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	**J (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), 100 to 200 (2) (550 Ω at 200°C), 150 to 300 (2) (4 kΩ at 200°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)	---

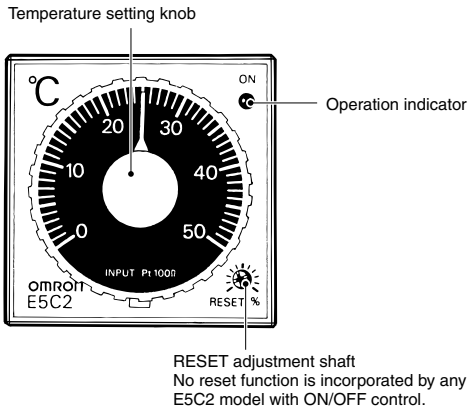
Note: 1. Values in ( ) are the minimum unit.
2. Values in ( ) are the thermistor resistive value.

■ 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

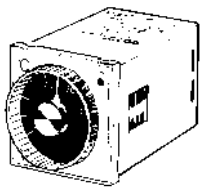


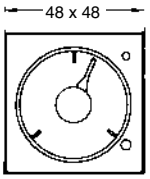
Operation Indicator

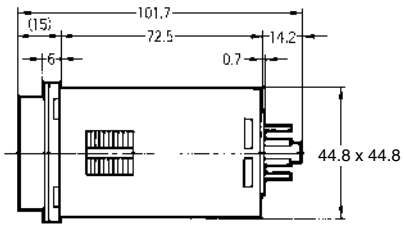
Indicator		Output
Red	Lit	ON
	Not lit	OFF

Dimensions

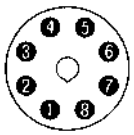
Note: All units are in millimeters unless otherwise indicated.



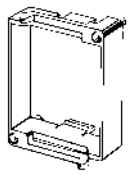


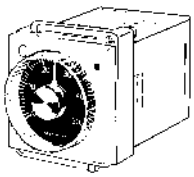


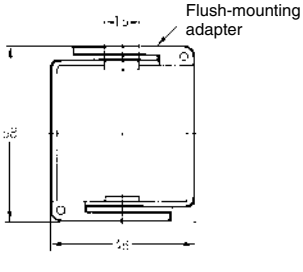
Terminal Arrangement (Bottom View)

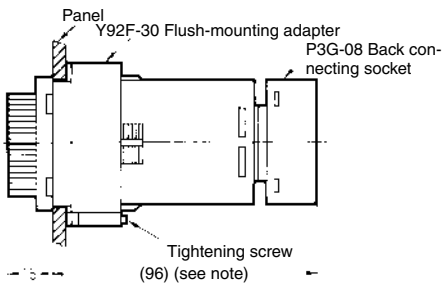


Dimensions with Flush-mounting Adapter (Accessory), and Back Connecting Socket (Sold Separately)



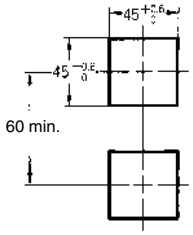




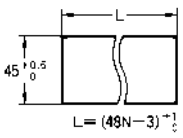


Note: 109 mm for US08 Back Connecting Socket

Panel Cutout



Side-by-side Mounting of N Controllers

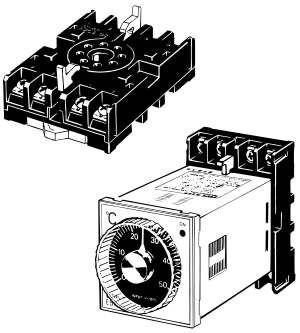


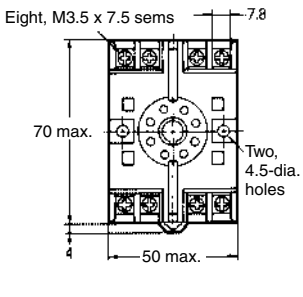
N	2	3	4	5	6
L	93^{+1}_{0}	141^{+1}_{0}	189^{+1}_{0}	237^{+1}_{0}	285^{+1}_{0}

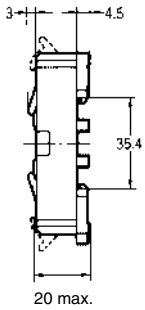
Note: 1. Recommended panel thickness is 1 to 4 mm.
2. Close side-by-side mounting is possible (in a single direction).

Accessories (Order Separately)

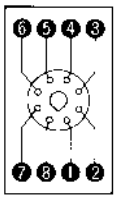
P2CF-08 Front Connecting Socket



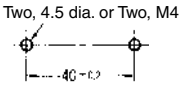




Terminal Arrangement/ Internal Connections (Top View)



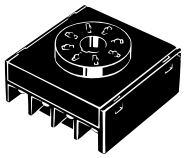
Mounting Holes

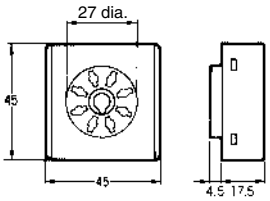


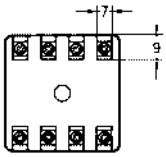
Note: Can also be mounted to a DIN track.

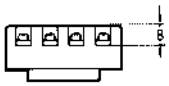
Note: A finger-protection model (P2CF-08-E) is also available.

P3G-08 Back Connecting Socket (for Flush Mounting)

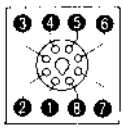








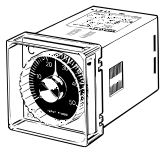
Terminal Arrangement/ Internal Connections (Bottom View)



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.

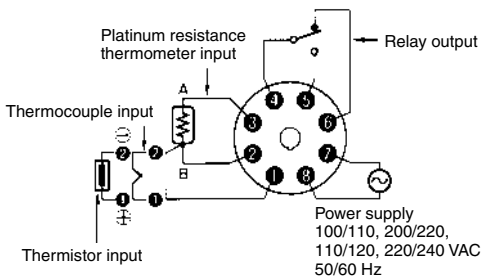
Appearance	
Model	Y92A-48B

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.

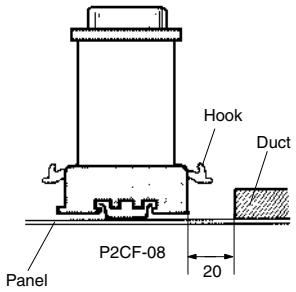
The E5C2 operates at either 50 or 60 Hz.

Precautions

Mounting

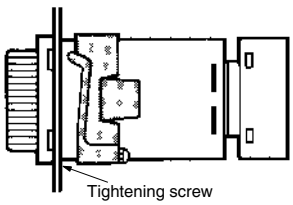
Track Mounting (E5C2 with P2CF-08)

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.

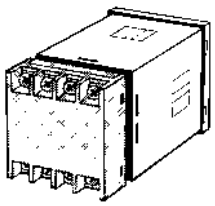


Flush Mounting

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.

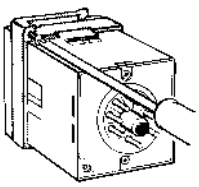


The P3G-08 can be wired in the same way as the P2CF-08.



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 benzine, 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

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
			Current	No	E5AN-C3MTC-500	E5AN-C3MP-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.
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

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

	Platinum resistance thermometer input				
Input type	Platinum resistance thermometer				
Name	Pt100			JPt100	
Temperature range	850 / −200	500.0 / −199.9	100.0 / 0.0	500.0 / −199.9	100.0 / 0.0
Set value	0	1	2	3	4

	Thermocouple input																		
Input type	Thermocouple														ES1A Infrared Temperature Sensor				Analog input
Name	K		J		T		E	L	U		N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 165°C	K160 to 260°C	0 to 50 mV
Temperature range	1300 / −200	500.0 / −20.0	850 / −100	400.0 / −20.0	400 / −200	400.0 / −199.9	600 / 0	850 / −100	400 / −200	400.0 / −199.9	1300 / −200	1700 / 0	1700 / 0	1800 / 100	70 / 0	120 / 0	165 / 0	260 / 0	Usable in the following ranges by scaling: −1999 to 9999 or −199.9 to 999.9
Set value	0	1	2	3	4	17	5	6	7	18	8	9	10	11	12	13	14	15	16

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. 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)

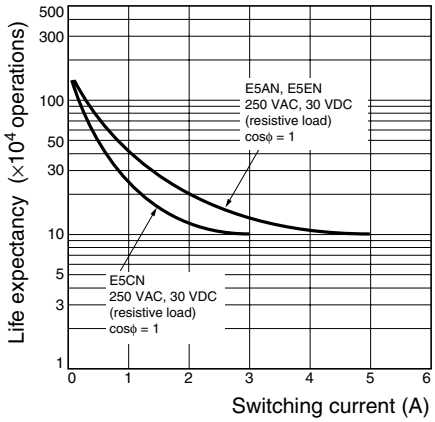
Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

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

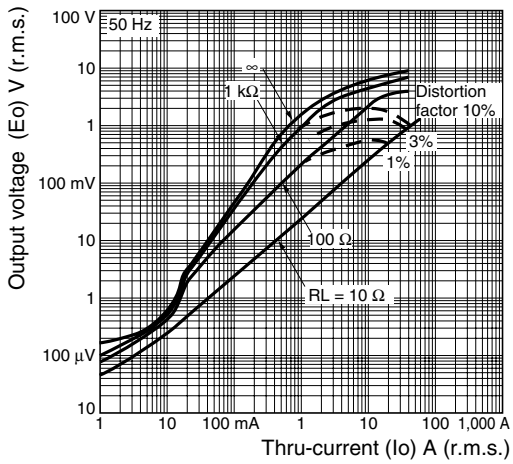
Electrical Life Expectancy Curve for Relays (Reference Values)



E54-CT1

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

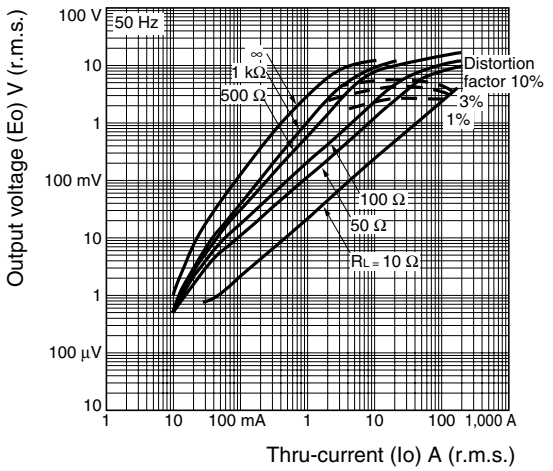
Maximum continuous heater current: 50 A (50/60 Hz)
Number of windings: 400±2
Winding resistance: 18±2 Ω



E54-CT3

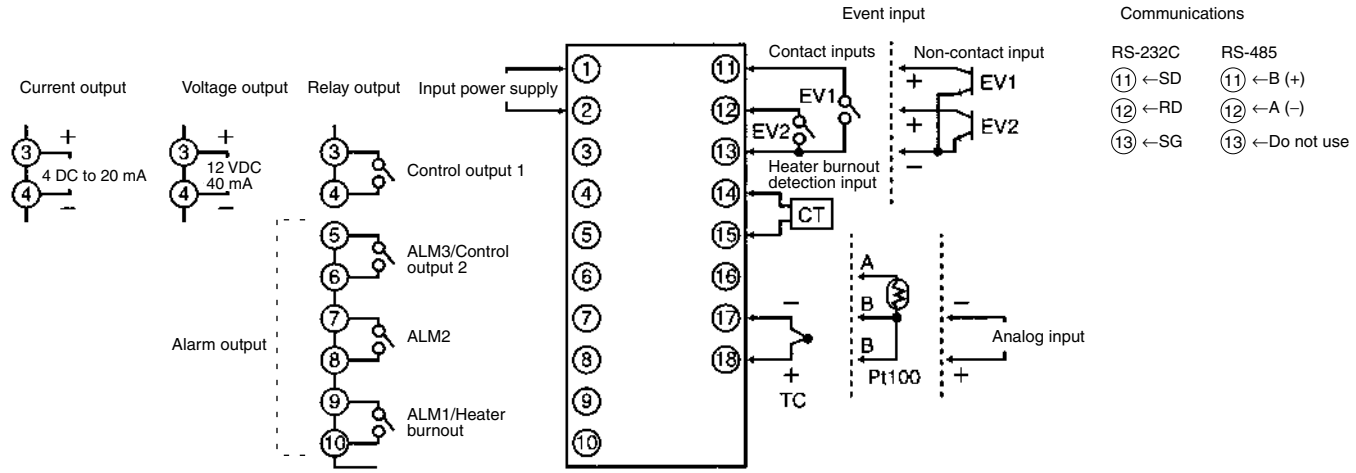
Thru-current (Io) vs. Output Voltage (Eo) (Reference Values)

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



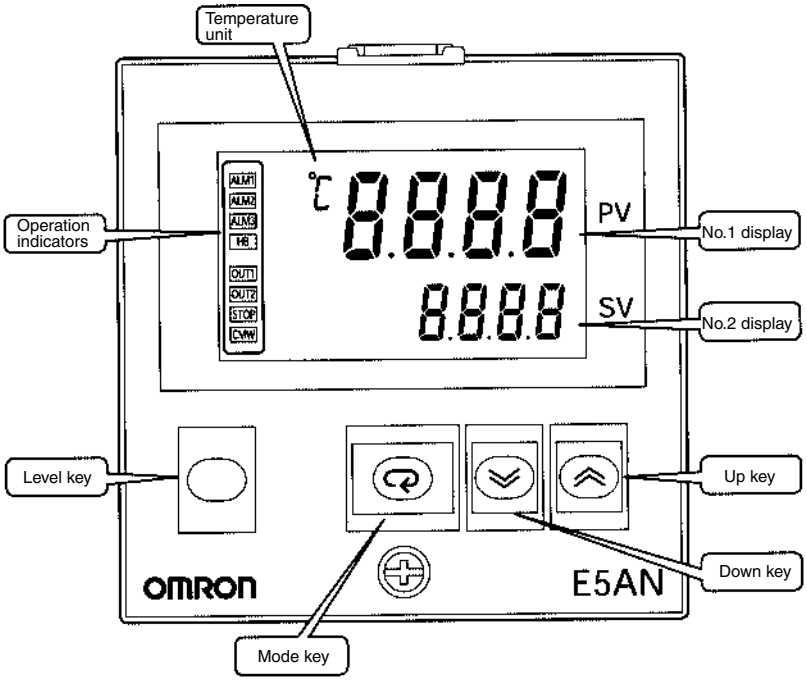
Wiring Terminals

- 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.



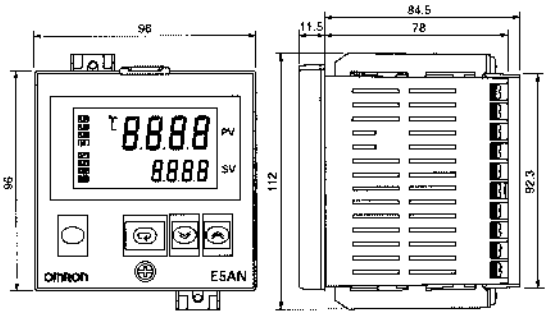
Note: Two input power supplies are available: 100 to 240 VAC or 24 VDC.

Nomenclature



Dimensions

Note: All units are in millimeters unless otherwise indicated.

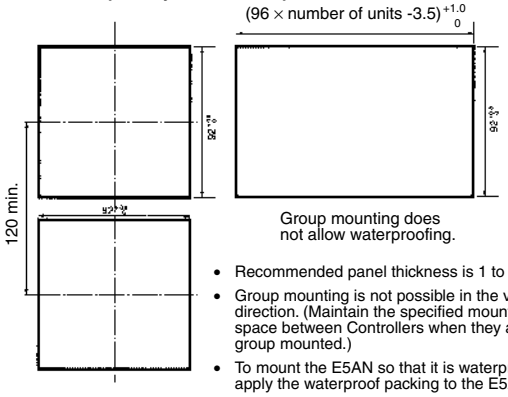


Panel Cutouts

Mounted Separately

Group Mounted

$(96 \times \text{number of units} - 3.5)^{+1.0}_{0}$

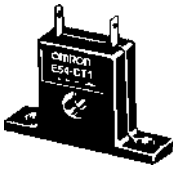


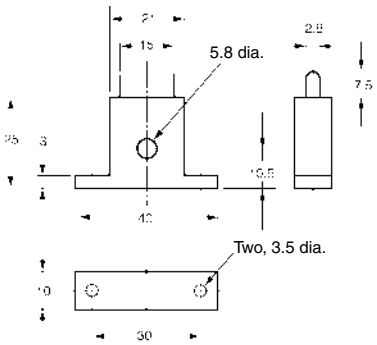
Group mounting does not allow waterproofing.

- 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 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.

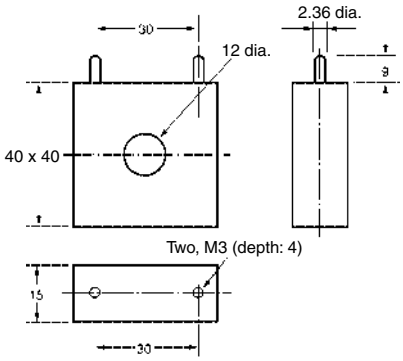
Current Transformer (Sold Separately)

E54-CT1



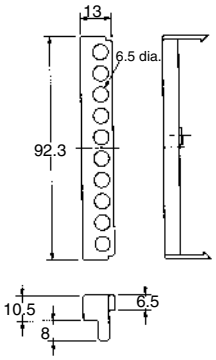


E54-CT3



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
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
			Current	No	E5EN-C3MTC-500	E5EN-C3MP-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.

■ 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

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

	Platinum resistance thermometer input				
Input type	Platinum resistance thermometer				
Name	Pt100			JPt100	
Temperature range	850 / −200	500.0 / −199.9	100.0 / 0.0	500.0 / −199.9	100.0 / 0.0
Set value	0	1	2	3	4

	Thermocouple input																		
Input type	Thermocouple													ES1A Infrared Temperature Sensor				Analog input	
Name	K		J		T		E	L	U		N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 165°C	K160 to 260°C	0 to 50 mV
Temperature range	1300 / −200	500.0 / −20.0	850 / −100	400.0 / −20.0	400 / −200	400.0 / −199.9	600 / 0	850 / −100	400 / −200	400.0 / −199.9	1300 / −200	1700 / 0	1700 / 0	1800 / 100	70 / 0	120 / 0	165 / 0	260 / 0	Usable in the following ranges by scaling: −1999 to 9999 or −199.9 to 999.9
Set value	0	1	2	3	4	17	5	6	7	18	8	9	10	11	12	13	14	15	16

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. 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)

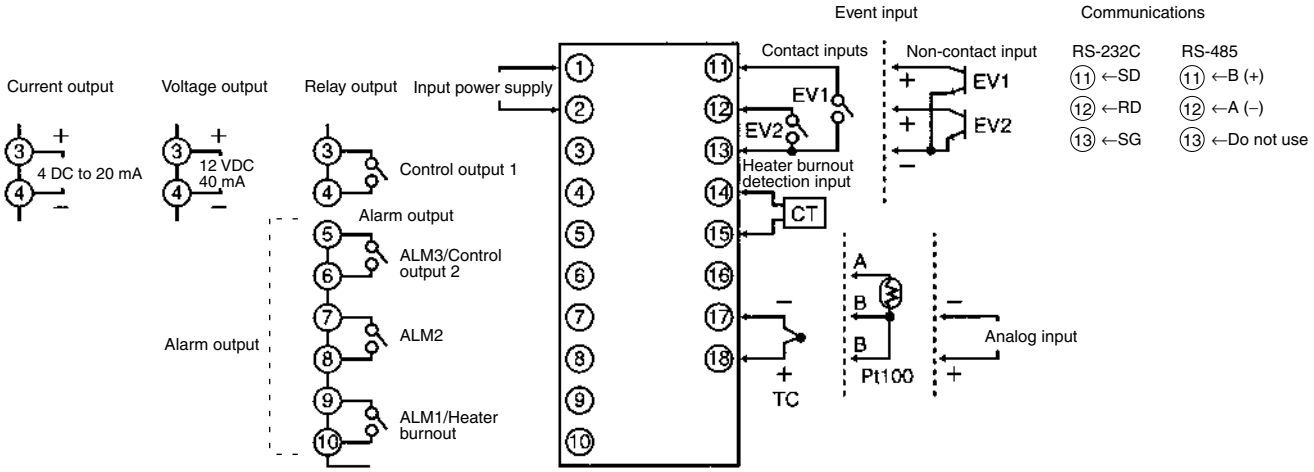
Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

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.

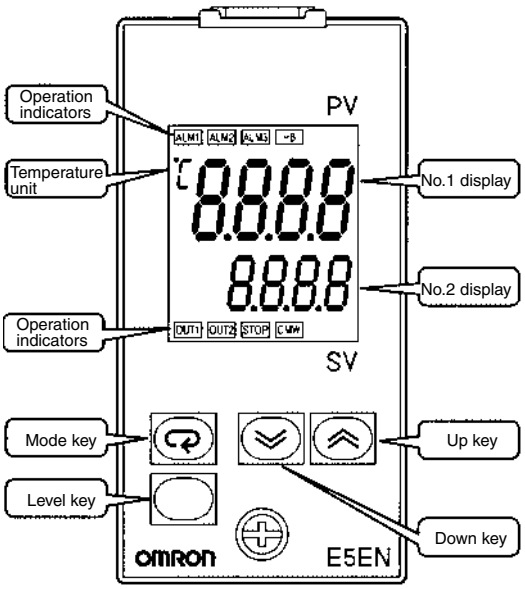
Wiring Terminals

- 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.



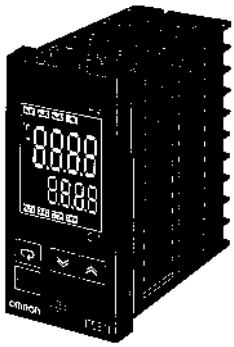
Note: Two input power supplies are available: 100 to 240 VAC or 24 VDC.

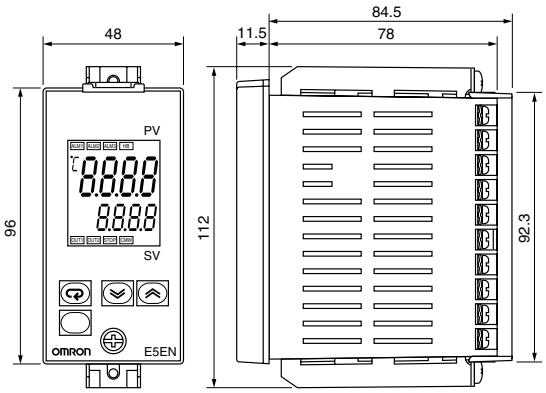
Nomenclature



Dimensions

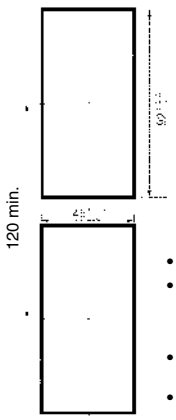
Note: All units are in millimeters unless otherwise indicated.





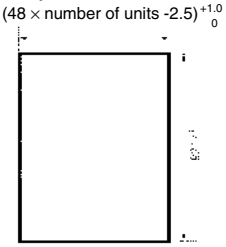
Panel Cutouts

Mounted Separately



Group Mounted

$(48 \times \text{number of units} - 2.5)^{+1.0}_{0}$

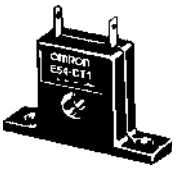


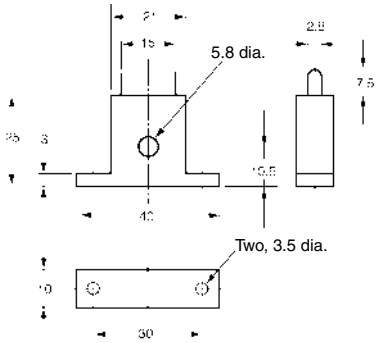
Group mounting does not allow waterproofing.

- 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.

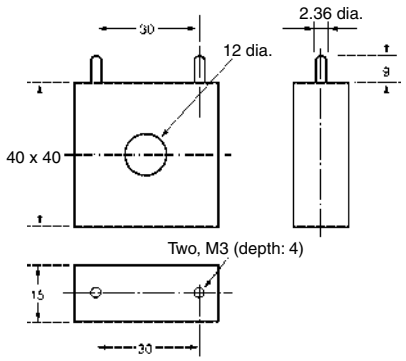
Current Transformer (Sold Separately)

E54-CT1



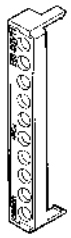


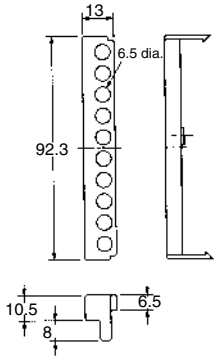
E54-CT3



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
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.

■ 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

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

	Platinum resistance thermometer input				
Input type	Platinum resistance thermometer				
Name	Pt100			JPt100	
Temperature range	1800 to −200	500.0 to −199.9	100.0 to 0.0	500.0 to −199.9	100.0 to 0.0
Set value	0	1	2	3	4

	Thermocouple input																	
Input type	Thermocouple														ES1A Infrared Temperature Sensor				Analog input
Name	K		J		T		E	L	U		N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 165°C	K160 to 260°C	0 to 50 mV
Temperature range	1800 to −200	1300 to −200	500.0 to −20.0	850 to −100	400.0 to −20.0	400 to −200	400.0 to −199.9	600 to 0	850 to −100	400 to −200	400.0 to −199.9	1300 to −200	1700 to 0	1700 to 0	1800 to 100	70 to 0	120 to 0	165 to 0	260 to 0	Usable in the following ranges by scaling: −1999 to 9999 or −199.9 to 999.9
Set value	0	1	2	3	4	17	5	6	7	18	8	9	10	11	12	13	14	15	16

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)

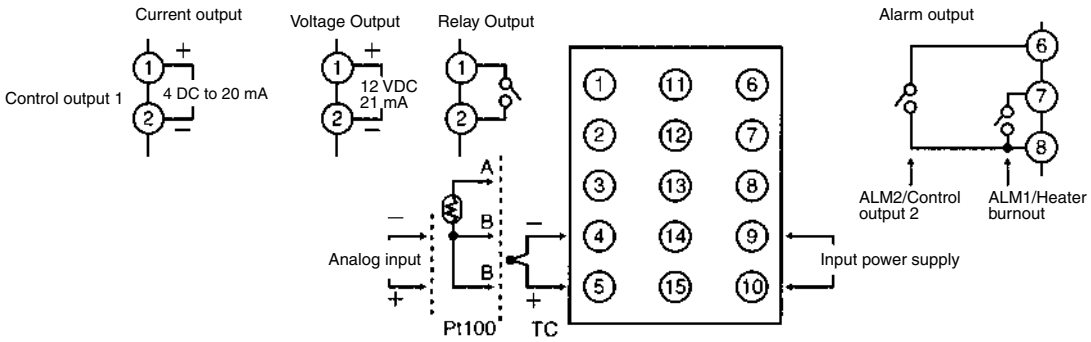
Note 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

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.

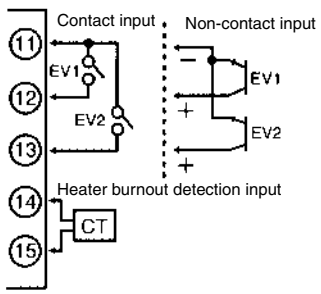


Two input power supplies are available: 100 to 240 VAC or 24 VDC.

■ Option Units

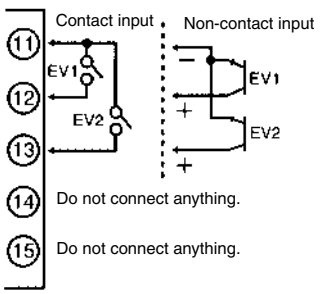
E53-CNHB Event Input/Heater Burnout Alarm Unit

Event Input/Heater Burnout Detection



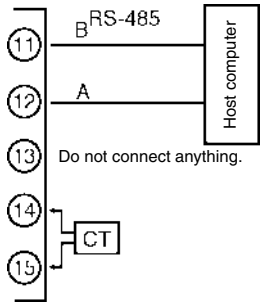
E53-CNB Event Input

Event Input



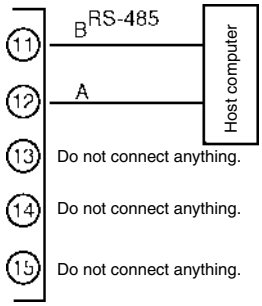
E53-CNH03 Communications/Heater Burnout Alarm Unit

Communications Specification/Heater Burnout Specification

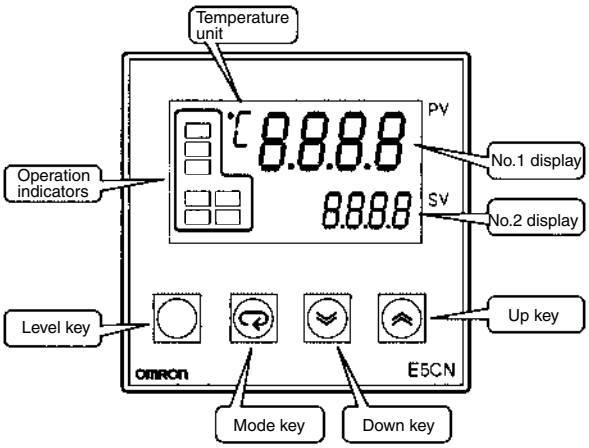


E53-CN03 Communications Unit

Communications Specification

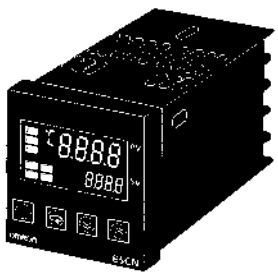


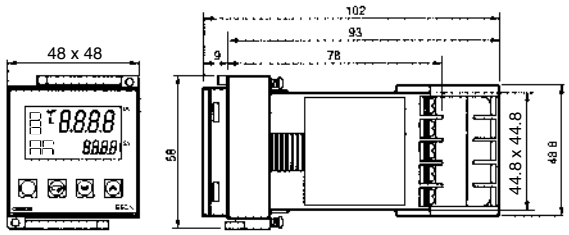
Nomenclature



Dimensions

Note: All units are in millimeters unless otherwise indicated.





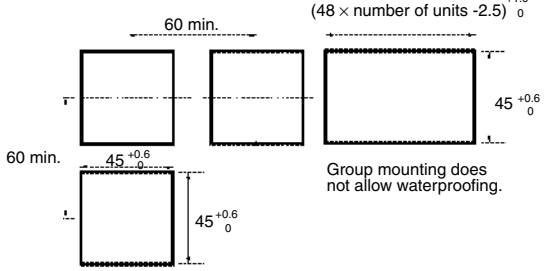
Note: The suffix "500" is added to the model number of each Controller provided with a E53-COV10 Terminal Cover.

Panel Cutouts

Mounted Separately

Group Mounted

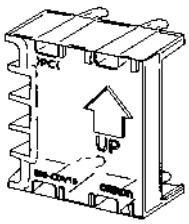
$(48 \times \text{number of units} - 2.5)^{+1.0}_{0}$

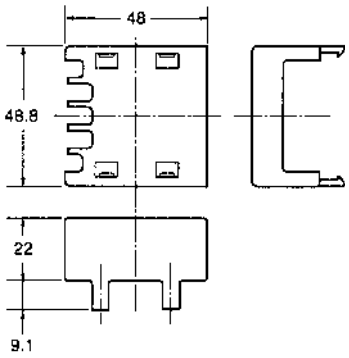


- Recommended panel thickness is 1 to 5 mm.
- Group mounting is not possible in the vertical direction. (Maintain the specified mounting space between Controllers when they are group mounted.)
- To mount the E5CN so that it is waterproof, apply the waterproof packing to the E5CN.
- When two or more E5CNs are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

Terminal Cover

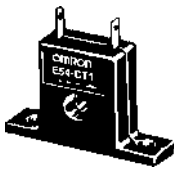
E53-COV10

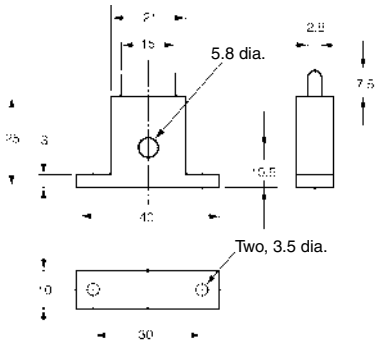




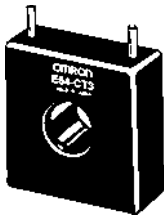
Current Transformer (Sold Separately)

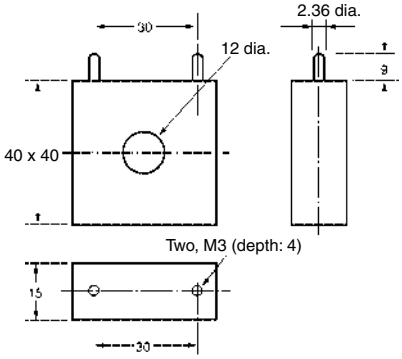
E54-CT1





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
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
			Voltage (for driving SSR)	E5GN-Q1TC	E5GN-Q1P
	24 VAC/VDC	---	Relay	E5GN-RTC	E5GN-RP
			Voltage (for driving SSR)	E5GN-QTC	E5GN-QP
		1 (see note 1)	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.

■ 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

	Platinum resistance thermometer input				
Input type	Platinum resistance thermometer				
Name	Pt100			JPt100	
Temperature range	1800 to −200				
	850 to −200	500.0 to −199.9	100.0 to 0.0	500.0 to −199.9	100.0 to 0.0
Set value	0	1	2	3	4

	Thermocouple input																		
Input type	Thermocouple														ES1A Infrared Temperature Sensor				Analog input
Name	K		J		T		E	L	U		N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 165°5C	K160 to 260°C	0 to 50 mV
Temperature range	1800 to −200																		Usable in the following ranges by scaling: −1999 to 9999 or −199.9 to 999.9
	1300 to −200	500.0 to −20.0	850 to −100	400.0 to −20.0	400 to −200	400.0 to −199.9	600 to 0	850 to −100	400 to −200	400.0 to −199.9	1300 to −200	1700 to 0	1700 to 0	1800 to 100	70 to 0	120 to 0	165 to 0	260 to 0	
Set value	0	1	2	3	4	17	5	6	7	18	8	9	10	11	12	13	14	15	16

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.

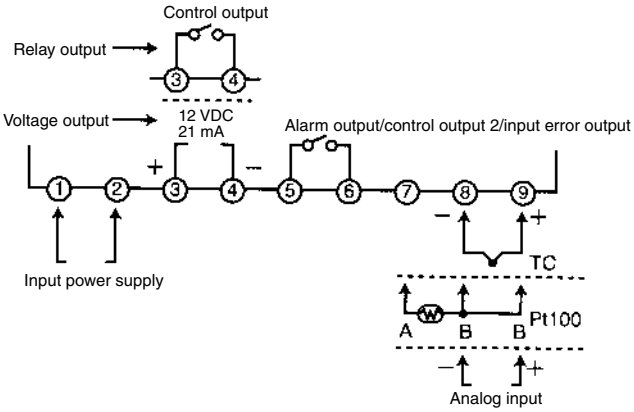
■ Communications Specifications

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.

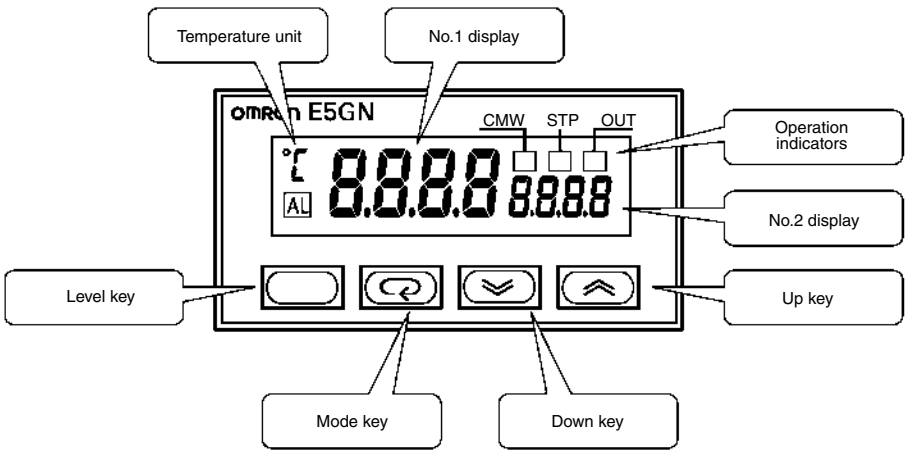
Wiring Terminals

- 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.



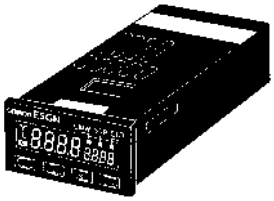
Two input power supplies are available:
100 to 240 VAC or 24 VAC/VDC (no polarity).

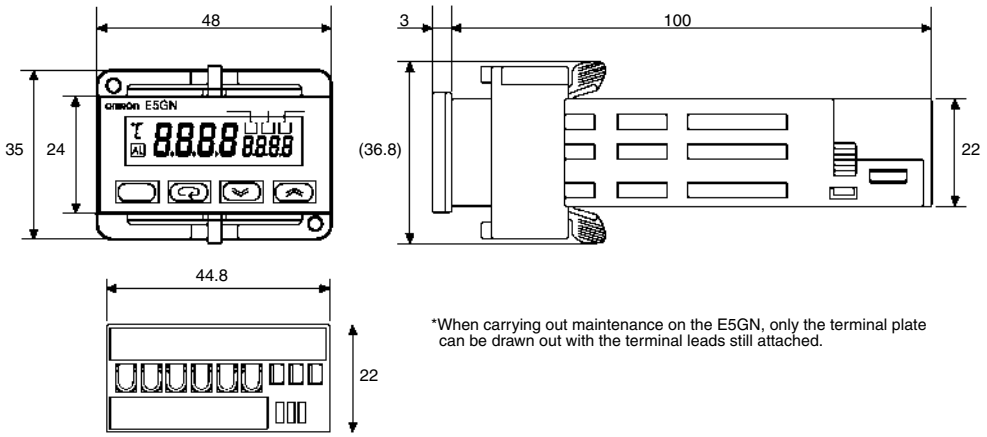
Nomenclature



Dimensions

Note: All units are in millimeters unless otherwise indicated.

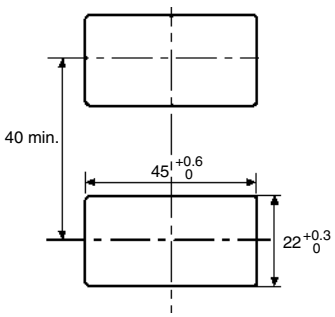




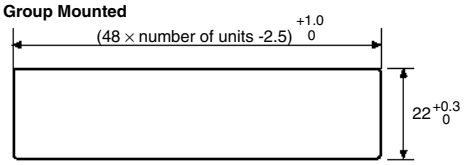
*When carrying out maintenance on the E5GN, only the terminal plate can be drawn out with the terminal leads still attached.

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.

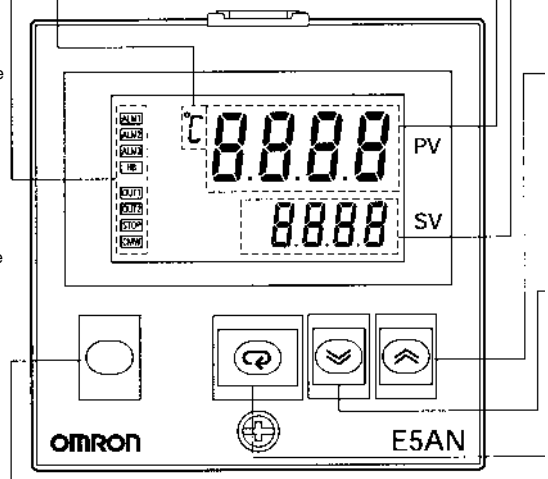
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Nomenclature

E5AN

Operation Indicators

1. 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.
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. 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.
4. 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.
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.

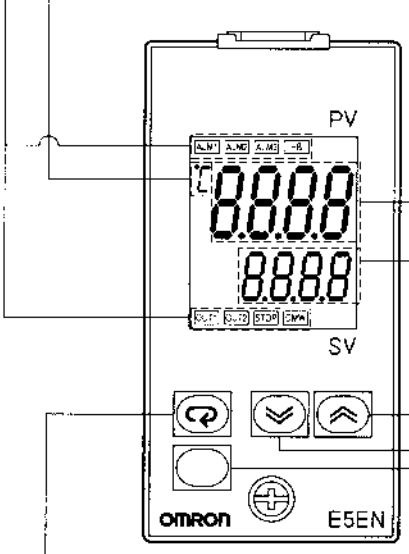
Level + Mode Keys
This key combination sets the E5AN to the "protect level."

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

1. 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.
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. 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.
4. 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.
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.

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.

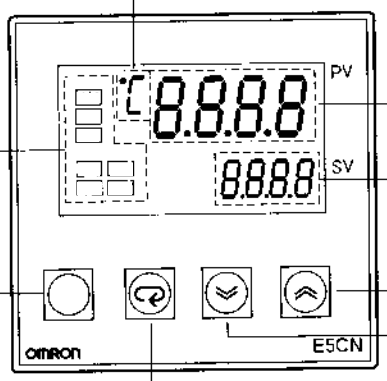
E5CN

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."

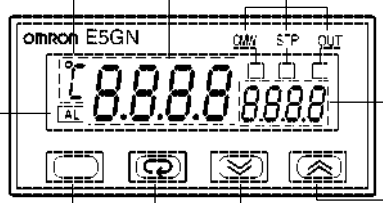
E5GN

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.

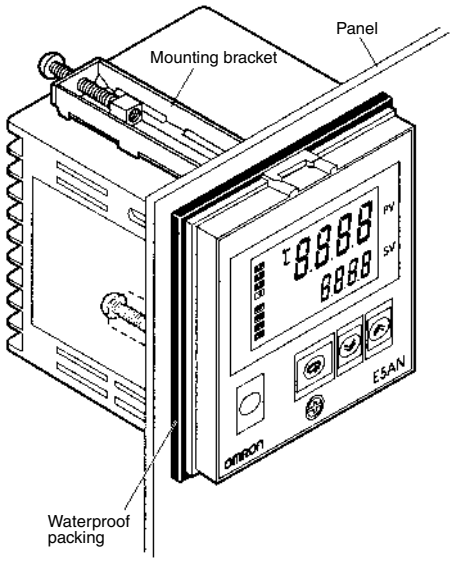
Installation

■ E5AN/E5EN

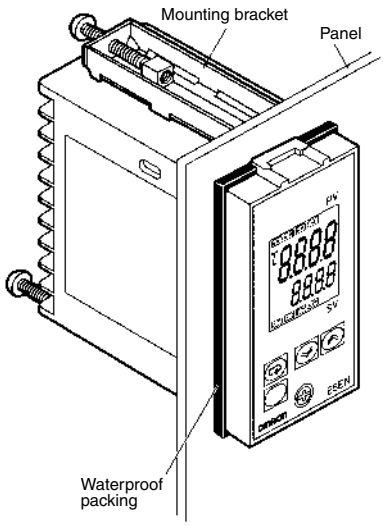
Mounting

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



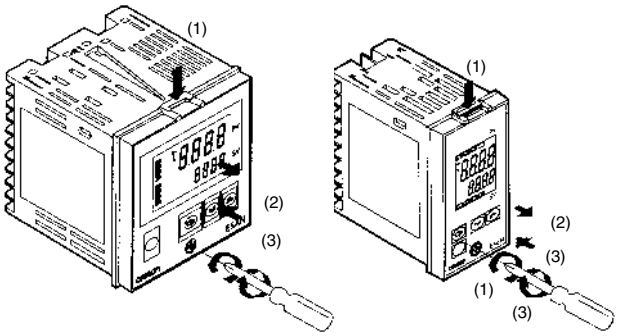
E5EN



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

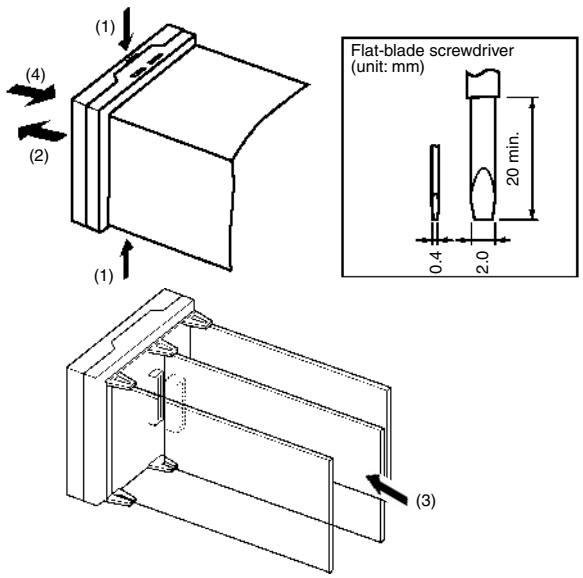
If communications, event input, or heater burnout functions are required, mount the E53-CNH03/E53-CN03 Communications Unit or the E53-CNHB/E53-CNB Event Input Unit. The heater burnout function is supported on either of these two Option Units.

Option Units

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

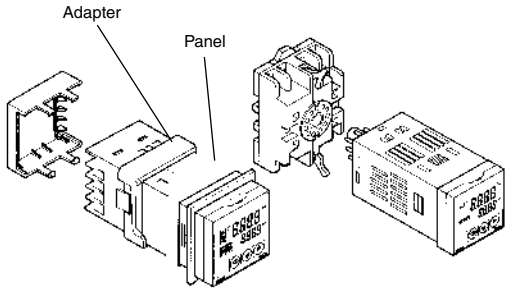
Note: Terminal label: x1

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).

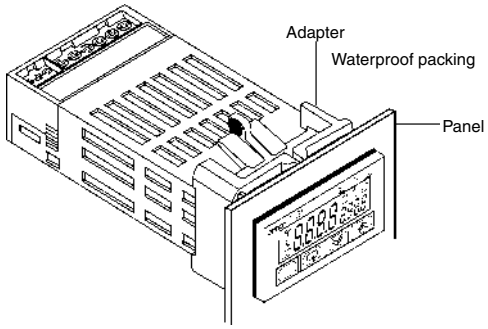
Attaching the Terminal Cover

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

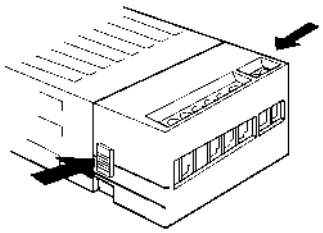
1. Insert the E5GN into the mounting hole in the panel from the front.
2. Push the adapter along the E5GN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque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



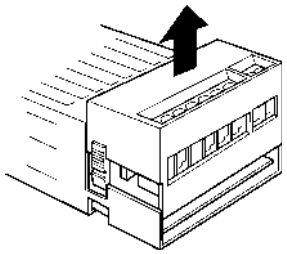
Removing and Attaching the Terminal Plate

The E5GN can be replaced by removing the terminal plate.

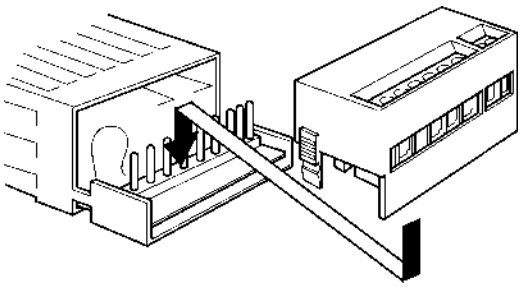
1. Press down hard on the fasteners on both sides of the terminals to unlock the terminal plate and pull upwards.



2. Draw out the terminal plate as it is.



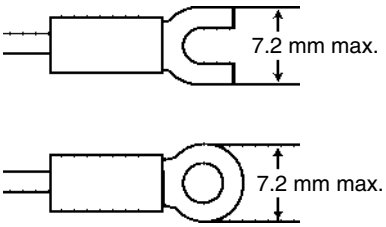
3. Before you insert the terminal plate again, make sure that the pins match the positions of the holes in the terminal plate.



■ 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.

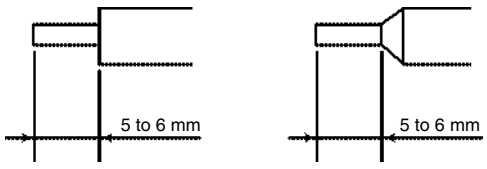


E5GN

- 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.



Electrical wire　　Pin terminal

- 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

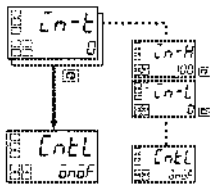
On previous Controllers, sensor input type, alarm type and control period were set on DIP switches. These hardware settings are now set in parameters in setup menus. The ◯ and ⇄ keys are used to switch between setup menus, and the amount of time that you hold the keys down for determines which setup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

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

1. ON/OFF Control

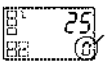
Typical Application Examples

Changing Parameters



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

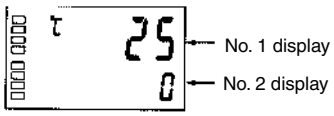
Changing Set Values



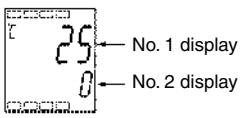
Use the ⌄ or ⌃ keys to change the set value displayed in the setup menu.

Display

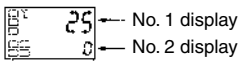
E5AN



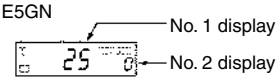
E5EN



E5CN



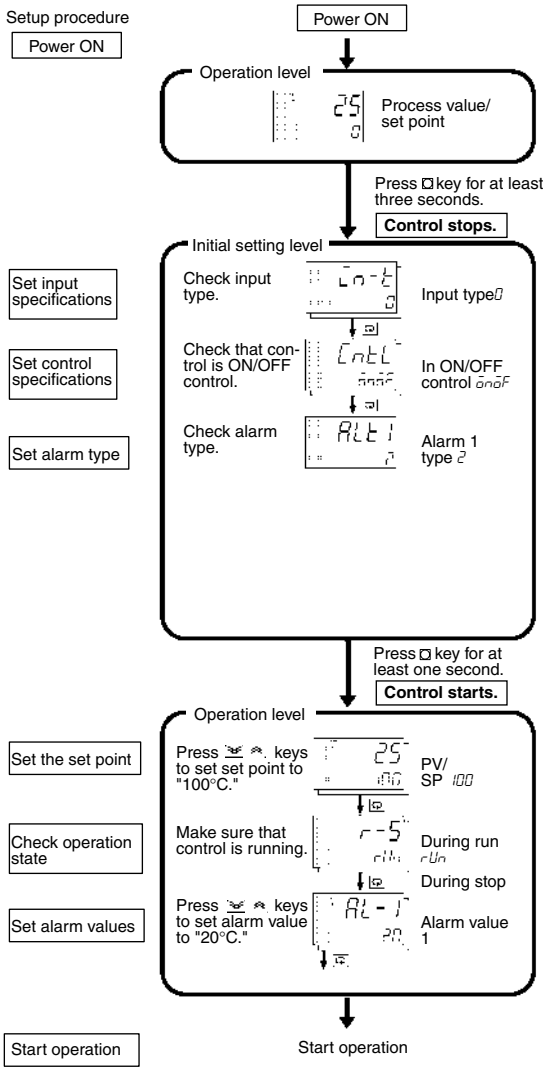
E5GN



Typical Example

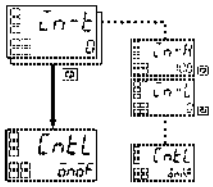
Input type:	0 K thermocouple –200 to 1300˚C
Control method:	ON/OFF control
Alarm type:	2 upper limit
Alarm value 1:	20˚C (For setting deviation)
Set point:	100˚C

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



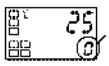
2. PID Control Using Autotuning

Changing Parameters



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

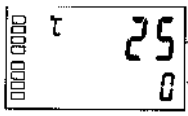
Changing Set Values



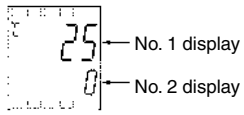
Use the ▼ or ▲ keys to change the set value displayed in the setup menu.

Display

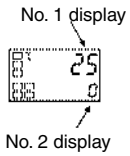
E5AN



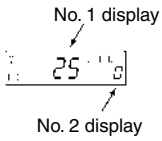
E5EN



E5CN



E5GN



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

Set input specifications

Set control specifications

Self-tuning

Check control period

Check alarm type

Set the set point

AT execution

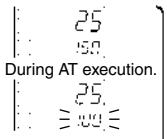
Set operation status

Set alarm values

Start operation

PV/SP

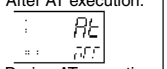
After AT execution.



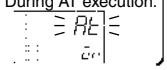
During AT execution.

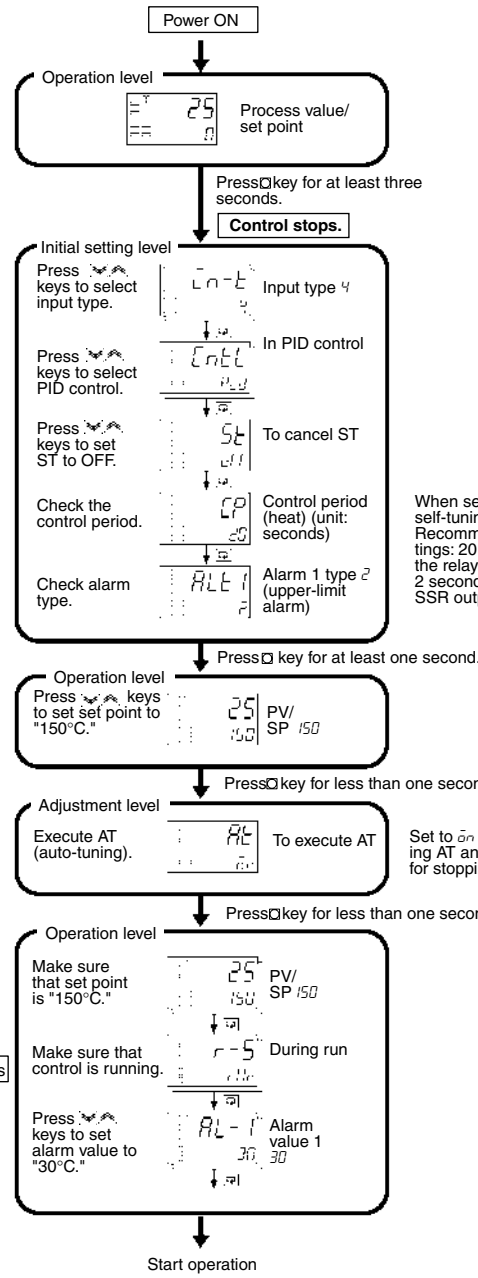
While AT is being executed, SP will flash.

After AT execution.



During AT execution.



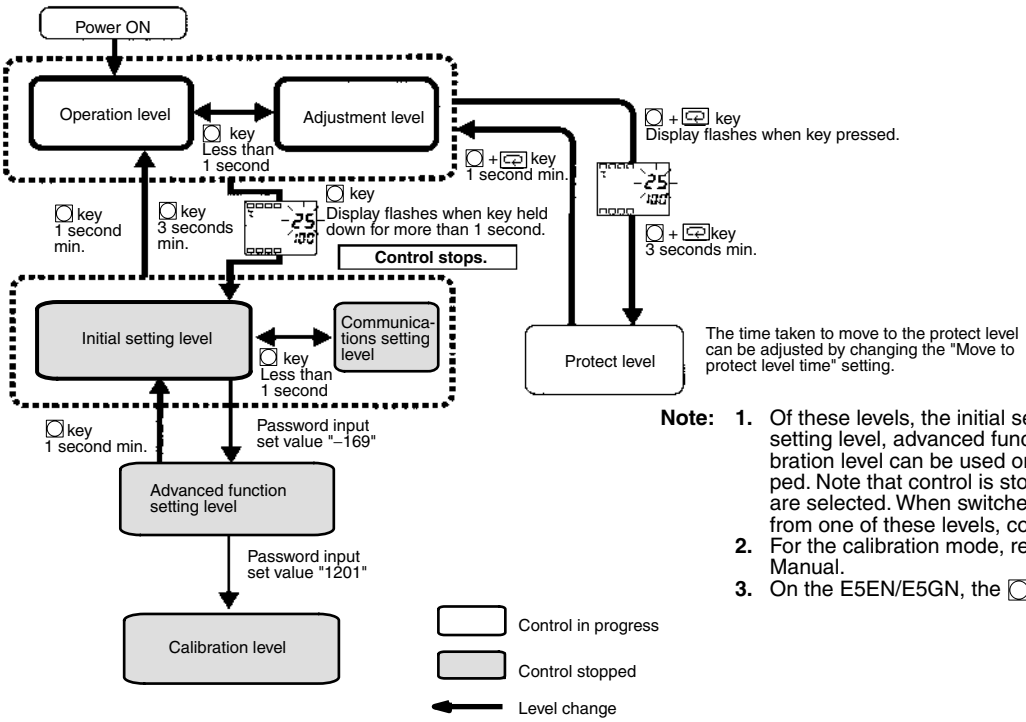


■ Specification Setting after Turning ON Power

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

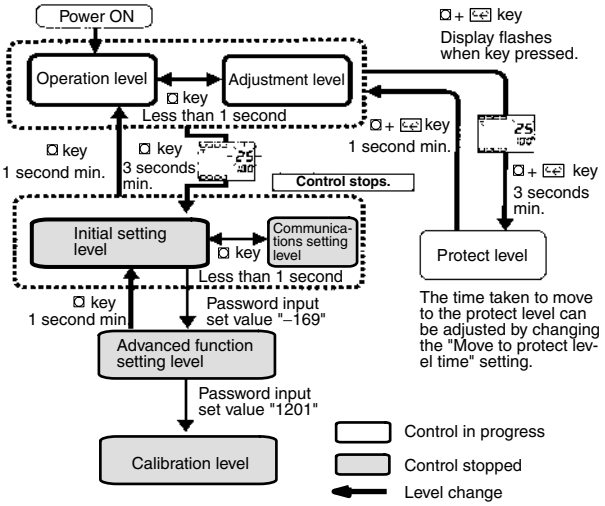
To select this level, you must enter the password (“1201”) in the advanced function setting level. This level is for offsetting deviation in the input circuit.

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.

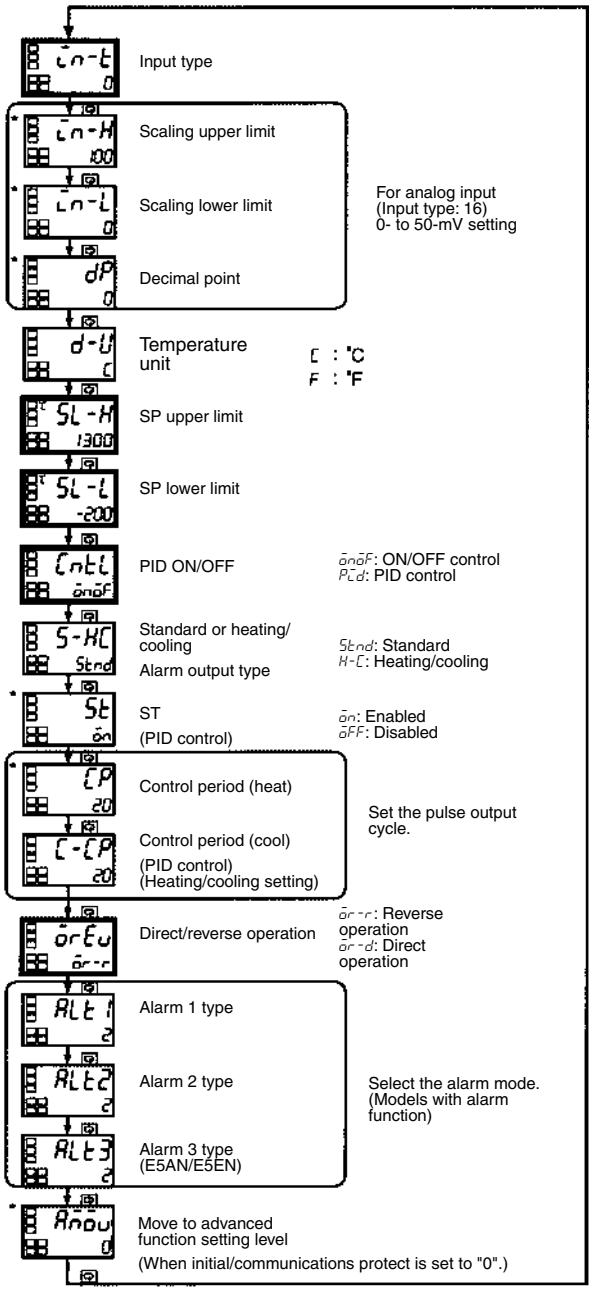


The move from the operation level to the initial setting level, press ◯ key for three seconds or more.

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.

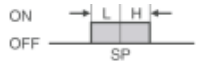
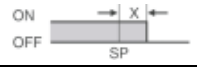
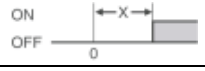
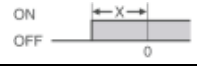
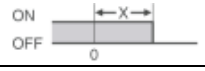
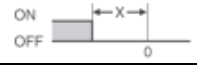
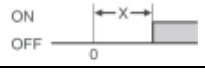
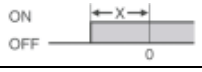
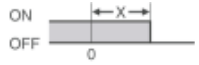
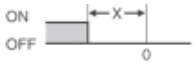
When using the platinum resistance thermometer input type, follow the specifications listed in the following table.

	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.

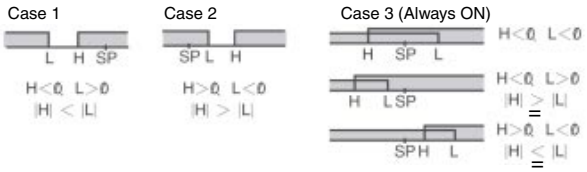
Alarm 1 and Alarm 2

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.)

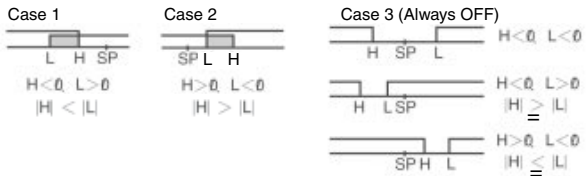
Set Value	Alarm Type	Alarm Output Operation	
		When X is positive	When X is negative
0	Alarm function OFF	Output OFF	
1*1	Upper- and lower-limit (deviation)		*2
2	Upper-limit (deviation)		
3	Lower-limit (deviation)		
4*1	Upper- and lower-limit range (deviation)		*3
5*1	Upper- and lower-limit with standby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

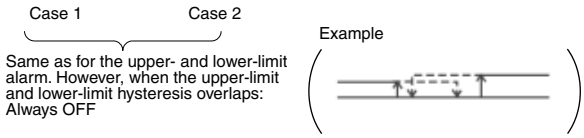
*2: Set value: 1, Upper- and lower-limit alarm



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



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



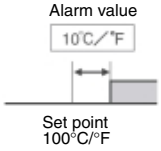
*5: Set value: 5, Upper- and lower-limit with standby sequence alarm. Always OFF when the upper-limit and lower-limit hysteresis overlaps.

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.

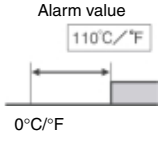
When an alarm type other than the absolute-value alarm is selected

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



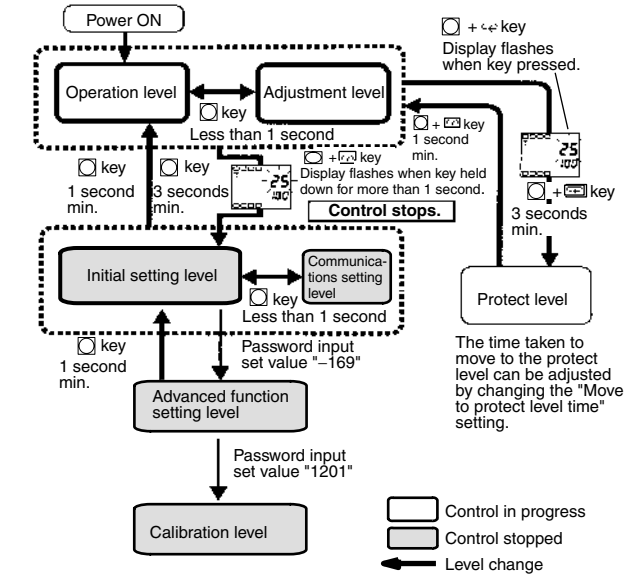
When the absolute-value alarm is selected

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



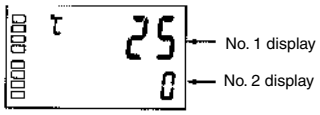
Parameters

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.

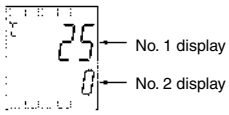


Display

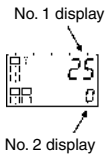
E5AN



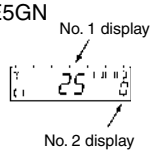
E5EN

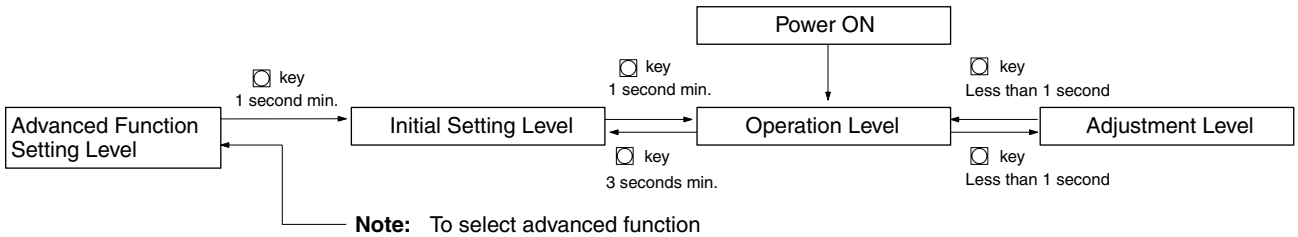


E5CN



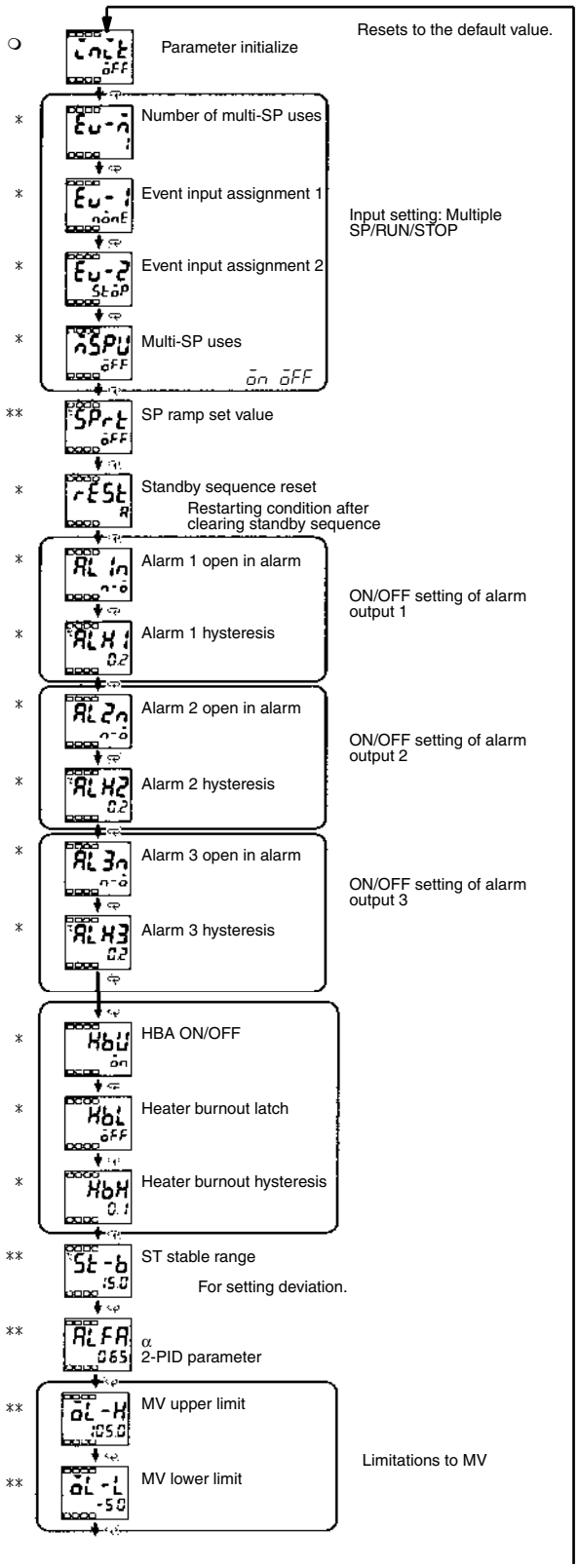
E5GN

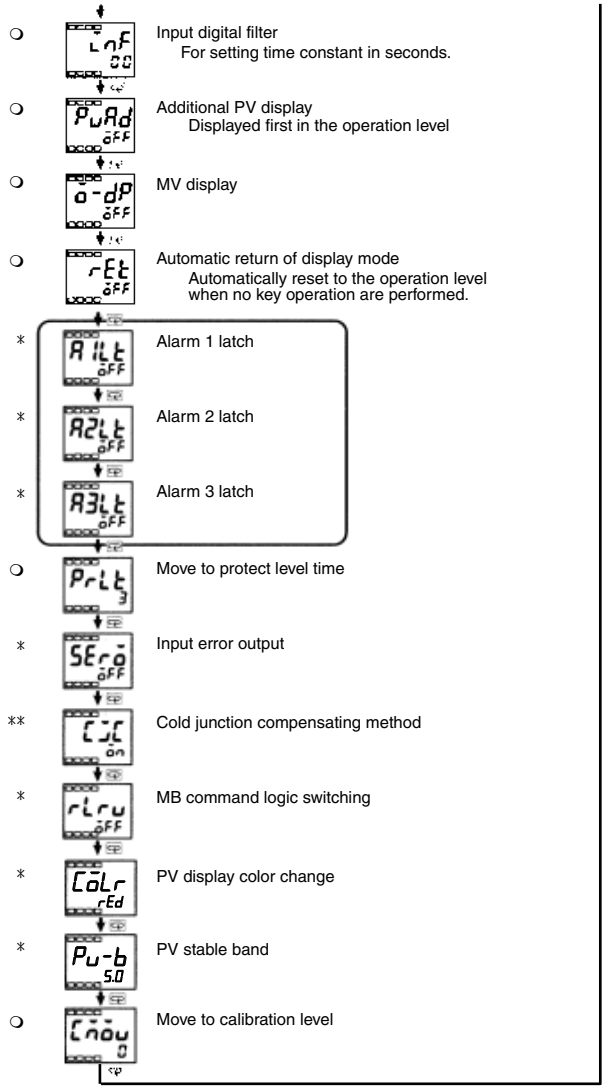




Note: To select advanced function setting level, you must enter the password ("−169") in the initial setting level.

Advanced Function Setting Level

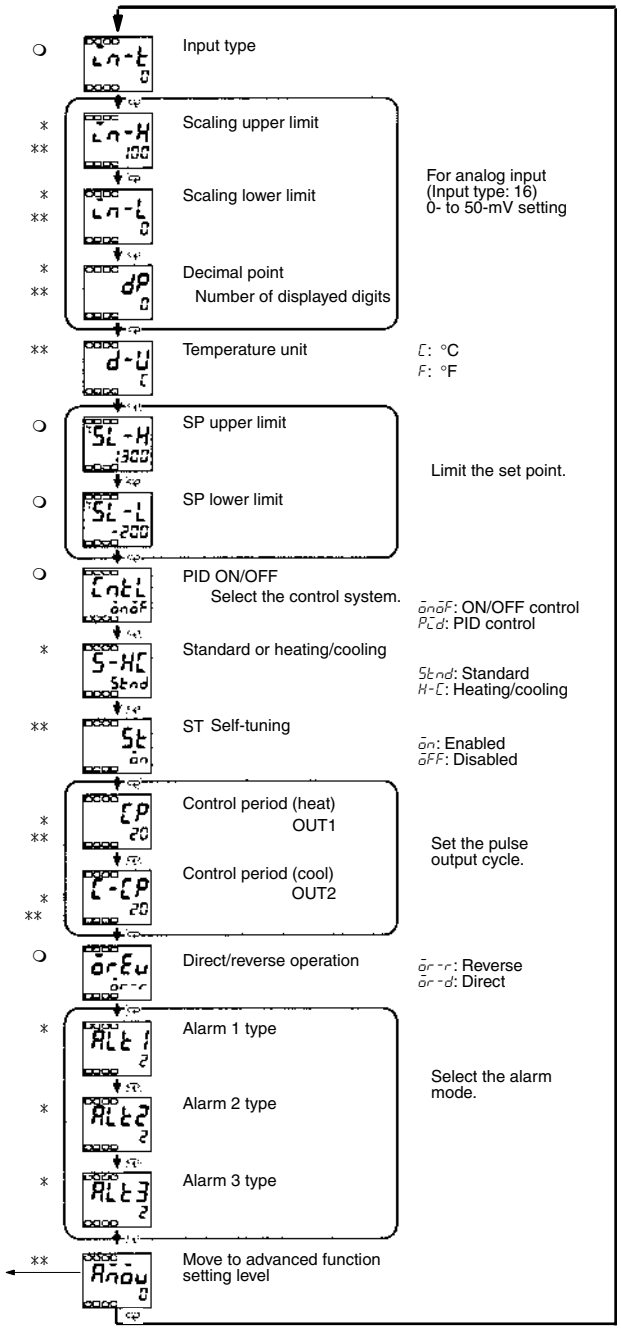




Note: These diagrams show all the parameters that may be displayed. Depending on the specifications of the model used, there may be some parameters that are not displayed. The following symbols are used to distinguish between these parameters.

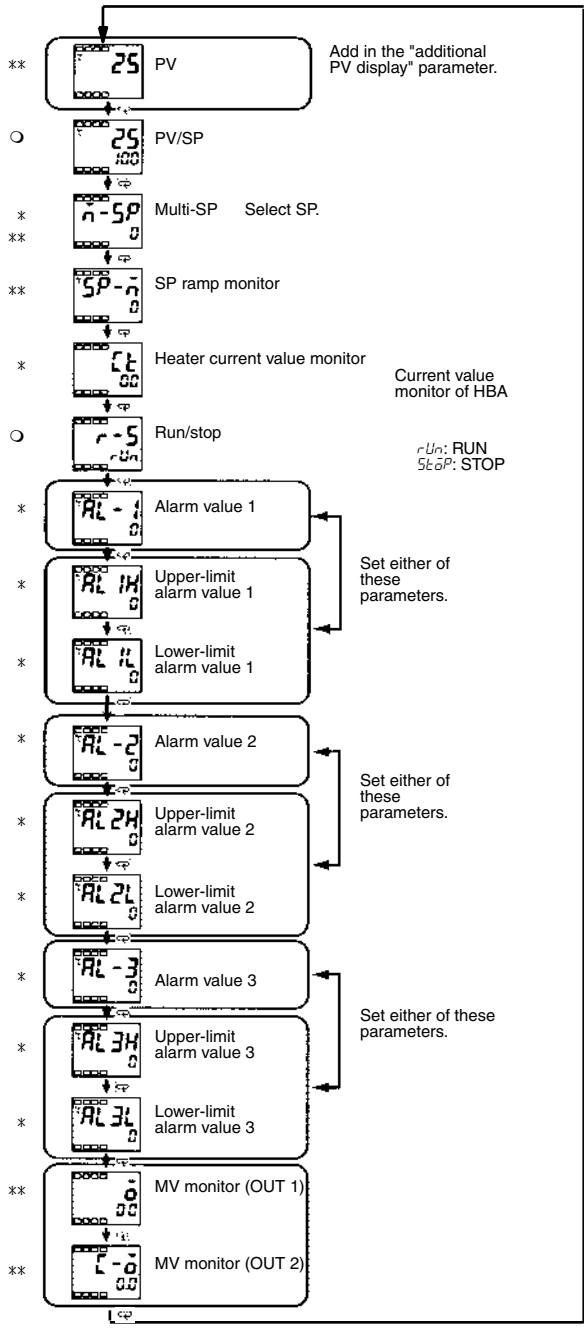
❍: Displayed for all models regardless of the settings of other parameters.
∗: Not displayed for some models.
∗∗: Depending on the settings of other parameters, may not be displayed.

Initial Setting Level



Note: To select advanced function setting level, you must enter the password ("–169") in the initial setting level.

Operation Level



The displays for parameters which can be switched (i.e., parameters other than simply numerical ones) show the contents of those parameters.

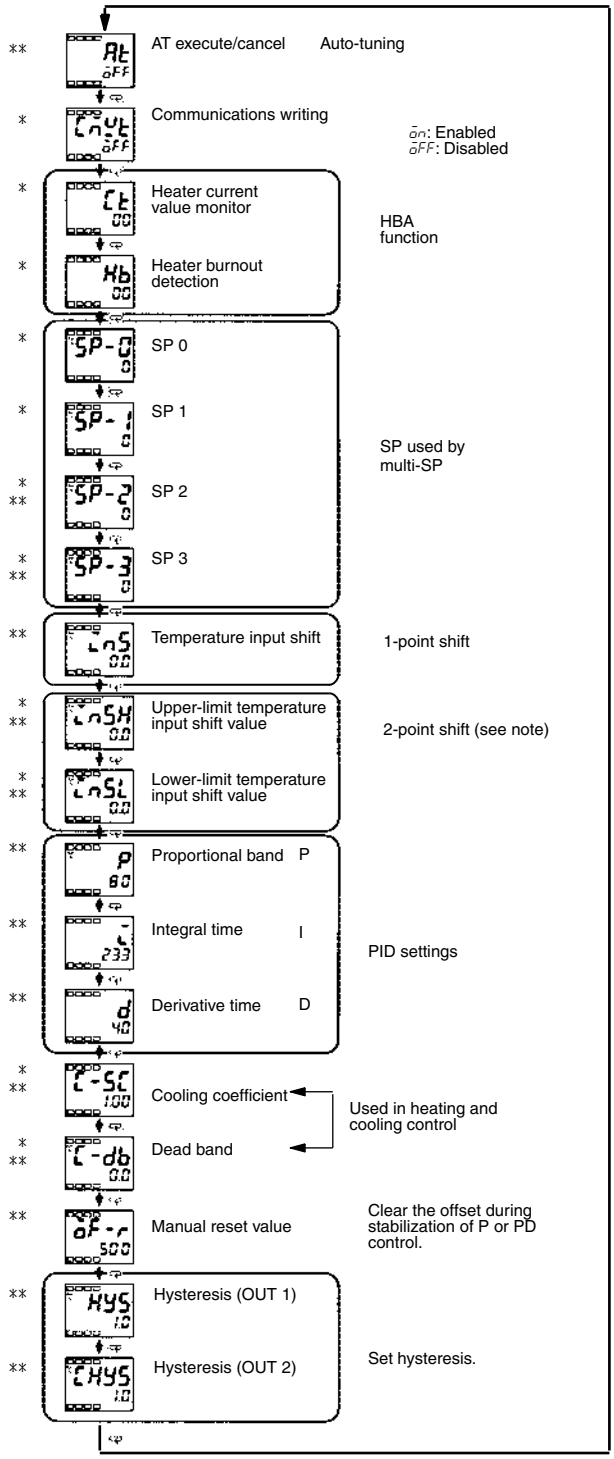
Note: These diagrams show all the parameters that may be displayed. Depending on the specifications of the model used, there may be some parameters that are not displayed. The following symbols are used to distinguish between these parameters.

❍: Displayed for all models regardless of the settings of other parameters.

∗: Not displayed for some models.

∗∗: Depending on the settings of other parameters, may not be displayed.

Adjustment Level



The 2-point shift setting is only possible when the input type is an infrared temperature sensor.

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.
∗: Not displayed for some models.
∗∗: Depending on the settings of other parameters, may not be displayed.

Protect Level

Operation/adjustment protection
Restricts display and modification of menus in the operation and adjustment levels.

Initial setting/communications protection
Restricts display and modification of menus in the initial setting, operation level and adjustment levels.

Setting change protection
Protects changes to setups by operating the front panel keys.

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	Communications 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

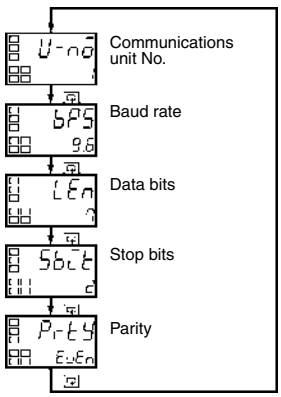
Set the E5AN/E5EN/E5CN/E5GN communications specifications in the communications setting level. For setting communications parameters, use the E5AN/E5EN/E5CN/E5GN panel. The communications parameters and their settings are listed in the following table.

Parameter	Displayed characters	Set (monitor) value	Set value
Communications unit No.	U-no	0 to 99	0.**1** to 99
Baud rate	bPS	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	Sbit	1/2	1/**2** (bit)
Parity	Prty	None, even, odd	non**E**/**EVEn**/odd

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.

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

Communications Unit No. (U-no)

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 (bPS)

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 (Sbit)

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

Parity (Prty)

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

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
S.Err (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
H.Err (H. Err)	HB error (See note.)		OFF	OFF

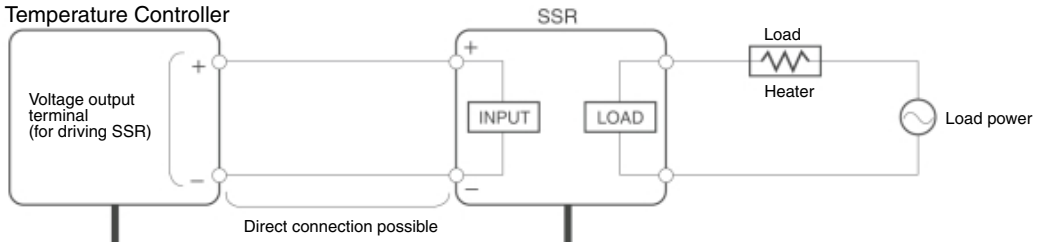
Note 1. If the input is within the range for which control is possible but outside the displayable range (–1999 (–199.9) to 9999 (999.9)), CCCC will be displayed if the value is less than –1999 (–199.9), and JJJJ will be displayed if it is greater than 9999 (999.9). Control output and alarm output will 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.

Peripheral Devices

■ Temperature Sensor / SSR

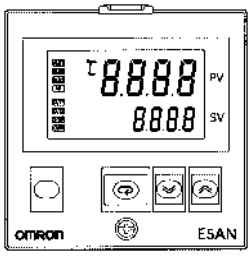
Connection Example with SSR



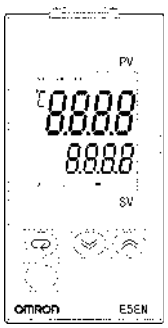
E52

ES1A

E5AN



E5EN



E5CN

E5GN

3 units
5 units
(E5AN/
E5EN)

G3PB (Single-phase): 240 VAC
15 A, 25 A, 35 A, 45 A)

Rated input voltage:
12 to 24 VDC

Compact and slim models with a built-in radiator

2 units
4 units
(E5AN/
E5EN)

G3PB (Three-phase): 240 VAC/400 VAC
(15 A, 25 A, 35 A, 45 A)

Rated input voltage:
12 to 24 VDC

Simultaneous three-phase control with a built-in radiator

3 units
5 units
(E5AN/
E5EN)

G3PA: 240 VAC (10 A, 20 A, 40 A)
400 VAC (20 A, 30 A)

Rated input voltage:
5 to 24 VDC

Compact and slim models with a built-in radiator

3 units
5 units
(E5AN/
E5EN)

4 units
for
480-VAC
models

G3NA: 240 VAC (5 A, 10 A, 20 A, 40 A)
480 VAC (10 A, 20 A, 40 A)

Rated input voltage:
5 to 24 VDC

Standard models with screw terminals

1 unit
2 units
(E5AN/
E5EN)

G3NE: 240 VAC (5 A, 10 A, 20 A)

Rated input voltage:
12 VDC

Compact and low-cost models with tab terminals

4 units
8 units
(E5AN/
E5EN)

G3NH: 440 VAC (75 A, 150 A)

Rated input voltage:
5 to 24 VDC

For controlling high-power heater

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

■ 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.

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 mm^2) to AWG14 (2.081 mm^2) for terminals 1 to 6 and use cables of a thickness AWG28 (0.081 mm^2) to AWG22 (0.326 mm^2) 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.

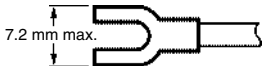
In the case of Temperature Controllers with alarm outputs, alarm output may not be generated properly when an abnormality occurs in the device. It is suggested that a separate alarm device be incorporated in the system.

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.

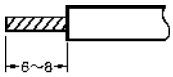
E5AN/E5EN/E5CN



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-E1-07

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.

Model Number Structure

■ Model Number Legend

Refer to the following when ordering set models.

E5CK-□□□
1 2 3

1. Control Output 1/Control Output 2
- AA: Without Output Unit (field interchangeable)
- RR: Relay/Relay
- QR: Pulse (NPN)/Relay
- CR: Linear (4 to 20 mA)/Relay
- VR: Linear (0 to 10 V)/Relay
- QQ: Pulse (NPN)/Pulse (NPN)

2. Auxiliary Output
- 1: Auxiliary output (1 point)

3. Option
- 01: RS-232C serial communication
- 03: RS-485 serial communication
- B: Event input (1 point)
- F: Transfer output (4 to 20 mA)

Note: E5CK-VR1 and E5CK-QQ1 are not available, but with options.

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

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 to 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 kΩ 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 kΩ max., OFF: 100 kΩ 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.

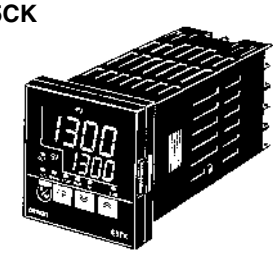
A/M Key

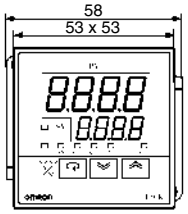
Press to select the auto operation or manual operation.

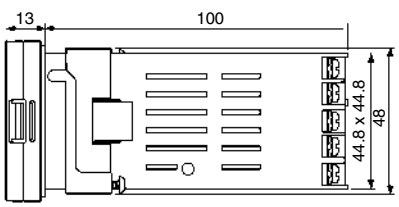
Dimensions

Note: All units are in millimeters unless otherwise indicated.

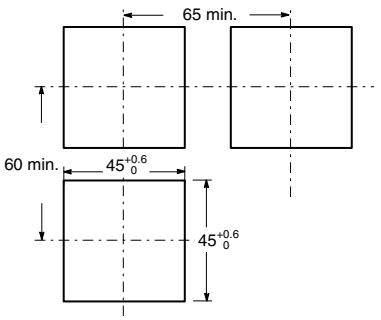
E5CK







Panel Cutouts

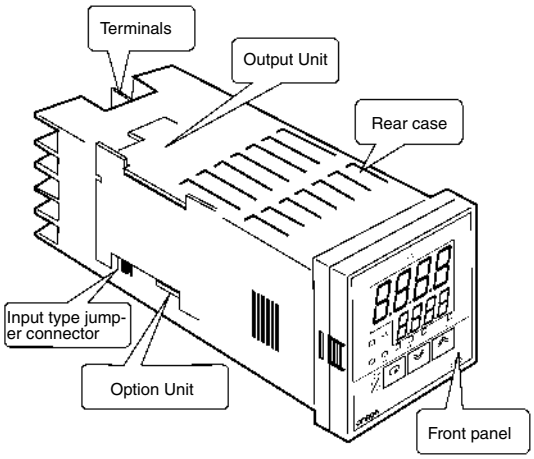


Note: **1.** Recommended panel thickness is 1 to 5 mm.
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

Installation

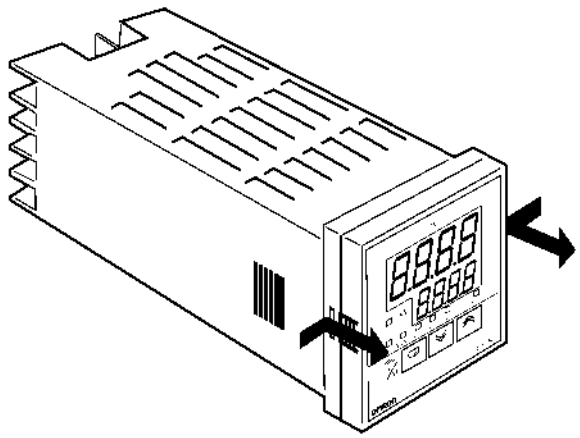
■ Installation

Main Parts



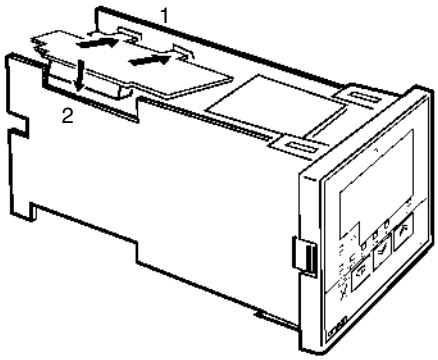
Draw-out

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.



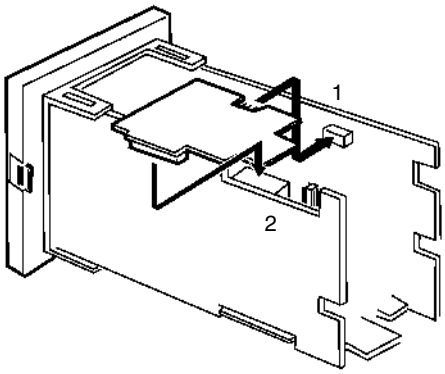
Setting Up the Output Unit

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).



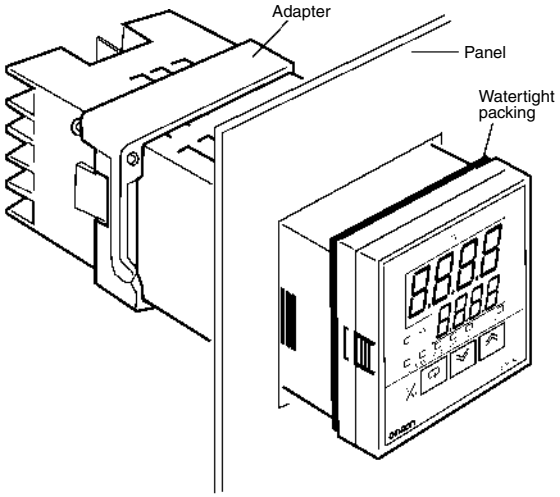
Setting Up the Option Unit

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).



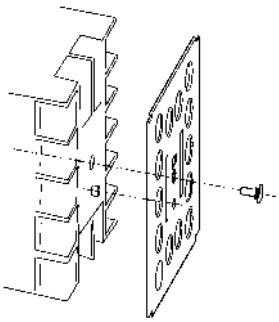
■ Mounting

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.



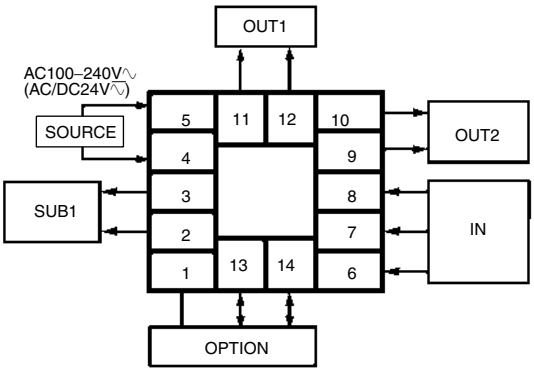
Terminal Cover

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



Precautions

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

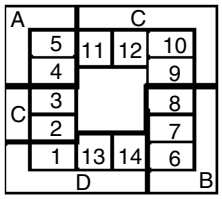
Solderless terminals are recommended when wiring the Controller.

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 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.

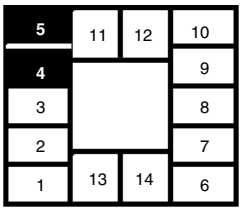
- Option unit: E53-CKB or E53-CKF



Wiring

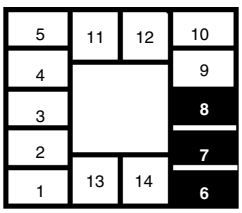
Power Supply

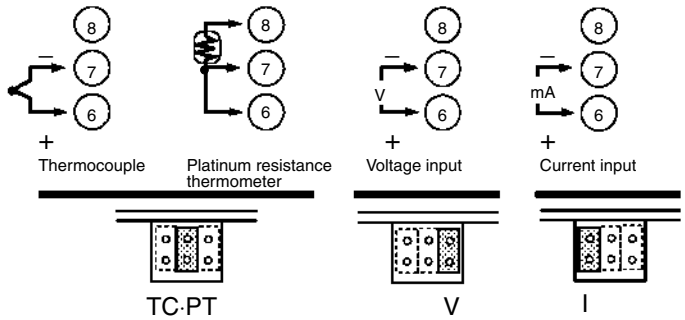
Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 4 and 5 according to the specification.



Input

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

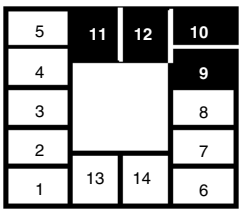


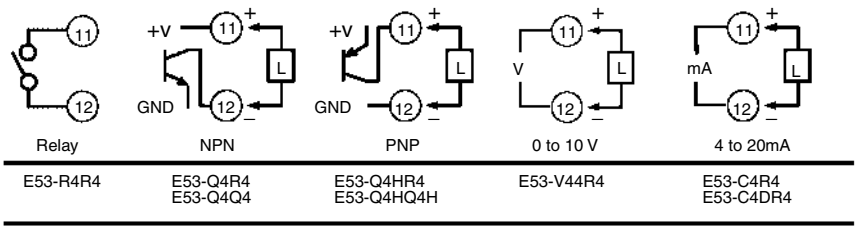


Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the inputs to a common position (TC/PT) as the temperature input.

Control Output

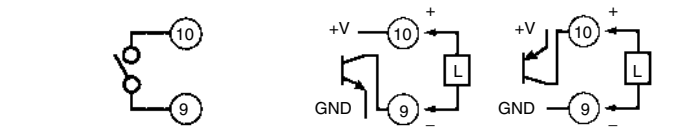
Terminal numbers 11 and 12 are for control output 1 (OUT1). The five output types and internal equalizing circuits are available according to the Output Unit.





Relay	NPN	PNP	0 to 10 V	4 to 20mA
E53-R4R4	E53-Q4R4 E53-Q4Q4	E53-Q4HR4 E53-Q4HQ4H	E53-V44R4	E53-C4R4 E53-C4DR4

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.



E53-R4R4/E53-V44R4 E53-Q4R4/E53-C4R4 E53-Q4HR4/E53-C4DR4	E53-Q4Q4	E53-Q4HQ4H

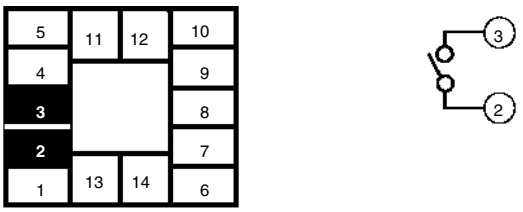
The following table shows the specifications for each output type.

Output type	Specifications
Relay Voltage (NPN) Voltage (PNP)	3 A at 250 VAC 20 mA at 12 VDC (with short-circuit protection) 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:

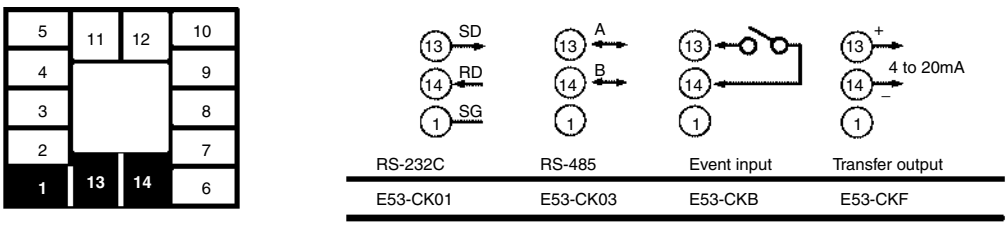


Relay specifications are as follows:
SPST-NO, 250 VAC, 1 A

Option

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

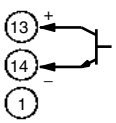
The following four connections are possible depending on the model of the Option Unit.



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:



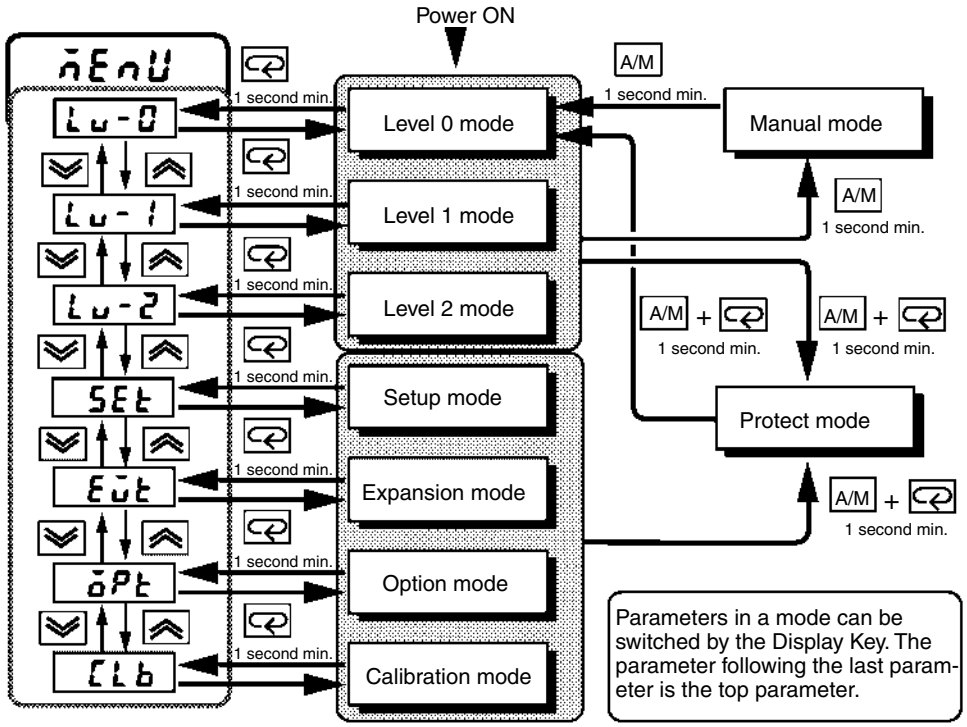
Transfer output specifications are as follows:
4 to 20 mA, load: 500 Ω max., resolution approx. 2600

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.

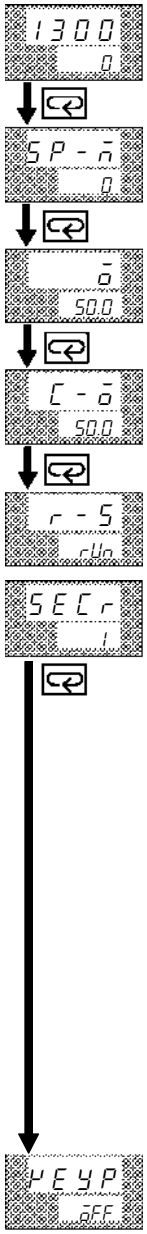
Expansion Mode — The mode for setting expanded functions. In this mode, set ST (self-tuning), SP setting limiter, select advanced PID or ON/OFF control, specify the standby sequence resetting method, initialize parameters, and set the time for automatic return to the monitoring display.

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.

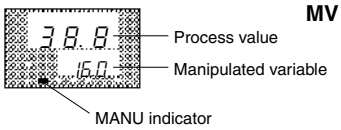
Run/Stop

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

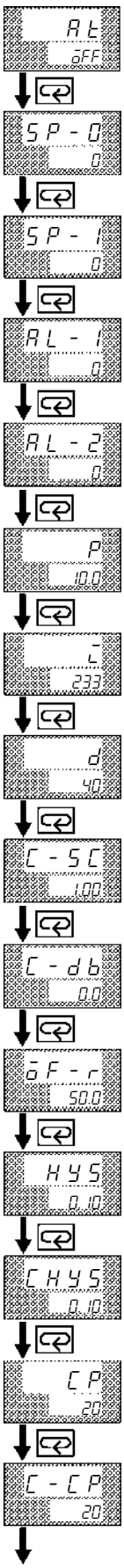
The Unit will be in only level 0 mode and the menu will not be available when this parameter is set to "4" to "6."
Only the "PV/SP monitor" and "set point" parameter can be used when this parameter is set to "5."
Only the "PV/SP monitor" parameter can be used when this parameter is set to "6."

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."

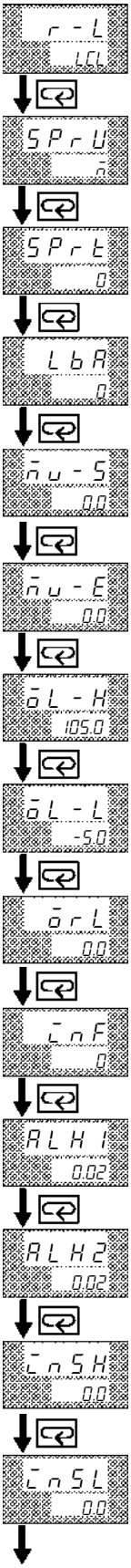
Hysteresis (Heat)
Available when the Controller is in ON/OFF control.

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, or is in advanced PID control.

Control Period (Cool)
Available when the Controller has a relay or voltage output, or 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

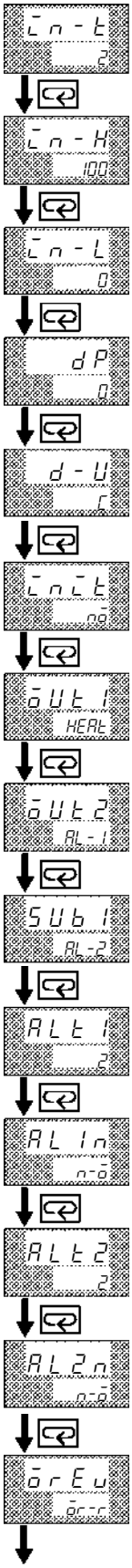
Alarm 1 Hysteresis
Available only when the Controller has an alarm output.

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.

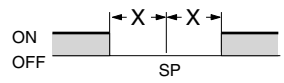
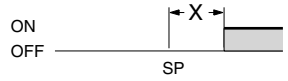
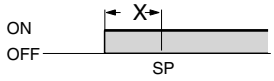
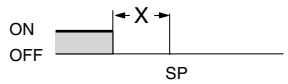
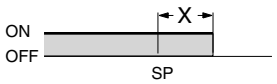
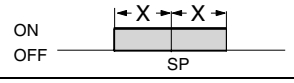
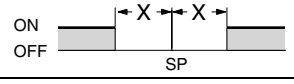
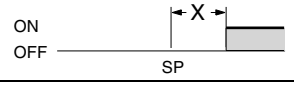
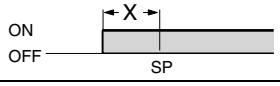
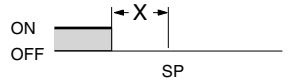
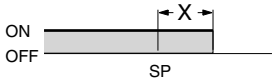
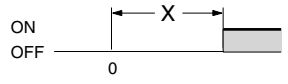
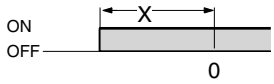
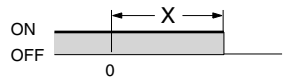
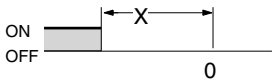
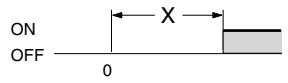
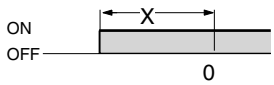
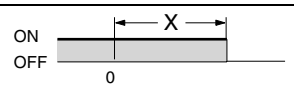
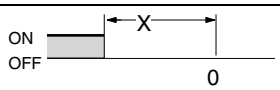
Alarm 1 Type
Available only when the Controller has an alarm output (see the table on the next page).

Alarm 1 Open in Alarm

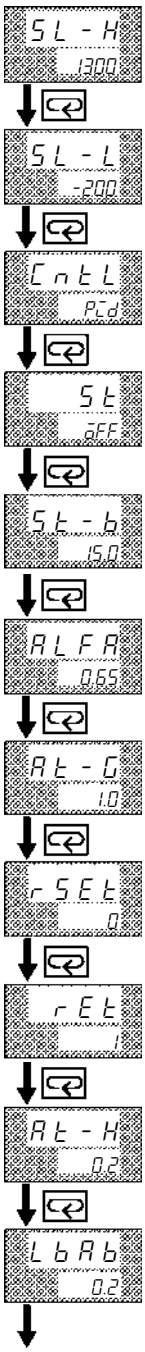
Alarm 2 Type

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



SP Setting Upper Limit

SP Setting Lower Limit

PID/ON/OFF

ST

Available if the Controller in standard control or advanced PID control has a temperature input.

ST Stable Range

Available if the Controller in standard control or advanced PID control with the ST set to ON has a temperature input.

α

Available if the Controller is in advanced PID control with the ST set to OFF.

AT Calculated Gain

Available if the Controller is in advanced PID control with the ST set to OFF.

Standby Sequence Reset Method

Automatic Return of Display Mode

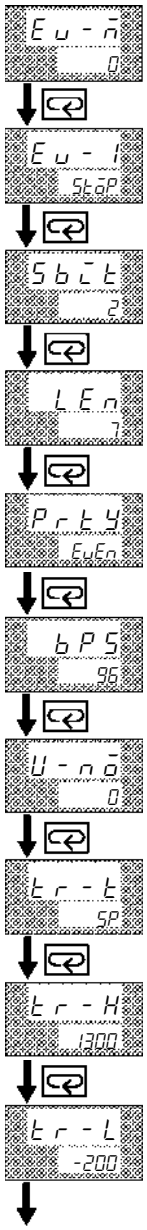
AT Hysteresis

Available if the Controller is in advanced PID control with the ST set to OFF.

LBA Detection Width

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

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.

S.Err 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.

E111 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.

E333 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.

R.Err Calibration Data Error

This error is output only during temperature input and is displayed for two seconds when the power is turned ON.

Meaning 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.

cccc / ɔɔɔɔ 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 ±10%) is larger than the display range (–1999 to 9999).

- When less than “–1999” cccc
- When greater than “9999” ɔɔɔɔ

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 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

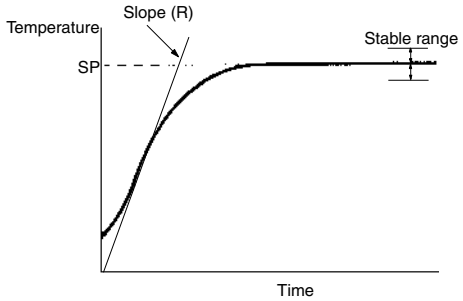
SRT will start if the following conditions are satisfied simultaneously when the E5CK is turned on or the set point is changed.

At the time the E5CK starts operating	At the time set point is changed
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).	**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 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.	**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.

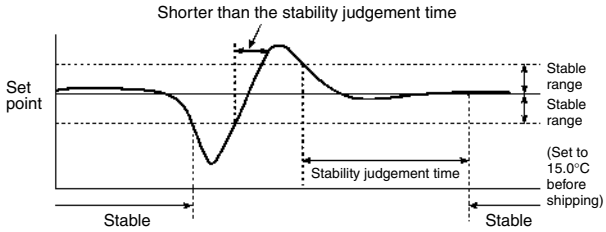
PID Constant Refreshing Conditions

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.



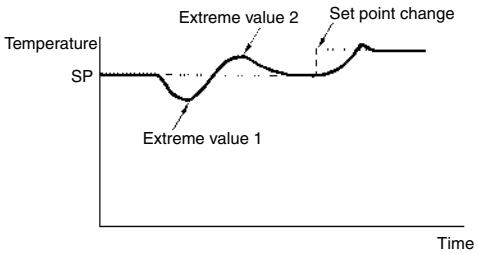
Balanced Status

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

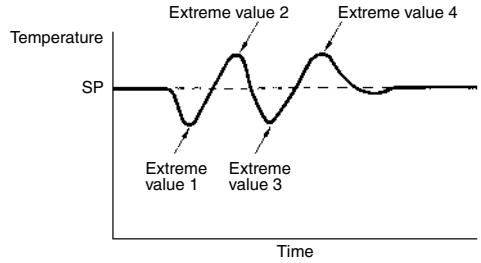
1. DT will start if the temperature that has been stable varies due to external disturbance and the deflection of the temperature exceeds the stable range, and then the temperature becomes stable, provided that the number of maximum temperature values is less than four.

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

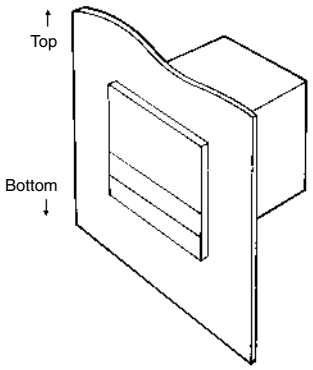
Period of Guarantee

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.

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. H079-E1-05

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

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: Two 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 92 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-COV0809	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	Standard Model According to Output Unit (see *"Output Unit Ratings and Characteristics"*) Position-proportional Model 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	Standard 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 Option 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

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 kΩ max., resolution: approx. 2,600 0 to 5 VDC, permissible load impedance: 1 kΩ 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 kΩ max., OFF: 100 kΩ 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	±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)

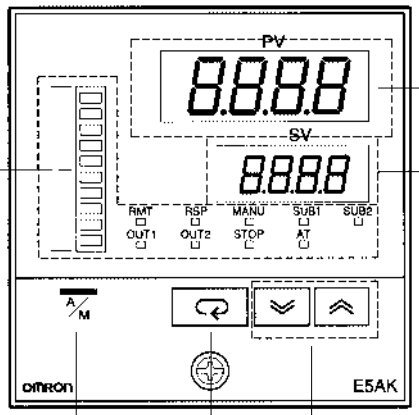
Note: 1. Use the K2CU-F□□A-□GS (with gate input terminals) for the detection of three-phase heater burnout.
2. The heater burnout alarm is always OFF if the alarm is set to 0.0 A and always ON if the alarm is set to 50.0 A.
3. No heater burnout detection or heater current value measurement is possible 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.

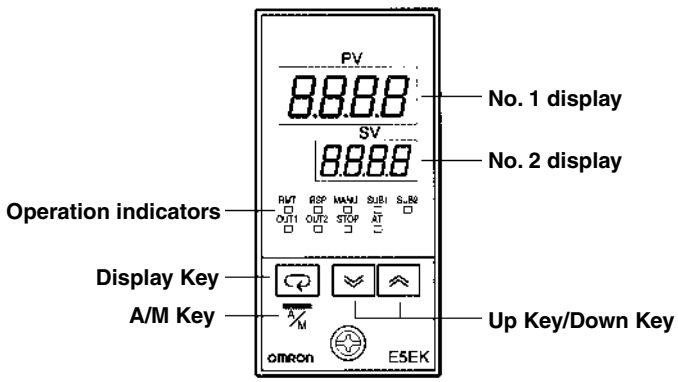
No. 2 Display
Displays the set point, manipulated variable, or parameter settings.

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.

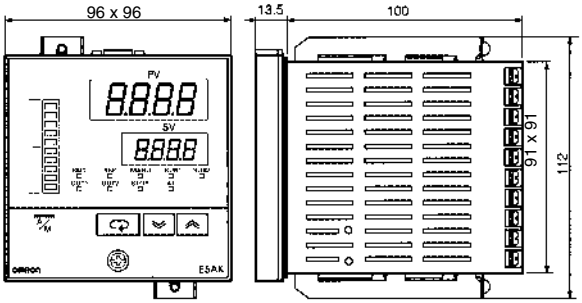
E5EK



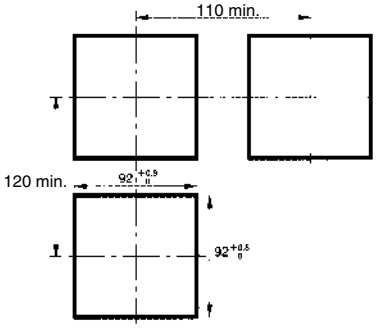
Dimensions

Note: All units are in millimeters unless otherwise indicated.

E5AK

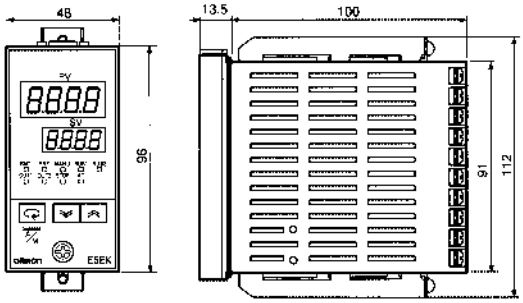


Panel Cutouts

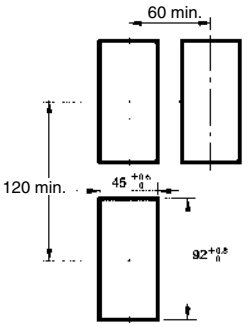


Note: **1.** Recommended panel thickness is 1 to 8 mm.
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

E5EK



Panel Cutouts

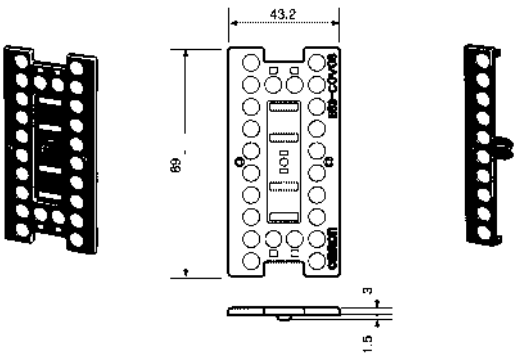


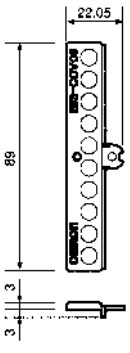
Note: **1.** Recommended panel thickness is 1 to 8 mm.
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

Accessories (Order Separately)

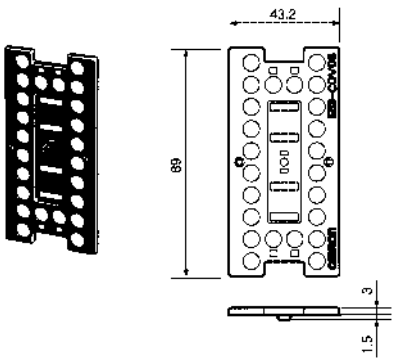
Terminal Cover

E53-COV0809



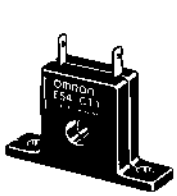


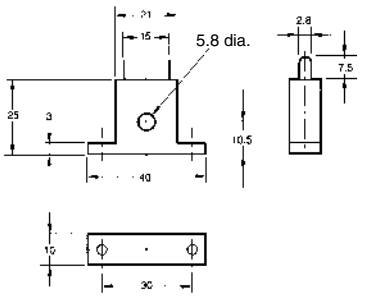
E53-COV08



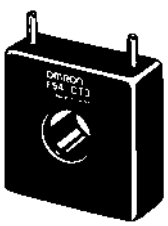
Current Transformer

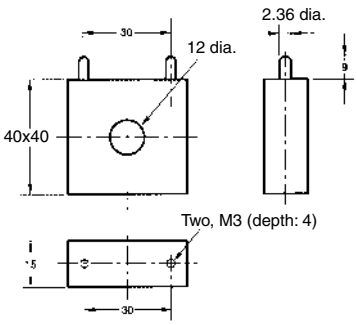
E54-CT1





E54-CT3





Installation

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

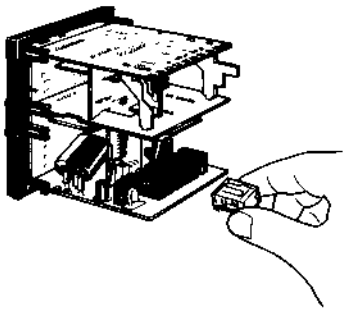
■ Settings

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.)

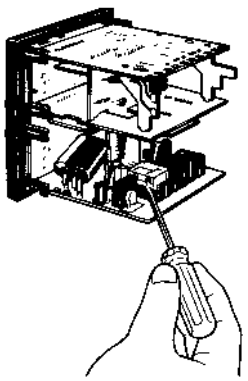
When setting up the Output Units, draw out the internal mechanism from the housing and insert the Output Units into the sockets for control outputs 1 and 2.

Setting Up the Output Unit



Removing the Output Unit

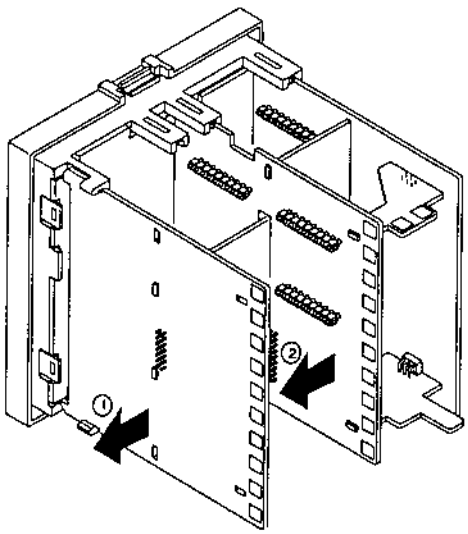
To replace the Output Unit, use a flat-blade screwdriver to push up the Output Unit.



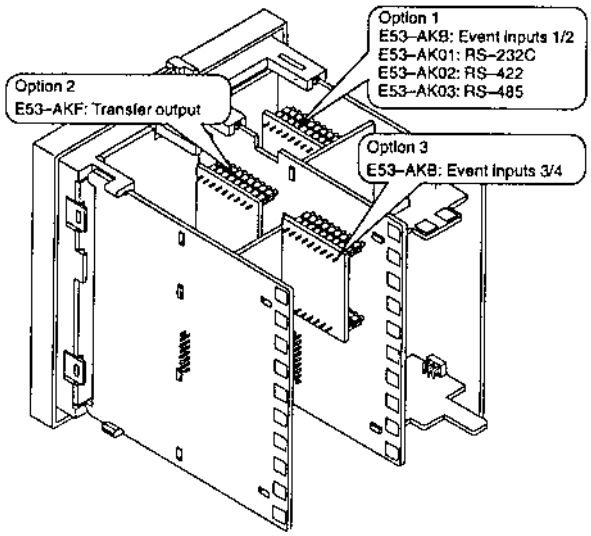
Setting Up the Option Unit

• E5AK

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



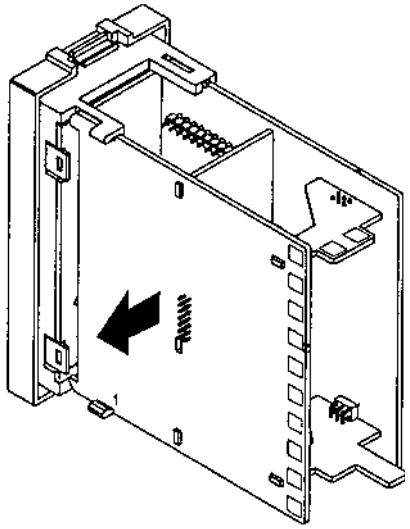
2. Insert the Option Units into the sockets for options 1 to 3. The following diagram shows the relationship between the Option Units and mounting positions.



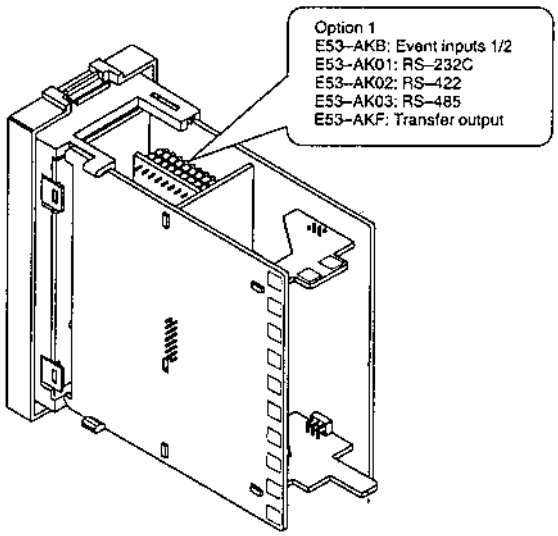
3. Mount the option boards and the power board in the order shown.

• 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.

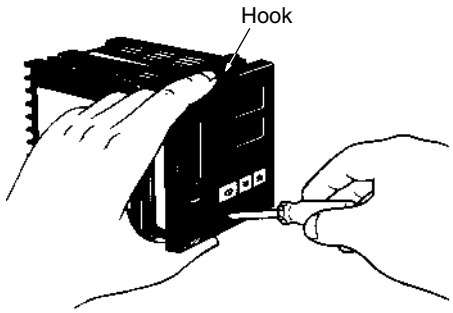


3. Mount the option board and the power board in the order shown.

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.

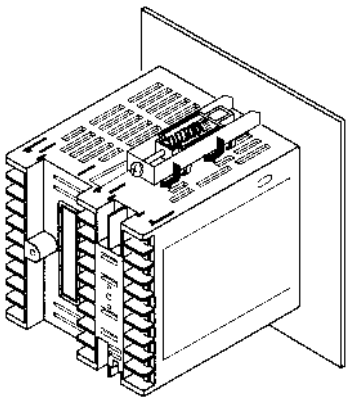


2. Draw out the internal mechanism while holding the left and right sides of the front panel.

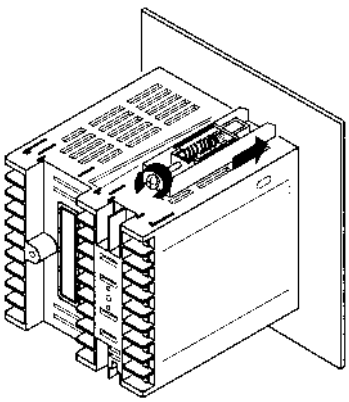
Mounting

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.

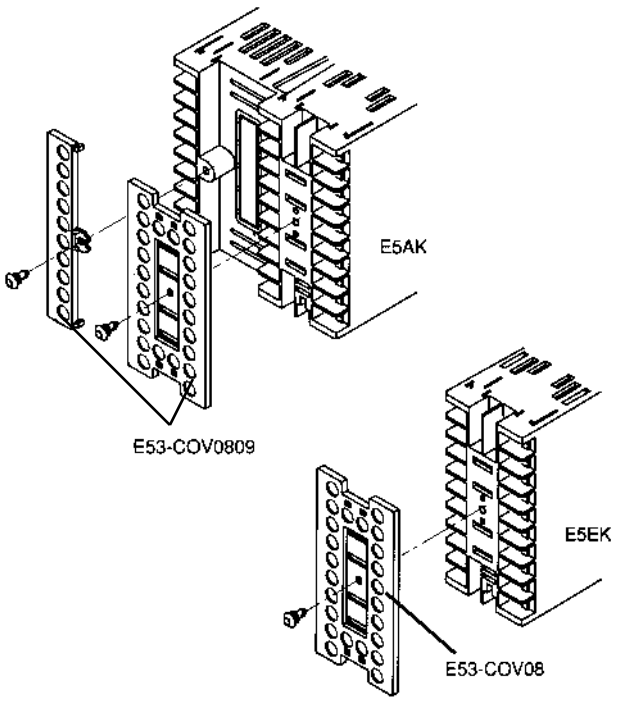


3. Tighten the mounting bracket screws on the upper and lower parts of the E5AK in small increments alternately and equally until the ratchet start to slide.



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

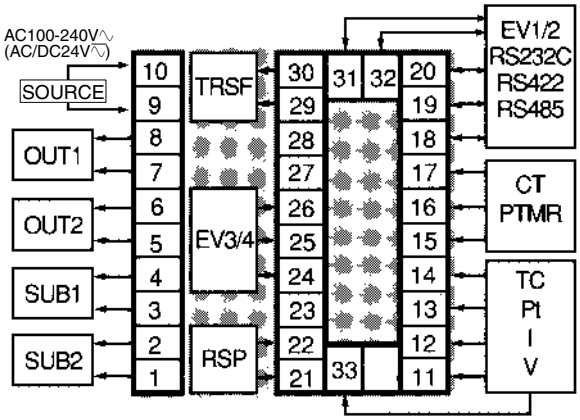
Fasten the terminals covers as follows by using the snap pins. Snap pins are provided with the terminal covers.



Wiring

■ Wiring Terminals for E5AK

Terminal Arrangement



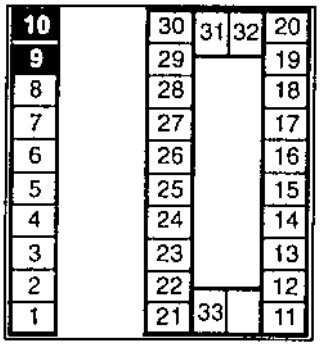
TRSF: Transfer output
EV1 to 4: Event input
PTMR: Potentiometer
RSP: Remote SP input

Wiring

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

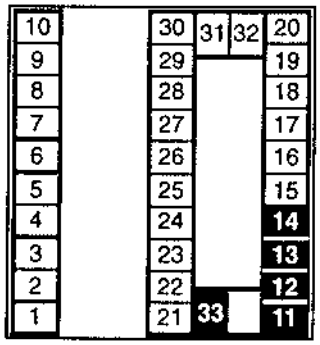
Power Supply

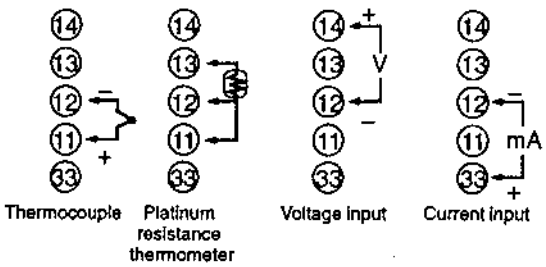
Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 9 and 10 according to the specifications.



Sensor Input

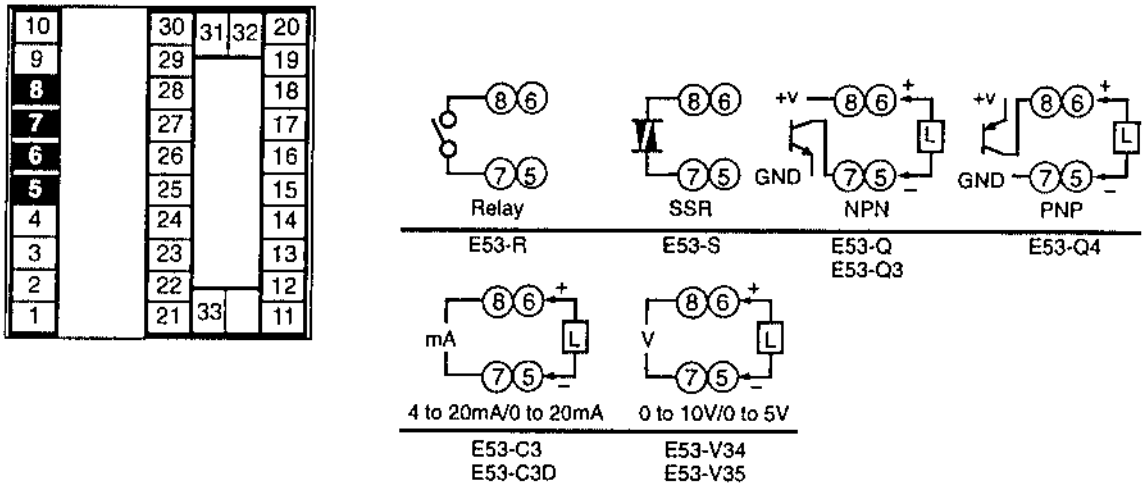
Connect the sensor input to terminal numbers 11 to 14 and 33 as follows according to the input type.





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.



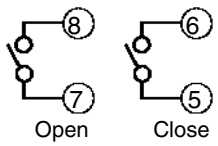
With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted.

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 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

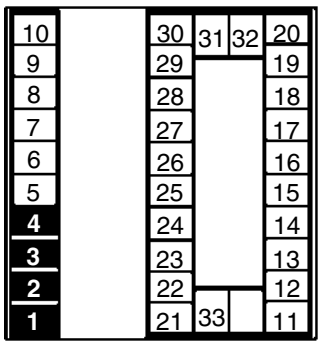
With E5AK-PRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

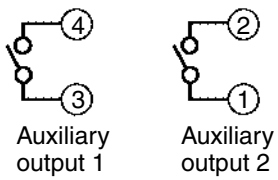
When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



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:

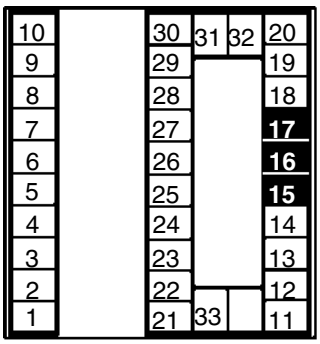


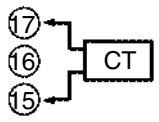


Output specifications are as follows:
SPST-NO, 3 A at 250 VAC

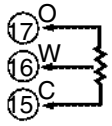
CT Input/Potentiometer

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:





CT input

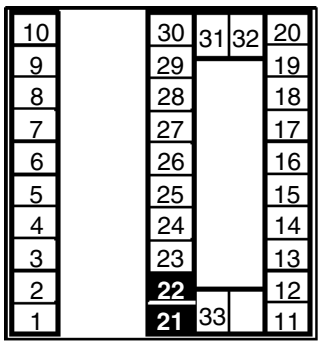


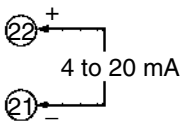
Potentiometer

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

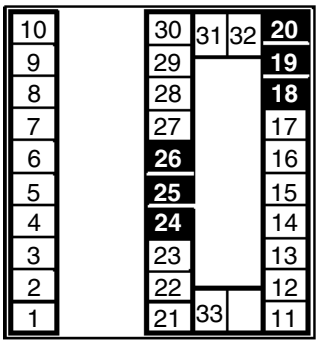
Connect the input (RSP) to be used as the remote SP to terminal numbers 21 and 22. Only 4 to 20 mA inputs can be connected. Connect the input as follows:





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:

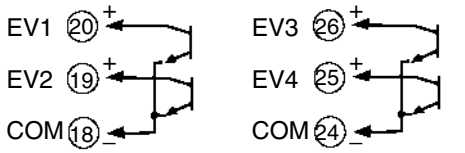


Terminals 18 and 24 (COM) are connected internally.

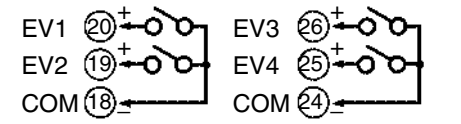
Use event inputs under the following conditions:

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:



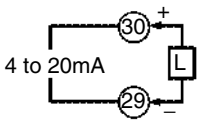
Event input 1 and 2 Event input 3 and 4



Event input 1 and 2 Event input 3 and 4

Transfer Output

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



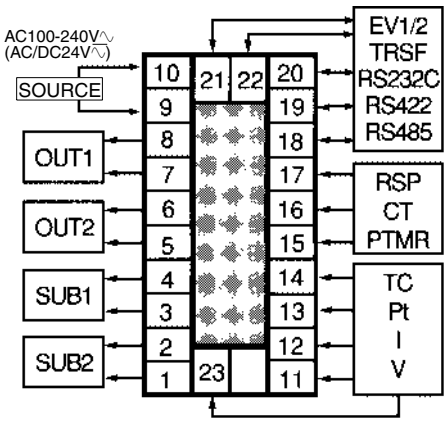
Transfer output specifications are as follows: 4 to 20 mA,
Permissible load impedance: 600 Ω max.,
Resolution: Approx. 2600

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



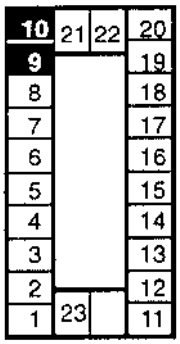
TRSF: Transfer output
EV1/2: Event input
PTMR: Potentiometer
RSP: Remote SP input

Wiring

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

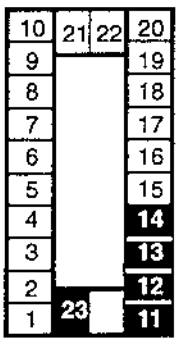
Power Supply

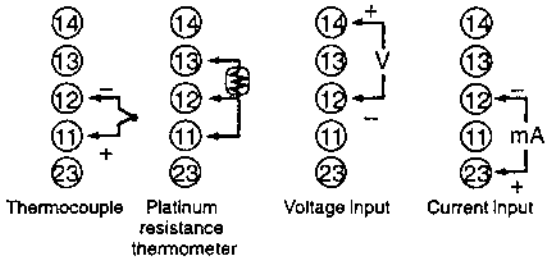
Input 100 to 240 VAC or AC/DC 24 V to terminal numbers 9 and 10 according to the specifications.



Sensor Input

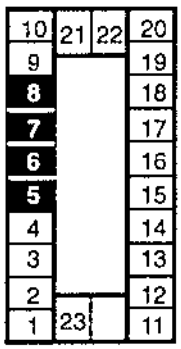
Connect the sensor input to terminal numbers 11 to 14 and 33 as follows according to the input type.

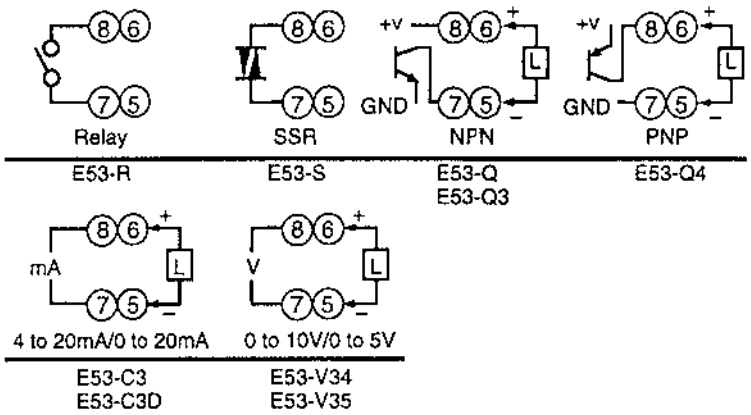




Control Output

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.





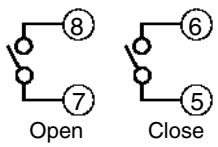
With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted.

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 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

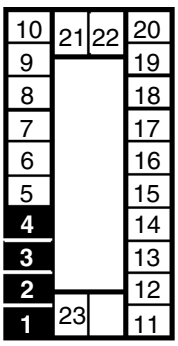
With E5EK-PRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

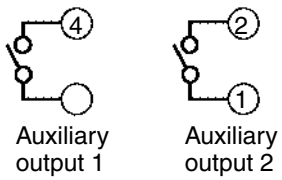
When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



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:

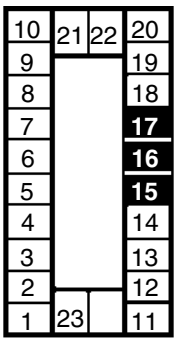


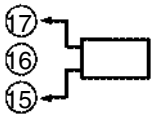


Output specifications are as follows:
SPST-NO, 3A at 250 VAC

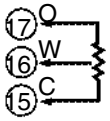
CT Input/Potentiometer

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:





CT input

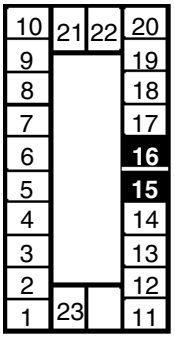


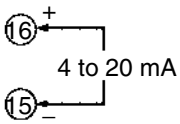
Potentiometer

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

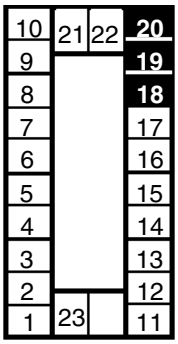
Connect the input (RSP) to be used as the remote SP to terminal numbers 15 and 16. However, note that the remote SP cannot be used on the E5EK-PRR2 Controller. Only 4 to 20 mA inputs can be connected. Connect the input as follows:

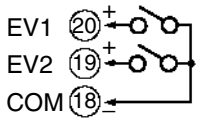




Event Input

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:



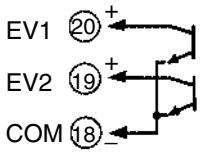


Event input 1 and 2

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.

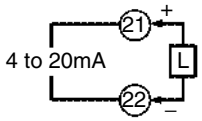
Polarities during no-contact input are as follows:



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.

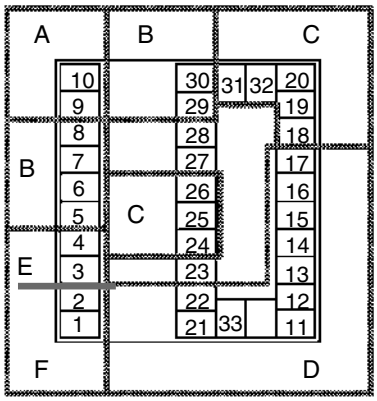
Solderless terminals are recommended when wiring the Controller.

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.

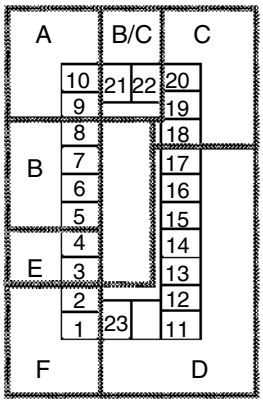
Power Blocks

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

E5AK



E5EK

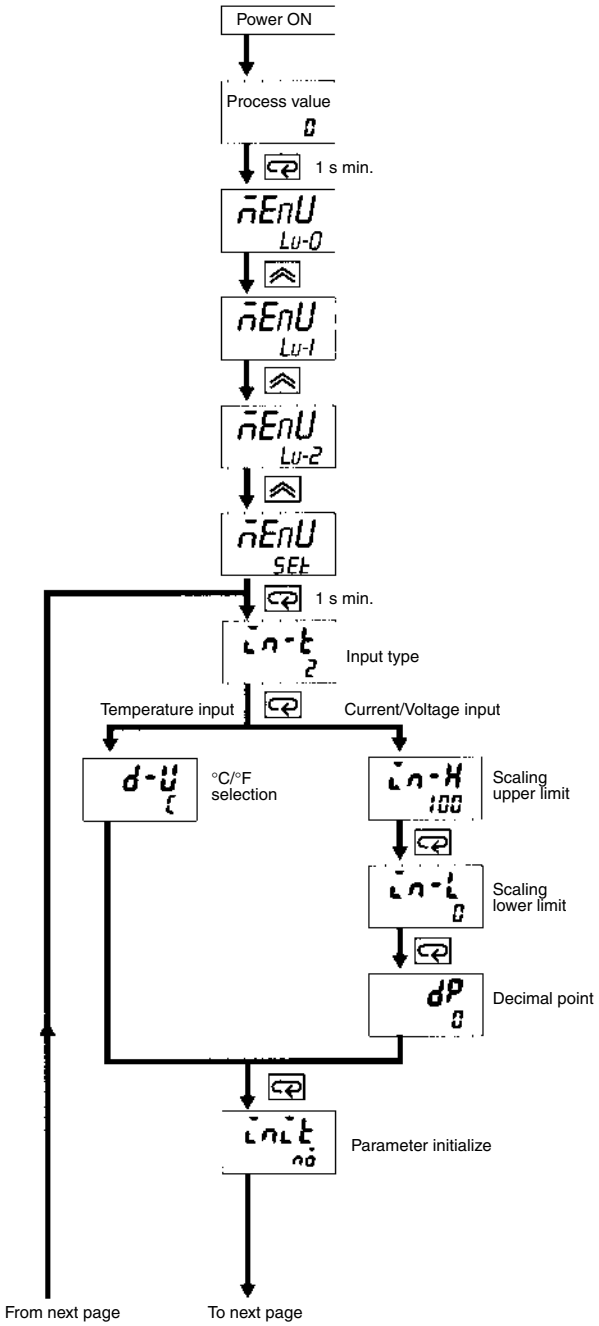


Note: Terminals 21 and 22 of the E5EK belong to the B block when a transfer output is set to option 1 and to the C block for other Option Units.

Operation

■ After Turning ON Power

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



■ Input Type

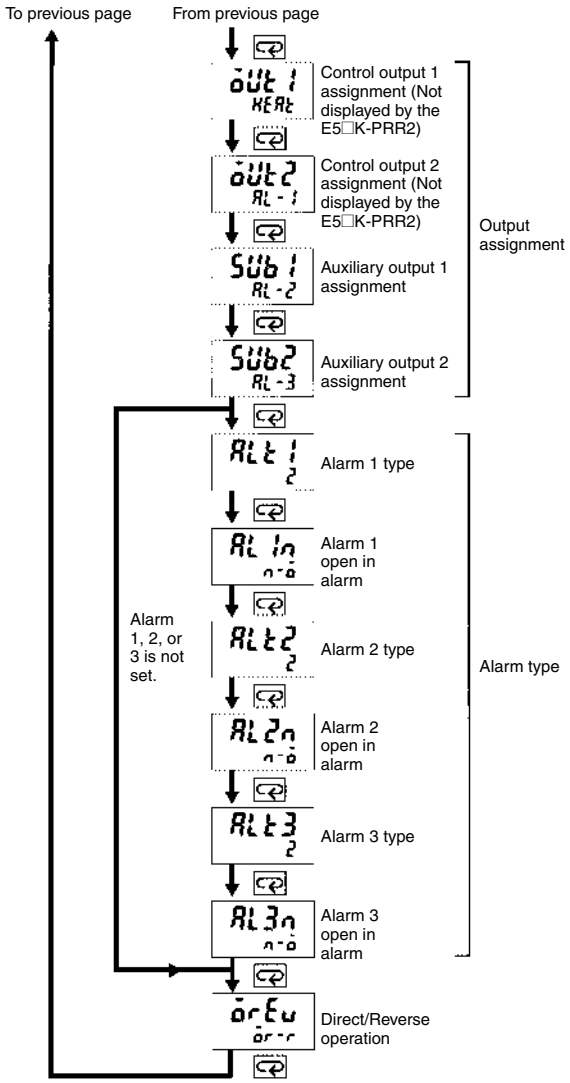
Set the code according to the following table. Default is "2: K1 thermocouple."

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)	
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)	
17	4 to 20 mA		Current input
18	0 to 20 mA		
19	1 to 5 V		Voltage input
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

Output function \ Assignment destination	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

Output function \ Assignment destination	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

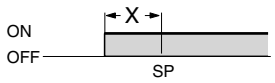
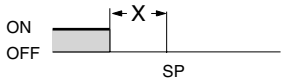
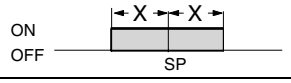
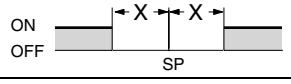
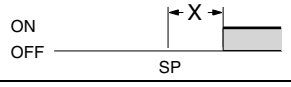
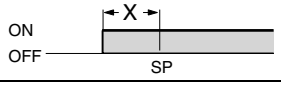
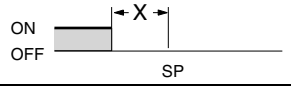
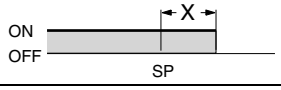
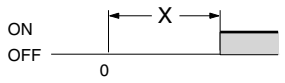
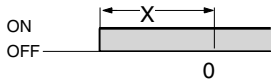
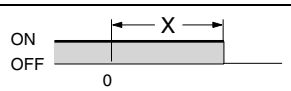
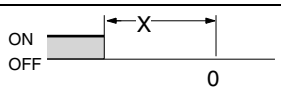
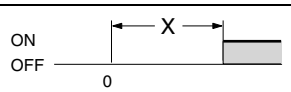
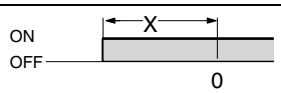
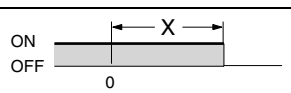
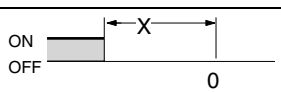
LBA

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.

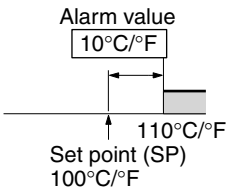
■ Alarm Mode Selectors

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		

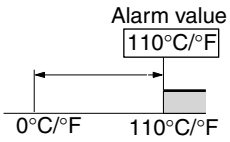
Deviation Alarm

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

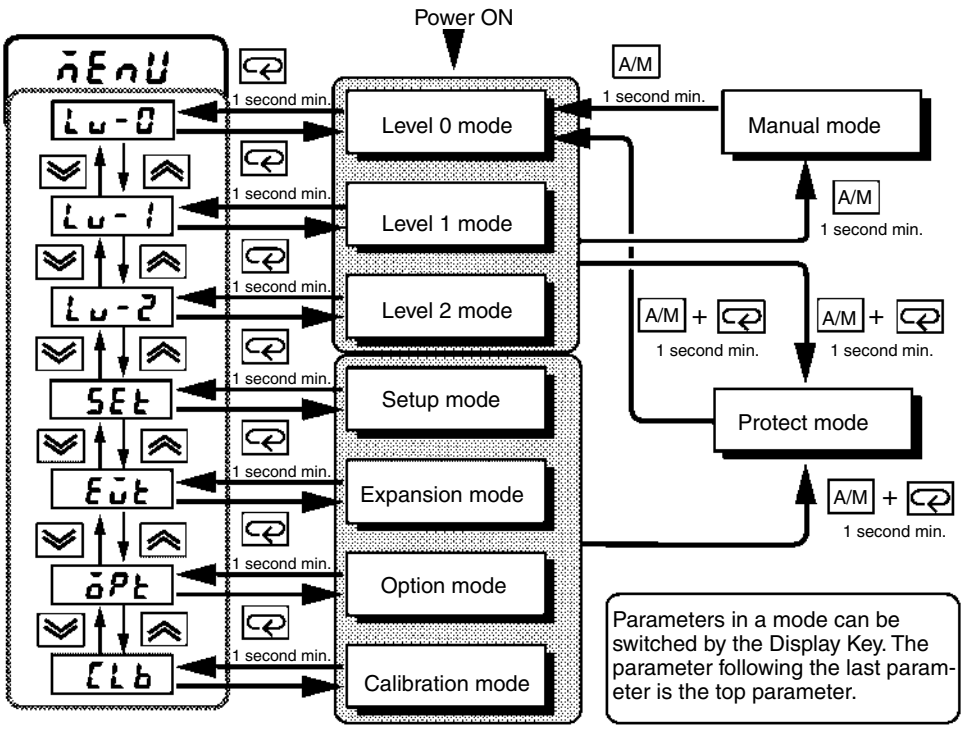
Alarm type and close in alarm (normally open)/open in alarm (normally close) can be set independently from each alarm.

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-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.

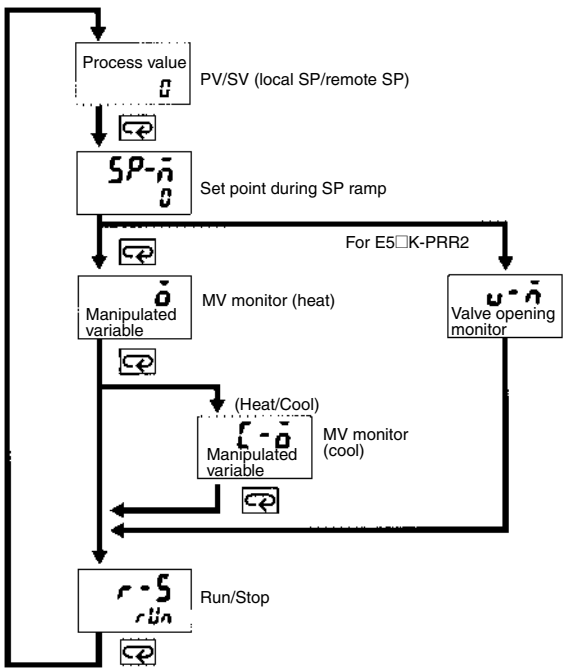
Level 0 Mode	Set the Controller to this mode during normal operation. In this mode, change the set point during operation, and start or stop Controller operation. The process value, ramp SP, and manipulated variable can only be monitored in this mode.
Level 1 Mode	The main mode for adjusting control. 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 93 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

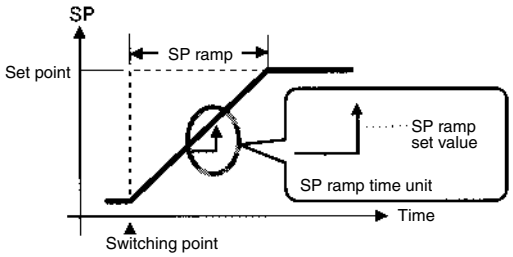
Monitors remote SP in the local SP mode.

Set Point During SP Ramp

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

SP Ramp

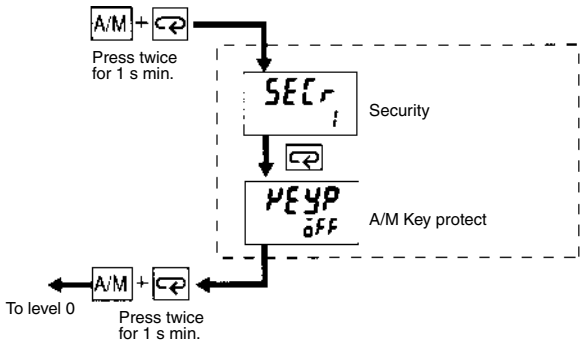
With the SP ramp function, the Controller operates according to the value (set point during SP ramp) limited by a change rate, instead of the changed set point when the set point is changed. The interval in which the set point during SP ramp is limited is referred to as the "SP ramp."



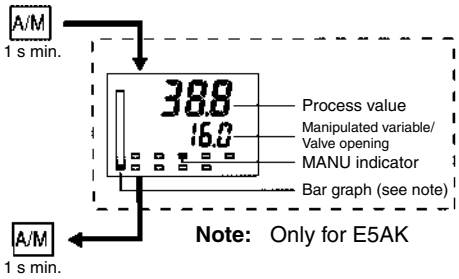
The change rate during the SP ramp is specified by the "SP ramp set value" and "SP ramp time unit" parameters. At the "SP ramp set value" default "0," the SP ramp function is disabled.

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."

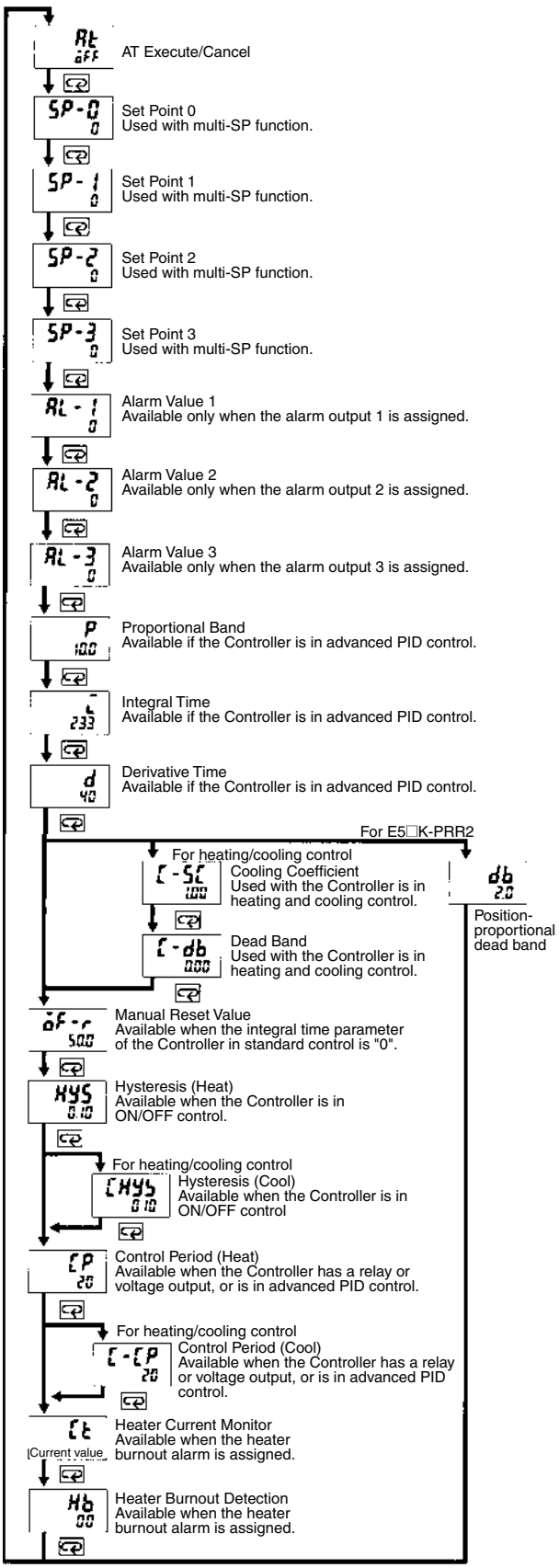
Only the "PV/SP" parameter in the level 0 mode can be used when this parameter is set to "5."

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

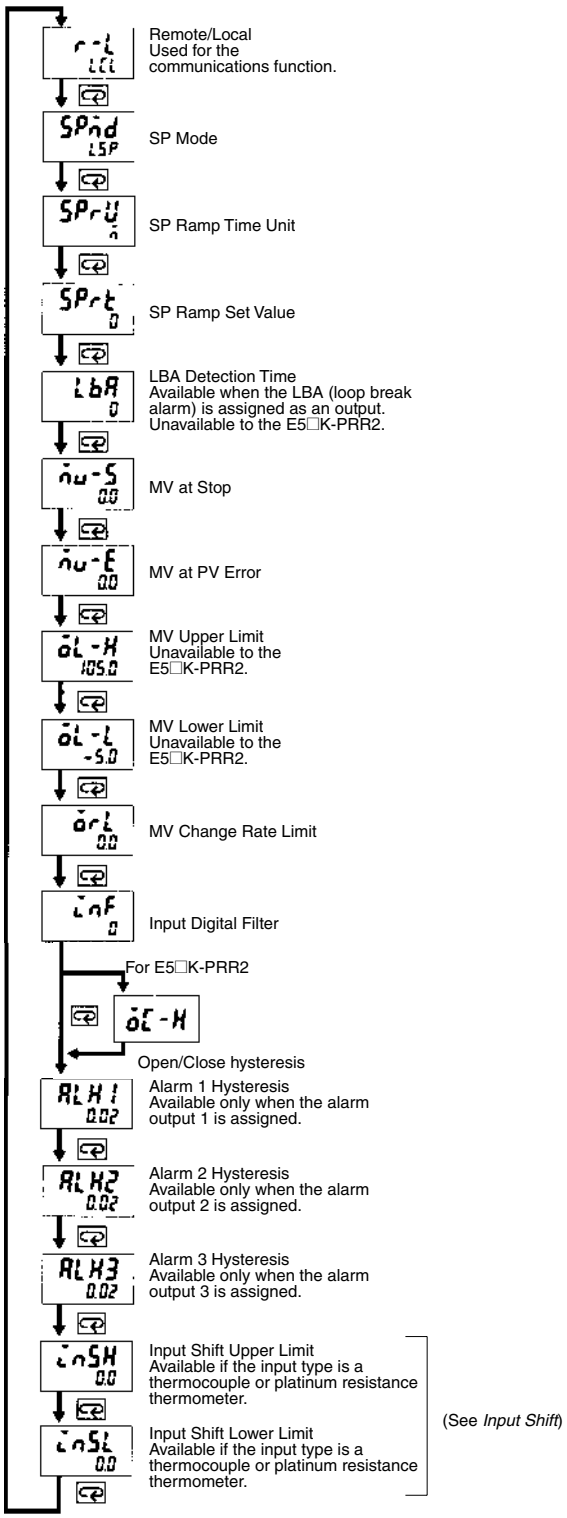
A/M Key Protect

Invalidate the function of the A/M Key.

Level 1 Mode



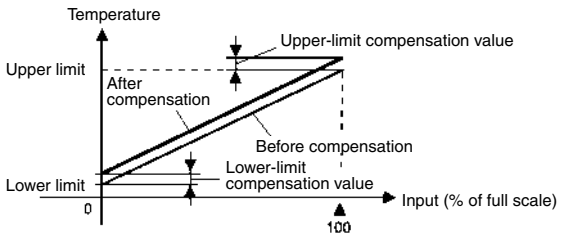
Level 2 Mode



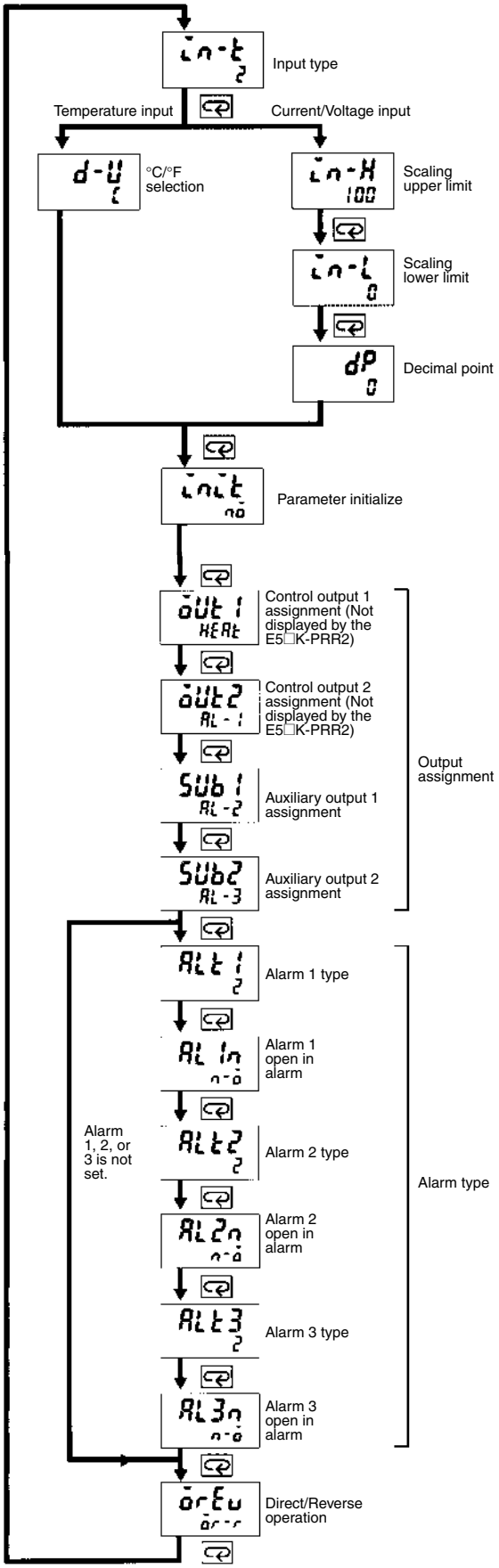
Input Shift

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.

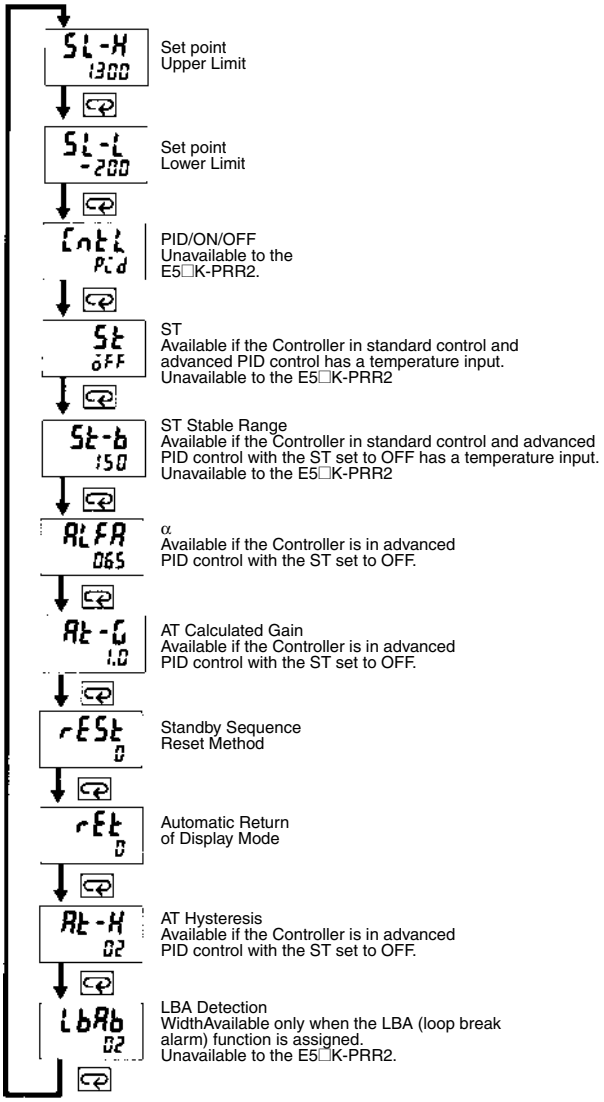
To set the input shift, set shift values in the “input shift upper limit” and “input shift lower limit” parameters (level 2 mode).



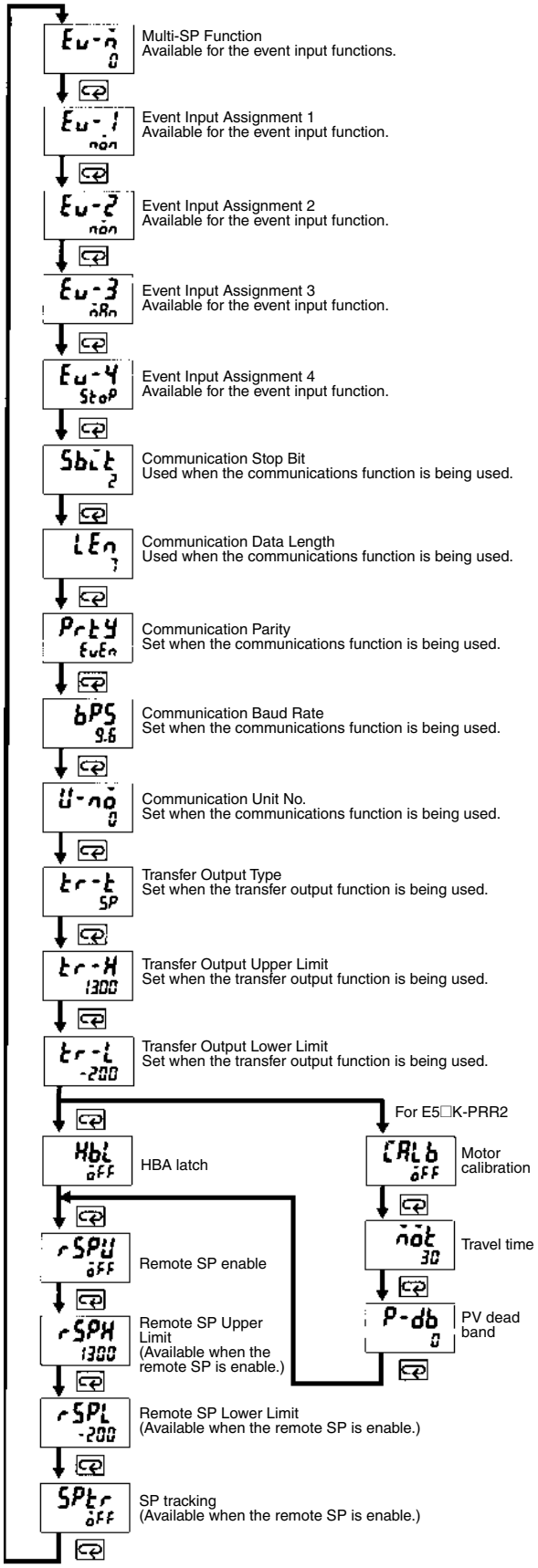
Setup Mode



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.

S.Err 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.

E111 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.

E333 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.Err Calibration Data Error

This error is output only during temperature input and is displayed for two seconds when the power is turned ON.

Meaning 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.

cccc / ɔɔɔɔ 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 ±10%) is larger than the display range (–1999 to 9999).

- When less than “–1999” cccc
- When greater than “9999” ɔɔɔɔ

Operation Control continues, allowing normal operation.

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

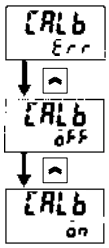
Meaning

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

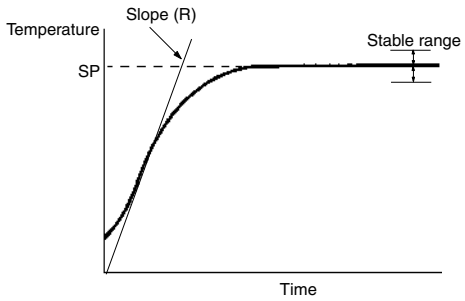
SRT will start if the following conditions are satisfied simultaneously when the E5AK/E5EK is turned on or the set point is changed.

At the time the E5AK/E5EK starts operating	At the time set point is changed
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).	**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 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.	**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.

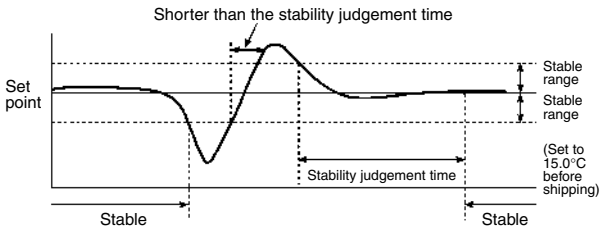
PID Constant Refreshing Conditions

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.



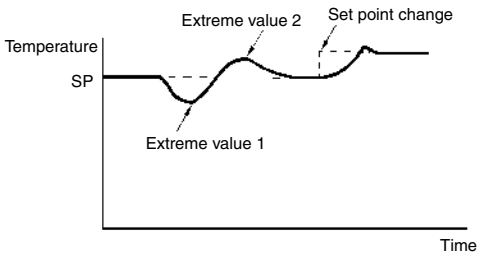
Balanced Status

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

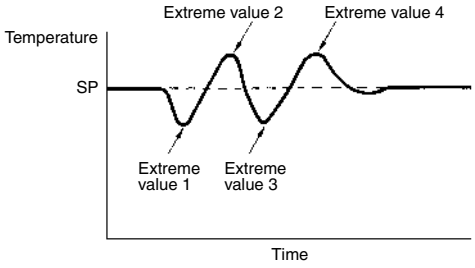
1. DT will start if the temperature that has been stable varies due to external disturbance and the deflection of the temperature exceeds the stable range, and then the temperature becomes stable, provided that the number of maximum temperature values is less than four.

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.

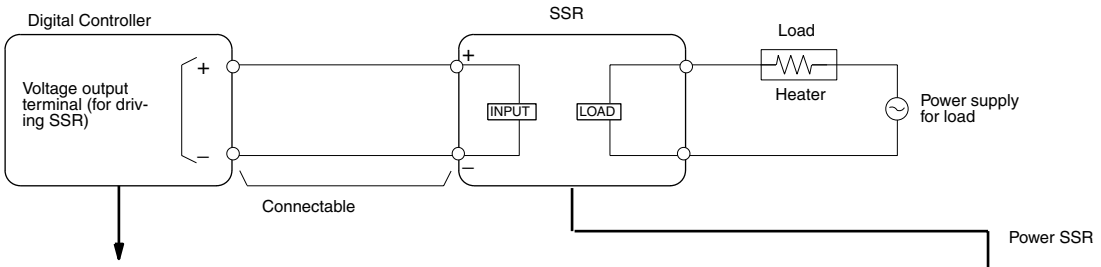


Note: In specific applications where temperature varies periodically due to disturbance, internal parameters need to be adjusted. For details, refer to the *E5AK/E5EK User's Manual (H83/H85)*.

Peripheral Devices

■ SSR

Connection Example of Digital Controller and SSR



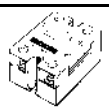
E5AK/E5EK

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

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.

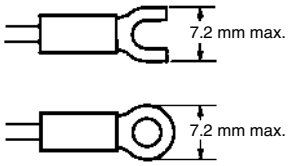
Use the specified compensating conductors for thermocouples. Use lead wires having a small resistance for platinum resistance thermometers.

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

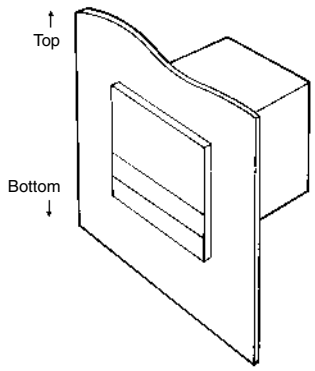
Period of Guarantee

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

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

E5AK-T/E5EK-T

1/4 DIN 1/8 DIN

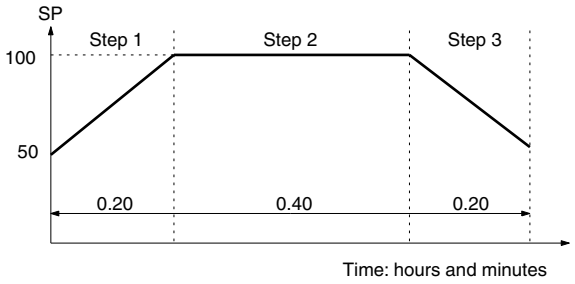
E5CK-T

1/16 DIN

Contents

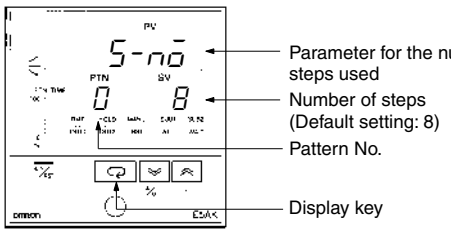
■ Programming is as easy as following the steps below.

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

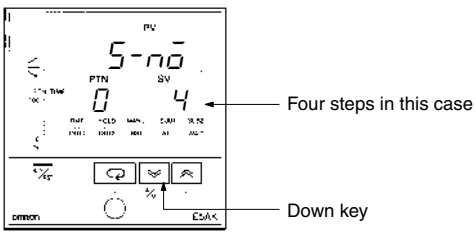


Step No.	Target value	Time (hours.minutes)
0	50	0.00
1	100	0.20
2	100	0.40
3	50	0.20

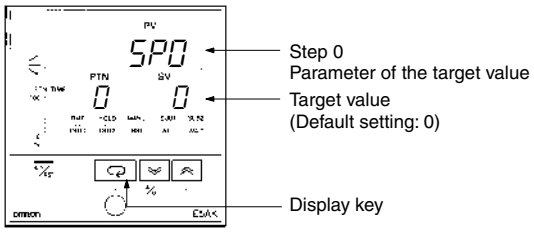
1. Press the Display Key to shift to the display for the number of steps.



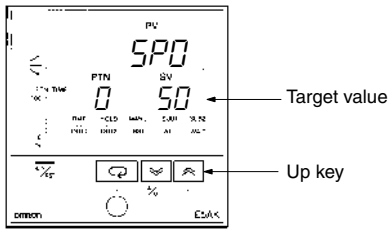
2. Press the Down Key and set the number of steps.



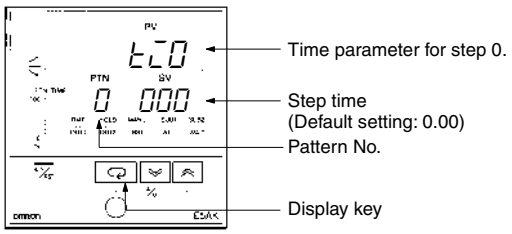
3. Press the Display Key to shift to the display for the target value of step 0.



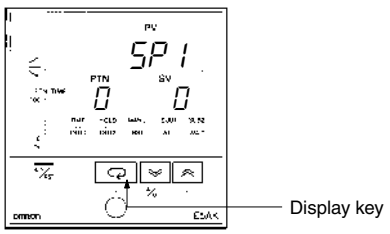
4. Set the target value to "50."



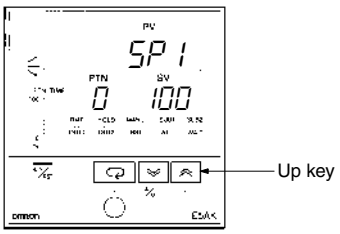
5. Press the Display Key to shift to the display for the time of step 0.



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.

Description	Model	Specification
Output Unit	E53-R	Relay
	E53-S	SSR
	E53-Q	Pulse (NPN) 12 VDC at 40 mA max.
	E53-Q3	Pulse (NPN) 24 VDC at 20 mA max.
	E53-Q4	Pulse (PNP) 24 VDC at 20 mA max.
	E53-C3	Linear (4 to 20 mA) under a load of 600 Ω max.
	E53-C3D	Linear (0 to 20 mA) under a load of 600 Ω max.
	E53-V34	Linear (0 to 10 V) under a load of 1 kΩ min.
	E53-V35	Linear (0 to 5 V) under a load of 1 kΩ min.

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 133 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-TAA2-K, E5□K-TPRR2-K

■ Accessories (Order Separately)

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

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

Name	Model	Connectable models
Terminal Cover	E53-COV0809	E5AK
	E53-COV08	E5EK

Unit Label

Model	Y92S-L1

Specifications

■ Ratings

Item	100- to 240-VAC type	24-VAC/VDC type
Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC/VDC, 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	
Sensor 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 (Input impedance: 150 Ω) Voltage input: 1 to 5 V, 0 to 5 V, 0 to 10 V (Input impedance: 1 MΩ)	
Control output	According to Output Unit (see *Output Unit Ratings and Characteristics*)	
Auxiliary output	SPST-NO, 3 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	
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	
Current Transformer input	Connect an exclusive Current Transformer (E54-CT1 or E54-CT3)	
Other functions	Standard Manual output, heating/cooling control, SP limiter, loop burnout alarm, MV limiter, MV change rate limiter, input digital filter, input shift, run/reset, protect functions, scaling function	

■ 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

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).

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)	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)
Set time	0 to 99 hrs 59 min or 0 to 99 min 59 s
Program capacity	8 patterns (E5AK) or 4 patterns (E5EK), 16 steps
Programming method	Time or ramp setting method
Time accuracy	±0.2% (±500 ms) of the set value
Sampling period	Temperature input: 250 ms Analog 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: 3 V (47 to 68 MHz) 10 V (0.15 to 47 MHz, 68 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, CSA C22.2 No. 142 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 max. 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 max. is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C max. is ±3°C ±1 digit maximum.
The indication accuracy of the W thermocouple at any temperature is (±0.3% of the indicated value or ±2°C, whichever is greater) ±1 digit maximum.
The indication accuracy of the PLII thermocouple at any temperature is (±0.3% of the indicated value or ±2°C, whichever is greater) ±1 digit maximum.

■ Output Unit Ratings and Characteristics

Model		Specifications
E53-R	**Relay output**	5 A at 250 VAC (resistive load)
E53-S	**SSR output**	1 A at 75 to 250 VAC (resistive load)
E53-Q	**Voltage output**	NPN: 40 mA at 12 VDC (with short-circuit protection)
E53-Q3		NPN: 20 mA at 24 VDC (with short-circuit protection)
E53-Q4		PNP: 20 mA at 24 VDC (with short-circuit protection)
E53-C3	**Linear current output**	4 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2,600
E53-C3D		0 to 20 mA, permissible load impedance: 600 Ω max., resolution: approx. 2,600
E53-V34	**Linear voltage output**	0 to 10 VDC, permissible load impedance: 1 kΩ min., resolution: approx. 2,600
E53-V35		0 to 5 VDC, permissible load impedance: 1 kΩ min., 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

Model			Specifications
E53-AKB	**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.
E53-AK01	**Communications**	**RS-232C**	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
E53-AK02		**RS-422**	
E53-AK03		**RS-485**	
E53-AKF	**Transfer output**		4 to 20 mA: Permissible load impedance: 600 Ω max. Resolution: approx. 2,600

Note: Event input is used for switching the target value, run or stop command, or automatic and manual mode with an external signal input.

■ 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	±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

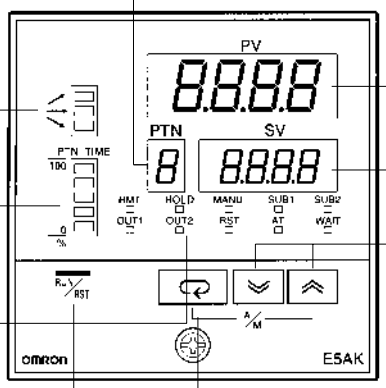
Pattern Number
Indicates the pattern number.

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.

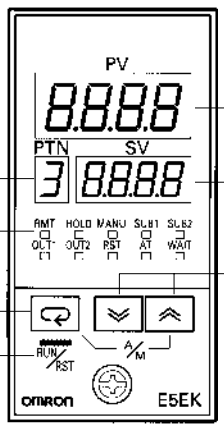
Display 2
Displays the present SP, manipulated variable, or parameter settings.

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



Pattern Number

Operation indicators

Display Key

RUN/RST Key

Display 1

Display 2

Up Key/Down 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

Specifications

■ Ratings

Item	100- to 240-VAC type	24-VAC/VDC type
Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC/VDC, 50/60 Hz
Power consumption	15 VA	6 VA, 3.5 W
Operating voltage range	85% to 110% of rated supply voltage	
Sensor 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, 3 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	Standard Manual output, heating/cooling control, SP limiter, loop burnout alarm, MV limiter, MV change rate limiter, input digital filter, input shift, run/reset, protect functions, scaling function	

■ 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).

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 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)
Program capacity	4 patterns, 16 steps (possible to use up to 4 patterns with the communications function.)
Programming method	Time or ramp setting method
Time accuracy	±0.2% (±500 ms) of the set value
Sampling period (see note 2)	Temperature input: 250 ms Analog 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: 4kV contact discharge (level 2) 8kV air discharge (level 3) Immunity RF-interference: ENV50140: 10V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 3 V (47 to 68 MHz) 10 V (0.15 to 47 MHz, 68 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2kV power-line (level 3) 2kV I/O signal-line (level 4)
Approved standards	UL1092, CSA22.2 No. 142, CSA C22.2 No. 142 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 max. 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 max. is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C max. 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

Model	Control output 1/Control output 2
E53-R4R4	Relay / Relay
E53-Q4R4	Voltage (NPN) / Relay
E53-Q4HR4	Voltage (PNP) / Relay
E53-C4R4	4 to 20 mA / Relay
E53-C4DR4	0 to 20 mA / Relay
E53-V44R4	0 to 10 mA / Relay
E53-Q4Q4	Voltage (NPN) / Voltage (NPN)
E53-Q4HQ4H	Voltage (PNP) / Voltage (PNP)

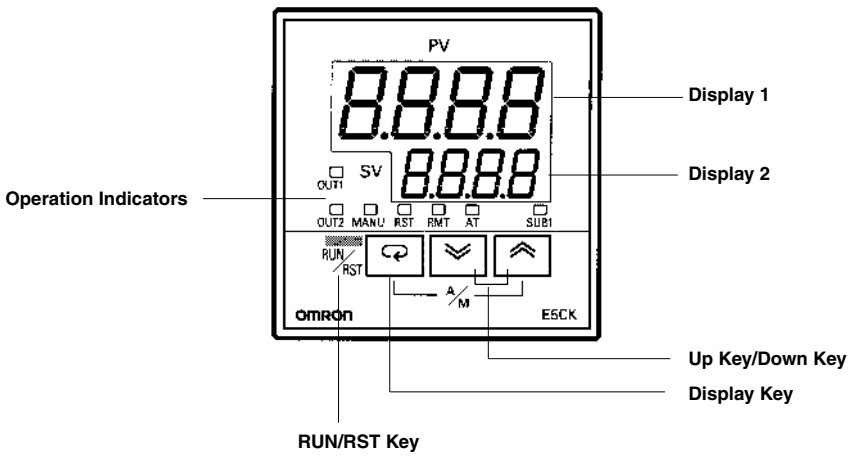
Output Type	Specifications
Relay	250 VAC. 3 A
Voltage (NPN)	12 VDC, 20 mA (with short-circuit protection)
Voltage (PNP)	12 VDC, 20 mA (with short-circuit protection)
0 to 10 V	0 to 10 VDC, Permissible load impedance: 1 kΩ min., Resolution: Approx. 2600
4 to 20 mA	4 to 20 mA, Permissible load impedance: 500 Ω max., Resolution: Approx. 2600

■ Option Unit Ratings and Characteristics

Model			Specifications
E53-CKB	**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.
E53-CK01	**Communications**	**RS-232C**	Transmission method: Half-duplex Synchronization method: Start-stop synchronization (asynchronous method) Baud rate: 1.2/2.4/4.8/9.6/19.2 kbps
E53-CK03		**RS-485**	
E53-CKF	**Transfer output**		4 to 20 mA DC: Permissible load impedance: 600 Ω max. Resolution: approx. 2,600

Note: Event input is used for switching the target value, run or stop command, or automatic and manual mode with an external signal input.

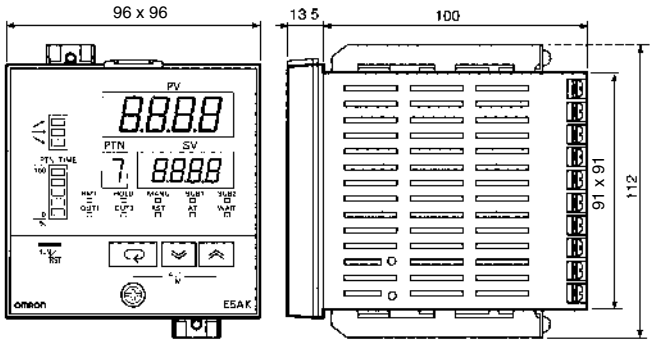
Nomenclature



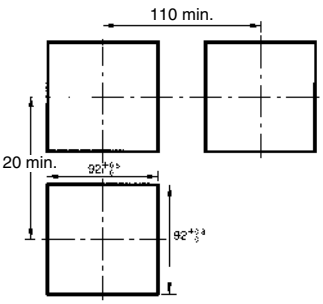
Dimensions

Note: All units are in millimeters unless otherwise indicated.

E5AK



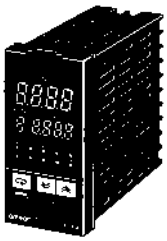
Panel Cutouts

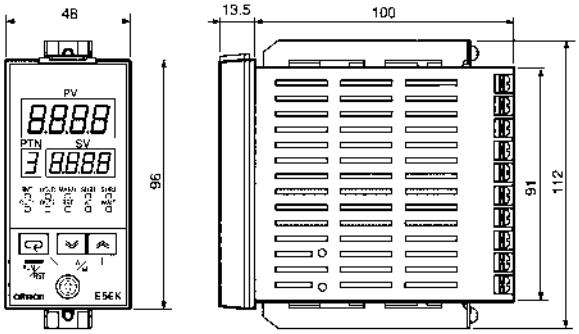


Note: 1. Recommended panel thickness is 1 to 8 mm.

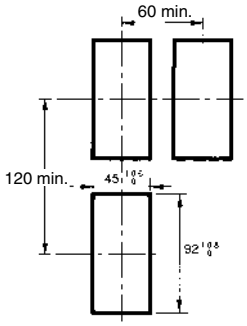
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

E5EK





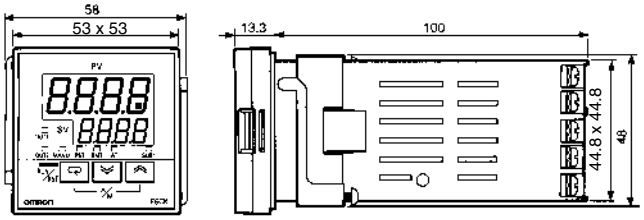
Panel Cutouts



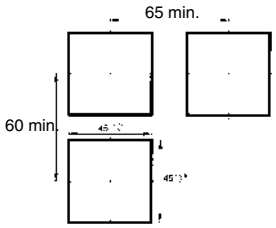
Note: 1. Recommended panel thickness is 1 to 8 mm.

2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

E5CK



Panel Cutouts



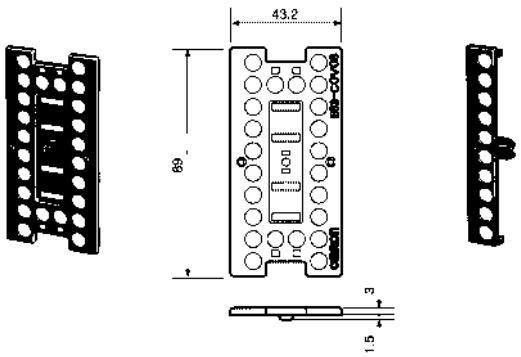
Note: 1. Recommended panel thickness is 1 to 5 mm.

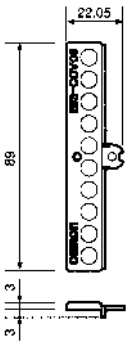
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

Accessories (Order Separately)

Terminal Cover

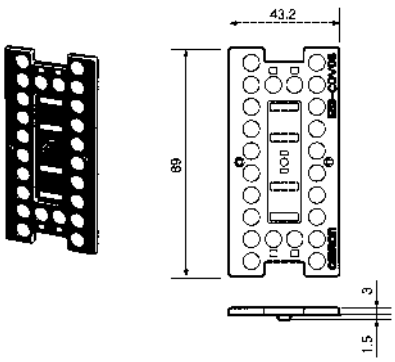
E53-COV0809 (E5AK)





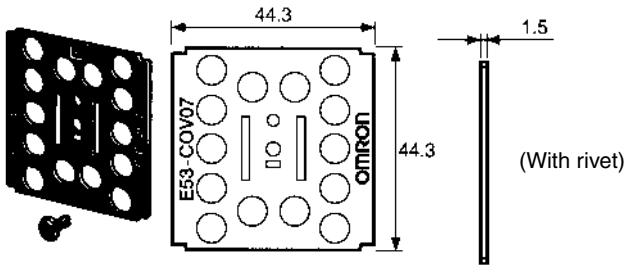
(With rivet)

E53-COV08 (E5EK)



(With rivet)

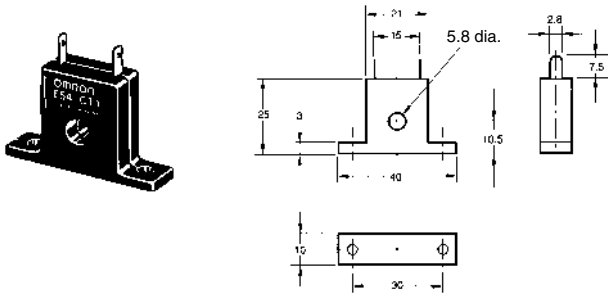
E53-COV07



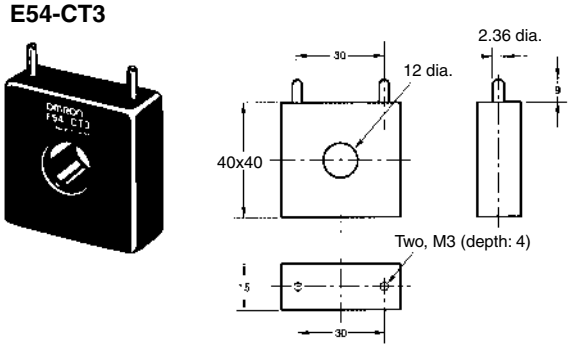
(With rivet)

Current Transformer

E54-CT1

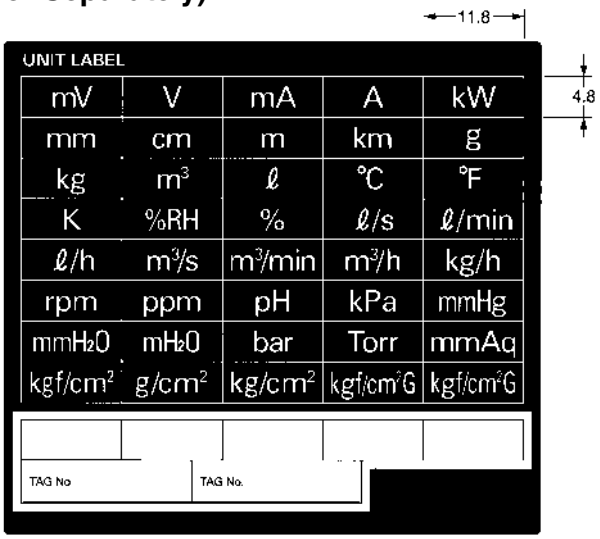


E54-CT3



Unit Label (Order Separately)

Y92S-L1



Installation

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

■ Settings (E5AK/E5EK)

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.)

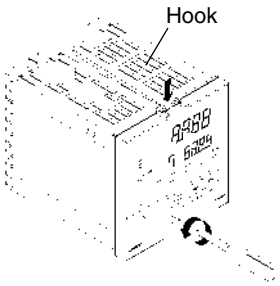
When setting up the Output Units, draw out the internal mechanism from the housing and insert the Output Units into the sockets for control outputs 1 and 2.

E5AK

Draw-out

When drawing out the internal mechanism from the housing, prepare a Phillips screwdriver matched to the size of the screw on the lower part of the front panel.

1. Press down on the hook on the top of the front panel, and turn the Phillips screwdriver to the left to loosen the screw on the lower part of the front panel.



2. Draw out the internal mechanism towards you holding both sides of the front panel.

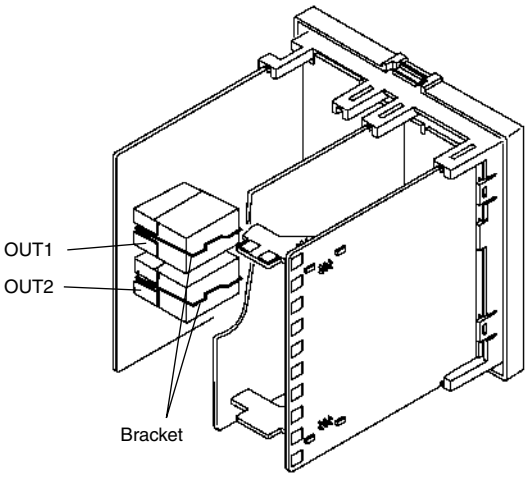
Setting Up the Output Unit

• Before Setup

Check the type of the Output Unit you are about to set up.

• Procedure

1. Check the positions of the sockets you are about to insert the Output Units into as shown in the following diagram.



2. Insert the Output Unit for control output 1 into the socket “OUT1” and the Output Unit for control output 2 into the socket “OUT2.”
3. Fasten the Output Units with the bracket (accessory).

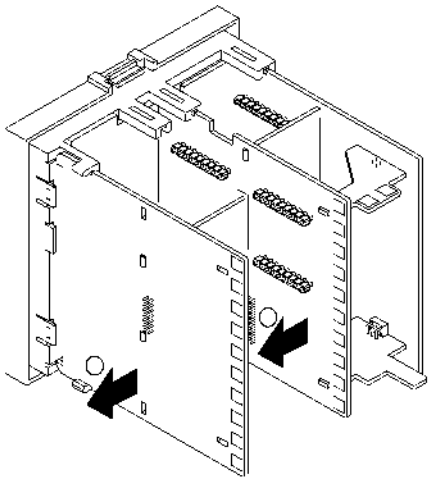
Setting Up the Option Unit

• Before Setup

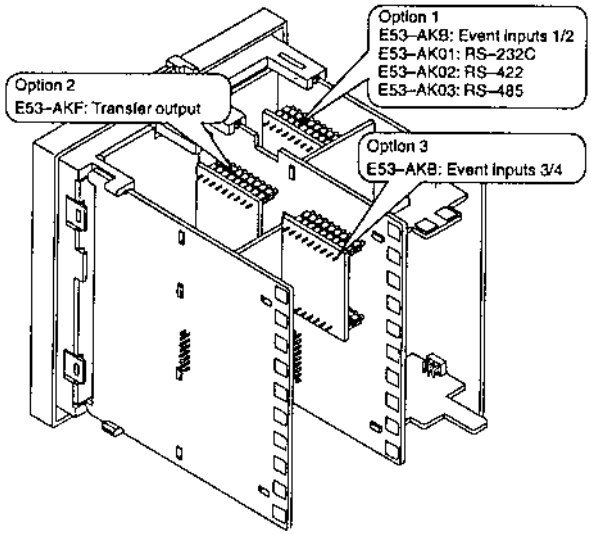
Check the type of the Option Unit you are about to set up.

• Procedure

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



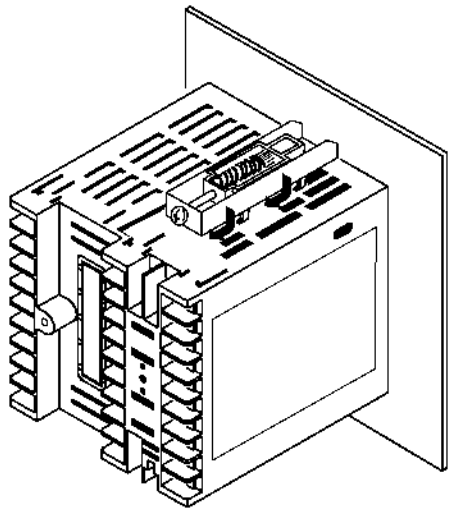
2. Insert the Option Units into the sockets for options 1 to 3. The following diagram shows the relationship between the Option Units and mounting positions.



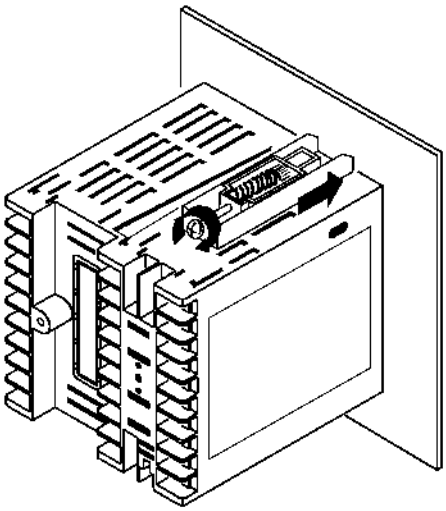
3. Mount the Option Boards and the power board in the order shown.

Mounting

1. Insert the E5AK-T Controller into the mounting hole in the panel.
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 alternately a little at a time until the ratchet starts to slide.



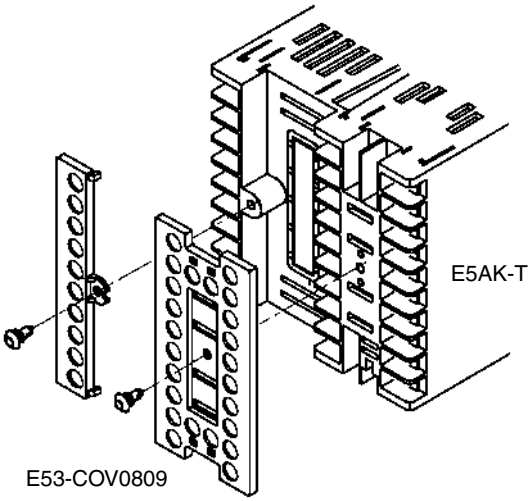
Setting Up the Terminal Cover

Fasten the Terminal Covers (E53-COV0809) to protect terminals.

E5AK-VV2-500 Controller is provided with Terminal Covers.

Use E53-COV09 for terminals 1 to 10, and E53-COV08 for terminals 11 to 33.

Fasten the Terminal Covers as follows by using the snap pins.

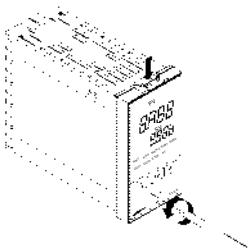


E5EK

Draw-out

When drawing out the internal mechanism from the housing, prepare a Phillips screwdriver matched to the size of the screw on the lower part of the front panel.

1. Press down on the hook on the top of the front panel, and turn the Phillips screwdriver to the left to loosen the screw on the lower part of the front panel.



2. Draw out the internal mechanism towards you holding both sides of the front panel.

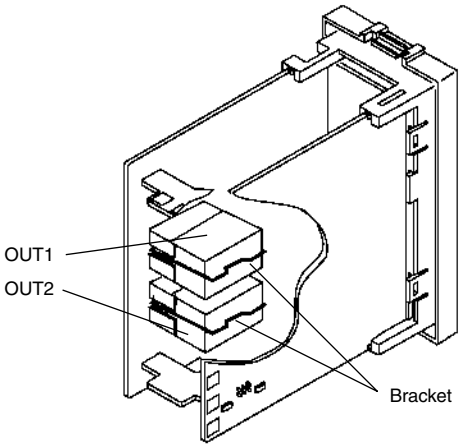
Setting Up the Output Unit

• Before Setup

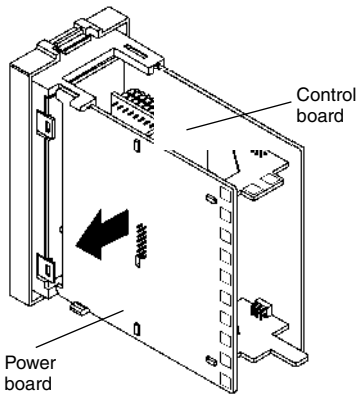
Check the type of the Option Unit you are about to set up.

• Procedure

1. Check the positions of the sockets you are about to insert the Output Units into as shown in the following diagram.



2. Remove the power board in the direction of the arrow in the figure below. The power board is connected to the control board by a connector at the center of the board.



3. Insert the Output Unit for control output 1 into the socket “OUT1” and the Output Unit for control output 2 into the socket “OUT2.”
4. Fasten the Output Units with the bracket (accessory).
5. Mount the power board at its original position.

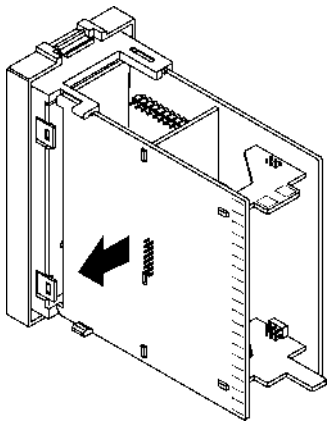
Setting Up the Option Unit

• Before Setup

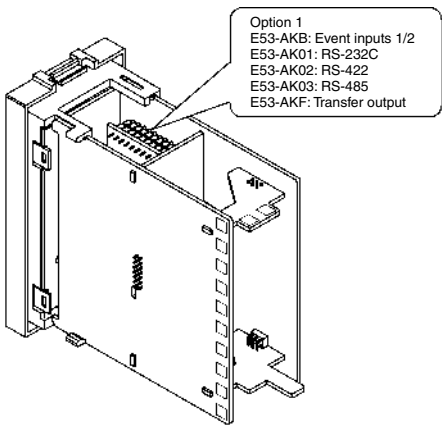
Check the type of the Option Unit you are about to set up.

• Procedure

1. Remove the power board and Option Boards in the order shown in the following diagram.



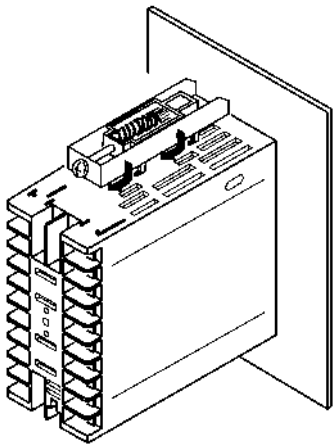
2. Insert the Option Unit into the socket for option 1. The following diagram shows the relationship between Option Unit and mounting position.



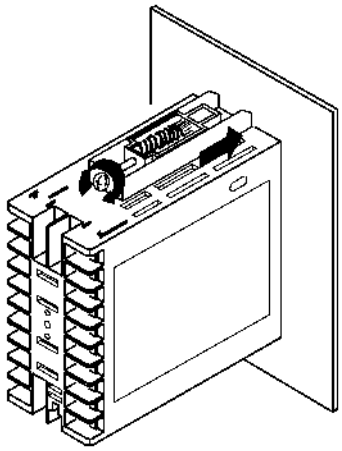
3. Mount the Option Board and the power board in the order shown.

Mounting

1. Insert the E5EK-T Controller into the mounting hole in the panel.
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 alternately a little at a time until the ratchet starts to slide.



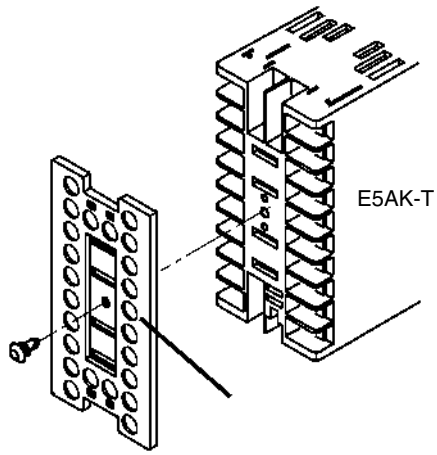
Setting Up the Terminal Cover

Fasten the Terminal Covers (E53-COV0809) to protect terminals.

E5AK-VV2-500 Controller is provided with Terminal Covers.

Use E53-COV09 for terminals 1 to 10, and E53-COV08 for terminals 11 to 33.

Fasten the Terminal Covers as follows by using the snap pins.



E53-COV08

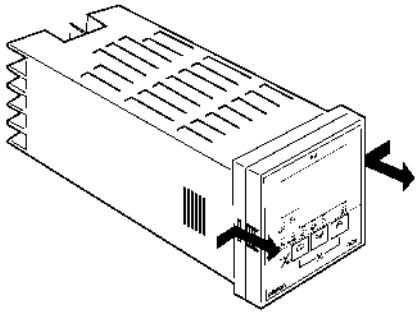
To remove the Terminal Covers, pull the edges of the snap pins.

E5CK

Draw-out

Draw out the internal mechanism from the housing.

1. Press in both of the hooks on the left and right sides of the front panel to unlock the internal mechanism from the housing.



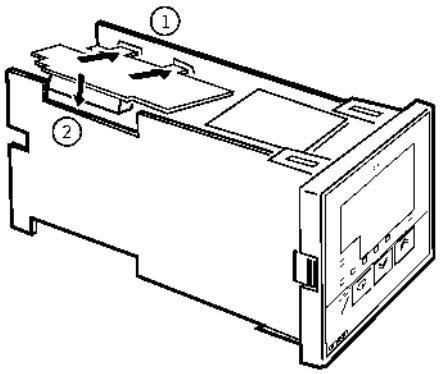
2. Draw out the internal mechanism towards you holding both sides of the front panel.

Setting Up the Output Unit

• Procedure

1. Two rectangular holes for slotting are provided on the power board (on right side of Controller). Fit the two protrusions on 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 (on left side of Controller).

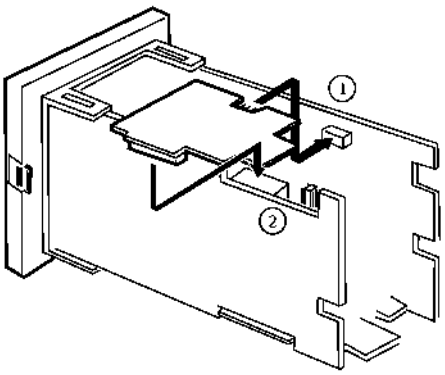


Setting Up the Option Unit

• Procedure

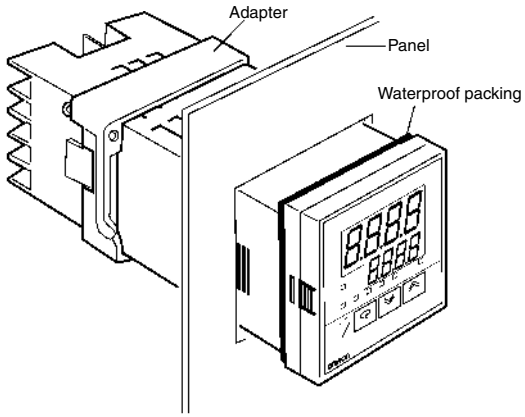
1. Place the Controller with its bottom facing up, and fit the board horizontally into the connector on the power board (on right side of Controller).

2. With the power board connected, fit the board vertically into the connector on the control board (on left side of Controller).



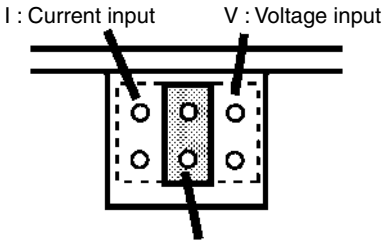
Mounting

1. Insert the E5EK-T Controller into the mounting hole in the panel.
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.



Setting the Input Type Jumper

Set the jumper to one of temperature input, voltage input or current input matched to the type of sensor connected to the input terminal.



The input type jumper is factory-set to “TC/PT (temperature input).”

When you disconnect or insert the input type jumper, do not hold it directly by its pins.

When you have finished setting the input type jumper, insert the internal mechanism back into the housing.

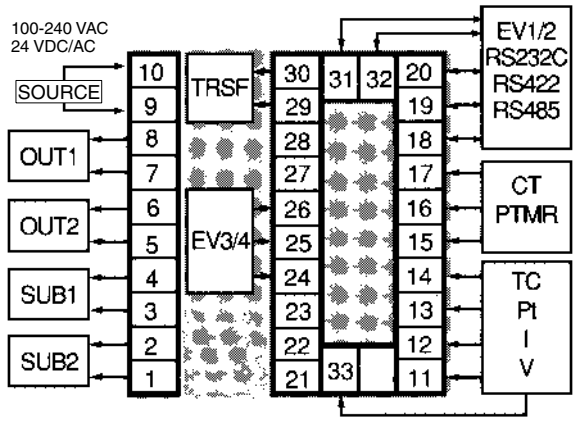
To do this, push in the internal mechanism until you hear the hooks on the front panel snap into place.

Wiring

■ Wiring Terminals

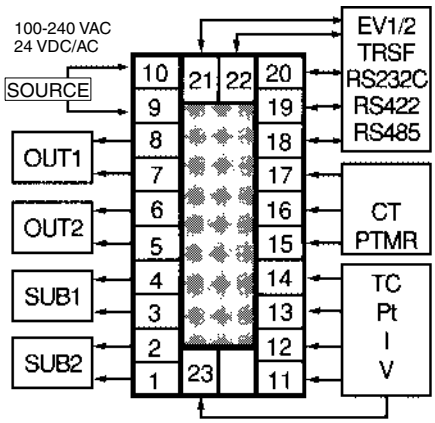
Terminal Arrangement

E5AK-T



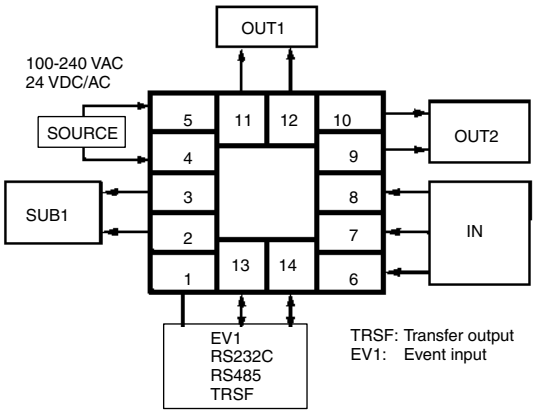
TRSF: Transfer output
EV1 to 4: Event input
PTMR: Potentiometer

E5EK-T



TRSF: Transfer output
EV1/2: Event input
PTMR: Potentiometer

E5CK-T



TRSF: Transfer output
EV1: Event input

■ Precautions when Wiring

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

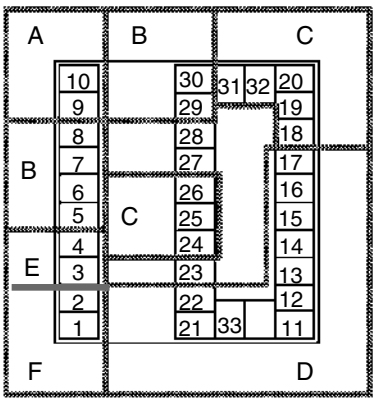
Solderless terminals are recommended when wiring the Controller.

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.

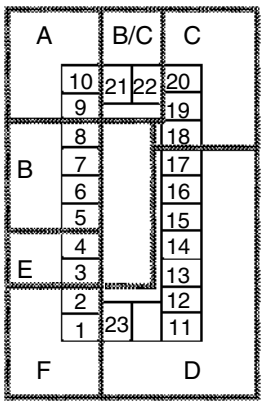
Power Blocks

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

E5AK



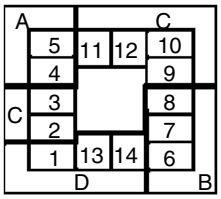
E5EK



E5CK

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

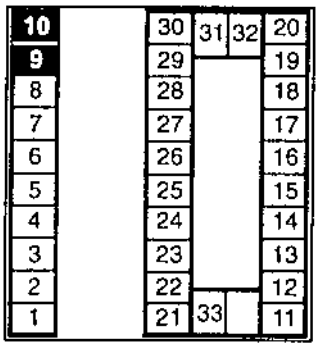


■ E5AK Wiring

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

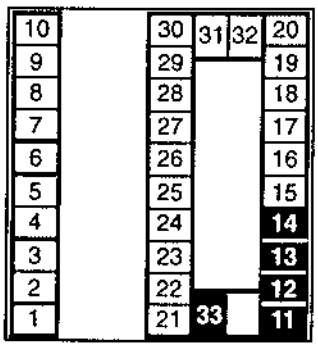
Power Supply

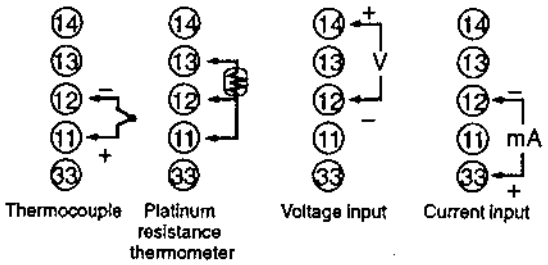
Input 100 to 240 VAC or 24 VAC/DC to terminal numbers 9 and 10 according to the specifications.



Sensor Input

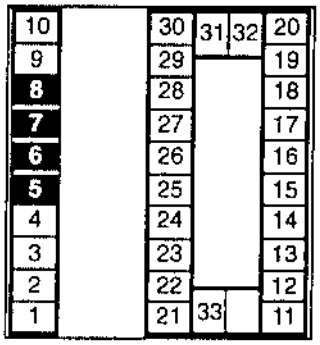
Connect the sensor input to terminal numbers 11 to 14 and 33 as follows according to the input type.

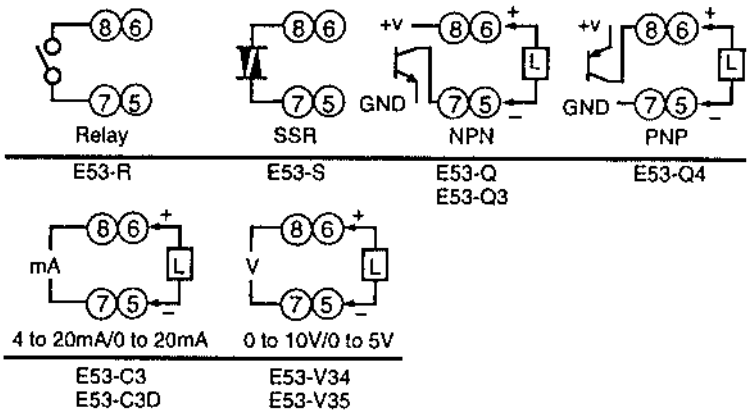




Control Output

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.

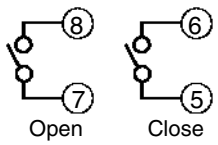




With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted.

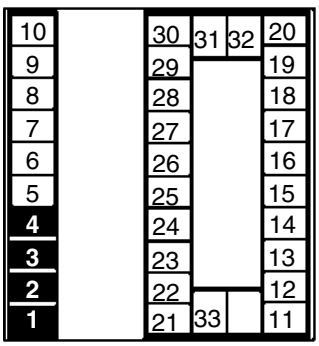
With E5AK-TPRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

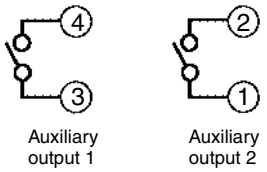
When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



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:

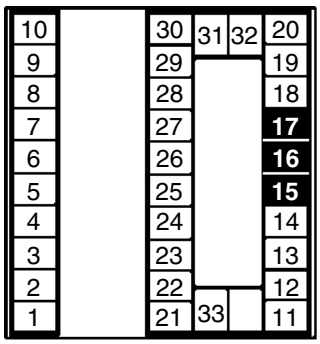


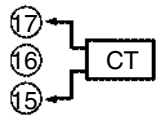


Output specifications are as follows:
SPST-NO, 3 A at 250 VAC

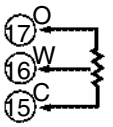
CT Input/Potentiometer

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:





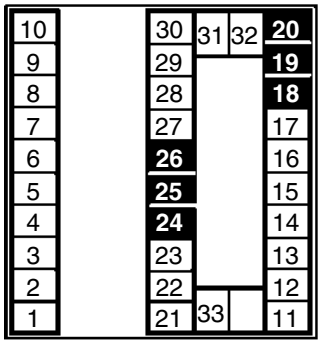
CT input

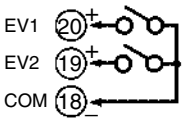


Potentiometer

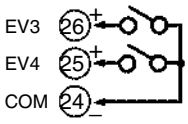
Event Input

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:





Event input 1 and 2



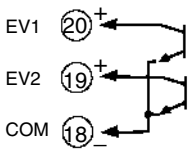
Event input 3 and 4

Terminals 18 and 24 (COM) are connected internally.

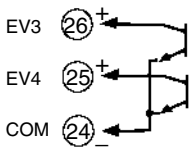
Use event inputs under the following conditions:

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:



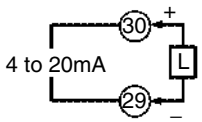
Event input 1 and 2



Event input 3 and 4

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 DC,
Permissible load impedance: 600 Ω max.,
Resolution: Approx. 2,600

Communications

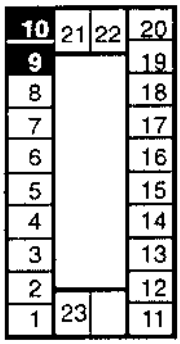
Terminal numbers 18 to 20, 31 and 32 can be used only on Controllers with Communications Units (E53-AK01/02/03). For details on wiring, refer to *Chapter 6, Using the Communications Function* in the *E5AK-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90).*

■ E5EK Wiring

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

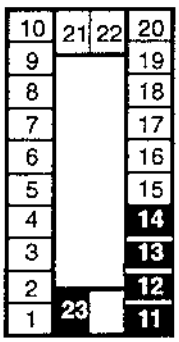
Power Supply

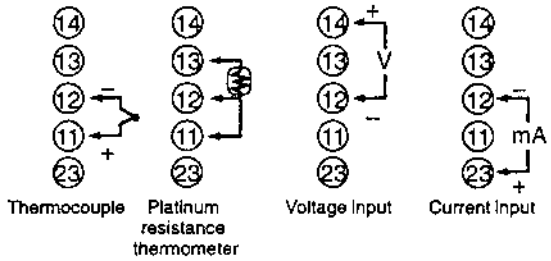
Input 100 to 240 VAC or 24 VAC/DC to terminal numbers 9 and 10 according to the specifications.



Sensor Input

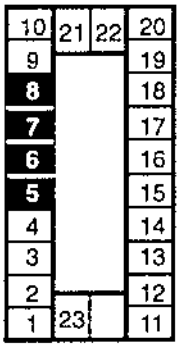
Connect the sensor input to terminal numbers 11 to 14 and 23 as follows according to the input type.

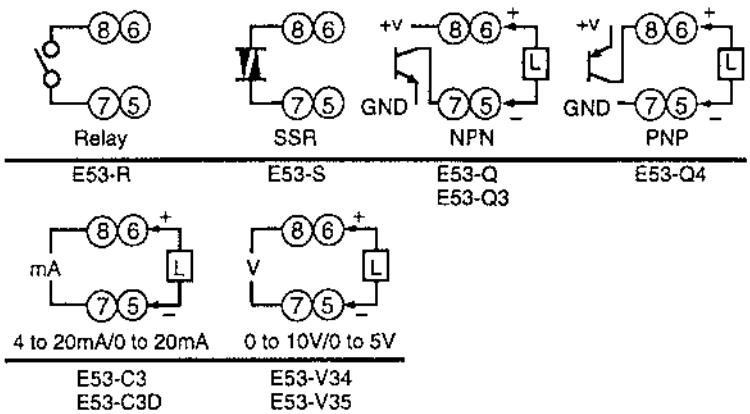




Control Output

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.

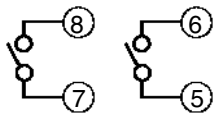




With E53-V□□ Output Units, approx. 2 V is output for one second after the power is interrupted.

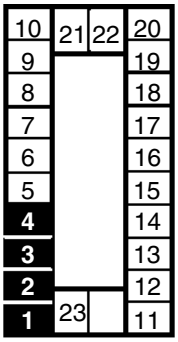
With E5EK-TPRR2 Controllers, the relay output (1 A at 250 VAC) is fixed.

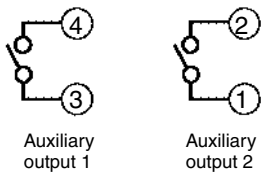
When replacing the Output Unit, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



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:



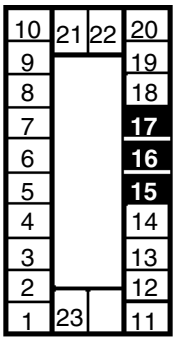


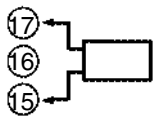
Output specifications are as follows:

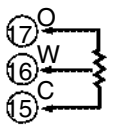
SPST-NO, 3A at 250 VAC

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-TPRR2 Controller, connect the potentiometer (PTMR) to terminal numbers 15 to 17. Connect each of these inputs as follows:



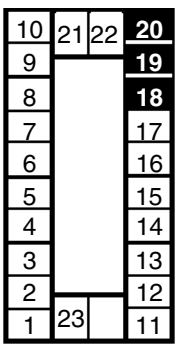


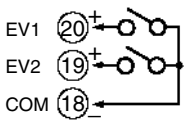


For details on CT inputs, refer to *Appendix, About Current Transformer* in the *E5AK-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90)*. For details on the potentiometer, refer to the *Instruction Manual* for the valve connected to the Controller. The variable resistance range is 100 Ω to 2.5 kΩ.

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:

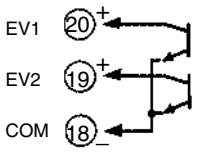




Use event inputs under the following conditions:

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.

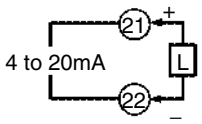
Polarities during no-contact input are as follows:



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 DC,
Permissible load impedance: 600 Ω max.,
Resolution: Approx. 2,600

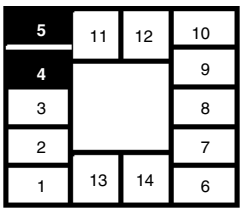
Communications

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-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90)*.

■ E5CK Wiring

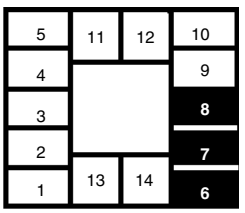
Power Supply

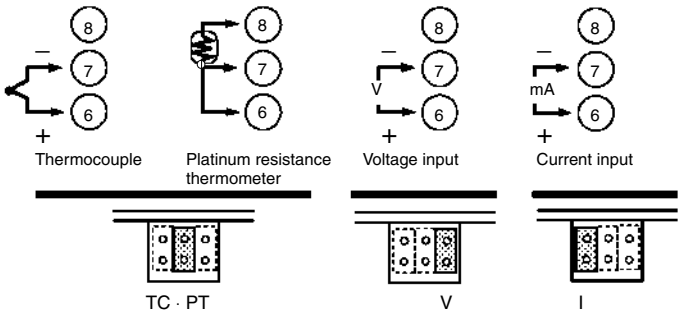
Input 100 to 240 VAC or 24 VAC/DC to terminal numbers 4 and 5 according to the specification.



Sensor Input

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

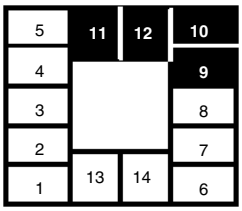


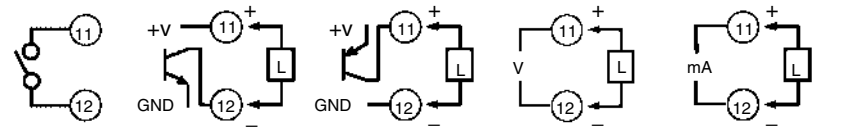


Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the inputs to a common position (TC/PT) as the temperature input.

Control Output

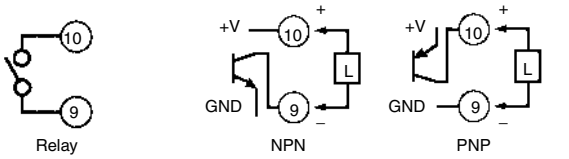
Terminal numbers 11 and 12 are for control output 1 (OUT1). The five output types and internal equalizing circuits are available according to the Output Unit.





Relay	NPN	PNP	0 to 10 V	4 to 20mA
E53-R4R4	E53-Q4R4 E53-Q4Q4	E53-Q4HR4 E53-Q4HQ4H	E53-V44R4	E53-C4R4 E53-C4DR4

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.

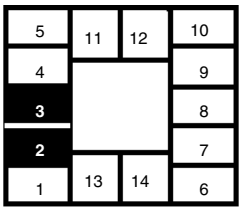


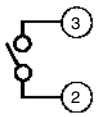
Relay	NPN	PNP
E53-R4R4 /E53-V44R4 E53-Q4R4 /E53-C4R4 E53-Q4HR4/E53-C4DR4	E53-Q4Q4	E53-Q4HQ4H

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:



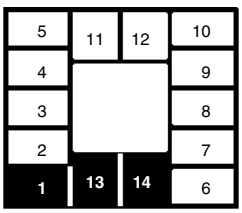


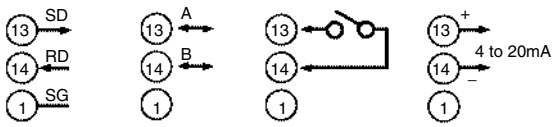
Relay specifications are as follows:
SPST-NO, 250 VAC, 1 A

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.



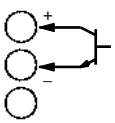


RS-232C	RS-485	Event input	Transfer output
E53-CK01	E53-CK03	E53-CKB	E53-CKF

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:



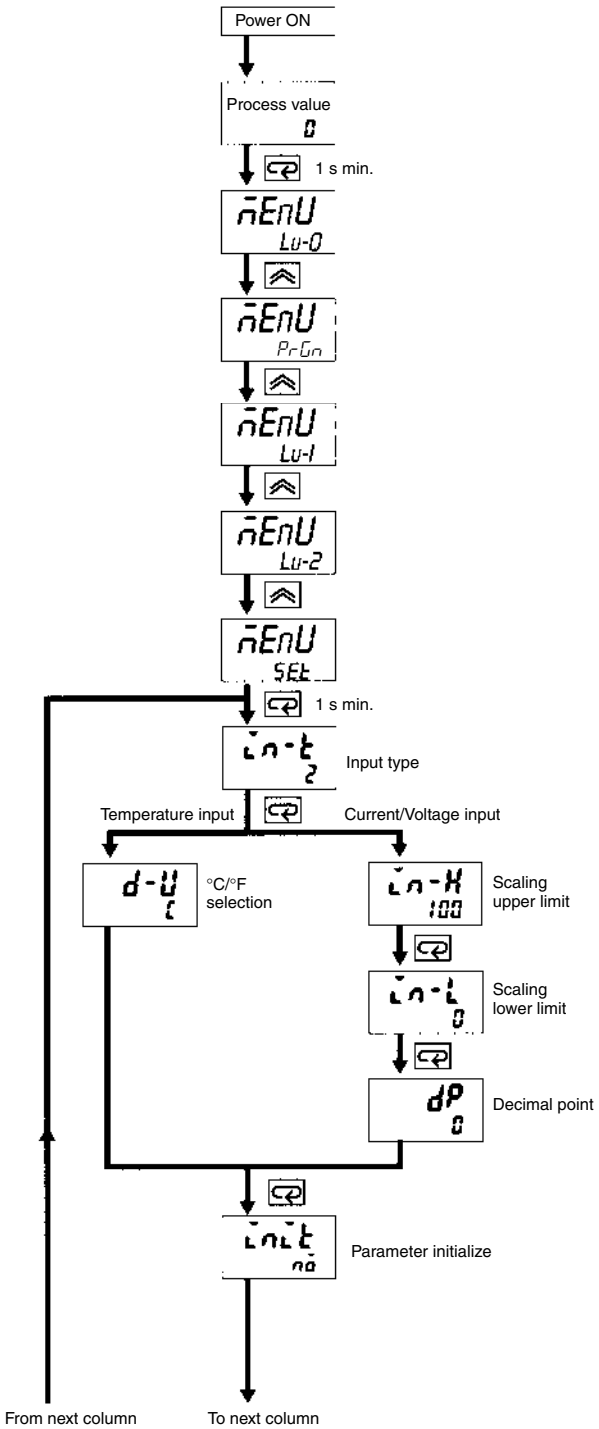
Transfer output specifications are as follows:
4 to 20 mA DC, load: 500 Ω max., resolution approx. 2,600

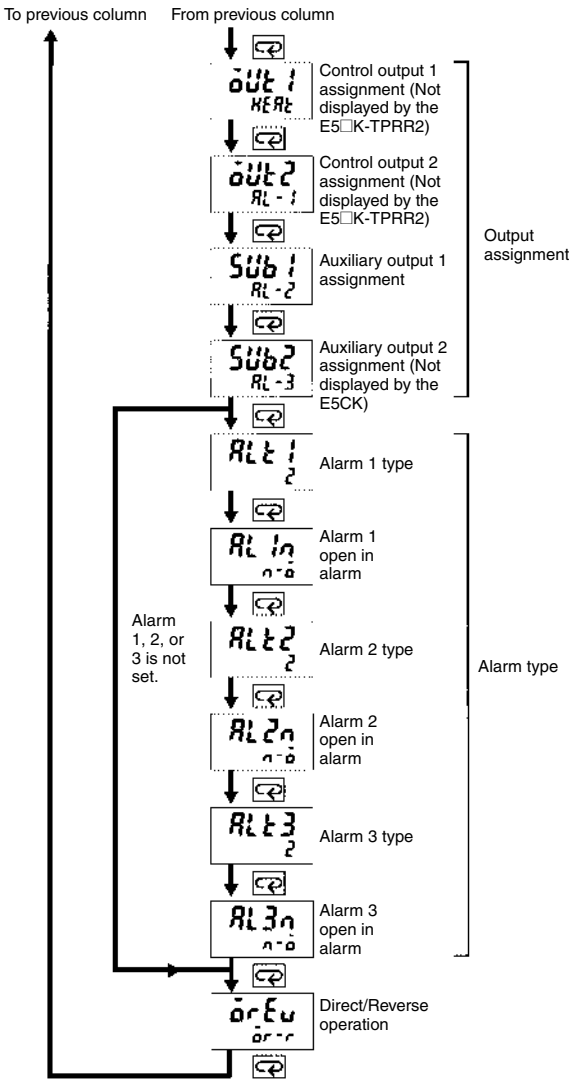
Operation

■ After Turning ON Power

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

Setup Mode





Note: 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.

■ 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)	
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)	
17	4 to 20 mA		Current input
18	0 to 20 mA		
19	1 to 5 V		Voltage input
20	0 to 5 V		
21	0 to 10 V		

■ Output Assignments

Thirteen output functions are available. Allocate these functions to the control outputs 1 and 2 and auxiliary outputs 1 and 2.

There are some limitations on some output function allocations.

Output function types and allocation limitations are as described in the following.

Identical output functions cannot be allocated doubly to the control output 1 or 2 and auxiliary output 1 or 2.

Standard Models

Assignment Destination / Output Function	Control Output		Auxiliary Output	
	1	2	1	2
Control output (heat) (see note 1)	Yes	Yes	No	No
Control output (cool) (see note 1)	Yes	Yes	No	No
Alarm 1	Yes	Yes	Yes	Yes
Alarm 2	Yes	Yes	Yes	Yes
Alarm 3	Yes	Yes	Yes	Yes
HBA (see notes 1, 2)	Yes	Yes	Yes	Yes
LBA (see note 1)	Yes	Yes	Yes	Yes
Time signal 1	Yes	Yes	Yes	Yes
Time signal 2	Yes	Yes	Yes	Yes
Program end	Yes	Yes	Yes	Yes
Stage output (see note 1)	Yes	Yes	Yes	Yes
Error 1 : Input error	No	No	Yes	Yes
Error 2 : A/D convertor error	No	No	Yes	Yes

Note: 1. Assignment is not possible with the control valve control type.

2. Heater burnout alarm is not available for the E5CK.

Position-proportional Models

Position-proportional-type Controllers support nine output functions. These are assigned to auxiliary outputs 1 and 2.

Restrictions on assignment destinations are placed on some of the outputs. The following table shows where outputs may be assigned to.

Assignment Destination / Output Function	Control Output		Auxiliary Output	
	1	2	1	2
Alarm 1	No	No	Yes	Yes
Alarm 2	No	No	Yes	Yes
Alarm 3	No	No	Yes	Yes
Time signal 1	No	No	Yes	Yes
Time signal 2	No	No	Yes	Yes
Stage output	No	No	Yes	Yes
Program end output	No	No	Yes	Yes
Error 1 : Input error	No	No	Yes	Yes
Error 2 : A/D converter error	No	No	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.

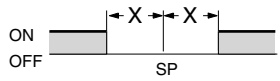
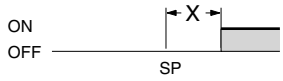
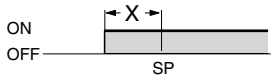
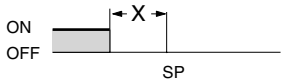
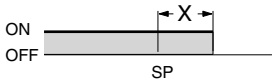
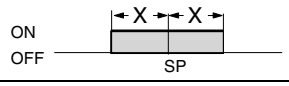
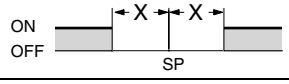
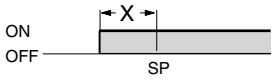
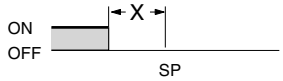
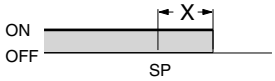
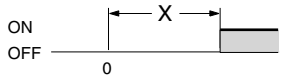
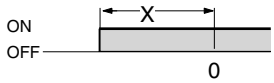
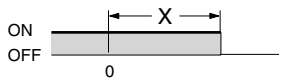
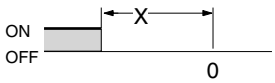
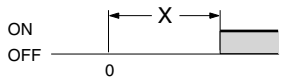
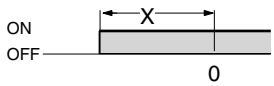
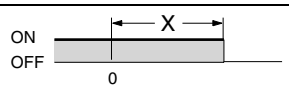
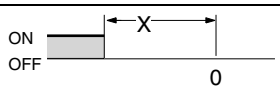
LBA

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.

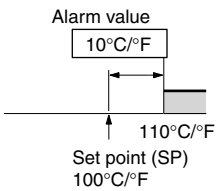
■ Alarm Mode Selectors

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		

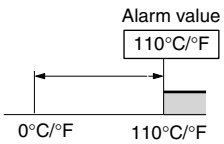
Deviation Alarm

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.



■ 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

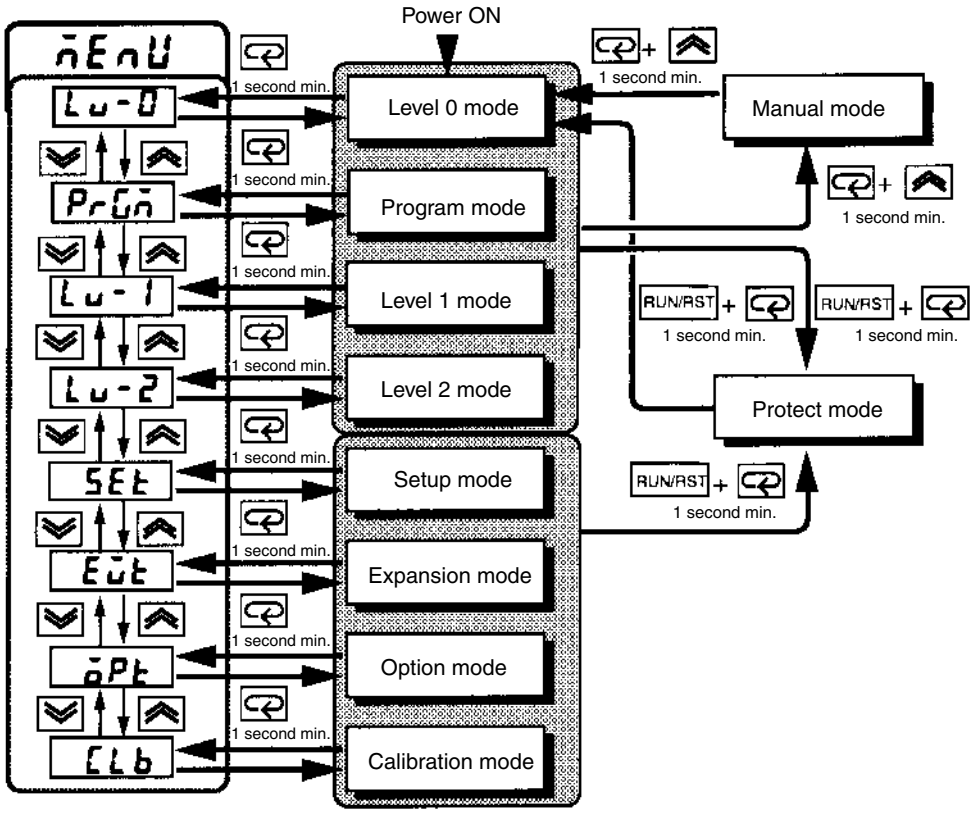
Alarm type and close in alarm (normally open)/open in alarm (normally close) can be set independently from each alarm.

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-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.



■ Parameters and Menus

Note: For more details on the functions of each part and display contents, refer to the *E5AK-T/E5EK-T/E5CK-T User’s Manual (H88/H89/H90)*.

Protect Mode The protect function is for preventing unwanted modification of parameters and switching between run and reset operation or auto and manual operation.

Manual Mode In this 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, you can change the set point and pattern during operation, and execute step operation (e.g. advance). You can only monitor (not change) the process value, step No., standby time, pattern elapsing time, pattern execution count, and manipulated variable.

Program Mode This is the programming mode. In this mode, you can set the number of steps used in each pattern, pattern execution count, alarm values, set points for each step, step time, and time signals for two steps.

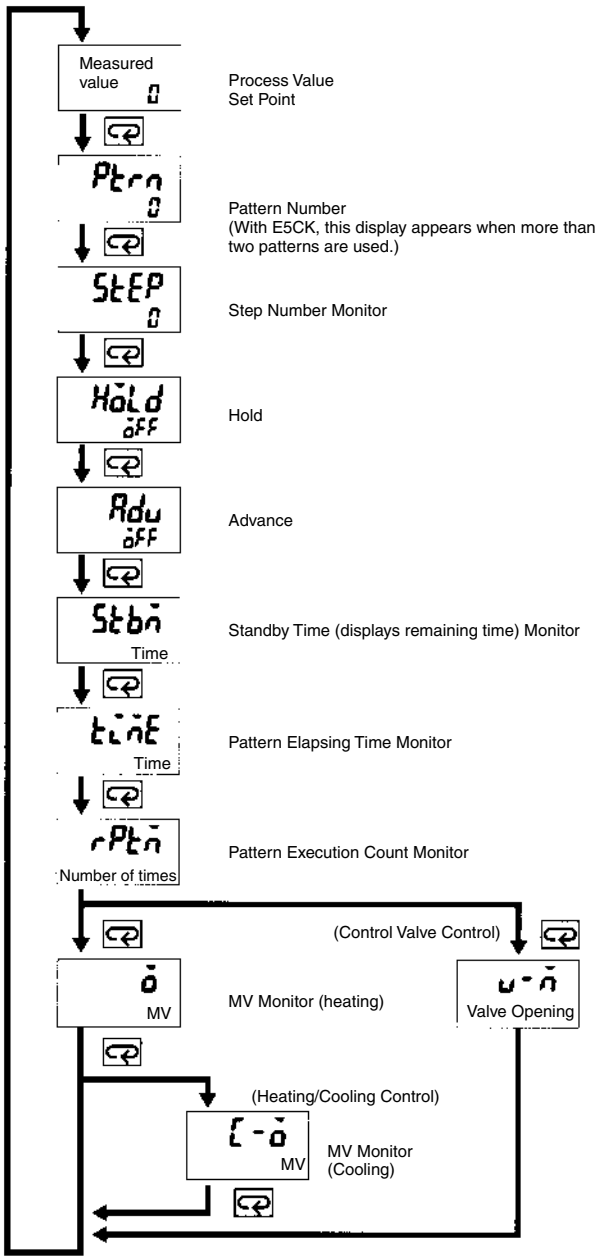
Level 1 Mode	This is the main mode for adjusting control. In this mode, you can execute AT (auto-tuning), and set up the control period, PID parameters and heater burnout alarm (HDA) conditions.
Level 2 Mode	This is the auxiliary mode for adjusting control. In this mode, you can set the parameters for limiting the manipulated variable, 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	This is the mode for setting the basic specifications. In this mode, you can set parameters that must be checked or set before an operation such as the input type, scaling, output assignments, and direct/reverse operation.
Expansion Mode	This is the mode for setting expanded functions. In this mode, you can set SP setting limiter, switching between 2-PID control or ON/OFF control, program time unit, selection of step time/rate of rise, time unit of ramp rise rate, and the time for automatic return to the monitoring display.
Option Mode	This is the mode for setting optional functions. You can select this mode only when an Option Unit is mounted in the Controller. In this mode, you can set the communications conditions, transfer output and event input parameters to match the type of Option Unit mounted in the Controller. Heater burnout alarm function and position-proportional travel time are also found in this mode.
Calibration Mode	This mode is provided so that the user can calibrate inputs and output. When calibrating input, the selected input type is calibrated. Whereas, transfer output can be calibrated only when the Communications Unit (E53-AKF) is set in the Controller.

■ Parameter Operation

Refer to the *E5AK-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90)* for each parameter and the calibration mode in detail.

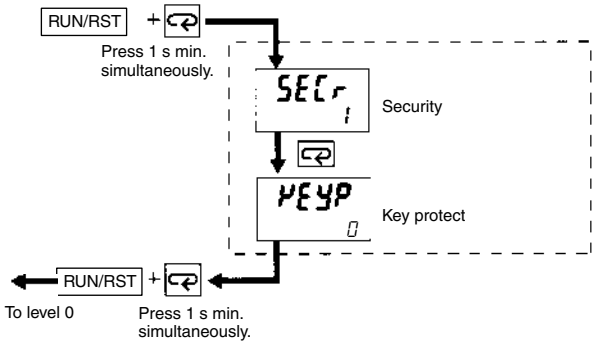
Refer to page 135 for the setting in detail.

Level 0 Mode



Protect Mode

Under this mode, key operations are invalidated for the Auto/Manual and Run/Reset.



Security

Before starting operation, apply key protection to the parameters that will not be changed during operation in order to prevent any accidental parameter changes.

Depending on the set values for the Security parameter (protect mode), ranges of parameter application will be restricted. The following table shows relationship between the set values and the scope of protection.

Mode	Set value						
	0	1	2	3	4	5	6
Calibration	Yes	No	No	No	No	No	No
Option	Yes	Yes	No	No	No	No	No
Expansion	Yes	Yes	No	No	No	No	No
Setup	Yes	Yes	No	No	No	No	No
Level 2	Yes	Yes	Yes	No	No	No	No
Level 1, 0	Yes	Yes	Yes	Yes	No	No	No
Program	Yes	Yes	Yes	Yes	Yes	No	No
Level 0	Yes	Yes	Yes	Yes	Yes	Yes	*

Note: *Only the "Process Value/Set Point" parameter display is possible.

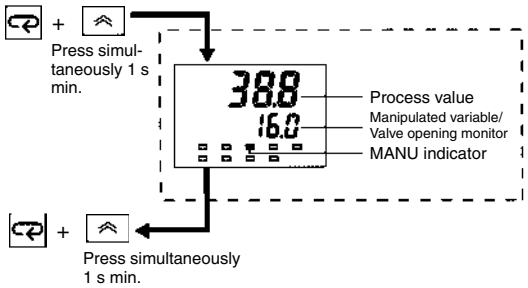
When the set value is "0," protection will not be applied.

When the set value is "5," only the parameter in the level 0 mode can be used and not possible to change to the menu screen.

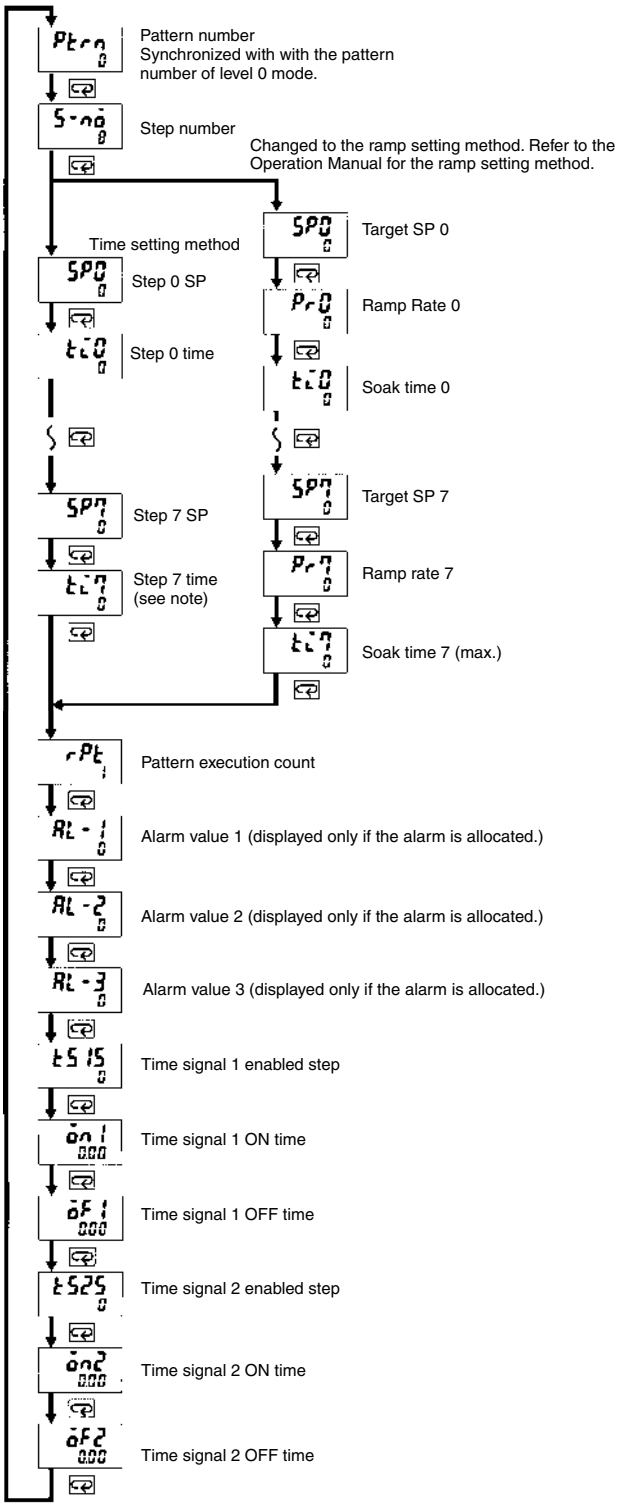
When the set value is "6," only the "Process Value/Set Point" can be monitored.

The default setting is "1."

Manual Mode



Program Mode

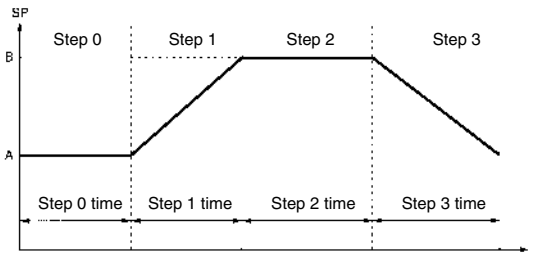


Time Setting Method

Set the number of steps to be used beginning with step 0 (e.g., step 0 SP, step 0 time, step 1 SP, and step 1 time).

The step target value can be set within a range between the lower and upper target value limits. The default value is zero.

The step time can be set within a range between 0.00 and 99.59 (in hr and min or min and s). The default value is 0.00.



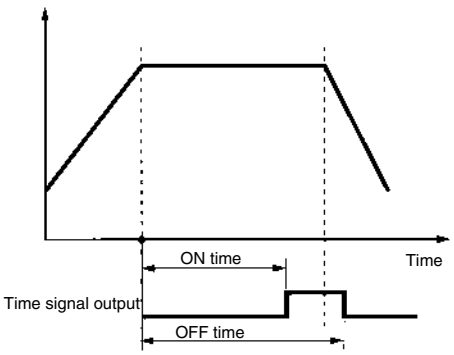
A: Step 0 and step 3 SP
B: Step 1 and step 2 SP

Step 0 is flat as shown in the above graph. Set step 0 to 0.00 so that step 1 will be the actual first step when writing ramp-start programs.

Note: Up to step 15 (i.e., a total of 16 steps) can be set in the time setting method.

Time Signal

Two types of time signal patterns can be set in each pattern.



Two types of time signal timers are available (i.e., ON-time and OFF-time use), each of which starts with the edge of the step.

The output is ON from the moment the ON time elapses until the OFF time elapses.

Set the step so that the time signal is triggered by the time signal 1/2 enabled step parameters. The default is step 0.

Set the ON/OFF timing with the timing signal 1/2 ON-time and time signal 1/2 OFF-time parameters in Program mode.

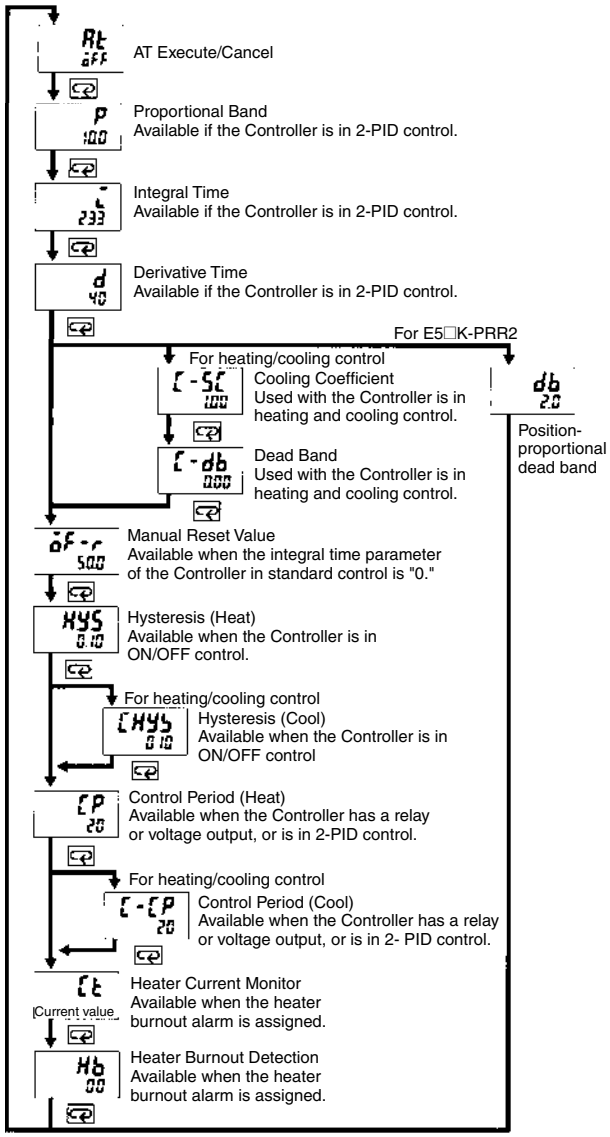
ON Conditions

If the ON time is shorter than the OFF time, the signal will be reset or ON after the ON time elapses until the next pattern starts.

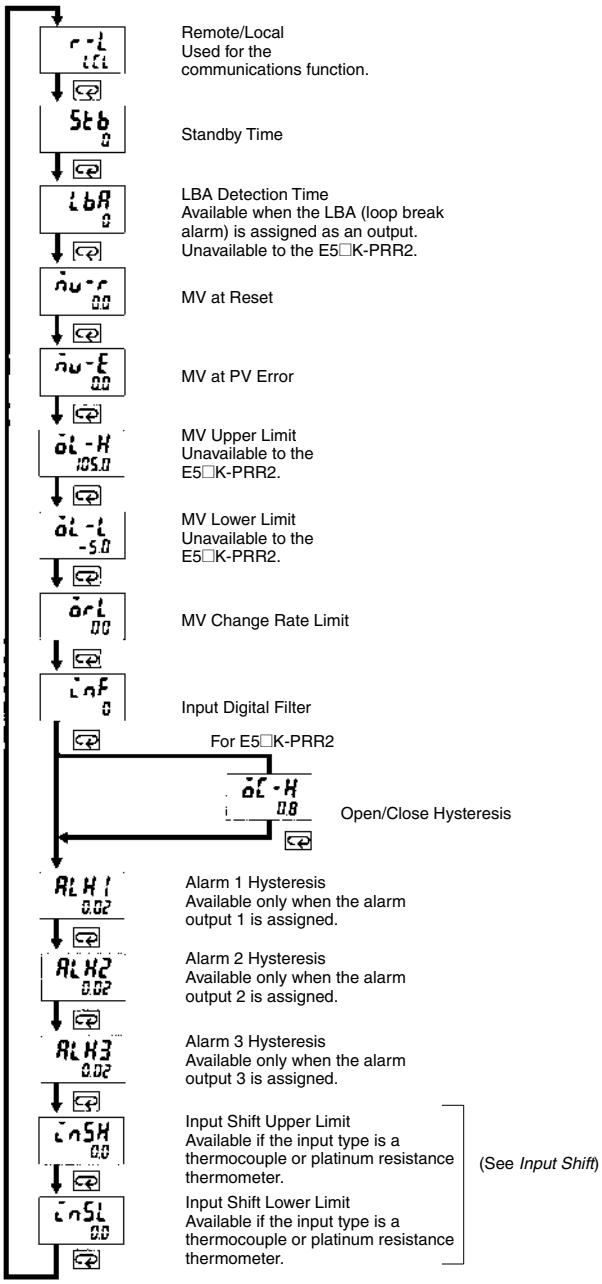
The signal is not ON if there is no difference in period between the ON time and OFF time.

If ADVANCE is executed while the time signal setting step is executed, the time equivalent to the setting step will be deemed to have elapsed. In the above graph, for example, the signal is ON from the edge of the next step until the OFF time elapses.

Level 1 Mode



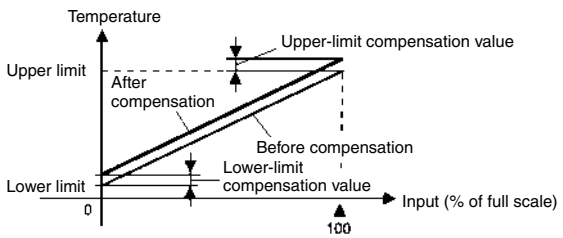
Level 2 Mode



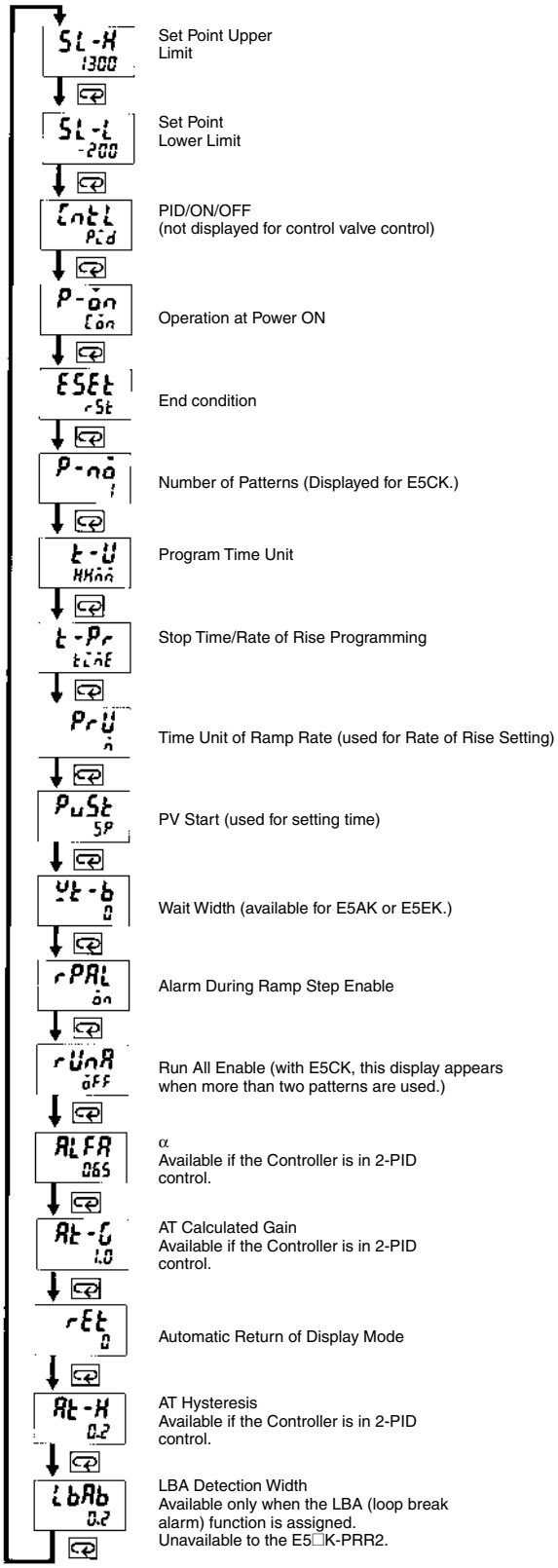
Input Shift

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.

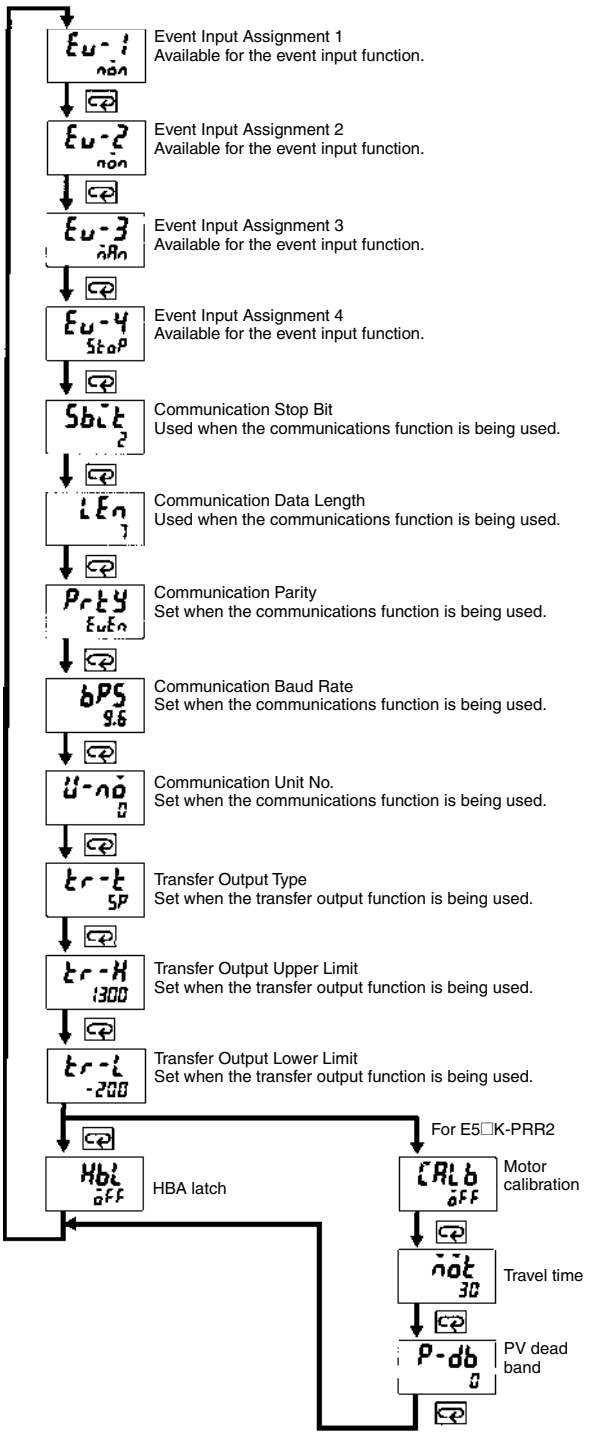
To set the input shift, set shift values in the "input shift upper limit" and "input shift lower limit" parameters (level 2 mode).



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.

S.Err — 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.

E111 — 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 E5□K-T 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.

E333 — 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 E5□K-T 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.Err — Calibration Data Error

This error is output only during temperature input and is displayed for two seconds when the power is turned ON.

Meaning 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.

cccc / ɔɔɔɔ — 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 ±10%) is larger than the display range (–1999 to 9999).

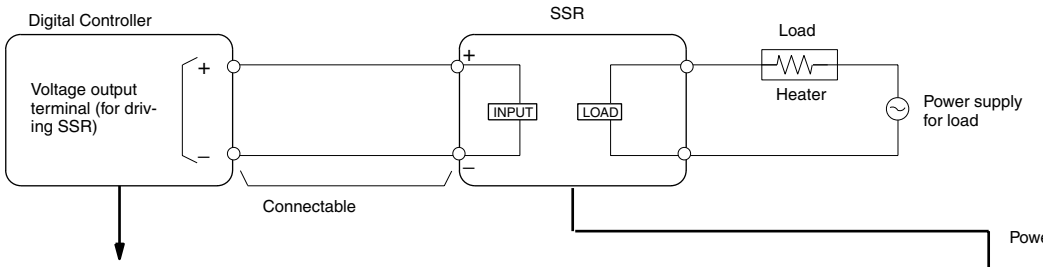
- When less than “–1999” cccc
- When greater than “9999” ɔɔɔɔ

Operation Control continues, allowing normal operation.

Peripheral Devices

■ SSR

Connection Example of Digital Controller and SSR



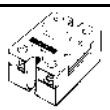
E5AK-T, E5EK-T

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: 5 pcs. E5CK: 3 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

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.

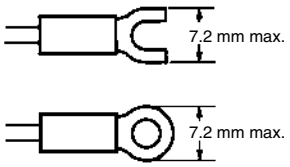
Use the specified compensating conductors for thermocouples. Use lead wires having a small resistance for platinum resistance thermometers.

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.



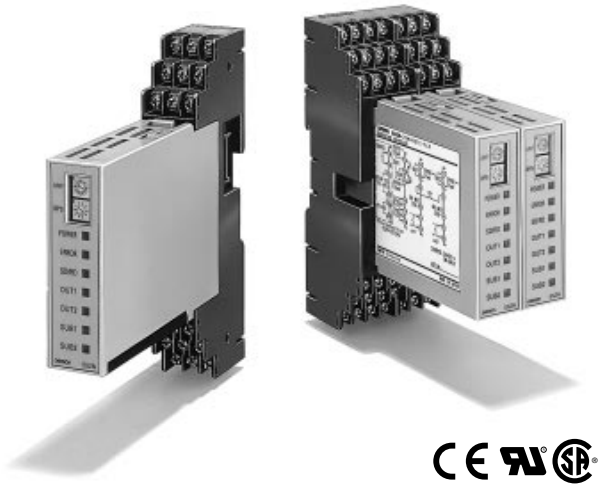
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H087-E1-03

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		Communi-cations 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.)	Heating or heat/cool control is selectable (See note 4.) Event input: 1 point per Unit	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)				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.)	Transistor output: 2 pts (sinking)	Transfer output (linear voltage output) (See note 2.)			Thermocouple	E5ZN-2CNF03TC-FLK
								Platinum resistance thermometer	E5ZN-2CNF03P-FLK
				Transistor output: 2 pts (sourcing)				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.

Current Transformer (CT) (Order Separately)

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

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.

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 163) 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

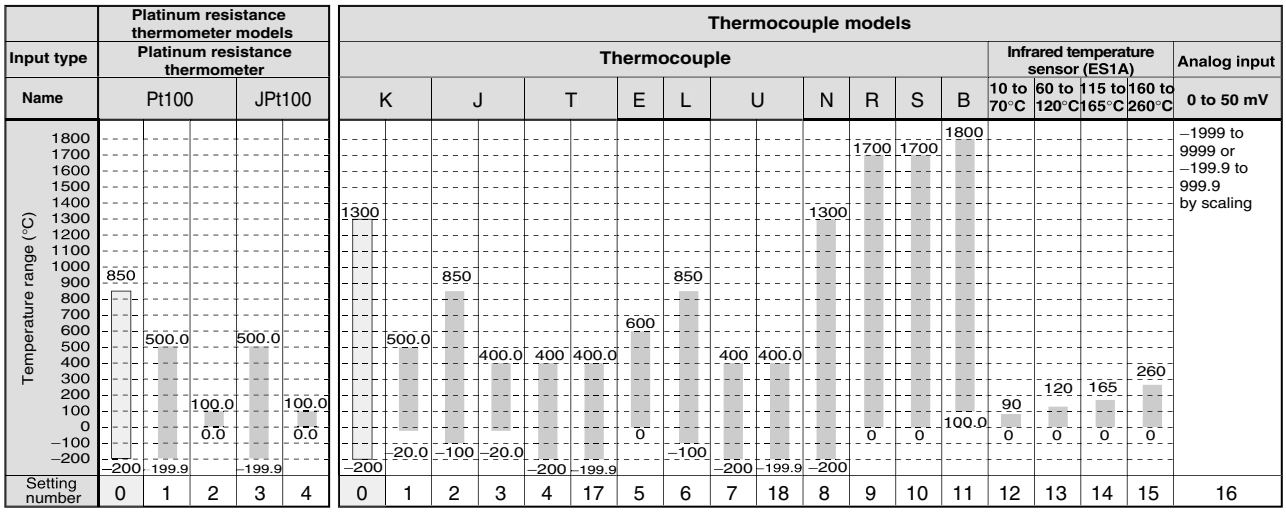
Power supply voltage	24 VDC		
Allowable voltage range	85% to 110% of the rated power supply voltage		
Power consumption	Approx. 3 W		
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Infrared temperature sensor (ES1A series): 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C (See note 1.) Voltage 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;
		Sinking	Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.
	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 ±0.5% or ±1°C, whichever is greater) ±1 digit max. (See note 1.) Platinum resistance thermometer: (Indicated value ±0.5% or ±1°C, whichever is greater) ±1 digit max. (See note 1.) Analog input: ±0.5% or ±1 digit max. CT input: ±5% FS ±1 digit max.
Transfer output	Accuracy: ±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 MΩ 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 ±X, ±Y, and ±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 ±2°C ±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 ±3°C ±1 digit max.

2. The transfer output accuracy for 0 to 4 mA when 0 to 20 mA DC is selected is ±0.5% FS +0.7 mA. The transfer output accuracy for 0 to 1 V when 0 to 5 VDC is selected is ±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 MΩ 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.)

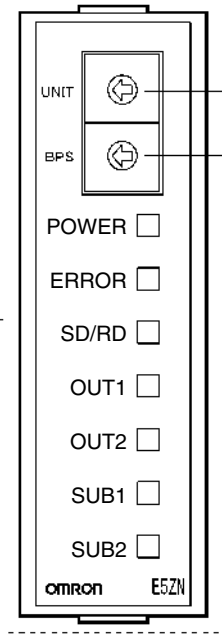
Note: 1. Use the K2CU-F□□A-□GS (with GATE input terminal) for burnout detection of 3-phase heaters.

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



Operation Indicators

POWER
Lights when power is turned ON.

ERROR
Lights when a fatal error (e.g., memory error or sensor error) occurs.

SD/RD (Communications Operation)
Flashes during communications with the host.

OUT1 (Control Output 1)
Lights when the control output 1 is ON.

OUT2 (Control Output 2)
Lights when the control output 2 is ON.

SUB1 (Auxiliary Output 1)
Lights when the auxiliary output 1 is ON.

SUB2 (Auxiliary Output 2)
Lights when the auxiliary output 2 is ON.

Unit Number Setting
Setting range of 0 to F allows up to 16 Units to be set.

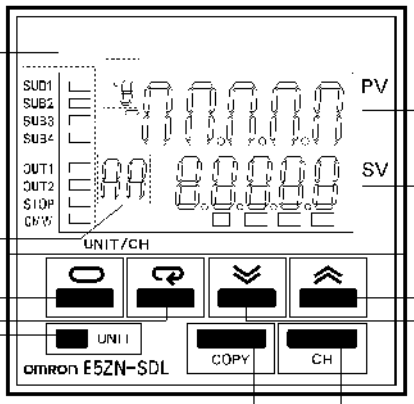
Baud Rate

E5ZN-SDL

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

Operation Indicators
- These indicators indicate the terminal operations for the E5ZN-2□□□□□□□.
- OUT1, OUT2 (Control Output 1, Control Output 2)
  Light when the control output 1 or the control output 2 functions are ON.
- SUB1, SUB2 (Auxiliary Output 1, Auxiliary Output 2)
  Light when the auxiliary output 1 or the auxiliary output 2 functions are ON.
- STOP
  Lights when operation stops. Lights for an event or when RUN/STOP is set to STOP during control. Remains unlit at other times.
- CMW (Communications Write Control)
  Lights when communications write is permitted and remains unlit when it is prohibited.
- SUB3 (Auxiliary Output 3)
  Pulse output models: Always not lit.
  Analog output models: Not lit when the auxiliary output drops to 0% or lower.
  Lit when the auxiliary output is above 0%.
- SUB4 (Auxiliary Output 4)
  Pulse output models: Always not lit.
  Analog output models: Not lit when the auxiliary output drops to 0% or lower.
  Lit when the auxiliary output is above 0%.

Temperature Unit
Displayed when the display unit for setting data is temperature. The display is determined by the setting for temperature unit, with either "°C" or "°F" displayed accordingly.



No. 1 Display
Displays the PV or the type of setting data.

No. 2 Display
Displays the target value, the control variable, or the set value for setting data (setting contents).

Up Key
Each time this key is pressed, the value displayed in No. 2 Display increases. If it is held down, the rate of increase becomes faster.
It can also be used to move to the next setting item.

Down Key
Each time this key is pressed, the value displayed in No. 2 Display decreases. If it is held down, the rate of decrease becomes faster.
It can also be used to return to the previous setting item.

Channel Key
Press this key to change the channel number.

Unit/Channel Indicator
Indicates the unit number and the channel number.

Level Key
Press this key to switch setting levels.

Mode Key
Press this key to switch setting data within the setting level.

UNIT Key
Press to switch the unit number.

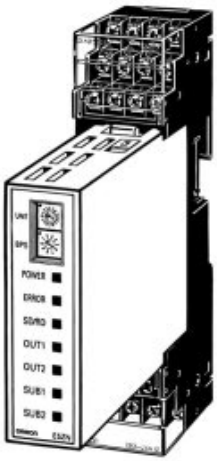
Level Key and Mode Key
Press together to switch to protect mode.

Copy Key
Press this key to read all the settings from the Temperature Controller to the Setting Display Unit, or to write from the Setting Display Unit to the Temperature Controller.

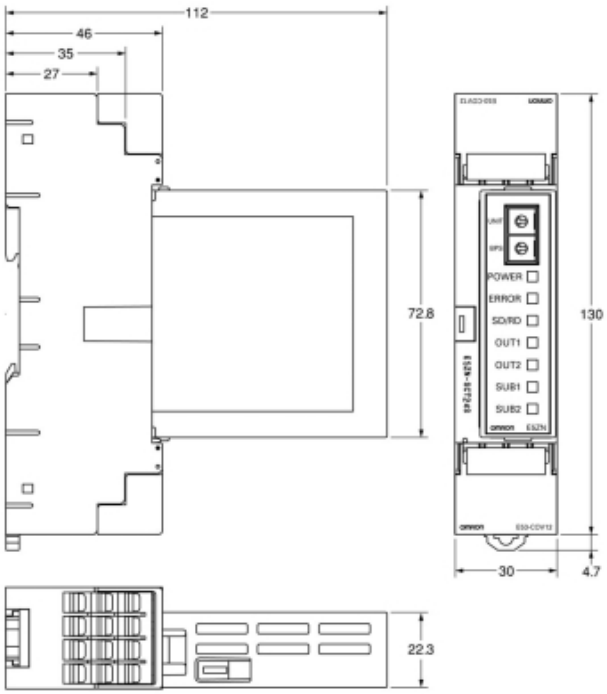
Dimensions

Note: All units are in millimeters unless otherwise indicated.

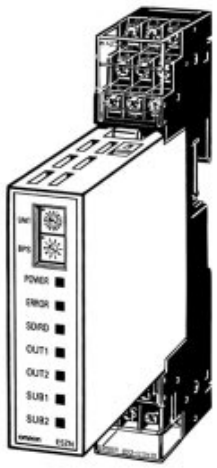
E5ZN-2□□□03□-FLK Connected to E5ZN-SCT24S-500



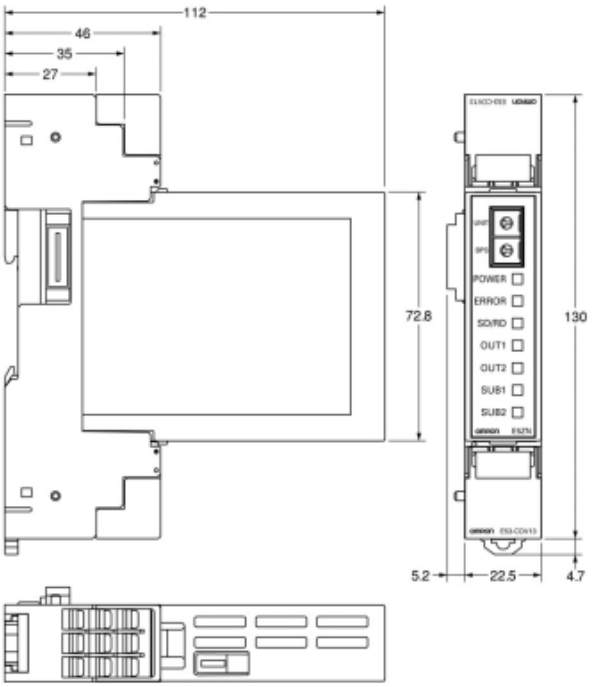
When only using one Unit, purchase the E5ZN-2□□□03□-FLK and the E5ZN-SCT24S-500 together. Also, when using horizontal side-by-side mounting, purchase the first Unit together with the E5ZN-SCT24S-500.



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



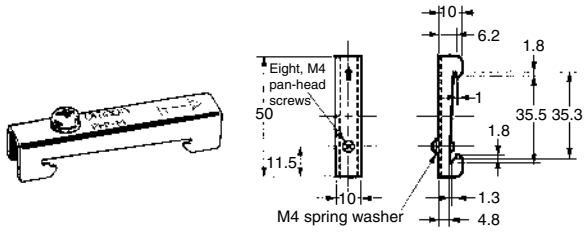
When mounting Units side-by-side, purchase the E5ZN-2□□□03□-FLK together with the E5ZN-SCT18S-500 for the second and subsequent Units.



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

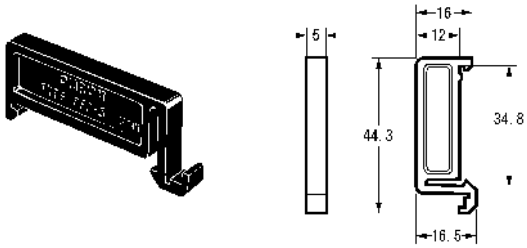
PFP-M



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

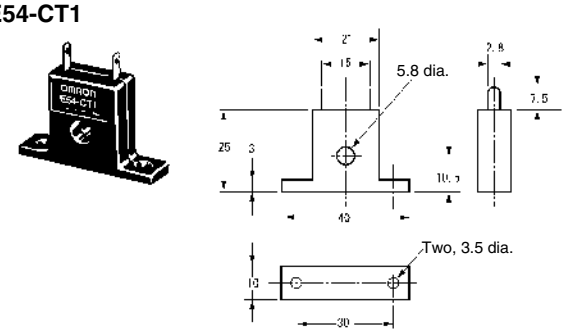
Spacer

PFP-S

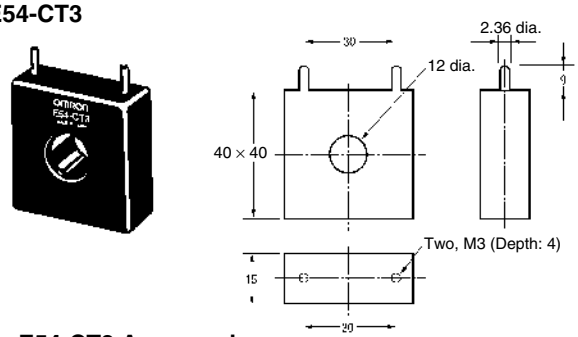


Current Transformer (Order Separately)

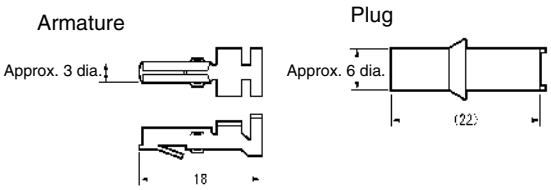
E54-CT1



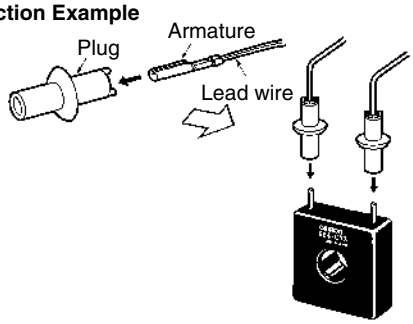
E54-CT3



E54-CT3 Accessories

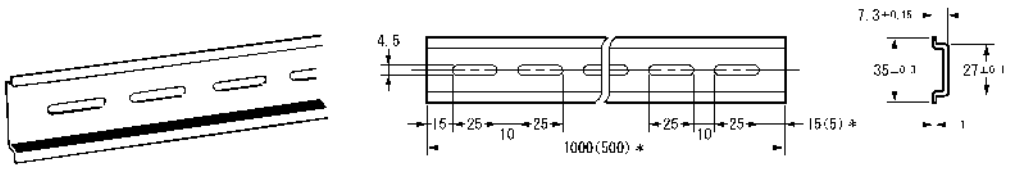


Connection Example



Mounting Track (for DIN Track Mounting - Order Separately)

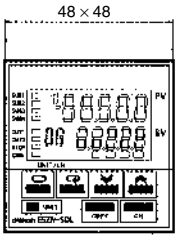
PFP-100N
PFP-50N

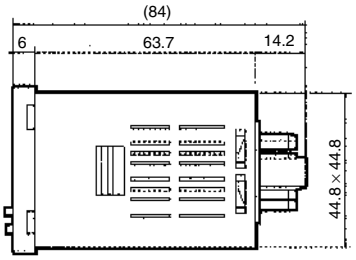


* Indicates dimensions for the PFP-50N.

Setting Display Unit

E5ZN-SDL

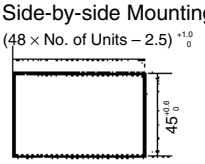




Panel Cutout Dimensions

Individual Mounting

Side-by-side Mounting

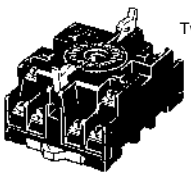


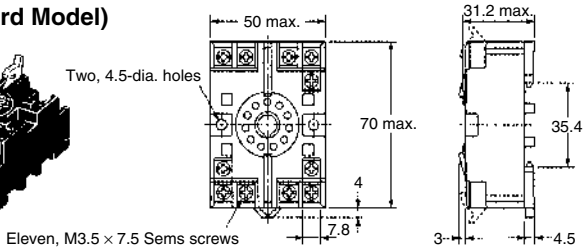
- The mounting panel thickness is 1 to 5 mm.
- Vertical side-by-side mounting is not possible. (Allow sufficient space above and below.)
- When mounting several Units, make sure that the ambient tem-perature specifications are not exceeded.

E5ZN-SDL Wiring Sockets

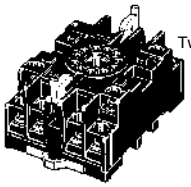
Front-connecting Sockets

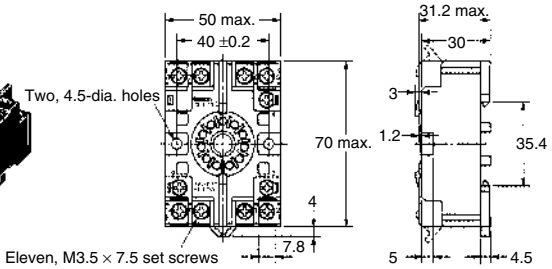
P2F-11 (Standard Model)





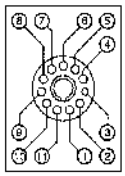
P2F-11-E (with Finder Protection)



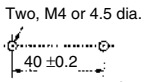


Terminal Arrangement/ Internal Connections

(TOP VIEW)



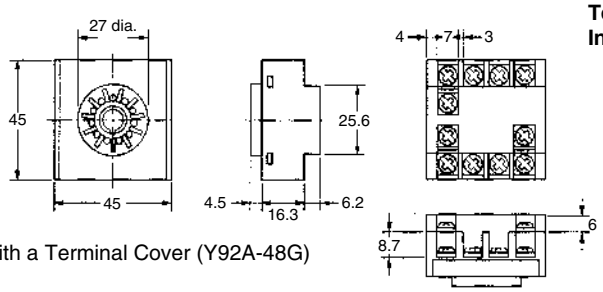
Mounting Hole Cutout Dimensions



Note: DIN track mounting is also possible.

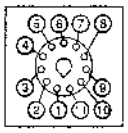
Back-connecting Sockets

P3GA-11 (Standard Model)



Terminal Arrangement/ Internal Connections

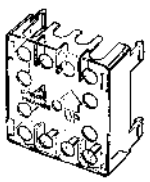
(BOTTOM VIEW)

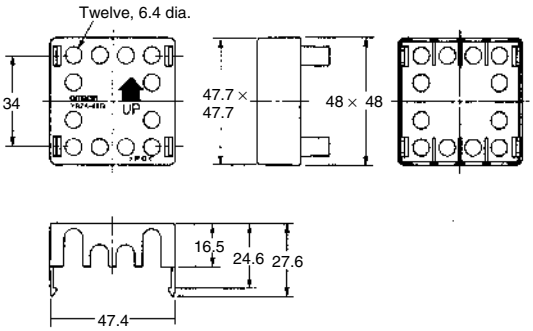


Note: Use in combination with a Terminal Cover (Y92A-48G) for finger protection.

Terminal Cover

Y92A-48G



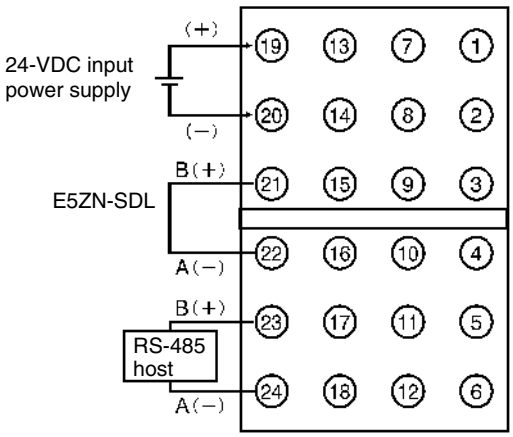


Installation

■ Connection Diagrams

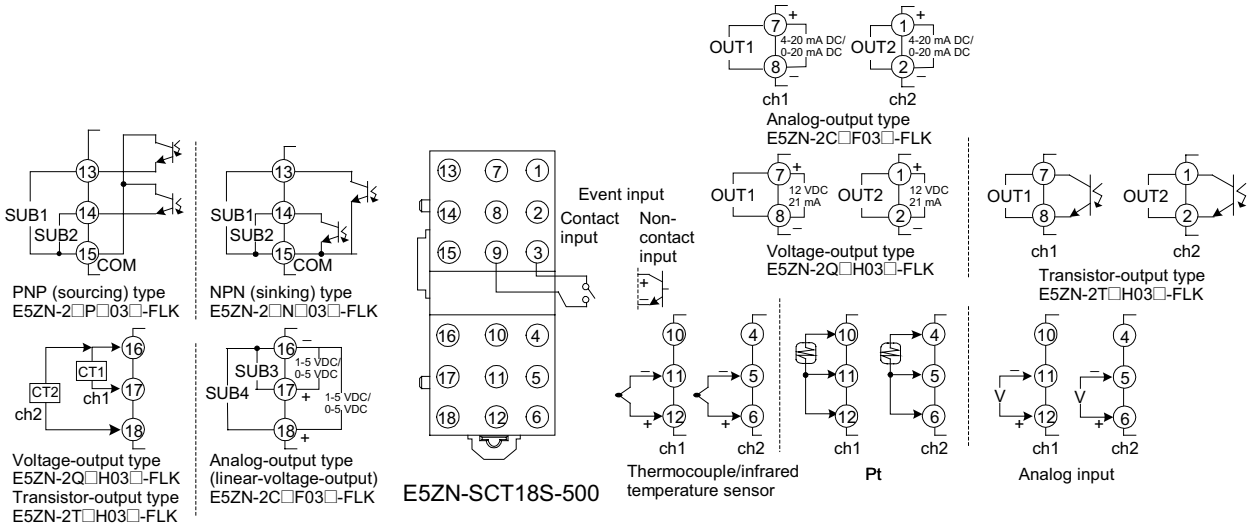
- Voltage output (control output) is not electrically isolated from internal circuitry. Therefore, when using grounded thermocouples, do not ground control output terminals. (Doing so may result in temperature measurement errors due to unwanted current paths.)
- There is basic insulation between the 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

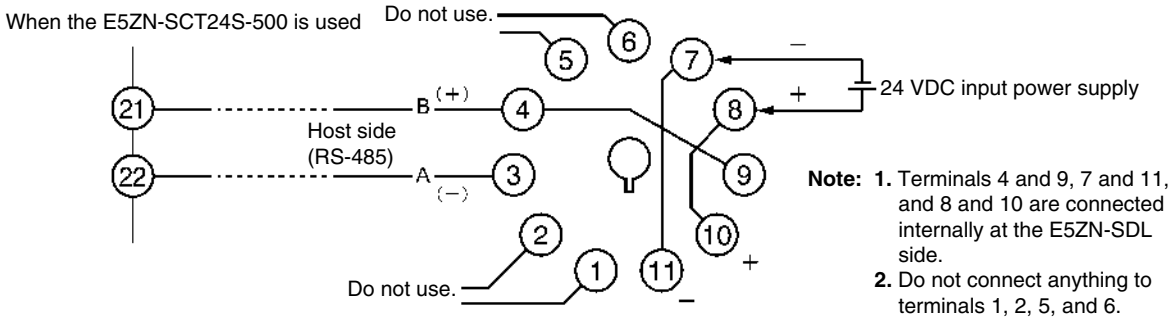


Wiring for terminals 1 to 18 is the same as for the E5ZN-SCT18-500. See below.

Using with the E5ZN-SCT18S-500



E5ZN-SDL



Note: 1. Terminals 4 and 9, 7 and 11, and 8 and 10 are connected internally at the E5ZN-SDL side.
2. Do not connect anything to terminals 1, 2, 5, and 6.

Note: Purchase either a P2CF-11 or a P3GA-11 Socket separately. (Refer to page 170.)

Operation

■ E5ZN-SDL Setting Data

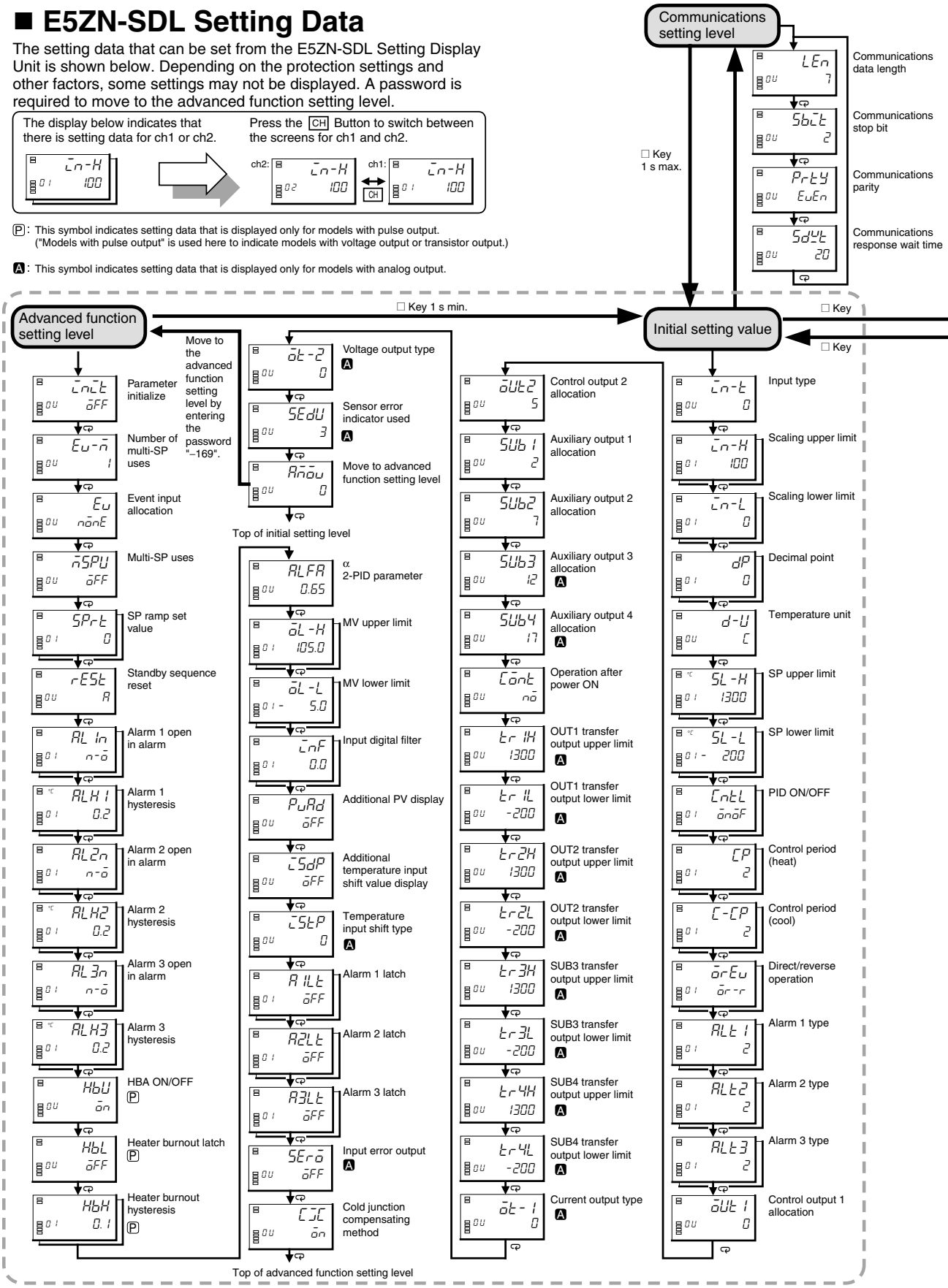
The setting data that can be set from the E5ZN-SDL Setting Display Unit is shown below. Depending on the protection settings and other factors, some settings may not be displayed. A password is required to move to the advanced function setting level.

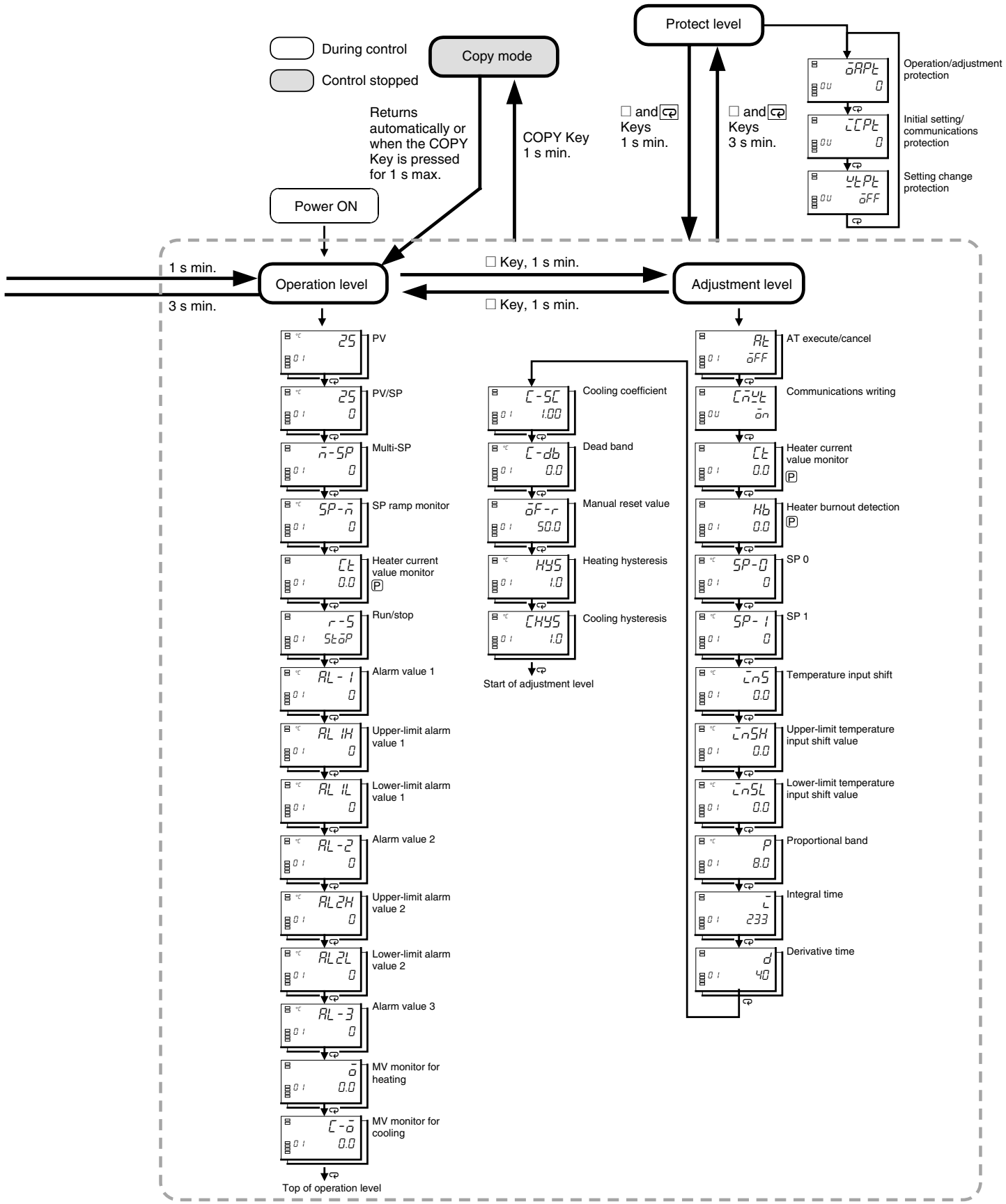
The display below indicates that there is setting data for ch1 or ch2.

Press the CH Button to switch between the screens for ch1 and ch2.

Ⓟ: 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.)

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




During control
Control stopped
Copy mode
Protect level
Returns automatically or when the COPY Key is pressed for 1 s max.
COPY Key 1 s min.
□ and Keys 1 s min.
□ and Keys 3 s min.
Operation/adjustment protection
Initial setting/ communications protection
Setting change protection
Power ON
1 s min.
3 s min.
Operation level
□ Key, 1 s min.
□ Key, 1 s min.
Adjustment level
PV
PV/SP
Multi-SP
SP ramp monitor
Heater current value monitor
Run/stop
Alarm value 1
Upper-limit alarm value 1
Lower-limit alarm value 1
Alarm value 2
Upper-limit alarm value 2
Lower-limit alarm value 2
Alarm value 3
MV monitor for heating
MV monitor for cooling
Top of operation level
Cooling coefficient
Dead band
Manual reset value
Heating hysteresis
Cooling hysteresis
Start of adjustment level
AT execute/cancel
Communications writing
Heater current value monitor
Heater burnout detection
SP 0
SP 1
Temperature input shift
Upper-limit temperature input shift value
Lower-limit temperature input shift value
Proportional band
Integral time
Derivative time

■ 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.

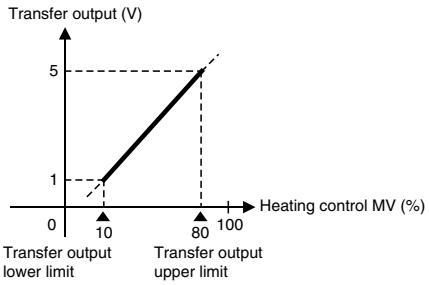
ch1	ch2
Transfer output for ch1 set point	Transfer output for ch2 set point
Transfer output for ch1 ramp set point	Transfer output for ch2 ramp set point
Transfer output for ch1 process value	Transfer output for ch2 process value
Transfer output for ch1 heating control MV	Transfer output for ch2 heating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



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

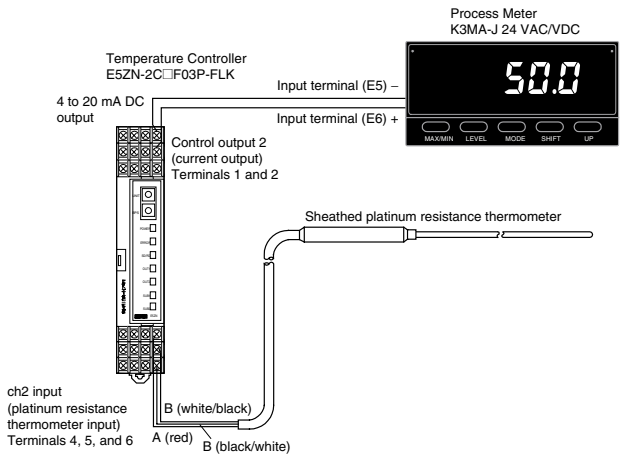
Temperature Controller: E5ZN-2C□F03P-FLK (current output, platinum resistance thermometer input)
Meter: K3MA-J 24 VAC/VDC (Process Meter)

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: in-t): 4 to 20 mA DC (4-20)
Scaling input value 1 (initial setting level: inP. 1): 4 mA (4.00)
Scaling display value 1 (initial setting level: dSP. 1): 0 (00000)
Scaling input value 2 (initial setting level: inP.2): 20 mA (20.00)
Scaling display value 2 (initial setting level: dSP.2): 100 (0 1000)
Decimal point (initial setting level: dP): One decimal place (0000.0)



Reading Temperatures for Multiple E5ZN Units

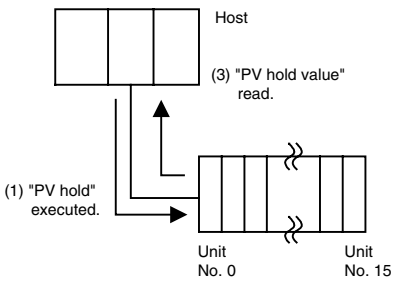
With conventional models, if the present temperature is read from multiple Temperature Controllers using host communications, there are time differences in the process temperatures read from each Temperature Controller, making it difficult to obtain concurrent data.

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.)

Fig. 1



(1) "PV hold" is executed from the host computer.
(2) The present temperature for each E5ZN Unit from Units No. 0 to 15 is written simultaneously to PV hold values.
(3) The PV hold values are read in order, starting with Unit No. 0.

Note: 1. 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.

2. The "PV hold" operation command cannot be executed and the "PV hold value" cannot be read from the E5ZN-SDL Setting Display Unit.

3. 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.

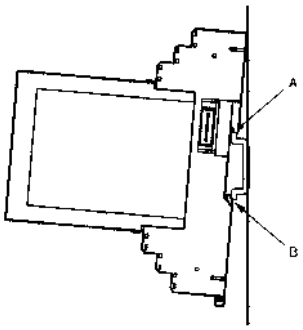
Waterproofing

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.

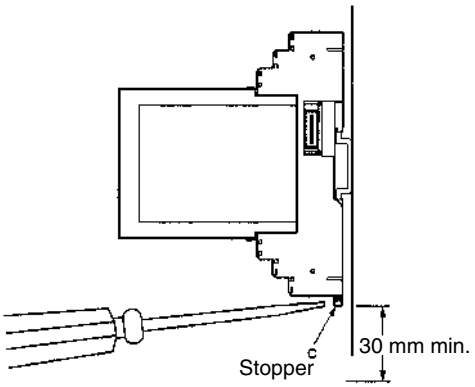
- Temperature Controller: IP00
- Terminal Unit: IP00

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.

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).

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-E1-02

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