

# 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 4

#### 1. Constant Value/Program

Blank: Constant value

T: Program

#### 2. 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)

#### 3. Auxiliary Output

1: Auxiliary output (1 point)

#### 4. 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
	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-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 $\Omega$ Voltage input: 1 M $\Omega$ min.	
Control output	According to Output Unit (see <i>Output Unit Ratings and Characteristics</i> )	
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 <i>Output Unit Ratings and Characteristics</i> )	

### Input Ranges

#### Platinum Resistance Thermometer

Input (switch selectable)	JPt100	Pt100
Range	$^{\circ}\text{C}$	-199.9 to 650.0
	$^{\circ}\text{F}$	-199.9 to 999.9
Resolution ( $^{\circ}\text{C}/^{\circ}\text{F}$ ) (main setting and alarm)	0	1

## Thermocouple

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

**Note:** Setting number is factory-set to 2 (K1).

Thermocouple W is W/Re 5-26 (tungsten rhenium 5, tungsten rhenium 26).

## Current/Voltage

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

## ■ Characteristics

Indication accuracy (See note.)	Thermocouple: (±0.3% of indication value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indication value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Proportional band (P)	0.1% to 999.9% FS (in units of 0.1% FS)
Integral (reset) time (I)	0 to 3,999 s (in units of 1 s)
Derivative (rate) time (D)	0 to 3,999 s (in units of 1 s)
Control period	1 to 99 s (in units of 1 s)
Manual reset value	0.0% to 100.0% (in units of 0.1%)
Alarm setting range	–1,999 to 9,999 or –199.9 or 999.9 (decimal point position dependent on input type)
Set time	0 to 99 hrs 59 min or 0 to 99 min 59 s
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	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 <sup>2</sup> (approx. 1G) for 10 min each in X, Y, and Z directions 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 (100 m/s <sup>2</sup> (approx. 10G) applied to the relay) 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 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  $-100^{\circ}\text{C}$  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  $400^{\circ}\text{C}$  or less is unrestricted.  
The indication accuracy of the R and S thermocouples at a temperature of  $200^{\circ}\text{C}$  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

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 k $\Omega$ min., Resolution: Approx. 2600
4 to 20 mA	4 to 20 mA, Permissible load impedance: 500 $\Omega$ max., Resolution: Approx. 2600

## ■ Option Unit Ratings and Characteristics

Model			Specifications
E53-CKB	Event input		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.
E53-CK01	Communications	RS-232C	Transmission method: Half-duplex
E53-CK03		RS-485	Synchronization method: Start-stop synchronization (asynchronous method) Baud rate: 1.2/2.4/4.8/9.6/19.2 kbps
E53-CKF	Transfer output		4 to 20 mA DC: Permissible load impedance: 600 $\Omega$ 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

### 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.

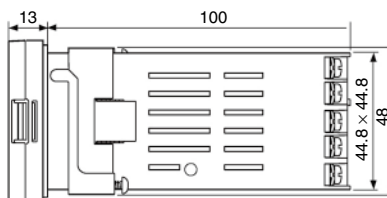
### A/M Key

Press to select the auto operation or manual operation.

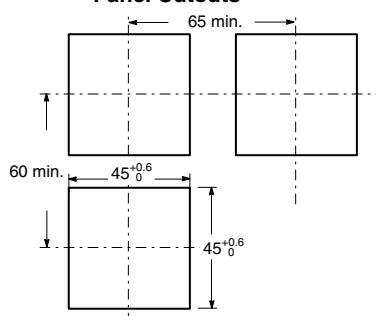
## Dimensions

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

### E5CK



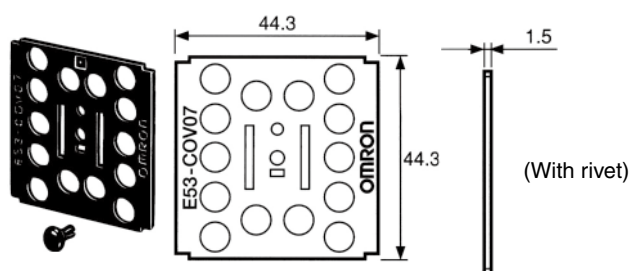
### Panel Cutouts



- 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.

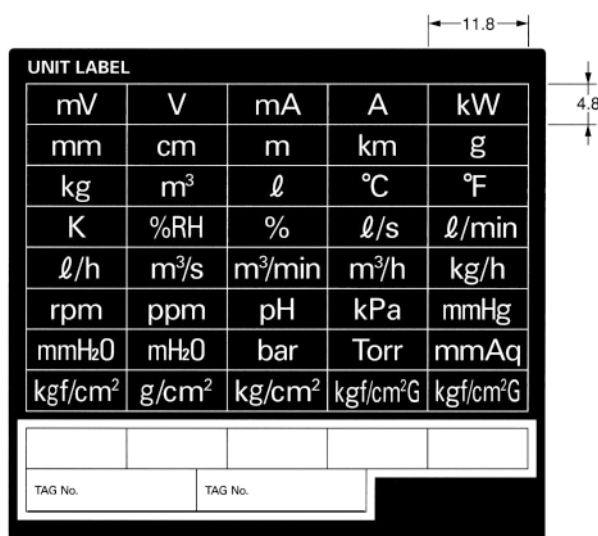
## Terminal Cover

E53-COV07



## Unit Label (Order Separately)

Y92S-L1



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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

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

# Safety Precautions for All Temperature Controllers

Refer to the precautions of individual product for more specific details.

## Warning

The following products contain lithium batteries. Do not disassemble, deform under pressure, heat to over 100°C, or incinerate these products. The lithium battery may ignite or explode. Applicable models: E5ZE, E5LD, and E5LC.



## Caution

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



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



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



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



The switching capacity and switching conditions will significantly affect 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.



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



Prepare a circuit with an overheating prevention alarm and implement 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.



Tighten the terminal screws to the following torque:

M3.5 screws: 0.74 to 0.90 N·m  
M3 screws: 0.40 to 0.56 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.

Make sure there will be no adverse affects from the device connected to the Temperature Controller before using the hardware test mode. Devices connected to the Temperature Controller may reach a dangerous state during the test.



## Operating Environment Precautions

- Do not use the Temperature Controller in the following locations:
  - Locations exposed to radiated heat from heating devices
  - Locations subject to exposure to water or oil
  - Locations subject to direct sunlight
  - Locations subject to dust or corrosive gases (in particular, sulfide gas and ammonia gas)
  - Locations subject to severe changes in temperature
  - Locations subject to icing or condensation
  - Locations subject to excessive shock or vibration
- Use and store the Temperature Controller within the rated temperature or humidity range 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 the heat they radiate and the service life of the products will decrease. In such cases, forced cooling by fans or other means of air ventilation will be required to cool down the Temperature Controllers.
- Allow enough space around the Temperature Controller to ensure proper heat dissipation. Do not block the ventilating holes.
- Be sure to wire properly with correct polarity of terminals.
- To wire the E5AN, E5EN, or E5CN using crimp terminals, use crimp terminals designed for M3.5 screws and with a width of 7.2 mm max.



- When wiring the E5GN, use a cable gauge of AWG24 (0.205 mm<sup>2</sup>) to AWG14 (2.081 mm<sup>2</sup>) for terminals 1 to 6, and use a cable gauge of AWG28 (0.081 mm<sup>2</sup>) to AWG22 (0.326 mm<sup>2</sup>) for terminals 7 to 9. The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.
- After wiring is completed, do not pull on or bend a terminal block lead wire with a force of 30 N or higher.
- Do not connect anything to unused terminals.
- Make sure that the power supply voltages and loads are within specification and rating ranges before using the Temperature Controller.
- To avoid inductive noise, keep the wiring for the Temperature Controller's terminal board away from power cables carrying high voltages or large currents. Also, do not wire power lines together with or parallel to Temperature Controller wiring. Using shielded cables to separate pipes and ducts is recommended. Attach surge absorbers or noise filters to peripheral devices that generate noise (e.g., motors, transformers, solenoids, magnetic coils, or other equipment that has an inductance element). If using a noise filter with the power supply, be sure to confirm the voltage and the current, and then 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, such as high-frequency welders and high-frequency machines, and from devices that generate surges.
- Make sure that the rated voltage is attained within two seconds of turning the power ON.
- Allow at least 30 seconds for the Temperature Controller to warm up.
- When using self-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, self-tuning will not be performed properly and optimum control will not be achieved.



## Precautions for Correct Use

14. 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.
15. Turn OFF the power before drawing out the Temperature Controller body. Do not touch or apply excessive force to the terminals or electronic parts. When inserting the body, make sure that electronic parts do not come in contact with the case.
16. When the terminal block for the E5GN is detached, do not touch or apply excessive force to any electronic parts.
17. Use alcohol to clean the Temperature Controller. Do not use thinner or other solvent-based substances.
18. Inverters with an output frequency of 50/60 Hz are available, but they may cause the internal temperature of Temperature Controller to rise, possibly resulting in smoke or burning. Do not use an inverter output to supply power to a Temperature Controller.

### ● Service Life

1. Use the Temperature Controller within the specified temperature and humidity ranges. If the product is installed inside a control panel, the temperature around the Temperature Controller and not the temperature around the control panel must be kept within the specified temperature range.
2. The service life of electronic devices such as Temperature Controllers is determined not only by the number of switching operations performed by the relay, but also by 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 extended by keeping the internal temperature of the Temperature Controller low.
3. If several Temperature Controllers are mounted side-by-side or are arranged vertically, the heat generated by them may cause the internal temperature of the products to rise, thus reducing their service life. To prevent this, take steps to ensure that the Temperature Controllers are cooled, such as installing fans. When providing forced cooling, however, be careful not to cool down the terminal sections alone to avoid measurement errors.

### ● Measurement Accuracy

1. When extending the lead wires for thermocouples, use a compensating conductor appropriate for the type of thermocouple use.
2. When extending the lead wires for platinum resistance thermometers, use lead wires with low resistance, and make the resistance in the 3 lead wires equal.
3. The type of Temperature Sensor and the input type for the Temperature Controller must be set the same.
4. There are two types of platinum resistance thermometers: Pt and JPt. Accurate measurement will not be possible if the input type for the Temperature Sensor is not set correctly.
5. Mount the Temperature Controller horizontally.
6. If significant errors occur, check to see if the input shift has been set correctly.

### ● Waterproofing

Sections without any specification on their degree of protection or those with IP□□ specifications are not waterproof.

### ● EN/IEC Compliance

Installing the following fuse in the power supply terminal block is recommended if the Temperature Controller is used in applications requiring EN/IEC compliance.

Recommended fuse: A T2A, 250-VAC, time lag fuse with low breaking capacity

### ● Operating Precautions

1. It takes approximately five 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.
2. When using the self-tuning capability of the E5□N, E5□K, or E5□J, 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, self-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.)
3. The reception of the Temperature Controller may be affected if it is used close to radios, television sets or wireless devices.

## Parameter Displays

The following displays are used to represent the characters for parameter names on the Temperature Controller.

### ● Seven-segment Digital Display

A	b	C	d	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

### ● Eleven-segment Digital Display

A	b	C	d	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

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## Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

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- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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