

Digital Controller

E5AK-T/E5EK-T

Advanced Programmable Digital Controllers Ideal for Worldwide Use

- Offers up to eight patterns of simple programming control (16 steps per pattern).
- Modular structure, one-stock type
- High-accuracy: 100-ms sampling (for analog input)
- Conforms to international EMC and safety standards.
- IP66/NEMA4 (indoor use) front face
- Serial communications (RS-232C, RS-422 and RS-485) and transfer output (4 to 20 mA)
- Position-proportional control model
- Heat/Cool control
- 24VAC/DC types are also available.



Ordering Information

Description	Model	Specification
Base Unit	E5AK-TAA2 AC100-240	Standard model
	E5AK-TAA2-500 AC100-240	Standard model with terminal cover
	E5AK-TAA2 AC/DC24	Standard model
	E5AK-TAA2-500 AC/DC24	Standard model with terminal cover
	E5AK-TPRR2 AC100-240	Position-proportional model
	E5AK-TPRR2-500 AC100-240	Position-proportional model with terminal cover
	E5AK-TPRR2 AC/DC24	Position-proportional model
	E5AK-TPRR2-500 AC/DC24	Position-proportional model with terminal cover
	E5EK-TAA2 AC100-240	Standard model
	E5EK-TAA2-500 AC100-240	Standard model with terminal cover
	E5EK-TAA2 AC/DC24	Standard model
	E5EK-TAA2-500 AC/DC24	Standard model with terminal cover
	E5EK-TPRR2 AC100-240	Position-proportional model
	E5EK-TPRR2-500 AC100-240	Position-proportional model with terminal cover
	E5EK-TPRR2 AC/DC24	Position-proportional model
	E5EK-TPRR2-500 AC/DC24	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.

Description	Model	Specification
Output Unit	E53-R	Relay
	E53-S	SSR
	E53-Q	Pulse (NPN) 12 VDC at 40 mA max.
	E53-Q3	Pulse (NPN) 24 VDC at 20 mA max.
	E53-Q4	Pulse (PNP) 24 VDC at 20 mA max.
	E53-C3	Linear (4 to 20 mA) under a load of 600 Ω max.
	E53-C3D	Linear (0 to 20 mA) under a load of 600 Ω max.
	E53-V34	Linear (0 to 10 V) under a load of 1 k Ω min.
	E53-V35	Linear (0 to 5 V) under a load of 1 k Ω min.

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

Description	Model	Specification
Option Unit	E53-AKB	Event input
	E53-AK01	Communication (RS-232C)
	E53-AK02	Communication (RS-422)
	E53-AK03	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 13 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-TAA2-K, E5□K-TPRR2-K

■ Accessories (Order Separately)

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

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

Name	Model	Connectable models
Terminal Cover	E53-COV0809	E5AK
	E53-COV08	E5EK

Unit Label

Model	Y92S-L1
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■ 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 (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
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).

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				
Setting	17	18	19	20	21

Specifications

■ Ratings

Item	100- to 240-VAC type	24-VAC/VDC type
Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC/VDC, 50/60 Hz
Power consumption	E5AK: 16 VA E5EK: 15 VA	12 VA, 8 W
Operating voltage range	85% to 110% of rated supply voltage	
Sensor 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 (Input impedance: 150 Ω) Voltage input: 1 to 5 V, 0 to 5 V, 0 to 10 V (Input impedance: 1 MΩ)	
Control output	According to Output Unit (see <i>Output Unit Ratings and Characteristics</i>)	
Auxiliary output	SPST-NO, 3 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	
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 Ω max., resolution: approx. 2,600	
Current Transformer input	Connect an exclusive Current Transformer (E54-CT1 or E54-CT3)	
Other functions	<u>Standard</u> 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	

Indication accuracy (see note)	<p>Thermocouple: ($\pm 0.3\%$ of indication value or $\pm 1^\circ\text{C}$, whichever greater) ± 1 digit max.</p> <p>Platinum resistance thermometer: ($\pm 0.2\%$ of indication value or $\pm 0.8^\circ\text{C}$, whichever greater) ± 1 digit max.</p> <p>Analog input: $\pm 0.2\%$ FS ± 1 digit max.</p>												
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	0 to 99 hrs 59 min or 0 to 99 min 59 s												
Program capacity	8 patterns (E5AK) or 4 patterns (E5EK), 16 steps												
Programming method	Time or ramp setting method												
Time accuracy	$\pm 0.2\%$ (± 500 ms) of the set value												
Sampling period	<p>Temperature input: 250 ms</p> <p>Analog input: 100 ms</p>												
Insulation resistance	20 M Ω min. (at 500 VDC)												
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between terminals of different polarities												
Vibration resistance	<p>Malfunction: 10 to 55 Hz, 10 m/s² (approx. 1G) for 10 min each in X, Y, and Z directions</p> <p>Destruction: 10 to 55 Hz, 20 m/s² (approx. 2G) for 2 hrs each in X, Y, and Z directions</p>												
Shock resistance	<p>Malfunction: 200 m/s² min. (approx. 20G), 3 times each in 6 directions (100 m/s² (approx. 10G) applied to the relay)</p> <p>Destruction: 300 m/s² min. (approx. 30G), 3 times each in 6 directions</p>												
Ambient temperature	<p>Operating: -10°C to 55°C (with no icing)/3-year warranty period: -10°C to 50°C</p> <p>Storage: -25°C to 65°C (with no icing)</p>												
Ambient humidity	Operating: 35% to 85%												
Enclosure ratings	<p>Front panel: NEMA4 for indoor use (equivalent to IP66)</p> <p>Rear case: IEC standard IP20</p> <p>Terminals: IEC standard IP00</p>												
Memory protection	Non-volatile memory (number of writings: 100,000 operations)												
Weight	<p>E5AK: approx. 450 g</p> <p>E5EK: approx. 320 g</p> <p>Mounting bracket: approx. 65 g</p>												
EMC	<table border="0"> <tr> <td>Emission Enclosure:</td> <td>EN55011 Group 1 class A</td> </tr> <tr> <td>Emission AC Mains:</td> <td>EN55011 Group 1 class A</td> </tr> <tr> <td>Immunity ESD:</td> <td>EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3)</td> </tr> <tr> <td>Immunity RF-interference:</td> <td>ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz)</td> </tr> <tr> <td>Immunity Conducted Disturbance:</td> <td>ENV50141: 3 V (47 to 68 MHz) 10 V (0.15 to 47 MHz, 68 to 80 MHz) (level 3)</td> </tr> <tr> <td>Immunity Burst:</td> <td>EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)</td> </tr> </table>	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: 3 V (47 to 68 MHz) 10 V (0.15 to 47 MHz, 68 to 80 MHz) (level 3)	Immunity Burst:	EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
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Immunity Burst:	EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)												
Approved standards	<p>UL1092, CSA22.2 No. 14, CSA C22.2 No. 142</p> <p>Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC1010-1)</p> <p>Conforms to VDE0106/part 100 (Finger Protection), when the separately-ordered terminal cover is mounted.</p>												

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■ 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 Ω max., resolution: approx. 2,600
E53-V34	Linear voltage output	0 to 10 VDC, permissible load impedance: 1 k Ω min., resolution: approx. 2,600
E53-V35		0 to 5 VDC, permissible load impedance: 1 k Ω 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	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-AK01	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-AK02		RS-422	
E53-AK03		RS-485	
E53-AKF	Transfer output		4 to 20 mA: Permissible load impedance: 600 Ω 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	1,000 VAC (for 1 min)
Vibration resistance	50 Hz, 98 m/s ² (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	$\pm 5\%$ 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

Pattern Number

Indicates the pattern number.

Program Status Indicators

The top indicator indicates the rising step, the middle indicator indicates the constant step, and the bottom indicator indicates the falling step.

Bar Graph

Indicates the rate of pattern elapsing time at the rate of 20% (5 levels) per one segment.

Operation Indicators

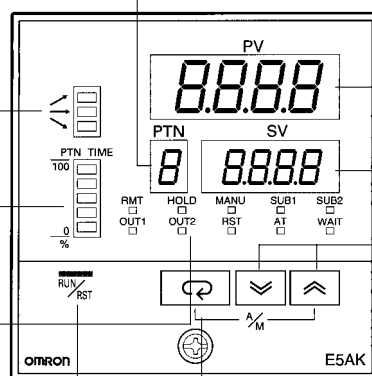
- OUT1
Lit when the pulse output function assigned to control output 1 turns ON.
- OUT2
Lit when the pulse output function assigned to control output 2 turns ON.
- SUB1
Lit when the output function assigned to auxiliary output 1 turns ON.
- SUB2
Lit when the output function assigned to auxiliary output 2 turns ON.
- MANU
Lit when the manual operation mode.
- RST
Lit when the operation is reset.
- RMT
Lit during remote operation.
- AT
Flashes during auto-tuning.
- HOLD
Lit when the program is on hold.
- WAIT
Lit when the program is waiting.

Display 1

Displays the process value or parameter code.

Display 2

Displays the present SP, manipulated variable, or parameter settings.



Up Key/Down Key

Press to increase or decrease the value on the No.2 display.

Display Key

Press to shift the display to the next parameter.

RUN/RST Key

Switches between RUN and RESET mode.

E5EK

