

# OMRON

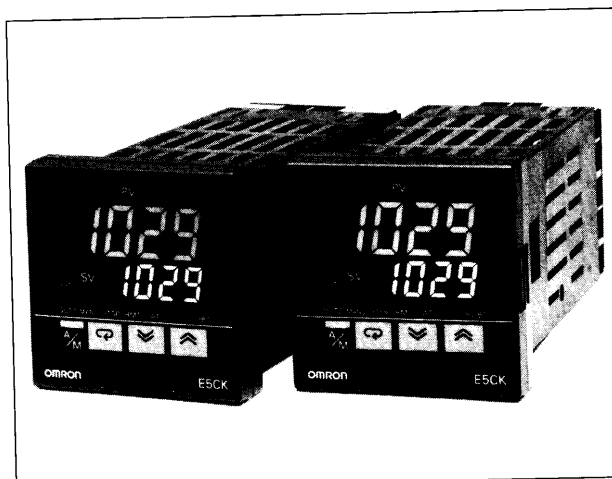
9 88 637 to 686

## Digital Controller ( $1/16$ Din)

## E5CK

### Advanced, Compact Digital Controllers

- IP66/NEMA4 (indoor use) front face.
- Modular structure, one-stock type.
- Heat/Cool control.
- Serial communications:  
RS-232C and RS-485. (option)
- Temperature and analog inputs.
- 4–20mA re-transmission. (option)
- High-accuracy: 100 ms sampling (for analog input).
- Advanced tuning which includes fuzzy self-tuning.
- Conforms to international EMC and safety standards.
- Event input. (option)
- Loop break alarm (LBA) facility.
- One alarm relay fitted as standard.



### Ordering Information

| Description | Model                 | Specification                              |
|-------------|-----------------------|--------------------------------------------|
| Base Units  | E5CK-AA1-500          | Base Unit (AC100–240V) with terminal cover |
|             | E5CK-AA1-500 AC/DC24V | Base Unit (AC/DC24V) with terminal cover   |

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

| Description  | Model     | Specification             |
|--------------|-----------|---------------------------|
| Output Units | E53-R4R4  | Relay/Relay               |
|              | E53-Q4R4  | Pulse (NPN)/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)   |

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

### ■ Temperature Ranges

#### Platinum Resistance Thermometer

| Input (software 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 Code                |    | 0               | 1               |

#### Thermocouple

| Input (software selectable)<br>(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 Code                              |    | 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 (software 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<br>-1999 to 9999<br>-199.9 to 999.9<br>-19.99 to 99.99<br>-1.999 to 9.999 |            |               |          |           |
| Setting Code                | 17                                                                                                                                | 18         | 19            | 20       | 21        |

## Specifications

## ■ Ratings

| Item                    | AC100-240V type                                                                                                                                                                                | AC/DC24V type      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Supply voltage          | AC100-240V, 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<br>Platinum resistance thermometer: JPt100, Pt100<br>Current input: 4 to 20 mA, 0 to 20 mA<br>Voltage input: 1 to 5 V, 0 to 5 V, 1 to 10 V |                    |
| Input impedance         | Current input: 150 $\Omega$<br>Voltage input: 1 M $\Omega$ max.                                                                                                                                |                    |
| 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 advanced PID control                                                                                                                                                                 |                    |
| 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")                                                                                                                       |                    |

## ■ Characteristics

|                                |                                                                                                                                                                                                                                                                                                                    |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indication accuracy (see note) | Thermocouple:<br>( $\pm 0.3\%$ of indication value or $\pm 1^\circ\text{C}$ , whichever greater) $\pm 1$ digit max.<br>Platinum resistance thermometer:<br>( $\pm 0.2\%$ of indication value or $\pm 0.8^\circ\text{C}$ , whichever greater) $\pm 1$ digit max.<br>Analog input: $\pm 0.2\%$ FS $\pm 1$ digit max. |
| Hysteresis                     | 0.01% to 99.99% FS (in units of 0.01% FS)                                                                                                                                                                                                                                                                          |
| Proportional band (P)          | 0.1% to 999.9% FS (in units of 0.1% FS)                                                                                                                                                                                                                                                                            |
| Integral (reset) time (I)      | 0 to 3,999 s (in units of 1 s)                                                                                                                                                                                                                                                                                     |
| Derivative (rate) time (D)     | 0 to 3,999 s (in units of 1 s)                                                                                                                                                                                                                                                                                     |
| Control period                 | 1 to 99 s (in units of 1 s)                                                                                                                                                                                                                                                                                        |
| Manual reset value             | 0.0% to 100.0% (in units of 0.1%)                                                                                                                                                                                                                                                                                  |
| Alarm setting range            | -1,999 to 9,999 or -199.9 or 999.9 (decimal point position dependent on input type)                                                                                                                                                                                                                                |
| Sampling period                | Temperature input: 250 ms<br>Analog input: 100 ms                                                                                                                                                                                                                                                                  |
| Insulation resistance          | 200 M $\Omega$ 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 <sup>2</sup> (approx. 1G) for 10 min each in X, Y, and Z directions<br>Destruction: 10 to 55 Hz, 20 m/s <sup>2</sup> (approx. 2G) for 2 hrs each in X, Y, and Z directions                                                                                                        |
| Shock resistance               | Malfunction: 200 m/s <sup>2</sup> min. (approx. 20G), 3 times each in 6 directions<br>(100 m/s <sup>2</sup> (approx. 10G) applied to the relay)<br>Destruction: 300 m/s <sup>2</sup> 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<br>Storage: -25°C to 65°C (with no icing)                                                                                                                                                                                           |
| Ambient humidity               | Operating: 35% to 85%                                                                                                                                                                                                                                                                                              |
| Enclosure ratings              | Front panel: NEMA4 for indoor use (equivalent to IP66)<br>Rear case: IEC standard IP20<br>Terminals: IEC standard IP00                                                                                                                                                                                             |
| Memory protection              | Non-volatile memory (number of writings: 100,000 operations)                                                                                                                                                                                                                                                       |
| Weight                         | Approx. 170 g;<br>Adapter: approx. 10 g                                                                                                                                                                                                                                                                            |

**Note:** The indication accuracy of the K1, T, and N thermocouples at a temperature of -100°C or less is  $\pm 2^\circ\text{C} \pm 1$  digit maximum. The indication accuracy of the U, L1, and L2 thermocouples at any temperature is  $\pm 2^\circ\text{C} \pm 1$  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  $\pm 3^{\circ}\text{C} \pm 1$  digit maximum.

The indication accuracy of the W thermocouple at any temperature is ( $\pm 0.3\%$  of the indicated value or  $\pm 3^{\circ}\text{C}$ , whichever is greater)  $\pm 1$  digit maximum.

The indication accuracy of the PLII thermocouple at any temperature is ( $\pm 0.3\%$  or  $\pm 2^{\circ}\text{C}$ , whichever is greater)  $\pm 1$  digit maximum.

## ■ Output Unit Ratings and Characteristics

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

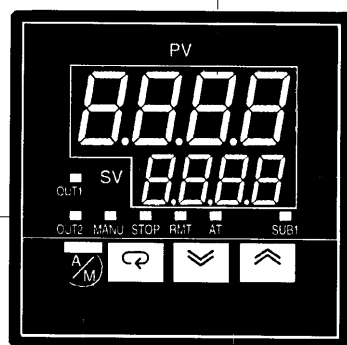
## ■ Option Unit Ratings and Characteristics

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

## Terminals/Connections

### Operation Indicators

- **OUT1**  
Lit when the pulse output function assigned to control output 1 turns ON.
- **OUT2**  
Lit when the pulse output function assigned to control output 2 turns ON.
- **SUB1**  
Lit when the output function assigned to auxiliary output 1 turns ON.
- **MANU**  
Lit when in the manual operation mode.
- **STOP**  
Lit when operation has stopped.
- **RMT**  
Lit 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

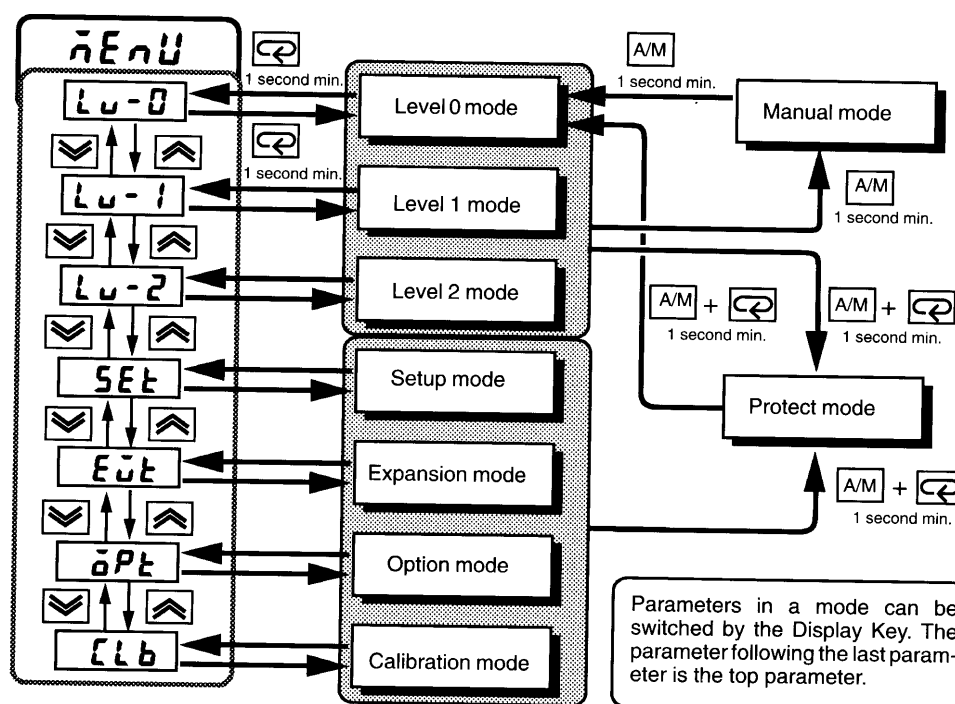
Press to select the auto operation or manual operation.

## 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.



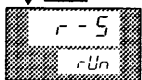
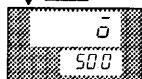
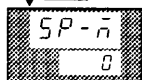
### ■ Parameters and Menus

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

|                         |                                                                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Protect Mode</b>     | Limits access to the menus and A/M Keys. The protect function can prevent unwanted modification of parameters and switching between the auto and manual operation.                                                                                                                    |
| <b>Manual Mode</b>      | The Controller can be switched to manual operation. The manipulated variable is only accessible in this mode.                                                                                                                                                                         |
| <b>Level 0 Mode</b>     | Set the Controller to this mode during normal operation. In this mode you can change the set point, and start or stop Controller operation. The process value, ramp SP, and manipulated variable can only be monitored in this mode.                                                  |
| <b>Level 1 Mode</b>     | The main mode for adjusting basic parameters, execute AT (auto-tuning), set alarm values, control period, and PID parameters.                                                                                                                                                         |
| <b>Level 2 Mode</b>     | The auxiliary mode for adjusting control. In this mode you can 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 inputs.          |
| <b>Setup Mode</b>       | The mode for setting the basic specifications parameters that must be checked or set before operation. Such as the input type, scaling, output assignments and direct/reverse operation.                                                                                              |
| <b>Expansion Mode</b>   | The mode for setting expanded functions. In this mode you can 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. |
| <b>Option Mode</b>      | The mode for setting option functions. Select this mode only when an Option Unit is installed in the Controller. In this mode you can set the communications conditions, transfer output or event input parameters to match the Option Unit being used.                               |
| <b>Calibration Mode</b> | This mode is used for setting limits on the analogue inputs and transfer output. (E53-CKF) only (if fitted).                                                                                                                                                                          |

## ■ 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 the selected is shown.

#### Set Point During SP Ramp

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

#### MV Monitor (Heat)

Used when the unit is heating control. (reverse action)

#### MV Monitor (Cool)

Used when the Unit is in cooling control. (direct operation)

#### Run/Stop

#### Security

Any mode marked with "X" in the following table is not displayed on the menu when this parameter is set from "0" to "4".

| 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 |

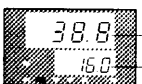
Only access to level "0" and monitor mode will be available when this parameter is set to either "4" or "6".

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.



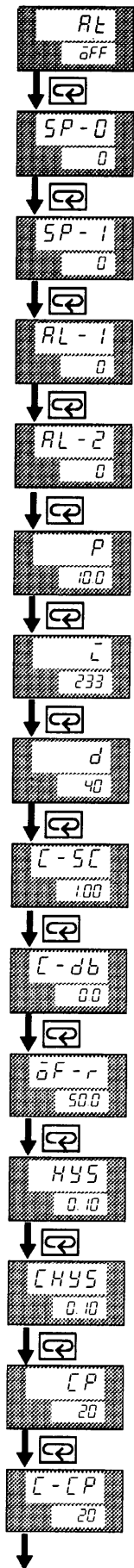
MANU indicator

Process value

Manipulated variable

#### 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 heat/cool mode.

**Dead Band**Used when the Controller is in heat/cool mode.  
(To separate heating and cooling proportional bands.)**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.

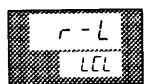
**Control Period (Heat)**

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

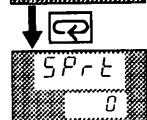
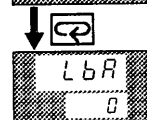
**Control Period (Cool)**

Available when the Controller has a relay or voltage output, or is in advanced PID control in heat/cool mode.

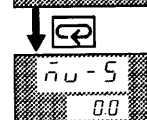
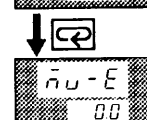
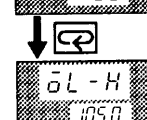
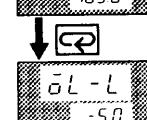
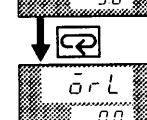
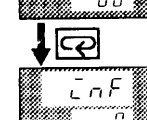
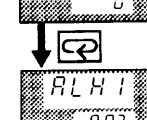
## Level 2 Mode

**Remote/Local**

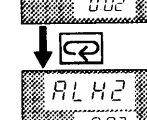
Used for the communications function.

**SP Ramp Time Unit****SP Ramp Set Value****LBA Detection Time**

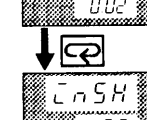
Available only when the LBA (loop break alarm) function of the Controller is selected.

**MV at Stop****MV at PV Error****MV Upper Limit****MV Lower Limit****MV Change Rate Limit****Input Digital Filter****Alarm 1 Hysteresis**

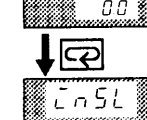
Available only when the Controller has an alarm output.

**Alarm 2 Hysteresis**

Available only when the Controller has a second alarm output.

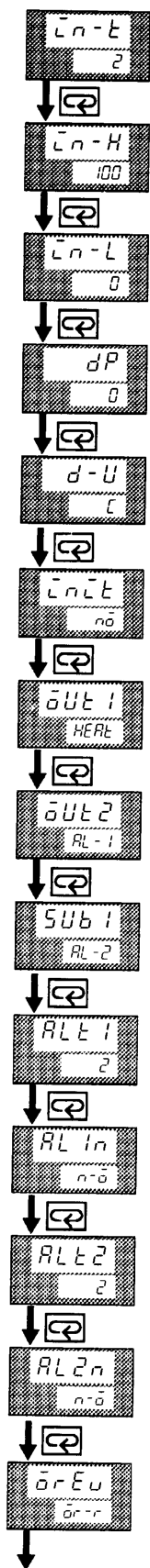
**Input Shift Upper Limit**

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 type 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**

Sets Output 1 to be heating, cooling, alarm 1, alarm 2, alarm 3, or LBA (loop break alarm) output.

**Control Output 2 Assignment**

Sets Output 2 to be heating, cooling, alarm 1, alarm 2, alarm 3, or LBA (loop break alarm) output.

**Auxiliary Output 1 Assignment**

Sets output to be alarm 1, alarm 2, alarm 3, LBA (loop break alarm), error 1, or error 2 output.

**Alarm 1 Type**

See option table.

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

**Alarm 1 Open in Alarm**

Allows alarm contact to be opened or closed. When alarm is active.

**Alarm 2 Type**

See option table.

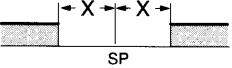
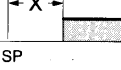
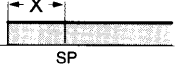
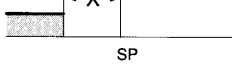
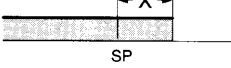
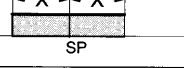
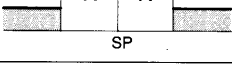
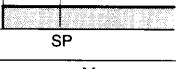
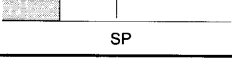
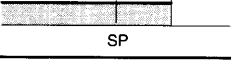
**Alarm 2 Open in Alarm**

Allows alarm contact to be opened or closed. When alarm is active.

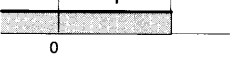
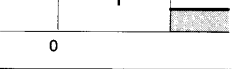
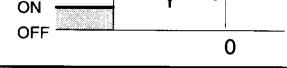
**Direct/Reverse Operation**

Direct = cooling application

Reverse = heating application

| Switch setting | Alarm operation                                                         | Alarm output                                                                              |                                                                                            |
|----------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
|                |                                                                         | When X or Y is positive                                                                   | When X or Y is negative                                                                    |
| 1              | Upper- and lower-limit alarm ( <u>deviation</u> )                       | ON OFF  | Always ON                                                                                  |
| 2              | Upper-limit alarm ( <u>deviation</u> )                                  | ON OFF  | ON OFF  |
| 3              | Lower-limit alarm ( <u>deviation</u> )                                  | ON OFF  | ON OFF  |
| 4              | Upper- and lower-limit range alarm ( <u>deviation</u> )                 | ON OFF  | Always OFF                                                                                 |
| 5              | Upper- and lower-limit alarm with standby sequence ( <u>deviation</u> ) | ON OFF  | Always OFF                                                                                 |
| 6              | Upper-limit alarm with standby sequence ( <u>deviation</u> )            | ON OFF  | ON OFF  |
| 7              | Lower-limit alarm with standby sequence ( <u>deviation</u> )            | ON OFF  | ON OFF  |

**Note:** Alarm settings 1–7 inclusive: Alarm value X is set **relative** to set point.

|    |                                                                |                                                                                             |                                                                                              |
|----|----------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 8  | <u>Absolute</u> -value upper-limit alarm                       | ON OFF    | ON OFF    |
| 9  | <u>Absolute</u> -value lower-limit alarm                       | ON OFF   | ON OFF   |
| 10 | <u>Absolute</u> -value upper-limit alarm with standby sequence | ON OFF  | ON OFF  |
| 11 | <u>Absolute</u> -value lower-limit alarm with standby sequence | ON OFF  | ON OFF  |

**Note:** Alarm settings 8–11 inclusive: Alarm value Y is **actual** value to 0.

## Expansion Mode

SL-H  
1300

**SP Setting Upper Limit**

Sets maximum, set point limit.

SL-L  
-200

**SP Setting Lower Limit**

Sets minimum, set point limit.

EntL  
P.d

**PID/ ON/OFF**

Control method selection.

St  
OFF

**Self tune**

Available if the Controller in standard control or advanced PID control has a temperature input. Activated if the temperature fluctuates outside the stable range.

St-b  
150

**ST Stable Range**

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

ALFA  
0.65

**ALFA**

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

At-G  
10

**AT Calculated Gain**

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

rSEt  
0

**Standby Sequence Reset Method**

rEt  
1

**Automatic Return of Display Mode**

To exit menus automatically.

At-H  
0.2

**AT Hysteresis**

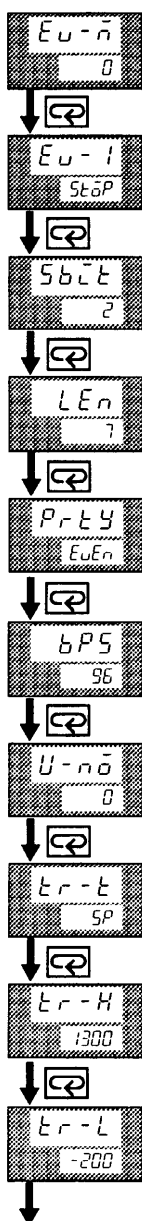
Available if the Controller is in advanced PID control with the ST set to OFF.

LbAb  
0.2

**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.

**5Err****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 (level2 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.E r r****Calibration Data Error****Meaning**

This error is displayed for two seconds when the power is turned ON.

**Action**

Calibration data is in error.

**Operation at Error**

Must be repaired – consult Omron.

Both control output functions and alarm output functions are active. However, note that the readout accuracy is not assured.

**CCCC  
JJJJ****Display Range Over****Meaning**

Though not an error, this is displayed when the process value exceeds the display range when the control range (setting range  $\pm 10\%$ ) is larger than the display range (–1999 to 9999).

- When less than “–1999” **CCCC**
- When greater than “9999” **JJJJ**

**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 difference between the set point and the process value at the time the E5CK starts operating is larger than the present proportional band value (P) $\times 1.27 + 4$ . | 2. The set point changing range is larger than the present proportional band value (P) $\times 1.27 + 4$ .  |
| 3. 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.               | 3. The process value is in stable condition before the set point is changed.                                |
|                                                                                                                                                                                | 4. 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.

**Imposition Completion Condition of Step Control Amount**

In order to prevent overshooting, the step controlled amount must be imposed continuously only while the present deviation is the same as or greater than the value obtained from the proportional band (P)  $\times$

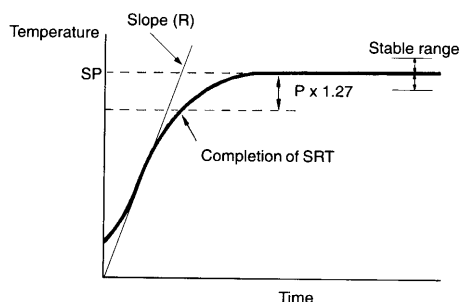
1.27. The step control will not be applied when the deviation becomes smaller than this value.

### 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 specified period, it is deemed that the temperature is stable.



### Balanced Status

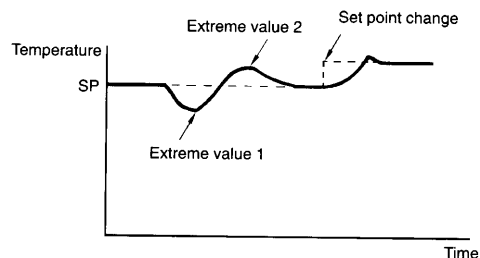
If the process value is within the stable range for 60 s when there is no output, it is deemed that the temperature is balanced.

### 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 (extreme values) is less than four.

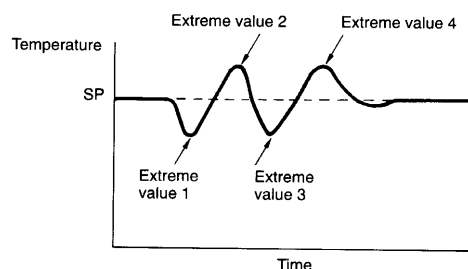
2. DT will start if the set point is changed under the condition that SRT does not start and the temperature becomes stable, provided that the number of maximum temperature values is less than four.

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.

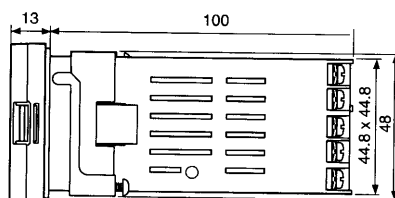
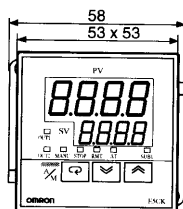
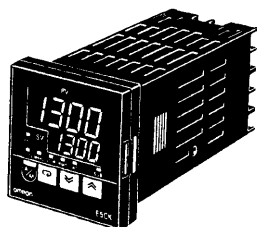


**Note:** In specific applications where temperature varies periodically due to disturbance, internal parameters need to be adjusted. For details, refer to the "E5CK User's Manual."

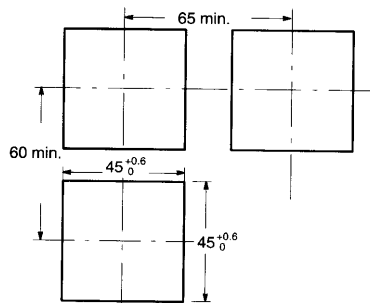
## Dimensions

**Note:** All units are in millimeters unless otherwise indicated.

### E5CK



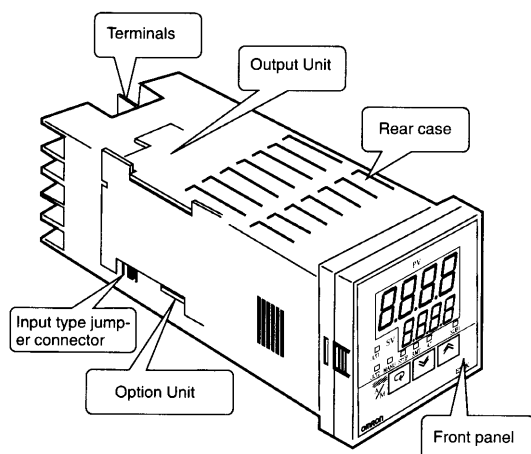
### Panel Cutouts



- 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.

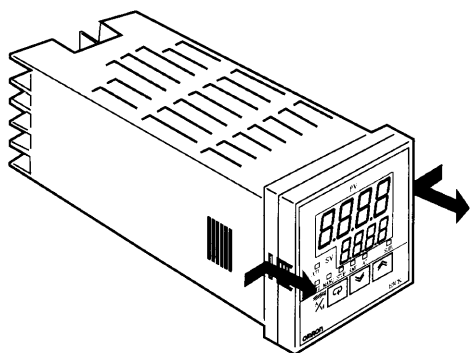
# Assembly/Disassembly

## ■ Installation Main Parts



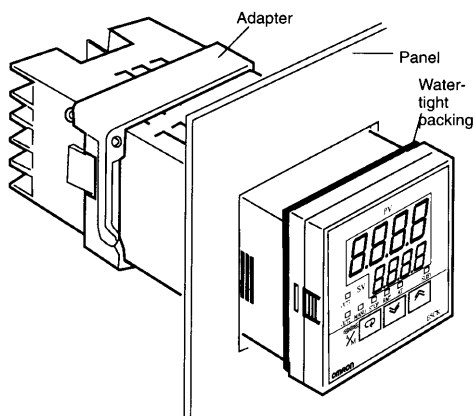
### Draw-out

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.



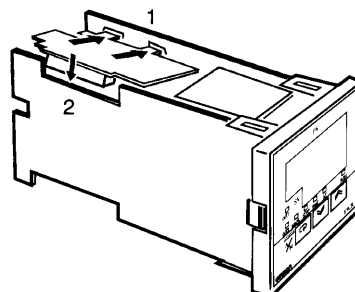
## ■ Mounting

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.



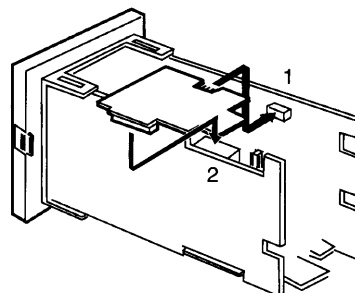
### Setting Up the Output Unit

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).



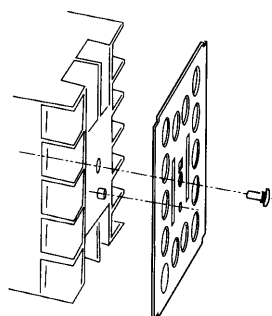
### Setting Up the Option Unit

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 powerboard connected, fit the board vertically into the Connector on the control board (left side of controller).

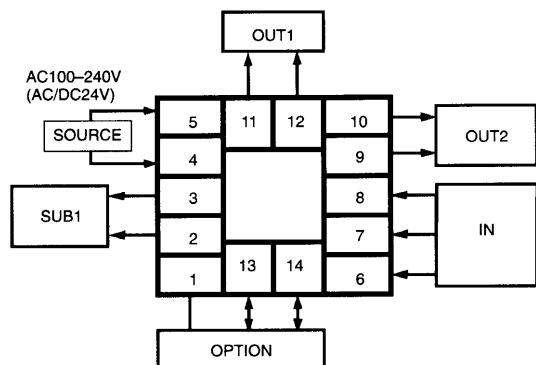


### Terminal Cover

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



## ■ Wiring Terminal Arrangement

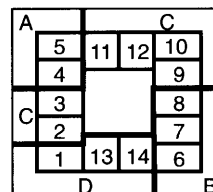


Solderless terminals are recommended when wiring the Controller. Tighten the terminal screws using a torque no greater than 0.78 N · m, or 8 kgf · cm max. Take care not to tighten the terminal screws too tightly.

### Power Blocks

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

- Option unit: E53-CKB or E53-CKF



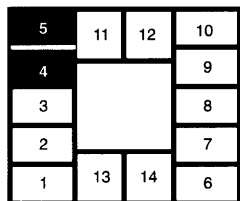
## Precautions

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

## Wiring

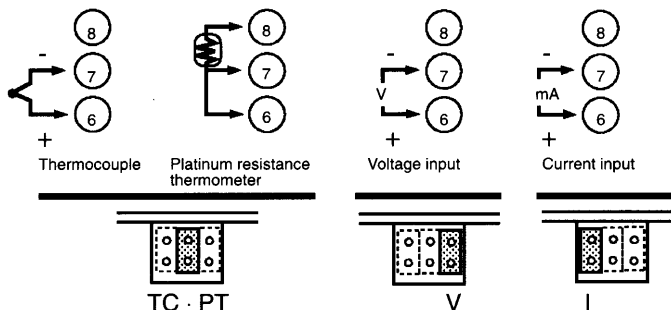
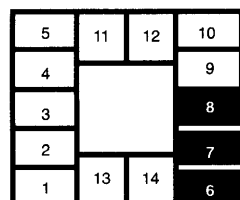
### Power Supply

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



### Input

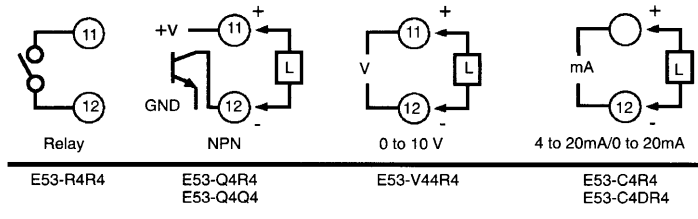
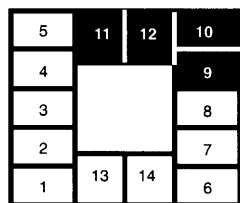
Connect the input to terminal numbers 6 to 8 as follows according to the input type.



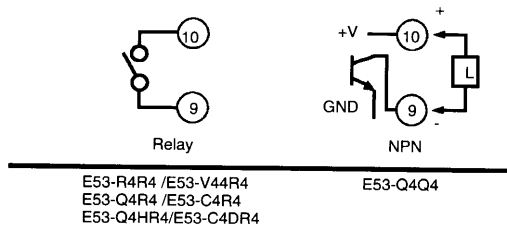
Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the inputs to a common position (TC/PT) as the temperature input.

### Control Output

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



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



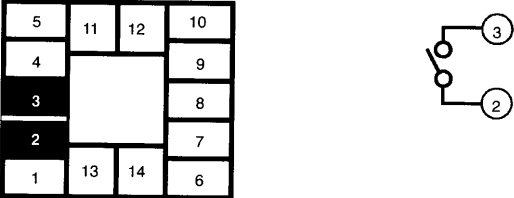
The following table shows the specifications for each output type.

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

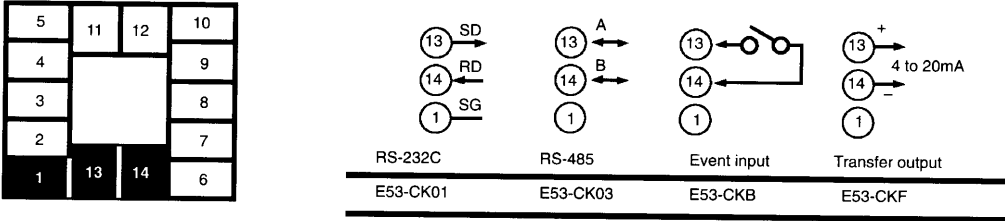


Relay specifications are as follows:  
SPST-NO, 250 VAC, 1 A

### Option

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

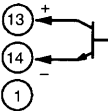
The following four connections are possible depending on the model of the Option Unit.



Use event inputs under the following conditions:

|                  |                                                                   |
|------------------|-------------------------------------------------------------------|
| Contact input    | ON: 1 k $\Omega$ max., OFF: 100 k $\Omega$ 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  $\Omega$  max., resolution approx. 2600

Cat. No. I-E5CK-002 In the interest of product improvement, specifications are subject to change without notice.

OMRON

LEADERS IN ADVANCED TECHNOLOGIES

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