

Ramp/Soak Process Controller

E5CK-T

Advanced, 1/16-DIN Ramp/Soak Process Controllers Ideal for Worldwide Use

- Offers one pattern of simple programming control, up to four patterns with communications (16 steps per pattern).
- Water-resistant front face meets IP66/NEMA 4 (indoor use).
- Modular structure, one-stock type.
- Heat/Cool 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.
- 3-year warranty.



Ordering Information

Order control output boards and option boards separately. A single output board and option board can be mounted to each base unit. For example, for a relay control output, order the E53-R4R4 output board in addition to the E5CK-TAA1-500 Process Controller. Model with -500 has a terminal cover for finger protection.

Process Controllers

Stock Note: Shaded models are normally stocked.

Description	DIN size	Supply voltage	Model
Base unit with terminal cover	1/16 DIN (48 x 48 mm)	100-240 VAC	E5CK-TAA1-500 AC100-240
			E5CK-TAA1 AC100-240

Note: Part numbers ending in -500 available at Omron USA, non -500 numbers available in Omron Canada only. Model with -500 has a terminal cover for finger protection.

Optional Output Boards

Stock Note: Shaded models are normally stocked.

Description	Specifications	Max. quantity	Model
Relay/Relay	SPST/SPST, 5 A, 250 VAC	1	E53-R4R4
Relay/Pulse	SPST, 5 A/NPN, 24 VDC	1	E53-Q4R4
	SPST, 5 A/PNP, 24 VDC	1	E53-Q4HR4
Relay/Linear current	SPST, 5 A/4-20 mA	1	E53-C4R4
	SPST, 5 A/0-20 mA	1	E53-C4DR4
Relay/Linear voltage	SPST, 5 A/0-10 VDC	1	E53-V44R4
Pulse/Pulse	NPN/NPN, 24 VDC	1	E53-Q4Q4
	PNP/PNP, 24 VDC	1	E53-Q4HQ4H
Computer communications	RS-232C	1	E53-CK01
	RS-485	1	E53-CK03
Event input	For remote set point	1	E53-CKB
Transfer output	4 to 20 mA	1	E53-CKF

Note: If the control period is less than 5 seconds, use an SSR (solid state relay) or pulse voltage output.

■ Accessories (Order Separately)

Stock Note: Shaded models are normally stocked.

Description	Specifications	Compatible controller	Max. quantity	Model
Current transformer; order only if using heater burnout alarm function	50 A load, 5.8 mm hole dia.	E5CK-T	1	E54-CT1
	120 A load, 12 mm hole dia.	E5CK-T	1	E54-CT3
Terminal cover (supplied with -500 models)	Provides finger protection from terminals (VDE0106 part 100)	E5CK-T	1	E53-COV07
Software	For setup and monitoring; requires optional computer communications board	All	1	Thermo Tools (see Note)

Note: Contact Omron for current version information.

Specifications

■ Ratings

Model		E5CK-T
Supply voltage		100 to 240 VAC, 50/60 Hz
Power consumption		15 VA
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 Board (see <i>Output Board Ratings and Characteristics</i>)
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 or communications features
Indication method		7-segment digital display and LEDs
Additional 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

■ 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% of indication value, ±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)
Set time		0 to 99 hrs 59 min or 0 to 99 min 59 s
Program capacity		1 pattern, 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%
Enclosure ratings	Front panel	NEMA 4 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: 10V (0.15 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. 14, 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 max. is $\pm 2^{\circ}\text{C} \pm 1$ digit maximum. The indication accuracy of the U and L 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 max. is unrestricted. The indication accuracy of the R and S thermocouples at a temperature of 200°C max. 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) ± 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) ± 1 digit maximum.
2. The sampling period of the standard model with CT and remote SP inputs is 250 ms.

■ Option Board Ratings and Characteristics

Model	Description		Specifications
E53-CKB	Event input		Contact input: ON: 1 k Ω max., OFF: 100 k Ω min. No-contact input: ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max.
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: Permissible load impedance: 500 Ω max. Resolution: approx. 2,600 steps

Note: Event input is used for switching the pattern number, run or reset command, or automatic and manual mode with an external signal input.

Temperature Ranges

Platinum Resistance Thermometer

Input (switch selectable)		JPt100	Pt100
Range	$^{\circ}\text{C}$	-199.9 $^{\circ}$ to 650.0 $^{\circ}$	-199.9 $^{\circ}$ to 650.0 $^{\circ}$
	$^{\circ}\text{F}$	-199.9 $^{\circ}$ to 999.9 $^{\circ}$	-199.9 $^{\circ}$ to 999.9 $^{\circ}$
Resolution $^{\circ}\text{C}/^{\circ}\text{F}$ (main setting and alarm)		0.1	0.1

Thermocouple

Input (switch selectable)		K1	K2	J1	J2	T	E	L1	L2	U	N	R	S	B	W	PLII
Range	$^{\circ}\text{C}$	-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
	$^{\circ}\text{F}$	-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 $^{\circ}\text{C}/^{\circ}\text{F}$ (main setting, alarm)		1	0.1	1	0.1	0.1	1	1	0.1	0.1	1	1	1	1	1	1

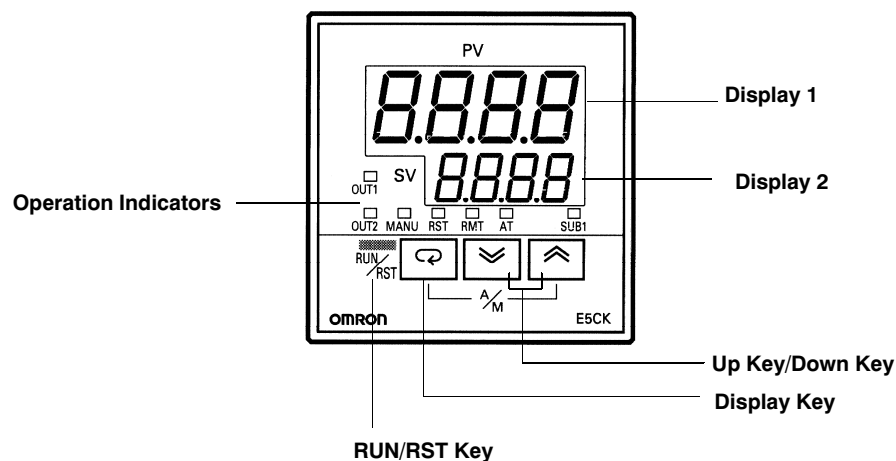
Note: 1. Setting number is factory-set to 2 (K1).
2. Thermocouple W is W/Re 5-26 (tungsten rhenium 5, tungsten rhenium 26).

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 (main setting and alarm)	Depends on range selected				

Nomenclature

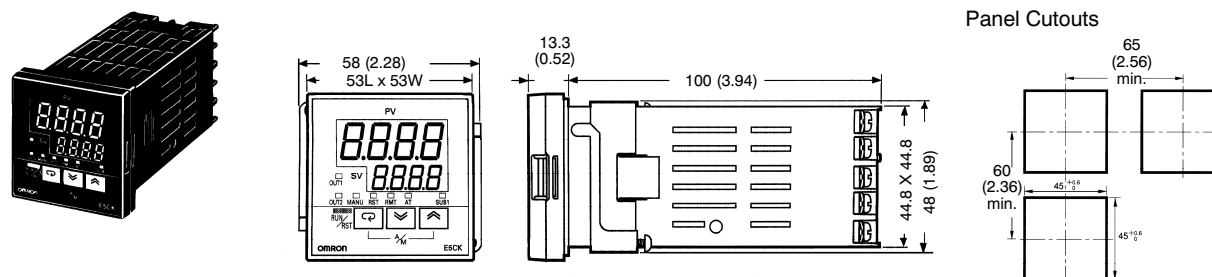
■ E5CK-T



Dimensions

Unit: mm (inch)

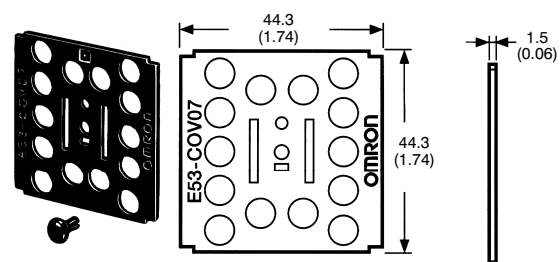
■ E5CK-T



■ Accessories

Terminal Cover

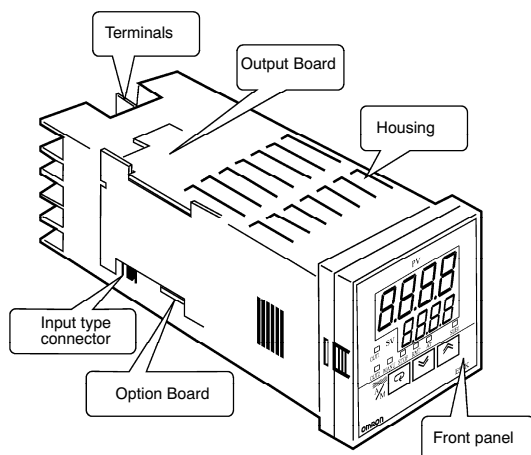
E53-COV07



Note: Terminal cover is supplied for controller with -500 in the part number; for non-500 model, order separately.

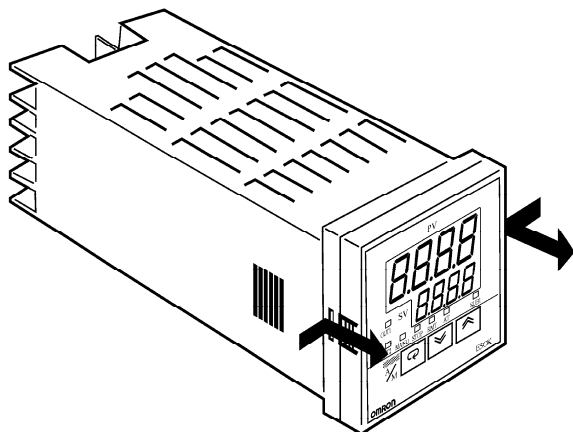
Installation

■ Main Parts



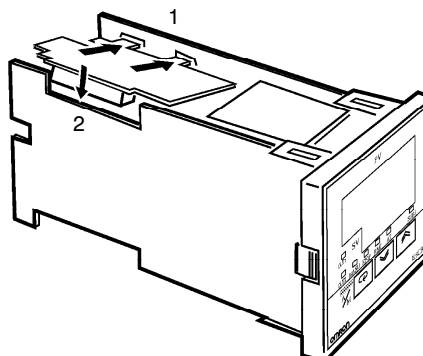
■ Removing Internal Mechanism

While pressing the hooks on the left and right sides of the front panel, carefully pull the internal mechanism from the housing.
(Refer to the drawing below.)



■ Setting Up the Output Board

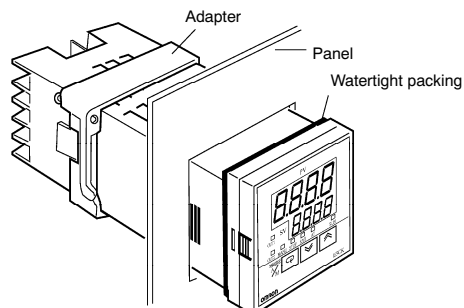
1. Two rectangular holes are provided on the power board (right side of Controller). Fit the two protrusions of the output board into these two holes.
2. With the output board fitted into the power board, fit the output board into the connector on the control board (left side of Controller).



■ Mounting the Controller

Note: On a standard model, set up the output boards for control outputs 1 and 2 before mounting the controller.

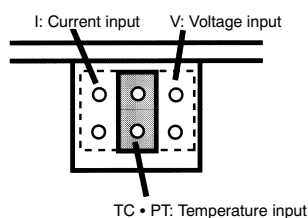
1. Insert the Controller into the panel's mounting hole at the position shown in the figure below.
2. Push the adapter along the Controller body from the terminals up to the panel, and fasten temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws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



Input Jumper Setting

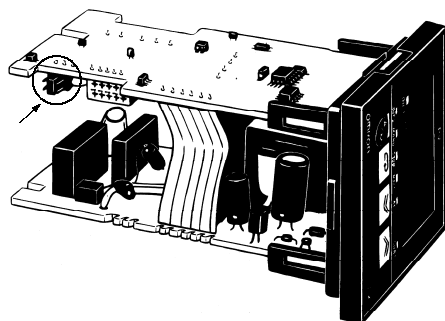
Note: The jumper is factory-set to TC • PT (temperature input).

Set the jumper to temperature, voltage, or current input according to the sensor connected to the input terminal.



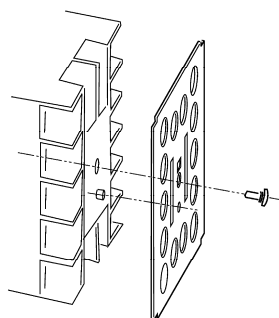
Note: Do not touch the pins of the jumper connector when setting the input type.

After setting the jumper, put on the housing, pressing the housing until the hooks of the front panel snap on.



Terminal Cover

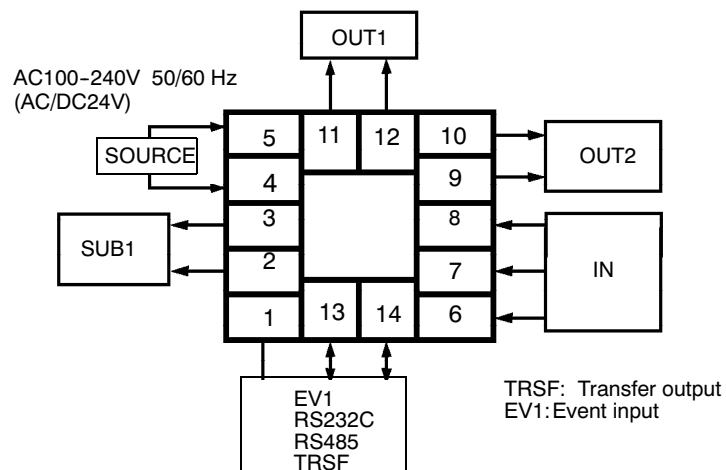
The E5CK-AA1-500 Controller is provided with a terminal cover E53-COV07. Fasten the terminal cover as follows by using the snap pin.



Wiring Terminals

Terminal Arrangement

E5CK-T



■ Wiring Precautions

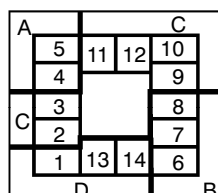
- Use ducts to separate input leads and power lines in order to protect the Controller and its lines from external noise.
- Solderless terminals are recommended when wiring the Controller.
- Tighten the terminal screws using a torque no greater than $0.78 \text{ N} \cdot \text{m}$, or $8 \text{ kgf} \cdot \text{cm}$ max. Be careful not to tighten the terminal screws too tightly.

Power Blocks for E5CK-T

The E5CK-T has independent power supplies for each of the terminal blocks shown below.

Note: The power supplies for blocks C (exclude relay output) and D are shared for the following option board:
E53-CKB or E53-CKF Option Board

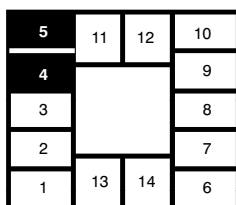
E5CK-T



■ E5CK-T Wiring

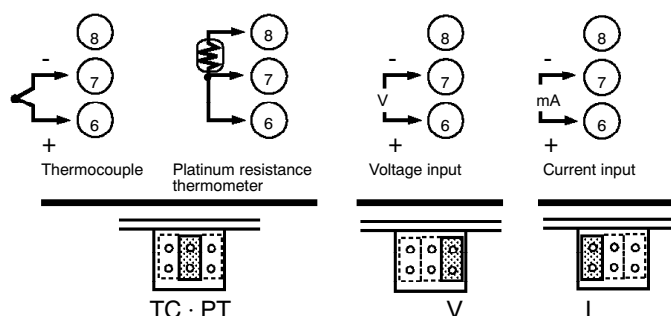
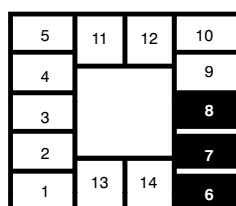
Power Supply

Input 100 to 240 VAC to terminal numbers 4 and 5 according to the specification.



Input

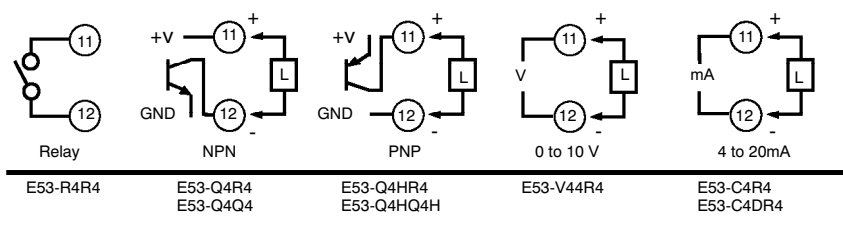
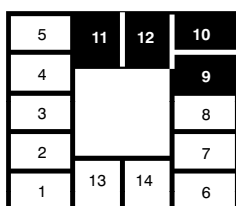
Connect the input to terminal numbers 6 to 8 as follows according to the input type.



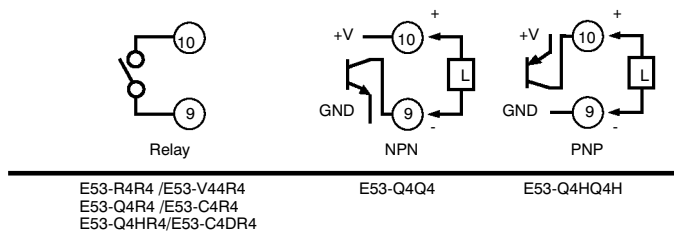
Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the inputs to a common position (TC/PT) as the temperature input.

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 board.



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 board.



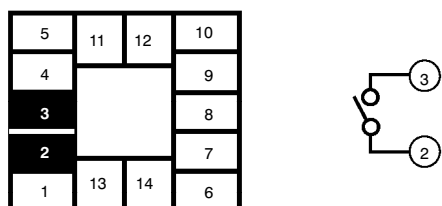
Specifications for Each Type of Output

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

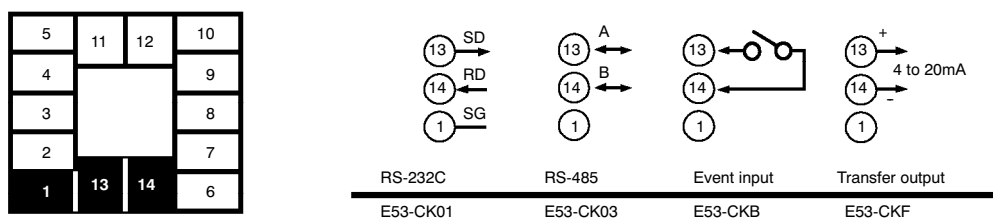


Relay specifications are as follows: SPST-NO, 250 VAC, 1 A

Option

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

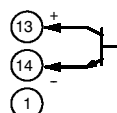
The following four connections are possible depending on the model of the option board.



Use event inputs under the following conditions:

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

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

Precautions

■ Operating Environment

- Operate the Controller within the rated ambient operating temperature, ambient operating humidity, and storage temperature ranges.
- Use the Controller according to the vibration resistance, shock resistance, and enclosure ratings.
- Do not install the Controller in places with corrosive gas or excessive dust.
- Do not install the Controller near machines generating high-frequency noise.

■ Mounting

- The dimensions of the 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 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 $0.78 \text{ N} \cdot \text{m}$ or $8 \text{ kgf} \cdot \text{cm}$.
- Use the following type of solderless terminals for M3.5 screws.

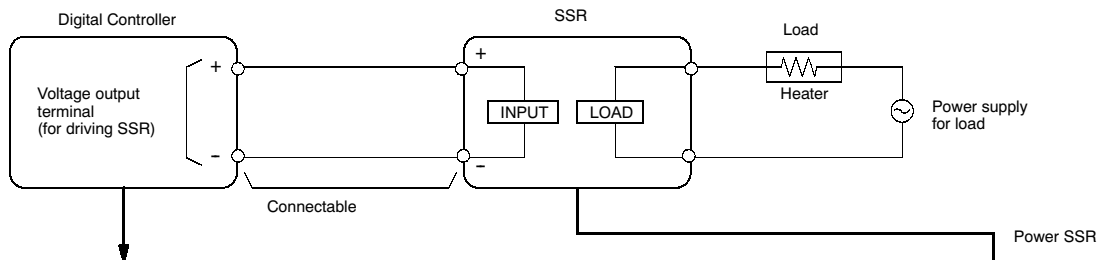


■ Operation

- The alarm outputs of a model with an alarm function may not turn ON correctly when the model malfunctions. The use of alarm equipment with the Controller 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.
- After power has been supplied to the Controller, several seconds are required until the relay is turned ON. Consider this time delay when designing sequenced circuits which incorporate a Controller.
- Do not use excessive force when removing 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 board to the Temperature Controller or Process Controller, make sure that the control output board is the appropriate type, or the system may malfunction.

SSR

Connection Example of Process Controller and SSR



E5□K-T

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



E5CK-T

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



See the following table.

Model	G3PA/G3PB	G3NA	G3NE
Appearance			
SSRs connected in parallel	E5AK-/E5EK-T: 8 pcs. E5CK-T: 4 pcs.	E5AK-/E5EK-T: 5 pcs. E5CK-T: 2 pcs.	E5AK-/E5EK-T: 2 pcs. E5CK-T: 1 piece
Rated input voltage	5 to 24 VDC	5 to 24 VDC	12 VDC
Features	Thin, SSR with built-in heat sink; 1-phase and 3-phase models	Standard model with screw terminals	Compact, low-cost model with tab terminals

Certain Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "Terms") are deemed part of all catalogs, manuals or other documents, whether electronic or in writing, relating to the sale of goods or services (collectively, the "Goods") by Omron Electronics LLC and its subsidiary companies ("Seller"). Seller hereby objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms. Please contact your Omron representative to confirm any additional terms for sales from your Omron company.
2. **Prices.** All prices stated are current, subject to change without notice by Seller. Buyer agrees to pay the price in effect at time of shipment.
3. **Discounts.** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Seller's payment terms and (ii) Buyer has no past due amounts owing to Seller.
4. **Orders.** Seller will accept no order less than \$200 net billing.
5. **Governmental Approvals.** Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Goods.
6. **Taxes.** All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Seller or required to be collected directly or indirectly by Seller for the manufacture, production, sale, delivery, importation, consumption or use of the Goods sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Seller.
7. **Financial.** If the financial position of Buyer at any time becomes unsatisfactory to Seller, Seller reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Seller may (without liability and in addition to other remedies) cancel any unshipped portion of Goods sold hereunder and stop any Goods in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
8. **Cancellation; Etc.** Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Seller fully against all costs or expenses arising in connection therewith.
9. **Force Majeure.** Seller shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
10. **Shipping; Delivery.** Unless otherwise expressly agreed in writing by Seller:
 - a. Shipments shall be by a carrier selected by Seller;
 - b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
 - c. All sales and shipments of Goods shall be FOB shipping point (unless otherwise stated in writing by Seller), at which point title to and all risk of loss of the Goods shall pass from Seller to Buyer, provided that Seller shall retain a security interest in the Goods until the full purchase price is paid by Buyer;
 - d. Delivery and shipping dates are estimates only.
 - e. Seller will package Goods as it deems proper for protection against normal handling and extra charges apply to special conditions.
11. **Claims.** Any claim by Buyer against Seller for shortage or damage to the Goods occurring before delivery to the carrier must be presented in writing to Seller within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Goods from Seller in the condition claimed.
12. **Warranties.** (a) **Exclusive Warranty.** Seller's exclusive warranty is that the Goods will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Seller (or such other period expressed in writing by Seller). Seller disclaims all other warranties, express or implied. (b) **Limitations.** SELLER MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE GOODS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE GOODS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Seller further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Goods or otherwise of any intellectual property right. (c) **Buyer Remedy.** Seller's sole obligation hereunder shall be to replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Good or, at Seller's election, to repay or credit Buyer an amount equal to the purchase price of the Good; provided that in no event shall Seller be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Goods unless Seller's analysis confirms that the Goods were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any goods by Buyer must be approved in writing by Seller before shipment. Seller shall not be liable for the suitability or unsuitability or the results from the use of Goods in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.
13. **Damage Limits; Etc.** SELLER SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE GOODS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Seller exceed the individual price of the Good on which liability is asserted.
14. **Indemnities.** Buyer shall indemnify and hold harmless Seller, its affiliates and its employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Seller is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Goods. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Seller and defend or settle any action brought against Seller to the extent that it is based on a claim that any Good made to Buyer specifications infringed intellectual property rights of another party.
15. **Property; Confidentiality.** The intellectual property embodied in the Goods is the exclusive property of Seller and its affiliates and Buyer shall not attempt to duplicate it in any way without the written permission of Seller. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Seller. All information and materials supplied by Seller to Buyer relating to the Goods are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
16. **Miscellaneous.** (a) **Waiver.** No failure or delay by Seller in exercising any right and no course of dealing between Buyer and Seller shall operate as a waiver of rights by Seller. (b) **Assignment.** Buyer may not assign its rights hereunder without Seller's written consent. (c) **Amendment.** These Terms constitute the entire agreement between Buyer and Seller relating to the Goods, and no provision may be changed or waived unless in writing signed by the parties. (d) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (e) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (f) As used herein, "including" means "including without limitation".

Certain Precautions on Specifications and Use

1. **Suitability of Use.** Seller shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Good in the Buyer's application or use of the Good. At Buyer's request, Seller will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Good. This information by itself is not sufficient for a complete determination of the suitability of the Good in combination with the end product, machine, system, or other application or use. The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of this Good, nor is it intended to imply that the uses listed may be suitable for this Good:
 - (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
 - (ii) Energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
 - (iii) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Good.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE SELLER'S PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
2. **Programmable Products.** Seller shall not be responsible for the user's programming of a programmable Good, or any consequence thereof.
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5. **Errors and Omissions.** The information in this catalog has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors, or omissions.

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ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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



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