CSM\_E5AK\_DS\_E\_3\_1

# Advanced Digital Controllers Ideal for Worldwide Use

- Modular structure
- High-accuracy: 100 ms sampling (for analog input)
- · Auto-tuning and fuzzy self-tuning
- Conforms to international EMC and safety standards.
- IP66/NEMA4 (indoor use) front face
- Remote set point
- Serial communications (RS-232C, RS-422 and RS-485) and transfer output (4 to 20 mA)
- Position-proportional control model
- Heating/cooling control



Refer to Safety Precautions for All Temperature Controllers.



Refer to *E5 K Operation* for operating procedures.

## **Model Number Structure**

### **■** Model Number Legend

E5AK- \_\_\_ \_ \_ -500

1. Model

AA: Standard model

PRR: Position-proportional model

T: Programmable type

2. Number of alarms

2: Two alarms

## **Ordering Information**

### **■ List of Models**

Description	Model	Specification
Base Unit	E5AK-AA2 AC100-240	Standard model
	E5AK-AA2-500 AC100-240	Standard model with terminal cover
	E5AK-PRR2 AC100-240	Position-proportional model
	E5AK-PRR2-500 AC100-240	Position-proportional model with terminal cover
	E5AK-TAA2 AC100-240	Standard model
	E5AK-TAA2-500 AC100-240	Standard model with terminal cover
	E5AK-TPRR2 AC100-240	Position-proportional model
	E5AK-TPRR2-500 AC100-240	Position-proportional model with terminal cover

Note: 1. When using the heater burnout alarm function with a standard model, the Linear Output Unit cannot be used for the control outputs (heat).

- 2. Be sure to specify the Current Transformer, Output Unit, and Option Unit when ordering.
- 3. The Digital Controller provides transfer outputs at 4 to 20 mA for the PV and other values and control outputs at 4 to 20 mA for the current outputs.

Description	Model	Specification
Output Unit	E53-R	Relay
	E53-S	SSR
	E53-Q	Pulse (NPN) 12 VDC
	E53-Q3	Pulse (NPN) 24 VDC
	E53-Q4	Pulse (PNP) 24 VDC
	E53-C3	Linear (4 to 20 mA)
	E53-C3D	Linear (0 to 20 mA)
	E53-V34	Linear (0 to 10 V)
	E53-V35	Linear (0 to 5 V)

Note: The Digital Controller uses a dedicated, high-resolution Output Unit. The E53-C Current Output Unit for the E5\(\sime\)X cannot be used with the Digital Controller.

Description	Model	Specification
Option Unit	E53-AKB	Event input
	E53-EN01	Communication (RS-232C)
	E53-EN02	Communication (RS-422)
	E53-EN03	Communication (RS-485)
	E53-AKF	Transfer output

**Note: 1.** The Option Unit can be used either by the E5AK or E5EK.

2. The E5AK allows a maximum of three Option Units to be mounted. Refer to page 8 for mounting combinations. The E5EK allows only one Option Unit to be mounted.

### **Inspection Report**

The Digital Controller can be provided together with an inspection report.

Refer to the following legend with the suffix "K" when ordering a model provided together with an inspection report. E5□K-AA2-K, E5□K-PRR2-K, E5□K-TAA2-K, E5□K-TPRR2-K, E53-AKF-K

## ■ Accessories (Order Separately)

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

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

Name	Model	Connectable models
Terminal Cover	E53-COV0809	E5AK

Note: The E53-COV0809 comes in a set with the two types of Terminal Covers listed on page 8.

### **Unit Label**

Model	Y92S-L1

### **Mounting Bracket**

Model	Y92H-5

**Note:** This mounting bracket set is included with the Temperature Controller. The set includes one bracket for the top and one for the bottom.

### **Waterproof Packing**

	Model	
Y92S-P4		

The Waterproof Packing is provided with the Digital Controller.

## **Specifications**

## **■** Ratings

Item	100 to 240 VAC type					
Supply voltage	100 to 240 VAC, 50/60 Hz					
Power consumption	E5AK: 16 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, 0 to 10 V					
Input impedance	Current input: 150 $\Omega$ ; Voltage input: 1 M $\Omega$ min.					
Control output	Standard Model, Programmable Model According to Output Unit (see Output Unit Ratings and Characteristics)					
	Position-proportional Model 2 Relay outputs: SPST-NO, 1 A at 250 VAC (including inrush current) *1					
Auxiliary output	SPST-NO, 3 A at 250 VAC (resistive load)					
Control method *2	ON/OFF or 2-PID control (with auto-tuning)					
Setting method	Digital setting using front panel keys					
Indication method	7-segment digital display and LEDs					
Potentiometer	100 $\Omega$ to 2.5 k $\Omega$					
Event input	Contact input: ON: 1 kΩ max., OFF: 100 kΩ min. No-contact input: ON: residual voltage: 1.5 V max., OFF: leakage current: 0.1 mA max.					
Transfer output	4 to 20 mA, permissible load impedance: 600 $\Omega$ max., resolution: approx. 2,600					
Remote SP input	Current input: 4 to 20 mA (Input impedance: 150 Ω)					
Current Transformer input	Connect an exclusive Current Transformer (E54-CT1 or E54-CT3)					
Other functions	Standard Manual output, heating/cooling control, SP limiter, loop burnout alarm, SP ramp, MV limiter, MV change rate limiter, input digital filter, input shift, run/stop, protect functions, scaling function.  Option Multiple SP, run/stop selection, transfer output functions					
Degree of protection	Conforms to IEC IP66 and NEMA4 (Indoor use)					

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

 $\ensuremath{\textbf{\$1.}}\xspace$  All control outputs are isolated electrically from the input circuits.

**\*2.**The E5AK-T/-TP do not support fuzzy self-tuning.

## **■ Input Ranges**

## **Platinum Resistance Thermometer**

Input (switch selectable)		JPt100	Pt100		
Range °C		-199.9 to 650.0	-199.9 to 650.0		
	°F	-199.9 to 999.9	-199.9 to 999.9		
Setting		0	1		

## **Thermocouple**

Input (so selecta (See no	ble)	K1	K2	J1	J2	Т	E	L1	L2	U	N	R	S	В	W	PLII
Range	°C	-200 to 1,300	0.0 to 500.0	-100 to 850	0.0 to 400.0	-199.9 to 400.0	0 to 600	-100 to 850	0.0 to 400.0	-199.9 to 400.0	-200 to 1,300	0 to 1,700	0 to 1,700	100 to 1,800	0 to 2,300	0 to 1,300
	°F	-300 to 2,300	0.0 to 900.0	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	0 to 1,100	-100 to 1,500	0.0 to 750.0	-199.9 to 700.0	-300 to 2,300	0 to 3,000	0 to 3,000	300 to 3,200	0 to 4,100	0 to 2,300
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

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

Thermocouple W is W/Re5-26 (tungsten rhenium 5, tungsten rhenium 26).

## **Current/Voltage**

Input (switch selectable)	Currer	nt input	Voltage input				
	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V		
Range	One of following ranges depending on results of scaling -1999 to 9999 -199.9 to 999.9 -19.99 to 99.99 -1.999 to 9.999						
Setting	17	18	19	20	21		

### ■ Characteristics

Indication accuracy (See note 1.)	Thermocouple: $(\pm 0.3\% \text{ of indication value or } \pm 1^{\circ}\text{C}$ , whichever greater) $\pm 1$ digit max.			
	Platinum resistance thermometer:			
	( $\pm 0.2\%$ of indication value or $\pm 0.8^{\circ}$ C, whichever greater) $\pm 1$ digit max.			
	Analog input: ±0.2% FS ±1 digit max.			
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)			
Proportional band (P)	0.1% to 999.9% FS (in units of 0.1% FS)			
Integral (reset) time (I)	0 to 3,999 s (in units of 1 s)			
Derivative (rate) time (D)	0 to 3,999 s (in units of 1 s)			
Control period	1 to 99 s (in units of 1 s)			
Manual reset value	0.0% to 100.0% (in units of 0.1%)			
Alarm setting range	-1,999 to 9,999 or -199.9 or 999.9 (decimal point position dependent on input type or result of scaling)			
Set time (See note 2.)	0 to 99 hrs 59 min or 0 to 99 min 59 s			
Program capacity (See note 2.)	8 patterns, 16 steps			
Programming method (See note 2.)	Time or ramp setting method			
Time accuracy (See note 2.)	±0.2% (±500 ms) of the set value			
Sampling period (See note 3.)	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/s² (approx. 1G) for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 20 m/s² (approx. 2G) for 2 hrs each in X, Y, and Z directions			
Shock resistance	Malfunction: 200 m/s² min. (approx. 20G), 3 times each in 6 directions			
	(100 m/s² (approx. 10G) applied to the relay)			
	Destruction: 300 m/s² min. (approx. 30G), 3 times each in 6 directions			
Ambient temperature	Operating: -10°C to 55°C (with no icing)/3-year warranty period: -10°C to 50°C Storage: -25°C to 65°C (with no icing)			
Ambient humidity	Operating: 35% to 85%			
Degree of protection	Front panel: NEMA4 for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00			
Memory protection	Non-volatile memory (number of writings: 100,000 operations)			
Weight	E5AK: approx. 450 g E5EK: approx. 320 g Mounting bracket: approx. 65 g			
ЕМС	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)			
	Immunity Conducted Disturbance: ENV50141: 10 V/m (pulse modulated, 900 MHz) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)			
Approved standards	UL61010C-1, CSA 22.2 No. 61010-1 Conforms to EN61326-1: 2006, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the separately-ordered terminal cover is mounted.			

Note: 1. The indication accuracy of the K1, T, and N thermocouples at a temperature of –100°C or less is ±2°C ±1 digit maximum. The indication accuracy of the U, L1, and L2 thermocouples at any temperature is ±2°C ±1 digit maximum.

The indication accuracy of the B thermocouple at a temperature of 400°C or less is unrestricted.

The indication accuracy of the R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.

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

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

- 2. For Programmable Models.
- 3. The sampling period of the standard model with CT and remote SP inputs is 250 ms.

## ■ Output Unit Ratings and Characteristics

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

Note: An output relay (1 A at 250 VAC) is mounted on the position-proportional model. (When replacing, use the E53-R.)

### ■ Option Unit Ratings and Characteristics

Model			Specifications
E53-AKB	2.5		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-EN01	Communications	RS-232C	Transmission method: Half-duplex
E53-EN02		RS-422	Synchronization method: Start-stop synchronization (asynchronous method)
E53-EN03		RS-485	Baud rate: 1.2/2.4/4.8/9.6/19.2 kbps Transmission code: ASCII
E53-AKF	Transfer output		4 to 20 mA: 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.

## **■** Current Transformer Ratings

Dielectric strength	ctric strength 1,000 VAC (for 1 min)	
Vibration resistance 50 Hz, 98 m/s² (10G)		
Weight	E54-CT1: approx. 11.5 g; E54-CT3: approx. 50 g	
Accessories (E54-CT3 only)  Armature: 2; Plug: 2		

### **■** Heater Burnout Alarm

Max. heater current	Single-phase 50 A VAC (See note 1.)
Heater current value display accuracy	±5% FS±1 digit max.
Heater burnout alarm setting range	0.1 to 49.9 A (in units of 0.1 A) (See note 2.)
Min. detection ON time	190 ms (See note 3.)

- Note: 1. Use the K2CU-F□□A-□GS (with gate input terminals) for the detection of three-phase heater burnout.
  - 2. The heater burnout alarm is always OFF if the alarm is set to 0.0 A and always ON if the alarm is set to 50.0 A.
  - 3. No heater burnout detection or heater current value measurement is possible if the control output (heat) is ON for less than 190 ms.

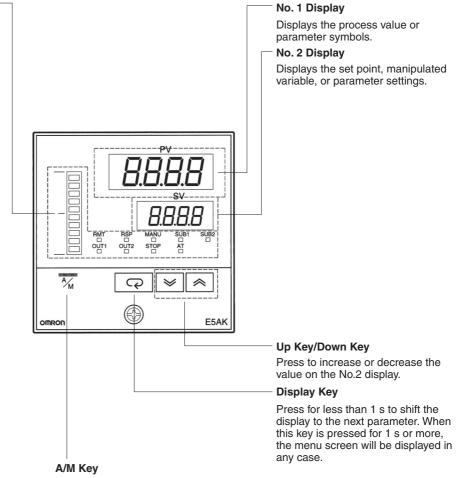
### **Nomenclature**

#### E5AK

#### **Operation Indicators**

- OUT1
   Lights when the pulse output function assigned to control output 1 turns ON.
- OUT2 Lights when the pulse output function assigned to control output 2 turns ON.
- SUB1
   Lights when the output function
   assigned to auxiliary output 1
   turns ON.
- SUB2
   Lights when the output function assigned to auxiliary output 2 turns ON.
- MANU Lights when the manual operation mode.
- STOP Lights during operation has stopped.
- RMT
   Lights during remote operation.
- Flashes during auto-tuning.

  RSP
- RSP Lights during remote SP operation.
- Bar Graph
   On a standard model (E5AK-AA2), this bar graph indicates the manipulated variable (heat) in 10% increments per single segment. On a position-proportional model (E5AK-PRR2), this bar graph indicates the valve opening in 10% increments per single segment.



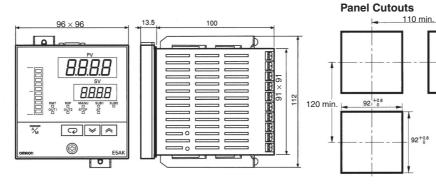
Press to select the auto operation or manual operation.

## **Dimensions**

Note: All units are in millimeters unless otherwise indicated.

#### E5AK



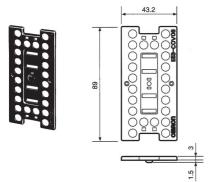


- Note: 1. Recommended panel thickness is 1 to 8 mm.
  - Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

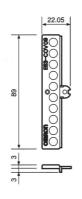
## **Accessories (Order Separately)**

### **Terminal Cover**

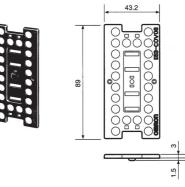
E53-COV0809







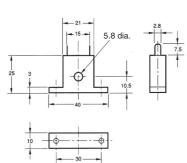
E53-COV08



## **Current Transformer**

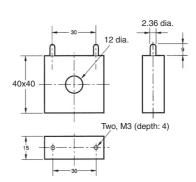
E54-CT1





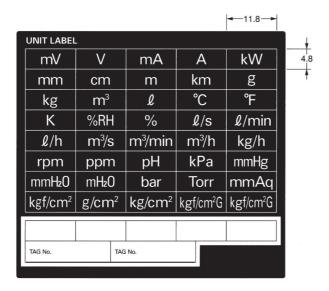
E54-CT3





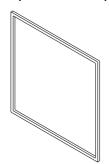
### **Unit Label (Order Separately)**

Y92S-L1



### **Waterproof Packing**

Y92S-P4 (for DIN  $96 \times 96$ )



Order the Waterproof Packing separately if it becomes lost or damaged. (Refer to page 3.)

The Waterproof Packing can be used to achieve an IP66 degree of protection.

(Deterioration, shrinking, or hardening of the waterproof packing may occur depending on the operating environment. Therefore, periodic replacement is recommended to ensure the level of waterproofing specified in IP66. The time for periodic replacement depends on the operating environment. Be sure to confirm this point at your site. Consider one year a rough standard. OMRON shall not be liable for the level of water resistance if the customer does not perform periodic replacement.)

The Waterproof Packing does not need to be attached if a waterproof structure is not required.

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.

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

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#### **Disclaimers**

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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.

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#### **ERRORS AND OMISSIONS**

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2009.4

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



### **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

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