-P4 (for E5AR)



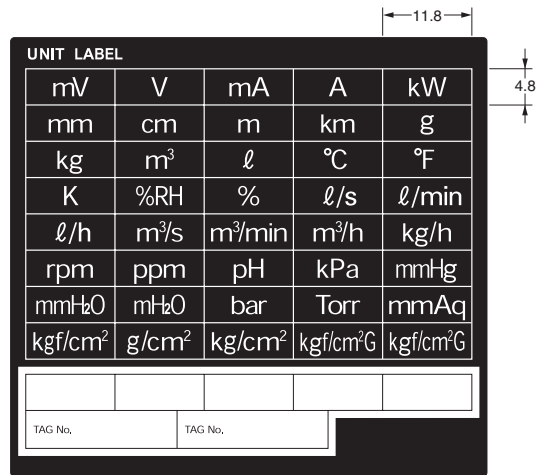
If the rubber packing is lost or damaged, it can be ordered using the following model number: Y92S-P4.

(Depending on the operating environment, deterioration, contraction, or hardening of the rubber packing may occur and so, in order to ensure the level of waterproofing specified in NEMA4, periodic replacement is recommended.)

Note: Rubber packing is provided with the Controller.

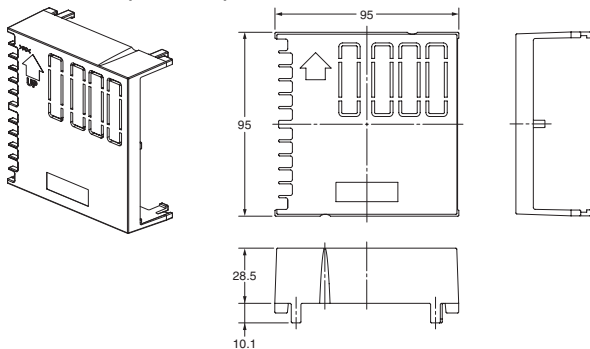
Unit Label Sheet (Sold Separately)

Y92S-L1



Terminal Cover (Sold Separately)

E53-COV14 (for E5AR)



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Ordering Information

■ Digital Controllers

Standard Controllers

Size	Control type	Control mode	Outputs (control/transfer)	Optional functions			Model	
				Auxiliary outputs (SUB)	Event inputs	Serial communications		
48 × 96 mm	Basic control (1 loop)	Single-loop standard control Single-loop heating and cooling control	2 points: Pulse voltage and Pulse voltage/current	4	2	No	E5ER-Q4B	
			2 points: Current and Current				E5ER-C4B	
			2 points: Pulse voltage and Pulse voltage/current				RS-485	E5ER-Q43B-FLK (See note 2.)
			2 points: Current and Current					E5ER-C43B-FLK (See note 2.)
			2 points: Pulse voltage and Pulse voltage/current	2 (See note 3.)	6	E5ER-QT3DB-FLK (See note 2.)		
			2 points: Current and Current			E5EAR-CT3DB-FLK (See note 2.)		
			4 points: Pulse voltage and Pulse voltage/current and Current (2 points)	4	2	E5ER-QC43B-FLK		
2-loop control	2-loop standard control Single-loop heating and cooling control Single-loop cascade control Single-loop control with remote SP Single-loop proportional control	2 points: Pulse voltage and Pulse voltage/current	2 (See note 3.)	4	RS-485	E5ER-QT3DW-FLK		
		2 points: Current and Current				E5ER-CT3DW-FLK		
Position-proportional control (1 loop)	Single-loop position-proportional control	Relay output (1 open, 1 closed)	2 (See note 3.)	4	No	E5ER-PRTDF		
		Relay output (1 open, 1 closed) and Current (transfer) output (1 point)	4	No	RS-485	E5ER-PRQ43F-FLK		

Note 1: Specify the power supply specifications when ordering. Model numbers for 100 to 240 VAC are different from those for 24 VAC/VDC.

2: These models are for 100 to 240 VAC only.

3: The auxiliary outputs are transistor outputs.

DeviceNet-compatible Controllers

Size	Control type	Control mode	Outputs (control/transfer)	Optional functions			Model
				Auxiliary outputs (SUB)	Event inputs	DeviceNet communications	
48 × 96 mm	Basic control (1 loop)	Single-loop standard control Single-loop heating and cooling control	2 points: Pulse voltage Pulse voltage/current	2 (See note 2.)	2	Yes	E5ER-QTB-DRT
			2 points: Current Current				E5ER-CTB-DRT
	2-loop control	2-loop standard control Single-loop heating and cooling control Single-loop cascade control Single-loop standard control with remote SP Single-loop proportional control	2 points: Pulse voltage Pulse voltage/current	2 (See note 2.)	None	Yes	E5ER-QTW-DRT
			2 points: Current Current				E5ER-CTW-DRT
Position-proportional control (1 loop)	Single-loop position-proportional control	Relay output (1 open, 1 closed)	2 (See note 2.)	None	Yes	E5ER-PRTF-DRT	

Note 1: Specify the power supply specifications when ordering. Model numbers for 100 to 240 VAC are different from those for 24 VAC/VDC.
2: The auxiliary outputs are transistor outputs.

Inspection Results

The Inspection Report can be ordered at the same time as the Digital Controller using the following model number.

Inspection Report (Sold Separately)

Descriptions	Model
Inspection Report for E5ER	E5ER-K

Terminal Cover (Sold Separately)

Descriptions	Model
Terminal Cover for E5ER	E53-COV15

Specifications

■ Ratings

Item	Supply voltage (See note 1.)	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz; 24 VDC
Operating voltage range		85% to 110% of rated supply voltage	
Power consumption		17 VA max. (with maximum load)	11 VA/7 W max. (with maximum load)
Sensor input (See note 2.)		Thermocouple: K, J, T, E, L, U, N, R, S, B, W Platinum resistance thermometer: Pt100 Current input: 4 to 20 mA DC, 0 to 20 mA DC (including remote SP input) Voltage input: 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC (including remote SP input) (Input impedance: 150 Ω for current input, approx. 1 MΩ for voltage input)	
Control output	Voltage (pulse) output	12 VDC, 40 mA max. with short-circuit protection circuit (E5AR-QQ□WW-□: 21 mA max.)	
	Current output	0 to 20 mA DC, 4 to 20 mA DC; load: 500 Ω max. (including transfer output) (Resolution: Approx. 54,000 for 0 to 20 mA DC; Approx. 43,000 for 4 to 20 mA DC)	
	Relay output	Position-proportional control type (open, closed) N.O., 250 VAC, 1 A (including inrush current)	
Auxiliary output		<u>Relay Output</u> N.O., 250 VAC, 1 A (resistive load) <u>Transistor Output</u> Maximum load voltage: 30 VDC; Maximum load current: 50 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.	
Potentiometer input		100 Ω to 2.5 kΩ	
Event input	Contact	Input ON: 1 kΩ max.; OFF: 100 kΩ min.	
	No-contact	Input ON: Residual voltage of 1.5 V max.; OFF: Leakage current of 0.1 mA max.	
		Short-circuit: Approx. 4 mA	
Remote SP input		Refer to the information on sensor input.	
Transfer output		Refer to the information on control output.	
Control method		2-PID or ON/OFF control	
Setting method		Digital setting using front panel keys or setting using serial communications	
Indication method		7-segment digital display and single-lighting indicator Character Height No. 1 display: 9.5 mm; No. 2 display: 7.2 mm; No. 3 display: 7.2 mm	
Other functions		Depends on model.	
Ambient operating temperature		-10 to 55°C (with no icing or condensation) For 3 years of assured use: -10 to 50°C (with no icing or condensation)	
Ambient operating humidity		25% to 85%	
Storage temperature		-25 to 65°C (with no icing or condensation)	


Note 1: The supply voltage (i.e., 100 to 240 VAC or 24 VAC/VDC) depends on the model. Be sure to specify the required type when ordering.

2: The Controller is equipped with multiple sensor input. Temperature input or analog input can be selected with the input type setting switch. There is basic insulation between power supply and input terminals, power supply and output terminals, and input and output terminals.


Input Ranges

The E5ER has multi-inputs. The default setting is 2 (K-type thermocouple, -200.0 to 1300.0°C or -300.0 to 2300.0°F).


Platinum Resistance Thermometer Input

Input		Pt100	
Range	°C	-200.0 to 850.0	-150.0 to 150.0
	°F	-300.0 to 1500.0	-199.99 to 300.0
Setting		0	1
Minimum setting unit (SP and alarm)		0.1	0.01
Input type setting switch		Set to TC.PT. 	

Thermocouple Input

Input		K		J		T	E	L	U	N	R	S	B	W
Range	°C	-200.0 to 1300.0	-20.0 to 500.0	-100.0 to 850.0	-20.0 to 400.0	-200.0 to 400.0	0.0 to 600.0	-100.0 to 850.0	-200.0 to 400.0	-200.0 to 1300.0	0.0 to 1700.0	0.0 to 1700.0	100.0 to 1800.0	0.0 to 2300.0
	°F	-300.0 to 2300.0	0.0 to 900.0	-100.0 to 1500.0	0.0 to 750.0	-300.0 to 700.0	0.0 to 1100.0	-100.0 to 1500.0	-300.0 to 700.0	-300.0 to 2300.0	0.0 to 3000.0	0.0 to 3000.0	300.0 to 3200.0	0.0 to 4100.0
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14
Minimum setting unit (SP and alarm)		0.1												
Input type setting switch		Set to TC.PT. 												

Current/Voltage Input

Input	Current			Voltage		
Range	4 to 20 mA	0 to 20 mA		1 to 5 V	0 to 5 V	0 to 10 V
Setting	15	16		17	18	19
Input type setting switch	Set to ANALOG. 					

■ Characteristics

Indication accuracy	Thermocouple input with cold junction compensation: ($\pm 0.1\%$ of PV or $\pm 1^\circ\text{C}$, whichever is greater) ± 1 digit max. (See note 1.) Thermocouple input without cold junction compensation: ($\pm 0.1\%$ FS or $\pm 1^\circ\text{C}$, whichever is smaller) ± 1 digit (See note 2.) Analog input: $\pm 0.1\%$ FS ± 1 digit max. Platinum resistance thermometer input: ($\pm 0.1\%$ of PV or $\pm 0.5^\circ\text{C}$, whichever is greater) ± 1 digit max. Position-proportional potentiometer input: $\pm 5\%$ FS ± 1 digit max.
Control mode	Standard control (heating or cooling control), heating/cooling control, standard control with remote SP (2-input models only), heating/cooling control with remote SP (2-input models only), cascade standard control (2-input models only), cascade heating/cooling control (2-input models only), proportional control (2-input models only), position-proportional control (control-valve control models only)
Control period	0.2 to 99.0 s (in units of 0.1 s) for time-proportioning control output
Proportional band (P)	0.00% to 999.99% FS (in units of 0.01% FS)
Integral time (I)	0.0 to 3,999.9 s (in units of 0.1 s)
Derivative time (D)	0.0 to 3,999.9 s (in units of 0.1 s)
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Manual reset value	0.0% to 100.0% (in units of 0.1% FS)
Alarm setting range	-19,999 to 99,999 EU (See note 3.) (The decimal point position depends on the input type and the decimal point position setting.)
Input sampling period	50 ms
Insulation resistance	20 M Ω min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min (between charged terminals of different polarities)
Vibration resistance	10 to 55 Hz, 20 m/s ² for 10 min each in X, Y, and Z directions
Shock resistance	100 m/s ² , 3 times each in X, Y, and Z directions
Inrush current	100 to 240-VAC models: 50 A max. 24 VAC/VDC models: 30 A max.
Weight	E5AR: Controller only: Approx. 450 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 30 g E5ER: Controller only: Approx. 330 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 16 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66); Rear case: IP20; Terminals: IP00
Memory protection	Non-volatile memory (number of writes: 100,000)
Applicable standards	UL3121-1, CSA C22.2 No. 1010-1 EN61010-1 (IEC61010-1): Pollution degree 2/overvoltage category 2
EMC	EMI: EN61326 Radiated Interference Electromagnetic Field Strength: EN55011 Group 1 Class A Noise Terminal Voltage: EN55011 Group 1 Class A EMS: EN61326 ESD Immunity: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Electromagnetic Immunity: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz, 1.4 GHz to 2 GHz) (level 3) Burst Noise Immunity: EN61000-4-4: 2 kV power line (level 3) 2 kV output line (relay output) (level 4) 1 kV measurement line, I/O signal line (level 4) 1 kV communications line (level 3) Conducted Disturbance Immunity: EN61000-4-6: 3 V (0.15 to 80 MHz) (level 3) Surge Immunity: EN61000-4-5: 1 kV line to line (power line, output line (relay output)) (level 2) 2 kV line to ground (power line, output line (relay output)) (level 3) Power Frequency Magnetic Field Immunity: EN61000-4-8: 30 A/m (50 Hz) continuous field Voltage Dip/Interrupting Immunity: EN61000-4-11: 0.5 cycle, 100% (rated voltage)

- Note 1:** K-, T-, or N-type thermocouple at -100°C max.: $\pm 2^\circ\text{C} \pm 1$ digit max.
U- or L-type thermocouple: $\pm 2^\circ\text{C} \pm 1$ digit max.
B-type thermocouple at 400°C max.: No accuracy specification.
R- or S-type thermocouple at 200°C max.: $\pm 3^\circ\text{C} \pm 1$ digit max.
W-type thermocouple: ($\pm 0.3\%$ of PV or $\pm 3^\circ\text{C}$, whichever is greater) ± 1 digit max.
- 2:** U- or L-type thermocouple: $\pm 1^\circ\text{C} \pm 1$ digit
R- or S-type thermocouple at 200°C max.: $\pm 1.5^\circ\text{C} \pm 1$ digit
- 3:** "EU" (Engineering Unit) represents the unit after scaling. If a temperature sensor is used it is either $^\circ\text{C}$ or $^\circ\text{F}$.

■ Communications Specifications

RS-485 Serial Communications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	9,600, 19,200, or 384,000 bps
Transmission code	ASCII (CompoWay/F), RTU Remote Terminal Unit (MODBUS)
Data bit length	7 or 8 bits
Stop bit length	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Block check character (BCC) Start-stop synchronization data format
Flow control	None
Interface	RS-485
Retry function	None

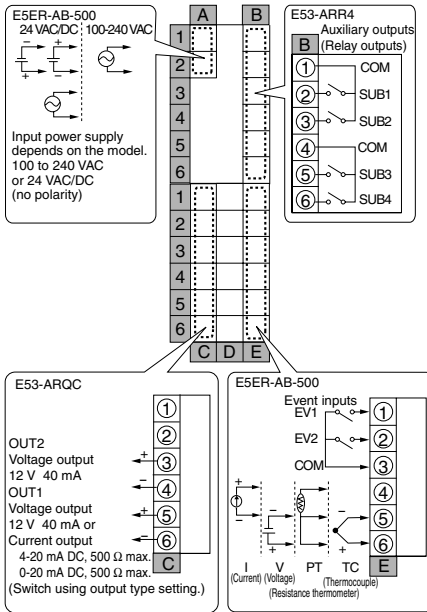
DeviceNet

Item		Specifications			
Communications protocol		Conforms to DeviceNet			
Communications functions	Remote I/O communications	<ul style="list-style-type: none"> • Master-slave connections (polling, bit-strobe, COS, or cyclic) • Conform to DeviceNet specifications. 			
	I/O allocations	<ul style="list-style-type: none"> • Can allocate any I/O data from the Configurator. • Can allocate any data, such as parameters specific to the Devicenet, and the Digital Controller variable area. • Up to 2 blocks for the IN Area, up to a total of 100 words. • One block for the OUT Area, up to 100 words (first word is always allocated to Output Enable Bits). 			
	Message communications	<ul style="list-style-type: none"> • Explicit message communications • CompoWay/F communications commands can be sent (commands are sent in explicit message format). 			
Connection format		Combination of multidrop and T-branch connections (for trunk and drop lines)			
Baud rate		DeviceNet: 500, 250, or 125 kbps, or automatic detection of master baud rate			
Communications media		Special 5-wire cable (2 signal lines, 2 power lines, and 1 shield line)			
Communications distance	Baud rate	Network length	Drop line length	Total drop line length	
	500 kbps	100 m max. (100 m max.)	6 m max.	39 m max.	
	250 kbps	250 m max. (100 m max.)	6 m max.	78 m max.	
	125 kbps	500 m max. (100 m max.)	6 m max.	156 m max.	
	The values in parentheses apply when Thin Cables are used.				
Supply voltage		DeviceNet power supply: 24 VDC			
Allowable voltage range		DeviceNet power supply: 11 to 25 VDC			
Current consumption		50 mA max. (24 VDC)			
Maximum number of nodes that can be connected		64 (includes Configurator when used)			
Maximum number of slaves that can be connected		63			
Error control		CRC error detection			
Power supply		Power supplied from DeviceNet communications connector.			

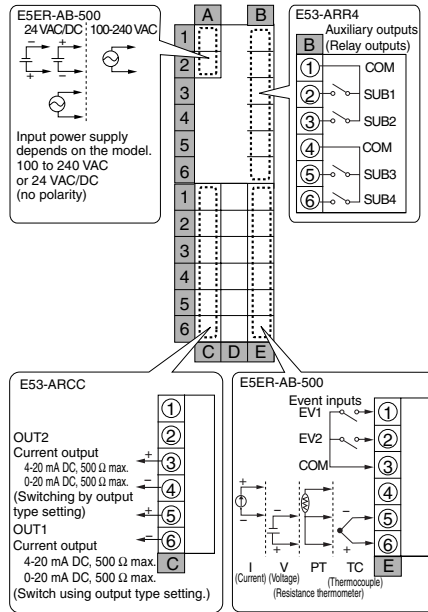
Wiring Terminals

E5ER Standard Controller Connections

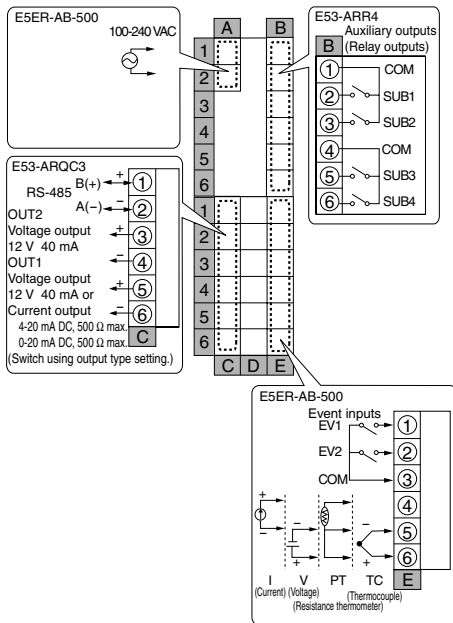
E5ER-Q4B



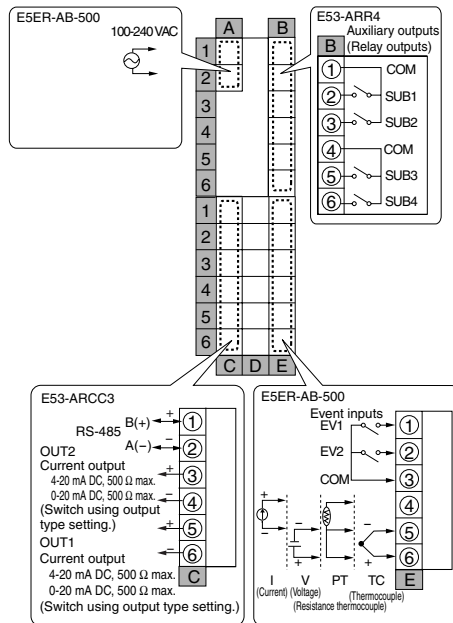
E5ER-C4B



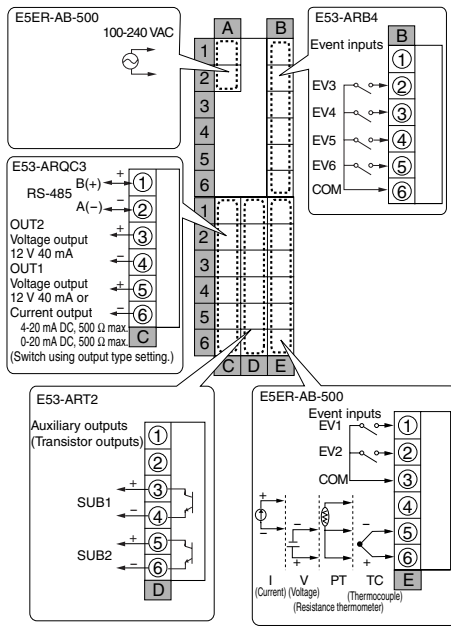
E5ER-Q43B-FLK



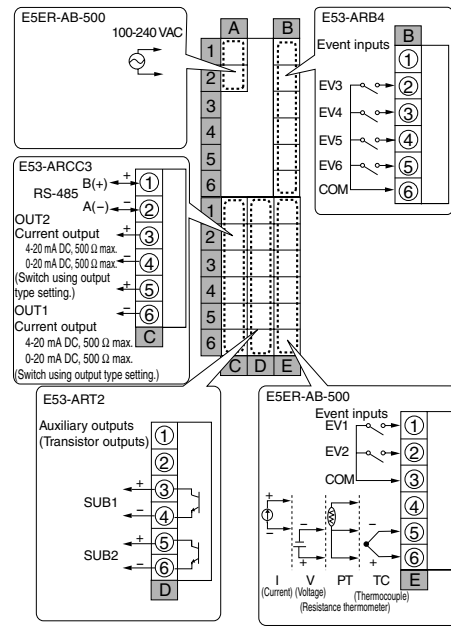
E5ER-C43B-FLK



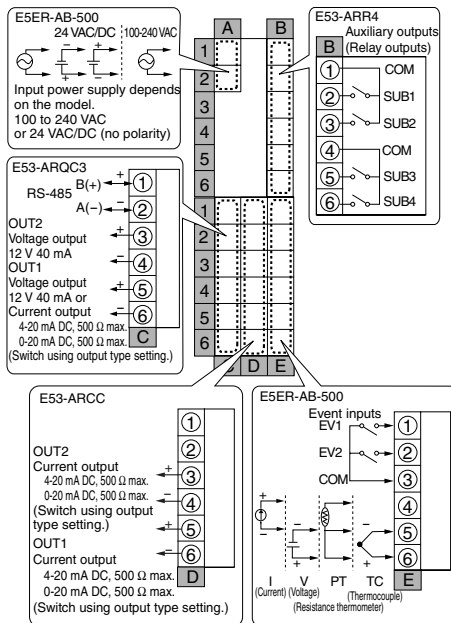
E5ER-QT3DB-FLK



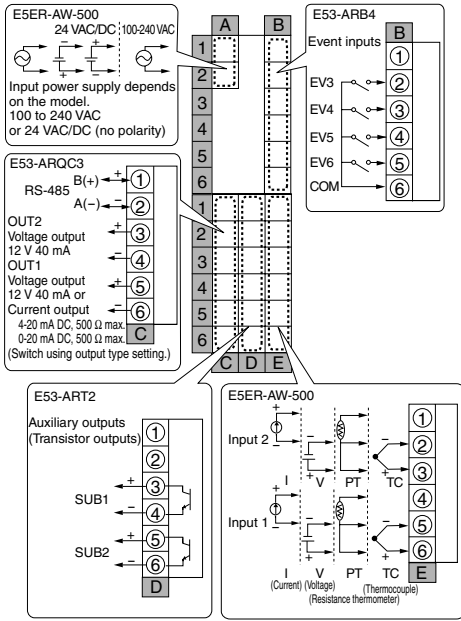
E5ER-CT3DB-FLK



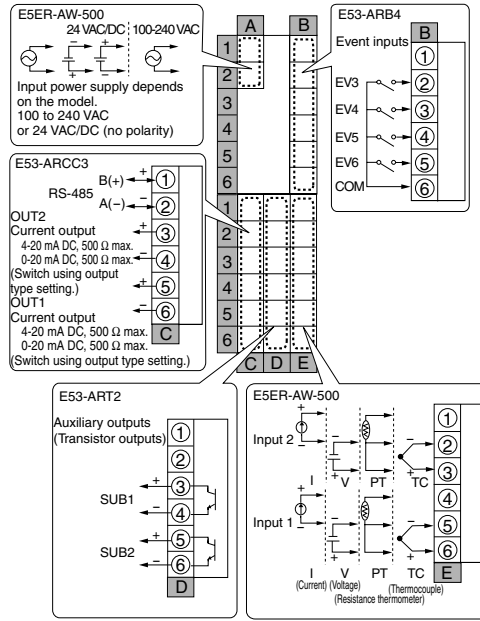
E5ER-QC43B-FLK



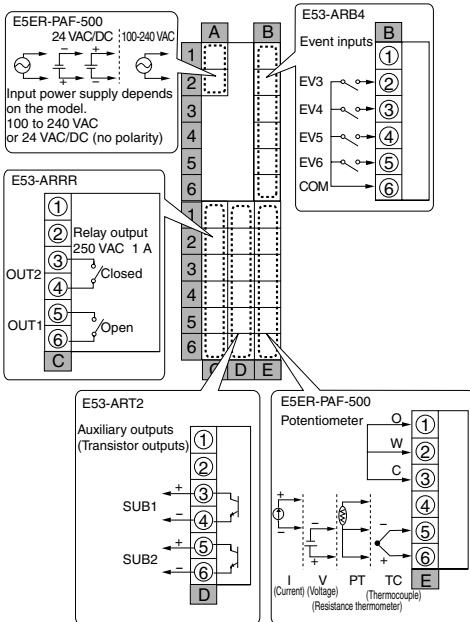
E5ER-QT3DW-FLK (2-loop Control)



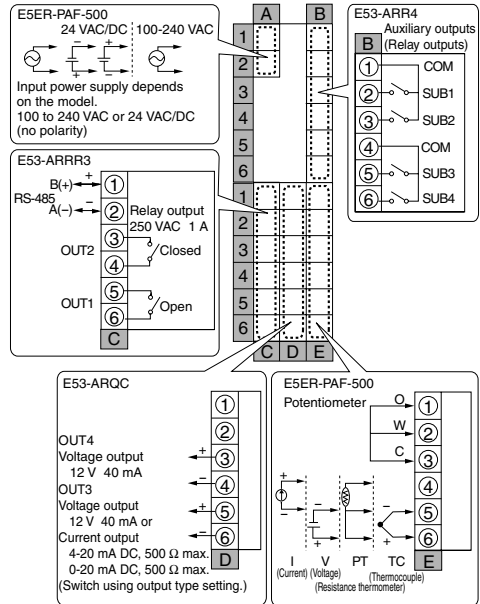
E5ER-CT3DW-FLK (2-loop Control)



E5ER-PRTDF

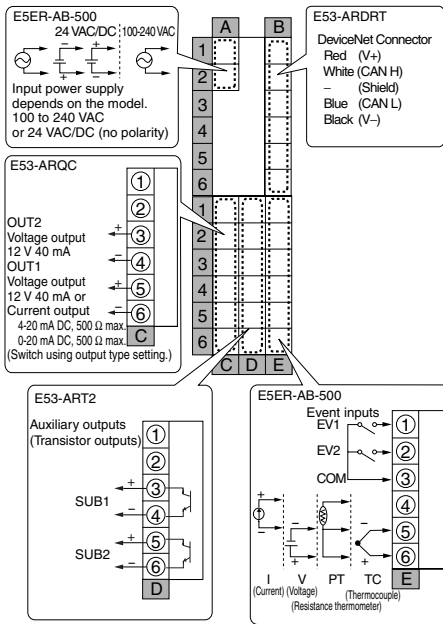


E5ER-PRQ43F-FLK

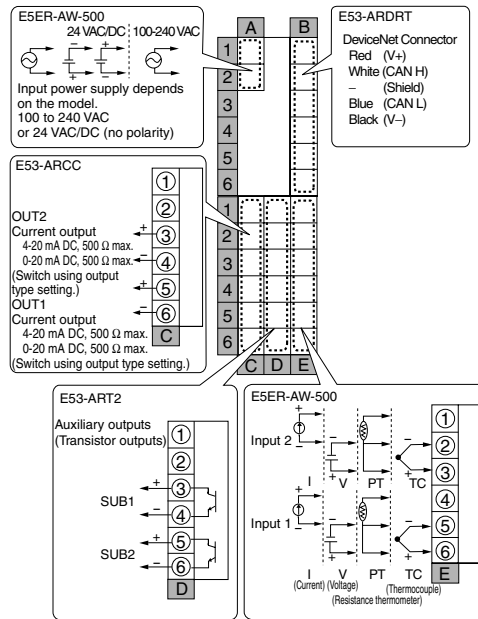


E5ER DeviceNet-compatible Controller Connections

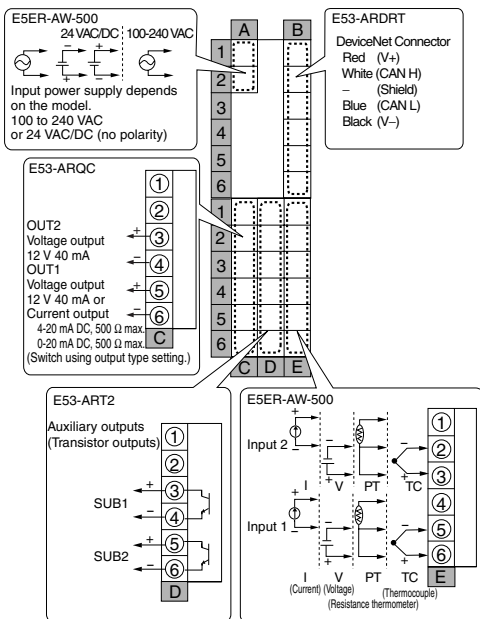
E5ER-QTB-DRT



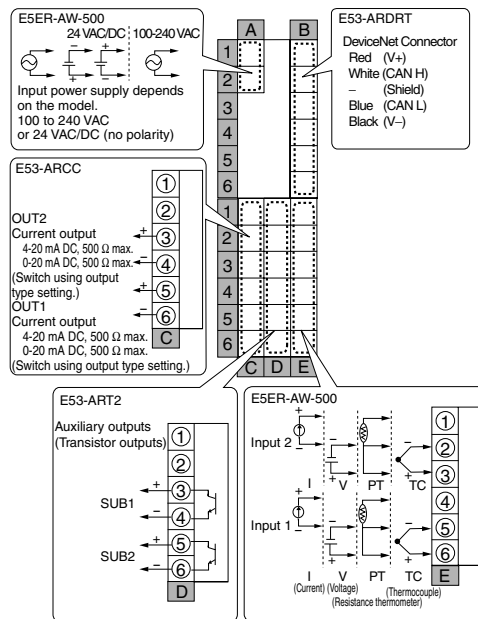
E5ER-CTB-DRT



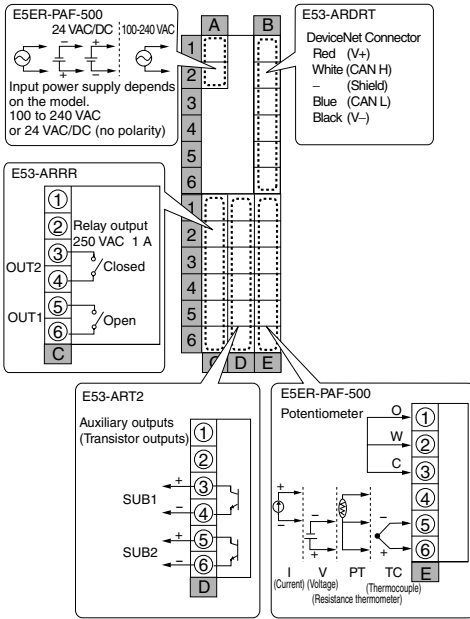
E5ER-QTW-DRT (2-loop Control)



E5ER-CTW-DRT (2-loop Control)

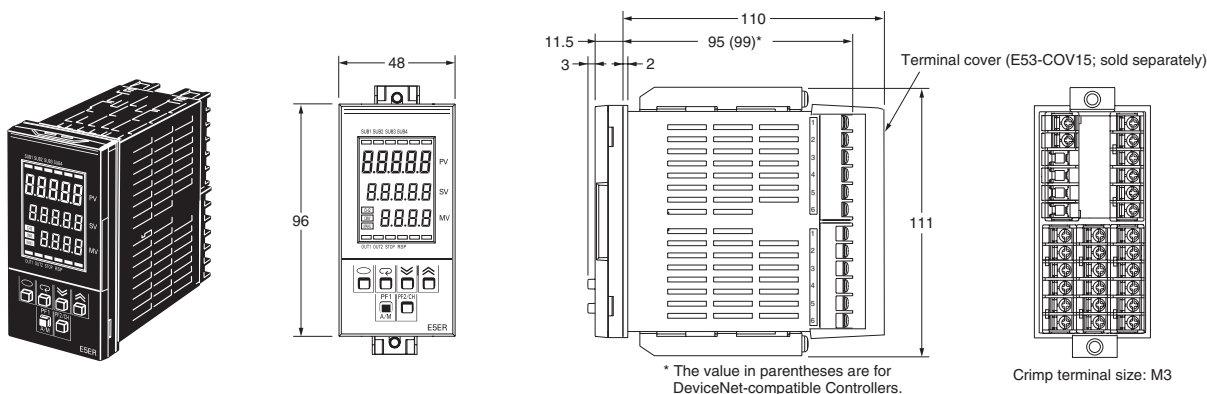


E5ER-PRTF-DRT

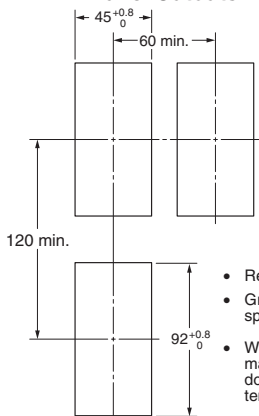


Dimensions

Note: All units are in millimeters unless otherwise indicated.

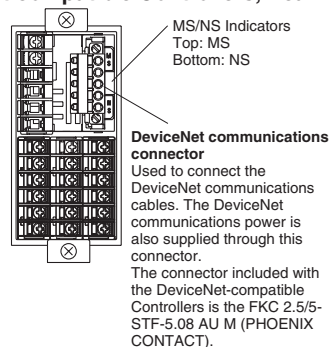


Panel Cutouts



- Recommended panel thickness is 1 to 8 mm.
- Group mounting is not possible. (Maintain the specified mounting space between Controllers.)
- When two or more Controllers are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

DeviceNet-compatible Controllers, Rear Panel



Rubber Packing (Sold Separately)

Y92S-P5 (for E5ER)



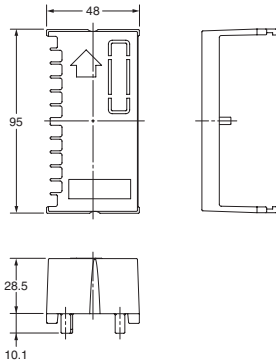
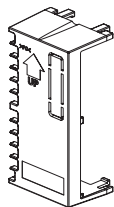
If the rubber packing is lost or damaged, it can be ordered using the following model number: Y92S-P5.

(Depending on the operating environment, deterioration, contraction, or hardening of the rubber packing may occur and so, in order to ensure the level of waterproofing specified in NEMA4, periodic replacement is recommended.)

Note: Rubber packing is provided with the Controller.

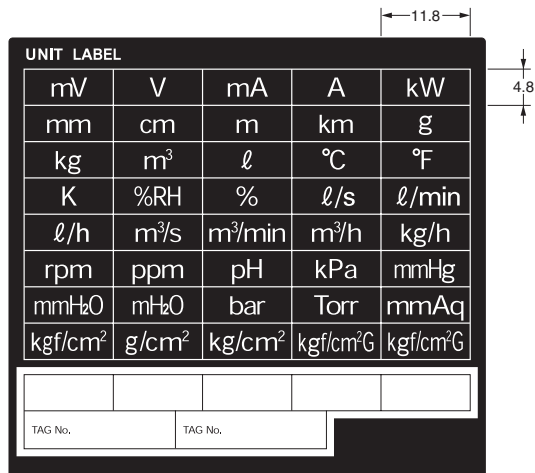
Terminal Cover (Sold Separately)

E53-COV15 (for E5ER)



Unit Label Sheet (Sold Separately)

Y92S-L1



Temperature Controller

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

E5AR/E5ER Common Information

■ Features/Performance

High-speed Sampling at 50 ms for Stable Control of Targets Requiring High-speed Response

The E5□R-DRT offers high-speed sampling at 50 ms for 4 loops (two to fivefold improvement on previous OMRON products). This is optimal for control operations such as high-speed response control by ceramic heaters, flowrate control, and pressure control.

Precision Control through High-resolution Temperature/Analog Inputs. Extraction of Square Root for Flowrate Control.

The high resolution and precision of inputs (Pt100, 0.01°C resolution), and high resolution and external overshooting adjustment function of outputs allow precision control/transfer.

The analog inputs have a high resolution (5-digit display at 0.01% resolution for Pt), and high precision of $\pm 0.1\%$ FS (two to three times better than previous OMRON products). The transfer and control outputs also have a high resolution of 1/43,000 (for 4 to 20 mA, a twentyfold improvement on previous OMRON products). In addition to PID autotuning, external interference gain parameters are provided to improve resistance to external interference. This allows high resolution when measuring, detecting changes, or logging internal temperature and humidity of devices, such as environmental testing equipment.

Simultaneous 5-digit Digital Display of PVs and SPs

Process values (PVs), set points (SPs), and manipulated variables (MVs)/Bank No. data is displayed simultaneously in a 3-row digital display. This simplifies PID tuning and monitoring of device status. The negative LCD display with backlight and simultaneous display of a bar graph (E5AR only) provides high visual clarity.

Multipoint, Cascade, and Proportional Control Using a Single Unit with 2 Temperature/Analog Inputs, and Standard Control of 4 Loops from a Single Unit with 4 Inputs (See Note). And Position-proportional Control.

The series includes models with 1, 2, and 4 temperature/analog inputs (see note). Various control modes can be selected in the software settings, including standard control, heating and cooling control, cascade control, proportional control, and remote SP control. This enables a single Unit to perform multipoint control (up to 4 inputs for the E5AR only), cascade control, and proportional control.

Particularly with multipoint control, a single Unit can be used to simultaneously control up to 4 points, such as temperature, humidity, and pressure, thereby contributing to reduced costs per loop and smaller panels.

Models that perform position-proportional control can be used to control proportional motors.

Note: The size of models with 4 analog inputs is 96 x 96 mm (E5AR only).

Easily Coordinate Control of PLCs Using Multiple I/O

Up to 6 event inputs are provided (depending on the model). These can be used to externally control memory bank switching, RUN/STOP, auto/manual, SP mode, and remote/local operations. A single transfer output (depends on the model) is also provided. This allows external output of PVs, SPs, MVs, and SP ramp values for each loop. Up to 4 auxiliary outputs are also provided. This allows external output of 11 alarm modes and input errors.

Using RS-485 communications (CompoWay/F), data can be easily shared with CS/CJ-series or other OMRON PLCs through a CJ1W-CIF21 Simple Communications Unit. MODBUS protocol is also supported.

Conforms to DeviceNet Multivendor Network

A DeviceNet connection enables high-speed data transfer by allocating settings and parameters to be monitored in PLC I/O areas. This greatly reduces the program development requirements for communications.

Using the DeviceNet Configurator, all parameters can be uploaded or downloaded in a single operation. Set parameters can also be saved, loaded, and printed, dramatically reducing maintenance time.

Various Calculation Functions

Calculation functions are provided as a standard feature, such as SP ramp, extraction of square root, and straight-line and broken-line approximation.

Download Initial Settings, and Mask, Print, Save in CSV Format, or Tune Display Settings Interactively from a Personal Computer. (CompoWay/F-compatible Models with Communications Functions Only)

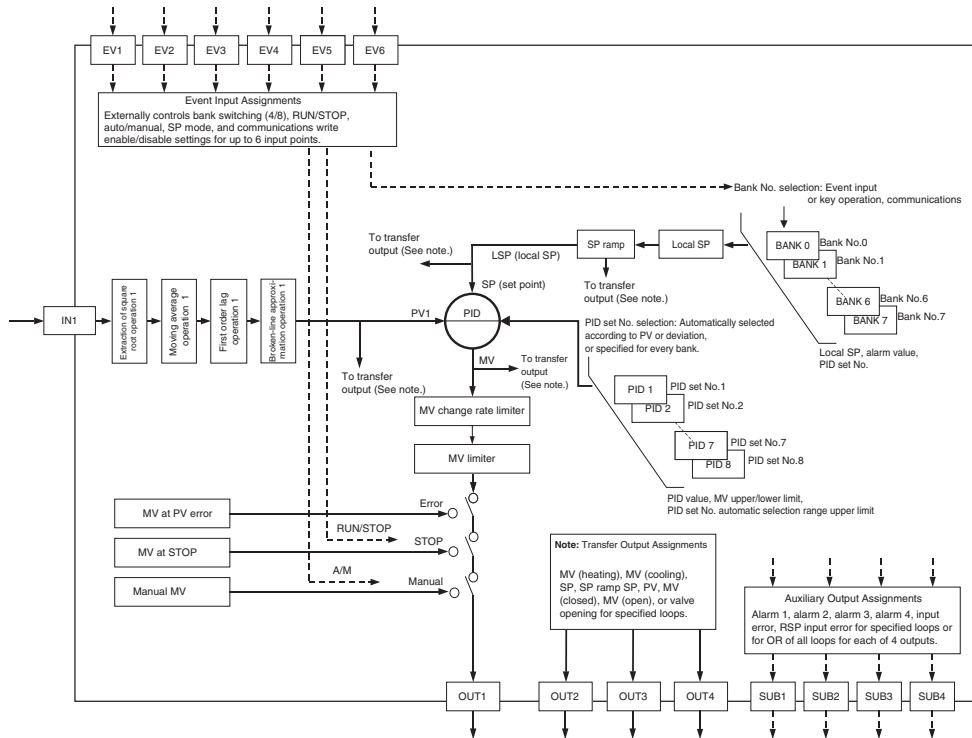
Thermo Tools (Support Software sold separately) can be used to simply set initial settings from a personal computer. (Downloading initial settings reduces the time required for setting.)

Required setting data alone can also be displayed and set. Setting data can be saved as a document. PID tuning can also be performed while monitoring PV trends (fine tuning is also possible).

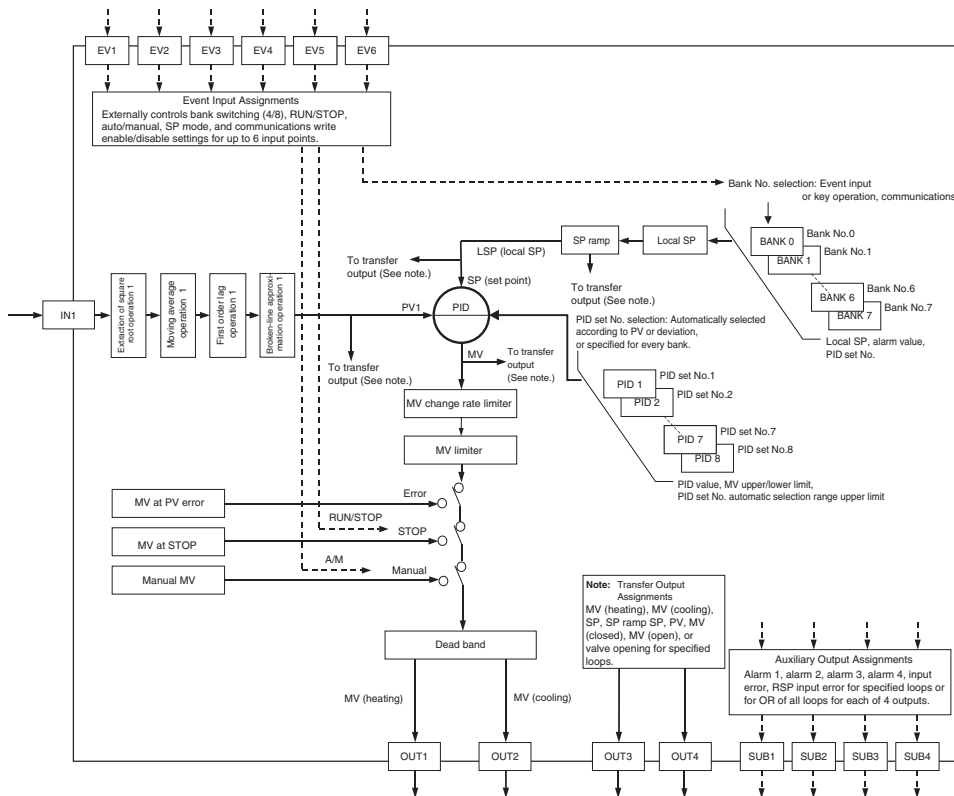
E5AR/E5ER Common Information

I/O Block Diagram

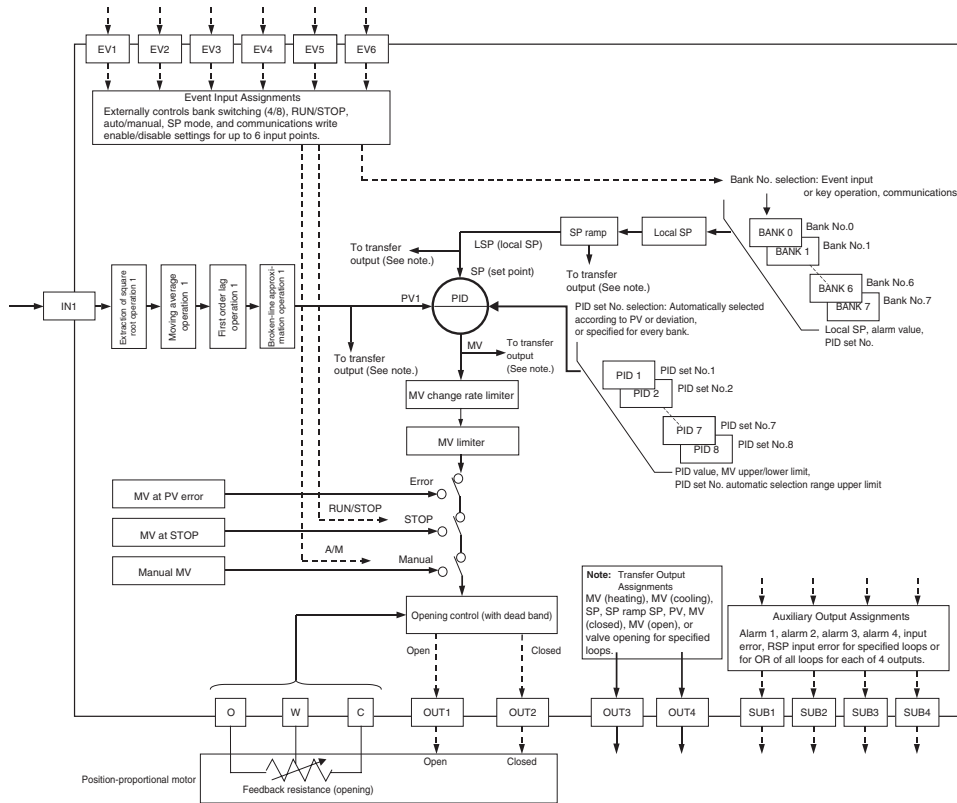
Standard Control Mode



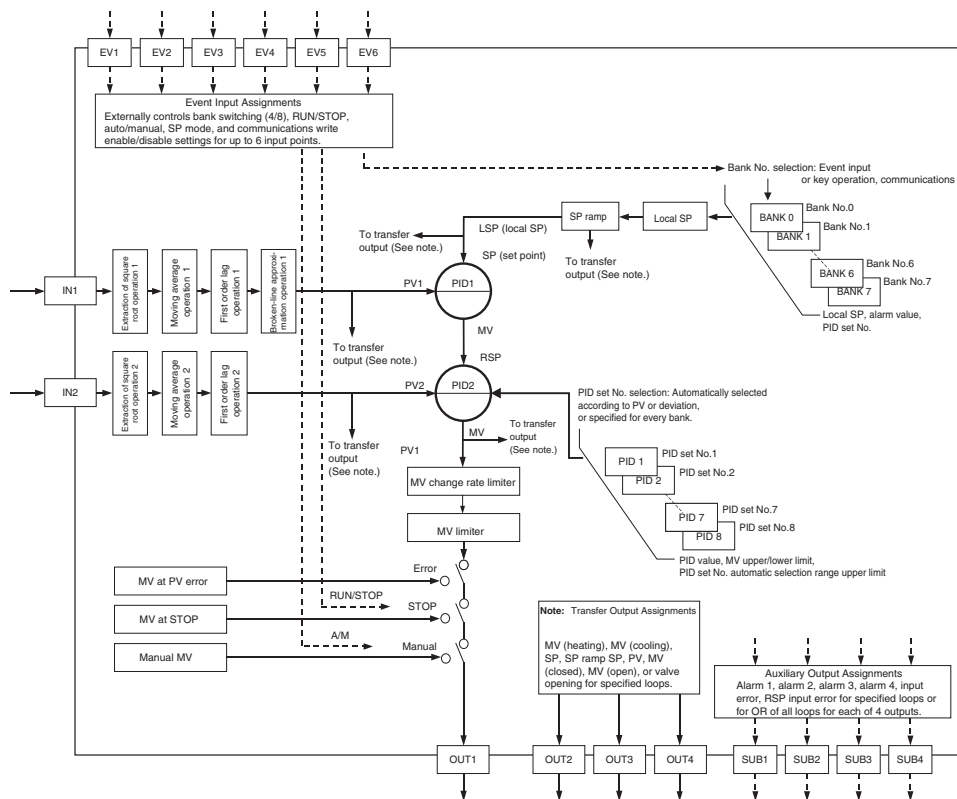
Heating and Cooling Control Mode



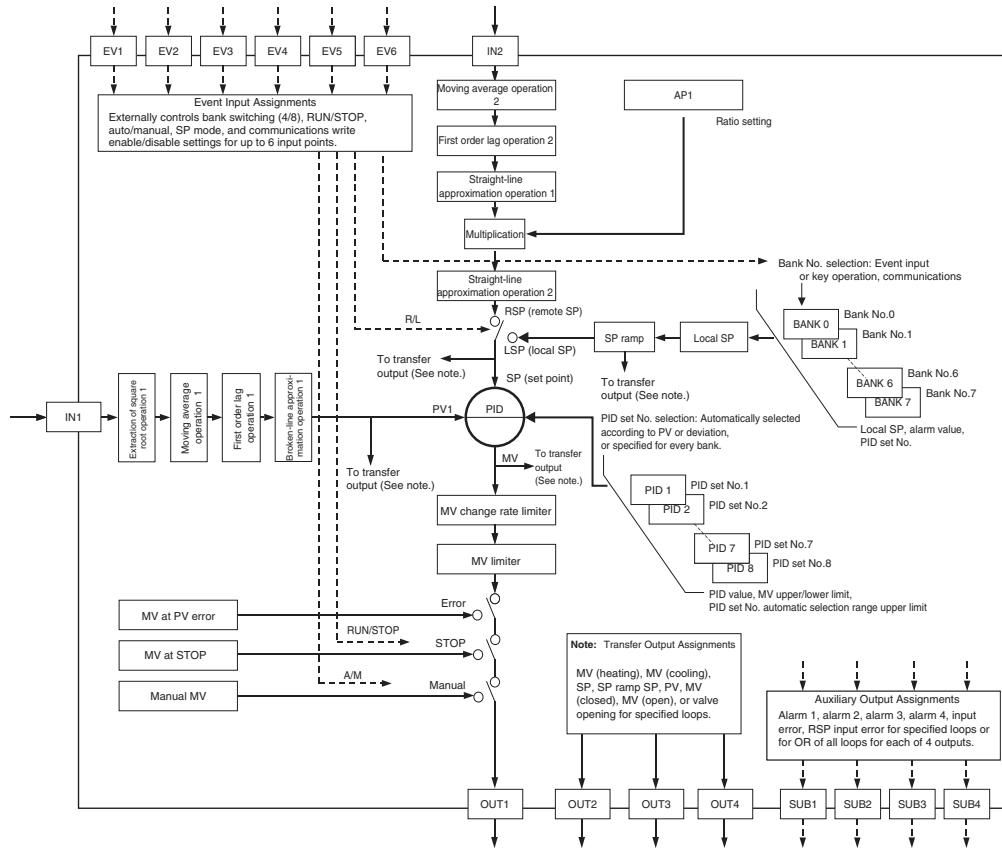
Single-loop Position-Proportional Control Mode



Single-loop Cascade Control Mode (2-Loop Controller)

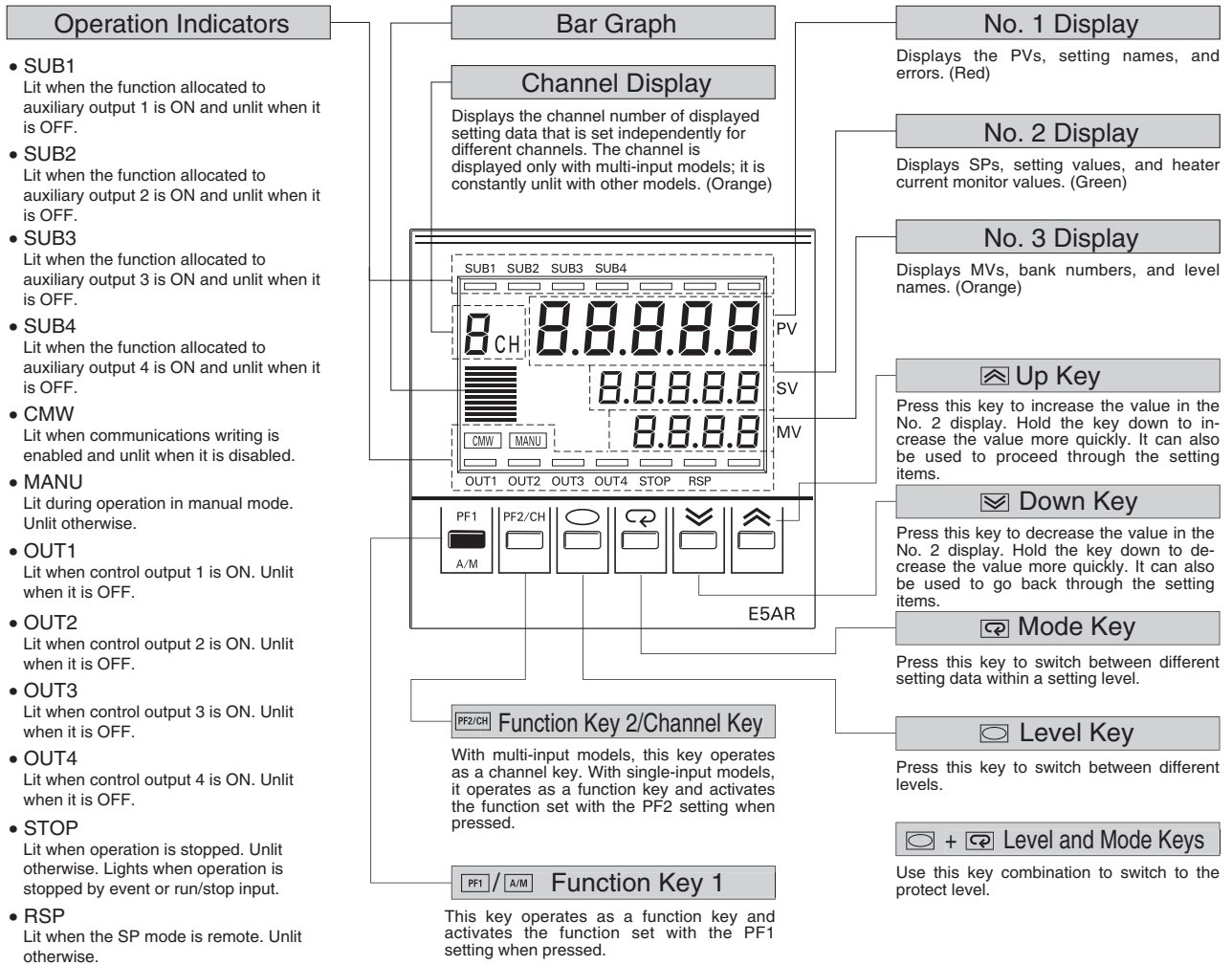


Single-loop Proportional Control Mode (2-Loop Controller)



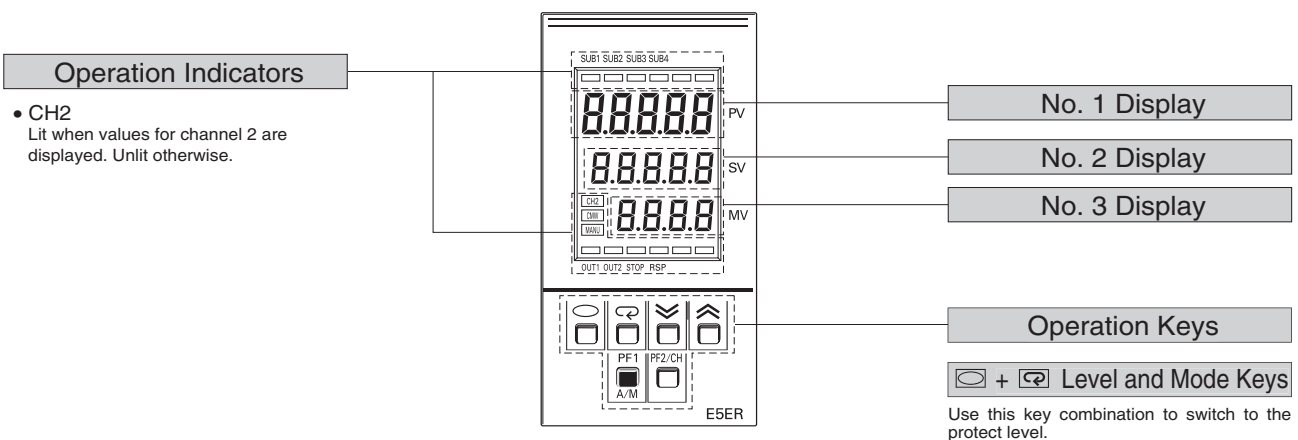
Nomenclature

E5AR



E5ER

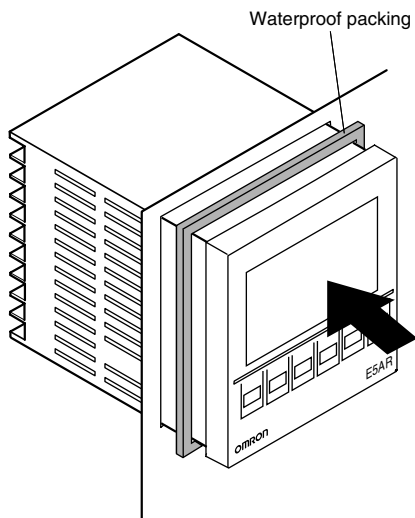
Items without explanations are explained in the diagram for the E5AR.



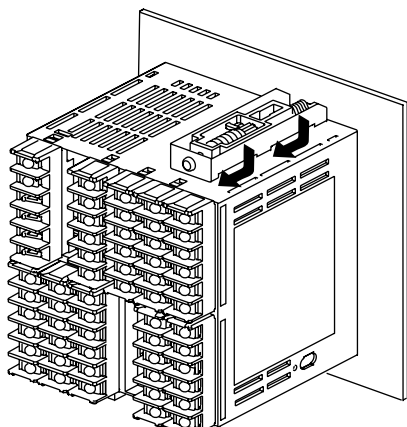
Installation

E5AR

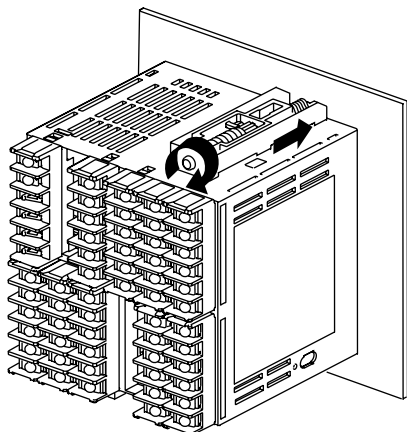
1. Ensure waterproofing by mounting with waterproof packing.
2. Insert the E5AR into the mounting hole panel.



3. Insert the mounting brackets into the grooves on the top and bottom of the rear case.

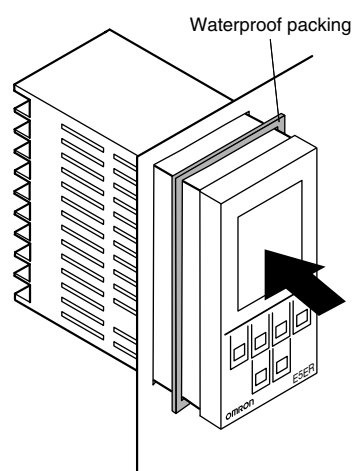


4. Tighten the screws on the mounting brackets alternately, keeping an even balance, until the ratchet stops tightening.

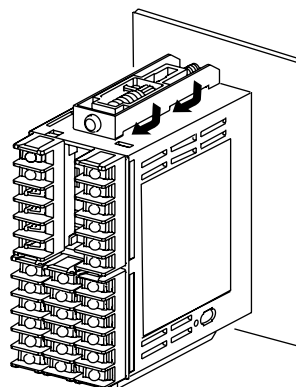


E5ER

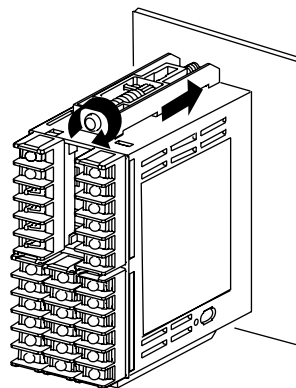
1. Ensure waterproofing by mounting with waterproof packing.
2. Insert the E5ER into the mounting hole panel.



3. Insert the mounting brackets into the grooves on the top and bottom of the rear case.



4. Tighten the screws on the mounting brackets alternately, keeping an even balance, until the ratchet stops tightening.



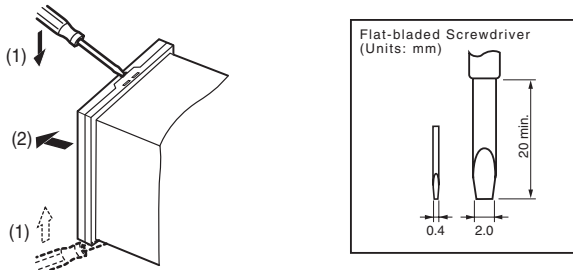
Drawing Out

Although the Unit does not have to be drawn out for standard operation, it can be drawn out for maintenance if necessary.

Removing the Front Panel

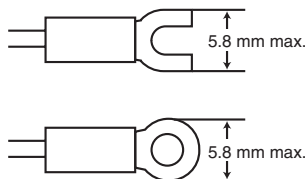
A flat-bladed screwdriver (shown below) is required to remove the front panel.

1. Insert the screwdriver in the holes (2) at the top and bottom of the front panel and unfasten the hooks.
2. Insert the screwdriver in the gap between the front panel and the rear case and pull out the front panel a little. Then, hold the top and bottom of the front panel and pull in the direction of the arrow (below) to remove.



Wiring Precautions

- Prevent the influence of noise by separating input lines and power lines.
- Use crimp terminals.
- Tighten the terminal screws using a torque between 0.40 and 0.56 N·m.
- Use M3 crimp terminals with the following dimensions.



Initial Setup

Typical Example

This example shows how to perform initial setup for the E5AR-Q4B (100 to 240 VAC) and is based on the following conditions.

Input type: Pt100 (-200.0 to 850.0°C)

Control method: PID control

Output: Pulse voltage output

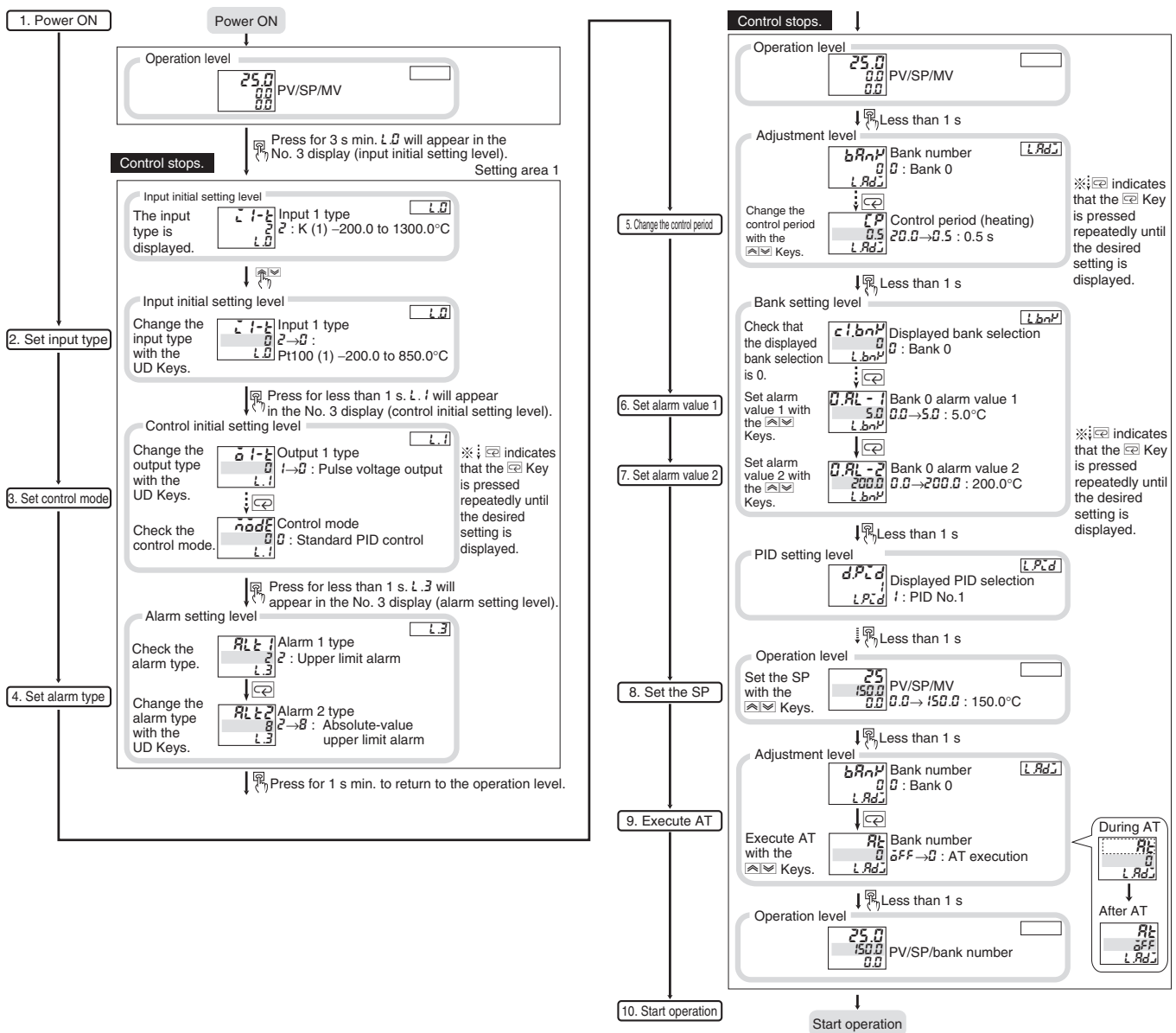
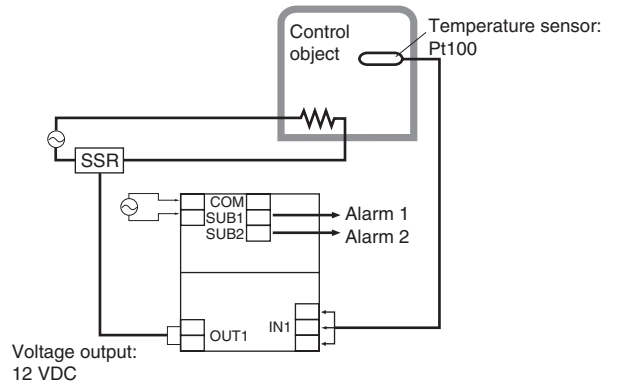
Control period: 0.5 s

Alarm 1: Upper limit alarm at 5.0°C

Alarm 2: Absolute-value upper limit alarm at 200.0°C

PID: Obtained by auto-tuning (AT)

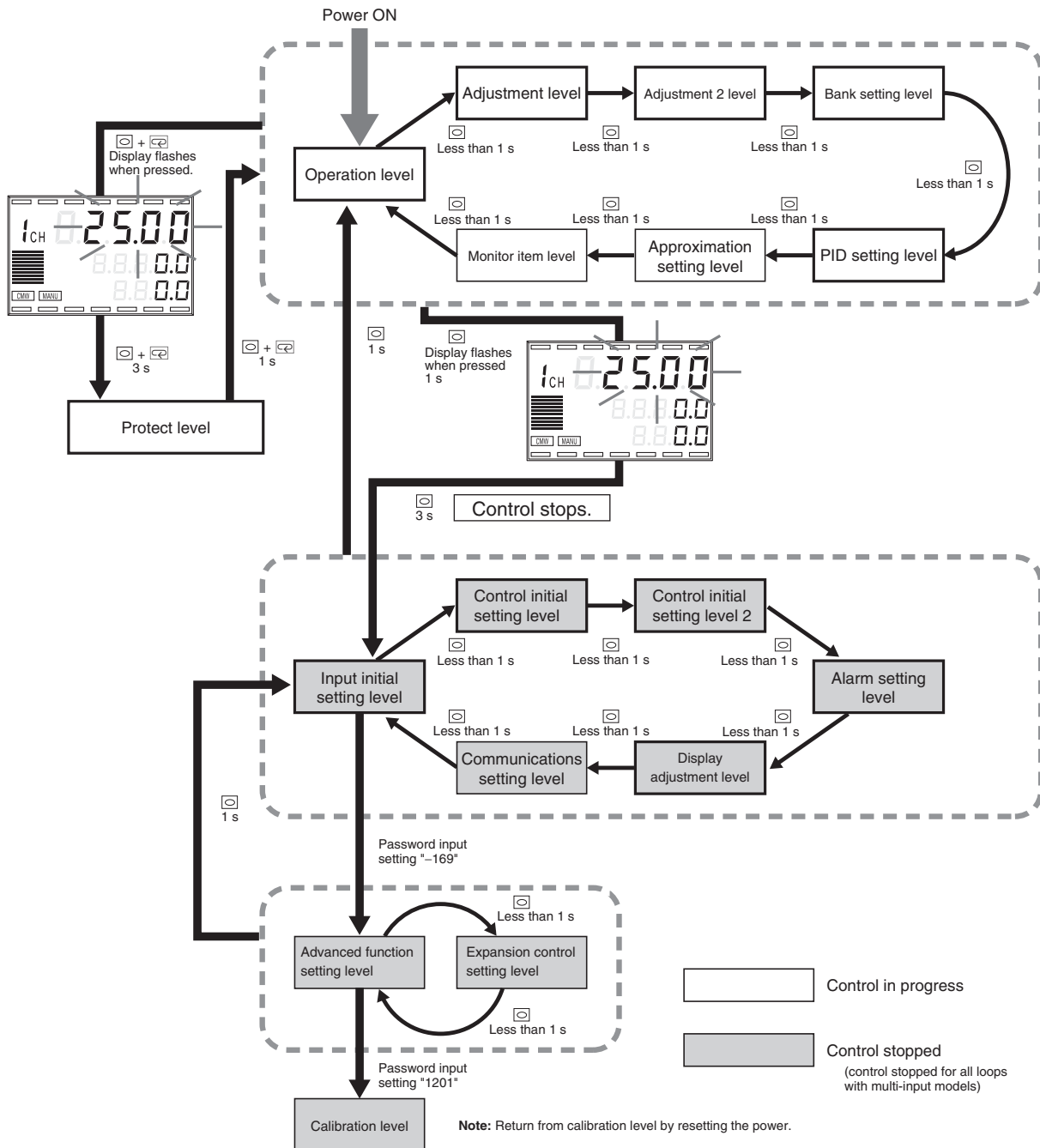
SP: 150.0°C



Specification Setting after Turning ON Power



Setting Level Configuration and Key Operations

Setting items are divided into “levels” and the settings are referred to as “parameters.” With the E5AR/E5ER, setting items are classified into the 17 types shown below. When power is turned ON, all the indicators light for approx. 1 min before the Unit enters the operation level.

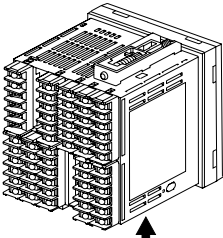


Note: Depending on the model or settings, some levels may not be displayed.

Input Allocation List

Set value	Input type name	Input range		Input type switch
		(°C)	(°F)	
0	Pt100 (1)	-200.0 to 850.0	-300.0 to 1500.0	Set to TC.PT 
1		-150.00 to 150.00	-199.99 to 300.00	
2	K	-200.0 to 1300.0	-300.0 to 2300.0	Set to TC.PT 
3		-20.0 to 500.0	0.0 to 900.0	
4	J	-100.0 to 850.0	-100.0 to 1500.0	
5		-20.0 to 400.0	0.0 to 750.0	
6	T	-200.0 to 400.0	-300.0 to 700.0	
7	E	0.0 to 600.0	0.0 to 1100.0	
8	L	-100.0 to 850.0	-100.0 to 1500.0	
9	U	-200.0 to 400.0	-300.0 to 700.0	
10	N	-200.0 to 1300.0	-300.0 to 2300.0	
11	R	0.0 to 1700.0	0.0 to 3000.0	
12	S	0.0 to 1700.0	0.0 to 3000.0	
13	B	100.0 to 1800.0	300.0 to 3200.0	
14	W	0.0 to 2300.0	0.0 to 4100.0	
15	4 to 20 mA	One of the following ranges is displayed by scaling.		
16	0 to 20 mA			
17	1 to 5 V			
18	0 to 5 V			
19	0 to 10 V			

• The initial set value is 2 and the factory setting for the input type switch is TC.PT.

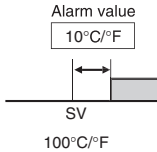


Input type switch (bottom)

The following example shows the settings required for the alarm to turn ON when the temperature exceeds 110°C/°F.

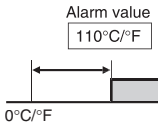
Alarms Other Than Absolute-value Alarms (Alarm Types 1 to 7)

Set the alarm value as a deviation from the SP.




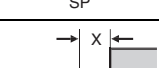

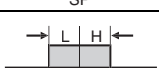
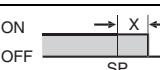
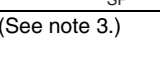
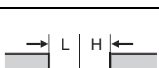
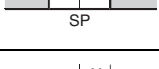
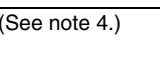
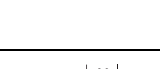
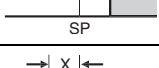
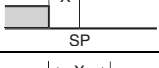
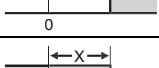
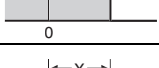
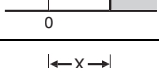
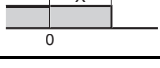
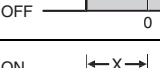

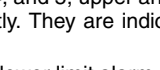
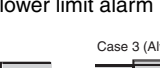
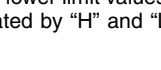


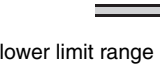
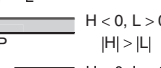
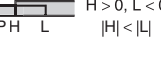
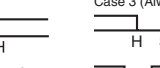
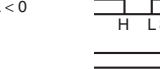
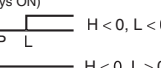
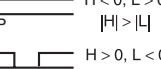








Absolute-value Alarms (Alarm Types 8 to 11)

Set the alarm value as an absolute value with respect to 0°C/°F.



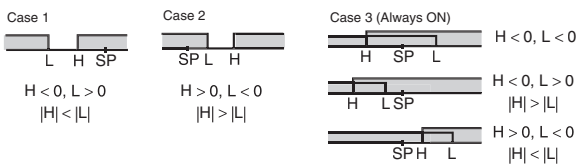
Alarm Type List

Alarm values are indicated by "X" in the following table. In cases where upper and lower limits are set independently, the upper limit is indicated by "H" and the lower limit is indicated by "L." If upper/lower limit, upper/lower limit range, or upper/lower limit with standby sequence is selected as the alarm type, set both the alarm upper limit and alarm lower limit values. For any other selection, set the (single) alarm value.

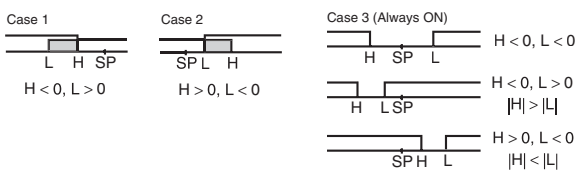
Set value	Alarm type	Alarm output function	
		Positive alarm value (X)	Negative alarm value (X)
0	No alarm function	Output OFF	
1 (See note 1.)	Upper/lower limit	ON  OFF 	(See note 2.)
2	Upper limit	ON  OFF 	ON  OFF 
3	Lower limit	ON  OFF 	ON  OFF 
4 (See note 1.)	Upper/lower limit range	ON  OFF 	(See note 3.)
5 (See notes 1 and 6.)	Upper/lower limit with standby sequence	ON  OFF 	(See note 4.)
6 (See note 6.)	Upper limit with standby sequence	ON  OFF 	ON  OFF 
7	Lower limit with standby sequence	ON  OFF 	ON  OFF 
8	Absolute-value upper-limit	ON  OFF 	ON  OFF 
9	Absolute-value lower-limit	ON  OFF 	ON  OFF 
10 (See note 6.)	Absolute-value upper-limit with standby sequence	ON  OFF 	ON  OFF 
11 (See note 6.)	Absolute-value lower-limit with standby sequence	ON  OFF 	ON  OFF 

Note 1: With set values 1, 4, and 5, upper and lower limit values can be set independently. They are indicated by "H" and "L" respectively.

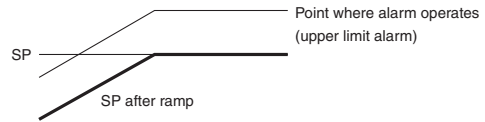
2: Set value 1: Upper/lower limit alarm



3: Set value 4: Upper/lower limit range

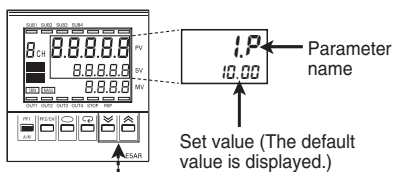


- Set value 5: Upper/lower limit with standby sequence
Based on the above explanation for the upper/lower limit alarm, in cases 1 and 2, if the upper and lower limits effectively overlap because of hysteresis, operation will be always OFF; in case 3, operation will be always OFF.
- Set value 5: Upper/lower limit with standby sequence
If the upper and lower limits effectively overlap because of hysteresis, operation will be always OFF.
- For more details on the standby sequence, refer to the *User's Manual (Z182)*.
- If SP ramp is used, the alarm function will operate with respect to the SP after ramp during operation, and will operate with respect to the SP while operation is stopped.



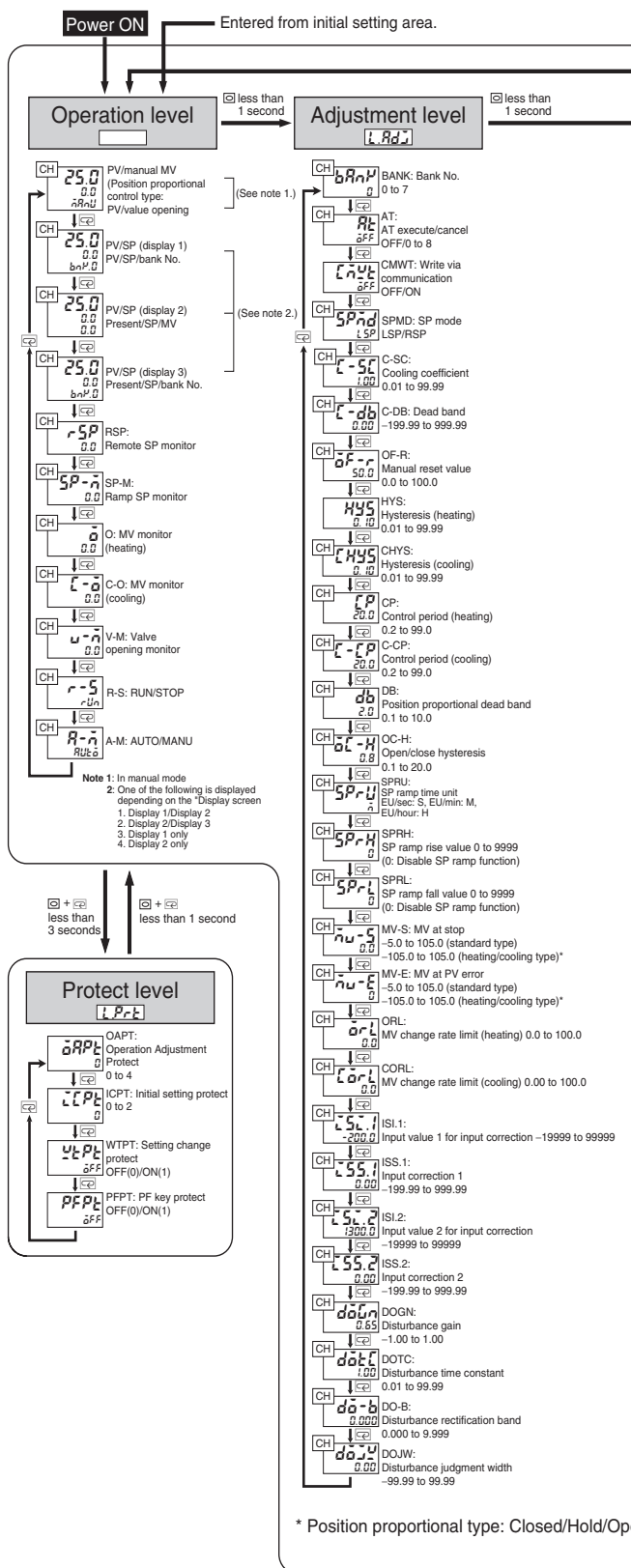
Parameter Lists

Display of Parameter Names and Set Values



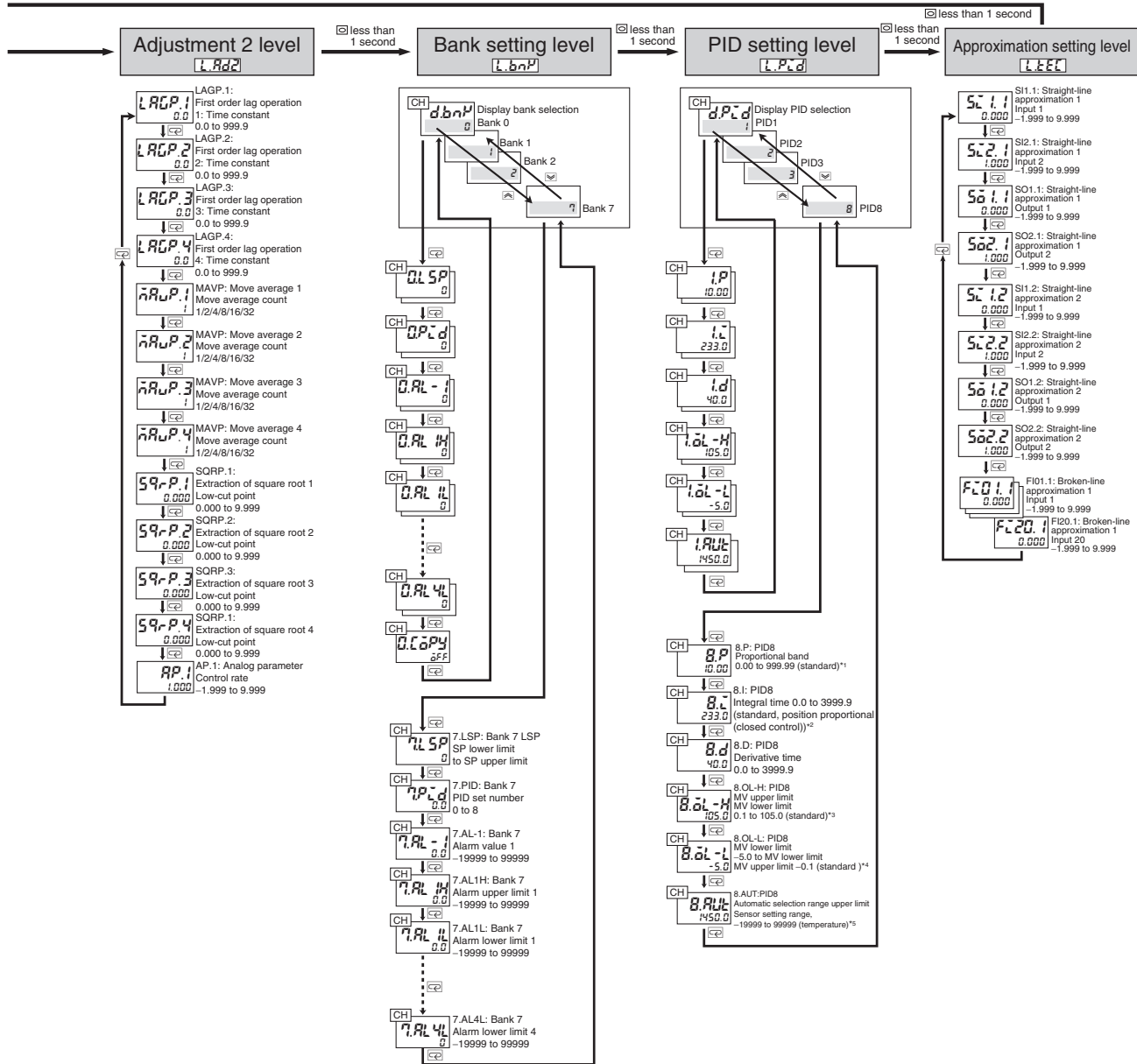
Change with \leftarrow \rightarrow keys

Note: Although all the parameters are listed here, the parameters that are actually displayed may vary with the model and/or functions used.



Temperature Controller

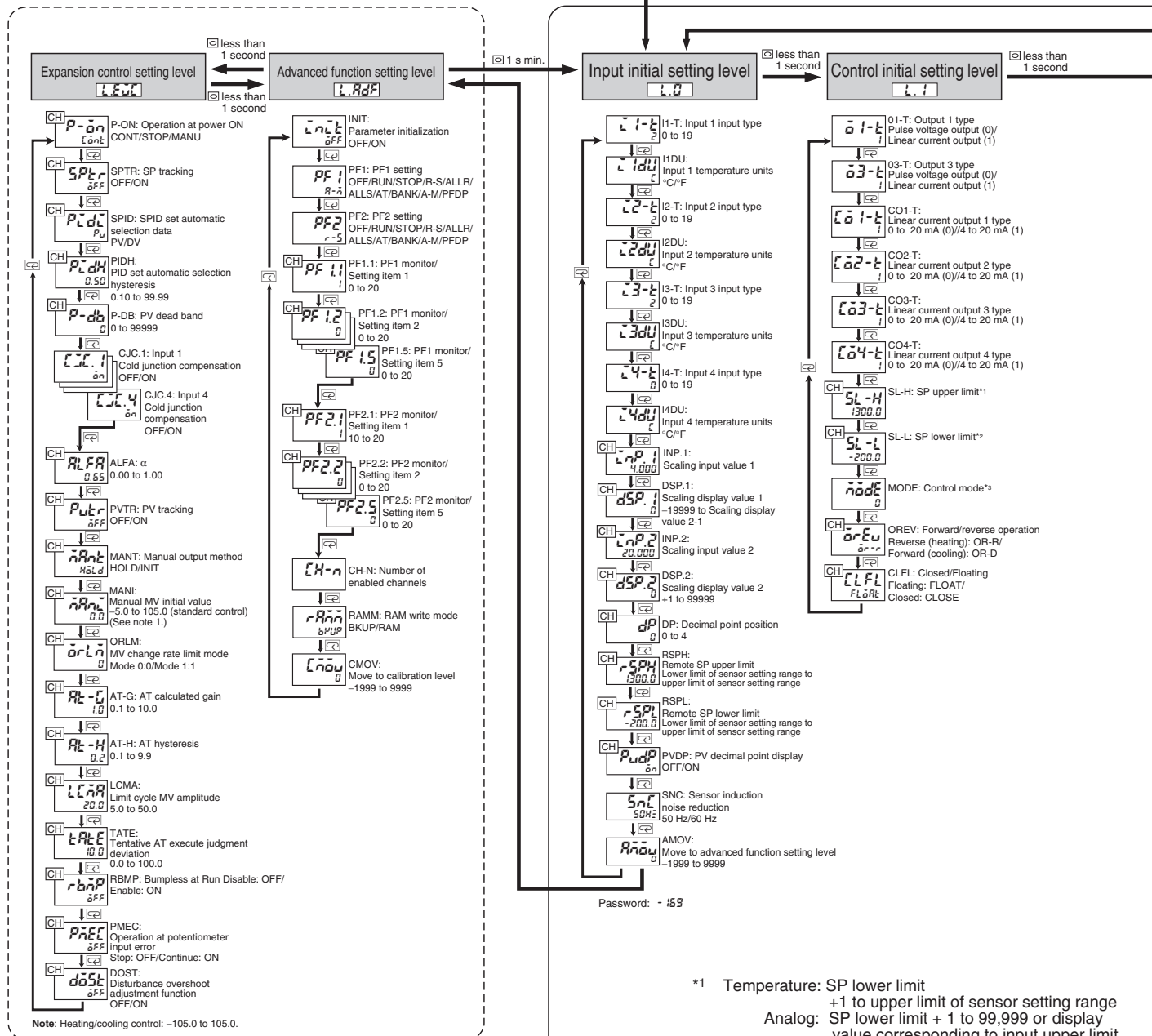
Operation adjustment area



- *1 Position proportional type: 0.01 to 999.99.
- *2 Position proportional (floating control) type: 0.1 to 3999.9.
- *3 Heating and cooling control: 0.0 to 105.0.
- *4 Heating and cooling control: -105.0 to 0.0.
- *5 Analog type: -10% to 110% of scaling display range, with a maximum of -19999 to 99999.

Press the key for 3 seconds to move to the input initial setting level (page 28).
Control stops.

Entered from operation adjustment area.

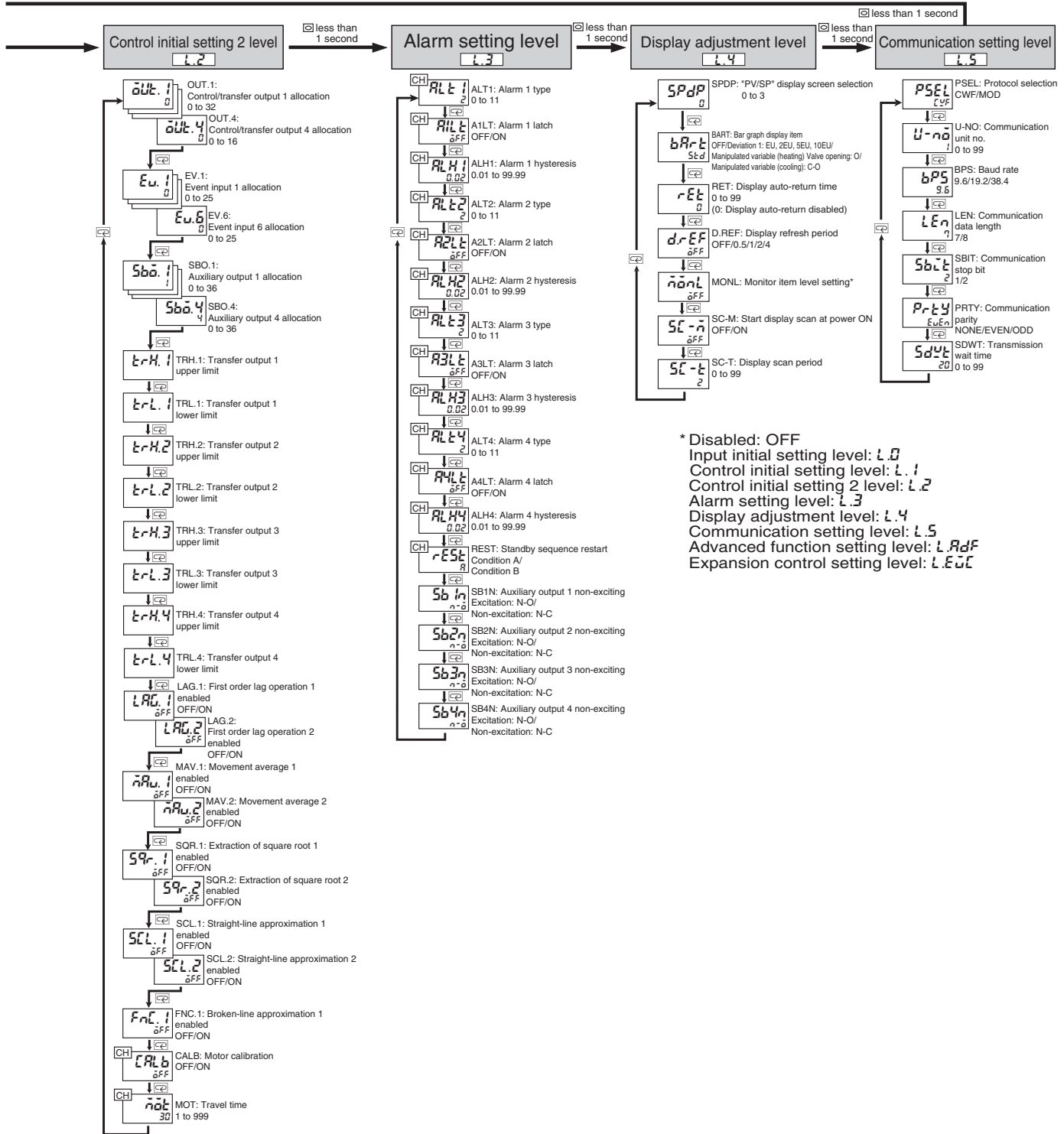


Note: Heating/cooling control: -105.0 to 105.0.

Password: -159

- *1 Temperature: SP lower limit
+1 to upper limit of sensor setting range
Analog: SP lower limit + 1 to 99,999 or display value corresponding to input upper limit, whichever is smaller
display value 2
- *2 Temperature: Lower limit of sensor setting range to SP upper limit -1
Analog: -1,999 or display value corresponding to input lower limit
- *3 1/4 input Standard (0)/heating or cooling (1)
2 input Standard (0)/heating or cooling (1)
Standard with remote SP (2)/
Heating or cooling (3) with remote SP/
Proportion (4)/Cascade standard (5)/
Cascade heating or cooling (6)

Initial setting area



* Disabled: OFF
 Input initial setting level: L.0
 Control initial setting level: L.1
 Control initial setting 2 level: L.2
 Alarm setting level: L.3
 Display adjustment level: L.4
 Communication setting level: L.5
 Advanced function setting level: L.RdF
 Expansion control setting level: L.EUc

Press the key for 1 s min. to move to the operation level (page 26).

Protect Level

The protect function can be used to restrict the setting items that can be changed and thereby prevent unintentional setting changes. The protection functions that can be used include operation adjustment protection, initial setting level protection, setting change protection, and PF key protection.

Operation/Adjustment Protection

Key operations in the operation level, adjustment level 2, bank setting level, PID setting level, approximation setting level, and monitor item level can be restricted using the settings shown below.

Set value	Operation		Adjustment, adjustment 2	Bank setting, PID setting, approximation setting, monitor item
	PV/SP	Other		
0	☆	☆	☆	☆
1	☆	☆	☆	▲
2	☆	☆	▲	▲
3	☆	▲	▲	▲
4	○	▲	▲	▲

☆: Can be displayed and changed

○: Can be displayed

▲: Cannot be displayed and moving levels is not possible.

Default set value: 0

Initial Setting Level Protection

Movement to the input initial setting level, control initial setting level, control initial setting level 2, alarm setting level, display adjustment level, and communications setting level can be restricted using the settings shown below.

Set value	Movement to the input initial setting level	Movement to control initial setting level, control initial setting level 2, alarm setting level, display adjustment level, and communications setting level
0	Permitted: Move to advanced function setting levels" displayed.	Permitted
1	Permitted: Move to advanced function setting levels" not displayed.	Permitted
2	Prohibited	Prohibited

Communications Setting Level

Set the communications specifications in the communications setting level using panel operations. The communications parameters and their settings are listed in the following table.

Parameter	Displayed characters	Set values	Displayed set values
Protocol selection	P5EL	CompoWay/F, Modbus	/ n̄od
Communications unit number	U-n̄	0 to 99	0, to 99
Baud rate	bPS	9.6/19.2/38.4 (kbps)	/ 19.2 / 38.4
Data length	LEn	7/8 (bits)	8 (bit)
Stop bits	Sbc̄t	1/2 (bits)	1 /
Parity	Pr̄tY	None/even/odd	n̄ / odd
Response send waiting time	SdYt	0 to 9,999 s	o to 9999

Note: The highlighted values indicate default settings.

Before executing communications, set the communications unit number, baud rate, and other communications parameters using key operations in the way described below. Refer to the *User's Manual (Z182)* for details on other operations.

- If the set value for initial setting level protection is set to 2, nothing will happen when an attempt is made to enter the input initial setting level from the operation level, adjustment level, adjustment level 2, bank setting level, PID setting level, approximation setting level, or monitor item level by pressing the Level Key for 1 s min. (Also, the display will not flash as it usually does when changing level.)
- The default set value for initial setting level protection is 0.

Setting Change Protection

Settings can be protected from changes using the Up and Down Keys using the settings shown below.

Set value	Description
OFF	Settings can be changed with key operations.
ON	Settings (except those in the protect level) cannot be changed with key operations.

- Default set value: OFF

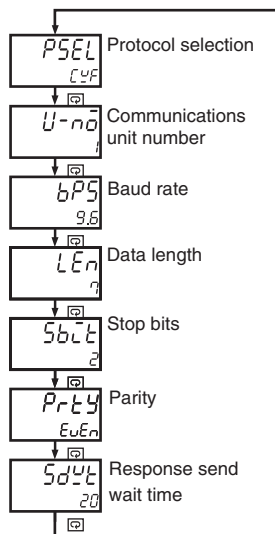
PF Key Protection

The PF1 and PF2 Keys can be enabled/disabled using the settings shown below.

Set value	Description
OFF	PF1 and PF2 Keys enabled.
ON	PF1 and PF2 Keys disabled. (Operations as function keys or loop keys are prohibited.)

- The default set value for PF key protection is OFF.

3. Press the Mode Key to move around the parameters in the way shown below.
4. Change the parameter settings as required using the Up and Down Keys.



Set the communications parameters to match those of the computer to be communicated with.

Protocol Selection (PSEL)

Select either CompoWay/F or Modbus as the communications protocol. CompoWay/F is a general-purpose communications-based unified communications protocol developed by OMRON. Modbus is a communications protocol that conforms to the RTU Mode of the Modicon Inc.'s Modbus Protocol (specifications: PI-MBUS-300 Rev. J).

Communications Unit Number (U-n0)

When communicating with the host computer, the unit number must be set in each Controller so that the host computer can identify each one. The number can be set to any integral value in the range 0 to 99. The default setting is 1. When using more than one Controller, be careful not to use the same number twice. Duplicate settings will cause malfunction. The set value becomes valid when the power is turned OFF and ON again.

Baud Rate (bPS)

Use this parameter to set the speed of communications with the host computer. It can be set to one of the following values; 9.6 (9,600 bps), 19.2 (19,200 bps), or 38.4 (38,400 bps). The setting becomes valid when the power is turned OFF and ON again.

Data Length (LEN)

The length of communications data can be set to either 7 or 8 bits.

Stop Bits (Sbct)

The number of communications stops bits can be set to either 1 or 2.

Parity (Prty)

The communications parity can be set to none, even, or odd.

Response Send Wait Time (Sdwt)

Changes to the response send wait time are enabled either after software reset or when the power is turned OFF and ON again.

Error Display (Troubleshooting)

When an error occurs, error codes will be displayed in the No.1 and/or No. 2 displays. Check the error contents and take the appropriate counter-measures.

Display 1	Display 2	Error description	Remedies	Output state at error	
				Control output	Alarm output
Unit	Err	Unit error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
Unit	CHG	Unit change			
dSP	Err	Display unit error			
555	Err	Main unit error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
EEP	Err	EEPROM error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
5Err	Normal display	Sensor input error	Check that the input wiring is correct, that the input type switch is set correctly, that there is no disconnection or short-circuit, and that the input type is correct. If there are no irregularities with the above items, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	MV is output according to the "MV at PV error" setting.	Same operation as when upper limit is exceeded.
cccc cccc	Normal display	Outside display range (below) Outside display range (above)	This is not an error, however, the present value is outside of the display range (-19999 to 99999).	Normal operation	Normal operation
Normal display	The RSP run indicator is blinking	RSP input error	Check and see if the wire to the RSP input is broken or shorted.	MV is output according to the "MV at PV error" setting.	OFF
Normal display	-----	Potentiometer input error	Check the potentiometer wire.	Normal operation	Normal operation
ALb	Err	Motor calibration error	Check the wiring to the potentiometer and the valve drive motor, and then repeat motor calibration.	OFF	OFF
c1-t c2-t c3-t c4-t	A set value flashes	Input type switch error	Make sure the input type switch and the displayed "Input type" setting accord with the input type you will use.	OFF	OFF

Note: If the Controller does not operate as expected after making the settings, check the wiring and the settings. If the Controller still does not operate as expected, it is possible that parameters have been set incorrectly. It is recommended that the Controller is initialized and the settings performed again. (Initializing the Controller will return all settings to their default values. Make a note of the settings before performing initialization.)

Temperature Controller

Troubleshooting

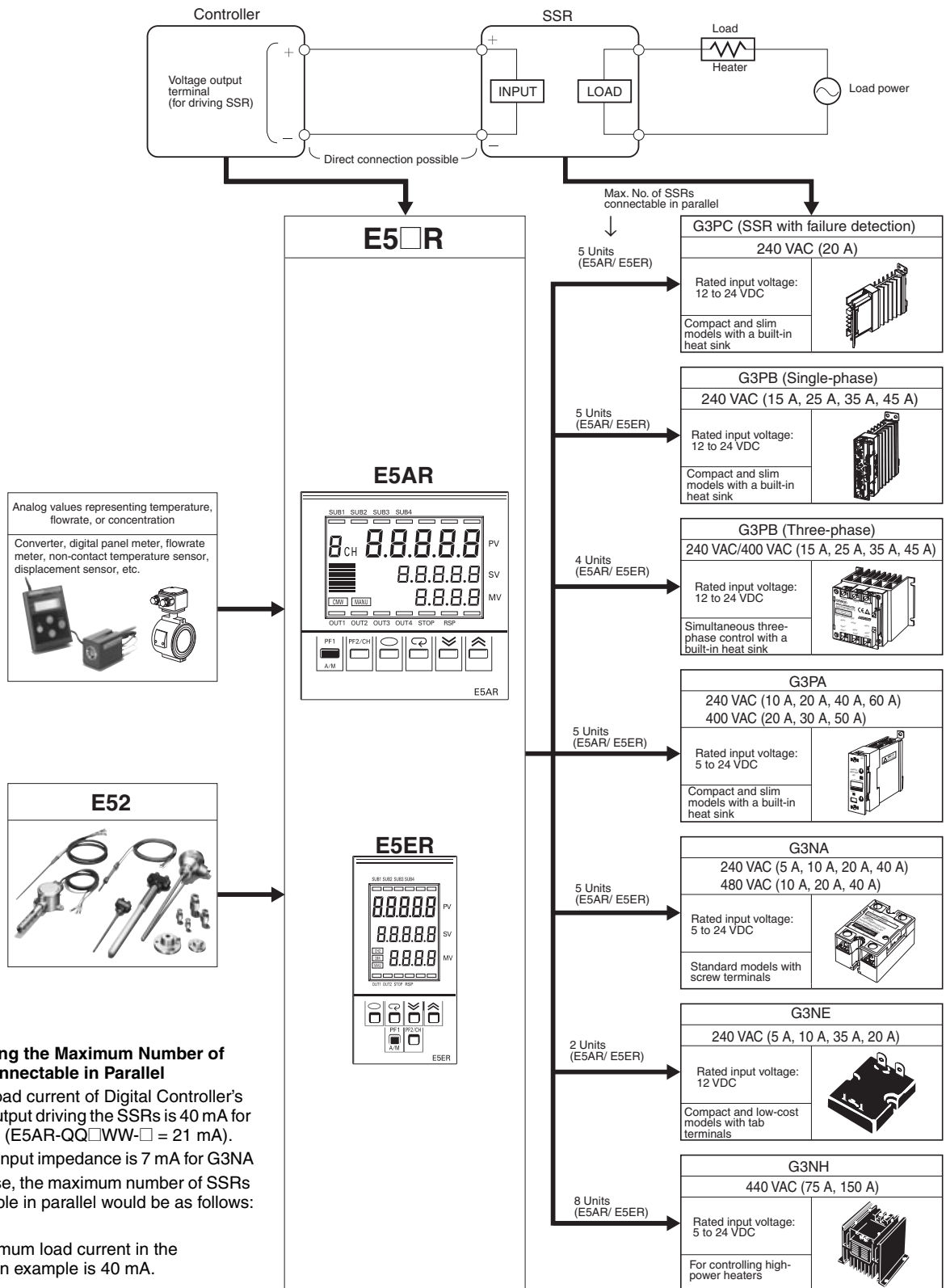
If the temperature does not increase, outputs do not turn ON, or large discrepancies in the temperature occur, perform the checks listed in the following table.

Problem	Items to check and probable cause	Countermeasure
The temperature does not rise. Outputs do not turn ON.	1. Has control stopped? If the STOP indicator is lit, control has stopped.	Set $rUn/5t\bar{o}P$ to rUn in the operation level. The STOP indicator will turn OFF.
	2. Is control set to forward operation? Control must be set to reverse operation for heating control.	Set $\bar{o}rEu$ to $\bar{o}r-r$ in the initial setting level.
	3. Are the OUT indicators for control output lit or flashing? If the control output is not current output, the OUT indicators turn ON in synchronization with the output.	If the OUT indicators do not light at all, check items 1 and 2. If the OUT indicators are continuously lit, check connections to sensors, heaters, and other peripheral devices.
	4. If PID control is used, it is possible that the PID constants are unsuitable.	If possible, obtain the PID constants using auto-tuning. (Auto-tuning uses 100% output with respect to the load and so overshooting may occur.)
There are large discrepancies in the temperature.	1. Is the correct type of sensor used?	After checking the sensor type, check the setting for input type ($\bar{c}*-\bar{t}$) in the initial setting level. (*: 1 to 4)
	2. Are input correction values set?	Check the settings for input correction ($\bar{c}5\bar{c}*$, $\bar{c}55*$) in the adjustment level. ($\bar{c}5\bar{c}$, *: 1 to 4) To display the temperature as measured by the sensor, set to 0.0.
	3. Is a compensating conductor used to extend the thermocouple connection?	Be sure to use a compensating conductor that is suitable for the sensor used.
	4. Is the sensor separated by a long distance? Is the insertion length short?	Check the installation location of the sensor with respect to the measured object. The sensor's insertion length must be at least 20 times the diameter of the protective tubing.
	Checking temperature controller input: <u>Thermocouple</u> Short the input terminals to display the room temperature. <u>Platinum Resistance Thermometer</u> Connect a resistance to the input terminals and check the display. Connect 100 Ω to A-B and short B-B: 0°C Connect 140 Ω to A-B and short B-B: Approx. 100°C	

Peripheral Devices

Temperature Sensor and SSR

Connection Example with SSR



Calculating the Maximum Number of SSRs Connectable in Parallel

A: Max. load current of Digital Controller's voltage output driving the SSRs is 40 mA for the E5AR (E5AR-QQ□WW-□ = 21 mA).

B: SSR's input impedance is 7 mA for G3NA
In this case, the maximum number of SSRs connectable in parallel would be as follows:

$$A/B = 5$$

The maximum load current in the connection example is 40 mA.

Precautions

⚠ WARNING

Always provide protective circuits in the network. Without protective circuits, malfunctions may possibly result in accidents that cause serious injury or significant property damage. Provide double or triple safety measures in external control circuits, such as emergency stop circuits, interlock circuits, or limit circuits, to ensure safety in the system if an abnormality occurs due to malfunction of the product or another external factor affecting the product's operation.



Before transferring programs to other nodes or changing I/O memory of other nodes, check the nodes to confirm safety. Changing the program or I/O memory of other nodes may occasionally cause unexpected operation, resulting in minor or moderate injury, or damage to the equipment.



Do not attempt to disassemble, repair, or modify the product. Doing so may occasionally result in minor or moderate injury due to electric shock.



⚠ CAUTION

Do not attempt to disassemble, repair, or modify the product. Doing so may occasionally result in minor injury due to electric shock.



Do not touch the terminals, or electronic components or patterns on the PCB within 1 minute after turning OFF the power. Doing so may occasionally result in minor injury due to electric shock.



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 in locations where flammable or explosive gases are present. Doing so may occasionally result in minor or moderate explosion, causing minor or moderate injury, or property damage.



Tighten the screws on the terminal block and the connector locking screws securely using a tightening torque within the following ranges. Loose screws may occasionally cause fire, resulting in minor or moderate injury, or damage to the equipment.



Terminal block screws: 0.40 to 0.56 N·m

Connector locking screws: 0.25 to 0.30 N·m

Perform correct setting of the product according to the application. Failure to do so may occasionally cause unexpected operation, resulting in minor or moderate injury, or damage to the equipment.



Ensure safety in the event of product failure by taking safety measures, such as installing a separate overheating prevention alarm system. Product failure may occasionally prevent control, or operation of alarm outputs, resulting in damage to the connected facilities and equipment.



Do not use the equipment for measurements within Measurement Categories II, III, or IV (according to IEC61010-1). Doing so may occasionally cause unexpected operation, resulting in minor or moderate injury, or damage to the equipment. Use the equipment for measurements only within the Measurement Category for which the product is designed.



The service life of the output relays depends on the switching capacity and switching conditions. Consider the actual application conditions and use the product within the rated load and electrical service life. Using the product beyond its service life may occasionally result in contact welding or burning.



Make sure that the product will not be adversely affected if the DeviceNet cycle time is lengthened as a result of changing the program with online editing. Extending the cycle time may cause unexpected operation, occasionally resulting in minor or moderate injury, or damage to the equipment.



■ Precautions for Safe Use

1. Use and store the product within the specified ambient temperature and humidity ranges. If several products are mounted side-by-side or arranged in a vertical line, the heat dissipation will cause the internal temperature of the products to rise, shortening the service life. If necessary, cool the products using a fan or other cooling method.
2. Provide sufficient space around the product for heat dissipation. Do not block the vents on the product.
3. Use the product within the noted supply voltage and rated load.
4. Be sure to confirm the name and polarity for each terminal before wiring the terminal block and connectors.
5. Do not connect anything to unused terminals.
6. Use the specified size of crimp terminals (M3, width: 5.8 mm max.) for wiring the terminal block.
7. To connect bare wires to the terminal block, use AWG22 to AWG14 (cross-sectional area: 0.326 to 2.081 mm²) to wire the power supply terminals and AWG28 to AWG16 (cross-sectional area: 0.081 to 1.309 mm²) for other terminals. (Length of exposed wire: 6 to 8 mm)
8. Ensure that the rated voltage is achieved no longer than 2 s after turning the power ON.
9. Turn OFF the power first before drawing out the product. Never touch the terminals or the electronic components, or subject them to physical shock. When inserting the product, do not allow the electronic components to contact the case.
10. Do not remove the inner circuit board.
11. Output turns OFF when shifting to the initial setting level in certain modes. Take this into consideration when setting up the control system.
12. Allow the product to warm up for at least 30 minutes after the power is turned ON.
13. Install surge absorbers or noise filters in devices near the product that generate noise (in particular, devices with an inductance component, such as motors, transformers, solenoids, and magnetic coils). If a noise filter is used for the power supply, check the voltage and current, and install the noise filter as close as possible to the product. Separate the product as far as possible from devices generating strong high-frequency noise (e.g., high-frequency welders and high-frequency sewing machines) or surges.
Do not tie noise filter input/output wires together.
14. Keep the wiring for the product's terminal block and connector separate from high-voltage, high-current power lines to prevent inductive noise. Do not run the wiring parallel to or in the same cable as power lines. The influence of noise can also be reduced by using separate wiring ducts or shield lines.
15. Install an external switch or circuit breaker and label them clearly so that the operator can quickly turn OFF the power.
16. Do not use the product in the following locations.
 - Locations where dust or corrosive gases (in particular, sulfuric or ammonia gas) are present.
 - Locations where icing or condensation may occur.
 - Locations exposed to direct sunlight.
 - Locations subject to excessive shock or vibration.

- Locations where the product may come into contact with water or oil.
 - Locations subject to direct radiant heat from heating equipment.
 - Locations subject to extreme temperature changes.
17. Cleaning: Do not use thinners. Use commercially available alcohol.
 18. Use the specified cables for the communications lines and stay within the specified DeviceNet communications distances. Refer to the *DeviceNet Manual (W267)* for details on communications distance specifications and cables.
 19. Do not pull the DeviceNet communications cables with excessive force or bend them past their natural bending radius.
 20. Do not connect or remove connectors while the DeviceNet power is being supplied. Doing so will cause product failure or malfunction.

■ Precautions for Correct Use

Service Life

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 product is installed inside a control panel, make sure that the temperature around the product, not the temperature around the control panel, does not exceed 55°C.

The service life of this product and similar electronic devices is determined not only by the number of switching operations of relays but also by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature becomes, the shorter the service life becomes and, the lower the temperature becomes, the longer the service life becomes. Therefore, the service life can be extended by lowering the temperature of the product.

Be sure to install the product according to the specified conditions. Otherwise, the heat generated by the product will cause the internal temperature to rise, shortening the service life. If necessary, cool the product using fans or other means of air ventilation.

When providing forced cooling, however, be careful not to cool down the terminals sections alone to avoid measurement errors.

Noise Countermeasures

To prevent inductive noise, separate the wiring for the product's terminal block and connector from high-voltage, high-current power lines. Do not run the wiring parallel to or in the same cable as power lines. The influence of noise can also be reduced by using separate wiring ducts or shield lines.

Install surge absorbers or noise filters in devices near the product that generate noise (in particular, devices with an inductance component, such as motors, transformers, solenoids, and magnetic coils).

If a noise filter is used for the power supply, check the voltage and current, and install the noise filter as close as possible to the product.

Separate the product as far as possible from devices generating strong high-frequency noise (e.g., high-frequency welders and high-frequency sewing machines) or surges.

Measurement Accuracy

When extending the thermocouple lead wire, be sure to use a compensating wire that matches the thermocouple type.

When extending the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance, and make sure that the resistances of the three lead wires are the same.

If the measurement accuracy is low, check whether the input shift is set correctly.

Waterproofing

The degree of protection is as shown below.

Front panel	NEMA 4X indoor use (equivalent to IP66)
Rear case	IP20
Terminals	IP00

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 catalog.
- 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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H122-E1-02

In the interest of product improvement, specifications are subject to change without notice.



ThermoTools

The clever way to configure your industrial control components

Temperature Controller

ThermoTools

The clever way to configure your industrial control components



Supporting your needs

Programmable industrial control components are becoming more and more advanced. As the world's largest supplier of temperature and process controllers, Omron naturally takes a leading role in this field. In addition to the 'basic' control functions, modern controllers must be capable to perform much more advanced and high level functions as well.

As functionality increases, the number of parameters that must be programmed in a 'basic line' of controllers already exceeds over 100 parameters. This requires significant programming time during the installation, especially if you have a large number of applications and use a variety of controllers. Omron recognises that today's temperature and process controllers and signal processing instrumentation require advanced software tools to support you and help you save valuable set up time. The advanced ThermoTools software package has been designed to reduce your installation, programming and testing time significantly!



ThermoTools

ThermoTools is an advanced software support package for Omron temperature controllers, process controllers and intelligent signal processors that exploits state-of-the-art ActiveX® technology.

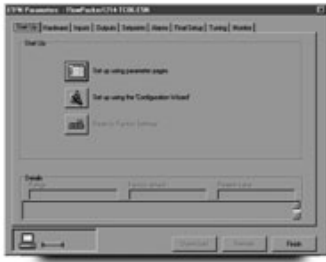
The ThermoTools software provides an extensive range of functions to set up, configure and monitor Omron industrial control components equipment.

Easy file handling and printing facilities help you to record your valuable process data and parameter lists for use in installation, maintenance and quality assurance documentation.

ThermoTools supported products.

A large range of 'digital programmable products' is supported by ThermoTools, and more will follow.

supported hardware products	
E5*N series, Basic Temperature controller line: E5GN, E5CN, E5EN and E5AN	Temperature controllers and Process controllers
E5*K series, Advanced Process and Temperature line: Standard controller models: E5CK, E5EK and E5AK Programmable controller models: E5CK-T, E5EK-T and E5AK -T	
E5*R series, Advanced Process and Temperature Controller line: E5ER and E5AR	
E5ZN, Compact multi-loop controller All E5ZN models	
E5ZE series, Compact multi-loop controller line: All E5ZE models	
K3N series: Advanced line of Intelligent Signal Processors K3NC, K3NH, K3NP, K3NR, K3NV, K3NX, K3GN and H8GN	Intelligent signal processors



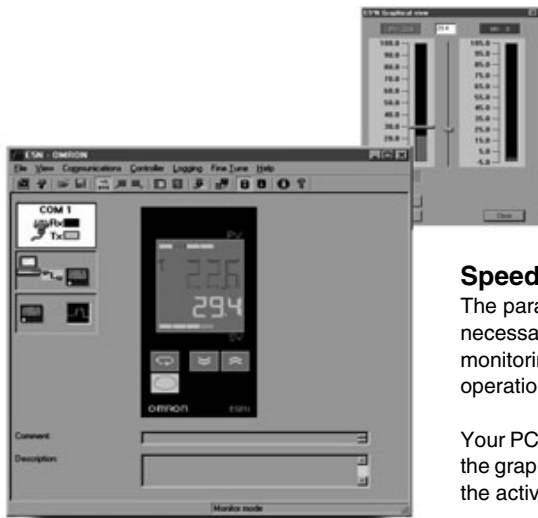
Simple yet advanced at the same time...

ThermoTools is equipped with extended help functionality, that covers everything from getting started to becoming familiar with the advanced functionality. The 'configuration wizard' can be used to configure controllers for 'basic' applications. The wizard will ask you a sequence of questions about the type of controller set up that you require based on the most commonly used parameters. This allows you to create a quick and easy set up.

All parameters at your fingertips

The ThermoTools components use a series of tabs to display information regarding the controller parameters, all sorted in a very logical order, making each parameter easy to find.

Even if no device is connected you are still able to edit, save and load parameter sets. If a device is connected, two modes are available; the configuration mode and the monitoring mode. In configuration mode, parameter sets may be downloaded to, and uploaded from, the controller. Parameter sets can also be saved to store your settings, for use on other applications. In this way you can create a library for your applications and their settings. Listing details of the machine, customer or application can be done in the notes section, for quick and easy recognition or retrieval. If required you can also reset all parameter values in the controller back to their factory defaults by pressing the 'Reset to factory settings' button.



Speeding up installation

The parameter pages allow you to rapidly make all the necessary settings for your application. With the versatile monitoring functions you can check, test and modify the operation of your application instantly.

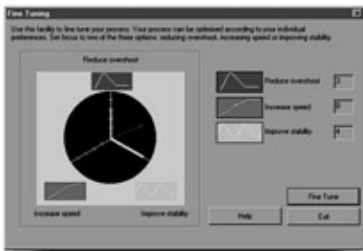
Your PC can be used to display the controller front and with the graphical view you can also monitor in bar graph format the active setpoint, process and output values.

Full support

Depending on the controller that is connected to your PC, the functions of ThermoTools change instantly, allowing access to all functions available for that model. Full support is included for the whole functionality of the selected product, so that maximum product capabilities are at your disposal.



For example: When using the E5K-T programmable controllers, the 'recipes' can be set, numerically and seen graphically. Once these are set changes to the 'Ramp's and Soak's' can be made easily by selecting that particular step. Also the versatile K3N series signal processors are fully supported. ThermoTools supports several different types of file handling functions: saving, loading, exporting to CSV or HTML format. ThermoTools also supports the saving of full sets of parameter values to a controller-family specific file. These files can then be copied, loaded and run by the ThermoTools application. A paper copy of the parameters can be printed. Either as a list of all parameters or only the parameters that have been changed compared to the factory default. Your project, application or quality documentation can than be easily created and maintained.



Including many advanced functions

ThermoTools does not only allow you to upload or download and store your parameters, but also offers several advanced functions.

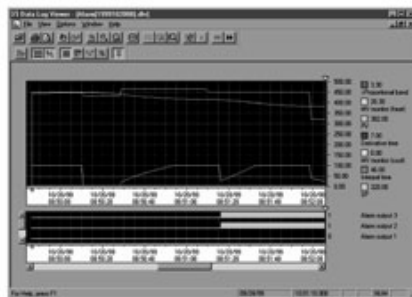
Personal fine tuning

All modern controllers from Omron can perform Auto-tuning, which will tune the PID parameters for a 'standard preferred performance'. Due to our vast experience with controllers, we were able to incorporate a knowledge-based functionality that enables you to further fine-tune your process to a greater level of detail. You can give more emphasis to reduce the over-shoot, increase the speed or improve stability. Though these three parameters are in contradiction with each other you can even combine two of these

parameters to improve your process according to the precise needs of your application or customer requirements!

Logging and trending facilities

ThermoTools offers you very sophisticated logging function and data log viewer. ThermoTools allows you to select which parameters need to be logged, for how long, at what rate and within what limits. The data log viewer then allows viewing of the logged data including live updates, zoom and printing facilities. The log files can be exported to CSV format usable in other packages or applications.



Contact your local Omron representative office to discover the full functionality of this advanced software package. You will find the telephone numbers of Omron offices throughout Europe in this folder.

Simple to use, yet advanced Software, for advanced products

The ThermoTools software package offers you the following main functionality:

- Off-line configuration mode with full upload and download capability and on-line monitoring mode for more precise adjustments.
- Sophisticated 'live logging and trending' facility for testing and recording key parameter values.
- File handling to save instrument configurations in several different file formats; a ThermoTools file (for rapid instrument cloning), a spreadsheet or an HTML file.
- Auto-tuning as well as a 'personal fine tuning' facility for optimisation of advanced PID parameters according to your specific process response preferences.
- Remote configuration of multiple Omron controllers and intelligent signal processors when utilising a multi-drop protocol (RS422/RS485) in an easy-to-use windows based package.
- 'Configuration Wizard' providing instrument configuration, suitable for users of all levels.
- Multi-loop support for the E5ZE, E5ZN and E5□R temperature controllers including a 'Replication' function for you to copy parameter values between control points and memory banks.
- Comprehensive help system, including introduction to the Omron control components.

The right software & the right hardware... your IDEAL combination.

Combining ThermoTools software with OMRON controllers and intelligent signal processors enables you not only to easily configure our advanced equipment saving valuable set-up time when installing, configuring or commissioning, it will also help you to store all your important process parameters, copy them to other controllers for multiple applications and to make use of the maximum capabilities of your products.

Technical specifications

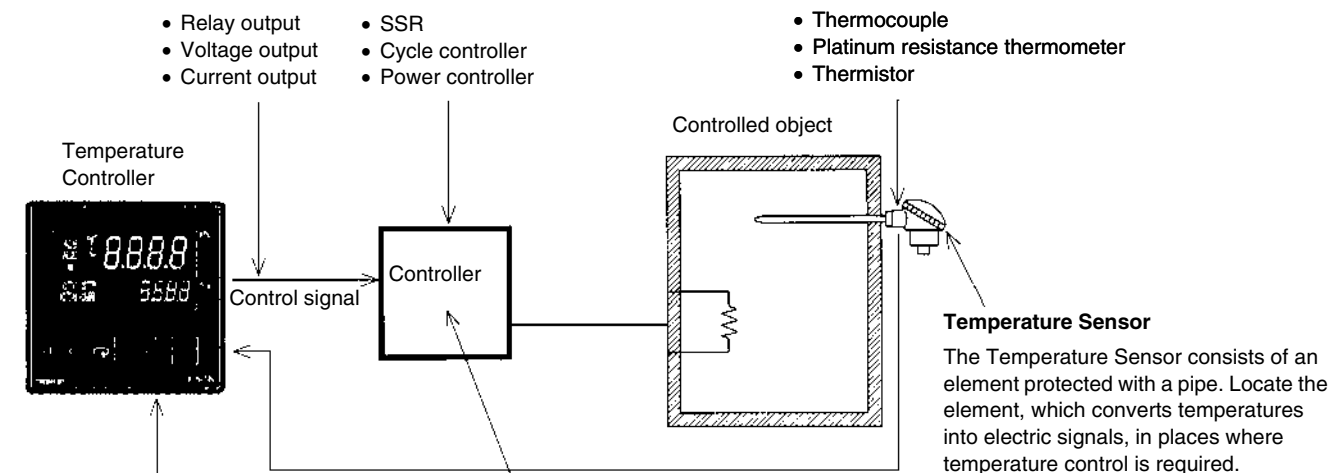
PC requirements

MS Windows. Recommended: Windows2000
 Pentium 133 MHz
 64 MB
 650 MB Space
 CD-ROM Drive
 SVGA (800x600). Recommended: XGA (1024x768), High-color (16bit)
 RS-232C port, COM1 – COM4, (USB port can be used when use K3CS)

Technical Information

Configuration Example of Temperature Control

The following is an example of the configuration of temperature control.



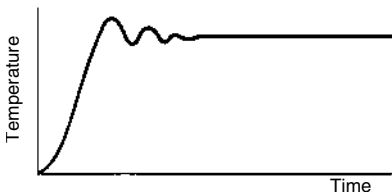
Electronic Temperature Controller
The Electronic Temperature Controller is a product that receives electric signal input from the temperature sensor, compares the electric signal input with the set point, and outputs adjustment signals to the Controller.

Controller
The Controller is used to heat up or cool down furnaces and tubs using a device, such as a solenoid or fuel valve, to switch electric currents supplied to heaters or coolers.

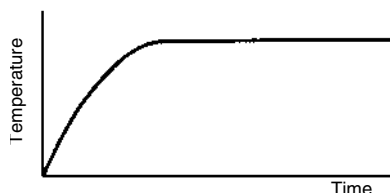
Temperature Control

The set point is input into the Temperature Controller in order to operate the Temperature Controller. The time required for stable temperature control varies with the controlled object. Attempting to shorten the response time will usually result in the overshooting or hunting of temperature. When reduce the overshooting or hunting of temperature, the response time must not be shortened. There are applications that require prompt, stable control in the waveform shown in (1) despite overshooting. There are other applications that require the suppression of overshooting in the waveform shown in (3) despite the long time required to stabilize temperature. In other words, the type of temperature control varies with the application and purpose. The waveform shown in (2) is considered to be a proper one for standard applications.

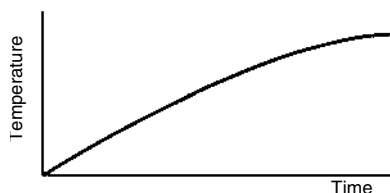
1. The temperature stabilizes after overshooting several times.



2. Proper response



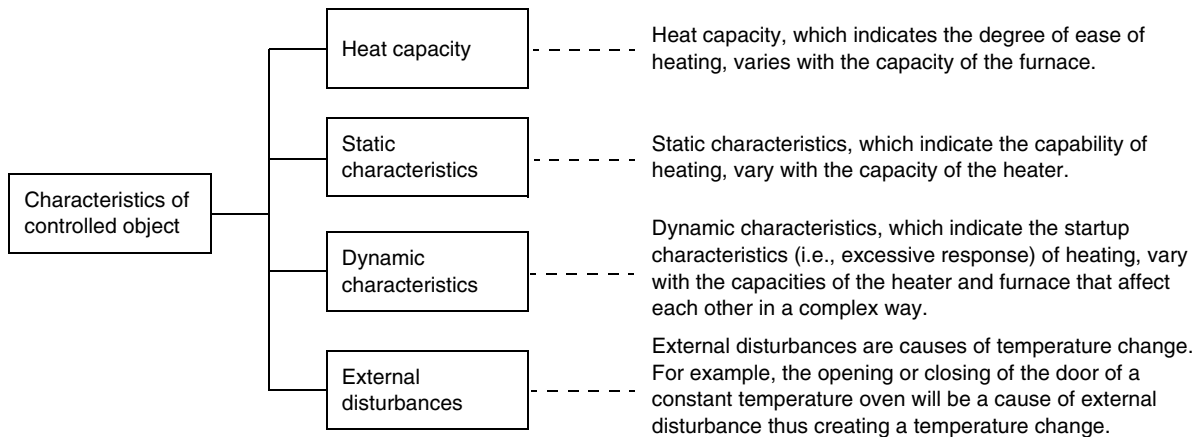
3. The response is slow in reaching the set point.



Temperature Controller

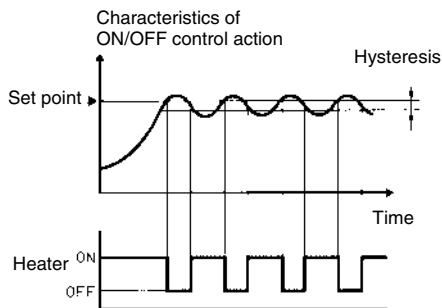
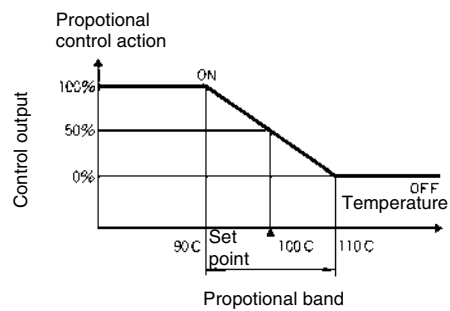
Characteristics of the Controlled Object

Before selecting the Temperature Controller and Temperature Sensor models, it is necessary to understand the thermal characteristics of the controlled object for proper temperature control.



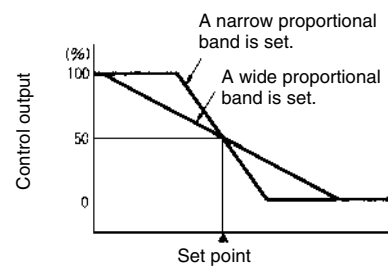
ON/OFF Control Action

As shown in the graph below, if the process value is lower than the set point, the output will be turned ON and power will be supplied to the heater. If the process value is higher than the set point, the output will be turned OFF with power to the heater shut off. This control method is called ON/OFF control action, in which the output is turned ON and OFF on the basis of the set point to keep the temperature constant. In this operation, the temperature is controlled with two values (i.e., 0% and 100% of the set point). Therefore, the operation is also called two-position control action.



Example:

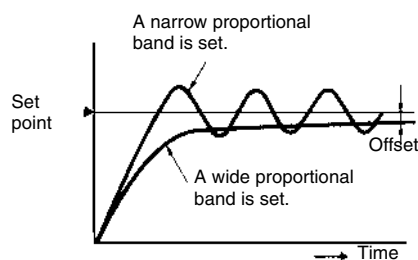
If a Temperature Controller with a temperature range of 0° to 400°C has a 5% proportional band, the width of the proportional band will be converted into a temperature range of 20°C. In this case, provided that the set point is 100°C, a full output is kept turned ON until the process value reaches 90°C, and the output is OFF periodically when the process value exceeds 90°C. When the process value is 100°C, there will be no difference in time between the ON period and the OFF period (i.e., the output is turned ON and OFF with the same interval).



P Action

P action (or proportional control action) is used for obtaining the output in proportion to the input.

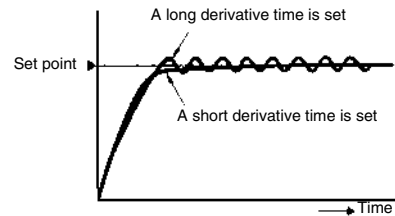
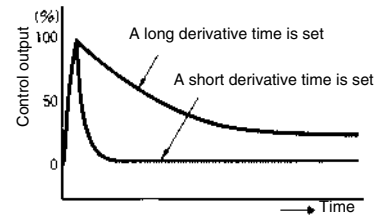
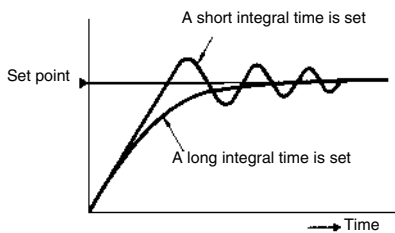
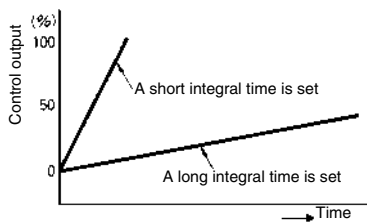
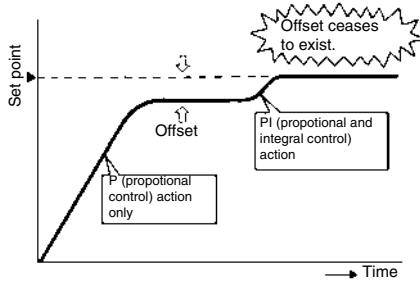
The Temperature Controller in P action has a proportional band with the set point in the proportional band. The control output varies in proportion to the deviation in the proportional band. In normal operation, a 100% control output will be ON if the process value is lower than the proportional band. The control output will be decreased gradually in proportion to the deviation if the process value is within the proportional band, and a 50% control output will be ON if the set point coincides with the process value (i.e., there is no deviation). This means P action ensures smooth control with minimal hunting compared with the ON/OFF control action.



I Action

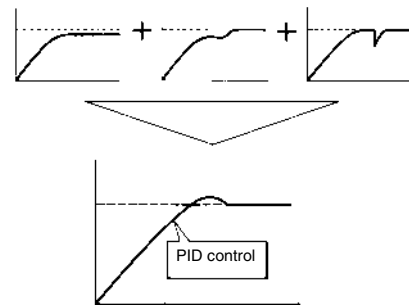
I action (or integral control action) is used for obtaining the output in proportion to the time integral value of the input.

P action causes an offset. Therefore, if proportional control action and integral control action are used in combination, the offset will be reduced as the time goes by until finally the control temperature will coincide with the set point and the offset will cease to exist.



PID Control

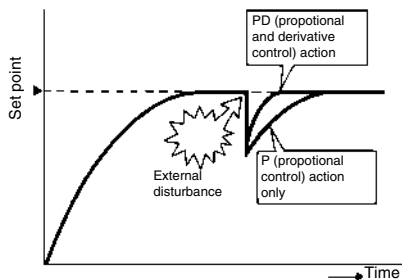
PID control is a combination of proportional, integral, and derivative control actions, in which the temperature is controlled smoothly by proportional control action without hunting, automatic offset adjustment is made by integral control action, and quick response to an external disturbance is made possible by derivative control action.



D Action

D action (or derivative control action) is used for obtaining the output in proportion to the time derivative value of the input.

Proportional control action corrects the result of control and so does integral control action. Therefore, proportional control action and integral control action respond slowly to temperature change, which is why derivative control action is required. Derivative control action corrects the result of control by adding the control output in proportion to the slope of temperature change. A large quantity of control output is added for a radical external disturbance so that the temperature can be quickly in control.

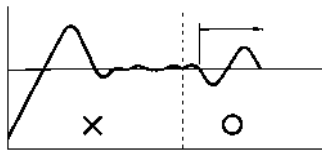


■ 2-PID Control

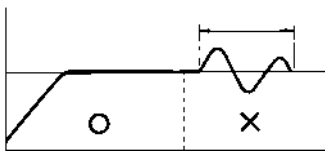
Conventional PID control uses a single control block to control the responses of the Temperature Controller to a target value and external disturbances. Therefore, the response to the target value will oscillate due to overshooting if importance is attached to the response to external disturbances with the P and I parameters set to small values and the D parameter set to a large value in the control block. On the other hand, if importance is attached to the response to the target value (i.e., the P and I parameters are set to large values), the Temperature Controller will not be able to respond to external disturbances quickly. It will be impossible to satisfy both the types of responses in this case.

2-PID control eliminates this weakness while retaining the strengths of PID control, thus making it possible to improve both types of responses.

PID-Control

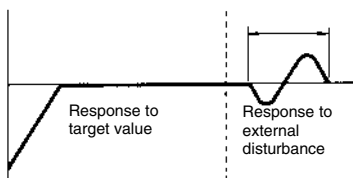


Response to the target value will become slow if response to the external disturbance is improved.



Response to the external disturbance will become slow if response to the target value is improved.

2-PID-Control

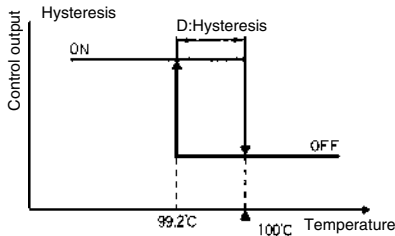


Controls both the target value response and external disturbance response.

Control

Hysteresis

ON/OFF control action turns the output ON or OFF on the basis of the set point. This means the output frequently changes according to minute temperature changes, which shortens the life of the output relay or unfavorably affects some devices connected to the Temperature Controller. Therefore, a margin is prepared between the ON and OFF operations. This margin is called hysteresis.

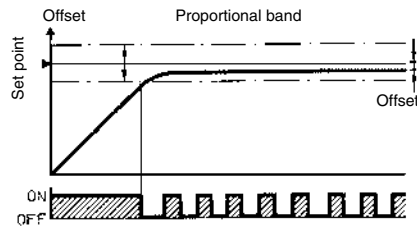


Example:

If the Temperature Controller with a temperature range of 0°C to 400°C has a 0.2% hysteresis, D will be 0.8°C. Therefore if the set point is 100°C, the output will turn OFF at a process value of 100°C and will turn ON at a process value of 99.2°C.

Offset

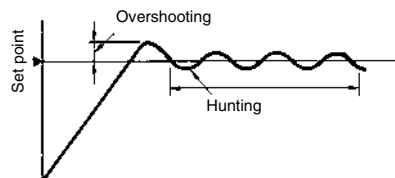
Proportional control action causes an error in the process value due to the heat capacity of the controlled object and the capacity of the heater, which results in a small discrepancy between the process value and set point in stable operation. This error is called offset. Offset may exist above or below the set point.



Hunting and Overshooting

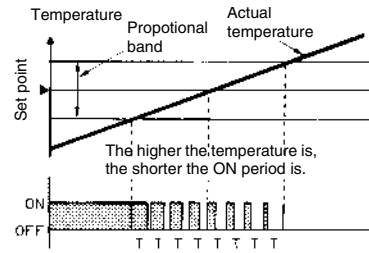
ON/OFF control action often involves the waveform shown in the following graph. A temperature rise in excess of the set point after temperature control starts is called overshooting. Temperature oscillation near the set point is called hunting. Improved temperature control is to be expected if the degrees of overshooting and hunting are low.

Hunting and Overshooting in ON/OFF Control Action



Control Cycle and Time-proportioning Control Action

The control output will be turned ON intermittently according to a preset cycle if P action is used with a relay or SSR. This preset cycle is called control cycle and this control method is called time-proportioning control action.



T: Control cycle

$$\text{Control output} = \frac{T_{ON}}{T_{ON} + T_{OFF}} \times 100 (\%)$$

T_{ON} : ON period

T_{OFF} : OFF period

Example;

If the control cycle is 10 s with an 80% control output, the ON and OFF periods will be the following values.

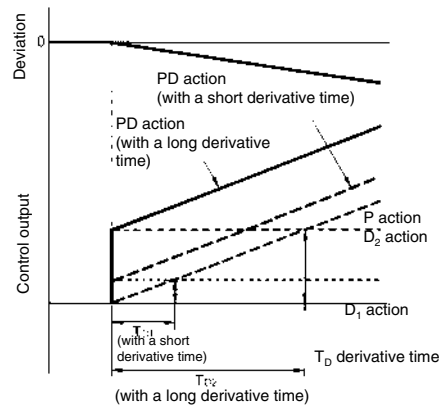
T_{ON} : 8 s

T_{OFF} : 2 s

Derivative Time

Derivative time is the period required for a ramp-type deviation in derivative control (e.g., the deviation shown in the following graph) to coincide with the control output in proportional control action. The longer the derivative time is, the stronger the derivative control action is.

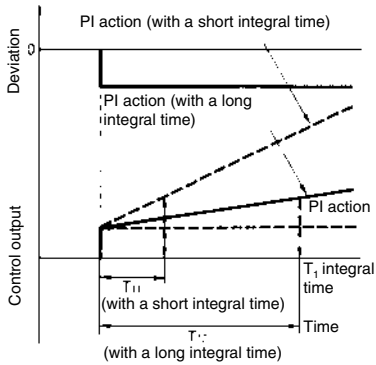
PD Action and Derivative Time



Integral Time

Integral time is the period required for a step-type deviation in integral control (e.g., the deviation shown in the following graph) to coincide with the control output in proportional control action. The shorter the integral time is, the stronger the integral control action is. If the integral time is too short, however, hunting may result.

PI Action and Integral Time

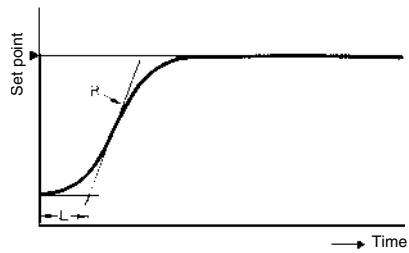


Auto-tuning

PID constants for temperature control vary in value and combination according to the characteristics of the controlled object. There has been a variety of conventional methods suggested and implemented to obtain PID constants from the waveforms of temperatures to be controlled by the Temperature Controller in actual operation. Among them, auto-tuning methods make it possible to obtain PID constants suitable to a variety of objects. Auto-tuning methods include the step response, marginal sensitivity, and limit cycle methods.

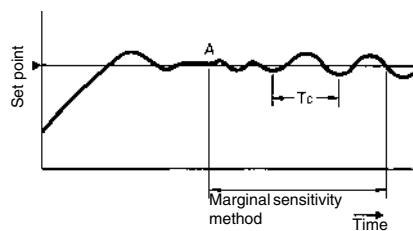
Step Response Method

The value most frequently used must be the set point in this method. Calculate the maximum temperature ramp R and the dead time L from a 100% step-type control output. Then obtain the PID constants from R and L .



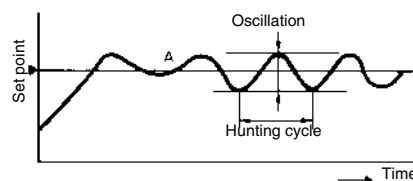
Marginal Sensitivity Method

Proportional control action starts from the start point A in this method. Narrow the width of the proportional band until the temperature starts to oscillate. Then obtain the PID constants from the value of the proportional band and the oscillation cycle T at that time.



Limit Cycle Method

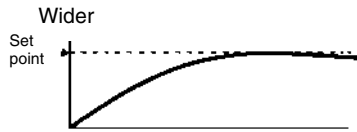
ON/OFF control action starts from the start point A in this method. Then obtain the PID constants from the hunting cycle T and oscillation D .



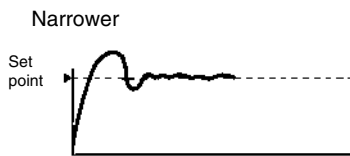
Readjustment of PID Constants

PID constants calculated in auto-tuning operation normally do not cause problems except for some particular applications, in which case, refer to the following to readjust the PID constants.

Response to Change in Proportional Band

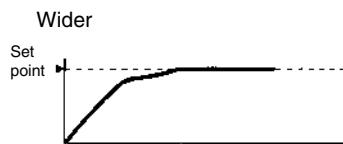


It is possible to suppress overshooting although a comparatively long startup time and set time will be required.

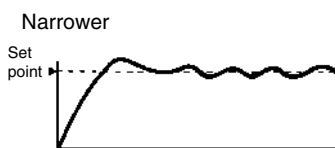


The process value reaches the set point within a comparatively short time and keeps the temperature stable although overshooting and hunting will result until the temperature becomes stable.

Response to Change in Integral Time



It is possible to reduce hunting, overshooting, and undershooting although a comparatively long startup time and set time will be required.

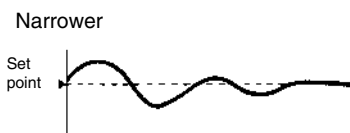


The process temperature reaches the set point within a comparatively short time although overshooting, undershooting, and hunting will result.

Response to Change in Derivative Time



The process value reaches the set point within a comparatively short time with comparatively small amounts of overshooting and undershooting although fine-cycle hunting will result due to the change in process value.

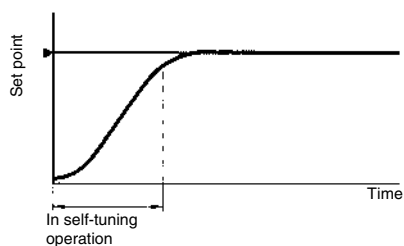


It will take a comparatively long time for the process value to reach the set point with heavy overshooting and undershooting.

Self-tuning Function

(Applicable Model: E5CS)

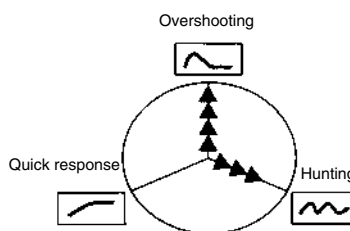
The self-tuning function is incorporated by E5CS Digital Temperature Controller. The function makes it possible to calculate and use an optimum proportional band automatically according to change in the temperature.



Fine-tuning Function

(Applicable Models: ES100X, ES100P)

The fine-tuning function is incorporated by the ES100 Digital Controller. Tuning is a delicate and troublesome job. The fine-tuning function performs fuzzy logic calculations to adjust the PID constants after the degrees of requirements for suppressing overshooting and hunting and improvements in response are set.



PID Control and Tuning Methods

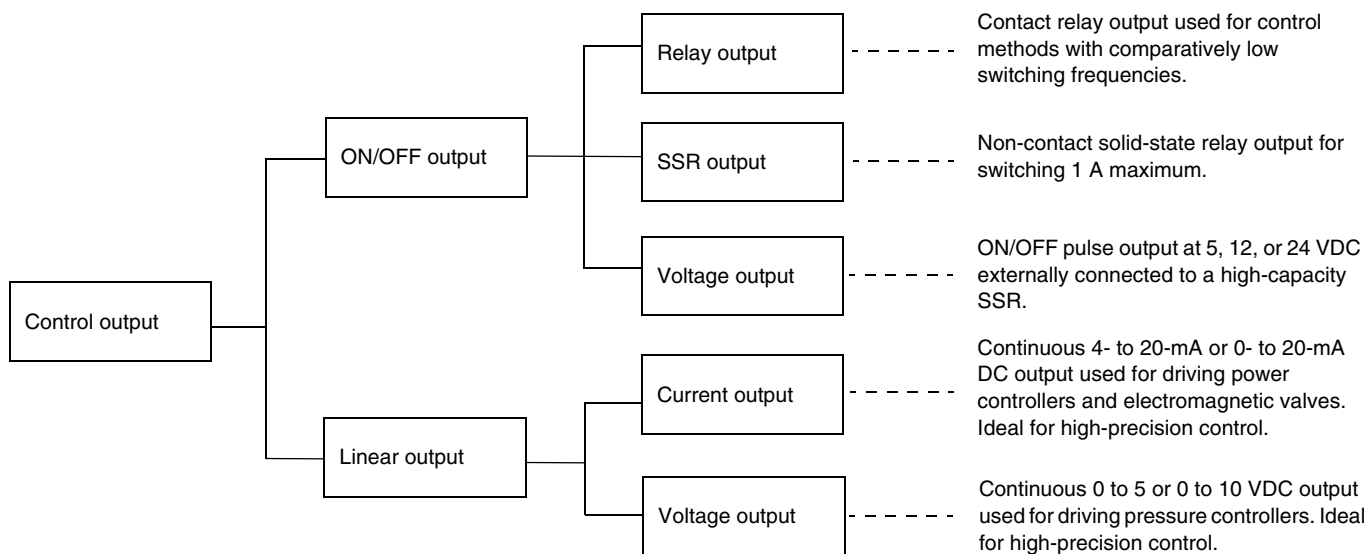
Model	Type of PID control		
	PID	2-PID	PID with fuzzy control
E5□N		AT, ST	
E5□K		AT, ST	
E5CS	ST*		
E5ZD		AT	AT
E5ZE			AT
ES100X			AT, FT
ES100P			AT, FT

Note: ST stands for fuzzy self-tuning function, ST* stands for self-tuning function, FT stands for fine-tuning function, and AT stands for auto-tuning function.

Auto-tuning Method

Type	Tuning method	
	Step response method	Limit cycle method
E5□N	Not built-in	Built-in
E5ZD	Not built-in	Built-in
E5ZE	Not built-in	Built-in
E5□K	Not built-in	Built-in
ES100X/P	Not built-in	Built-in

■ Control Output



Alarm

Alarm

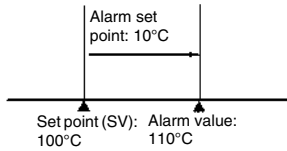
The Temperature Controller compares the process value and the preset alarm value, turns the alarm signal ON, and displays the type of alarm in the preset operation mode.

Deviation Alarm

The deviation alarm turns ON according to the deviation from the set point in the Temperature Controller.

Setting Example

Alarm temperature is set to 110°C.



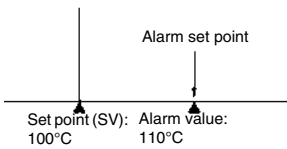
The alarm set point in the above example is set to 10°C.

Absolute-value Alarm

The absolute-value alarm turns ON according to the alarm temperature regardless of the set point in the Temperature Controller.

Setting example

Alarm temperature is set to 110°C.



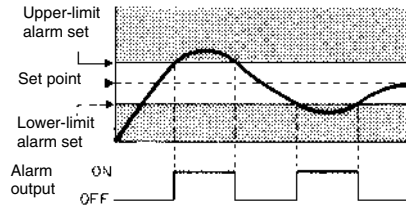
The alarm set point in the above example is set to 110°C.

Standby Sequential Alarm

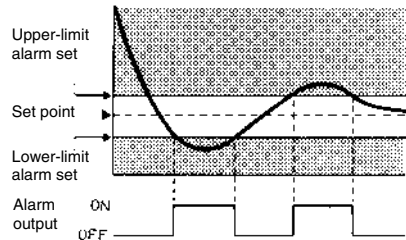
It may be difficult to keep the process value outside the specified alarm range in some cases (e.g., when starting up the Temperature Controller) and as a result the alarm turns ON abruptly. This can be prevented with the standby sequential function of the Temperature Controller. This function makes it possible to ignore the process value right after the Temperature Controller is turned on or right after the Temperature Controller starts temperature control. In this case, the alarm will turn ON if the process value enters the alarm range after the process value has been once stabilized.

Example of Alarm Output with Standby Sequence Set

Temperature Rise

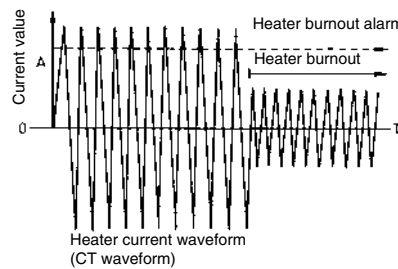


Temperature Drop

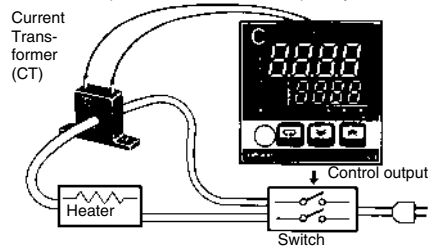


Heater Burnout Alarm (Single-phase Use Only)

Many types of heaters are used to raise the temperature of the controlled object. The CT (Current Transformer) is used by the Temperature Controller to detect the heater current. If power interruption is caused by heater burnout, the Temperature Controller will detect the heater burnout from the CT and will output the heater burnout alarm.



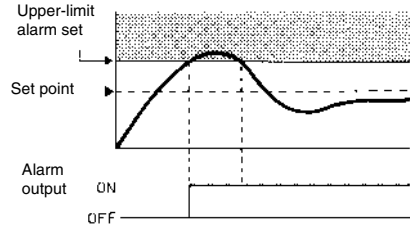
The wires connected to the Temperature Controller has no polarity



Latch Alarm

Applicable Models: E5□N

An alarm will usually turn OFF if the process value is not within the specified alarm range. The latch alarm function makes it possible to keep the alarm output turned ON once the alarm is triggered.



LBA

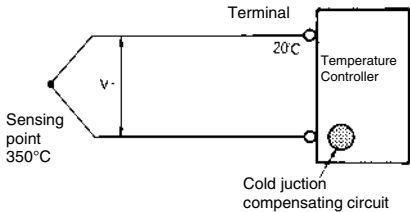
Applicable Models: E5□K

The LBA (loop burnout alarm) is a function to turn the alarm signal ON by assuming the occurrence of control loop failure if there is no input change with the control output set to the highest or lowest value. Therefore, this function can be used to detect control loop errors.

Temperature Sensor

Cold Junction Compensating Circuit

The thermocouple generates a thermo-electromotive force according to the difference in temperature between the hot junction and cold junction. The temperature sensor data will change if there is any change in the temperature of the cold junction regardless of whether there is any change in the temperature of the hot junction. Therefore, another temperature sensor is employed to detect the temperature of the cold junction connected to the thermocouple and make an electrical compensation so that the temperature of the cold junction will be always 0°C. This compensation is called cold junction compensation.



The thermo-electromotive force V_T is calculated from the following formula: $V_T = K (350 - 20)$

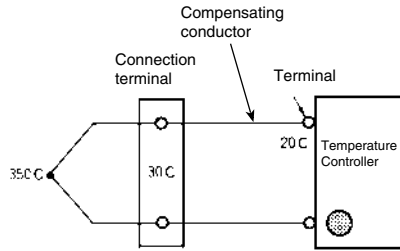
Condition:
 The terminal temperature is 20°C.
 $V_T = K (350 - 20) + K \cdot 20 = K \cdot 350$

↑
 Thermo-electromotive force of thermocouple

↑
 Thermo-electromotive force generated by cold junction compensating circuit

Compensating Conductor

An actual application has a sensing point that may be located far away from the Temperature Controller. Special-conductor thermocouples are expensive. Therefore, the compensating conductor is connected to the thermocouple in such a case. The compensating conductor must be in conformity with the characteristics of the thermocouple, otherwise precise temperature sensing will not be possible.



Example of Compensating Conductor Use

$$K (350 - 30) + K (30 - 20) + K \cdot 20 + K \cdot 350$$

↑
 Thermo-electromotive force of thermocouple

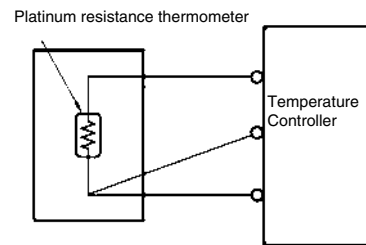
↑
 Thermo-electromotive force generated by cold junction compensating circuit

↑
 Thermo-electromotive force through compensating conductor

Three-wire Resistance Thermometer

The three-wire platinum resistance thermometer is used by OMRON's Temperature Controller. One of the resistance conductors of the three-wire resistance thermometer is connected to two wires and the other resistance conductor is connected to another wire, the wiring of which eliminates the influence of the resistance of the extended lead wires.

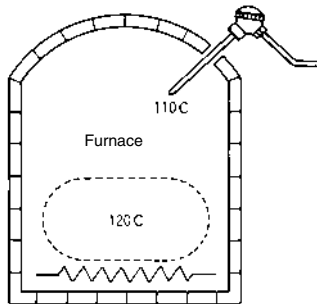
Connection of Three-wire Platinum Resistance Thermometer



Temperature Controller

Input Compensation

A preset point is added to or subtracted from the temperature detected by the temperature sensor of the Temperature Controller to display the process value. The difference between the detected temperature and displayed temperature is set as an input compensation value.



Input compensation value: 10°C
 (Displayed value is 120°C)
 (120 - 110 = 10)

Platinum Resistance Thermometer

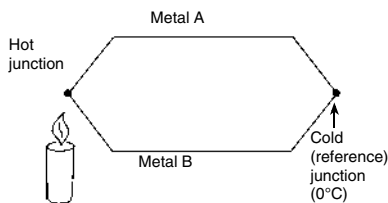
The resistance of a metal will increase if the temperature of the metal increases. This is especially true if the metal is platinum. The platinum resistance thermometer makes use of the nature of platinum (e.g., its resistance increases with the temperature rise) by incorporating a fine platinum wire wound around a mica or ceramic plate.

Thermocouple

A thermocouple consists of two different metal wires with the ends connected together. If the two contacts are different in temperature, the thermocouple will generate a voltage called thermo-electromotive force. The power of thermo-electromotive force depends on the metals. The temperature sensor making use of this voltage as input to the Temperature Controller is called a thermocouple.

Hot Junction and Cold Junction

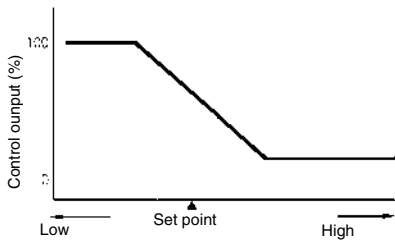
A thermocouple has hot junction and cold junction. The hot junction is for temperature sensing and the cold junction is connected to the Temperature Controller.



Output

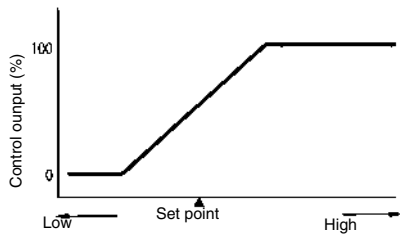
Reverse Operation

The Temperature Controller in reverse operation will increase control output if the process value is lower than the set point (i.e., if the Temperature Controller has a negative deviation).



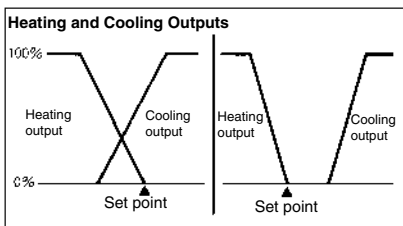
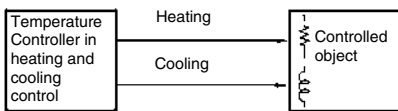
Normal Operation

The Temperature Controller in normal operation will increase control output if the process value is higher than the set point (i.e., if the Temperature Controller has a positive deviation).



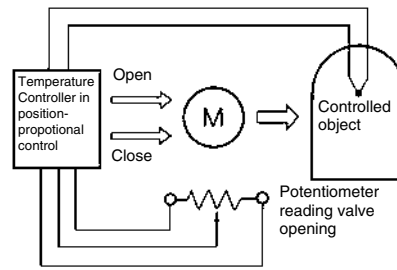
Heating and Cooling Control

The controlled object may be in heating and cooling control if the temperature control of the controlled object is difficult with heating alone. A single Temperature Controller has heating control output and cooling control output.



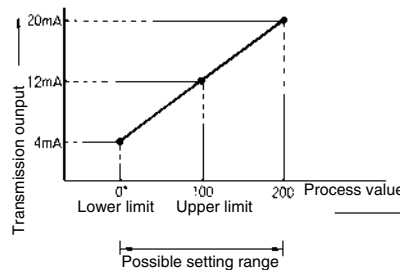
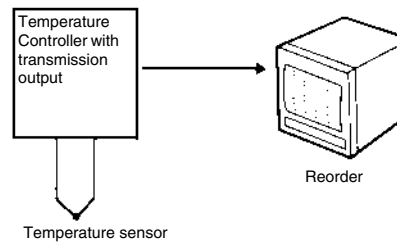
Position-proportioning Control

This control is also called ON/OFF servo control. If a valve with a control motor is applied to temperature control with the Temperature Controller and a potentiometer, the Temperature Controller will read the valve opening from the potentiometer and will turn the open and close signals ON along with control output for temperature control.



Transmission Output

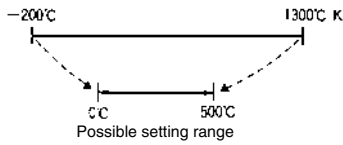
The Temperature Controller with current output independent from control output is available. The process value or set point within the available temperature range of the Temperature Controller is converted into 4- to 20-mA linear output that can be input into recorders to keep the results of temperature control on record. The upper and lower limits can be set for transmission output in the E5CK-jF. Therefore, the transmission output between the upper and lower limits will be turned ON if the E5CK-jF is used.



Setting

Set Limit

The set point range depends on the temperature sensor and the set limit is used to restrict the set point range. This restriction affects the transmission output of the Temperature Controller.



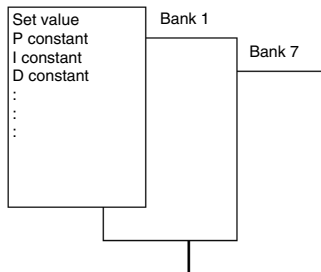
Multiple Set Points

Two or more set points independent from each other can be set in the Temperature Controller in control operation.

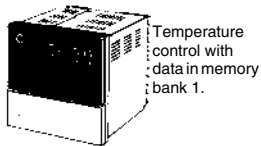
8 Banks

The Temperature Controller stores a maximum of eight groups of data (e.g., set value and PID constant data) in built-in memory banks for temperature control. The Temperature Controller selects one of these banks in actual control operation.

Memory Bank 0



Bank 1 is selected.



SP Ramp

The SP ramp function controls the target value change rate with the variation factor. Therefore, when the SP ramp function is enabled, some range of the target value will be controlled if the change rate exceeds the variation factor as shown below.

