OMRON

Digital Controllers
E5□R

E5□R-series Digital Controllers offer high speed, high precision, and multiple I/O and use a 5-digit, 3-row LCD display for high visual clarity.

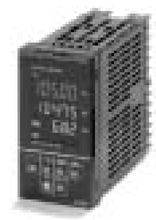
- A short sampling period of 50 ms enables use in applications requiring high-speed response.
- PV, SP, and MV data is displayed simultaneously in a 3-row, negative LCD display with a backlight.
- Multiloop control, cascade control, and proportional control are possible with a single Controller.
- When using models with communications functions, initial settings can be downloaded and settings can be masked using Support Software (Thermo Tools).
- Equipped with calculation functions as a standard (e.g., square root calculation and broken-line approximation).

E5□R Series

E5AR

96 × 96 × 95 mm

E5ER



96 × 48 × 95 mm

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■ E5□R Selection Guide

E5AR (96 × 96 mm)

Basic models

1 loop for standard control/
1 loop for heating and cooling control

- 4 alarm outputs, 2 event inputs, 2 outputs (control/transfer)
- 4 alarm outputs, 6 event inputs, RS-485 communications, 4 outputs (control/transfer)

2-loop models

2 loops for standard control/
2 loops for heating and cooling control
1 loop for cascade control
1 loop for standard control with remote SP
1 loop for proportional control

- 4 alarm outputs, 4 event inputs, RS-485 communications, 4 outputs (control/transfer)

4-loop models

4 loops for standard control
2 loops for standard control
2 loops for heating and cooling control

- 4 alarm outputs, 4 event inputs, RS-485 communications, 4 outputs (control/transfer)

Position-proportional control models

1 loop for position-proportional control

- 4 alarm outputs, 4 event inputs, 2 relay outputs (open, closed)
- 4 alarm outputs, 4 event inputs, 2 relay outputs (open, closed) RS-485 communications, 1 output (transfer)

E5ER (48 × 96 mm)

Basic models

1 loop for standard control/
1 loop for heating and cooling control

- 4 alarm outputs, 2 event inputs, 2 outputs (control/transfer)
- 4 alarm outputs, 2 event inputs, RS-485 communications, 4 outputs (control/transfer)

2-loop models

2 loops for standard control/
1 loop for heating and cooling control
1 loop for cascade control
1 loop for standard control with remote SP
1 loop for proportional control

- 4 alarm outputs, 4 event inputs, RS-485 communications, 2 outputs (control/transfer)

Position-proportional control models

1 loop for position-proportional control

- 4 alarm outputs, 4 event inputs, 2 relay outputs (open, closed)
- 4 alarm outputs, no event input, 2 relay outputs (open, closed) RS-485 communications, 1 output (transfer)

OMRON

Digital Controllers
E5AR

E5AR Digital Controllers offer high speed, high precision, and multiple I/O and use a 5-digit, 3-row LCD display for high visual clarity.

- A short sampling period of 50 ms enables use in applications requiring high-speed response.
- PV, SP, and MV data is displayed simultaneously in a 3-row, negative LCD display with a backlight.
- Bar graph to show MV (manipulated variable), valve opening, or deviation.
- Multiloop control, cascade control, and proportional control are possible with a single Controller.
- When using models with communications functions, initial settings can be downloaded and settings can be masked using Support Software (Thermo Tools).
- Equipped with calculation functions as a standard (e.g., square root calculation and broken-line approximation).

Model Number Structure

■ Model Number Legend

Base Unit

E5AR-□□□□-500
1 2 3 4 5 6

1. **Size**
   A: 96 mm × 96 mm
2. **Control Type**
   Blank: Standard control or heating and cooling control
   P: Position-proportional control
3. **Output Unit**
   A: Output Units to be selected from Option Unit.
4. **Auxiliary Output**
   Blank: None
   4: 4 relay outputs
5. **Input**
   B: Sensor input and 2 event inputs
   F: Sensor input and potentiometer input
   W: 2 multi-inputs
6. **Terminal Cover**
   -500: Terminal cover is attached.

Output/Digital Input Unit

E53-AR□
1

1. **Type of Output/Digital Input Unit**
   QC: Voltage output/current output and voltage output
   CC: 2 current outputs
   QC3: Voltage output/current output and voltage output with RS-485 communications
   CC3: 2 current outputs with RS-485 communications
   RR: 2 relay outputs for position-proportional control
   RR3: 2 relay outputs with RS-485 communications for position-proportional control
   B4: 4 event inputs

Note: Voltage/current can be selected with software settings.

Ordering Information

Note: E5AR models are configured by combining a Base Unit, Output Unit, and Digital Input Unit. There are 7 possible combinations, which are shown in the table under *Combination List*. Refer to this list when making your selection.

Descriptions	Ordering model	Specifications
Base Unit (AC100-240 or AC/DC24)	E5AR-A4B-500	Single Loop Control Unit with 2 event inputs and 4 auxiliary outputs
	E5AR-PA4F-500	Position-proportional Control Unit with potentiometer input and 4 auxiliary outputs
	E5AR-A4W-500	2-loop Control Unit with 4 auxiliary outputs
	E5AR-A4WW-500	4-loop Control Unit with 4 auxiliary outputs
Output Unit	E53-ARQC	Voltage output/current output (See note 1.) and voltage output
	E53-ARCC	2 current outputs
	E53-ARQC3	Voltage output/current output (See note 1.) and voltage output with RS-485 communications
	E53-ARCC3	2 current outputs with RS-485 communications
Output Unit (for position-proportional control only)	E53-ARRR	2 relay outputs for open and close
	E53-ARRR3	2 relay outputs for open and close with RS-485 communications
Digital Input Unit	E53-ARB4	4 event inputs

Descriptions	Model
Inspection Report for E5AR	E5AR-K

Descriptions	Model
Terminal Cover for E5AR	E53-COV14

Note 1. Voltage or current can be selected with software settings.

2. The Terminal Cover comes with the E5AR Base Unit and does not have to be purchased separately.

■ Combination List

As shown in the following table, E5AR models can be created with 7 possible combinations of Base Unit, Output Unit, and Digital Input Unit. Operation is not possible for any other combination. The “set descriptions” are numbers used in related manuals to refer to the corresponding combination. When ordering, use the “ordering model” numbers.

Control type	Control mode	Output	Auxiliary output	Event input	Serial communications	Set descriptions	Ordering model
Basic control	Single-loop standard control Single-loop heating and cooling control	2 points: Voltage Voltage/Current (See note.)	4	2	No	E5AR-Q4B	E5AR-A4B-500 E53-ARQC
		2 points: Current Current				E5AR-C4B	E5AR-A4B-500 E53-ARCC
		4 points: Voltage Voltage/Current (See note.) Current Current		6	RS-485	E5AR-QC43DB-FLK	E5AR-A4B-500 E53-ARQC3 E53-ARCC E53-ARB4
2-loop control	2-loop standard control 2-loop heating and cooling control Single-loop cascade control Single-loop control with remote SP Single-loop ratio control	4 points: Voltage Voltage Voltage/Current (See note.) Voltage/Current (See note.)	4	4	RS-485	E5AR-QQ43DW-FLK	E5AR-A4W-500 E53-ARQC3 E53-ARQC E53-ARB4
4-loop control	4-loop standard control 2-loop standard control 2-loop heating and cooling control	4 points: Current Current Current Current	4	4	RS-485	E5AR-CC43DWW-FLK	E5AR-A4WW-500 E53-ARCC3 E53-ARCC E53-ARB4
Position-proportional control	Single-loop position-proportional control	Relay output (1 open and 1 close)	4	4	No	E5AR-PR4DF	E5AR-PA4F-500 E53-ARRR E53-ARB4
		Relay output (1 open and 1 close) Transfer output			RS-485	E5AR-PRQ43DF-FLK	E5AR-PA4F-500 E53-ARRR3 E53-ARQC E53-ARB4

Note: Voltage or current can be selected with software settings.

Specifications

■ Ratings

Item	Supply voltage (See note 1.)	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz; 24 VDC
Operating voltage range		85% to 110% of rated supply voltage	
Power consumption		E5AR: 22 VA max. (with maximum load) E5ER: 17 VA max. (with maximum load)	E5AR: 15 VA/10 W E5ER: 11 VA/7 W
Sensor input (See note 2.)		Thermocouple: K, J, T, E, L, U, N, R, S, B, W Platinum resistance thermometer: Pt100 Current input: 4 to 20 mA DC, 0 to 20 mA DC (including remote SP input) Voltage input: 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC (including remote SP input) (Input impedance: 150 Ω for current input, approx. 1 MΩ for voltage input)	
Control output	**Voltage (pulse) output**	12 VDC, 40 mA max. with short-circuit protection circuit	
	Current output	0 to 20 mA DC, 4 to 20 mA DC; load: 500 Ω max. (including transfer output) (Resolution: Approx. 54,000 for 0 to 20 mA DC; Approx. 43,000 for 4 to 20 mA DC)	
	Relay output	Position-proportional control type (open, closed) N.O., 250 VAC, 1 A (including inrush current)	
Auxiliary output		Relay Output N.O., 250 VAC, 1 A (resistive load) Transistor Output Maximum load voltage: 30 VDC; Maximum load current: 50 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.	
Potentiometer input		100 Ω to 2.5 kΩ	
Event input	**Contact**	Input ON: 1 kΩ max.; OFF: 100 kΩ min.	
	No-contact	Input ON: Residual voltage of 1.5 V max.; OFF: Leakage current of 0.1 mA max.	
		Short-circuit: Approx. 7 mA	
Remote SP input		Refer to the information on sensor input.	
Transfer output		Refer to the information on control output.	
Control method		2-PID or ON/OFF control	
Setting method		Digital setting using front panel keys or setting using serial communications	
Indication method		7-segment digital display and single-lighting indicator Character Height No. 1 display: 12.8 mm; No. 2 display: 7.7 mm; No. 3 display: 7.7 mm	
Other functions		Depends on model.	
Ambient operating temperature		−10 to 55 °C (with no icing or condensation) For 3 years of assured use: −10 to 50 °C	
Ambient operating humidity		25% to 85%	
Storage temperature		−25 to 65 °C (with no icing or condensation)	

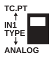
Note 1. The supply voltage (i.e., 100 to 240 VAC or 24 VAC/VDC) depends on the model. Be sure to specify the required type when ordering.

2. The Controller is equipped with multiple sensor input. Temperature input or analog input can be selected with the input type setting switch. There is basic insulation between power supply and input terminals, power supply and output terminals, and input and output terminals.

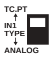
Input Ranges

The E5AR has multi-inputs. The default setting is 2 (K-type thermocouple, −200.0 to 1300.0 °C or −300.0 to 2300.0 °F).

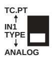
Platinum Resistance Thermometer Input

Input		**Pt100**	
Range	**°C**	−200.0 to 850.0	−150.00 to 150.00
	°F	−300.0 to 1500.0	−199.99 to 300.00
Setting		0	1
Minimum setting unit (SP and alarm)		0.1	0.01
Input type setting switch		Set to TC.PT.	

Thermocouple Input

Input		**K**		**J**		**T**	**E**	**L**	**U**	**N**	**R**	**S**	**B**	**W**
Range	**°C**	−200.0 to 1300.0	−20.0 to 500.0	−100.0 to 850.0	−20.0 to 400.0	−200.0 to 400.0	0.0 to 600.0	−100.0 to 850.0	−200.0 to 400.0	−200.0 to 1300.0	0.0 to 1700.0	0.0 to 1700.0	100.0 to 1800.0	0.0 to 2300.0
	°F	−300.0 to 2300.0	0.0 to 900.0	−100.0 to 1500.0	0.0 to 750.0	−300.0 to 700.0	0.0 to 1100.0	−100.0 to 1500.0	−300.0 to 700.0	−300.0 to 2300.0	0.0 to 3000.0	0.0 to 3000.0	300.0 to 3200.0	0.0 to 4100.0
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14
Minimum setting unit (SP and alarm)		0.1												
Input type setting switch		Set to TC.PT. 												

Current/Voltage Input

Input	**Current**		**Voltage**		
	4 to 20 mA	**0 to 20 mA**	**1 to 5 V**	**0 to 5 V**	**0 to 10 V**
Range	Depending on the scaling settings, one of the following ranges will be displayed. −19999 to 99999 −1999.9 to 9999.9 −199.99 to 999.99 −19.999 to 99.999 −1.9999 to 9.9999				
Setting	15	16	17	18	19
Input type setting switch	Set to ANALOG. 				

■ Characteristics

Indication accuracy	Thermocouple input with cold junction compensation: (±0.1% of PV or ±1°C, whichever is greater) ±1 digit max. (See note 1.) Thermocouple input without cold junction compensation: (±0.1% FS or ±1°C, whichever is smaller) ±1 digit (See note 2.) Analog input: ±0.1% FS ±1 digit max. Platinum resistance thermometer input: (±0.1% of PV or ±0.5°C, whichever is greater) ±1 digit max. Position-proportional potentiometer input: ±5% FS ±1 digit max.
Control mode	Standard control (heating or cooling control), heating/cooling control, standard control with remote SP (2-input models only), heating/cooling control with remote SP (2-input models only), cascade standard control (2-input models only), cascade heating/cooling control (2-input models only), proportional control (2-input models only), position-proportional control (control-valve control models only)
Control period	0.2 to 99.0 s (in units of 0.1 s) for time-proportioning control output
Proportional band (P)	0.00% to 999.99% FS (in units of 0.01% FS)
Integral time (I)	0.0 to 3,999.9 s (in units of 0.1 s)
Derivative time (D)	0.0 to 3,999.9 s (in units of 0.1 s)
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Manual reset value	0.0% to 100.0% (in units of 0.1% FS)
Alarm setting range	−19,999 to 99,999 EU (See note 3.) (The decimal point position depends on the input type and the decimal point position setting.)
Input sampling period	50 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min (between charged terminals of different polarities)
Vibration resistance	10 to 55 Hz, 20 m/s² for 10 min each in X, Y, and Z directions
Shock resistance	100 m/s², 3 times each in X, Y, and Z directions
Inrush current	100 to 240-VAC models: 50 A max. 24 VAC/VDC models: 30 A max.
Weight	E5AR: Controller only: Approx. 450 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 30 g E5ER: Controller only: Approx. 330 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 16 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66); Rear case: IP20; Terminals: IP00
Memory protection	Non-volatile memory (number of writes: 100,000)
Applicable standards	UL3121-1, CSA C22.2 No. 1010-1 EN61010-1 (IEC61010-1): Pollution degree 2/overvoltage category 2
EMC	EMI: EN61326 Radiated Interference Electromagnetic Field Strength: EN55011 Group 1 class A Noise Terminal Voltage:EN55011 Group 1 class A EMS: EN61326 Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity Electromagnetic:EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse-modulated, 900±5 MHz) (level 3) Immunity Burst Noise: EN61000-4-4: 2 kV power line (level 3) 2 kV measurement line, I/O signal line (level 4) 1 kV communications line (level 3) Immunity Conducted Disturbance: EN61000-4-6: (0.15 to 80 MHz) (level 3) Immunity Surge: EN61000-4-5: 1 kV line to line (power line, output line (relay output)) (level 2) 2 kV line to ground (power line, output line (relay output)) (level 3) Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 100% (rated voltage)

Note 1. K-, T-, or N-type thermocouple at −100°C max.: ±2°C ±1 digit max.
U- or L-type thermocouple: ±2°C ±1 digit max.
B-type thermocouple at 400°C max.: No accuracy specification.
R- or S-type thermocouple at 200°C max.: ±3°C ±1 digit max.
W-type thermocouple: (±0.3% of PV or ±3°C, whichever is greater) ±1 digit max.

2. U- or L-type thermocouple: ±1°C ±1 digit
R- or S-type thermocouple at 200°C max.: ±1.5°C ±1 digit

3. ”EU” (Engineering Unit) represents the unit after scaling. If a temperature sensor is used it is either °C or °F.

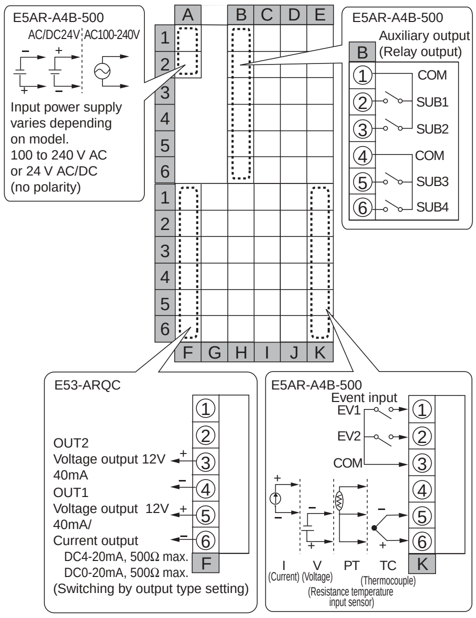
■ Communications Specifications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	9,600, 19,200, or 38,4000 bps
Transmission code	ASCII
Data bit length	7 or 8 bits
Stop bit length	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Block check character (BCC) Start-stop synchronization data format
Flow control	None
Interface	RS-485
Retry function	None

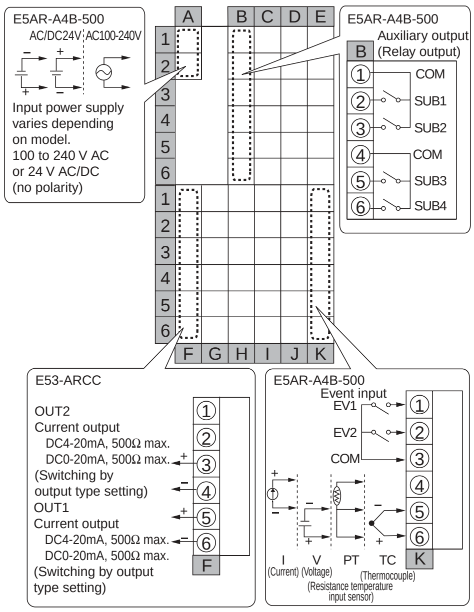
Wiring Terminals

■ Connections

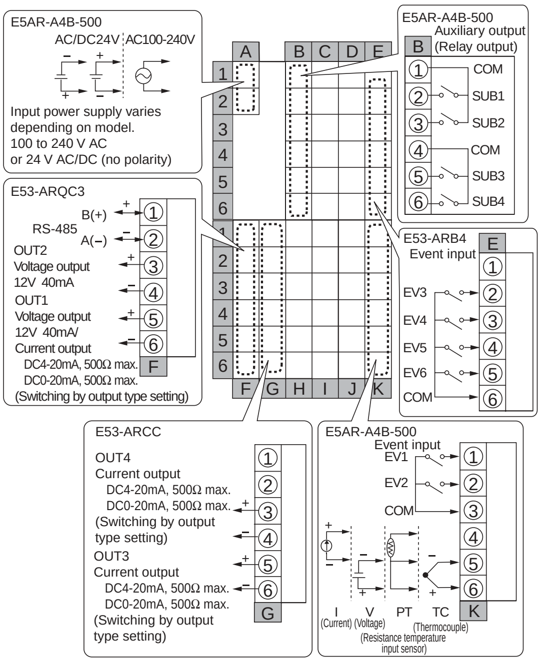
E5AR-Q4B



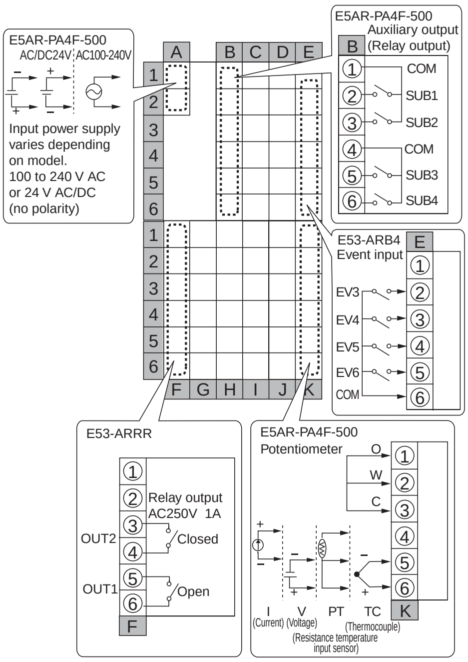
E5AR-C4B



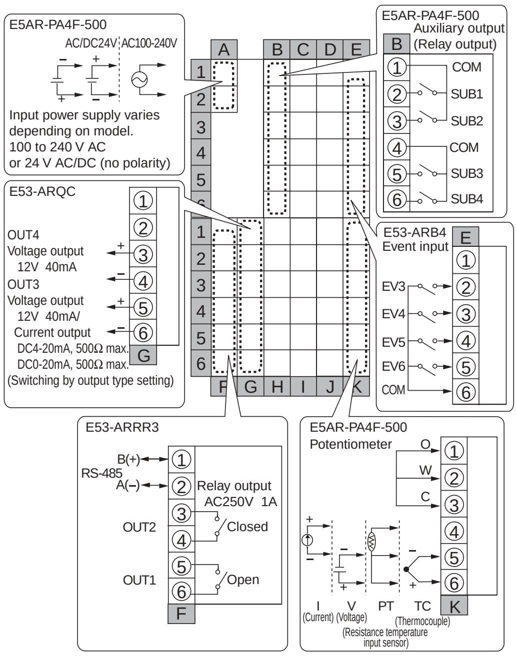
E5AR-QC43DB-FLK



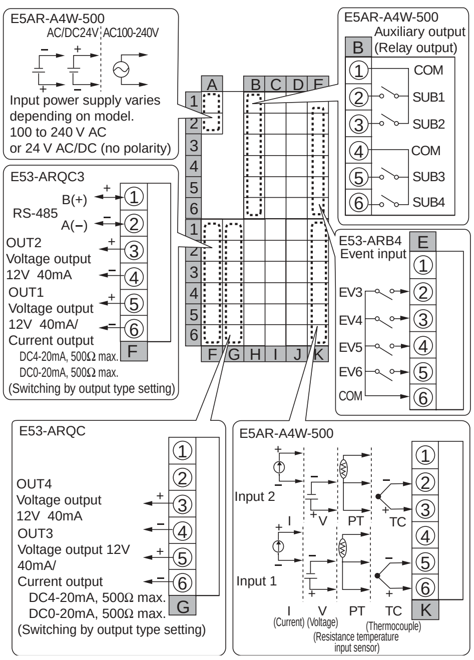
E5AR-PR4DF



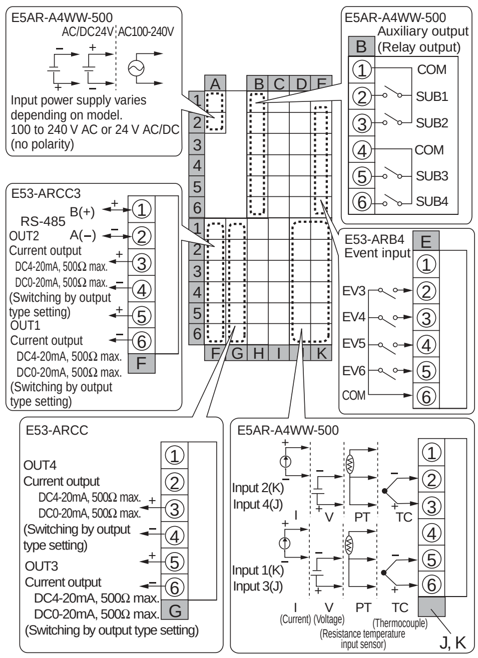
E5AR-PRQ43DF-FLK



E5AR-QQ43DW-FLK (2-input type)

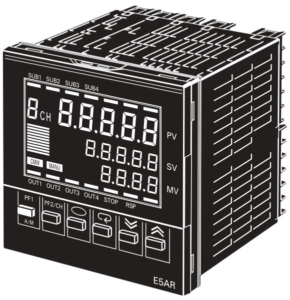


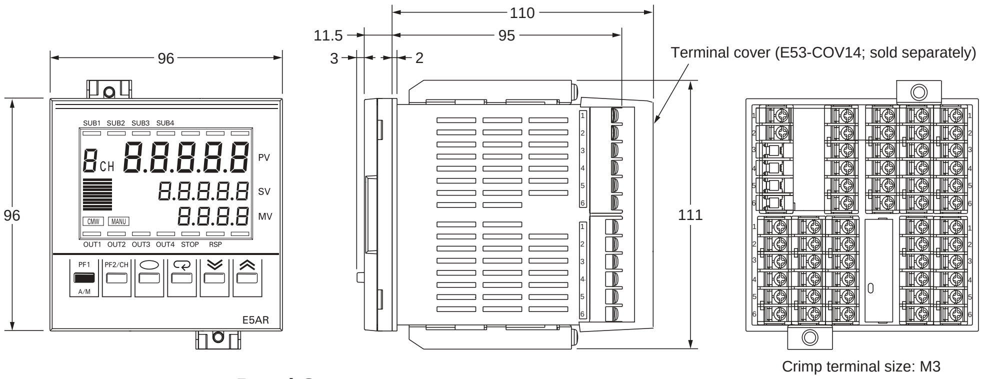
E5AR-CC43DWW-FLK (4-input type)



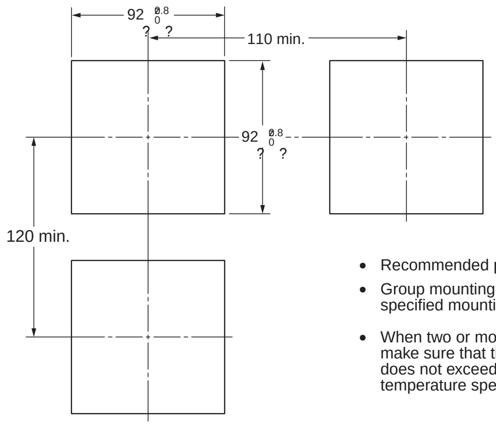
Dimensions

Note: All units are in millimeters unless otherwise indicated.





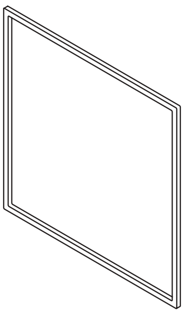
Panel Cutouts



- Recommended panel thickness is 1 to 8 mm.
- Group mounting is not possible. (Maintain the specified mounting space between Controllers.)
- When two or more Controllers are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

Rubber Packing (Sold Separately)

Y92S-P4 (for E5AR)



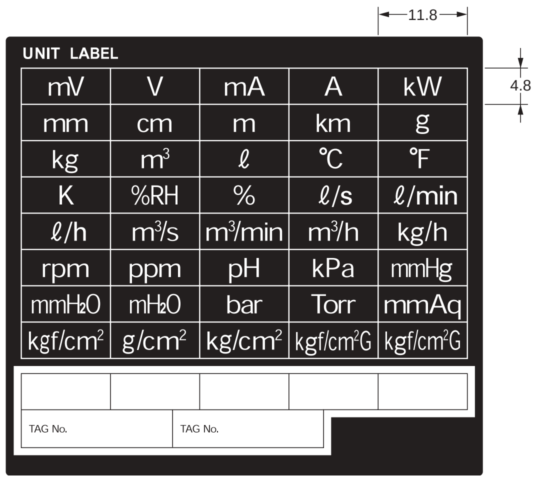
If the rubber packing is lost or damaged, it can be ordered using the following model number: Y92S-P4.

(Depending on the operating environment, deterioration, contraction, or hardening of the rubber packing may occur and so, in order to ensure the level of waterproofing specified in NEMA4, periodic replacement is recommended.)

Note: Rubber packing is provided with the Controller.

Unit Label Sheet (Sold Separately)

Y92S-L1



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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

OMRON

Digital Controllers
E5ER

E5ER Digital Controllers offer high speed, high precision, and multiple I/O and use a 5-digit, 3-row LCD display for high visual clarity.

- A short sampling period of 50 ms enables use in applications requiring high-speed response.
- PV, SP, and MV data is displayed simultaneously in a 3-row, negative LCD display with a backlight.
- Multipoint control, cascade control, and proportional control are possible with a single Controller.
- When using models with communications functions, initial settings can be downloaded and settings can be masked using Support Software (Thermo Tools).
- Equipped with calculation functions as a standard (e.g., square root calculation and broken-line approximation).

Model Number Structure

■ Model Number Legend

Base Unit

E5ER-□□□□-500
1 2 3 4 5 6

1. **Size**
   E: 96 mm × 48 mm
2. **Control Type**
   Blank: Standard control or heating and cooling control
   P: Position-proportional control
3. **Output Unit**
   A: Output Units to be selected from Option Unit.
4. **Auxiliary Output**
   Blank: None
   4: 4 relay outputs
5. **Input**
   B: Sensor input and 2 event inputs
   F: Sensor input and potentiometer input
   W: 2 multi-inputs
6. **Terminal Cover**
   -500: Terminal cover is attached.

Output/Digital Input Unit

E53-AR□
1

1. **Type of Output/Digital Input Unit**
   QC: Voltage output/current output and voltage output
   CC: 2 current outputs
   QC3: Voltage output/current output and voltage output with RS-485 communications
   CC3: 2 current outputs with RS-485 communications
   R4: 4 auxiliary outputs
   RR: 2 relay outputs for position-proportional control
   RR3: Relay outputs with RS-485 communications for position-proportional control
   B4: 4 event inputs
   T2: Auxiliary output: 2 transistor outputs

Note: Voltage/current can be selected with software settings.

Ordering Information

Note: E5ER models are configured by combining a Base Unit, Output Unit, and Digital Input Unit. There are 7 possible combinations, which are shown in the table under *Combination List*. Refer to this list when making your selection.

Descriptions	Model	Specifications
Base Unit (AC100-240 or AC/DC24	E5ER-AB-500	Single Loop Control Unit with 2 event inputs
	E5ER-PAF-500	Position-proportional Control Unit with potentiometer input
	E5ER-AW-500	2-loop Control Unit
Output Unit	E53-ARQC	Voltage output/current output (See note 1.) and voltage output
	E53-ARCC	2 current outputs
	E53-ARQC3	Voltage output/current output (See note 1.) and voltage output with RS-485 communications
	E53-ARCC3	2 current outputs with RS-485 communications
Output Unit (for position-proportional control only)	E53-ARRR	2 relay outputs for open and close
	E53-ARRR3	2 relay outputs for open and close with RS485 communications
Digital Output Unit	E53-ART2	2 transistor outputs
Auxiliary Output Unit	E53-ARR4	4 relay outputs (auxiliary outputs)
Digital Input Unit	E53-ARB4	4 event inputs

Descriptions	Model
Inspection Report for E5ER	E5ER-K

Descriptions	Model
Terminal Cover for E5ER	E53-COV15

Note 1. Voltage or current can be selected with software settings.

2. Terminal Cover comes with the E5AR Base Unit and does not have to be purchased separately.

■ Combination List

As shown in the following table, E5ER models can be created with 7 possible combinations of Base Unit, Output Unit, and Digital Input Unit. Operation is not possible for any other combination. The "set descriptions" are numbers used in related manuals to refer to the corresponding combination. When ordering, use the "ordering model" numbers.

Control type	Control mode	Output	Auxiliary output	Event input	Serial communications	Set descriptions	Ordering model
Basic control	Single-loop standard control Single-loop heating and cooling control	2 points: Voltage Voltage/Current (See note.)	4	2	No	E5ER-Q4B	E5ER-AB-500 E53-ARQC E53-ARR4
		2 points: Current Current				E5ER-C4B	E5ER-AB-500 E53-ARCC E53-ARR4
		4 points: Voltage Voltage/Current (See note.) Current Current			RS-485	E5ER-QC43B-FLK	E5ER-AB-500 E53-ARQC3 E53-ARCC E53-ARR4
2-loop control	2-loop standard control Single-loop heating and cooling control Single-loop cascade control Single-loop control with remote SP Single-loop ratio control	2 points: Voltage Voltage/Current (See note.)	2	4	RS-485	E5ER-QT3DW-FLK	E5ER-AW-500 E53-ARQC3 E53-ART2 E53-ARB4
		2 points: Current Current				E5ER-CT3DW-FLK	E5ER-AW-500 E53-ARCC3 E53-ART2 E53-ARB4
Position-proportional control	Single-loop position-proportional control	Relay output (1 open and 1 close)	2	4	No	E5ER-PRTDF	E5ER-PAF-500 E53-ARRR E53-ART2 E53-ARB4
		Relay output (1 open and 1 close) Transfer output	4	No	RS-485	E5ER-PRQ43F-FLK	E5ER-PAF-500 E53-ARRR3 E53-ARQC E53-ARR4

Note: Voltage or current can be selected with software settings.

Specifications

■ Ratings

Item	Supply voltage (See note 1.)	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz; 24 VDC
Operating voltage range		85% to 110% of rated supply voltage	
Power consumption		E5AR: 22 VA max. (with maximum load) E5ER: 17 VA max. (with maximum load)	E5AR: 15 VA/10 W E5ER: 11 VA/7 W
Sensor input (See note 2.)		Thermocouple: K, J, T, E, L, U, N, R, S, B, W Platinum resistance thermometer: Pt100 Current input: 4 to 20 mA DC, 0 to 20 mA DC (including remote SP input) Voltage input: 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC (including remote SP input) (Input impedance: 150 Ω for current input, approx. 1 MΩ for voltage input)	
Control output	**Voltage (pulse) output**	12 VDC, 40 mA max. with short-circuit protection circuit	
	Current output	0 to 20 mA DC, 4 to 20 mA DC; load: 500 Ω max. (including transfer output) (Resolution: Approx. 54,000 for 0 to 20 mA DC; Approx. 43,000 for 4 to 20 mA DC)	
	Relay output	Position-proportional control type (open, closed) N.O., 250 VAC, 1 A (including inrush current)	
Auxiliary output		Relay Output N.O., 250 VAC, 1 A (resistive load) Transistor Output Maximum load voltage: 30 VDC; Maximum load current: 50 mA; Residual voltage: 1.5 V max.; Leakage current: 0.4 mA max.	
Potentiometer input		100 Ω to 2.5 kΩ	
Event input	**Contact**	Input ON: 1 kΩ max.; OFF: 100 kΩ min.	
	No-contact	Input ON: Residual voltage of 1.5 V max.; OFF: Leakage current of 0.1 mA max.	
		Short-circuit: Approx. 7 mA	
Remote SP input		Refer to the information on sensor input.	
Transfer output		Refer to the information on control output.	
Control method		2-PID or ON/OFF control	
Setting method		Digital setting using front panel keys or setting using serial communications	
Indication method		7-segment digital display and single-lighting indicator Character Height No. 1 display: 9.5 mm; No. 2 display: 7.2 mm; No. 3 display: 7.2 mm	
Other functions		Depends on model.	
Ambient operating temperature		−10 to 55 °C (with no icing or condensation) For 3 years of assured use: −10 to 50 °C	
Ambient operating humidity		25% to 85%	
Storage temperature		−25 to 65 °C (with no icing or condensation)	

Note 1. The supply voltage (i.e., 100 to 240 VAC or 24 VAC/VDC) depends on the model. Be sure to specify the required type when ordering.

2: The Controller is equipped with multiple sensor input. Temperature input or analog input can be selected with the input type setting switch. There is basic insulation between power supply and input terminals, power supply and output terminals, and input and output terminals.

Input Ranges

The E5ER has multi-inputs. The default setting is 2 (K-type thermocouple, −200.0 to 1300.0 °C or −300.0 to 2300.0 °F).

Platinum Resistance Thermometer Input

Input		**Pt100**	
Range	**°C**	−200.0 to 850.0	−150.0 to 150.0
	°F	−300.0 to 1500.0	−199.99 to 300.0
Setting		0	1
Minimum setting unit (SP and alarm)		0.1	0.01
Input type setting switch		Set to TC.PT.	

Thermocouple Input

Input		**K**		**J**		**T**	**E**	**L**	**U**	**N**	**R**	**S**	**B**	**W**
Range	**°C**	−200.0 to 1300.0	−20.0 to 500.0	−100.0 to 850.0	−20.0 to 400.0	−200.0 to 400.0	0.0 to 600.0	−100.0 to 850.0	−200.0 to 400.0	−200.0 to 1300.0	0.0 to 1700.0	0.0 to 1700.0	100.0 to 1800.0	0.0 to 2300.0
	°F	−300.0 to 2300.0	0.0 to 900.0	−100.0 to 1500.0	0.0 to 750.0	−300.0 to 700.0	0.0 to 1100.0	−100.0 to 1500.0	−300.0 to 700.0	−300.0 to 2300.0	0.0 to 3000.0	0.0 to 3000.0	300.0 to 3200.0	0.0 to 4100.0
Setting		2	3	4	5	6	7	8	9	10	11	12	13	14
Minimum setting unit (SP and alarm)		0.1												
Input type setting switch		Set to TC.PT.												

Current/Voltage Input

Input	**Current**		**Voltage**		
Range	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V
Setting	15	16	17	18	19
Input type setting switch	Set to ANALOG.				

Characteristics

Indication accuracy	Thermocouple input with cold junction compensation: (±0.1% of PV or ±1°C, whichever is greater) ±1 digit max. (See note 1.) Thermocouple input without cold junction compensation: (±0.1% FS or ±1°C, whichever is smaller) ±1 digit (See note 2.) Analog input: ±0.1% FS ±1 digit max. Platinum resistance thermometer input: (±0.1% of PV or ±0.5°C, whichever is greater) ±1 digit max. Position-proportional potentiometer input: ±5% FS ±1 digit max.
Control mode	Standard control (heating or cooling control), heating/cooling control, standard control with remote SP (2-input models only), heating/cooling control with remote SP (2-input models only), cascade standard control (2-input models only), cascade heating/cooling control (2-input models only), proportional control (2-input models only), position-proportional control (control-valve control models only)
Control period	0.2 to 99.0 s (in units of 0.1 s) for time-proportioning control output
Proportional band (P)	0.00% to 999.99% FS (in units of 0.01% FS)
Integral time (I)	0.0 to 3,999.9 s (in units of 0.1 s)
Derivative time (D)	0.0 to 3,999.9 s (in units of 0.1 s)
Hysteresis	0.01% to 99.99% FS (in units of 0.01% FS)
Manual reset value	0.0% to 100.0% (in units of 0.1% FS)
Alarm setting range	–19,999 to 99,999 EU (See note 3.) (The decimal point position depends on the input type and the decimal point position setting.)
Input sampling period	50 ms
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min (between charged terminals of different polarities)
Vibration resistance	10 to 55 Hz, 20 m/s^2 for 10 min each in X, Y, and Z directions
Shock resistance	100 m/s^2, 3 times each in X, Y, and Z directions
Inrush current	100 to 240-VAC models: 50 A max. 24 VAC/VDC models: 30 A max.
Weight	E5AR: Controller only: Approx. 450 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 30 g E5ER: Controller only: Approx. 330 g; Mounting bracket: Approx. 60 g; Terminal cover: Approx. 16 g
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66); Rear case: IP20; Terminals: IP00
Memory protection	Non-volatile memory (number of writes: 100,000)
Applicable standards	UL3121-1, CSA C22.2 No. 1010-1 EN61010-1 (IEC61010-1): Pollution degree 2/overvoltage category 2
EMC	EMI: EN61326 Radiated Interference Electromagnetic Field Strength: EN55011 Group 1 class A Noise Terminal Voltage:EN55011 Group 1 class A EMS: EN61326 Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity Electromagnetic:EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse-modulated, 900±5 MHz) (level 3) Immunity Burst Noise: EN61000-4-4: 2 kV power line (level 3) 2 kV measurement line, I/O signal line (level 4) 1 kV communications line (level 3) Immunity Conducted Disturbance: EN61000-4-6: (0.15 to 80 MHz) (level 3) Immunity Surge: EN61000-4-5: 1 kV line to line (power line, output line (relay output)) (level 2) 2 kV line to ground (power line, output line (relay output)) (level 3) Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 100% (rated voltage)

Note 1. K-, T-, or N-type thermocouple at –100°C max.: ±2°C ±1 digit max.
U- or L-type thermocouple: ±2°C ±1 digit max.
B-type thermocouple at 400°C max.: No accuracy specification.
R- or S-type thermocouple at 200°C max.: ±3°C ±1 digit max.
W-type thermocouple: (±0.3% of PV or ±3°C, whichever is greater) ±1 digit max.

2. U- or L-type thermocouple: ±1°C ±1 digit
R- or S-type thermocouple at 200°C max.: ±1.5°C ±1 digit

3. "EU" (Engineering Unit) represents the unit after scaling. If a temperature sensor is used it is either °C or °F.

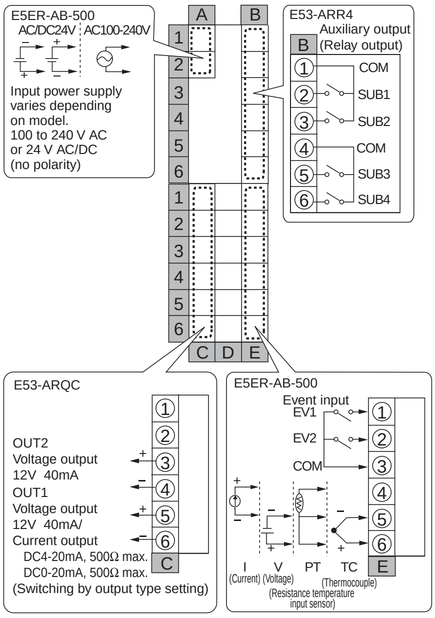
Communications Specifications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	9,600, 19,200, or 38,4000 bps
Transmission code	ASCII
Data bit length	7 or 8 bits
Stop bit length	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Block check character (BCC) Start-stop synchronization data format
Flow control	None
Interface	RS-485
Retry function	None

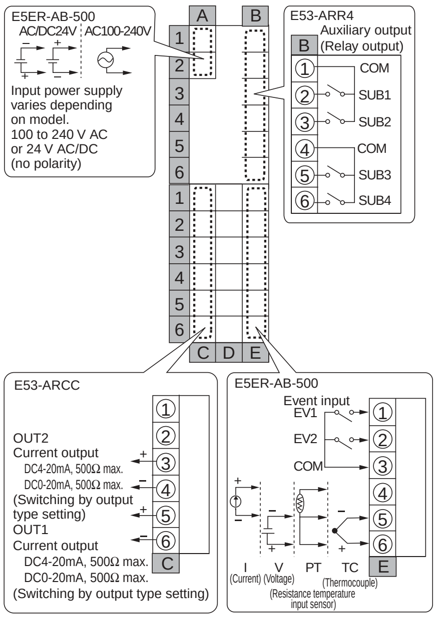
Wiring Terminals

■ Connections

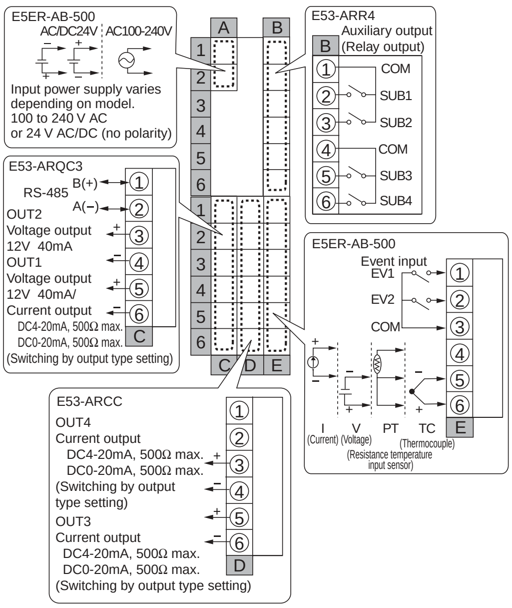
E5ER-Q4B



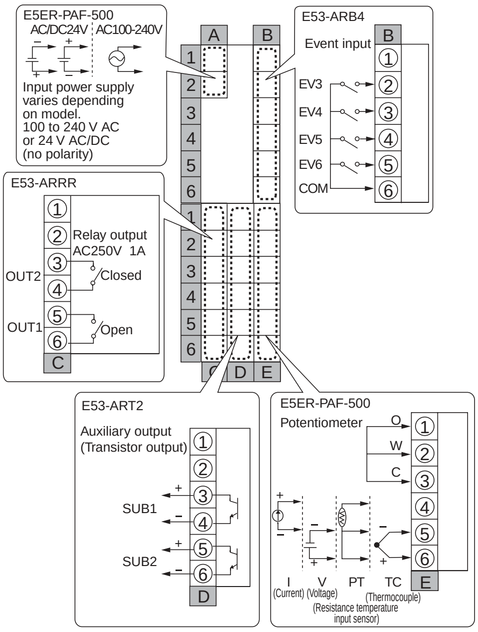
E5ER-C4B



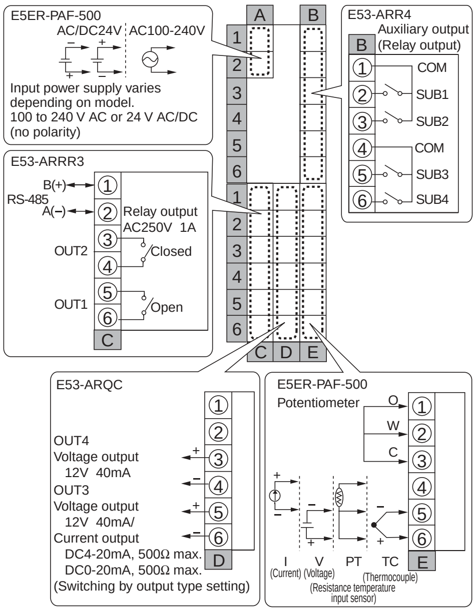
E5ER-QC43DB-FLK



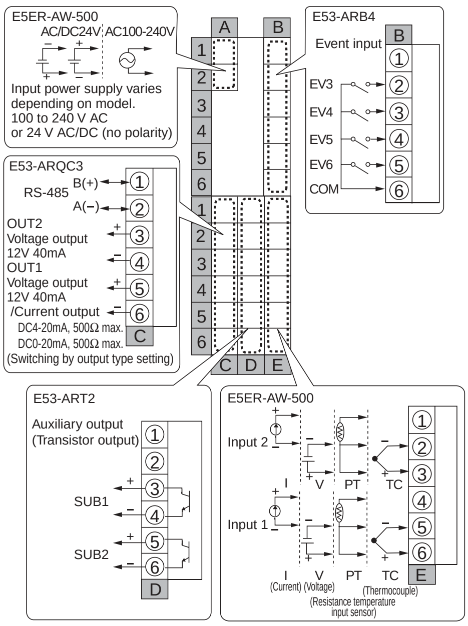
E5ER-PRTDF



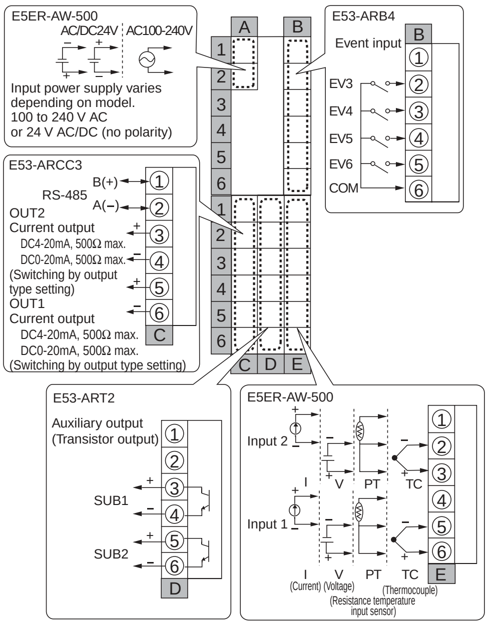
E5ER-PRQ43F-FLK



E5ER-QT3DW-FLK

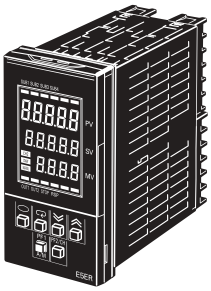


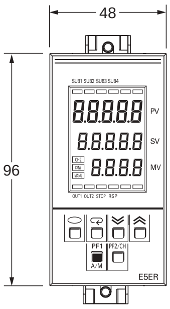
E5ER-CT3DW-FLK

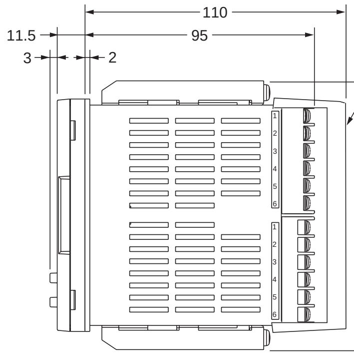


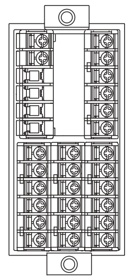
Dimensions

Note: All units are in millimeters unless otherwise indicated.



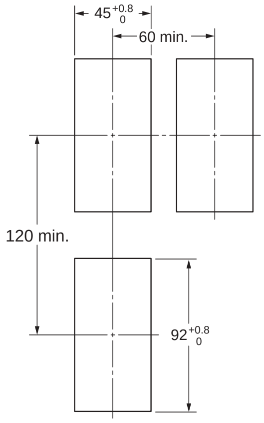






Crimp terminal size: M3

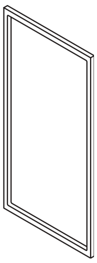
Panel Cutouts



- Recommended panel thickness is 1 to 8 mm.
- Group mounting is not possible. (Maintain the specified mounting space between Controllers.)
- When two or more Controllers are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.

Rubber Packing (Sold Separately)

Y92S-P5 (for E5ER)



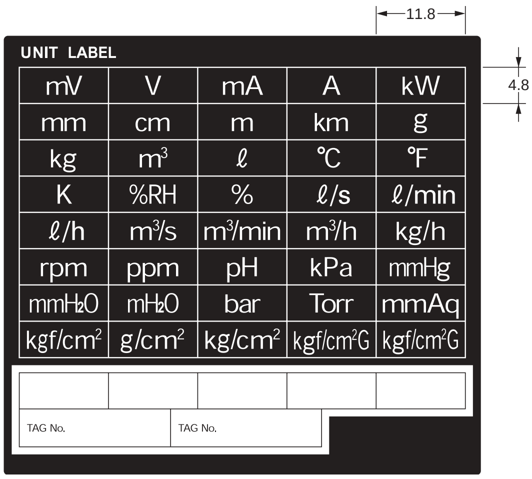
If the rubber packing is lost or damaged, it can be ordered using the following model number: Y92S-P5.

(Depending on the operating environment, deterioration, contraction, or hardening of the rubber packing may occur and so, in order to ensure the level of waterproofing specified in NEMA4, periodic replacement is recommended.)

Note: Rubber packing is provided with the Controller.

Unit Label Sheet (Sold Separately)

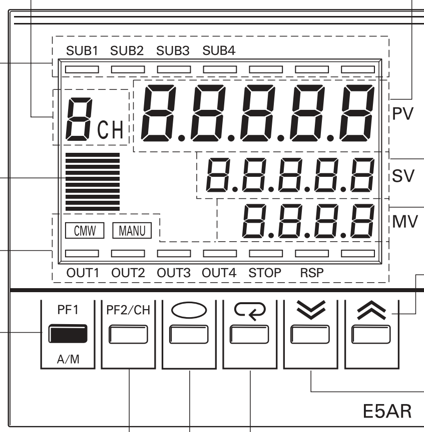
Y92S-L1



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Nomenclature

E5AR



Operation Indicators

- SUB1
  Lit when the function allocated to auxiliary output 1 is ON and unlit when it is OFF.
- SUB2
  Lit when the function allocated to auxiliary output 2 is ON and unlit when it is OFF.
- SUB3
  Lit when the function allocated to auxiliary output 3 is ON and unlit when it is OFF.
- SUB4
  Lit when the function allocated to auxiliary output 4 is ON and unlit when it is OFF.
- CMW
  Lit when communications writing is enabled and unlit when it is disabled.
- MANU
  Lit during operation in manual mode. Unlit otherwise.
- OUT1
  Lit when control output 1 is ON. Unlit when it is OFF.
- OUT2
  Lit when control output 2 is ON. Unlit when it is OFF.
- OUT3
  Lit when control output 3 is ON. Unlit when it is OFF.
- OUT4
  Lit when control output 4 is ON. Unlit when it is OFF.
- STOP
  Lit when operation is stopped. Unlit otherwise. Lights when operation is stopped by event or run/stop input.
- RSP
  Lit when the SP mode is remote. Unlit otherwise.

Bar Graph

Channel Display

Displays the channel number of displayed setting data that is set independently for different channels. The channel is displayed only with multi-input models; it is constantly unlit with other models. (Orange)

PF2/CH Function Key 2/Channel Key

With multi-input models, this key operates as a channel key. With single-input models, it operates as a function key and activates the function set with the PF2 setting when pressed.

PF1 / A/M Function Key 1

This key operates as a function key and activates the function set with the PF1 setting when pressed.

No. 1 Display

Displays the PVs, setting names, and errors. (Red)

No. 2 Display

Displays SPs, setting values, and heater current monitor values. (Green)

No. 3 Display

Displays MVs, bank numbers, and level names. (Orange)

Up Key

Press this key to increase the value in the No. 2 display. Hold the key down to increase the value more quickly. It can also be used to proceed through the setting items.

Down Key

Press this key to decrease the value in the No. 2 display. Hold the key down to decrease the value more quickly. It can also be used to go back through the setting items.

Mode Key

Press this key to switch between different setting data within a setting level.

Level Key

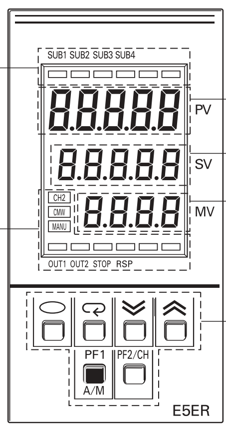
Press this key to switch between different levels.

+ Level and Mode Keys

Use this key combination to switch to the protect level.

E5ER

Items without explanations are explained in the diagram for the E5AR.



Operation Indicators

- CH2
  Lit when values for channel 2 are displayed. Unlit otherwise.

No. 1 Display

No. 2 Display

No. 3 Display

Operation Keys

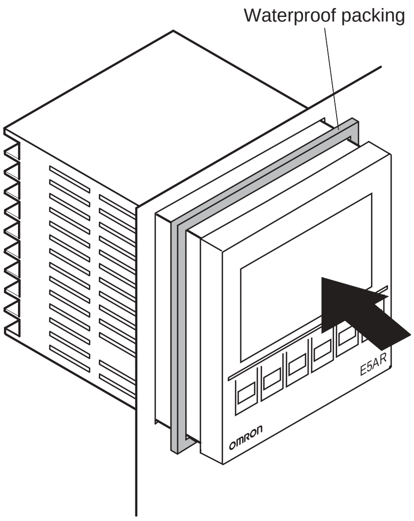
+ Level and Mode Keys

Use this key combination to switch to the protect level.

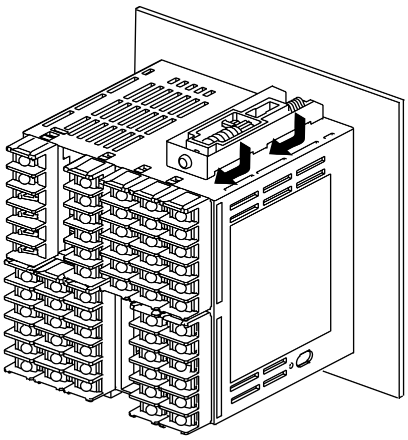
Installation

E5AR

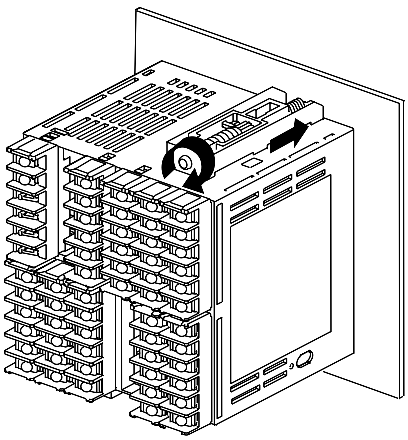
1. Ensure waterproofing by mounting with waterproof packing.
2. Insert the E5AR into the mounting hole panel.



3. Insert the mounting brackets into the grooves on the top and bottom of the rear case.

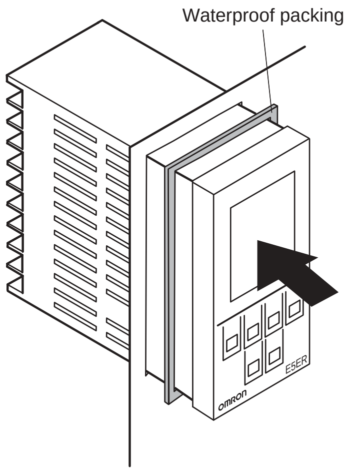


4. Tighten the screws on the mounting brackets alternately, keeping an even balance, until the ratchet stops tightening.

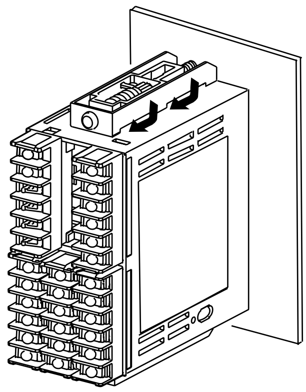


E5ER

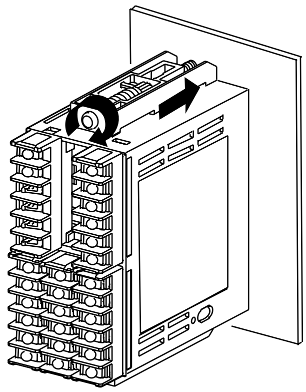
1. Ensure waterproofing by mounting with waterproof packing.
2. Insert the E5AR into the mounting hole panel.



3. Insert the mounting brackets into the grooves on the top and bottom of the rear case.



4. Tighten the screws on the mounting brackets alternately, keeping an even balance, until the ratchet stops tightening.



Drawing Out

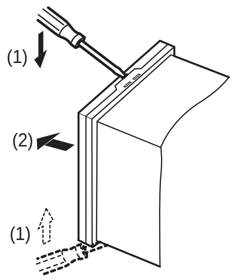
Although the Unit does not have to been drawn out for standard operation, it can be drawn out for maintenance if necessary.

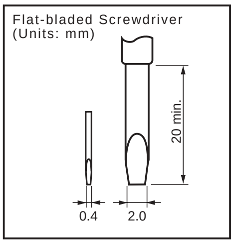
Removing the Front Panel

A flat-bladed screwdriver (shown below) is required to remove the front panel.

1. Insert the screwdriver in the holes (2) at the top and bottom of the front panel and unfasten the hooks.

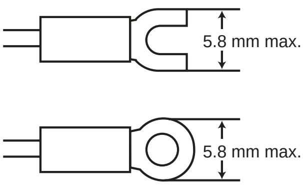
2. Insert the screwdriver in the gap between the front panel and the rear case and pull out the front panel a little. Then, hold the top and bottom of the front panel and pull in the direction of the arrow (below) to remove.





Wiring Precautions

- Prevent the influence of noise by separating input lines and power lines.
- Use crimp terminals.
- Tighten the terminal screws using a torque between 0.40 and 0.56 N·m.
- Use M3 crimp terminals with the following dimensions.

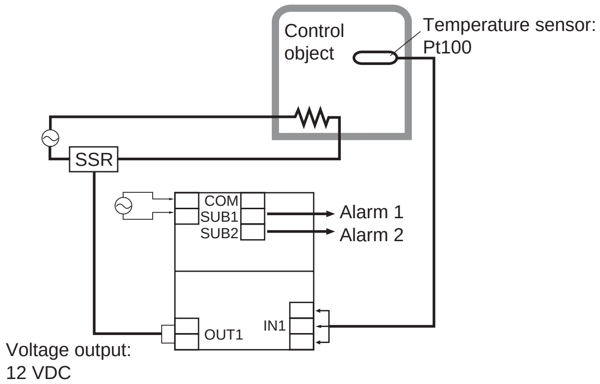


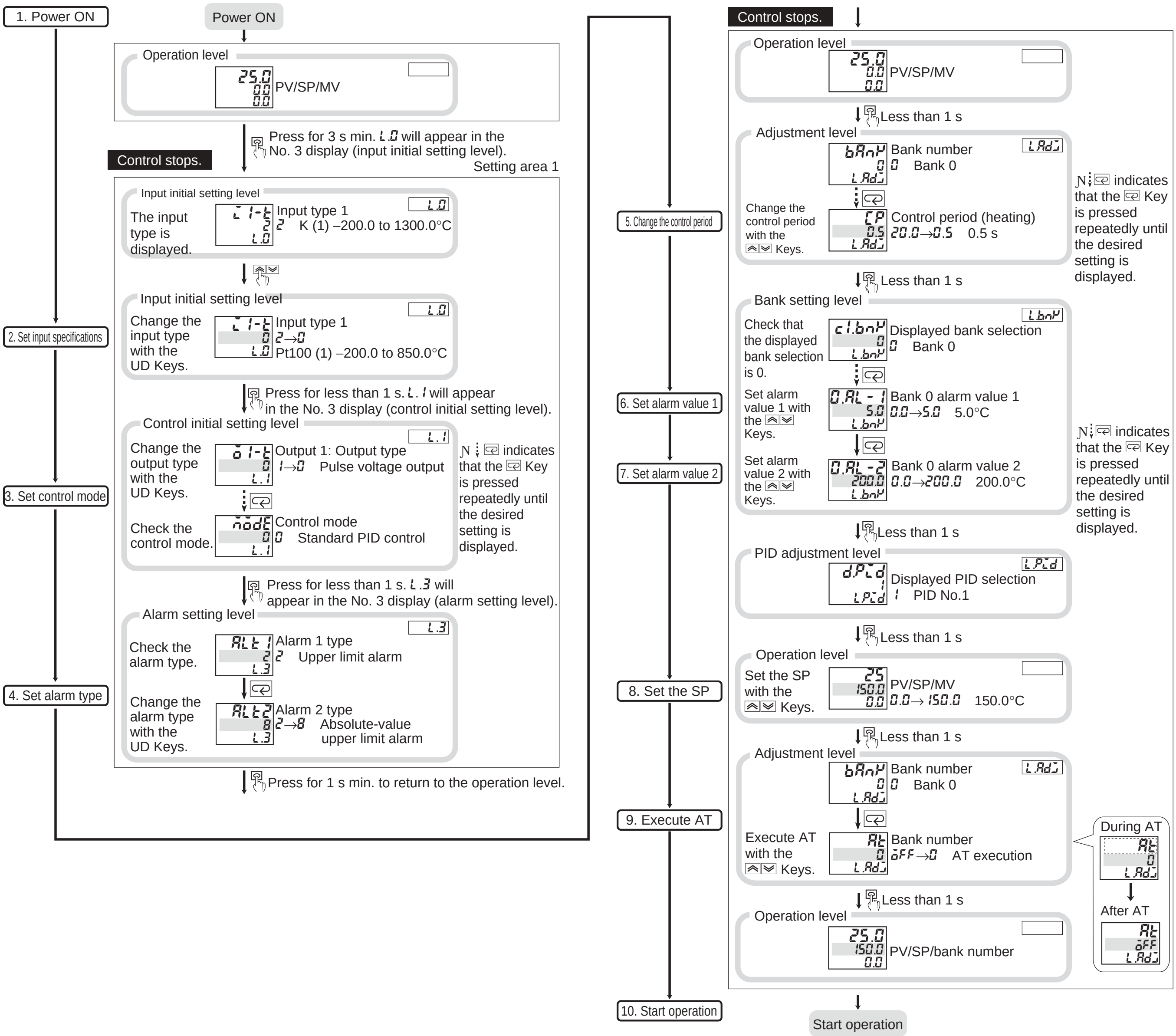
Initial Setup

Typical Example

This example shows how to perform initial setup for the E5AR-Q4B (100 to 240 VAC) and is based on the following conditions.

Input type: Pt100 (–200.0 to 850.0 °C)
Control method: PID control
Output: Pulse voltage output
Control period: 0.5 s
Alarm 1: Upper limit alarm at 5.0 °C
Alarm 2: Absolute-value upper limit alarm at 200.0 °C
PID: Obtained by auto-tuning (AT)
SP: 150.0 °C

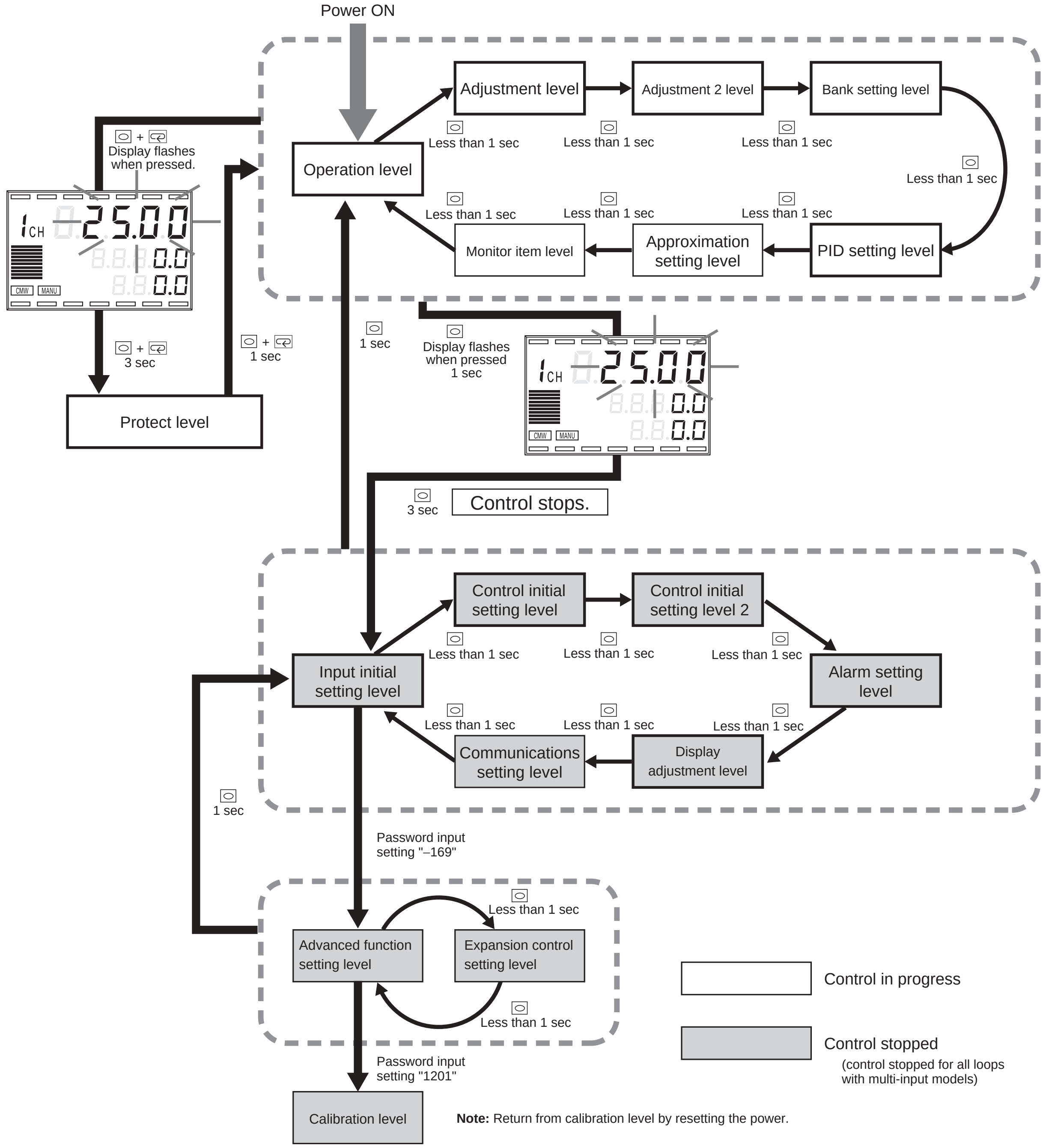




Specification Setting after Turning ON Power

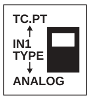
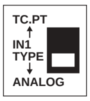
Setting Level Configuration and Key Operations

Setting items are divided into “levels” and the settings are referred to as “parameters.” With the E5AR/E5ER, setting items are classified into the 17 types shown below. When power is turned ON, all the indicators light for approx. 1 min before the Unit enters the operation level.

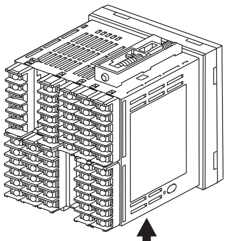


Note: Depending on the model or settings, some levels may not be displayed.

Input Allocation List

Set value	Input type name	Input range (°C)	Input range (°F)	Input type switch
0	Pt100 (1)	−200.0 to 850.0	−300.0 to 1500.0	Set to TC.PT
1		−150.00 to 150.00	−199.99 to 300.00	
2	K	−200.0 to 1300.0	−300.0 to 2300.0	
3		−20.0 to 500.0	0.0 to 900.0	
4	J	−100.0 to 850.0	−100.0 to 1500.0	
5		−20.0 to 400.0	0.0 to 750.0	
6	T	−200.0 to 400.0	−300.0 to 700.0	
7	E	0.0 to 600.0	0.0 to 1100.0	
8	L	−100.0 to 850.0	−100.0 to 1500.0	
9	U	−200.0 to 400.0	−300.0 to 700.0	
10	N	−200.0 to 1300.0	−300.0 to 2300.0	
11	R	0.0 to 1700.0	0.0 to 3000.0	
12	S	0.0 to 1700.0	0.0 to 3000.0	
13	B	100.0 to 1800.0	300.0 to 3200.0	
14	W	0.0 to 2300.0	0.0 to 4100.0	
15	4 to 20 mA	One of the following ranges is displayed by scalling. −19999 - 99999 −1999.9 - 9999.9 −199.99 - 999.99 −19.999 - 99.999 −1.9999 - 9.9999		Set to ANA-LOG
16	0 to 20 mA			
17	1 to 5 V			
18	0 to 5 V			
19	0 to 10 V			

• The initial set value is 2 and the factory setting for the input type switch is TC.PT.

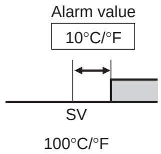


Input type switch (bottom)

The following example shows the settings required for the alarm to turn ON when the temperature exceeds 110 °C/°F.

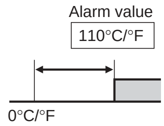
Alarms Other Than Absolute-value Alarms (Alarm Types 1 to 7)

Set the alarm value as a deviation from the SP.



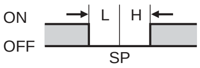
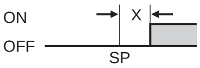
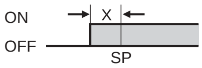
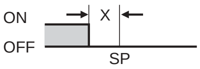
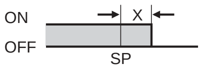
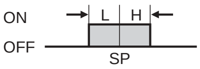
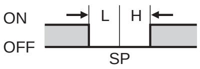
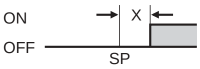
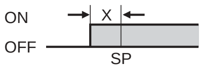
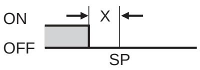
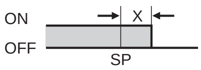
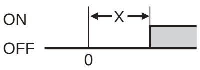
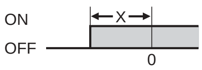
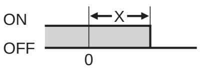
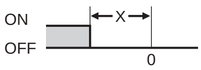
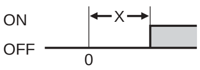
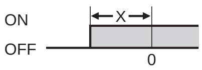
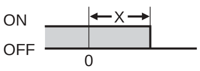
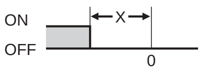
Absolute-value Alarms (Alarm Types 8 to 11)

Set the alarm value as an absolute value with respect to 0 °C/°F.



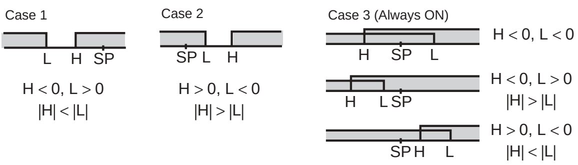
Alarm Type List

Alarm values are indicated by “X” in the following table. In cases where upper and lower limits are set independently, the upper limit is indicated by “H” and the lower limit is indicated by “L.” If upper/lower limit, upper/lower limit range, or upper/lower limit with standby sequence is selected as the alarm type, set both the alarm upper limit and alarm lower limit values. For any other selection, set the (single) alarm value.

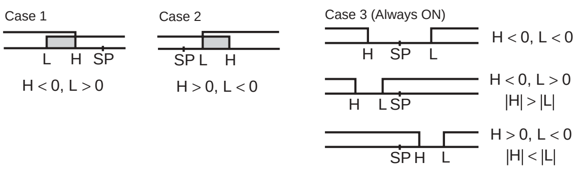
Set value	Alarm type	Alarm output function	
		Positive alarm value (X)	Negative alarm value (X)
0	No alarm function	Output OFF	
1 (See note 1.)	Upper/lower limit		(See note 2.)
2	Upper limit		
3	Lower limit		
4 (See note 1.)	Upper/lower limit range		(See note 3.)
5 (See notes 1 and 6.)	Upper/lower limit with standby sequence		(See note 4.)
6 (See note 6.)	Upper limit with standby sequence		
7	Lower limit with standby sequence		
8	Absolute-value upper-limit		
9	Absolute-value lower-limit		
10 (See note 6.)	Absolute-value upper-limit with standby sequence		
11 (See note 6.)	Absolute-value lower-limit with standby sequence		

Note 1: With set values 1, 4, and 5, upper and lower limit values can be set independently. They are indicated by “H” and “L” respectively.

2: Set value 1: Upper/lower limit alarm



3: Set value 4: Upper/lower limit range

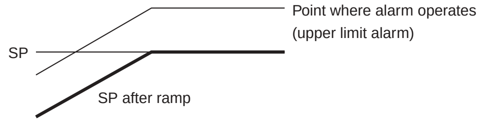


4: Set value 5: Upper/lower limit with standby sequence
Based on the above explanation for the upper/lower limit alarm, in cases 1 and 2, if the upper and lower limits effectively overlap because of hysteresis, operation will be always OFF; in case 3, operation will be always OFF.

5: Set value 5: Upper/lower limit with standby sequence
If the upper and lower limits effectively overlap because of hysteresis, operation will be always OFF.

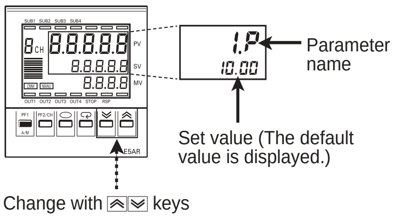
6: For more details on the standby sequence, refer to the *User’s Manual* (Z182).

7: If SP ramp is used, the alarm function will operate with respect to the SP after ramp during operation, and will operated with respect to the SP while operation is stopped.

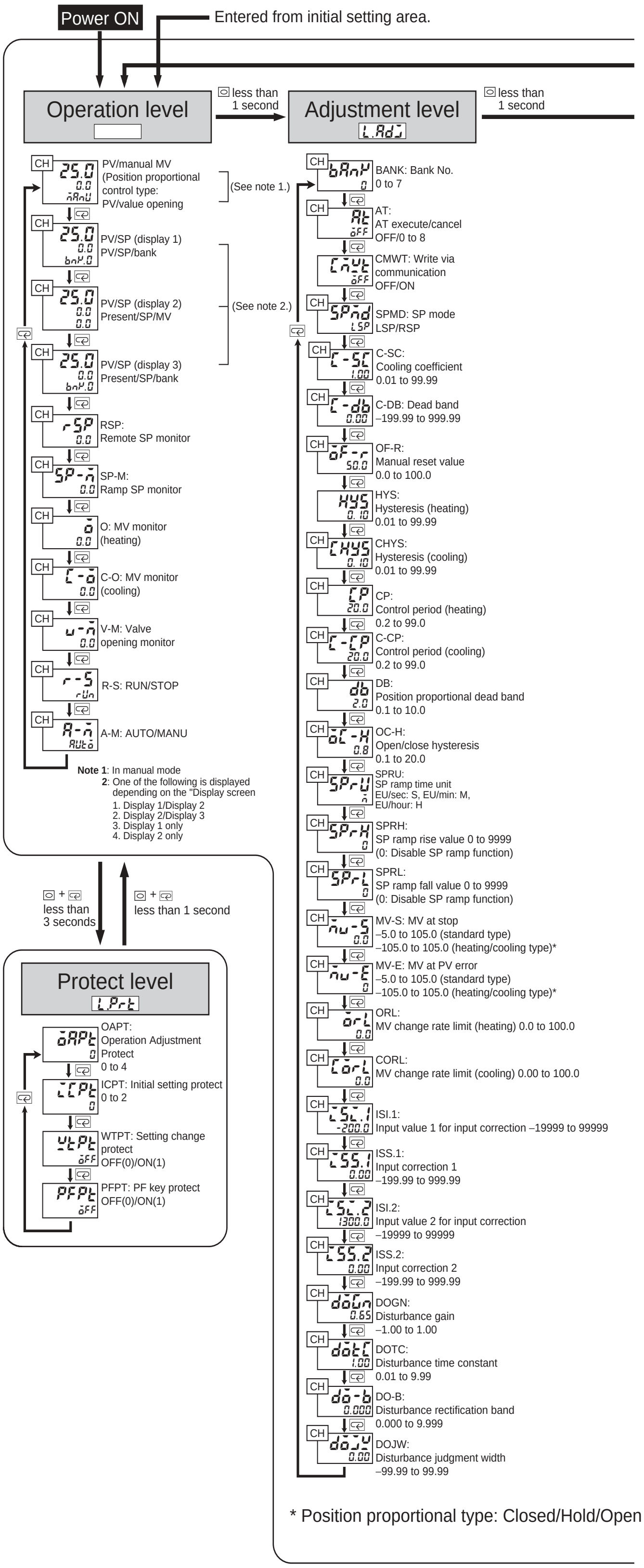


■ Parameter Lists

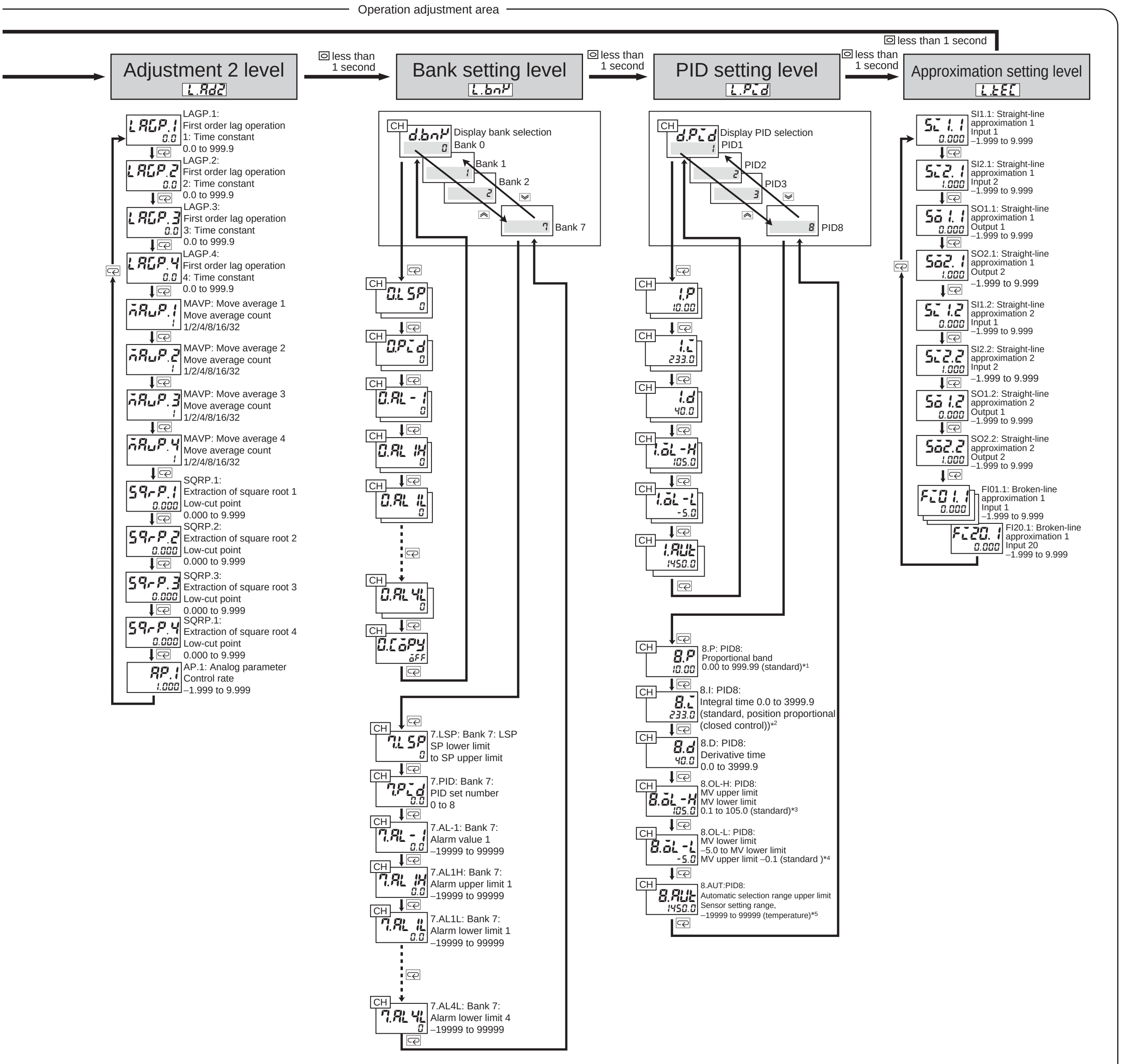
Display of Parameter Names and Set Values



Note: Although all the parameters are listed here, the parameters that are actually displayed may vary with the model and/or functions used.



* Position proportional type: Closed/Hold/Open (–1/0/1)



*1 Position proportional type: 0.01 to 999.99.
*2 Position proportional (floating control) type: 0.1 to 3999.9.
*3 Heating and cooling control: 0.0 to 105.0.
*4 Heating and cooling control: –105.0 to 0.0.
*5 Analog type: –10% to 110% of scaling display range, with a maximum of –19999 to 99999.

Press the key for 3 seconds to move to the input initial setting level (page 28).

Control stops.

Entered from operation adjustment area.

Expansion control setting level (L.EXC)

(less than 1 second, to/from Advanced function setting level)

- CH P-ON: Operation at power ON — CONT/STOP/MANU
- CH SPTR: SP tracking — OFF/ON
- CH SPID: SPID set automatic selection data — PV/DV
- CH PIDH: PID set automatic selection hysteresis — 0.10 to 99.99
- CH P-DB: PV dead band — 0 to 99999
- CJC.1: Input 1 Cold junction compensation — OFF/ON
- CJC.4: Input 4 Cold junction compensation — OFF/ON
- CH ALFA: α — 0.00 to 1.00
- CH PVTR: PV tracking — OFF/ON
- CH MANT: Manual output method — HOLD/INIT
- CH MANI: Manual MV initial value — –5.0 to 105.0 (standard control) (See note 1.)
- CH ORLM: MV change rate limit mode — Mode 0:0/Mode 1:1
- CH AT-G: AT calculated gain — 0.1 to 10.0
- CH AT-H: AT hysteresis — 0.1 to 9.9
- CH LCMA: Limit cycle MV amplitude — 5.0 to 50.0
- CH TATE: Tentative AT execute judgment deviation — 0.0 to 100.0
- CH RBMP: Bumpless at Run Disable: OFF/Enable: ON
- CH PMEC: Operation at potentiometer input error — Stop: OFF/Continue: ON
- CH DOST: Disturbance overshoot adjustment function — OFF/ON

Note: Heating/cooling control: –105.0 to 105.0.

Advanced function setting level (L.ADF)

(1 s min., to Input initial setting level)

- INIT: Parameter initialization — OFF/ON
- PF1: PF1 setting — OFF/RUN/STOP/R-S/ALLR/ALLS/AT/BANK/A-M/PFDP
- PF2: PF2 setting — OFF/RUN/STOP/R-S/ALLR/ALLS/AT/BANK/A-M/PFDP
- CH PF1.1: PF1 monitor/Setting item 1 — 0 to 20
- CH PF1.2: PF1 monitor/Setting item 2 — 0 to 20
- PF1.5: PF1 monitor/Setting item 5 — 0 to 20
- CH PF2.1: PF2 monitor/Setting item 1 — 10 to 20
- CH PF2.2: PF2 monitor/Setting item 2 — 0 to 20
- PF2.5: PF2 monitor/Setting item 5 — 0 to 20
- CH-N: Number of enabled channels
- RAMM: RAM write mode — BKUP/RAM
- CMOV: Move to calibration level — –1999 to 9999

Input initial setting level (L.0)

(less than 1 second, to Control initial setting level)

- I1-T: Input 1 input type — 0 to 19
- I1DU: Input 1 temperature units — °C/°F
- I2-T: Input 2 input type — 0 to 19
- I2DU: Input 2 temperature units — °C/°F
- I3-T: Input 3 input type — 0 to 19
- I3DU: Input 3 temperature units — °C/°F
- I4-T: Input 4 input type — 0 to 19
- I4DU: Input 4 temperature units — °C/°F
- CH INP.1: Scaling input value 1
- CH DSP.1: Scaling display value 1 — –19999 to Scaling display value 2-1
- CH INP.2: Scaling input value 2
- CH DSP.2: Scaling display value 2 — Scaling display value 1 +1 to 99999
- CH DP: Decimal point position — 0 to 4
- CH RSPH: Remote SP upper limit — SPlower limit to SP upper limit
- CH RSPL: Remote SP lower limit — SP lower limit to SP upper limit
- CH PVDP: PV decimal point display — OFF/ON
- SNC: Sensor induction noise reduction — 50 Hz/60 Hz
- AMOV: Move to advanced function setting level — –1999 to 9999

Password: -169

Control initial setting level (L.1)

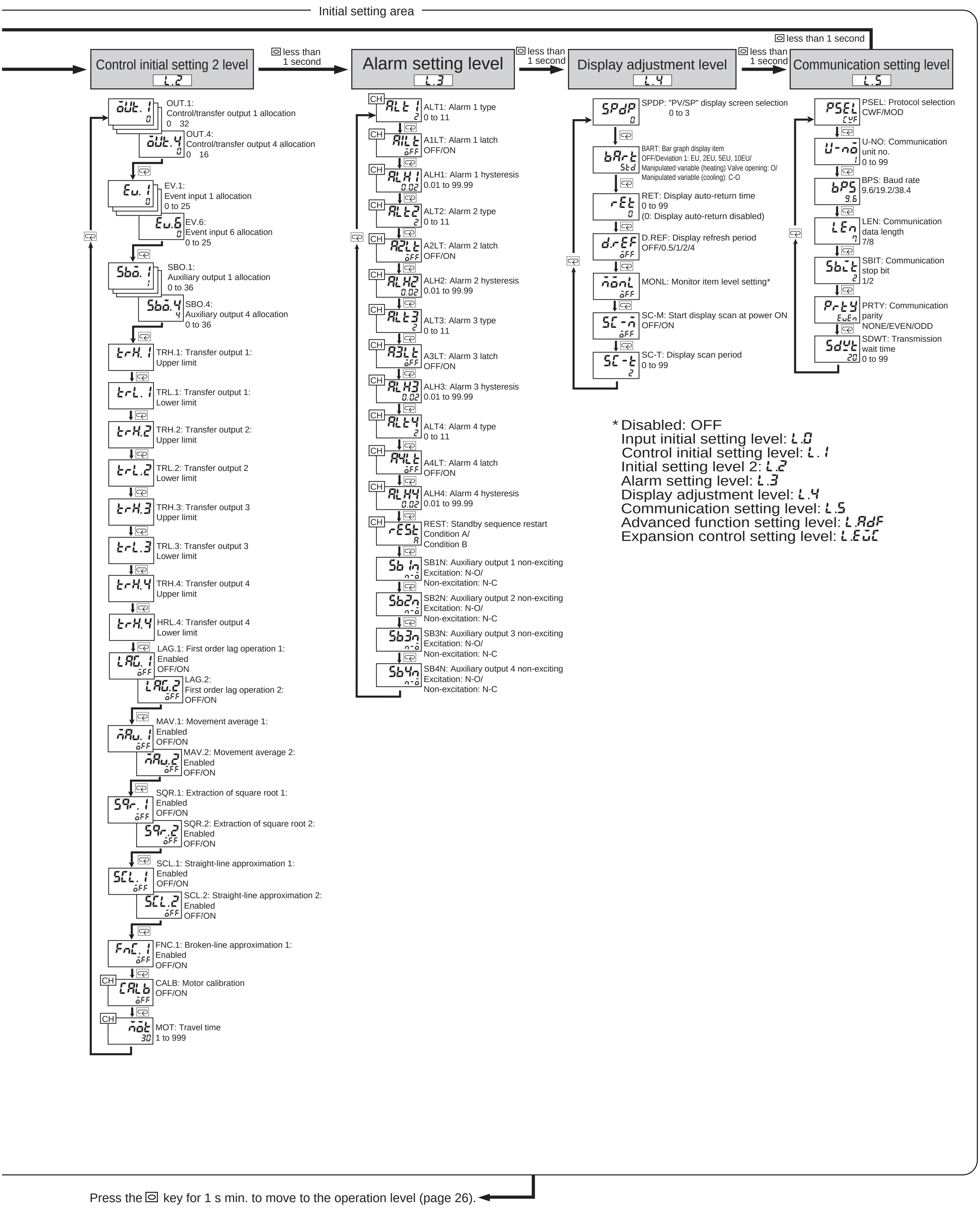
(less than 1 second)

- 01-T: Output 1: Output type — Pulse voltage output (0)/Linear current output (1)
- 03-T: Output 3 Output type — Pulse voltage output (0)/Linear current output (1)
- CO1-T: Linear current output 1 output type — 0 to 20 mA (0)//4 to 20 mA (1)
- CO2-T: Linear current output 2 output type — 0 to 20 mA (0)//4 to 20 mA (1)
- CO3-T: Linear current output 3 output type — 0 to 20 mA (0)//4 to 20 mA (1)
- CO4-T: Linear current output 4 output type — 0 to 20 mA (0)//4 to 20 mA (1)
- CH SL-H: SP upper limit*1
- CH SL-L: SP lower limit*2
- MODE: Control mode*3
- CH OREV: Forward/reverse operation — Reverse (heating): OR-R/Forward (cooling): OR-D
- CH CLFL: Closed/Floating — Floating: FLOAT/Closed: CLOSE

*1 Temperature: SP lower limit +1 to upper limit of sensor setting range
Analog: SP lower limit + 1 to 99,999 or display value corresponding to input upper limit, whichever is smaller display value 2

*2 Temperature: Lower limit of sensor setting range to SP upper limit –1
Analog: –1,999 or display value corresponding to input lower limit

*3 1/4 input Standard (0)/heating or cooling (1)
2 input Standard (0)/heating or cooling (1)
Standard with remote SP (2)/
Heating or cooling (3) with remote SP/
Proportion (4)/Cascade standard (5)/
Cascade heating or cooling (6)



Press the key for 1 s min. to move to the operation level (page 26).

■ Protect Level

The protect function can be used to restrict the setting items that can be changed and thereby prevent unintentional setting changes. The protection functions that can be used include operation adjustment protection, initial setting level protection, setting change protection, and PF key protection.

Operation/Adjustment Protection

Key operations in the operation level, adjustment level 2, bank setting level, PID setting level, approximation setting level, and monitor item level can be restricted using the settings shown below.

Set value	Operation		Adjustment, adjustment 2	Bank setting, PID setting, approximation setting, monitor item
	PV/SP	Other		
0	☆	☆	☆	☆
1	☆	☆	☆	▲
2	☆	☆	▲	▲
3	☆	▲	▲	▲
4	❍	▲	▲	▲

☆: Can be displayed and changed
❍: Can be displayed
▲: Cannot be displayed and moving levels is not possible.
Default set value: 0

Initial Setting Level Protection

Movement to the input initial setting level, control initial setting level, control initial setting level 2, alarm setting level, display adjustment level, and communications setting level can be restricted using the settings shown below.

Set value	Movement to the input initial setting level	Movement to control initial setting level, control initial setting level 2, alarm setting level, display adjustment level, and communications setting level
0	Permitted to move to advanced function setting levels" displayed.	Permitted
1	Permitted to move to advanced function setting levels" not displayed.	Permitted
2	Prohibited	Prohibited

- If the set value for initial setting level protection is set to 2, nothing will happen when an attempt is made to enter the input initial setting level from the operation level, adjustment level, adjustment level 2, bank setting level, PID setting level, approximation setting level, or monitor item level by pressing the Level Key for 1 s min. (Also, the display will not flash as it usually does when changing level.)
- The default set value for initial setting level protection is 0.

Setting Change Protection

Settings can be protected from changes using the Up and Down Keys using the settings shown below.

Set value	Description
OFF	Settings can be changed with key operations.
ON	Settings (except those in the protect level) cannot be changed with key operations.

- Default set value: OFF

PF Key Protection

The PF1 and PF2 Keys can be enabled/disabled using the settings shown below.

Set value	Description
OFF	PF1 and PF2 Keys enabled.
ON	PF1 and PF2 Keys disabled. (Operations as function keys or loop keys are prohibited.)

- The default set value for PF key protection is OFF.

Communications Setting Level

Set the communications specifications in the communications setting level using panel operations. The communications parameters and their settings are listed in the following table.

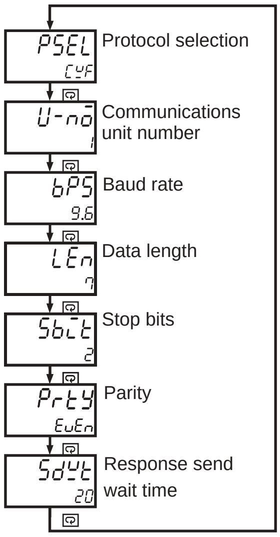
Parameter	Displayed characters	Set values	Displayed set values
Protocol selection	psel	CompoWay/F, Modbus	cwt / mod
Communications unit number	u-no	0 to 99	0, 1 to 99
Baud rate	bps	9.6/19.2/38.4 (kbps)	9.6 / 19.2 / 38.4
Data length	len	7/8 (bits)	8 (bit)
Stop bits	sbit	1/2 (bits)	1 / 2
Parity	prty	None/even/odd	none / eUen / odd
Response send waiting time	sdwt	0 to 9,999 s	0 to 20 to 9999

Note: The highlighted values indicate default settings.

Before executing communications, set the communications unit number, baud rate, and other communications parameters using key operations in the way described below. Refer to the *User's Manual (H123)* for details on other operations.

1. Press the Level Key for 3 s min. to move from the operation level to the initial setting level.
2. Press the Level Key to move from the initial setting level to the communications setting level.

3. Press the Mode Key to move around the parameters in the way shown below.
4. Change the parameter settings as required using the Up and Down Keys.



Set the communications parameters to match those of the computer to be communicated with.

Protocol Selection (psel)

Select either CompoWay/F or Modbus as the communications protocol. CompoWay/F is a general-purpose communications-based unified communications protocol developed by OMRON Modbus is a communications protocol that conforms to the RTU Mode of the Modicon Inc.'s Modbus Protocol (specifications: PI-MBUS-300 Rev. J).

Communications Unit Number (u-no)

When communicating with the host computer, the unit number must be set in each Controller so that the host computer can identify each one. The number can be set to any integral value in the range 0 to 99. The default setting is 1. When using more than one Controller, be careful not to use the same number twice. Duplicate settings will cause malfunction. The set value becomes valid when the power is turned OFF and ON again.

Baud Rate (bps)

Use this parameter to set the speed of communications with the host computer. It can be set to one of the following values; 9.6 (9,600 bps), 19.2 (19,200 bps), or 38.4 (38,400 bps). The setting becomes valid when the power is turned OFF and ON again.

Data Length (len)

The length of communications data can be set to either 7 or 8 bits.

Stop Bits (sbit)

The number of communications stops bits can be set to either 1 or 2.

Parity (prty)

The communications parity can be set to none, even, or odd.

Response Send Wait Time (sdwt)

Changes to the response send wait time are enabled either after software reset or when the power is turned OFF and ON again.

Error Display (Troubleshooting)

When an error occurs, error codes will be displayed in the No.1 and/or No. 2 displays. Check the error contents and take the appropriate countermeasures.

Display 1	Display 2	Error description	Remedies	Output state at error	
				Control output	Alarm output
unit	err	Unit error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
unit	chg	Unit change			
disp	err	Display unit error			
sys	err	Main unit error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
eep	err	EEPROM error	First, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	OFF	OFF
s.err	Normal display	Sensor input error	Check that the input wiring is correct, that the input type switch is set correctly, that there is no disconnection or short-circuit, and that the input type is correct. If there are no irregularities with the above items, reset the power. If the display does not change, repair is necessary. If the error is removed, it is possible that the original error was caused by noise. Check that there are no possible sources of noise.	MV is output according to the “MV at PV error” setting.	Same operation as when upper limit is exceeded.
<<<<< >>>>>	Normal display	Outside display range (below) Outside display range (above)	This is not an error, however, the present value is outside of the display range (−19999 to 99999).	Normal operation	Normal operation
Normal display	The RSP run indicator is blinking	RSP input error	Check and see if the wire to the RSP input is broken or shorted.	MV is output according to the “MV at PV error” setting.	OFF
Normal display	-----	Potentiometer input error	Check the potentiometer wire.	Normal operation	Normal operation
calb	err	Motor calibration error	Check the wiring to the potentiometer and the valve drive motor, and then repeat motor calibration.	OFF	OFF
i1-t i2-t i3-t i4-t	A set value flashes	Input type switch error	Make sure the input type switch and the displayed “Input type” setting accord with the input type you will use.	OFF	OFF

Note: If the Controller does not operate as expected after making the settings, check the wiring and the settings. If the Controller still does not operate as expected, it is possible that parameters have been set incorrectly. It is recommended that the Controller is initialized and the settings performed again. (Initializing the Controller will return all settings to their default values. Make a note of the settings before performing initialization.)

Troubleshooting

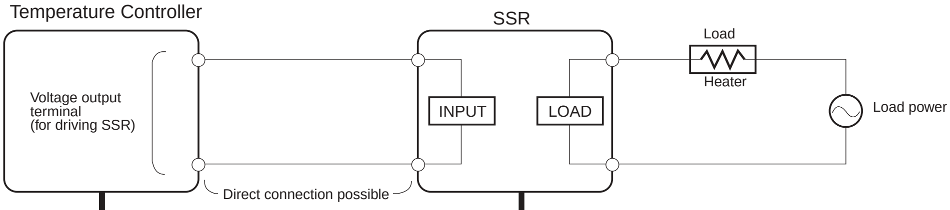
If the temperature does not increase, outputs do not turn ON, or large discrepancies in the temperature occur, perform the checks listed in the following table.

Problem	Items to check and probable cause	Countermeasure
The temperature does not rise. Outputs do not turn ON.	1. Has control stopped? If the STOP indicator is lit, control has stopped.	Set run/stop to run in the operation level. The STOP indicator will turn OFF.
	2. Is control set to forward operation? Control must be set to reverse operation for heating control.	Set oreU to or-r in the initial setting level.
	3. Are the OUT indicators for control output lit or flashing? If the control output is not current output, the OUT indicators turn ON in synchronization with the output.	If the OUT indicators do not light at all, check items 1 and 2. If the OUT indicators are continuously lit, check connections to sensors, heaters, and other peripheral devices.
	4. If PID control is used, it is possible that the PID constants are unsuitable.	If possible, obtain the PID constants using auto-tuning. (Auto-tuning uses 100% output with respect to the load and so overshooting may occur.)
There are large discrepancies in the temperature.	1. Is the correct type of sensor used?	After checking the sensor type, check the setting for input type (i✻-t) in the initial setting level. (✻: 1 to 4)
	2. Are input correction values set?	Check the settings for input correction (isi.✻, iss.✻) in the adjustment level. (isi, ✻: 1 to 4) To display the temperature as measured by the sensor, set to 0.0.
	3. Is a compensating conductor used to extend the thermocouple connection?	Be sure to use a compensating conductor that is suitable for the sensor used.
	4. Is the sensor separated by a long distance? Is the insertion length short?	Check the installation location of the sensor with respect to the measured object. The sensor's insertion length must be at least 20 times the diameter of the protective tubing.
	Checking temperature controller input: Thermocouple Short the input terminals to display the room temperature. Platinum Resistance Thermometer Connect a resistance to the input terminals and check the display. Connect 100 Ω to A-B and short B-B: 0°C Connect 140 Ω to A-B and short B-B: Approx. 100°C	

Peripheral Devices

Temperature Sensor and SSR

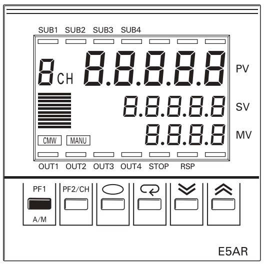
Connection Example with SSR



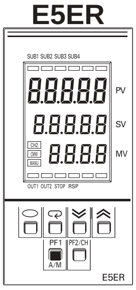
Max. No. of SSRs connectable in parallel

E5□R

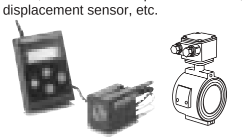
E5AR



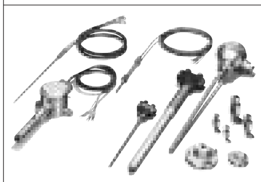
E5ER



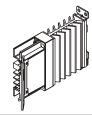
Analog values representing temperature, flowrate, or concentration
Converter, digital panel meter, flowrate meter, non-contact temperature sensor, displacement sensor, etc.



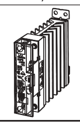
E52



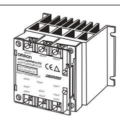
5 Units (E5AR/ E5ER)

G3PC (SSR with failure detection)	
240 VAC (20 A)	
Rated input voltage: 12 to 24 VDC	
Compact and slim models with a built-in heat sink	

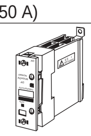
5 Units (E5AR/ E5ER)

G3PB (Single-phase)	
240 VAC (15 A, 25 A, 35 A, 45 A)	
Rated input voltage: 12 to 24 VDC	
Compact and slim models with a built-in heat sink	

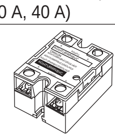
4 Units (E5AR/ E5ER)

G3PB (Three-phase)	
240 VAC/400 VAC (15 A, 25 A, 35 A, 45 A)	
Rated input voltage: 12 to 24 VDC	
Simultaneous three-phase control with a built-in heat sink	

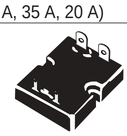
5 Units (E5AR/ E5ER)

G3PA	
240 VAC (10 A, 20 A, 40 A, 60 A) 400 VAC (20 A, 30 A, 50 A)	
Rated input voltage: 5 to 24 VDC	
Compact and slim models with a built-in heat sink	

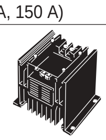
5 Units (E5AR/ E5ER)

G3NA	
240 VAC (5 A, 10 A, 20 A, 40 A) 480 VAC (10 A, 20 A, 40 A)	
Rated input voltage: 5 to 24 VDC	
Standard models with screw terminals	

2 Units (E5AR/ E5ER)

G3NE	
240 VAC (5 A, 10 A, 35 A, 20 A)	
Rated input voltage: 12 VDC	
Compact and low-cost models with tab terminals	

8 Units (E5AR/ E5ER)

G3NH	
440 VAC (75 A, 150 A)	
Rated input voltage: 5 to 24 VDC	
For controlling high-power heaters	

Calculating the Maximum Number of SSRs Connectable in Parallel

A: Max. load current of Digital Controller's voltage output (driving SSRs) = 21 mA for the E5CN

B: SSR's input impedance = 7 mA for G3NA

In this case, the maximum number of SSRs connectable in parallel would be as follows:

A/B = 5

Precautions

Precautions in Using the Product

Before using the Digital Controller under the following conditions, make sure that the ratings and performance characteristics of the Digital Controller are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms, and also consult your OMRON representative.

- Using the Digital Controller under conditions which are not described in the manual
- Applying the Digital Controller to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment
- Applying the Digital Controller to systems, machines, and equipment that may have a serious influence on lives and property if used improperly, and especially require safety

Precautions on Safety

- Definition of Precautionary Information

⚠ Caution

Indicates a potentially hazardous situation which, if not avoided, may result in injury or in property damage.

- Precautionary Information

⚠ Caution

Do not touch the terminals with the power ON. Doing so may cause electric shock.

Do not touch the terminals, electronic parts, or patterns on the board with the power ON and 1 minutes after the power is turned OFF. These may cause electric shock.

Do not allow metal fragments or lead wire scraps to fall inside the Digital Controller.
These actions may cause an electric shock, fire, or malfunction.

Do not use the Digital Controller in flammable and explosive gas atmospheres. There is danger of explosion.

Never disassemble, repair, or modify the Digital Controller. Doing so may cause electric shock, fire, or malfunction.

The life of the output relays varies greatly with the switching capacity and other switching conditions. Always use the output relays within their rated load and electrical life expectancy.
If an output relay is used beyond its life expectancy, its contacts may become fused or burned.

Tighten the terminal screws to a torque of 0.40 to 0.56 N·m. Loose screws may cause fire or malfunction.

Set all settings according to the control target of the Digital Controller. If the settings are not appropriate for the control target, the Digital Controller may operate in an unexpected manner, resulting in damage to the Digital Controller or resulting in failure.

To maintain safety in the event of a Digital Controller malfunction, always take appropriate safety measures, such as installing an alarm on a separate line to prevent excessive temperature rise. If a malfunction prevents proper control, a major accident may result.

Notice

Please ensure that this manual is made available to the end user.
To ensure safety, please observe the following:

1. Use and store the Digital Controller within the specified ambient temperature and humidity ranges. If necessary, cool the Digital Controller.
2. Do not prevent heat dissipation by obstructing the periphery of the Digital Controller. Do not block the vents on the Digital Controller Unit.
3. The supplied power voltage and load must be within the rated and specified ranges.
4. Incorrect wire connections may cause failures. Be sure to check each terminal name, the connection to that terminal, and the polarity before turning on the power.
5. Use the specified size of crimp terminals for wiring (M3, 5.8 mm max. in width).
6. Do not connect anything to unused terminals.
7. For bare-wire connection materials, use AWG22 to AWG14 for power supply, and AWG28 to AWG16 for other than power supply. (Remove the sheath to expose 6 to 8 mm of the end of the wire.)
8. Ensure that the rated voltage is attained within 2 seconds after turning on the power.
9. If you need to draw out the Digital Controller, turn off the power first. Never touch the terminals or the electronic components, or subject them to physical shock. When inserting the Digital Controller, do not allow the electronic components to contact the case.
10. Do not remove the inner circuit board.
11. The output may turn OFF when shifting to certain levels. Take this into consideration when performing control.
12. Allow a warm-up time of at least 30 minutes.
13. Install the Digital Controller as far away as possible from devices that emit strong, high-frequency energy or devices that cause surges. Do not tie noise filter input/output wires together.
14. Keep the Digital Controller wiring separate from high-voltage, high-current power lines. Avoid connecting in parallel with a power line or on the same line as a power line.
15. Install a switch or circuit breaker that allows the operator to immediately turn off the power, and label suitably.
16. Do not use in the following locations:
    Locations where dust or corrosive gas is present (in particular, sulfur or ammonia gases)
    Locations where condensation or ice may form
    Locations directly exposed to sunlight
    Locations subject to strong shocks or vibration
    Locations where water or oil may splatter on the Digital Controller
    Locations directly exposed to radiant heat from heating equipment
    Locations subject to sudden or extreme changes of temperature
17. Cleaning: Do not use thinners. Use commercially available alcohol.

■ Correct Use

Service Life

Use the Digital Controller within the following temperature and humidity ranges:
Temperature: −10°C to 55°C (with no icing or condensation)
Humidity: 25% to 85%
When the Digital Controller is installed inside a control panel, ensure that the temperature around the Digital Controller, not the temperature around the control panel, does not exceed 55°C.

The service life of relays used for the control output or alarm output largely varies depending on switching conditions. Be sure to confirm their performance under actual operating conditions and do not use them beyond the allowable number of switching operations. If they are used in a deteriorated condition, insulation between circuits may be damaged and, as a result, the Digital Controller itself may be damaged or burnt.

The service life of electronic devices such as Digital Controllers is determined not only by the number of switching operations of relays but also by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature becomes, the shorter the service life becomes and, the lower the temperature becomes, the longer the service life becomes. Therefore, the service life can be extended by lowering the temperature of the Digital Controller using fans or other means of air ventilation. When providing forced cooling, however, be careful not to cool down the terminals sections alone to avoid measurement errors.

Measurement Accuracy

When extending or connecting the thermocouple lead wire, be sure to use compensating wires that match the thermocouple types.

When extending or connecting the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance.

When wiring the platinum resistance thermometer to the Digital Controller, keep the wire route as short as possible. Separate this wiring away from the power supply wiring and load wiring to avoid inductive or other forms of noise.

Mount the Digital Controller so that it is horizontally level.

If the measurement accuracy is low, check that input shift has been set correctly.

Waterproofing

The degree of protection is as shown below. Sections without any specification on their degree of protection or those with IP□0 have not been waterproofed.
Front panel: NEMA4 indoor use (equivalent to IP 66)
Rear case: IP 20
Terminal section: IP 00

Noise Countermeasures

In order to reduce inductive noise, separate the wiring for the Controller's terminal block from power lines carrying large voltages or currents. Do not run the wiring parallel to or in the same cable as power lines. The influence of noise can also be reduced by using separate wiring ducts or shield lines.

Install surge absorbers or noise filters in devices near the Controller that generate noise (in particular, devices with an inductance component, such as motors, transformers, solenoids, and magnetic coils).

When using a noise filter in the power supply, install the filter as close to the Controller as possible. Check that the voltage and current are within the allowable range.

Separate the Controller as far as possible from devices generating strong high-frequency noise (e.g, high-frequency welders and high-frequency sewing machines) or surges.

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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H122-E1-01 **In the interest of product improvement, specifications are subject to change without notice.**

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