

# Temperature Controllers


# E5CS

CSM\_E5CS\_DS\_E\_5\_1

## Simple Functions in DIN 48 × 48 mm-size Plug-in Temperature Controllers

- Easy setting using DIP switch.
- Models with two alarms added to Series, ideal for applications requiring alarms.
- Universal-input (thermocouple/platinum resistance thermometer) models also available.
- Clearly visible digital display with character height of 13.5 mm.
- RoHS compliant.



 Refer to *Safety Precautions for All Temperature Controllers*.

Refer to *E5CS/E5CSV Operation* for operating procedures.

## Model Number Structure

### ■ Model Number Legend

#### Plug-in Models

E5CS-□□□□U-W  
1 2 3 4 5 6

#### 1. Control Outputs

- R: Relay
- Q: Voltage for driving SSR

#### 2. Alarm Outputs

- Blank: No alarm
- 1: 1 alarm
- 2: 2 alarms

#### 3. Input

- KJ: Thermocouple
- P: Platinum resistance thermometer
- G: Thermistor
- T: Thermocouple/platinum resistance thermometer (universal-input)

#### 4. Power Supply Voltage

- Blank: 100 to 240 VAC
- D: 24 VAC/VDC

#### 5. Terminal Shape

- U: Plug-in

#### 6. Case Color

- W: Light gray

**Note:** A functional explanation is provided here for illustration, but models are not necessarily available for all possible combinations. Refer to *Ordering Information* when ordering.

#### Examples

- Relay control output, without alarm, thermocouple input, plug-in construction, light gray case: E5CS-RKJU-W
- Relay control output, one alarm output, platinum resistance thermometer input, plug-in construction, light gray case: E5CS-R1PU-W

## Ordering Information

### ■ List of Models

#### Case Color: Light Gray, Thermocouple or Platinum Resistance Thermometer, Power Supply Voltage: 100 to 240 VAC

Size	Type	Control modes	Alarms	Outputs	Model with thermocouple	Model with platinum resistance thermometer
E5CS-U 48 × 48 mm	Plug-in	ON/OFF or PID	0	Relay	E5CS-RKJU-W	E5CS-RPU-W
				Voltage (for driving SSR)	E5CS-QKJU-W	E5CS-QPU-W
			1	Relay	E5CS-R1KJU-W	E5CS-R1PU-W
				Voltage (for driving SSR)	E5CS-Q1KJU-W	E5CS-Q1PU-W

#### Case Color: Light Gray, Thermocouple or Platinum Resistance Thermometer, Power Supply Voltage: 24 VAC/VDC

Size	Type	Control modes	Alarms	Outputs	Model with thermocouple	Model with platinum resistance thermometer
E5CS-U 48 × 48 mm	Plug-in	ON/OFF or PID	0	Relay	E5CS-RKJDU-W	E5CS-RPDU-W
				Voltage (for driving SSR)	E5CS-QKJDU-W	---
			1	Relay	E5CS-R1KJDU-W	E5CS-R1PDU-W
				Voltage (for driving SSR)	E5CS-Q1KJDU-W	---

#### Case Color: Light Gray, Thermistor or Universal-input, Power Supply Voltage: 100 to 240 VAC

Size	Type	Control modes	Alarms	Outputs	Model with thermistor	Model with universal-input (thermocouple and platinum resistance thermometer)
E5CS-U 48 × 48 mm	Plug-in	ON/OFF or PID	0	Relay	E5CS-RGU-W	E5CS-RTU-W
				Voltage (for driving SSR)	E5CS-QGU-W	E5CS-QTU-W
			1	Relay	E5CS-R1GU-W	E5CS-R1TU-W
				Voltage (for driving SSR)	E5CS-Q1GU-W	E5CS-Q1TU-W
			2 (See note.)	Relay	---	E5CS-R2TU-W
				Voltage (for driving SSR)	---	E5CS-Q2TU-W

**Note:** There is no alarm output 2 mode switch. The default setting for alarm output 2 is for the upper limit alarm mode. To change the setting, change the alarm type for alarm output 2 in initial setting level 5. For details, refer to the "E5CSV/E5CS-U Digital Temperature Controller User's Manual" (Cat. No. H140-E1-01).

#### Case Color: Light Gray, Thermistor, Power Supply Voltage: 24 VAC/VDC

Size	Type	Control modes	Alarms	Outputs	Model with thermistor
E5CS-U 48 × 48 mm	Plug-in	ON/OFF or PID	0	Relay	E5CS-RGDU-W
			1		E5CS-R1GDU-W

### ■ Accessories (Order Separately)

#### Socket without Alarm (8 Pins)

Type	Model
Front Connecting Socket	P2CF-08
Back Connecting Socket (flush mounting)	P3G-08
Front Connecting Socket (with finger protection)	P2CF-08-E
Finger Safe Terminal Cover for P3G	Y92A-48G

#### Socket with Alarm (11 Pins)

Type	Model
Front Connecting Socket	P2CF-11
Back Connecting Socket (flush mounting)	P3GA-11
Front Connecting Socket (with finger protection)	P2CF-11-E
Finger Safe Terminal Cover for P3G	Y92A-48G

#### Protective Cover

Type	Model
Hard Protective Cover	Y92A-48B

# Specifications

## ■ Ratings

<b>Supply voltage</b>		100 to 240 VAC, 50/60 Hz 24 VAC, 50/60 Hz; 24 VDC
<b>Operating voltage range</b>		85% to 110% of rated supply voltage
<b>Power consumption</b>		100 to 240 VAC: 5 VA 24 VAC: 3 VA, 24 VDC: 2 W
<b>Sensor input</b>		Thermocouple: K, J, L Platinum resistance thermometer: Pt100, JPt100 Thermistor: E52-THE□□ Universal-input (thermocouple/platinum resistance thermometer): K, J, L, T, U, N, R, Pt100, JPt100
<b>Control output</b>	<b>Relay output</b>	SPDT, 250 VAC, 3 A (resistive load)
	<b>Voltage output (for driving the SSR)</b>	12 VDC, 21 mA (with short-circuit protection circuit)
<b>Control method</b>		ON/OFF or 2-PID (with automatic PID parameter setting function)
<b>Alarm output</b>		SPST-NO, 250 VAC, 1A (resistive load)
<b>Setting method</b>		Digital setting using front panel keys
<b>Indication method</b>		7-segment digital display (character height: 13.5 mm) and deviation indicators
<b>Other functions</b>		<ul style="list-style-type: none"> <li>• Setting change prohibit (key protection)</li> <li>• Input shift</li> <li>• Temperature unit change (°C/°F)</li> <li>• Direct/reverse operation</li> <li>• Temperature range, Sensor switching (K/J/L, Pt100/JPt100)</li> <li>• Switching is performed between a thermocouple and platinum resistance thermometer for universal-input models.</li> <li>• Control period switching</li> <li>• 8-mode alarm output</li> <li>• Sensor error detection (excluding thermistor models)</li> </ul>
<b>Ambient operating temperature</b>		–10 to 55°C (with no condensation or icing); with 3-year guarantee: –10 to 50°C
<b>Ambient operating humidity</b>		25% to 85%
<b>Storage temperature</b>		–25 to 65°C (with no condensation or icing)

**Note:** Do not use an inverter output as the power supply. (Refer to *Safety Precautions for All Temperature Controllers*.)

## ■ Characteristics

<b>Setting accuracy</b>	Thermocouple (See note 1.):	(±1% of indication value or ±2°C, whichever is greater) ±1 digit max.
<b>Indication accuracy (ambient temperature of 23°C)</b>	Platinum resistance thermometer (See note 2.):	(±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max.
	Thermistor (See note 3.):	(1% FS of indication value) ±1 digit max.
<b>Influence of temperature</b>	R thermocouple inputs:	(±2% of PV or ±10°C, whichever is greater) ±1 digit max.
<b>Influence of voltage</b>	Other thermocouple inputs:	(±2% of PV or ±4°C, whichever is greater) ±1 digit max.
	Platinum resistance thermometer inputs:	(±1% of PV or ±2°C, whichever is greater) ±1 digit max.
	Thermistor:	(±2% FS) ±1 digit max.
<b>Hysteresis (for ON/OFF control)</b>	0.2% FS (0.1% FS for universal-input (thermocouple/platinum resistance thermometer) models)	
<b>Proportional band (P)</b>	1 to 999°C (automatic adjustment using auto-tuning/self-tuning)	
<b>Integral time (I)</b>	1 to 1,999 s (automatic adjustment using auto-tuning/self-tuning)	
<b>Derivative time (D)</b>	1 to 1,999 s (automatic adjustment using auto-tuning/self-tuning)	
<b>Alarm output range</b>	Absolute-value alarm:	Same as the control range
	Other:	0 to input setting range full scale (°C or °F)
	Alarm hysteresis:	0.2°C or °F (fixed)
<b>Control period</b>	2/20 s	
<b>Sampling period</b>	500 ms	
<b>Insulation resistance</b>	20 MΩ min. (at 500 VDC)	
<b>Dielectric strength</b>	2,000 VAC, 50/60 Hz for 1 min between current-carrying terminals of different polarity	
<b>Vibration resistance</b>	<b>Malfunction</b>	10 to 55 Hz, 20 m/s <sup>2</sup> for 10 min each in X, Y, and Z directions
	<b>Destruction</b>	10 to 55 Hz, 0.75-mm single amplitude for 2 hr each in X, Y, and Z directions
<b>Shock resistance</b>	<b>Malfunction</b>	100 m/s <sup>2</sup> min., 3 times each in six directions
	<b>Destruction</b>	300 m/s <sup>2</sup> min., 3 times each in six directions
<b>Life expectancy</b>	<b>Electrical</b>	100,000 operations min. (relay output models)
<b>Weight</b>	Approx. 110 g (Controller only)	
<b>Degree of protection</b>	Front panel: Equivalent to IP50, Enclosure Category 2 (IEC 60529), Rear case: IP20; Terminals: IP00	
<b>Memory protection</b>	EEPROM (non-volatile memory) (number of writes: 1,000,000)	
<b>EMC</b>	EMI Radiated:	EN 55011 Group 1 Class A
	EMI Conducted:	EN 55011 Group 1 Class A
	Radiated Electromagnetic Field Immunity:	EN 61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3)
	RF-interference Immunity:	EN 61000-4-3: 10 V/m (80-1000 MHz, 1.4-2.0 GHz amplitude modulated) (level 3) 10 V/m (900 MHz pulse modulated)
	Conducted Disturbance Immunity:	EN 61000-4-6: 3 V (0.15 to 80 MHz) (level 2)
	Noise Immunity (First Transient Burst Noise):	EN 61000-4-4
	Burst Immunity:	2 kV power-line (level 3), 1 kV I/O signal-line (level 3)
Surge Immunity:	EN 61000-4-5: Power line: Normal mode 1 kV; Common mode 2 kV Output line (relay output): Normal mode 1 kV; Common mode 2 kV	
Voltage Dip/Interrupting Immunity:	EN 61000-4-11 0.5 cycle, 100% (rated voltage)	
<b>Approved standards</b>	UL 61010-1 (listing) CSA C22.2 No.1010-1	
<b>Conformed standards</b>	EN 61326, EN 61010-1, IEC 61010-1	

**Note: 1.** The following exceptions apply to thermocouples.

- U, L: ±2°C ±1 digit max.
- R: ±3°C ±1 digit max. at 200°C or less

**2.** The following exception applies to platinum resistance thermometers.

- Input set values 1 for E5CS-U: 1% FS ±1 digit max.

**3.** The following exceptions apply to thermistors.

- When the unit setting is °C, temperature indication ranges exceeding the set temperature range ±10% FS may not be accurate.
- When the unit setting is °F, the temperature range for the input setting numbers 4 and 9 (609 to 630°F) and temperature indication ranges exceeding the set temperature range -5% FS to +10% FS may not be accurate.

## Temperature Range

### Thermocouple Input Models



The shaded value indicates the default setting status.

### Platinum Resistance Thermometer Input Models



The shaded value indicates the default setting status.

### Thermistor Input Models (For details on Sensors, refer to E52.)



The shaded value indicates the default setting status.

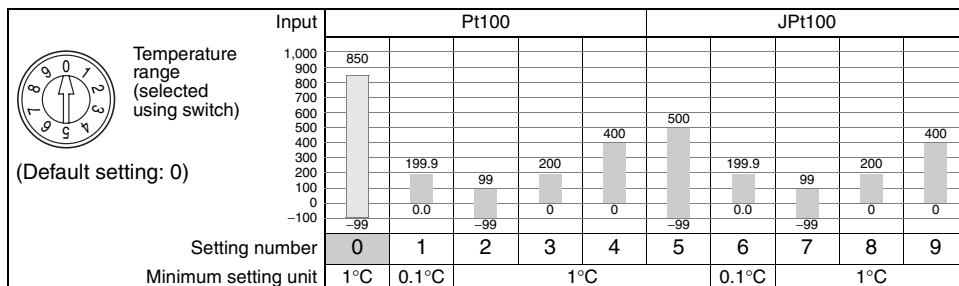
### Universal-input (Thermocouple/Platinum Resistance Thermometer) Models

#### • Using Thermocouple Sensors, Control Mode Switch 5: OFF



The shaded value indicates the default setting status.

#### • Using Platinum Resistance Thermometers, Control Mode Switch 5: ON



The shaded value indicates the default setting status.

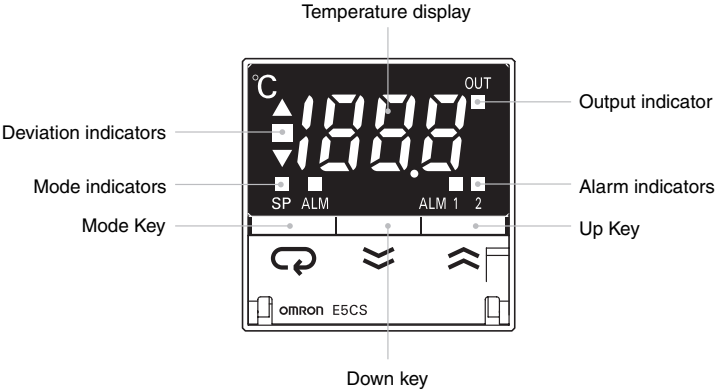
# External Connection Diagram

Sensor		Thermocouple (See note 3.)	Platinum resistance thermometer (See note 3.)	Thermistor
Plug-in models	Without alarms	<p>Voltage output models (See note 1.)</p> <p>Relay output models</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>	<p>Voltage output models (See note 1.)</p> <p>Relay output models</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>	<p>Voltage output models (See note 1.)</p> <p>Relay output models</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>
	With alarms	<p>Voltage output models (See note 1.)</p> <p>Two alarm points</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>	<p>Voltage output models (See note 1.)</p> <p>Two alarm points</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>	<p>Voltage output models (See note 1.)</p> <p>Relay output models</p> <p>100 to 240 VAC 24 VAC/VDC (See note 2.)</p>

- Note:**
1. The voltage output (12 VDC, 21 mA) is not electrically isolated from the internal circuits. When using a grounding thermocouple, do not connect output terminals 4 or 5 to ground. Otherwise, unwanted current paths will cause measurement errors.
  2. Models with 100 to 240 VAC and 24 VAC/VDC are separate. Models using 24 VDC have no polarity.
  3. Be sure to check the sensor type before using multi-output (thermocouple/platinum resistance thermometer) models.

## Nomenclature

### E5CS-U Plug-in Models

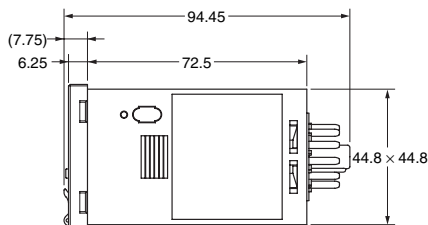
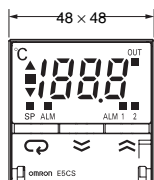
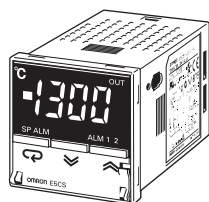


# Dimensions

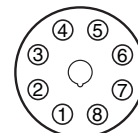
Note: All units are in millimeters unless otherwise indicated.

## Controller

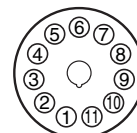
### E5CS-U



Terminal Arrangement (Bottom View)

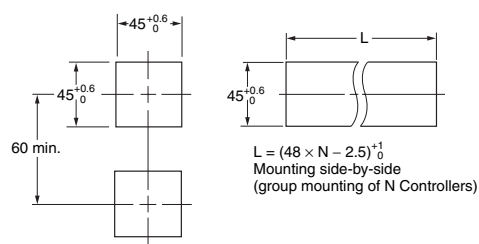


Models without alarms



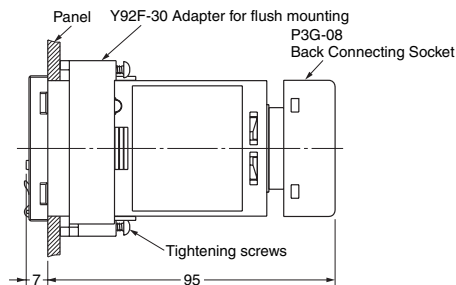
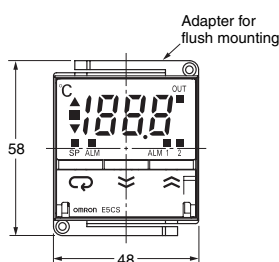
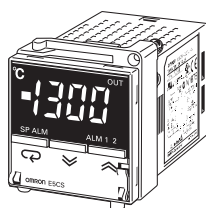
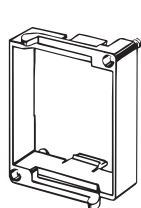
Models with alarms

Panel Cutout Dimensions

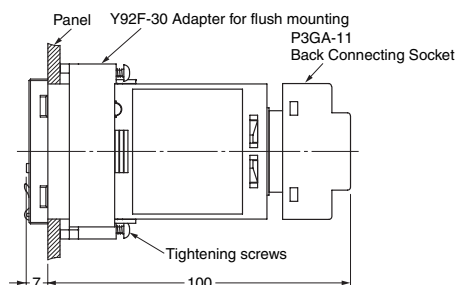
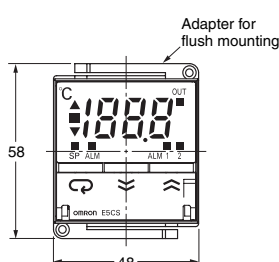
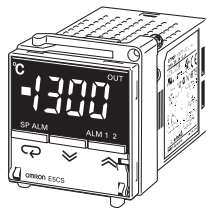
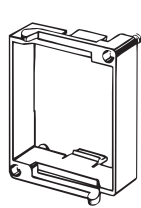


Note: The external dimensions are the same for both models with and without alarms.

### E5CS-U + Adapter for Flush Mounting (Enclosed) + Back Connecting Socket (Order Separately) (Without Alarms)



### E5CS-U + Adapter for Flush Mounting (Enclosed) + Back Connecting Socket (Order Separately) (With Alarms)

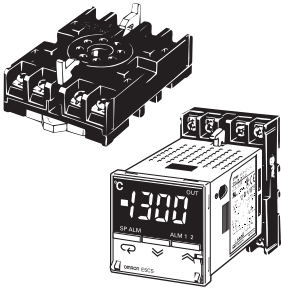


Note: Use the P2CF-08 and P3G-08 Sockets for models without alarms, and use the P2CF-11 and P3GA-11 Sockets for models with alarms.

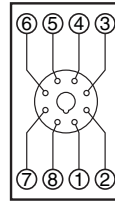
# Accessories (Order Separately)

## 8-pin Sockets without Alarms

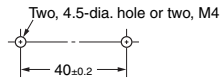
### P2CF-08 Front Connecting Socket



Terminal Arrangement/  
Internal Connections  
(Top View)



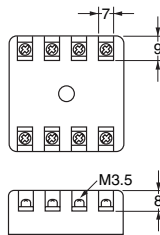
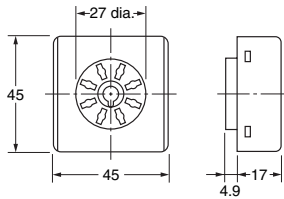
Mounting Hole Dimensions



Note: DIN Track mounting is also possible.

Note: The P2CF-08-E Socket with finger protection is also available.

### P3G-08 Back Connecting Socket

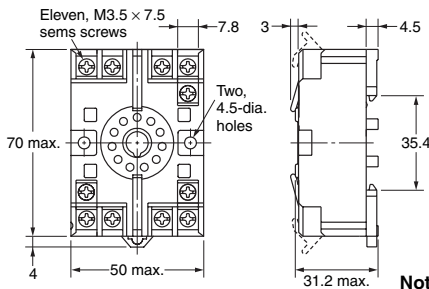
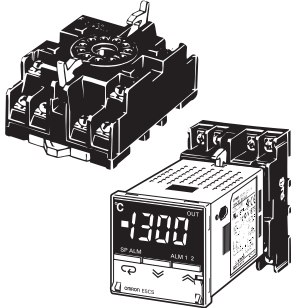


Terminal Arrangement  
(Bottom View)

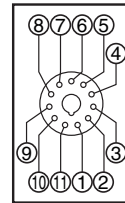
Note: The Y92A-48G Finger Safe Terminal Cover is also available.

## 11-pin Sockets with Alarms

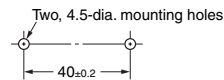
### P2CF-11 Front Connecting Socket



Terminal Arrangement/  
Internal Connections  
(Top View)



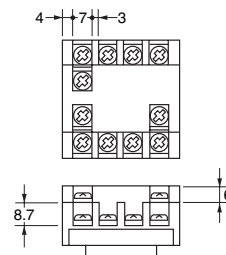
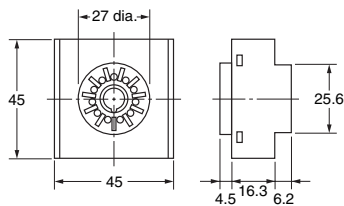
Mounting Hole Dimensions



Note: DIN Track mounting is also possible.

Note: The P2CF-11-E Socket with finger protection is also available.

### P3GA-11 Back Connecting Socket



Terminal Arrangement  
(Bottom View)

Note: The Y92A-48G Finger Safe Terminal Cover is also available.

Note: Do not use any other types of Sockets. Doing so will adversely affect the accuracy.

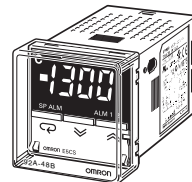
## Applicable Thermistors

Use Element Interchangeable Thermistors (E52-THE5A, E52-THE6D, and E52-THE6F) to connect to the E5CS-□GU. For details on Sensors, refer to E52.

## Hard Protective Cover

The Y92A-48B Hard Protective Cover is available for the following applications.

- To protect the set from dust and dirt.
- To prevent the panel from being accidentally touched causing displacement of set values.
- To provide effective protection against water droplets.





# Safety Precautions

---

Refer to *Safety Precautions for All Temperature Controllers*. Refer to *E5CS/E5CSV Operation* for operating procedures.

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.

## 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.

## Warranty and Limitations of Liability

### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

### LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

## Application Considerations

### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

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

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

### PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

## Disclaimers

### CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

### PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

### ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

2011.12

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

**OMRON Corporation**  
Industrial Automation Company

<http://www.ia.omron.com/>

(c)Copyright OMRON Corporation 2011 All Right Reserved.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## Omron:

[E5CS-Q1KJX-F](#) [E5CS-R1KJX-F](#) [E5CS-Q1KJX-522](#) [E5CSQ1PXF](#) [E5CS-QGU-W AC100-240](#) [E5CS-RKJU-W AC100-240](#) [E5CS-Q1KJU-W AC100-240](#) [E5CS-QKJU-W AC100-240](#) [E5CS-QPU-W AC100-240](#) [E5CS-R1KJU-W AC100-240](#) [E5CS-RPU-W AC100-240](#) [E5CS-R1P](#) [E5CS-RTU-W AC100-240](#) [E5CS-R1PU-W AC100-240](#) [E5CS-RGU-W AC100-240](#) [E5CS-R1PDU-W AC/DC24](#) [E5CS-Q1TU-W AC100-240](#) [E5CS-R1GU-W AC100-240](#) [E5CS-R2TU-W AC100-240](#) [E5CS-R1KJDU-W AC/DC24](#) [E5CS-Q1PU-W AC100-240](#) [E5CS-Q1PX-F](#)

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)