

Specifications

■ Input Type

Set the code according to the following table. Default is "2: K1 thermocouple."

Platinum Resistance Thermometer

Set value	Input type	
0	JPt100	–199.9 to 650.0 (°C) /–199.9 to 999.9 (°F)
1	Pt100	–199.9 to 650.0 (°C) /–199.9 to 999.9 (°F)
2	K1	–200 to 1,300 (°C) /–300 to 2,300 (°F)
3	K2	0.0 to 500.0 (°C) /0.0 to 900.0 (°F)
4	J1	–100 to 850 (°C) /–100 to 1,500 (°F)
5	J2	0.0 to 400.0 (°C) /0.0 to 750.0 (°F)
6	T	–199.9 to 400.0 (°C) /–199.9 to 700.0 (°F)
7	E	0 to 600 (°C) /0 to 1,100 (°F)
8	L1	–100 to 850 (°C) /–100 to 1,500 (°F)
9	L2	0.0 to 400.0 (°C) /0.0 to 750.0 (°F)
10	U	–199.9 to 400.0 (°C) /–199.9 to 700.0 (°F)
11	N	–200 to 1,300 (°C) /–300 to 2,300 (°F)
12	R	0 to 1,700 (°C) /0 to 3,000 (°F)
13	S	0 to 1,700 (°C) /0 to 3,000 (°F)
14	B	100 to 1,800 (°C) /300 to 3,200 (°F)
15	W	0 to 2,300 (°C) /0 to 4,100 (°F)
16	PLII	0 to 1,300 (°C) /0 to 2,300 (°F)
17	4 to 20 mA	Current input
18	0 to 20 mA	
19	1 to 5 V	Voltage input
20	0 to 5 V	
21	0 to 10 V	

■ Output Assignments

Thirteen output functions are available. Allocate these functions to the control outputs 1 and 2 and auxiliary outputs 1 and 2.

There are some limitations on some output function allocations.

Output function types and allocation limitations are as described in the following.

Identical output functions cannot be allocated doubly to the control output 1 or 2 and auxiliary output 1 or 2.

Standard Models

Assignment Destination Output Function	Control Output		Auxiliary Output	
	1	2	1	2
Control output (heat) (see note 1)	Yes	Yes	No	No
Control output (cool) (see note 1)	Yes	Yes	No	No
Alarm 1	Yes	Yes	Yes	Yes
Alarm 2	Yes	Yes	Yes	Yes
Alarm 3	Yes	Yes	Yes	Yes
HBA (see notes 1, 2)	Yes	Yes	Yes	Yes
LBA (see note 1)	Yes	Yes	Yes	Yes
Time signal 1	Yes	Yes	Yes	Yes
Time signal 2	Yes	Yes	Yes	Yes
Program end	Yes	Yes	Yes	Yes
Stage output (see note 1)	Yes	Yes	Yes	Yes
Error 1 : Input error	No	No	Yes	Yes
Error 2 : A/D convertor error	No	No	Yes	Yes

Note: 1. Assignment is not possible with the control valve control type.

2. Heater burnout alarm is not available for the E5CK.

Position-proportional Models

Position-proportional-type Controllers support nine output functions. These are assigned to auxiliary outputs 1 and 2.

Restrictions on assignment destinations are placed on some of the outputs. The following table shows where outputs may be assigned to.

Assignment Destination Output Function	Control Output		Auxiliary Output	
	1	2	1	2
Alarm 1	No	No	Yes	Yes
Alarm 2	No	No	Yes	Yes
Alarm 3	No	No	Yes	Yes
Time signal 1	No	No	Yes	Yes
Time signal 2	No	No	Yes	Yes
Stage output	No	No	Yes	Yes
Program end output	No	No	Yes	Yes
Error 1 : Input error	No	No	Yes	Yes
Error 2 : A/D converter error	No	No	Yes	Yes

With control output (cool), the conditions for switching from standard control to heating and cooling control are reached when the output function is assigned at the cooling side during heating and cooling control.

In other words, heating and cooling control is carried out when control output (cool) is assigned, and standard control is carried out when output is not assigned.

LBA

The LBA (loop break alarm) function is available when it is assigned as an output. The LBA function is not available when a memory or A/D converter error results.

LBA is a function for determining that an error has occurred somewhere on the control loop and outputting an alarm when the process value does not change with the manipulated variable at a maximum or minimum state. Accordingly, the LBA function can be used as a means for detecting a malfunctioning control loop.

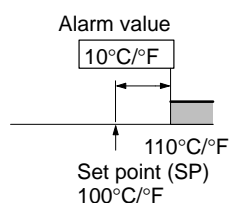
Alarm Mode Selectors

Alarm outputs are available if they are allocated as outputs. Factory setting is "2: Upper-limit alarm (deviation)."

Switch setting	Alarm operation	Alarm output	
		When X is positive	When X is negative
1	Upper- and lower-limit alarm (deviation)		Always ON
2	Upper-limit alarm (deviation)		
3	Lower-limit alarm (deviation)		
4	Upper- and lower-limit range alarm (deviation)		Always OFF
5	Upper- and lower-limit alarm with standby sequence (deviation)		Always OFF
6	Upper-limit alarm with standby sequence (deviation)		
7	Lower-limit alarm with standby sequence (deviation)		
8	Absolute-value upper-limit alarm		
9	Absolute-value lower-limit alarm		
10	Absolute-value upper-limit alarm with standby sequence		
11	Absolute-value lower-limit alarm with standby sequence		

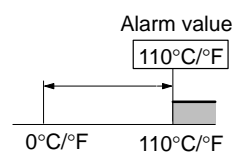
Deviation Alarm

If the alarm mode selector is set to a number between 1 to 7, alarm values are set to the width deviated from the set point as shown in the following illustration.



Absolute Alarm

If the alarm mode selector is set to 8 or 9, alarm values are set to the absolute value based on 0°C/°F as shown in the following illustration.



■ Close in Alarm/Open in Alarm

When the Controller is set to “close in alarm,” the status of the alarm output function is output as it is. When set to “open in alarm,” the status of the alarm output function is output inverted.

Condition	Alarm	Output	Output LED
Close in alarm	ON	ON	Lit
	OFF	OFF	Not lit
Open in alarm	ON	OFF	Lit
	OFF	ON	Not lit

Alarm type and close in alarm (normally open)/open in alarm (normally close) can be set independently from each alarm.

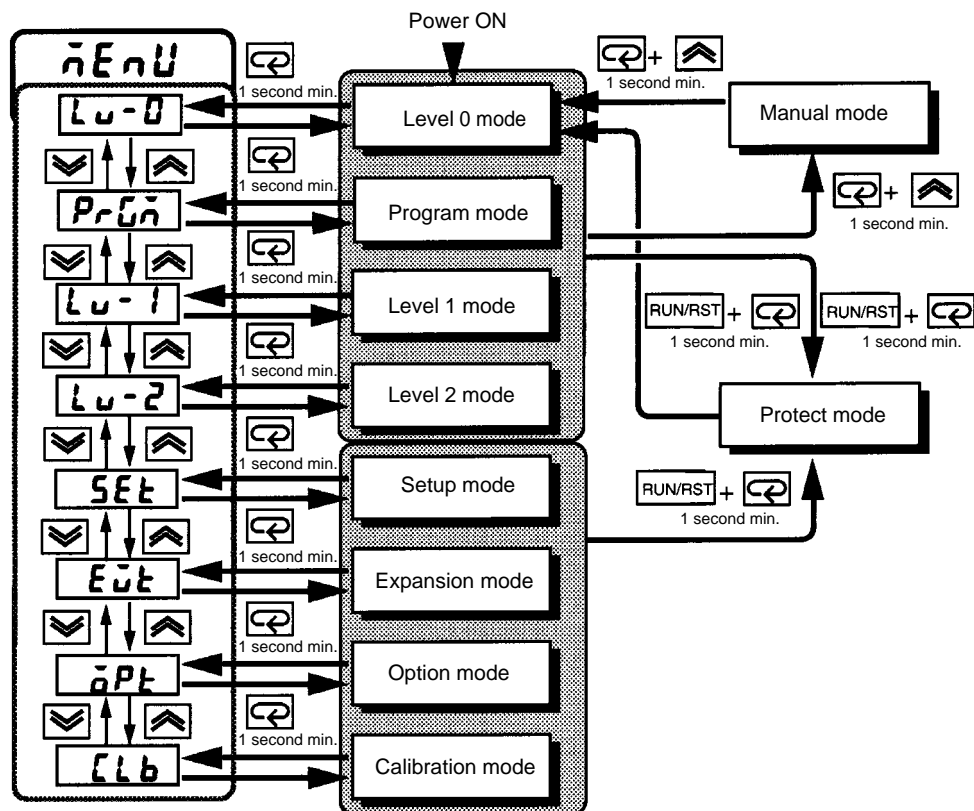
Close in alarm/Open in alarm is set in the “alarm 1 to 3 open in alarm” parameters (setup mode). Factory setting is “close in alarm” [$\overline{00}$].

Parameter Operations

■ Parameter Operation List

Switching to modes other than manual or protect mode is carried out using the mode selection in the menu display.

The figure below shows all parameters in the order that they are displayed. Some parameters are not displayed depending on the protect mode setting and conditions of use.



■ Parameters and Menus

Note: For more details on the functions of each part and display contents, refer to the *E5AK-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90)*.

Protect Mode

The protect function is for preventing unwanted modification of parameters and switching between run and reset operation or auto and manual operation.

Manual Mode

In this mode, the Controller can be switched to manual operation. The manipulated variable can be manipulated manually only in this mode.

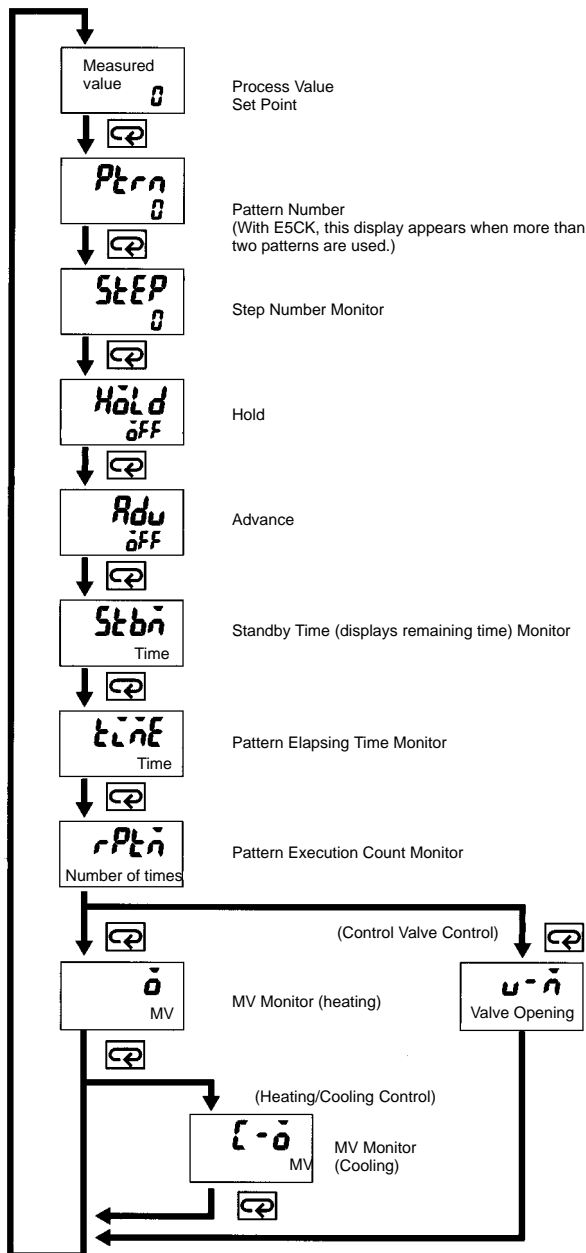
Level 0 Mode	Set the Controller to this mode during normal operation. In this mode, you can change the set point and pattern during operation, and execute step operation (e.g. advance). You can only monitor (not change) the process value, step No., standby time, pattern elapsing time, pattern execution count, and manipulated variable.
Program Mode	This is the programming mode. In this mode, you can set the number of steps used in each pattern, pattern execution count, alarm values, set points for each step, step time, and time signals for two steps.
Level 1 Mode	This is the main mode for adjusting control. In this mode, you can execute AT (auto-tuning), and set up the control period, PID parameters and heater burnout alarm (HDA) conditions.
Level 2 Mode	This is the auxiliary mode for adjusting control. In this mode, you can set the parameters for limiting the manipulated variable, switch between the remote and local modes, and set the loop break alarm (LBA), alarm hysteresis, and the digital filter value of inputs.
Setup Mode	This is the mode for setting the basic specifications. In this mode, you can set parameters that must be checked or set before an operation such as the input type, scaling, output assignments, and direct/reverse operation.
Expansion Mode	This is the mode for setting expanded functions. In this mode, you can set SP setting limiter, switching between 2-PID control or ON/OFF control, program time unit, selection of step time/rate of rise, time unit of ramp rise rate, and the time for automatic return to the monitoring display.
Option Mode	This is the mode for setting optional functions. You can select this mode only when an Option Unit is mounted in the Controller. In this mode, you can set the communications conditions, transfer output and event input parameters to match the type of Option Unit mounted in the Controller. Heater burn-out alarm function and position-proportional travel time are also found in this mode.
Calibration Mode	This mode is provided so that the user can calibrate inputs and output. When calibrating input, the selected input type is calibrated. Whereas, transfer output can be calibrated only when the Communications Unit (E53-AKF) is set in the Controller.

Parameter Operation

Refer to the *E5AK-T/E5EK-T/E5CK-T User's Manual (H88/H89/H90)* for each parameter and the calibration mode in detail.

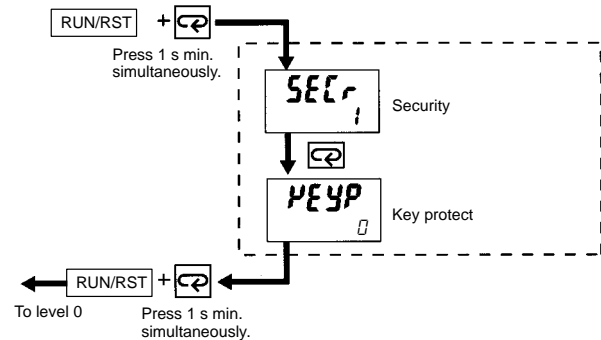
Refer to page 13 for the setting in detail.

Level 0 Mode



Protect Mode

Under this mode, key operations are invalidated for the Auto/Manual and Run/Reset.



Security

Before starting operation, apply key protection to the parameters that will not be changed during operation in order to prevent any accidental parameter changes.

Depending on the set values for the Security parameter (protect mode), ranges of parameter application will be restricted. The following table shows relationship between the set values and the scope of protection.

Mode	Set value						
	0	1	2	3	4	5	6
Calibration	Yes	No	No	No	No	No	No
Option	Yes	Yes	No	No	No	No	No
Expansion	Yes	Yes	No	No	No	No	No
Setup	Yes	Yes	No	No	No	No	No
Level 2	Yes	Yes	Yes	No	No	No	No
Level 1, 0	Yes	Yes	Yes	Yes	No	No	No
Program	Yes	Yes	Yes	Yes	Yes	No	No
Level 0	Yes	Yes	Yes	Yes	Yes	Yes	*

Note: *Only the "Process Value/Set Point" parameter display is possible.

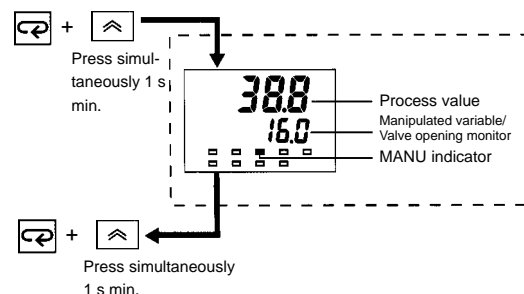
When the set value is "0," protection will not be applied.

When the set value is "5," only the parameter in the level 0 mode can be used and not possible to change to the menu screen.

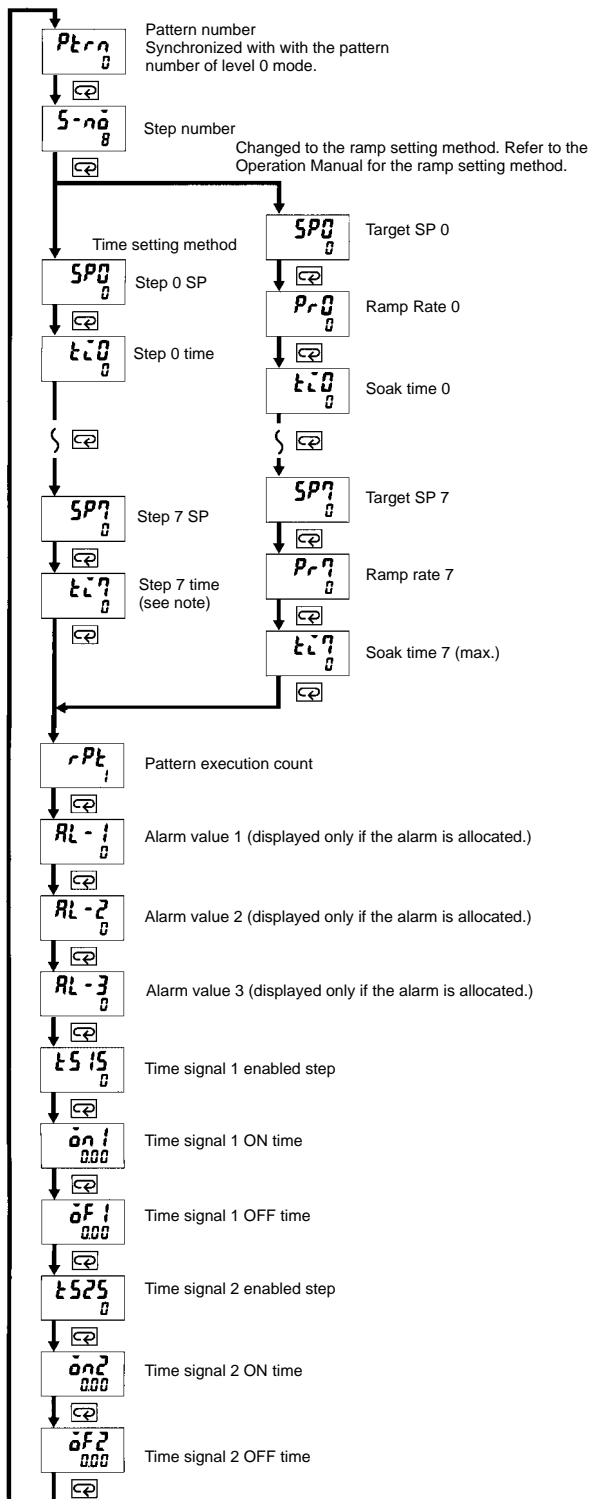
When the set value is "6," only the "Process Value/Set Point" can be monitored.

The default setting is "1."

Manual Mode



Program Mode

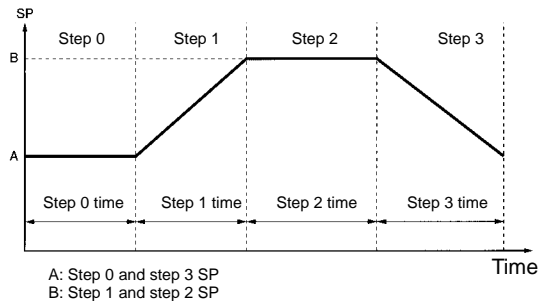


Time Setting Method

Set the number of steps to be used beginning with step 0 (e.g., step 0 SP, step 0 time, step 1 SP, and step 1 time).

The step target value can be set within a range between the lower and upper target value limits. The default value is zero.

The step time can be set within a range between 0.00 and 99.59 (in hr and min or min and s). The default value is 0.00.

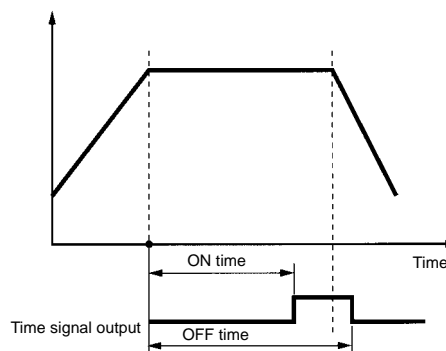


Step 0 is flat as shown in the above graph. Set step 0 to 0.00 so that step 1 will be the actual first step when writing ramp-start programs.

Note: Up to step 15 (i.e., a total of 16 steps) can be set in the time setting method.

Time Signal

Two types of time signal patterns can be set in each pattern.



Two types of time signal timers are available (i.e., ON-time and OFF-time use), each of which starts with the edge of the step.

The output is ON from the moment the ON time elapses until the OFF time elapses.

Set the step so that the time signal is triggered by the time signal 1/2 enabled step parameters. The default is step 0.

Set the ON/OFF timing with the timing signal 1/2 ON-time and time signal 1/2 OFF-time parameters in Program mode.

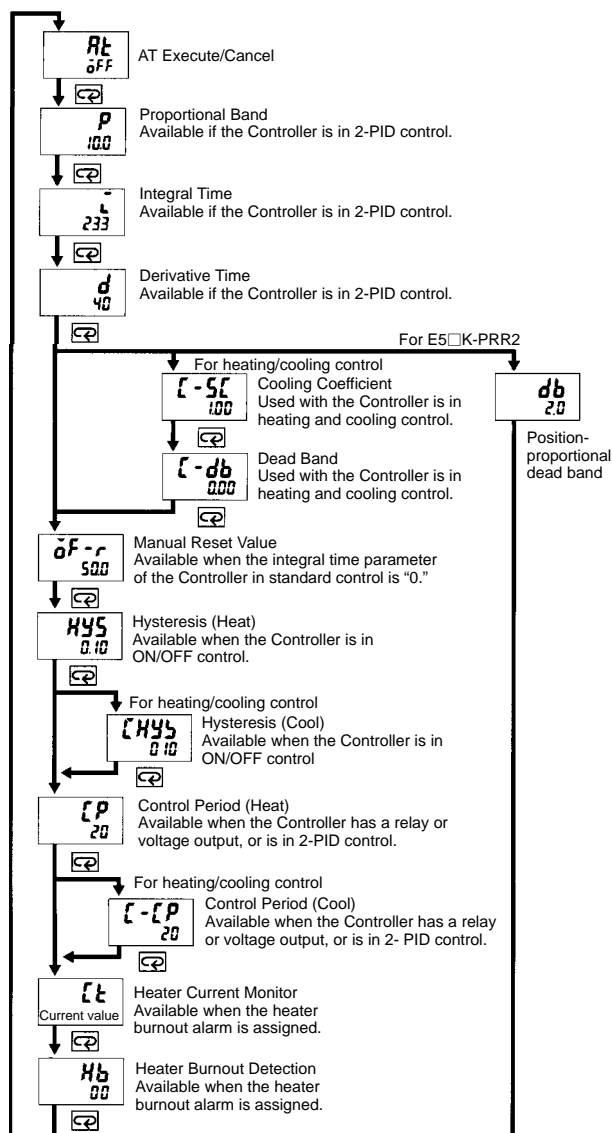
ON Conditions

If the ON time is shorter than the OFF time, the signal will be reset or ON after the ON time elapses until the next pattern starts.

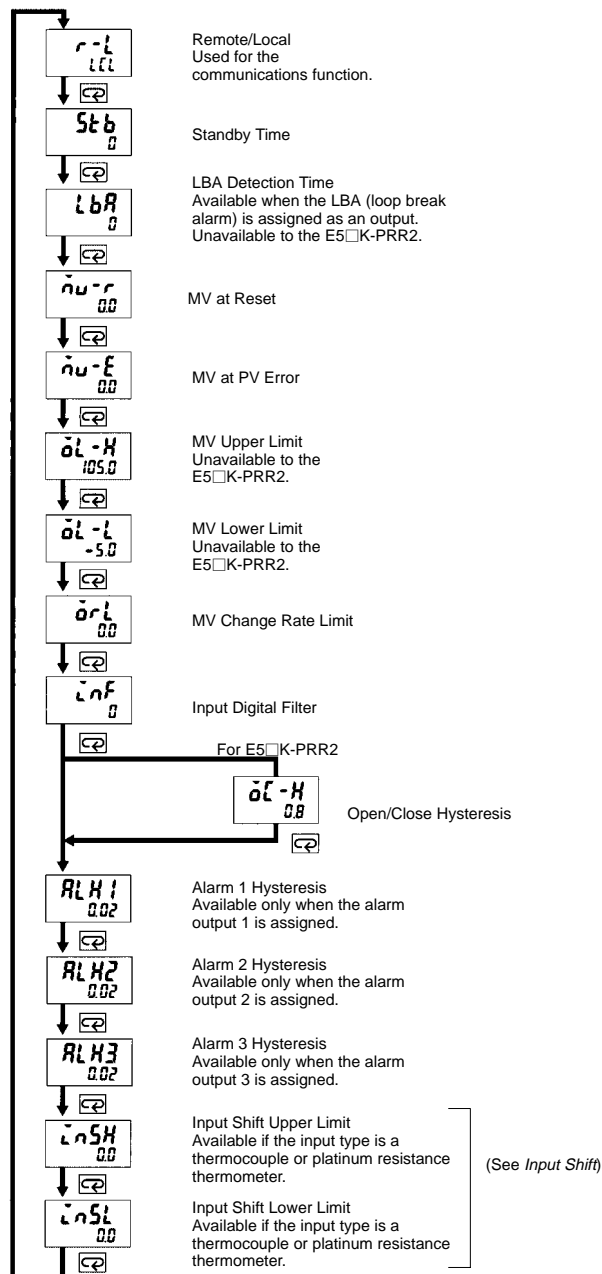
The signal is not ON if there is no difference in period between the ON time and OFF time.

If ADVANCE is executed while the time signal setting step is executed, the time equivalent to the setting step will be deemed to have elapsed. In the above graph, for example, the signal is ON from the edge of the next step until the OFF time elapses.

Level 1 Mode



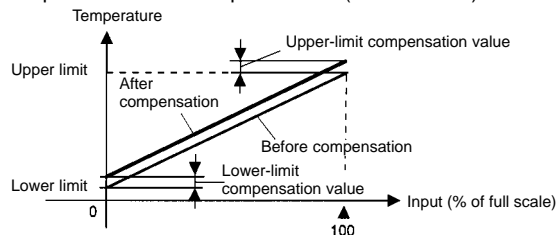
Level 2 Mode



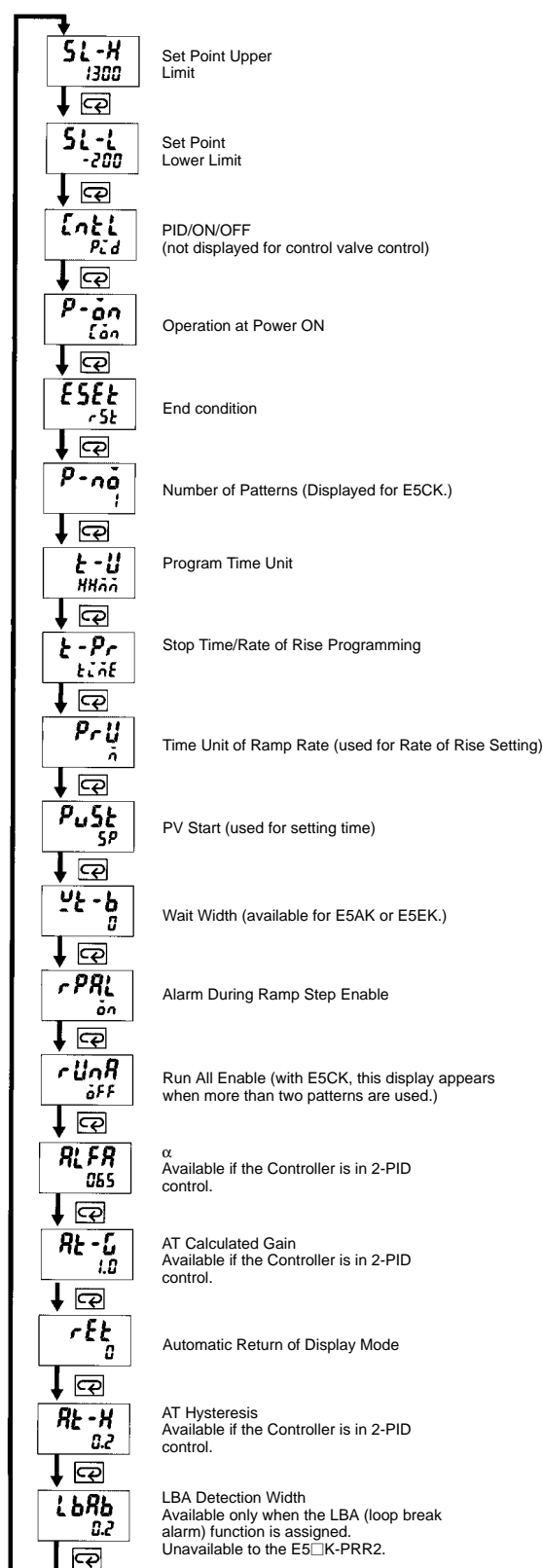
Input Shift

When temperature input is selected, scaling is not required. This is because input is treated as the "temperature" as it is matched to the input type. However, note that the upper- and lower-limit values of the sensor can be shifted. For example, if both the upper- and lower-limit values are shifted by 1.2°C, the process value (before shift) is regarded as 201.2°C after shift when input is 200°C before shift.

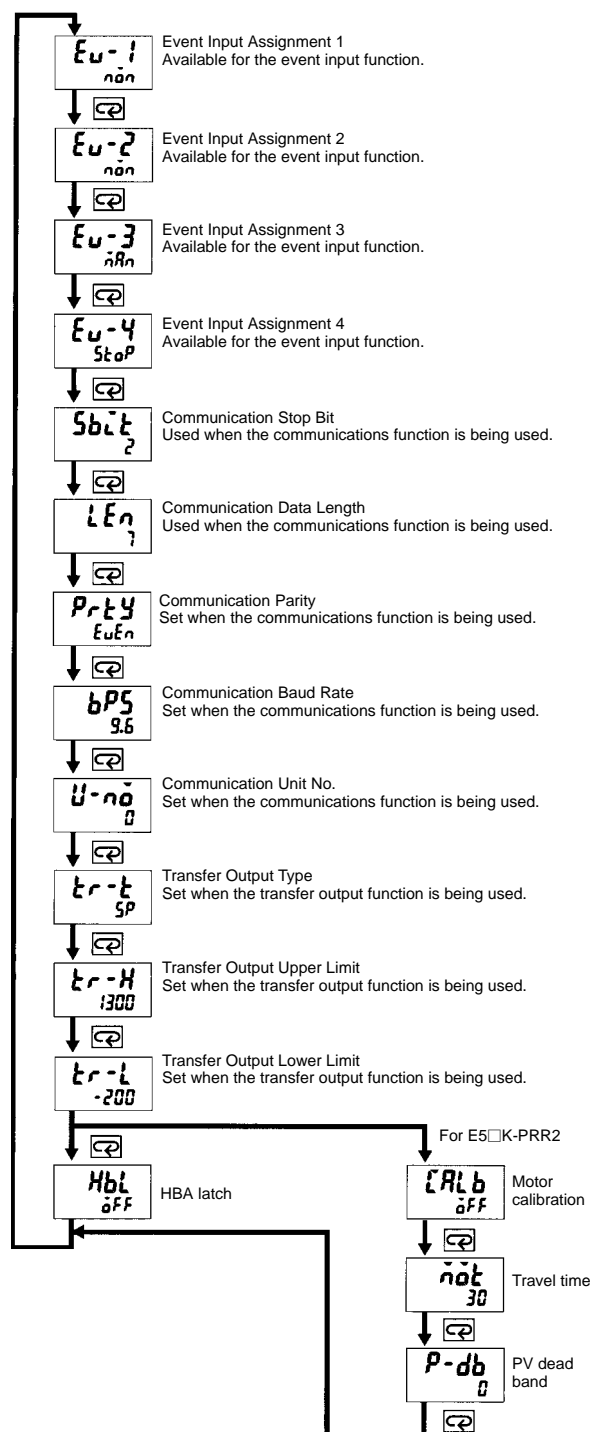
To set the input shift, set shift values in the "input shift upper limit" and "input shift lower limit" parameters (level 2 mode).



Expansion Mode

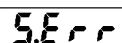


Option Mode



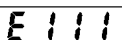
■ How to Use the Error Display

When an error has occurred, the No.1 display alternately indicates error codes together with the current display item. This section describes how to check error codes on the display, and the actions that must be taken to remedy the problem.



Input Error

Meaning	Input is in error.
Action	Check the wiring of inputs, disconnections, and shorts, and check the input type and the input type jumper connector.
Operation at Error	For control output functions, output the manipulated variable matched to the setting of the "MV at PV error" parameter (level 2 mode). Alarm output functions are activated when the upper limit is exceeded.



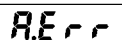
Memory Error

Meaning	Internal memory operation is in error
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5□K-T Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.



A/D Converter Error

Meaning	Internal circuits are in error.
Action	First, turn the power OFF then back ON again. If the display remains the same, the E5□K-T Controller must be repaired. If the display is restored to normal, the probable cause may be external noise affecting the control system. Check for external noise.
Operation at Error	Control output functions turn OFF (2 mA max. at 4 to 20 mA output, and output equivalent to 0% in case of other outputs). Alarm output functions turn OFF.



Calibration Data Error

	This error is output only during temperature input and is displayed for two seconds when the power is turned ON.
Meaning	Calibration data is in error.
Action	Must repair.
Operation at Error	Both control output functions and alarm output functions are active. However, note that the readout accuracy is not assured.



Display Range Over



Meaning	Though not an error, this is displayed when the process value exceeds the display range when the control range (setting range $\pm 10\%$) is larger than the display range (–1999 to 9999). <ul style="list-style-type: none"> • When less than “–1999” C C C C • When greater than “9999” J J J J
Operation	Control continues, allowing normal operation.

Precautions



WARNING

Do not touch the terminals while the power is ON.
This may cause an electric shock.

■ General Precautions

Be sure to observe these precautions to ensure safe use.

- Do not use the product in places where explosive or flammable gases may be present.
- Never disassemble, repair or modify the product.
- Tighten the terminal screws properly.
- Use the specified size of solderless terminals for wiring.
- Use the product within the rated supply voltage.
- Use the product within the rated load.
- The life expectancy of the output relay varies considerably according to its switching capacity and operating conditions. Be sure to use the output relay within its rated load and electrical life expectancy. If the output relay is used beyond its life expectancy, its contacts may become fused or burned.

■ Correct Use

If you remove the Controller from its case, never touch nor apply shock to the electronic parts inside.

Do not cover the E5□K-T. (Ensure sufficient space around the Controller to allow heat radiation.)

Do not use the Controller in the following places:

- Places subject to icing, condensation, dust, corrosive gas (especially sulfide gas or ammonia gas).
- Places subject vibration and large shocks.
- Places subject to splashing liquid or oil atmosphere.
- Places subject to intense temperature changes.
- Places subject to heat radiation from a furnace.

Be sure to wire properly with correct polarity of terminals.

When wiring input or output lines to the Controller, keep the following points in mind to reduce the influence from inductive noise:

- Allow adequate space between the high voltage/current power lines and the input/output lines.
- Avoid parallel or common wiring with high voltage sources and power lines carrying large currents.
- Using separating pipes, ducts, and shielded line is also useful in protecting the Controller, and its lines from inductive noise.

Cleaning: Do not use paint thinner or organic solvents. Use standard grade alcohol to clean the product.

Use a voltage (100 to 240 VAC at 50/60 Hz, or 24 VDC). At power ON, the prescribed voltage level must be attained within two seconds.

Allow as much space as possible between the Controller and devices that generate a powerful high frequency (high-frequency welders, high-frequency sewing machines, etc.) or surge. These devices may cause malfunctions.

If there is a large power-generating peripheral device and any of its lines near the Controller, attach a surge suppressor or noise filter to the device to stop the noise affecting the Controller system. In particular, motors, transformers, solenoids and magnetic coils have an inductance component, and therefore can generate very strong noise.

When mounting a noise filter on the power supply to the Controller, be sure to first check the filter's voltage and current capacity, and then mount the filter as close as possible to the Controller.

Use within the following temperature and humidity ranges:

- Temperature: -10°C to 55°C (with no icing or condensation)
Humidity: 35% to 85% (with no icing or condensation)
If the Controller is installed inside a control board, the ambient temperature must be kept to under 55°C , including the temperature around the Controller.
If the Controller is subjected to heat radiation, use a fan to cool the surface of the Controller to under 55°C .

Store within the following temperature and humidity ranges:

- Temperature: -25°C to 65°C (with no icing or condensation)
Humidity: 35% to 85% (with no icing or condensation)

Never place heavy objects on, or apply pressure to the Controller that may cause it to deform and deteriorate during use or storage.

Avoid using the Controller in places near a radio, television set, or wireless installing. These devices can cause radio disturbances which adversely affect the performance of the Controller.

Mounting

The dimensions of the Digital Controller conform to DIN 43700.

Recommended panel thickness is 1 to 8 mm (1 to 5 mm for E5CK).

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.

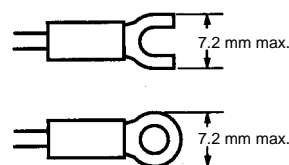
Use the specified compensating conductors for thermocouples. Use lead wires having a small resistance for platinum resistance thermometers.

Connection Example

Wire the terminals of the Unit using solderless terminals.

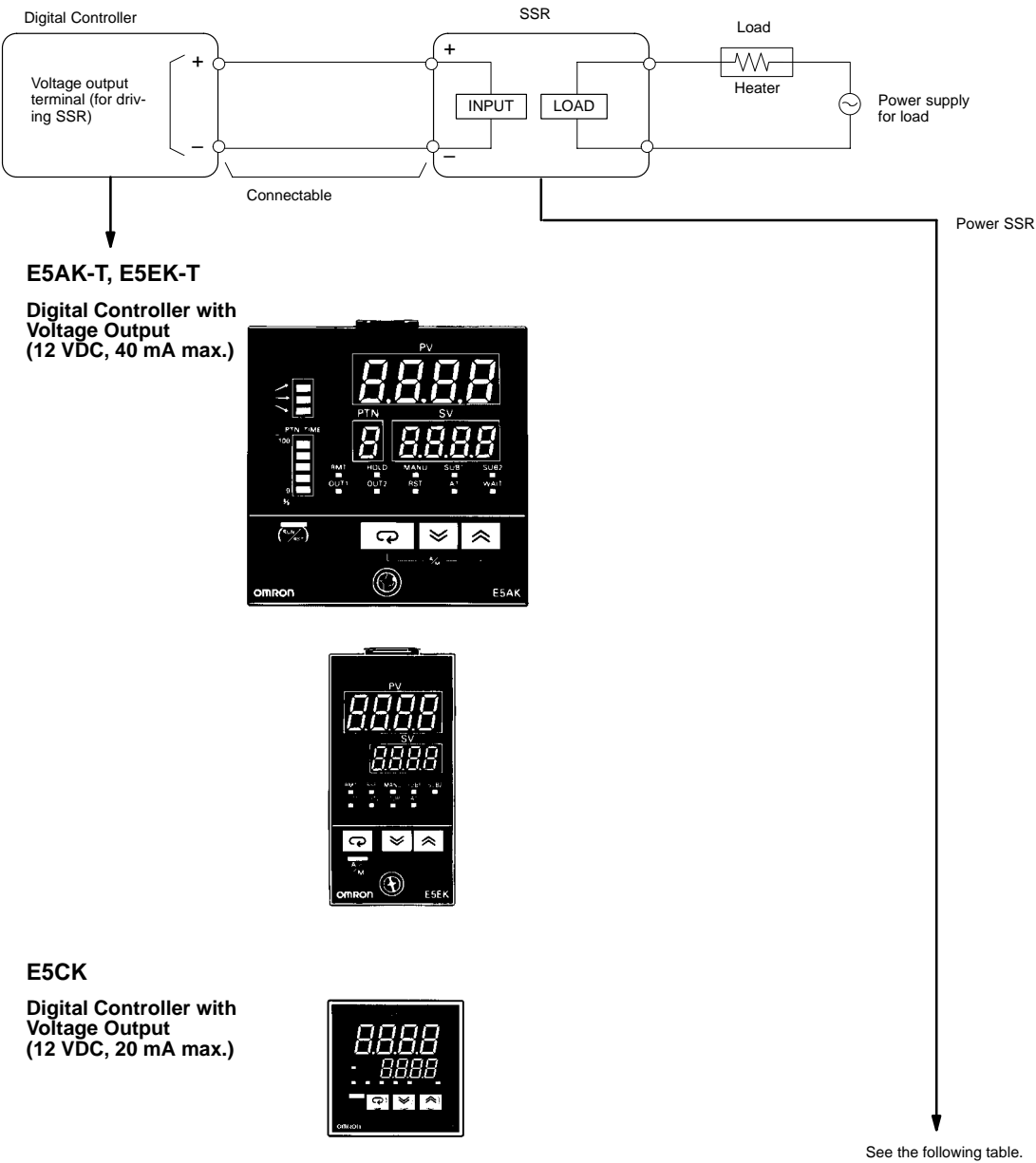
The tightening torque applied to the terminal screws of the Unit must be approximately $0.78\text{ N} \cdot \text{m}$ or $8\text{ kgf} \cdot \text{cm}$.

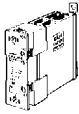
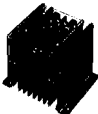



Use the following type of solderless terminals for M3.5 screws.



■ SSR

Connection Example of Digital Controller and SSR



Model	G3PA	G3NH	G3NA	G3NE	G3B
Appearance					
SSRs connected in parallel	E5AK/E5EK: 5 pcs. E5CK: 3 pcs.	E5AK/E5EK: 8 pcs. E5CK: 4 pcs.	E5AK/E5EK: 5 pcs. E5CK: 2 pcs.	E5AK/E5EK: 2 pcs. E5CK: 1 piece	E5AK/E5EK: 5 pcs. E5CK: 2 pcs.
Rated input voltage	5 to 24 VDC	5 to 24 VDC	5 to 24 VDC	12 VDC	5 to 24 VDC
Features	Thin, monoblock construction with heat sink	For high-power heater control	Standard model with screw terminals	Compact, low-cost model with tab terminals	Socket, model with 5-A switching capacity

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. H087-E1-2 In the interest of product improvement, specifications are subject to change without notice.

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Printed in Japan
1098-2M (1297) ④