OMRON

Digital Process Controller Series
E5□K

Advanced Process Digital Controllers with Fuzzy Logic

- Field configurable outputs, options.
- 100 ms sampling (for analog input).
- Advanced PID, or fuzzy self-tuning.
- Conforms to UL, CSA and CE standards.
- Water-resistant front panel meets IP66/NEMA 4X.
- Remote set point with optional event input board.
- Set point ramp.
- Serial communications available.
- Front panel programming.
- Heat only or heat/cool control.
- Auxiliary outputs (SPST) standard; two for E5AK/E5EK, one for E5CK.
- 3-year warranty.

Ordering Information

Note: Order Control Output Boards and Option Boards separately below.

Description	DIN size	Supply voltage	Model
Standard model	1/4 DIN (96 x 96 mm)	100 to 240 VAC	**E5AK-AA2-500**
Position-proportional model (See Note 3)		100 to 240 VAC	**E5AK-PRR2-500**
Standard model	1/8 DIN (48 x 96 mm)	100 to 240 VAC	**E5EK-AA2-500**
Position-proportional model (See Note 3)		100 to 240 VAC	**E5EK-PRR2-500**
Standard model	1/16 DIN (48 x 48 mm)	100 to 240 VAC	**E5CK-AA1-500**
Non-standard model with built-in quick auto-tune button (See *Nomenclature* section for details)		100 to 240 VAC	**E5CK-AA1-302**

Note: 1. When using the heater burnout alarm function with a standard model, the Linear Output Module cannot be used for the control outputs (heat). 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.
2. E5EK-PRR2/E5AK-PRR2 controllers are supplied with dedicated relay output.
3. Position-proportional models are intended for motorized valves (not 4-20 mA modulating valves). These use two relays (“open” and “close”) which will turn a motor clockwise or counter-clockwise, thus opening or closing the valve.
4. Part numbers ending in –500 include a Finger Safe cover.

■ Optional Output Boards

Description	Specifications	Compatible controller	Max. quantity	Model
Relay	SPST, 5 A, 250 VAC	E5AK/E5EK	2	**E53-R**
SSR (solid state relay)	1 A, 75 to 250 VAC	E5AK/E5EK	2	**E53-S**
Voltage pulse	NPN, 12 VDC	E5AK/E5EK	2	**E53-Q**
	NPN, 24 VDC	E5AK/E5EK	2	**E53-Q3**
	PNP, 24 VDC	E5AK/E5EK	2	**E53-Q4**
Linear current	4 to 20 mA	E5AK/E5EK	2	**E53-C3**
	0 to 20 mA	E5AK/E5EK	2	**E53-C3D**
Linear voltage	0 to 10 VDC	E5AK/E5EK	2	**E53-V34**
	0 to 5 VDC	E5AK/E5EK	2	**E53-V35**
Relay/Relay	SPST/SPST, 5 A, 250 VAC	E5CK	1	**E53-R4R4**
Relay/Pulse	SPST, 5 A/NPN, 24 VDC	E5CK	1	**E53-Q4R4**
	SPST, 5 A/PNP, 24 VDC	E5CK	1	**E53-Q4HR4**
Relay/Linear current	SPST, 5 A/4 to 20 mA	E5CK	1	**E53-C4R4**
	SPST, 5 A/0 to 20 mA	E5CK	1	**E53-C4DR4**
Relay/Linear voltage	SPST, 5 A/0 to 10 VDC	E5CK	1	**E53-V44R4**
Pulse/Pulse	NPN/NPN, 24 VDC	E5CK	1	**E53-Q4Q4**
	PNP/PNP, 24 VDC	E5CK	1	**E53-Q4HQ4H**
Computer communications	RS-232C	E5AK/E5EK	3/1	**E53-AK01**
	RS-232C	E5CK	1	**E53-CK01**
	RS-422	E5AK/E5EK	3/1	**E53-AK02**
	RS-485	E5AK/E5EK	3/1	**E53-AK03**
		E5CK	1	**E53-CK03**
Event input	For remote set point	E5AK/E5EK	3/1	**E53-AKB**
	For remote set point	E5CK	1	**E53-CKB**
Transfer output	4 to 20 mA	E5AK/E5EK	3/1	**E53-AKF**
	4 to 20 mA	E5CK	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)

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.	E5AK/E5EK	1	**E54-CT1**
	120 A load, 12 mm hole dia.	E5AK/E5EK	1	**E54-CT3**
Terminal cover (supplied with Standard models)	Provides finger protection from terminals (VDE0106 part 100)	E5AK	1	**E53-COV0809**
		E5CK	1	**E53-COV07**
		E5EK	1	**E53-COV08**
Software	For setup and monitoring; requires optional computer communications board	All	1	**Thermo Tools** (See Note)

Note: Contact Omron for current version information.

Input Types (selectable with input jumper connector)

Thermocouple

Input (field selectable) (See Notes)		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

Note: 1. Setting number is factory-set to 2 (K1).
2. Thermocouple W is W/Re5-26 (tungsten rhenium 5, tungsten rhenium 26).

Platinum Resistance Thermometer (RTD's)

Input (field 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

Current/Voltage

Input (field 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

Note: When a current/voltage input is selected, the decimal point is fully adjustable.

Specifications

■ Ratings

Model			E5□K Standard
Supply voltage			100–240 VAC, 50/60 Hz
Operating voltage range			85% to 110% of rated supply voltage
Power consumption		**E5AK**	16 VA
		E5EK	15 VA
		E5CK	10 VA (at 100 VAC) 14 VA (at 240 VAC)
Input	**Thermocouple**		K, J, T, E, L, U, N, R, S, B, W, PLII
	Platinum resistance thermometer (RTD)		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
Mean Time Between Failure			15.4 years (135,000 hours)
Control output (See Note 1)	**Relay**		SPST, 3 A at 250 VAC (resistive load) Mechanical life expectancy: 10,000,000 operations min. Electrical life expectancy: 100,000 operations min.
	Voltage (pulse)	**NPN**	20 mA at 12/24 VDC (with short-circuit protection)
		PNP	20 mA at 24 VDC (with short-circuit protection)
	Linear voltage	**0 to 10 VDC**	Permissible load impedance: 1 kΩ min. Resolution: Approximately 2600 steps
	Linear current	**4 to 20 mA**	Permissible load impedance: 500 Ω max. Resolution: Approximately 2600 steps
		0 to 20 mA	Permissible load impedance: 500 Ω max. Resolution: Approximately 2600 steps
Auxiliary output	**SPST-NO**	**E5AK**	3 A at 250 VAC (resistive load)
		E5EK	3 A at 250 VAC (resistive load)
		E5CK	1A at 250 VAC (resistive load)
Control method (See Note 2)			ON/OFF, Advanced PID Control (with auto-tuning) or Self-tuning
Setting method			Digital setting using front panel keys or communications features
Indication method – 7-seg. digital display and LEDs			E5AK: PV = 15 mm, SP = 10.5 mm E5EK: PV = 14 mm, SP = 9.5 mm E5CK: PV = 12 mm, SP = 8 mm
Potentiometer for valve positioning (for E5AK-PRR and E5EK-PRR only)			100 Ω to 2.5 kΩ
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.
Transmission output			4 to 20 mA, permissible load impedance: 600 Ω max., resolution: Approximately 2600 steps
Remote SP input (for E5AK and E5EK only)		**Current input**	4 to 20 mA (Input impedance: 150 Ω)
Current Transformer input (for E5AK and E5EK only)			Connect only an Omron 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
	Option		Multiple SP, run/stop selection, transfer output functions, auto/manual Communications (RS-232C, RS-422, or RS-485), Loop Break Alarm, and Transfer Output.
Standards		**UL**	File No.: E68481
		CSA	File No.: LR59623
		CE	File No.: EN50081-2; EN50082-2; IEC 1010-1

Note: 1. All control outputs are insulated from the input circuit.
2. Fuzzy self-tuning is available only when using the Digital Controller in standard control operation with temperature input.

■ Characteristics

Indication accuracy (See Note)		Thermocouple: ±0.3% of indication value or ±1°C, whichever is greater, ±1 digit max. Platinum resistance thermometer: ±0.2% of indication value or ±0.8°C, whichever is 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)
Sampling period	**Temperature input**	250 ms scan rate
	Analog input	100 ms scan rate
Insulation resistance		200 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
	Mechanical	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)
	Mechanical	300 m/s^2 min. (approx. 30G), 3 times each in 6 directions
Ambient temperature	**Operating**	-10°C to 55°C (14°F to 131°F) with no icing; with 3-year warranty period: -10°C to 50°C (14°F to 122°F)
	Storage	-25°C to 65°C (-13°F to 149°F) with no icing
Ambient humidity	**Operating**	35% to 85% RH
Enclosure ratings	**Front panel**	NEMA 4X 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
	E5CK	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)
Standards - Approvals		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)

Note: Indication Accuracy -

Of the K1, T, and N thermocouples at a temperature of -100°C or less: ±2°C ±1 digit maximum.
Of the U, L1, and L2 thermocouples at any temperature: ±2°C ±1 digit maximum.
Of the B thermocouple at a temperature of 400°C or less: unrestricted.
Of the R and S thermocouples at a temperature of 200°C or less: ±3°C ±1 digit maximum.
Of the W thermocouple at any temperature: ±0.3% of the indicated value or ±3°C, (whichever is greater) ±1 digit maximum.
Of the PLII thermocouple at any temperature: ±0.3% or ±2°C, whichever is greater ±1 digit maximum.

■ Option Board Ratings and Characteristics

Event inputs		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.
Communications	**Interface**	RS-232C and RS-485; RS-422 for E5AK and E5EK only
	Transmission method	Half-duplex
	Synchronization method	Start-stop synchronization (asynchronous method)
	Baud rate	1.2/2.4/4.8/9.6/19.2 kbps
Transfer output		4 to 20 mA: Permissible load impedance: E5AK and E5EK = 600 Ω max. E5CK = 500 Ω max. Resolution: E5AK and E5EK = approx. 2,600 steps E5CK = approx. 2,600 steps
		RS-232C Peer-to-peer only; maximum cable length = 15 m (49.2 feet) RS-422 and RS-485 32 controller maximum to host computer; maximum cable length = 500 m (1640 feet)

■ Current Transformer Ratings

Part number	E54-CT1	E54-CT3
Max. continuous heater current	50 amps	120 amps (See Note 1)
Dielectric strength	1,000 VAC (for 1 min)	
Vibration resistance	50 Hz, 98 m/s^2 (10G)	
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	--	Armature: 2; Plug: 2

Note: 1. Use within the max. heater current rating of controller table shown below.

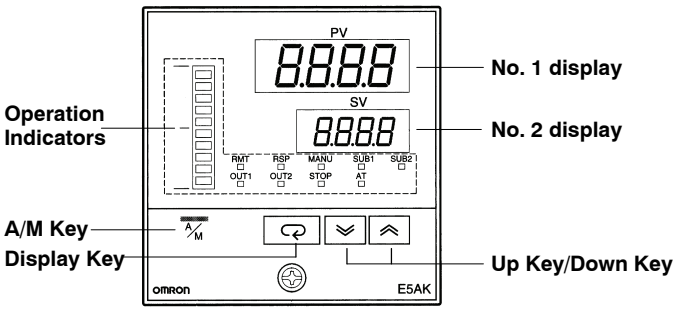
■ Heater Burnout Alarm

Max. heater current	Single-phase 50 A AC
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 1)
Min. detection ON time	190 ms (See Note 2)

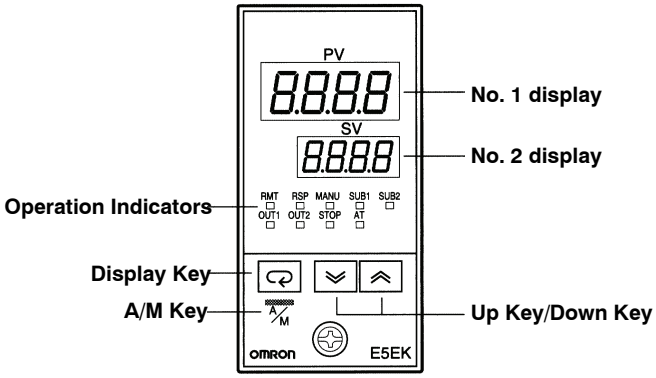
Note: 1. The heater burnout alarm is always OFF if the alarm is set to 0.0 A and always ON if the alarm is set to 50.0 A.
2. No heater burnout detection or heater current value measurement is possible if the control output (heat) is ON for less than 190 ms.

Nomenclature

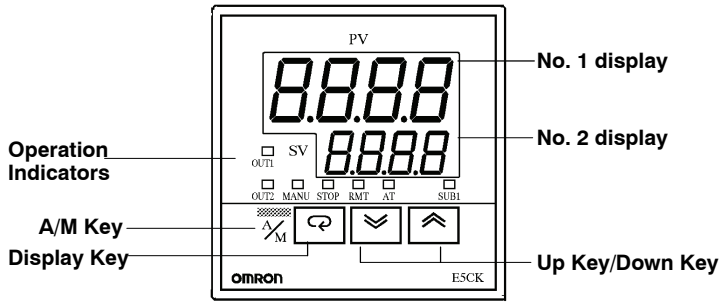
■ E5AK



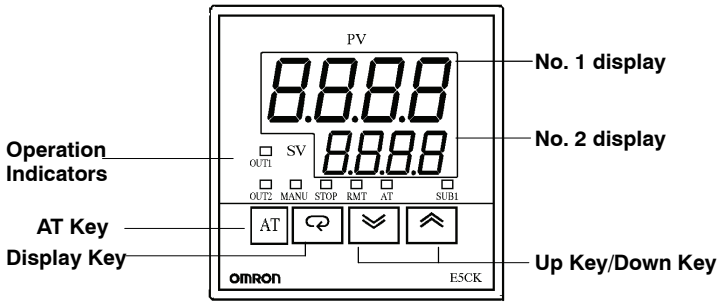
■ E5EK



■ E5CK



■ E5CK-302



Operation Indicators

- **OUT1**
  Lit when control output 1 turns ON.
- **OUT2**
  Lit when control output 2 turns ON.
- **SUB1**
  Lit when the output function assigned to auxiliary output 1 turns ON.
- **SUB2** (for E5AK and E5EK only)
  Lit when the output function assigned to auxiliary output 2 turns ON.
- **MANU**
  Lit when the manual operation mode is being used.
- **STOP**
  Lit when control operation has been stopped.
- **RMT**
  Lit during remote communications operation.
- **AT**
  Flashes during auto-tuning.
  Auto-tuning is completed when this LED stops flashing.
- **RSP** (for E5AK and E5EK only)
  Lit during remote SP operation.
- **Bar Graph** (for E5AK only)
  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.

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.

A/M Key
Press to select the auto operation or manual operation.

Up Key/Down Key
Press to increase or decrease the value on the No.2 display.

Display Key
Press quickly (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.

- **AT**
  Press key for automatic tuning.
- **A/M**
  This feature is located in level one. (Replaced AT feature in level one).

Operation

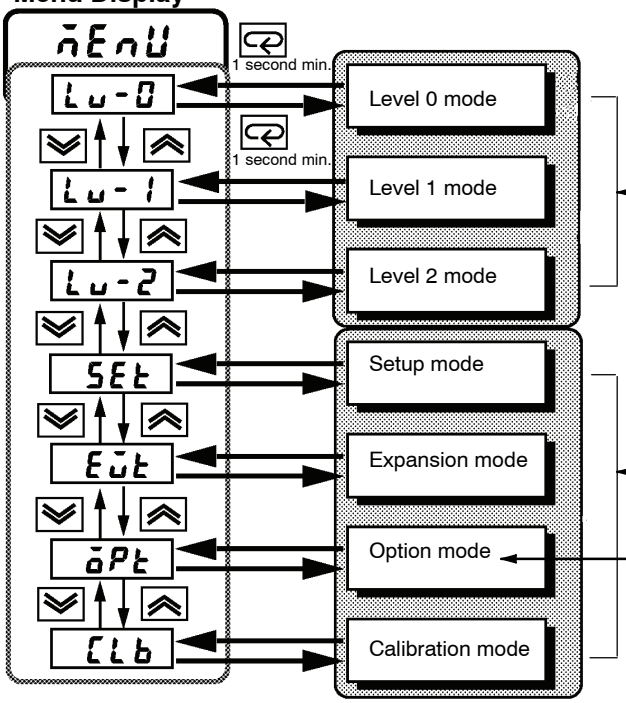
■ Operating Parameters

Mode Selection

Press the Display Key for 1 sec. min. to switch to modes other than the manual or protect mode.

The figure below (Menu Display) shows all modes in the order that they are displayed. Some parameters are not displayed, depending on the protect mode setting and the option boards used.

Menu Display



To Access *Protect Mode*

Press and hold the A/M Key and the Display Key for more than 1 second.

To Return to the Main PV/SP Display from the *Protect Mode*

Press and hold the A/M Key and the Display Key for more than 1 second.

To Access *Manual Mode*

Press and hold the A/M Key for more than 1 second.

To switch parameters **within** a mode, use the Display Key. Press the display key for <u>less</u> than one second to move between parameters.

Note:
1. **In Level 0 mode, Level 1 mode, and Level 2 mode:** The controller will maintain control of the process.
2. **In Setup mode, Expansion mode, Option mode, and Calibration mode:** Control of the process is not maintained. The outputs are inactive.
3. **Option Mode** will be accessible only when an option board is installed in the controller.

■ Parameters And Menus – For Setting The Controller

Protect Mode — **Limits use of the menu and A/M Keys.**
The protect function prevents unwanted modification of parameters and can also be used to prevent switching between the auto and manual operation.

Manual Mode — **Sets the controller to manual operation mode.**
You can only manually adjust the manipulated variable (MV) in this mode.

Level 0 Mode — **For normal operation.**
Change: the set point during operation, and start or stop Controller operation; and, (only in this mode) monitor the process value, ramp SP, and manipulated variable.

Level 1 Mode — **For adjusting primary control parameters.**
Execute: AT (auto-tuning); set alarm values; set the control period; and, set PID parameters.

Level 2 Mode — **For adjusting secondary control parameters.**
Set parameters for: limiting the manipulated variable and set point; switch between the remote and local modes; set the loop break alarm (LBA), alarm hysteresis, and the digital filter value of inputs.

Setup Mode — **For setting the basic specifications.**
Set parameters for: input type, scaling, output assignments and direct/reverse operation.

Expansion Mode — **For setting expanded functions.**
Set: ST (self-tuning), SP setting limiter. Select: advanced PID or ON/OFF control. Specify the standby sequence resetting method. Initialize parameters; and, set the time for automatic return to the monitoring display.

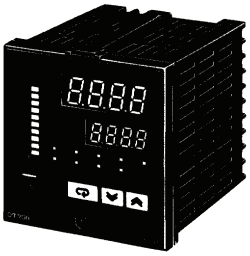
Option Mode — **For setting option functions.**
Set: the communications conditions; transfer: output and event input parameters to match the type of Option Board installed in the Controller. *This mode will be accessible <u>only</u> when an option board is installed in the controller.*

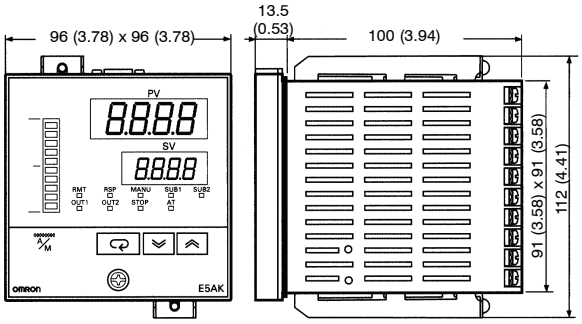
Calibration Mode — **For calibrating inputs and transfer output.**
Calibrate the selected input type. *Transfer output can be calibrated only when the Communications Unit (E53-CKF) has been installed in the Controller.*

Dimensions

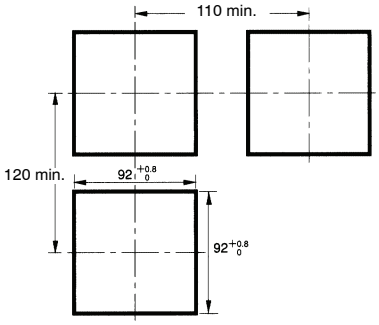
Unit: mm (inch)

■ E5AK



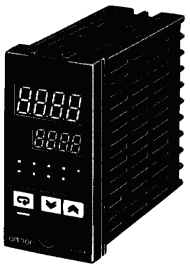


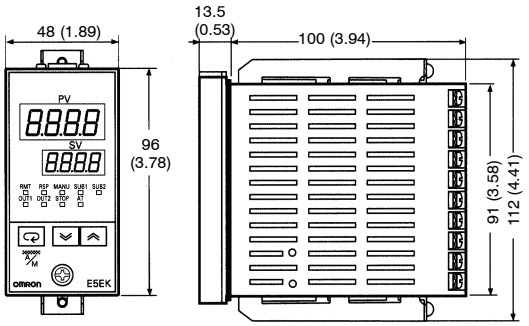
Panel Cutouts



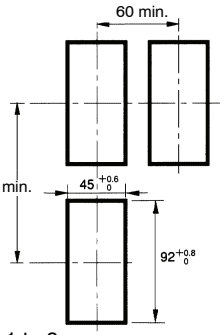
Note: 1. Recommended panel thickness is 1 to 8 mm.
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

■ E5EK



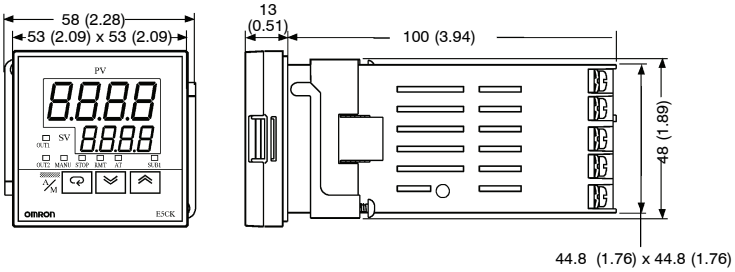


Panel Cutouts

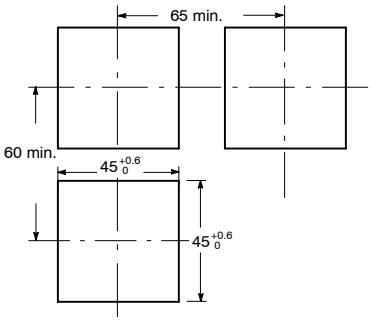


Note: 1. Recommended panel thickness is 1 to 8 mm.
2. Maintain the specified vertical and horizontal mounting space between each Unit. Units must not be closely mounted vertically or horizontally.

■ 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, either vertically or horizontally.

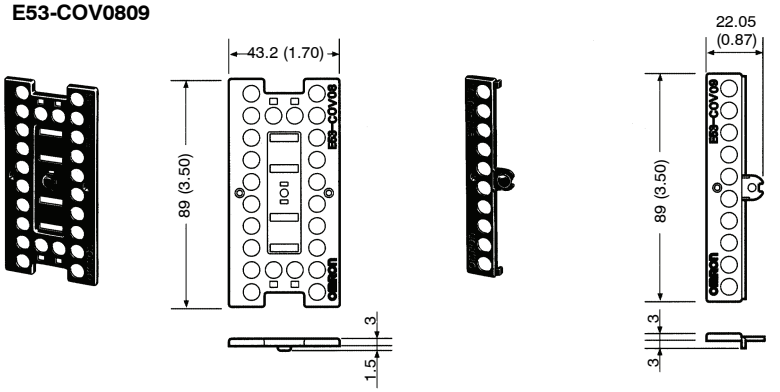
■ E5CK-302

The E5CK-302 model has the same dimension and cutouts as the E5CK.

■ Accessories (Order Separately)

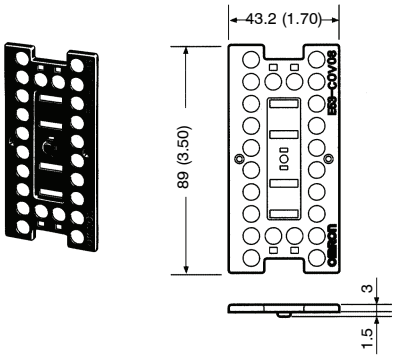
Terminal Cover for E5AK

E53-COV0809



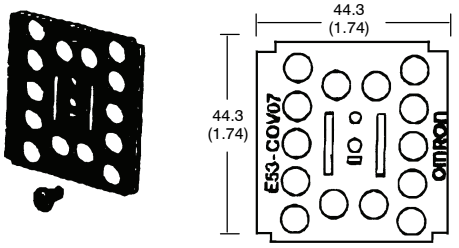
Terminal Cover for E5EK

E53-COV08



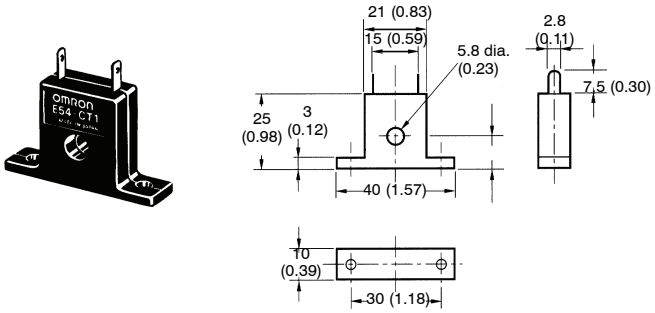
Terminal Cover for E5CK

E53-COV07

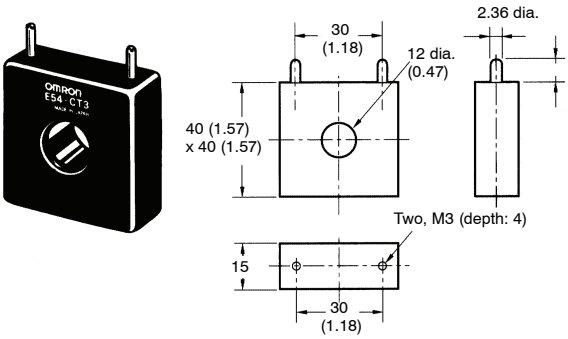


Current Transformer (E5AK and E5EK only for Heater Burnout Alarm)

E54-CT1



E54-CT3



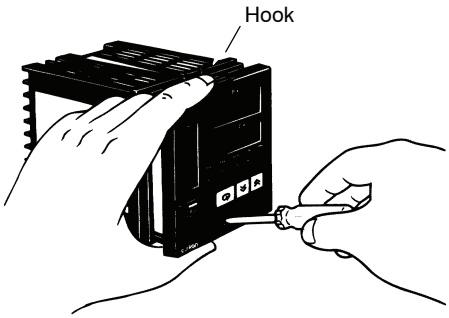
Installation

■ Remove Controller From Rear Housing

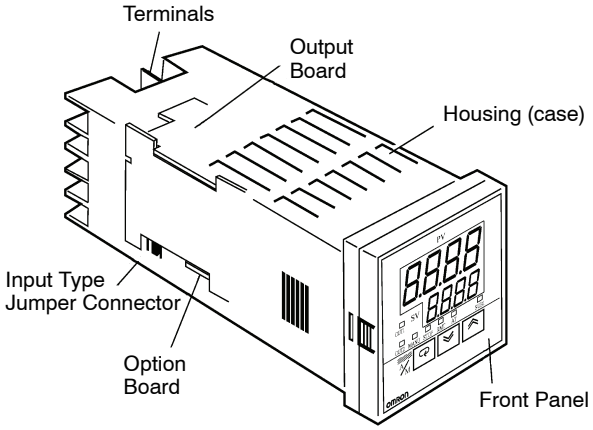
E5AK and E5EK

To pull out the internal mechanism from the housing, use a Phillips screwdriver matching the screw on the lower part of the front panel.

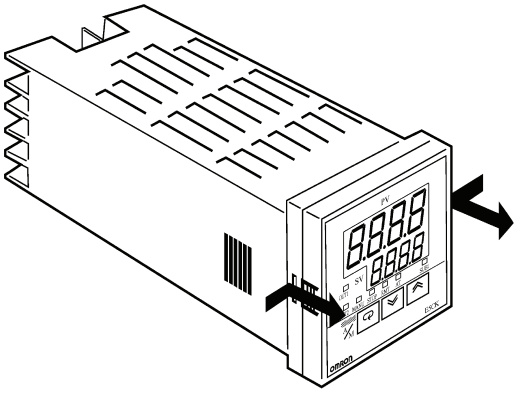
1. Turn the screw counterclockwise while pressing the hook on the upper part of the front panel.
2. Carefully pull out the internal mechanism while holding the left and right sides of the front panel.



E5CK



First, while pressing the hooks on the left and right sides of the front panel, pull the internal mechanism from the housing.



Settings

Note: Always turn off the power supply to the Digital Controller before changing any switch settings.

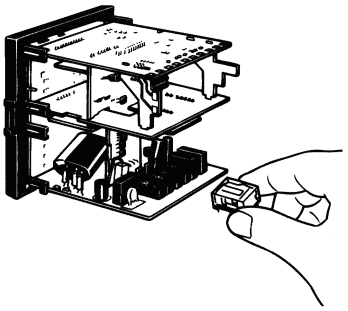
On a standard model, set up the Output Modules for control outputs 1 and 2 before mounting the Controller.

On a position-proportional model, the Relay Output Module is already set. Do not change that set-up parameter. Do not replace with other Output Modules.

Setting Up and Removing the Output Module

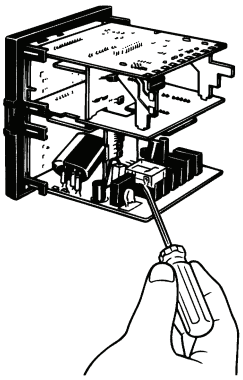
Setting Up the Output Module

When setting up the Output Modules, pull out the internal mechanism from the housing and insert the Output Modules into the sockets for control outputs 1 and 2.



Removing the Output Module

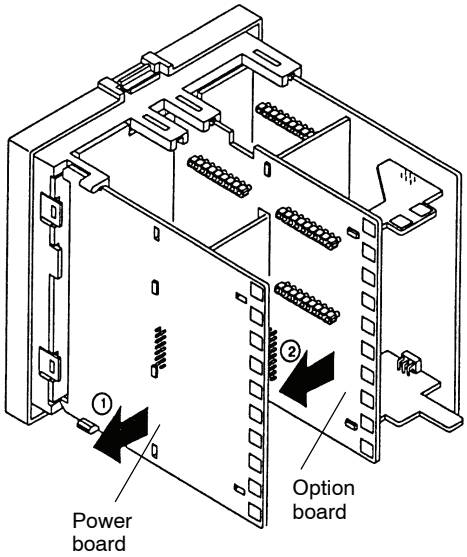
To replace the Output Module, use a flat-blade screwdriver to push up the Output Module.



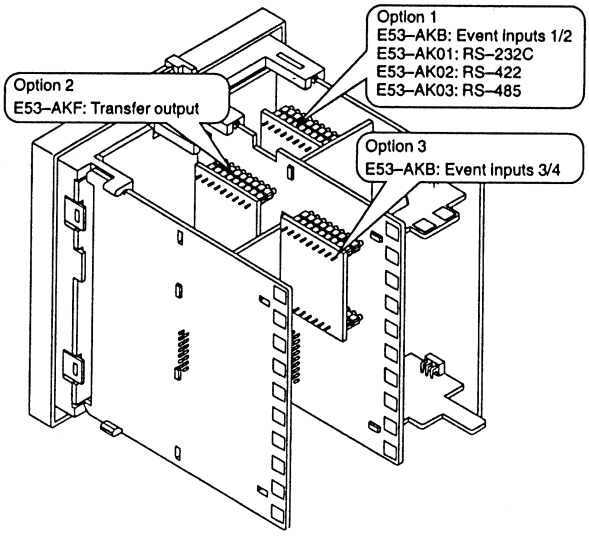
Setting Up the Option/Output Board

E5AK

1. Remove the Power Board and Option Boards in the order shown in the following diagram.



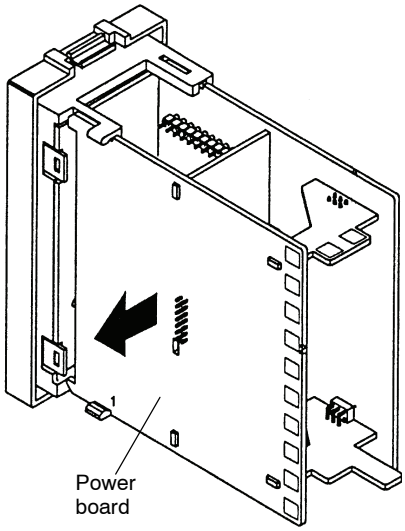
2. Insert the Option Boards into the sockets for options 1 to 3. The following diagram shows the relationship between the Option Boards and mounting positions.



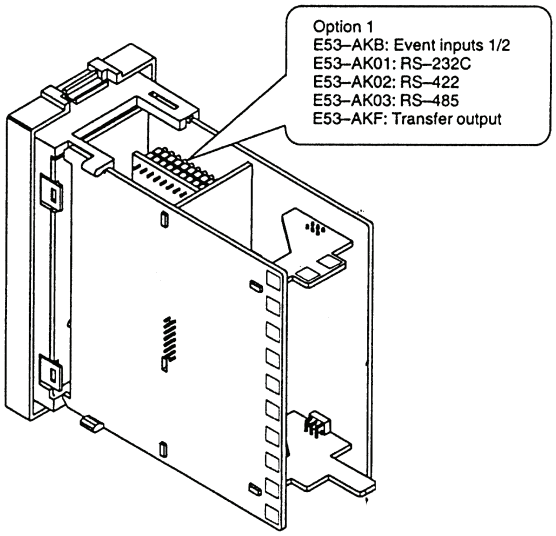
3. Mount the option boards and the power board in the order shown.

E5EK

1. Remove the Power Board in the order shown in the following diagram.



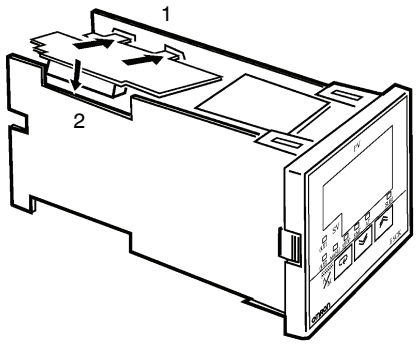
2. Insert the Option Board into the socket for option 1. The following diagram shows the relationship between the Option Board and mounting position.



3. Mount the option boards and the power board in the order shown.

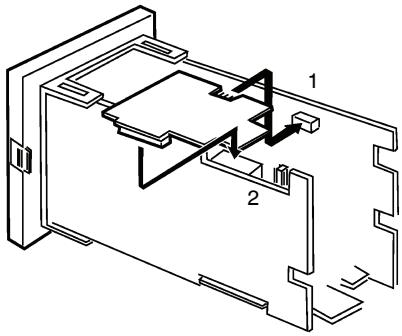
E5CK

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).



Set up the Option Board

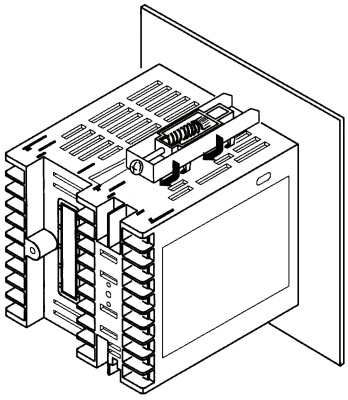
1. Place the bottom of the Controller facing up, fit the board horizontally into the connector on the power board (right side of controller).
2. With the Power Board connected, fit the board vertically into the connector on the control board (left side of Controller).



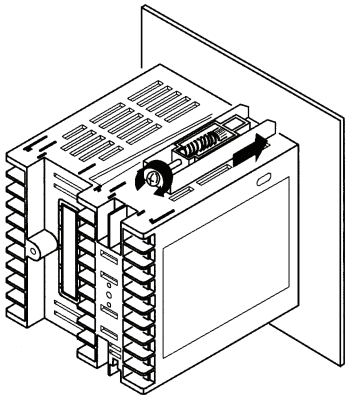
■ Mounting Controller

E5AK and E5EK

1. Insert the controller into the panel's mounting hole at the position shown in the figure below.
2. Fit the mounting bracket (accessory) into the mounting slots on the top and bottom of the rear case.

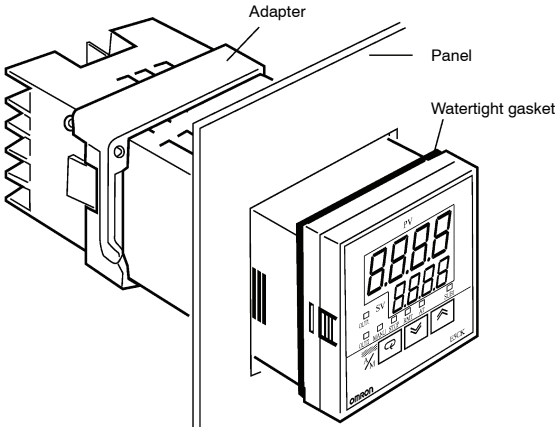


3. Tighten the mounting bracket screws on the upper and lower parts in small increments alternately and equally until the ratchet start to slide.



E5CK

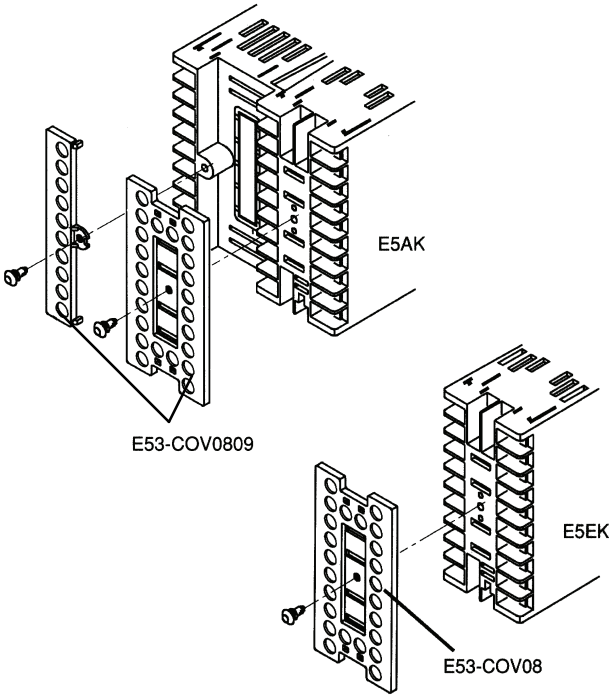
1. Insert the E5CK Controller into the cutout on the panel, as shown in the figure here.
2. Push the adapter along the Controller body from the terminals up to the panel, and fasten temporarily.
3. Tighten the two mounting screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to approximately 0.29 to 0.39 N • m, or 3 to 4 kgf • cm.



■ Mounting Terminal Cover

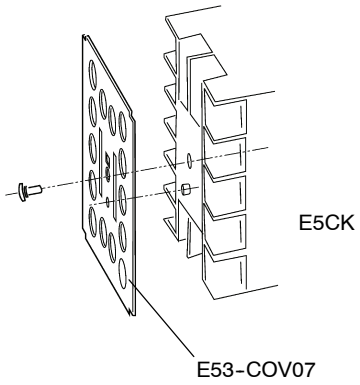
E5AK and E5EK

1. Fasten the terminals covers as follows by using the plastic pins. Plastic pins are provided with the terminal covers.



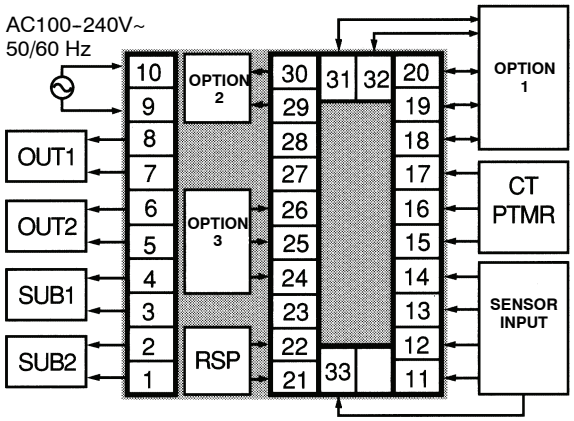
E5CK

1. The E5CK-AA1-500 Controller is provided with a Terminal Cover (E53-COV07). Fasten the Terminal Cover as follows by using the plastic pin.



■ Wiring Terminals for E5AK

E5AK Terminal Arrangement



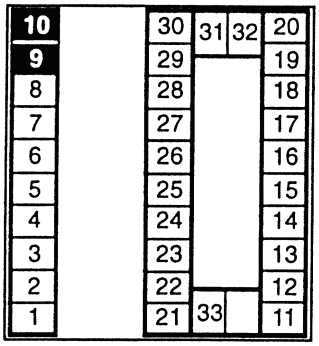
TRSF: Transfer output
EV1 to 4: Event input
PTMR: Potentiometer
RSP: Remote SP input

Wiring

In the following wiring diagrams, the left side of the terminal numbers indicate the inside of the Controller.

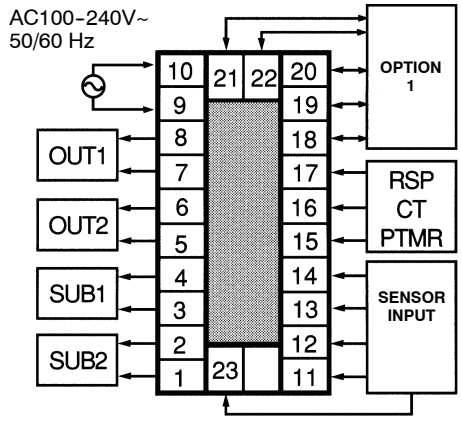
Power Supply

Input power to terminal numbers 9 and 10. Power specifications are as follows: 100 to 240 VAC, 50/60 Hz, approx. 16 VA



Wiring Terminals for E5EK

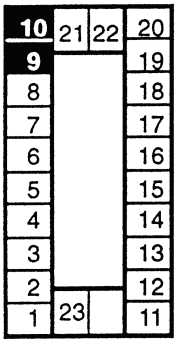
E5EK Terminal Arrangement



TRSF: Transfer output
EV1/2: Event input
PTMR: Potentiometer
RSP: Remote SP input

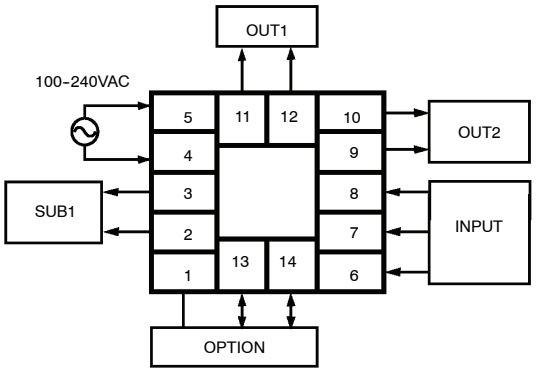
Power supply

Input power to terminal numbers 9 and 10. Power specifications are as follows: 100 to 240 VAC, 50/60 Hz, approx. 15 VA



■ Wiring Terminals for E5CK

E5CK Terminal Arrangement

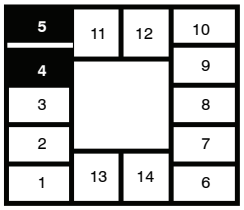


Wiring Precautions

- To protect the Controller and its lines from external noise, use the wire ducts to separate input leads and power lines.
- Use solderless terminals when wiring the Controller.
- Tighten the terminal screws using a torque no greater than 0.78 N • m, or 8 kgf • cm max. DO NOT tighten the terminal screws too tightly.

Power Supply

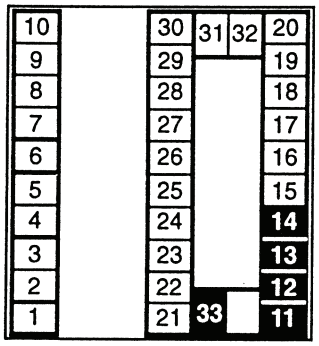
Input 100 to 240 VAC to terminal numbers 4 and 5.

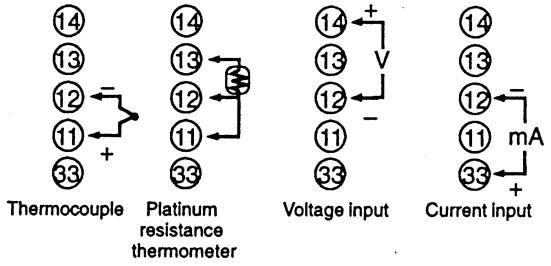


■ Input Wiring

E5AK

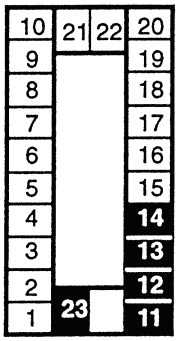
Connect the sensor input to terminal numbers 11 to 14 and 33 as follows according to the input type.

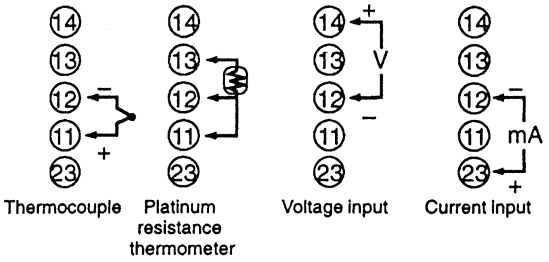




E5EK

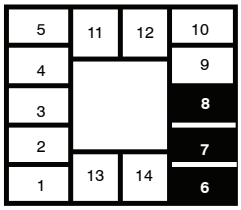
Connect the sensor input to terminal numbers 11 to 14 and 23 as follows according to the input type.

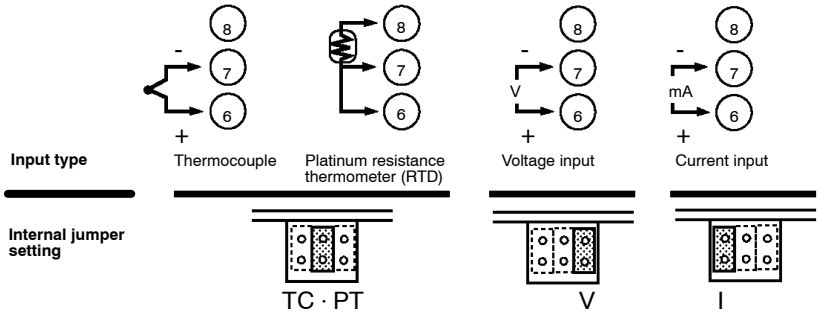




E5CK

Connect the sensor input to terminal numbers 6 to 8 as indicated here, according to the input type.



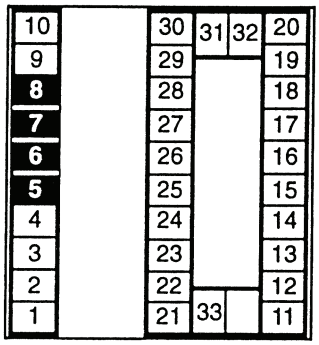


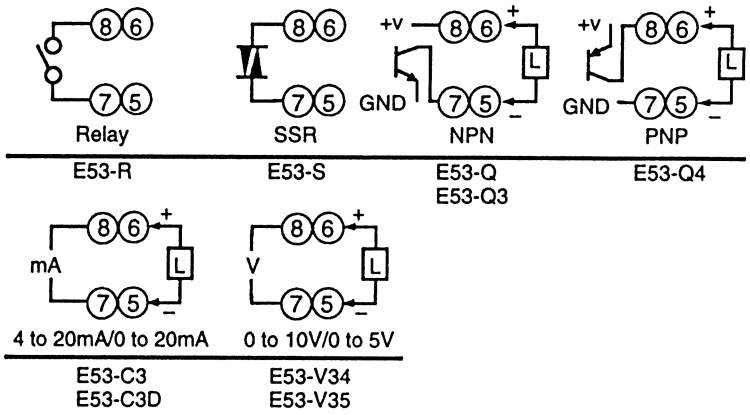
Match the inputs with the internal jumper settings for each input type. For thermocouple or platinum resistance thermometer inputs, set the internal jumper to a common position (TC/PT) as the temperature input.

■ Control Output

E5AK Control Output

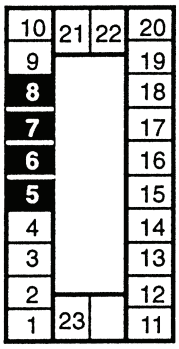
Terminal numbers 7 and 8 are for control output 1 (OUT1), and terminal numbers 5 and 6 are for control output 2 (OUT2). The following diagrams show the available Output Modules and their internal circuits.

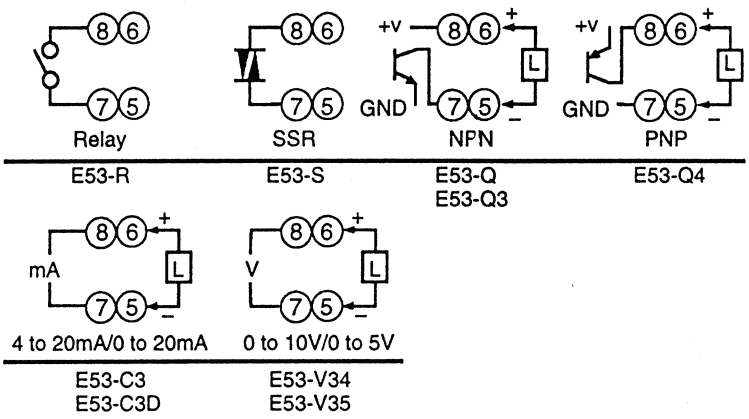




E5EK Control Output

Terminal numbers 7 and 8 are for control output 1 (OUT1), and terminal numbers 5 and 6 are for control output 2 (OUT2). The following diagrams show the available Output Modules and their internal circuits.



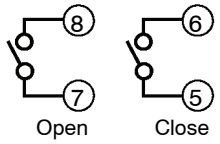


With E53-V□□ Output Modules, approx. 2 V is output for one second after the power is interrupted.

E5AK-PRR2/E5EK-PRR2 Controllers

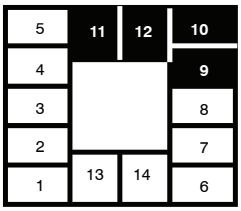
The E5AK-PRR2 and E5EK-PRR2 Controllers are supplied with relay output. This relay output is not compatible with any other module.

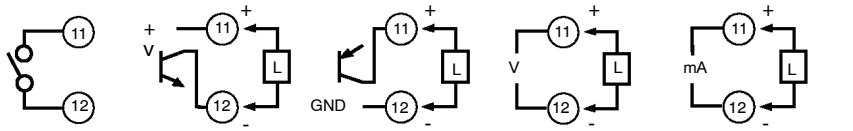
When replacing the Output Module, use the E53-R. The following diagrams show the relationship between terminals and open/close relay settings.



E5CK Control Output

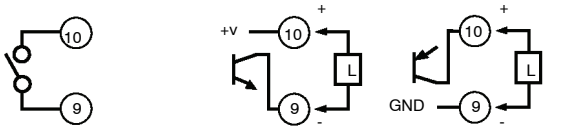
Terminal numbers 11 and 12 are for control output 1 (OUT1). The five output types and internal circuits are available according to the Output Board.





Output type	Relay	NPN	PNP	0 to 10 V	4 to 20 mA/0 to 20 mA
Part number	E53-R4R4	E53-Q4R4 E53-Q4Q4	E53-Q4HR4 E53-Q4HQ4H	E53-V44R4	E53-C4R4 E53-C4DR4

Terminal numbers 9 and 10 are for control output 2 (OUT2). The three output types and internal circuits are available according to the Output Board.

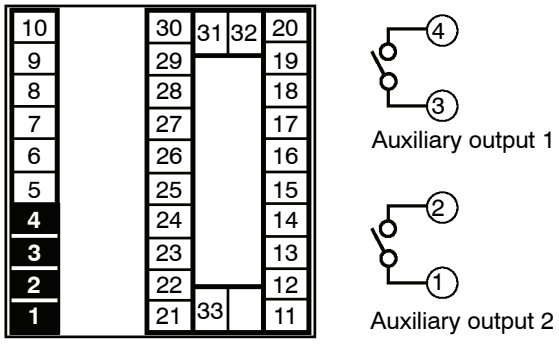


Output type	Relay	NPN	PNP
Part number	E53-R4R4 /E53-V44R4 E53-Q4R4 /E53-C4R4 E53-Q4HR4/E53-C4DR4	E53-Q4Q4	E53-Q4HQ4H

■ Auxiliary Output

E5AK

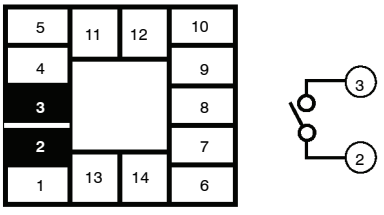
Terminal numbers 3 and 4 are for auxiliary output 1 (SUB1) and terminal numbers 1 and 2 are for auxiliary output 2 (SUB2). The following diagrams show the internal equalizing circuits for the auxiliary outputs:



Output specifications are as follows: SPST-NO, 3 A at 250 VAC

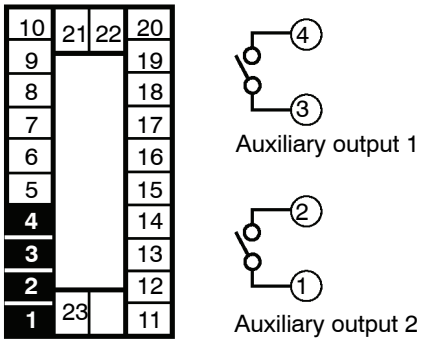
E5CK

Terminal numbers 2 and 3 are for auxiliary output 1 (SUB1). The internal equalizing circuit for auxiliary output 1 is as follows:



E5EK

Terminal numbers 3 and 4 are for auxiliary output 1 (SUB1) and terminal numbers 1 and 2 are for auxiliary output 2 (SUB2). The following diagrams show the internal equalizing circuits for the auxiliary outputs:

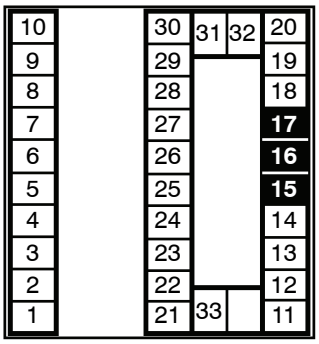


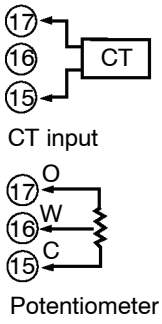
Output specifications are as follows: SPST-NO, 3 A at 250 VAC

■ CT Input/Potentiometer (for E5AK and E5EK only)

E5AK CT Input/Potentiometer

When using the HBA function on the E5AK-AA2 Controller, connect Current Transformer input (CT) to terminal numbers 15 to 17. When monitoring the valve opening on the E5AK-PRR2 Controller, connect the potentiometer (PTMR) to terminal numbers 15 to 17. Connect each of these inputs as follows:

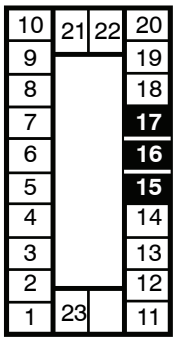


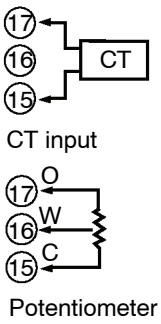


For details on CT inputs, refer to *Appendix, About Current Transformer* in your *User's Manual*. For details on the potentiometer, refer to the *Instruction Manual* for the valve connected to the Controller. The variable resistance range is 100 Ω to 2.5 kΩ.

E5EK CT Input/Potentiometer

When using the HBA function on the E5EK-AA2 Controller, connect Current Transformer input (CT) to terminal numbers 15 to 17. When monitoring the valve opening on the E5EK-PRR2 Controller, connect the potentiometer (PTMR) to terminal numbers 15 to 17. Connect each of these inputs as follows:



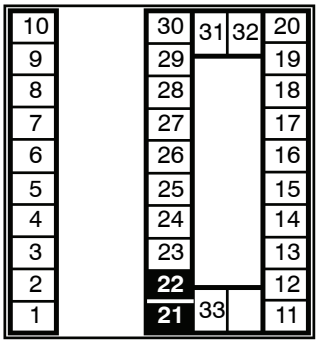


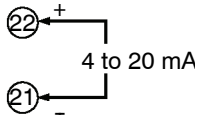
For details on CT inputs, refer to *Appendix, About Current Transformer* in your *User's Manual*. The potentiometer cannot be used simultaneously with remote SP input. For details on the potentiometer, refer to the *Instruction Manual* for the valve connected to the Controller. The variable resistance range is 100 Ω to 2.5 kΩ.

■ Remote Set Point Input (for E5AK and E5EK only)

E5AK Remote SP Input

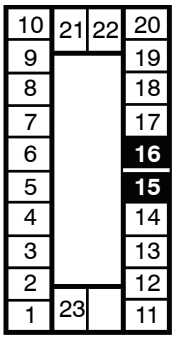
Connect the input (RSP) to be used as the remote SP to terminal numbers 21 and 22. Only 4 to 20 mA inputs can be connected. Connect the input as follows:

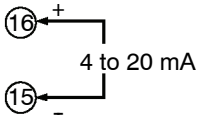




E5EK Remote SP Input

Connect the input (RSP) to be used as the remote SP to terminal numbers 15 and 16. However, note that the potentiometer cannot be used simultaneously with remote SP input. Only 4 to 20 mA inputs can be connected. Connect the input as follows:

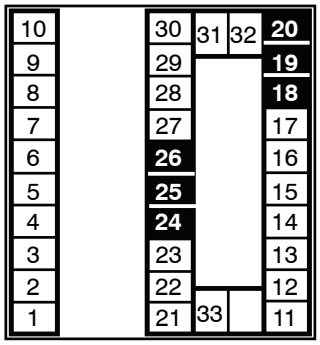




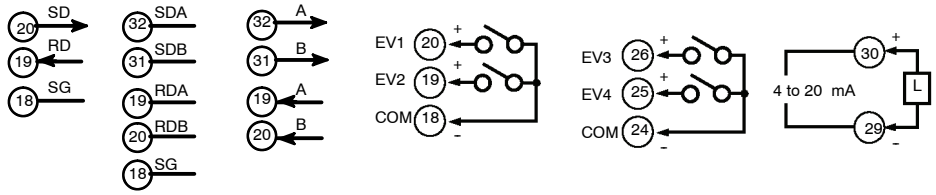
■ Option Board Wiring

E5AK

Connect event inputs 1 and 2 (EV1/2) to terminal numbers 18 to 20, and event events 3 and 4 (EV3/4) to terminal numbers 24 to 26. However, note that terminal numbers 18 to 20 cannot be used on Controllers with a communications function. Connect the event inputs as follows:



Terminals 18 and 24 (COM) are connected internally.



Option type	RS-232C	RS-422	RS-485	Event input 1 and 2 (no contact)	Event input 3 and 4 (no contact)	Transfer output
Part number	E53-AK01	E53-AK02	E53-AK03			

Use event inputs under the following conditions:

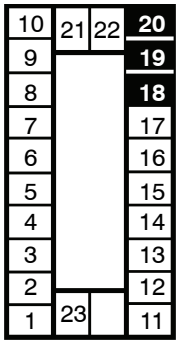
Contact input	ON: 1 kΩ max. OFF: 100 kΩ min.
No-contact input	ON: Residual voltage 1.5 V max., OFF: Leakage current 0.1 mA max.

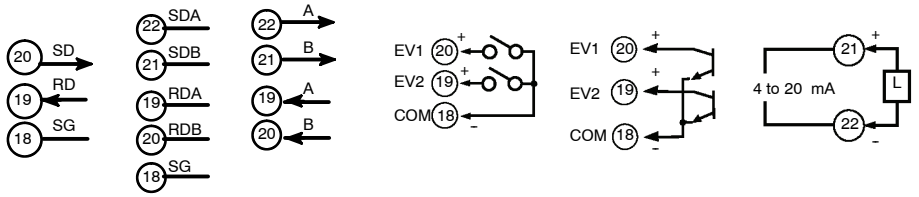
Communications

Terminal numbers 18 to 20, 31 and 32 can be used only on Controllers with Communications Units (E53-AK01/02/03). For details on wiring, refer to *Chapter 6, Using the Communications Function* in your *User's Manual*.

E5EK

Connect event inputs 1 and 2 (EV1/2) to terminal numbers 18 to 20. However, note that terminal numbers 18 to 20 cannot be used on Controllers with a communications function. Connect the event inputs as follows:





Option type	RS-232C	RS-422	RS-485	Event input 1 and 2	Event input 1 and 2 (no contact)	Transfer output
Part number	E53-AK01	E53-AK02	E53-AK03	E53-AKB	E53-AKB	E53-AKF

Use event inputs under the following conditions:

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.

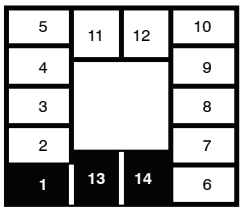
Communications

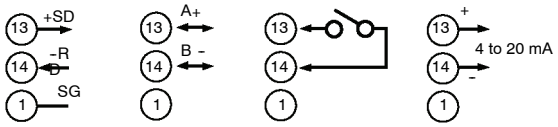
Terminal numbers 18 to 20, 31 and 32 can be used only on Controllers with Communications Units (E53-AK01/02/03). For details on wiring, refer to *Chapter 6, Using the Communications Function* in your *User's Manual*.

E5CK

Terminal numbers 1, 13, and 14 are valid only when the Option Board is set in the Controller

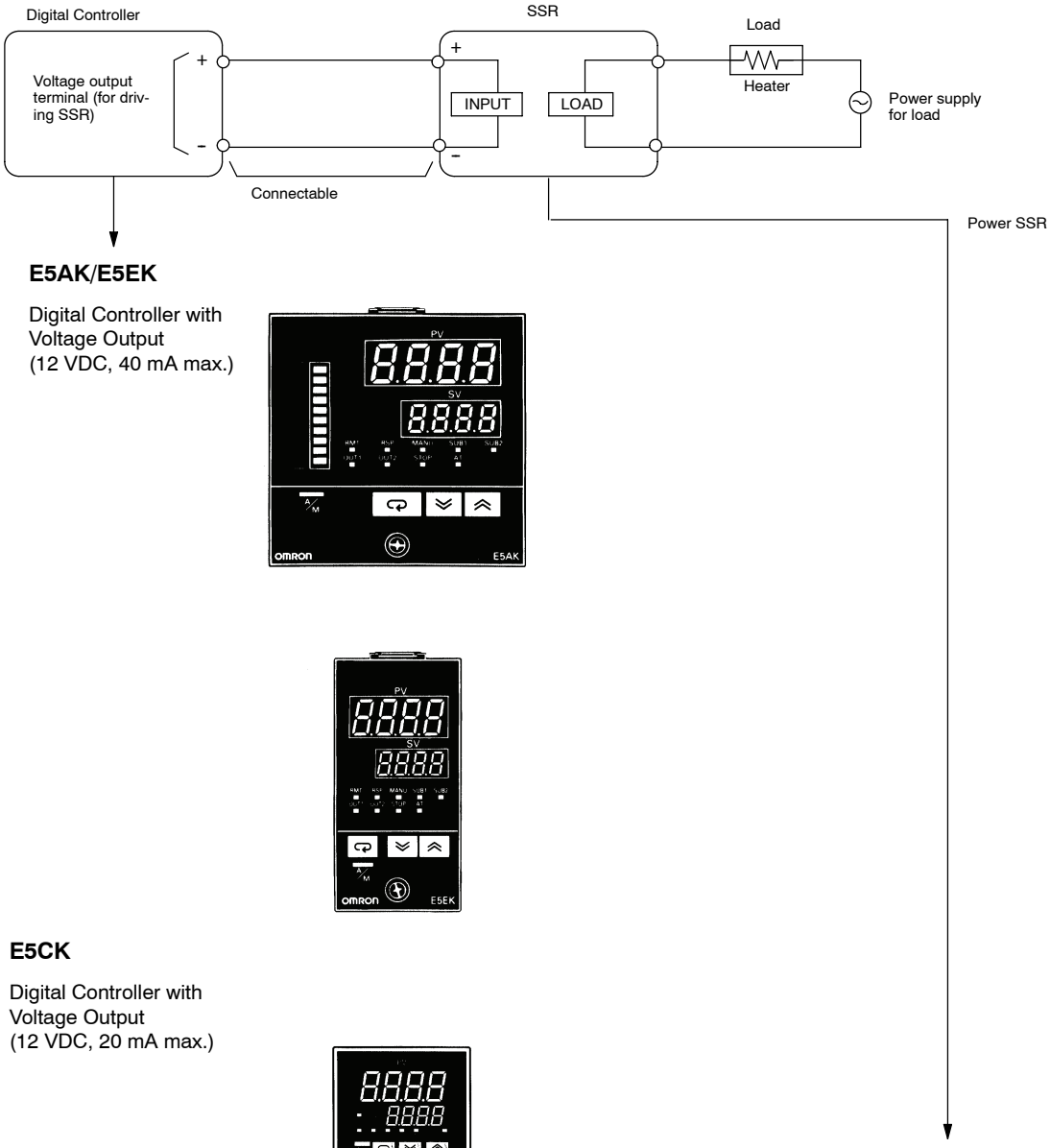
The following four connections are possible depending on the model of the Option Board.





Option type	RS-232C	RS-485	Event input	Transfer output
Part number	E53-CK01	E53-CK03	E53-CKB	E53-CKF

■ Connection Example of Digital Controller And SSR

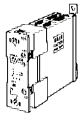
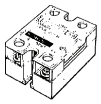


E5AK/E5EK

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

E5CK

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

Model	G3PA/G3PB	G3NA	G3NE
Appearance			
SSRs connected in parallel	E5AK/E5EK: 8 pcs. E5CK: 4 pcs.	E5AK/E5EK: 5 pcs. E5CK: 2 pcs.	E5AK/E5EK: 2 pcs. E5CK: 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

Precautions

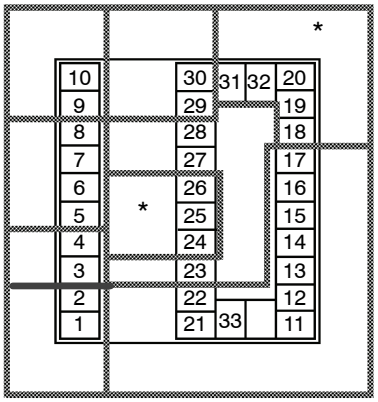
■ Precautions when Wiring

- Use wire 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 N • m, or 8 kgf • cm max. Take care not to tighten the terminal screws too tightly.

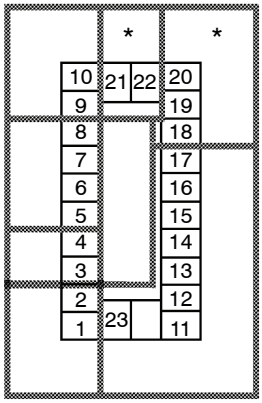
Power Blocks

The E5AK/E5EK has independent power supplies for each of the terminal blocks shown below.

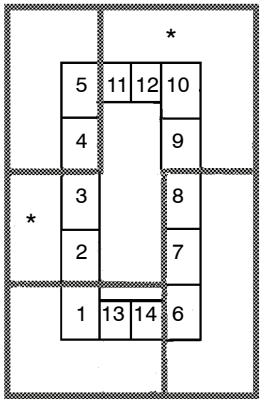
E5AK



E5EK



E5CK



* Uses same internal power supply

Note: Terminals 21 and 22 of the E5EK belong to the B block when a transfer output is set to option 1 and to the C block for other Option Boards.

■ Operating Environment

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

■ Correct Use

Mounting

- The dimensions of the Digital Controller conform to DIN 43700.
- Recommended panel thickness is 1 to 8 mm.
- Mount the Unit horizontally.

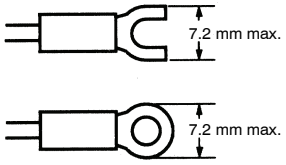
Connection

- To reduce inductive noise influence, the lead wires connecting the input type to the Digital 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 N • m or 8 kgf • cm.

Use the following type of solderless terminals for M3.5 screws.



■ Operation

- For models with alarm functions: The alarm outputs of a model with an alarm function may not turn ON properly when the model malfunctions. The use of alarm equipment with the model 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.
- Several seconds are required until the relay is turned ON after power has been supplied to the Digital Controller. You must take this time delay into consideration when designing sequenced circuits which incorporate a Digital Controller.
- Do not use excessive force when pulling out 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 Unit to the Temperature Controller or Digital Controller, make sure that the Control Output Unit is a suitable type. The use of an improper type of Control Output Unit may cause the system to malfunction.
- The heater burnout alarm will not be available if the Linear Output Unit is used.

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