OMRON

Temperature Controllers

Digital Temperature Controllers Basic Type
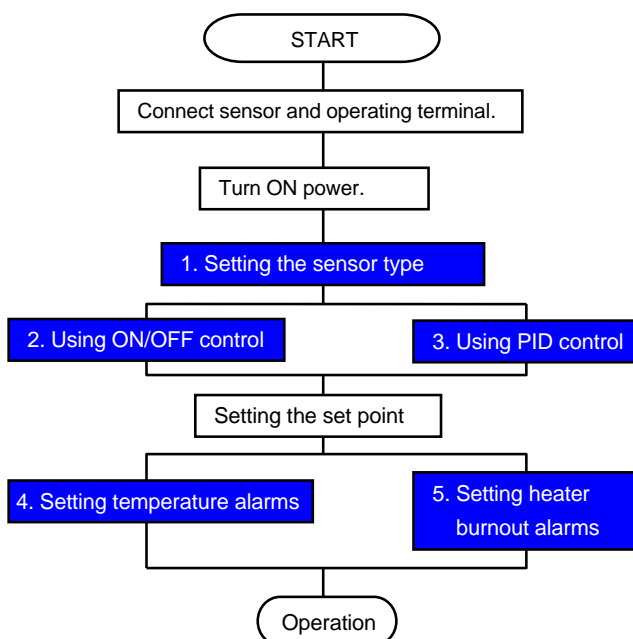
E5□N

Simplicity on the Worksite

Solutions Guide for FAQs

Basic Setup Procedure

```
               START
                 │
  Connect sensor and operating terminal.
                 │
          Turn ON power.
                 │
      1. Setting the sensor type
                 │
   ┌─────────────┴─────────────┐
2. Using ON/OFF control   3. Using PID control
   └─────────────┬─────────────┘
          Setting the set point
                 │
   ┌─────────────┴─────────────┐
4. Setting temperature    5. Setting heater
      alarms                 burnout alarms
   └─────────────┬─────────────┘
              Operation
```

CONTENTS

1. Setting the Sensor Type

2. Using ON/OFF Control

3. Using PID Control

4. Setting Temperature Alarms

5. Setting Heater Burnout Alarms

Introduction

This Solutions Guide is based on customer questions that were received at OMRON's Customer Support Center. It provides practical operating procedures for setting and changing the most common items: setting the sensor type, ON/OFF control, PID control, setting temperature alarms, and setting heater burnout alarms.

Keep this Guide in a convenient location onsite to help you make settings and changes.

If you are having trouble with Temperature Controller settings, this is the guidebook for you.
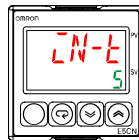
Setting the Sensor Type

Select and set the sensor type (i.e., the Input Type parameter) to the set value that corresponds to the type of sensor used in the application and the required temperature range.
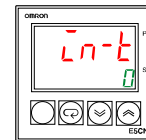The parameter is set to 5 (K thermocouple at −200 to 1,300 °C) by default.
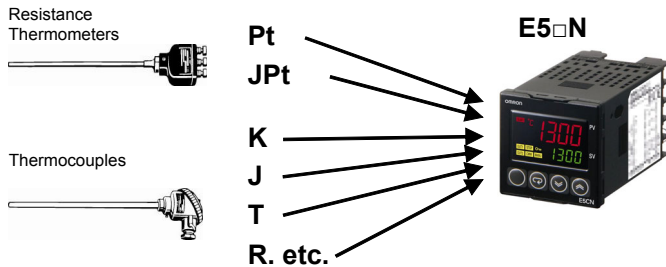
The set values (SVs) for the Input Type parameter depend on when the E5□N-series Temperature Controller was sold.
Check your Temperature Controller and set the correct value.

|					Current Temperature Controllers	Previous Temperature Controllers
Input type	Sensor type	Input temperature setting range			SV for models with 11-segment displays	SV for models with 7-segment displays
Resistance Thermometer	Pt100	-200	to	850 °C	0	0 (default)
		-199.9	to	500.0 °C	1	1
		0.0	to	100.0 °C	2	2
	JPt100	-199.9	to	500.0 °C	3	3
		0.0	to	100.0 °C	4	4
Thermocouples	K	-200	to	1300 °C	5 (default)	0 (default)
		-20.0	to	500.0 °C	6	1
	J	-100	to	850 °C	7	2
		-20.0	to	400.0 °C	8	3
	T	-200	to	400 °C	9	4
		-199.9	to	400.0 °C	10	17
	E	-200	to	600 °C	11	5
	L	-100	to	850 °C	12	6
	U	-200	to	400 °C	13	7
		-199.9	to	400.0 °C	14	18
	N	-200	to	1300 °C	15	8
	R	0	to	1700 °C	16	9
	S	0	to	1700 °C	17	10
	B	100	to	1800 °C	18	11
	W	0	to	2300 °C	24	Not supported.
	PLII	0	to	1300 °C	25	Not supported.

Any value can be set for any model.

The Temperature Controller models are different for resistance thermometers and thermocouples.

* When using the ES1B Infrared Temperature Sensor and an analog input, refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156).
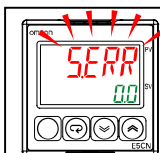
 ←If the setting of the Input Type parameter does not agree with the connected sensor, s.err (S.ERR: Input Error) will flash on the display as shown at the left when the power supply is turned ON.

Use the procedure on page 1-2 to set the Input Type parameter correctly.

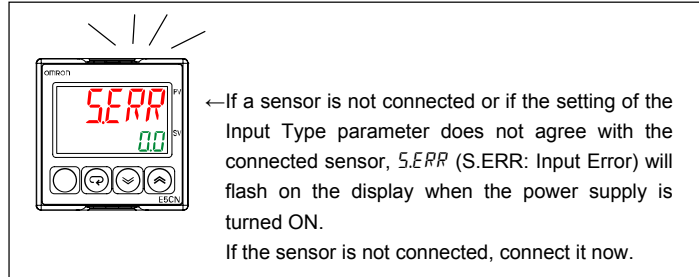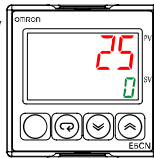## Setting the Sensor Type

1 Setting the Sensor Type

You set this parameter in the Initial Setting Level.

The parameter is set to 5 (K thermocouple at −200 to 1,300 °C) by default.
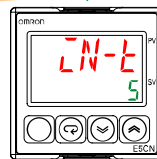
1 Turn ON the power supply.

Operating Display

←If a sensor is not connected or if the setting of the Input Type parameter does not agree with the connected sensor, 5.ERR (S.ERR: Input Error) will flash on the display when the power supply is turned ON.

If the sensor is not connected, connect it now.

2 Press the ◯ Key for at least 3 seconds.

Press the ◯ (Level) Key for at least 3 seconds.

← Flashes 3 times.

Initial Setting Level

←ĽN-Łc(IN-T) will be displayed to show that the Initial Setting Level has been entered.

3 Set the parameter with the ⊗⊗ Keys

Initial Setting Level

←ĽN-Ł (IN-T): Indicates the Input Type parameter.

←Default setting is 5 (5): K thermocouple at −200 to 1,300 °C.

Initial Setting Level

Change the set value with the ⊗⊗ (Up and Down) Keys.

←Input Type: 0 (Pt100 resistance thermometer at −200 to 850 °C) (example)
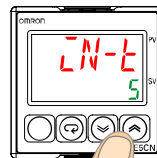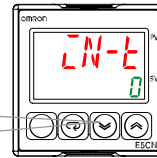
Set the number that you selected for the Input Type parameter on page 1-1.

(When finished, press the ◯ (Level) Key for at least 1 second to return to the operation display.)

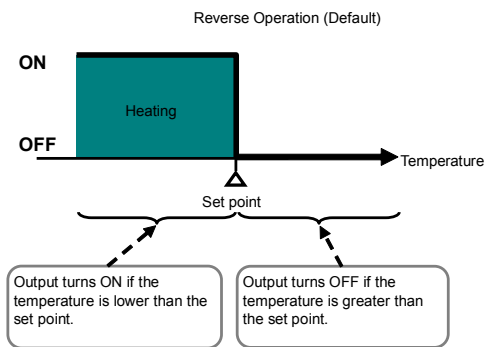Setting the Sensor Type

Using ON/OFF Control

The procedure to use ON/OFF control is given step by step in this section.
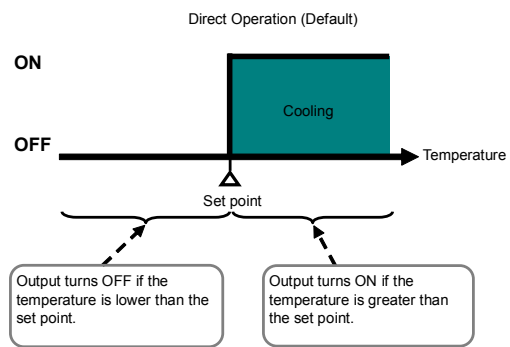
Step 1   Determining the Control Method

1   Select direct or reverse operation.

The default setting is for reverse operation.

For heating control, select reverse operation.

Reverse Operation (Default)

ON

Heating

OFF

Temperature

Set point

Output turns ON if the temperature is lower than the set point.

Output turns OFF if the temperature is greater than the set point.

For cooling control, select direct operation.

Direct Operation (Default)

ON

Cooling

OFF

Temperature

Set point

Output turns OFF if the temperature is lower than the set point.

Output turns ON if the temperature is greater than the set point.

2   Adjust the hysteresis.

With ON/OFF control, you can adjust the reset width (called the hysteresis) for heating or cooling operation. The default setting is 1.0°C.

Heating (Reverse) Operation

When the output turns OFF at the set point, the temperature will decrease. You can set the temperature width that determines when the output will turn ON again.
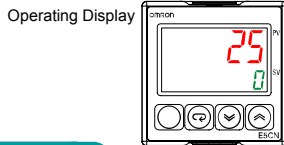
ON

Heating

OFF

Temperature

Set point

This width can be set as the hysteresis.
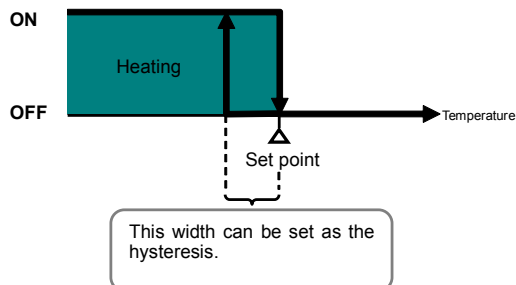
Cooling (Direct) Operation

When the output turns OFF at the set point, the temperature will increase. You can set the temperature width that determines when the output will turn ON again.

ON

Cooling

OFF

Temperature

Set point

This width can be set as the hysteresis.

Using ON/OFF Control
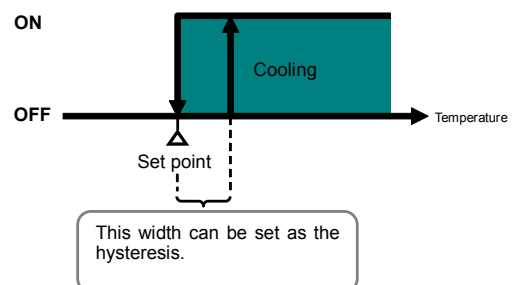
Using ON/OFF Control

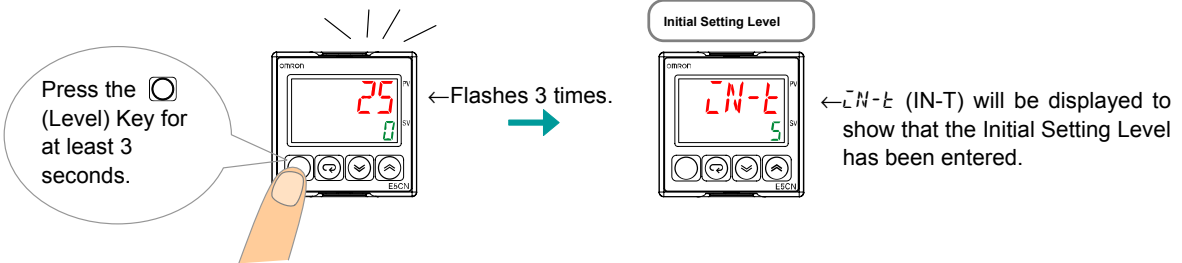# Step 2   Setting ON/OFF Control Parameters

1   Setting ON/OFF Control

You set this parameter in the Initial Setting Level. The parameter is set to ON/OFF control by default.
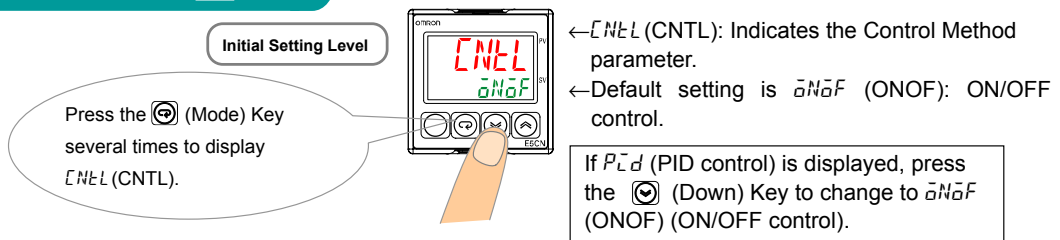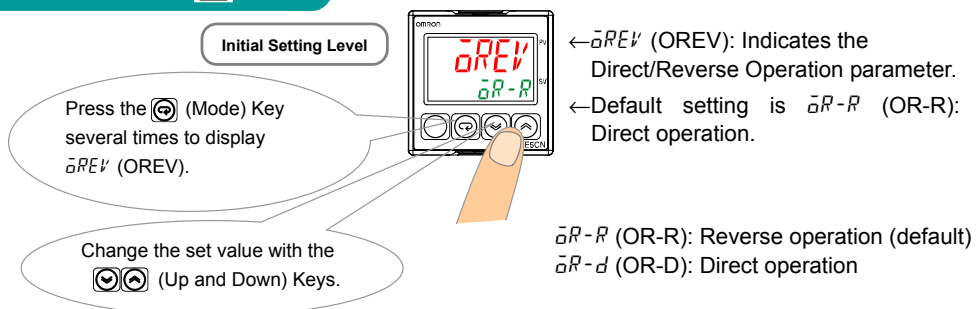
1 Turn ON the power supply.

Operating Display

2 Press the ⬭ Key for at least 3 seconds.

Press the ⬭ (Level) Key for at least 3 seconds.

←Flashes 3 times.

Initial Setting Level

←⌐N-⊦ (IN-T) will be displayed to show that the Initial Setting Level has been entered.

3 Change the parameter with the ⊚ Key.

Initial Setting Level

Press the ⊚ (Mode) Key several times to display ⌐N⊦L (CNTL).

←⌐N⊦L (CNTL): Indicates the Control Method parameter.
←Default setting is ⌐N⌐F (ONOF): ON/OFF control.

If P⌐d (PID control) is displayed, press the ⊙ (Down) Key to change to ⌐N⌐F (ONOF) (ON/OFF control).

2   Setting Direct or Reverse Operation

You set this parameter in the Initial Setting Level. The parameter is set to reverse operation by default.
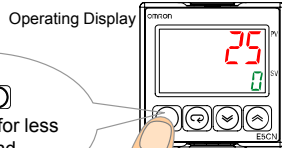
1 Change the parameter with the ⊚ Key.

Initial Setting Level

Press the ⊚ (Mode) Key several times to display ⌐REⱽ (OREV).

Change the set value with the ⊙⊚ (Up and Down) Keys.

←⌐REⱽ (OREV): Indicates the Direct/Reverse Operation parameter.
←Default setting is ⌐R-R (OR-R): Direct operation.

⌐R-R (OR-R): Reverse operation (default)
⌐R-d (OR-D): Direct operation

(When finished, press the ⬭ (Level) Key for at least 1 second to return to the operation display.)

3   Setting the Hysteresis

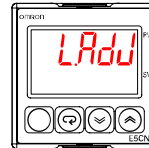You set this parameter in the Adjustment Level. The parameter is set to 1.0°C by default.

1 Turn ON the power supply.

Operating Display

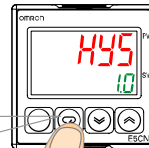Press the ○ (Level) Key for less than 1 second.

Adjustment Level

←*L.Adj* (L.ADJ) will be displayed to show that the Adjustment Level has been entered.

2 Change the parameter with the Ⓜ Key.

Adjustment Level

Press the Ⓜ (Mode) Key several times to display *HYS* (HYS).

←*HYS*(HYS): Indicates the Hysteresis parameter.
←Default setting is *1.0* (1.0°C).

3 Set the parameter with the ⊙⊙ Keys.

Adjustment Level
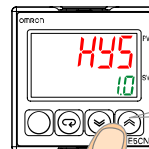
Change the set value with the ⊙⊙ (Up and Down) Keys.

(When finished, press the ○ (Level) Key to return to the operation display.)

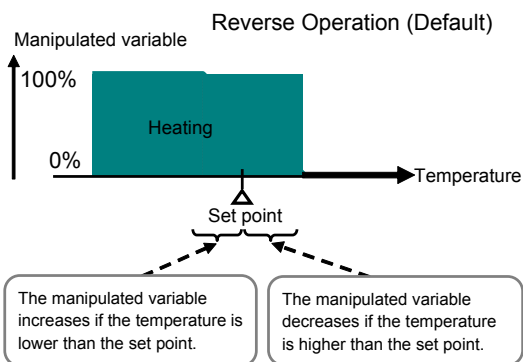# Using ON/OFF Control

MEMO

Using PID Control

The procedure to use PID control is given step by step in this section.
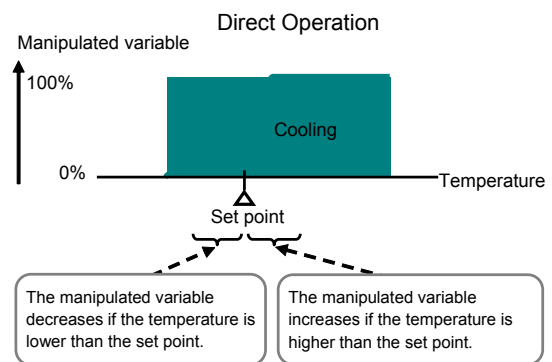
Step 1   Determining the Control Method

1 Select direct or reverse operation.

The default setting is for reverse operation.

For heating control, select reverse operation.

Reverse Operation (Default)

Manipulated variable

100%

Heating

0%

→Temperature

Set point

The manipulated variable increases if the temperature is lower than the set point.

The manipulated variable decreases if the temperature is higher than the set point.

For cooling control, select direct operation.

Direct Operation

Manipulated variable

100%

Cooling

0%

Temperature

Set point

The manipulated variable decreases if the temperature is lower than the set point.

The manipulated variable increases if the temperature is higher than the set point.

2 Adjust the PID constants.

You can automatically or manually set the PID constants that are used for PID control.

Adjusting the PID Constants

The suitable values of the PID constants that are used for temperature control depend on the characteristics of the controlled object.

There are three ways that you can use to set the PID constants. These are described below.

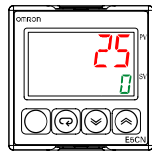|	
If you can allow the temperature to vary while tuning the PID constants and you need to calculate the optimum PID constants:	⟹ Use autotuning (AT).
If you know the PID constants in advance:	⟹ Set the PID constants manually.
If you cannot allow the temperature to vary and you need to automatically estimate the PID constants when the set point is changed: With self-tuning, calculation of the PID constants is affected by changes in the temperature, such as when a heater is turned ON and OFF. The PID constants will be automatically calculated and set. If there is an external source that causes temperature changes (such as a heater turning OFF), use autotuning or set the PID constants manually.	⟹ Use self-tuning (ST).

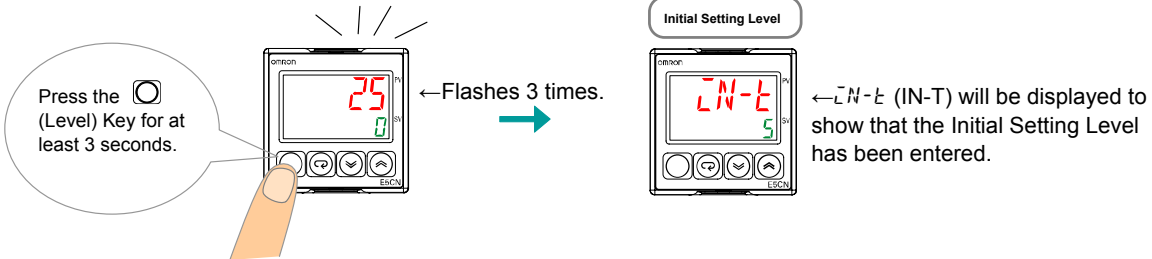# Step 2   Setting PID Control Parameters

1   Setting PID Control

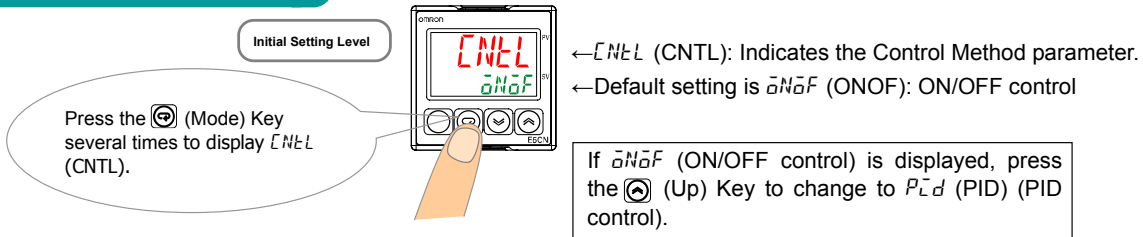You set this parameter in the Initial Setting Level. The parameter is set to ON/OFF control by default.
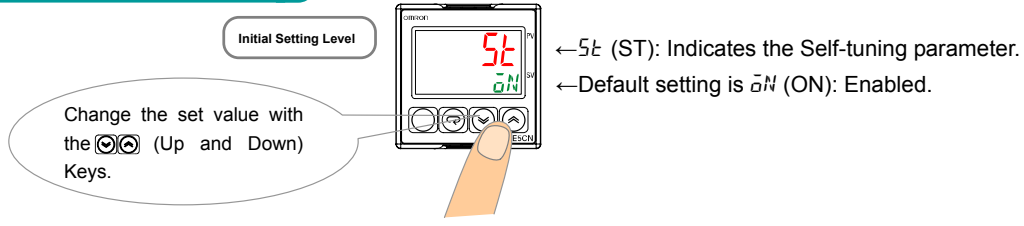
1   Turn ON the power supply.

**2**   Press the ⬭ Key for at least 3 seconds.

Press the ⬭ (Level) Key for at least 3 seconds.

←Flashes 3 times.

Initial Setting Level

←*ĹN-t* (IN-T) will be displayed to show that the Initial Setting Level has been entered.

3   Change the parameter with the ⊙ Key.

Initial Setting Level

Press the ⊙ (Mode) Key several times to display *ĆNtL* (CNTL).

←*ĆNtL* (CNTL): Indicates the Control Method parameter.
←Default setting is *ōNōF* (ONOF): ON/OFF control

If *ōNōF* (ON/OFF control) is displayed, press the ⊙ (Up) Key to change to *PĹd* (PID) (PID control).

4   Change the parameter with the ⊙ Key.

Initial Setting Level

Change the set value with the ⊙⊙ (Up and Down) Keys.

←*5t* (ST): Indicates the Self-tuning parameter.
←Default setting is *ōN* (ON): Enabled.

You cannot set the following parameters while self-tuning is enabled.
• Adjustment Level: MV Upper Limit, MV Lower Limit, and SP Ramp Set Value
• Advanced Function Setting Level: SP Ramp Time Unit
 * To set these parameters, first set the *5t* (ST) (self-tuning) parameter in the Initial Setting Level to *ōFF* (OFF) to disable self-tuning.
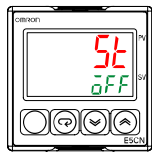
ōFF (OFF):   Self-tuning disabled. Use this setting to perform autotuning or to set the PID constants manually.
ōN (ON):   Self-tuning enabled. Use this setting to perform self-tuning

(Refer to **2. *Adjusting PID Constants*** on page 3-1.)

Using PID Control

2 Setting direct or reverse operation.

You set this parameter in the Initial Setting Level. The parameter is set to reverse operation by default.

1 Change the parameter with the ⊕ Key.

Initial Setting Level

Press the ⊕ (Mode) Key several times to display ōRE𝑉 (OREV).

Change the set value with the ⊙⊙ (Up and Down) Keys.

←ōRE𝑉 (OREV): Indicates the Direct/Reverse Operation parameter.
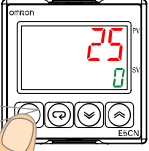
←Default setting is ōR-R (OR-R): Direct operation

ōR-R (OR-R): Reverse operation (default)
ōR-d (OR-D): Direct operation

(When finished, press the ◯ (Level) Key for at least 1 second to return to the operation display.)
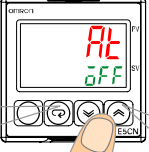
Using PID Control

Using PID Control

Executing Autotuning

1 Turn ON the power supply.

Operating Display

Press the ⬭ (Level) Key for less than 1 second.

Adjustment Level

←*L.Adj*(L.ADJ) will be displayed to show that the Adjustment Level has been entered.

2 Change the parameter with the 🔘 Key.

Adjustment Level

←*At* (AT): Indicates the Autotuning parameter.
←Default setting is *oFF* (OFF): Autotuning stopped.

Press the 🔘 (Mode) Key several times to display *At* (AT).

Use the ⬇⬆ (Up and Down) Keys to select *At-2* (AT-2) (100% autotuning).

3 Autotuning will start at *At-2*

Adjustment Level

Autotuning will be started when *At* (AT)
←starts flashing.
←*At-2* (AT-2): 100% autotuning executed.

oFF (OFF)   : Autotuning stopped (default).
At-2 (At-2) : 100% autotuning executed.
At-1 (At-1) : Refer to page 3-6.

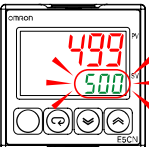**4** *At* stops flashing, autotuning is finished.

Adjustment Level

←*At* will stop flashing to indicate that autotuning is finished.

(When finished, press the ⬭ (Level) Key to return to the operation display.)
*You can return to the Operation Level during autotuning execution.

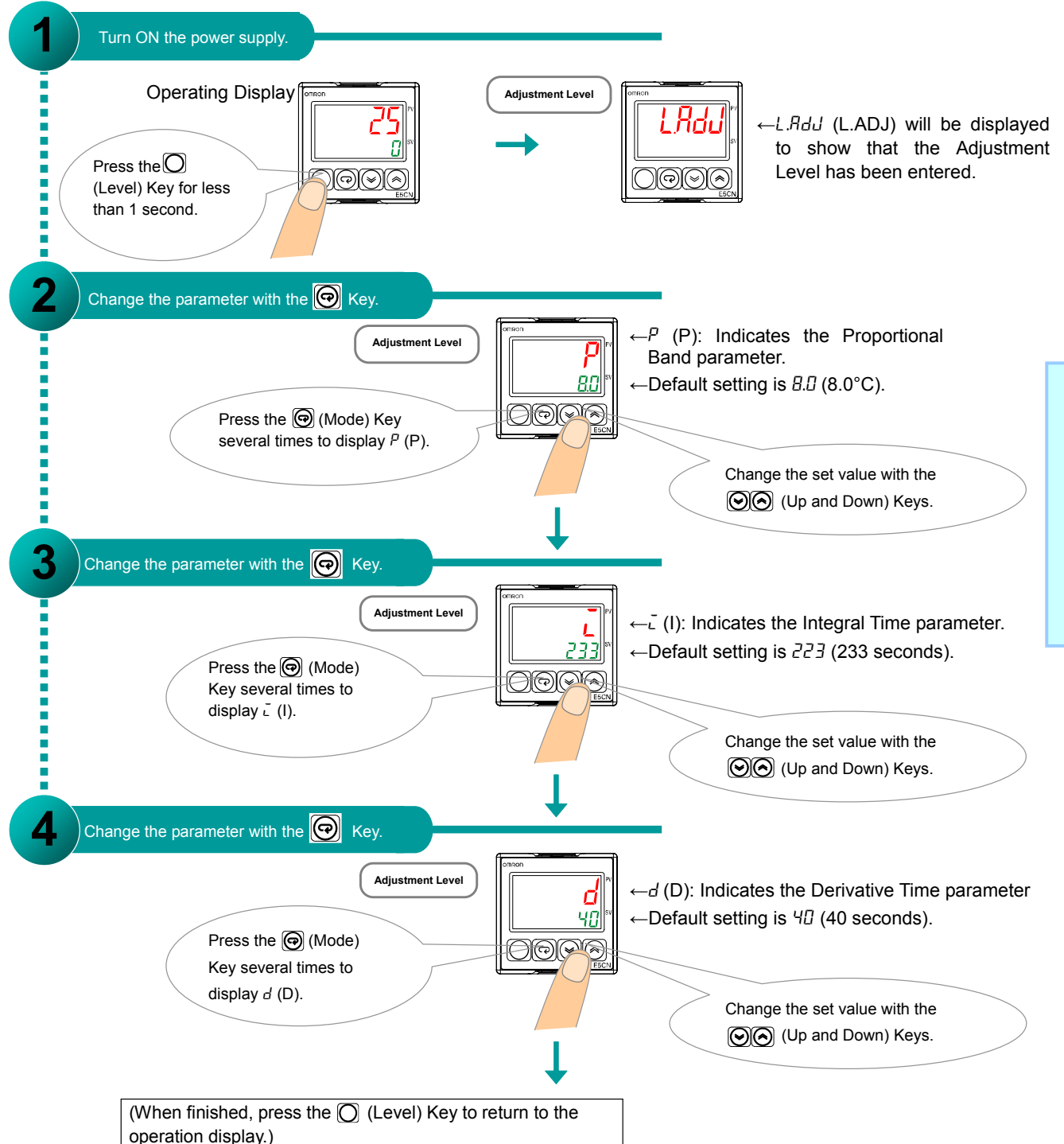● After Returning to Operation Level

Operating Display

←SV flashing: Autotuning is being executed.

Setting PID Constants Manually

You set the PID constants manually in the Adjustment Level.

The default settings of the PID constants are as follows: P (proportional band) = 8.0°C, I (integral time) = 233 seconds, D (derivative time) = 40 seconds.

1 Turn ON the power supply.

Operating Display

Press the ◯ (Level) Key for less than 1 second.

Adjustment Level

←*L.AdJ* (L.ADJ) will be displayed to show that the Adjustment Level has been entered.

2 Change the parameter with the 🔄 Key.

Adjustment Level

Press the 🔄 (Mode) Key several times to display *P* (P).

←*P* (P): Indicates the Proportional Band parameter.
←Default setting is *8.0* (8.0°C).

Change the set value with the ⊙⊙ (Up and Down) Keys.

3 Change the parameter with the 🔄 Key.

Adjustment Level

Press the 🔄 (Mode) Key several times to display *ī* (I).

←*ī* (I): Indicates the Integral Time parameter.
←Default setting is *223* (233 seconds).

Change the set value with the ⊙⊙ (Up and Down) Keys.

4 Change the parameter with the 🔄 Key.

Adjustment Level

Press the 🔄 (Mode) Key several times to display *d* (D).

←*d* (D): Indicates the Derivative Time parameter
←Default setting is *40* (40 seconds).

Change the set value with the ⊙⊙ (Up and Down) Keys.

(When finished, press the ◯ (Level) Key to return to the operation display.)

Using PID Control

Reference Information: PID Control

Problems with 100% Autotuning (AT-2)

If autotuning at 100% (AT-2) does not produce the desired results, you can also execute autotuning at 40% (AT-1).

●Autotuning at 40% (AT-1)

A 40% variation in the manipulated variable of the limit cycle is used for autotuning. Executing 40% autotuning may require more time than executing 100% autotuning (AT-2).
The limit cycle timing varies according to whether the deviation (DV) at the start of autotuning execution is less than 10% FS.
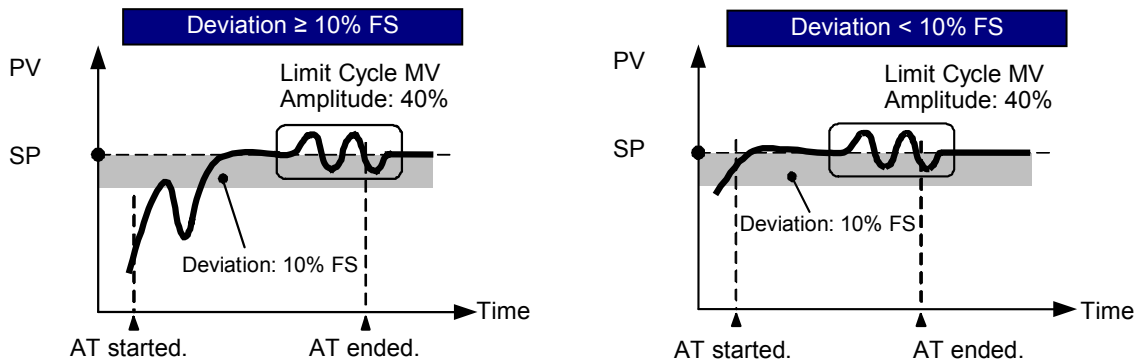
Using PID Control

Setting Temperature Alarms

The procedure to set temperature alarms is given step by step in this section.

Step 1   Determining the Alarm Set Value

1   Selecting the Alarm Type

How To Select an Alarm Type

E5□N

Alarm →

Temperature sensor
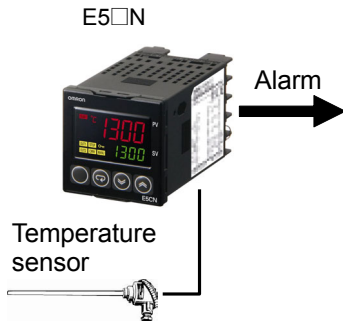
Consider the following three points and select the alarm type from tables on page 4-3 and 4-4.

1. In what cases do you want to output an alarm?

2. Do you need to link the alarm temperature to the set point?

3. Do you need an alarm when the power is turned ON.

Select from the table on page 4-3.

1. In what cases do you want to output an alarm?

● Outputting an alarm when the temperature exceeds a specific value

Upper-limit Alarm ON / OFF →**Upper-limit Alarm**

Upper-limit Alarm

● Outputting an alarm when the temperature goes below a specific value

Lower-limit Alarm OFF / ON →**Lower-limit Alarm**

Lower-limit Alarm

● Outputting an alarm when the temperature goes below a specific value or exceeds a specific value

Upper-limit Alarm ON / OFF
Lower-limit Alarm ON →**Upper-limit and Lower-limit Alarm**

Upper-limit and Lower-limit Alarm

● Outputting an alarm when the temperature is within a specific range

Upper-limit and Lower-limit Range Alarm OFF / ON / OFF →**Upper-limit and Lower-limit Range Alarm**

Upper-limit and Lower-limit Range Alarm

Setting Temperature Alarms

Setting Temperature Alarms

2. Do you need to link the alarm temperature to the set point?
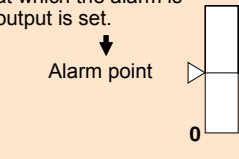
●Alarm linked to the set point
If the set point is changed, the set value of the alarm will also change.

Set this difference.

Alarm point

SP

Linked

Set the difference (deviation) between the set point and alarm point. → **Deviation**

●Alarm not linked to the set point
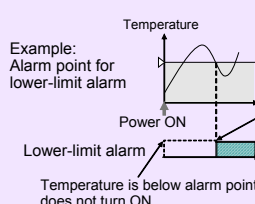
The actual temperature at which the alarm is output is set.

Alarm point

Fixed

0

Set the absolute temperature at which the alarm is output. → **Absolute value**

3. Do you need an alarm when the power is turned ON?

●Alarm not required when the power is turned ON

Temperature

Example: Alarm point for lower-limit alarm

Time

Power ON

Lower-limit alarm

Temperature is below alarm point, but alarm output does not turn ON.

Alarm output turns ON second time temperature goes below alarm point.

→ **Standby Sequence**

Standby Sequence

●Alarm also required when power is turned ON

Temperature

Example: Alarm point for lower-limit alarm

Time

Power ON

Lower-limit alarm output

Alarm output turns ON because temperature is below alarm point when power turns ON.

→ **No Standby Sequence**

No Standby Sequence

What Is a Standby Sequence For?

Particularly with a lower-limit alarm, the temperature is often below the alarm point when temperature control is started. In this case, an alarm would be output at the start of operation. To prevent this, a standby sequence is used to disable the first alarm.

In the default settings, the standby sequence is restarted (and the alarm is turned OFF) when operation is started, when the SP is changed, or when the alarm temperature is changed.

You can change the conditions for restarting the standby sequence.

For details, refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156).
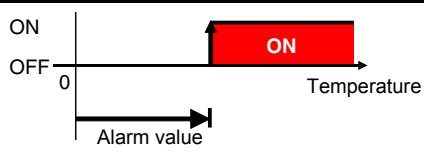
Setting Temperature Alarms
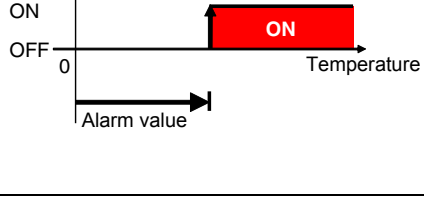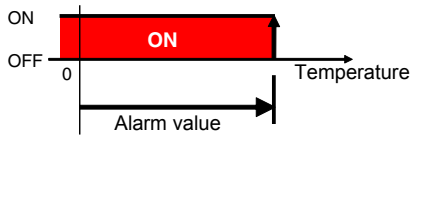
Setting Temperature Alarms
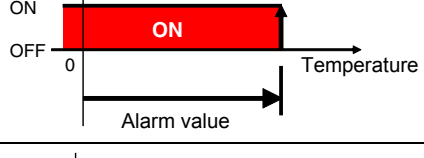
Available Alarm Types

You select the alarm type according to the required conditions.

Do you want to link the alarm temperature to the set point?	Do you need a standby sequence?	In what cases do you want to output an alarm?		Alarm Type No.	Name	Operation
				Set this number in the Temperature Controller — You use these numbers for the following Alarm Type parameters: ALt1 (ALT1), ALt2 (ALT2), and ALt3 (ALT3). Refer to page 4-6 for the procedure.		
-	-	None	⇒	0	No alarm	**Set this alarm type when you do not need an alarm.**
Deviation	No Standby Sequence	Upper-limit and Lower-limit Alarm	⇒	1	Upper-limit and Lower-limit Alarm	
		Upper-limit Alarm	⇒	2	Upper-limit Alarm	
		Lower-limit Alarm	⇒	3	Lower-limit Alarm	
		Upper-limit and Lower-limit Range Alarm	⇒	4	Upper-limit and Lower-limit Range Alarm	
	Standby Sequence	Upper-limit and Lower-limit Alarm	⇒	5	Upper-limit and Lower-limit Alarm with Standby Sequence	
		Upper-limit Alarm	⇒	6	Upper-limit Alarm with Standby Sequence	
		Lower-limit Alarm	⇒	7	Lower-limit Alarm with Standby Sequence	

Setting Temperature Alarms

Setting Temperature Alarms

Do you want to link the alarm temperature to the set point?	Do you need a standby sequence?	In what cases do you want to output an alarm?		Alarm Type No.	Name	Operation

Set this number in the Temperature Controller

You use these numbers for the following Alarm Type parameters: *RLE 1* (ALT1), *RLE 2* (ALT2), and *RLE 3* (ALT3). Refer to page 4-6 for the procedure.

Absolute value	No Standby Sequence	Upper-limit Alarm	⇒	**8**	Absolute-value Upper-limit Alarm	ON / OFF — ON (Temperature, Alarm value)
		Lower-limit Alarm	⇒	**9**	Absolute-value Lower-limit Alarm	ON / OFF — ON (Temperature, Alarm value)
	Standby Sequence	Upper-limit Alarm	⇒	**10**	Absolute-value Upper-limit Alarm with Standby Sequence	ON / OFF — ON (Temperature, Alarm value)
		Lower-limit Alarm	⇒	**11**	Absolute-value Lower-limit Alarm with Standby Sequence	ON / OFF — ON (Temperature, Alarm value)

* Refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156) for information on alarm types 12 (LBA) and 13 (PV Change Rate Alarm).

Setting Temperature Alarms

2 Determining the Alarm Value

What Value Is Set for an Alarm?

You set the temperature at which the alarm is output. There are two methods to set the temperature for the alarm types selected on pages 4-3 and 4-4: a deviation or an absolute temperature. Either positive or negative values can be set for the alarm value.
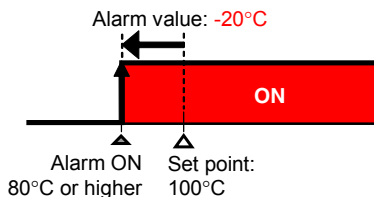
●Setting Deviations from the Set Point

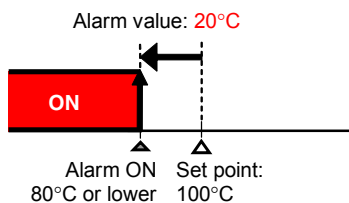• Setting an Upper-limit Alarm (Alarm Type 2)
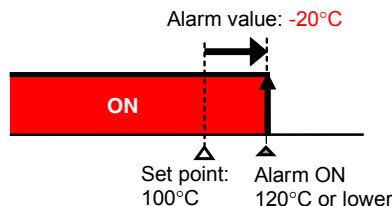
  Example: Alarm Value = 20

  Alarm value: 20°C

  ON

  Set point: 100°C
  Alarm ON 120°C or higher

  Example: Alarm Value = −20

  Alarm value: -20°C

  ON

  Alarm ON 80°C or higher
  Set point: 100°C
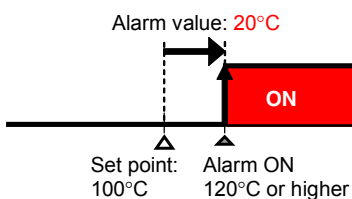
• Setting a Lower-limit Alarm (Alarm Type 3)

  Example: Alarm Value = 20

  Alarm value: 20°C

  ON

  Alarm ON 80°C or lower
  Set point: 100°C

  Example: Alarm Value = −20

  Alarm value: -20°C

  ON

  Set point: 100°C
  Alarm ON 120°C or lower

• Setting an Upper-limit Lower-limit Alarm (Alarm Type 1)

  Example: Alarm upper limit = 30, alarm lower limit = 20

  Alarm lower limit: 20°C   Alarm upper limit: 30°C

  ON   **ON**

  Alarm ON 80°C or lower
  Set point: 100°C
  Alarm ON 130°C or higher
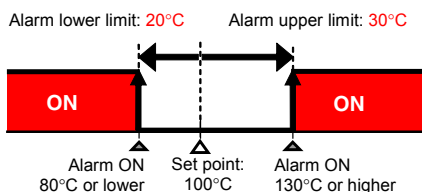
●Setting Absolute Temperatures

• Setting an Absolute-value Upper-limit Alarm (Alarm Type 8)

  The alarm output will turn ON when the alarm value is exceeded regardless of the value of the set point.

  Example: Alarm Value = 100

  Alarm value: 100°C

  ON

  0
  Alarm ON 100°C or higher
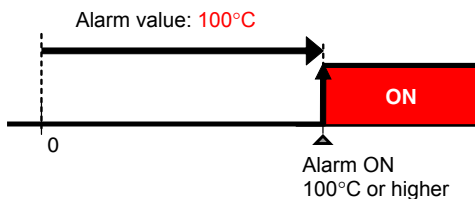
• Setting an Absolute-value Lower-limit Alarm (Alarm Type 9)

  The alarm output will turn ON when the temperature is below the alarm value regardless of the value of the set point.

  Example: Alarm Value = 100

  Alarm value: 100°C

  ON

  0
  Alarm ON 100°C or lower
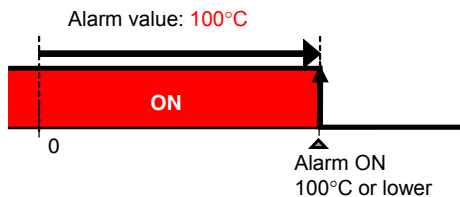
*There is no upper-limit lower-limit alarm that can be set with absolute values.
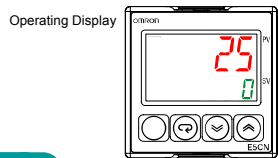
Setting Temperature Alarms

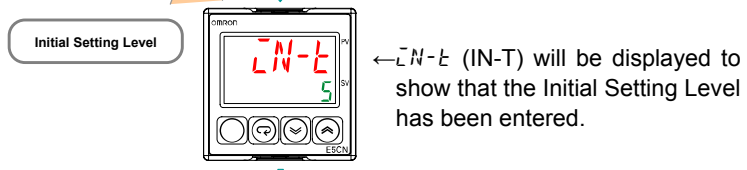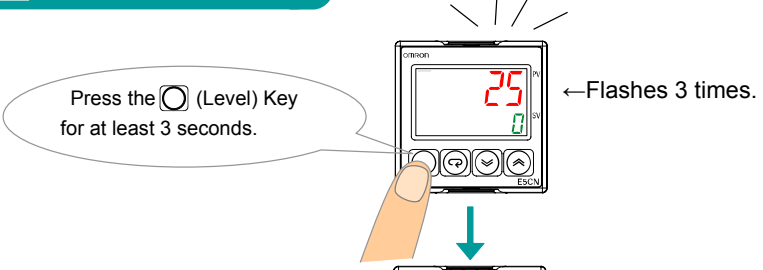## Step 2   Setting Alarm Parameters

1   Setting the Alarm Type

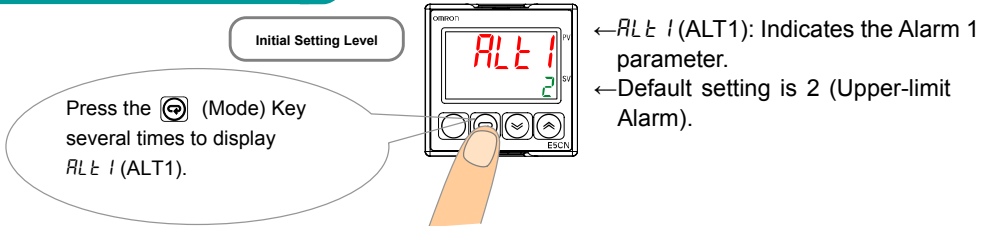You set this parameter in the Initial Setting Level. The parameter is set to 2 (Upper-limit Alarm) by default.
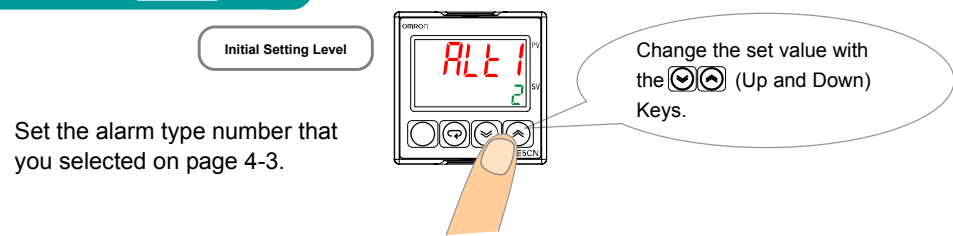
1 Turn ON the power supply.

Operating Display

2 Press the ⬭ Key for at least 3 seconds.

Press the ⬭ (Level) Key for at least 3 seconds.

←Flashes 3 times.

Initial Setting Level

←٢N-Ł (IN-T) will be displayed to show that the Initial Setting Level has been entered.

3 Change the parameter with the ⊚ Key.

Initial Setting Level

Press the ⊚ (Mode) Key several times to display ALŁ I (ALT1).

←ALŁ I (ALT1): Indicates the Alarm 1 parameter.
←Default setting is 2 (Upper-limit Alarm).

4 Set the parameter with the ⊙⊙ Keys.

Initial Setting Level

Set the alarm type number that you selected on page 4-3.

Change the set value with the ⊙⊙ (Up and Down) Keys.

If required, use the ⊚ (Mode) Key and the ⊙⊙ (Up and Down) Keys to repeat steps 3 and 4 and set alarm type numbers for ALŁ2 (ALT2) (Alarm 2) and ALŁ3 (ALT3) (Alarm 3).
(The number of alarms that is supported depends on the model of Temperature Controller. Some of the alarm parameters may not be displayed.)

(When finished, press the ⬭ (Level) Key for at least 1 second to return to the operation display.)

Setting Temperature Alarms

2 Setting the Alarm Value

You set the alarm value in the Operation Level.

The following procedure continues on from the procedure to set the Alarm Type parameter (Initial Setting Level).
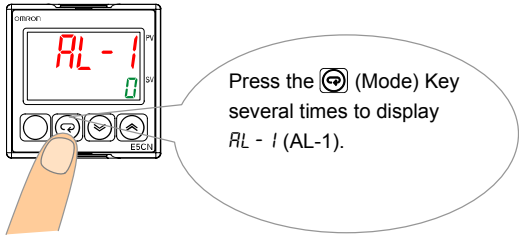
Start here if you just turned ON the power supply.

1 Press the ⬜ Key for at least 1 second.

Initial Setting Level

Press the ⬜ (Level) Key for at least 1 second.

Operation Level
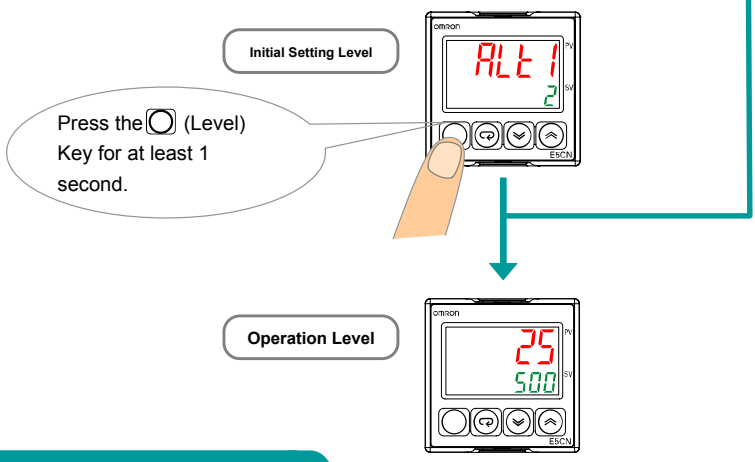
2 Change the parameter with the ⬓ Key.

Setting Alarm Type 2, 3, 6, 7, 8, 9,10, or 11 (Upper-limit Alarms and Lower-limit Alarms)

Press the ⬓ (Mode) Key several times to display *RL - 1* (AL-1).

Setting Alarm Type 1, 4, or 5 (Upper-limit and Lower-limit Alarms or Upper-limit and Lower-limit Range Alarms)

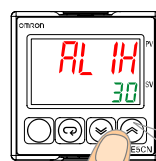Press the ⬓ (Mode) Key several times to display *RL 1H* (AL1H).
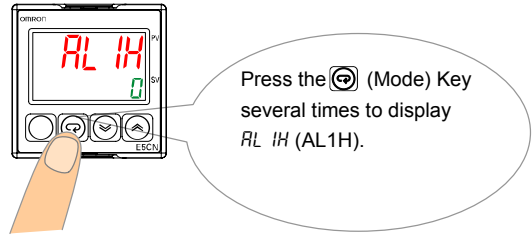
Setting Temperature Alarms

Setting Temperature Alarms

3 Set the alarm value with the ⊙⊙ Keys.

Setting Alarm Type 2, 3, 6, 7, 8, 9,10, or 11 (Upper-limit Alarms and Lower-limit Alarms)

Example:
Alarm Value 1 = Upper-limit Alarm: 30°C

Alarm Value 1: 30, *RL - 1* (AL-1)

SP   Alarm ON   ON
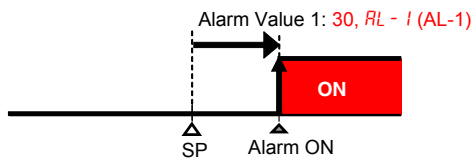
Operation Level
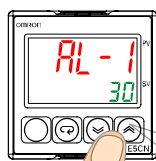
←*RL - 1* (AL-1): Alarm Value 1

Alarm value: 30°C (example)

Change the set value with the ⊙⊙ (Up and Down) Keys.

Setting Alarm Type 1, 4, or 5 (Upper-limit and Lower-limit Alarms or Upper-limit and Lower-limit Range Alarms)

Example:
Alarm Upper Limit 1 = 30°C,
Alarm Lower Limit 1 = 20°C

Alarm upper limit 1: 30, *RL 1H* (AL1H)

SP   Alarm ON   ON
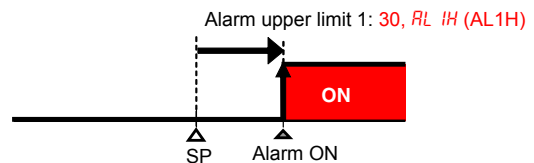
Alarm lower limit 1: 20, *RL 1L* (AL1L)


ON   Alarm ON   SP
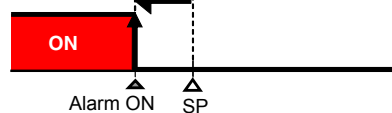
Operation Level

←*RL 1H* (AL1H): Alarm Upper Limit 1

Alarm value: 30°C (example)

Change the set value with the ⊙⊙ (Up and Down) Keys.

Press the ⊙ (Mode) Key several times to display *RL 1L* (AL1L).
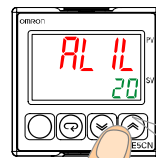
←*RL 1L* (AL1L): Alarm lower limit 1

Alarm value: 20°C (example)

Change the set value with the ⊙⊙ (Up and Down) Keys.

If required, use the ⊙ (Mode) Key and the ⊙⊙ (Up and Down) Keys to repeat steps 2 and 3 and set the alarm values for *RL - 2* (AL-2) (Alarm Value 2, *RL - 3* (AL-3) (Alarm Value 3), *RL 2H* (AL2H) (Alarm Upper Limit 2), *RL 2L* (AL2L) (Alarm Lower Limit 2), *RL 3H* (AL3H) (Alarm Upper Limit 3), and *RL 3L* (AL3L) (Alarm Lower Limit 3). (The number of alarms that is supported depends on the model of Temperature Controller. Some of the alarm parameters may not be displayed.)

(When finished, press the ⊙ (Mode) Key to return to the operation display.)

Setting Temperature Alarms

Step 3   Additional Settings as Required

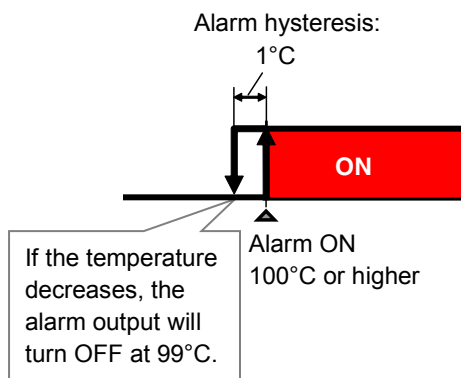## 1   Determining the Alarm Hysteresis (Deviation between ON and OFF)

What Is Alarm Hysteresis?

The alarm hysteresis is the difference between the temperature where the alarm output turns ON and the temperature where it turns OFF.
The default setting is 0.2°C

- Setting Hysteresis for an Upper-limit Alarm (Alarm Type 2)
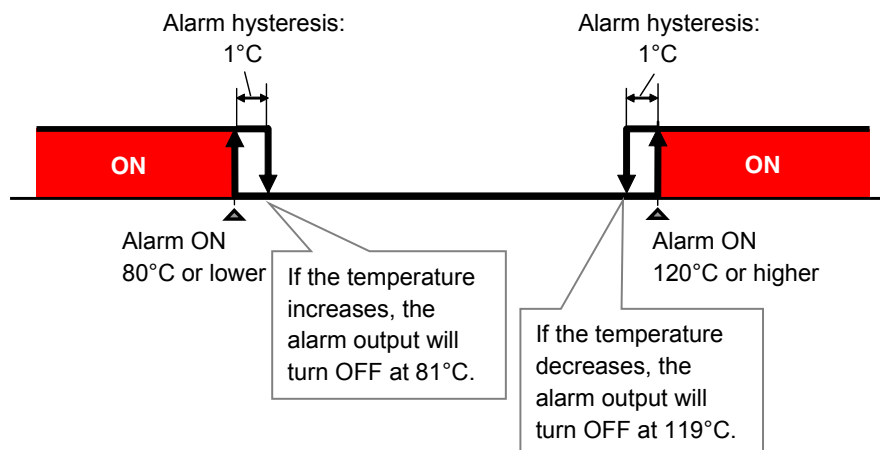
Example: Hysteresis = 1

Alarm hysteresis:
1°C

ON

If the temperature decreases, the alarm output will turn OFF at 99°C.

Alarm ON
100°C or higher

- Setting Hysteresis for a Lower-limit Alarm (Alarm Type 3)

Example: Hysteresis = 1

Alarm hysteresis:
1°C

ON

Alarm ON
100°C or lower

If the temperature increases, the alarm output will turn OFF at 101°C.
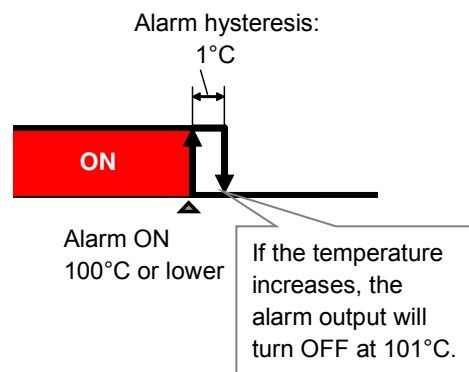
- Setting Hysteresis for an Upper-limit Lower-limit Alarm (Alarm Type 1)

Example: Hysteresis = 1

Alarm hysteresis:
1°C

Alarm hysteresis:
1°C

ON

ON

Alarm ON
80°C or lower

If the temperature increases, the alarm output will turn OFF at 81°C.

Alarm ON
120°C or higher

If the temperature decreases, the alarm output will turn OFF at 119°C.

Note: The same hysteresis is used for the upper and lower limits of an upper-limit and lower-limit alarm and an upper-limit and lower-limit range alarm
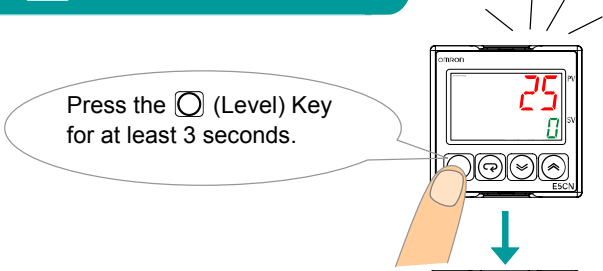
Setting Temperature Alarms

Setting Temperature Alarms

2   Setting the Hysteresis

You set this parameter in the Initial Setting Level. The parameter is set to 0.2°C by default.
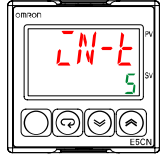
1   Turn ON the power supply.

Operating Display

2   Press the ⬭ Key for at least 3 seconds.
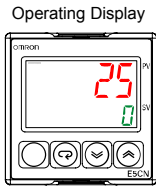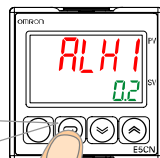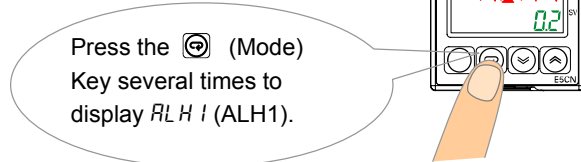
Press the ⬭ (Level) Key for at least 3 seconds.

Initial Setting Level

←*IN-t* (IN-T) will be displayed to show that the Initial Setting Level has been entered.
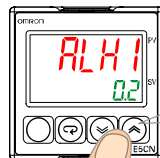
3   Change the parameter with the 🔁 Key.

Initial Setting Level

Press the 🔁 (Mode) Key several times to display *ALH1* (ALH1).

ALH1 (ALH1):
←Indicates the Alarm 1 Hysteresis parameter.
←Default setting is 0.2°C.

4   Set the parameter with the ⬇⬆ Keys.

Initial Setting Level

Change the set value with the ⬇⬆ (Up and Down) Keys

If required, use the 🔁 (Mode) Key and the ⬇⬆ (Up and Down) Keys to repeat steps 3 and 4 and set the hysteresis for *ALH2* (ALH2) (Alarm 2 Hysteresis) and *ALH3* (ALH3) (Alarm 3 Hysteresis) (The number of alarms that is supported depends on the model of Temperature Controller. Some of the alarm parameters may not be displayed.)

(When finished, press the ⬭ (Level) Key for at least 1 second to return to the operation display.)

Setting Temperature Alarms

Reference Information: Other Related Settings

Reversing Outputs

You can reverse the status of an auxiliary output (alarm output) before it is actually output.

With the default setting, the output will be ON when the alarm is ON and OFF when the alarm is OFF (NO: Close in Alarm).
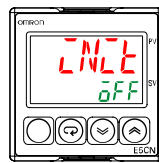
You can change the setting so that the output will be ON when the alarm is OFF and OFF when the alarm is ON (NC: Open in Alarm).

1 Go to the Advanced Function Setting Level.

Refer to page 4-14 for the procedure to enter the Advanced Function Setting Level.
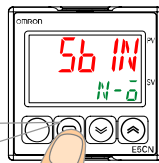
Advanced Function Setting Level

←⌐NⲓⴆⲦ (INIT) will be displayed to show that the Advanced Function Setting Level has been entered.

2 Change the parameter with the ⊕ Key.

Advanced Function Setting Level

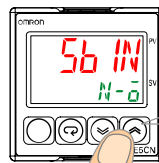�号ⴆ 1N (SB1N): Indicates the Auxiliary
←Output 1 Open in Alarm parameter.

←Default setting is N-ō (N-O): Close in Alarm

Press the ⊕ (Mode) Key several times to display �号ⴆ 1N (SB1N).

3 Set the parameter with the ⊙⊗ Keys.

Advanced Function Setting Level

Change between Open in Alarm and Close in Alarm with the ⊙⊗ (Up and Down) Keys.

N-ō (N-O): Close in Alarm
N-ⴆ (N-C): Open in Alarm

If required, use the ⊕ (Mode) Key and the ⊙⊗ (Up and Down) Keys to repeat steps 2 and 3 and set Open in Alarm or Close in Alarm for �号ⴆ2N (SB2N) (Auxiliary Output 2 Open in Alarm) and �号ⴆ3N (SB3N) (Auxiliary Output 3 Open in Alarm).
(The number of auxiliary outputs that is supported depends on the model of Temperature Controller. Some of the auxiliary output parameters may not be displayed.)

(When finished, press the ◯ (Level) Key for at least 1 second to return to the Initial Setting Level.)

*   For details, refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156).

Setting Temperature Alarms

Setting Temperature Alarms

Alarm Latch

You set a latch for an alarm output. If an alarm latch is enabled, the alarm, once it turns ON, will remain ON regardless of the present temperature until it is cleared by turning OFF the power, pressing the PF Key, or using an event input.

1 Go to the Advanced Function Setting Level.

Refer to page 4-14 for the procedure to enter the Advanced Function Setting Level.
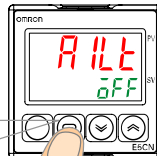
Advanced Function Setting Level
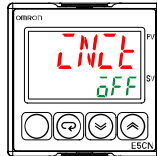
←ᴄ NᴄᴛE (INIT) will be displayed to show that the Advanced Function Setting Level has been entered.

2 Change the paraameter with the ⊚ Key.
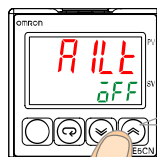
Advanced Function Setting Level

Press the ⊚ (Mode) Key several times to display ᴀ ıʟᴛ (A1LT).

ᴀ ıʟᴛ (A1LT):
←Indicates the Alarm 1 Latch parameter.
←Default setting is ᴏFF (OFF).

3 Set the parameter with the ⊗⊙ Keys.

Advanced Function Setting Level

Change between ON and OFF with the ⊗⊙ (Up and Down) Keys.

If required, use the ⊚ (Mode) Key and the ⊗⊙ (Up and Down) Keys to repeat steps 2 and 3 and set ON/OFF for ᴀᴢʟᴛ (A2LT) (Alarm 2 Latch) and ᴀᴣʟᴛ (A3LT) (Alarm 3 Latch).
(The number of alarms that is supported depends on the model of Temperature Controller. Some of the alarm parameters may not be displayed.)

(When finished, press the ◯ (Level) Key for at least 1 second to return to the Initial Setting Level.)

*   For details, refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156).

Alarm ON Delay and Alarm OFF Delay

Alarm ON Delay: You can delay the time when the output actually turns ON from when the alarm status turns ON.

Alarm OFF Delay: You can delay the time when the output actually turns OFF from when the alarm status turns OFF.

1   Go to the Advanced Function Setting Level.

Refer to page 4-14 for the procedure to enter the Advanced Function Setting Level.

Advanced Function Setting Level

←⌐N⌐ᵗ (INIT) will be displayed to show that the Advanced Function Setting Level has been entered.

2   Change the parameter with the ⊙ Key.

Advanced Function Setting Level

Press the ⊙ (Mode) Key several times to display 𝘙 𝘭ō𝘕 (A1ON).

𝘙 𝘭ō𝘕 (A1ON):
←Indicates the Alarm 1 ON Delay parameter.
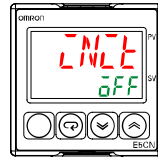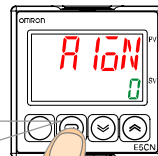
←Default setting is 𝘰 (0): Delay disabled.

3   Set the parameter with the ⊙⊙ Keys.

Advanced Function Setting Level

Change the set value with the ⊙⊙ (Up and Down) Keys.
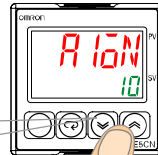
←Alarm 1 ON Delay: 10 seconds (example)

The Alarm OFF Delay parameter follows the Alarm ON Delay parameter.
If required, use the ⊙ (Mode) Key and the ⊙⊙ (Up and Down) Keys to repeat steps 2 and 3 and set the ON/OFF delays for 𝘙2ō𝘕 (A2ON) (Alarm 2 ON Delay), 𝘙3ō𝘕 (A3ON) (Alarm 3 ON Delay), 𝘙 𝘭ō𝘍 (A1OF) (Alarm 1 OFF Delay), 𝘙2ō𝘍 (A2OF) (Alarm 2 OFF Delay), and 𝘙3ō𝘍 (A3OF) (Alarm 3 OFF Delay).
(The number of alarms that is supported depends on the model of Temperature Controller. Some of the alarm parameters may not be displayed.)

(When finished, press the ◯ (Level) Key for at least 1 second to return to the Initial Setting Level.)

Setting Temperature Alarms

* For details, refer to the *E5CN/E5AN/E5EN/E5GN Digital Temperature Controllers User's Manual, Basic Type* (Cat. No. H156).

Alarm Parameter Setting Levels

Power ON
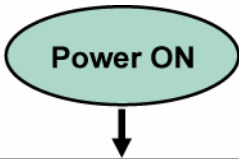
The displays that actually appear depend on the number of alarm outputs supported by the model of Temperature Controller.

Operation Level

One Alarm Value   **Two Alarm Values**

`AL-1` Alarm Value 1   `AL 1H` Alarm Value Upper Limit 1

`AL 1L` Alarm Value Lower Limit 1

`AL-2` Alarm Value 2   `AL 2H` Alarm Value Upper Limit 2

`AL 2L` Alarm Value Lower Limit 2

`AL-3` Alarm Value 3   `AL 3H` Alarm Value Upper Limit 3

`AL 3L` Alarm Value Lower Limit 3
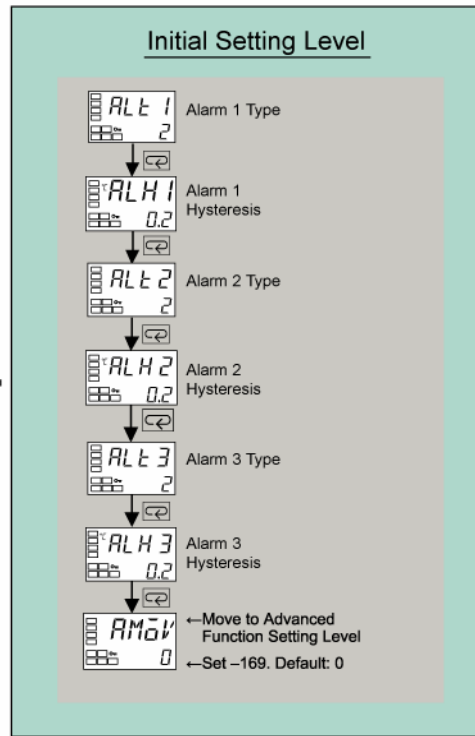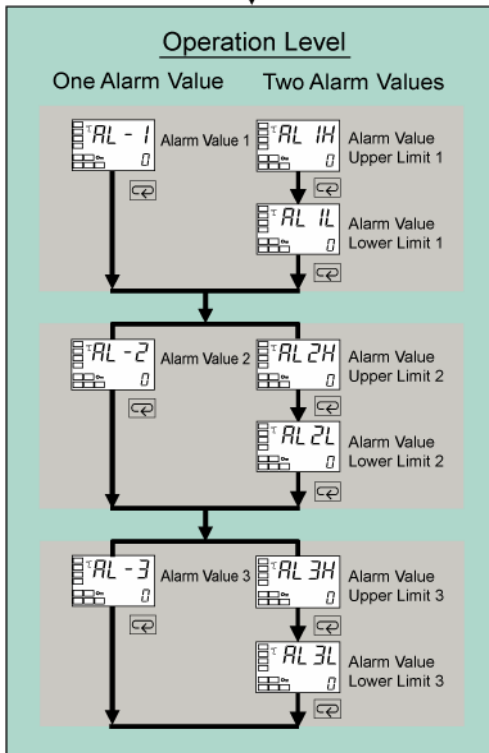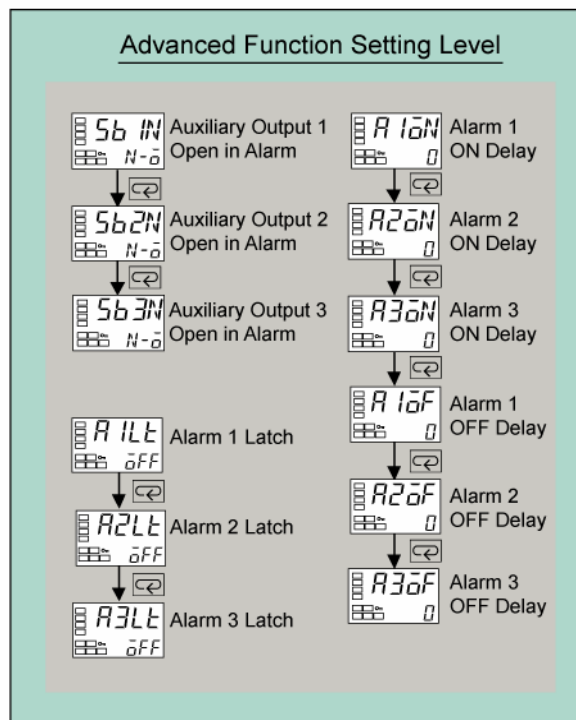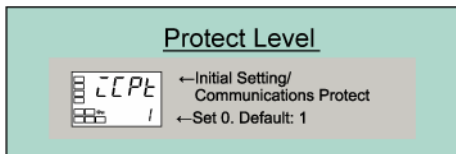
Press ◻ Key for at least 3 s.
Control stops.

Press ◻ Key for at least 1 s.

Press ◻ + ⟲ Keys for at least 3 s.   Press ◻ + ⟲ Keys for at least 1 s.

Initial Setting Level

`ALt 1` Alarm 1 Type — 2

`ALH 1` Alarm 1 Hysteresis — 0.2

`ALt 2` Alarm 2 Type — 2

`ALH 2` Alarm 2 Hysteresis — 0.2

`ALt 3` Alarm 3 Type — 2

`ALH 3` Alarm 3 Hysteresis — 0.2

`AMoV` ← Move to Advanced Function Setting Level — 0 ← Set −169. Default: 0

See lower left of page.   Press ◻ Key for at least 1 s.

Protect Level

`iCPt` ← Initial Setting/Communications Protect — 1 ← Set 0. Default: 1

## Moving to the Advanced Function Setting Level

1. Move from the Operation Level to the Protect Level.
2. Display the Initial Setting/Communications Protect parameter.

   `iCPt` ← Initial Setting/Communications Protect — 1 ← Set 0. Default: 1

3. Change the set value to 0.
4. Move from the Protect Level to the Operation Level to the Initial Setting Level.
5. Display the Move to Advanced Function Setting Level parameter.

   `AMoV` ← Move to Advanced Function Setting Level — 0 ← Set −169. Default: 0

6. Set the set value to −169.
7. Enter the Advanced Function Setting Level.

   `iNit` (INIT) will be displayed.

Advanced Function Setting Level

`Sb 1N` Auxiliary Output 1 Open in Alarm — N-o   `A 1oN` Alarm 1 ON Delay — 0

`Sb2N` Auxiliary Output 2 Open in Alarm — N-o   `A2oN` Alarm 2 ON Delay — 0

`Sb3N` Auxiliary Output 3 Open in Alarm — N-o   `A3oN` Alarm 3 ON Delay — 0

`A 1Lt` Alarm 1 Latch — oFF   `A 1oF` Alarm 1 OFF Delay — 0

`A2Lt` Alarm 2 Latch — oFF   `A2oF` Alarm 2 OFF Delay — 0

`A3Lt` Alarm 3 Latch — oFF   `A3oF` Alarm 3 OFF Delay — 0

Setting Heater Burnout Alarms

The procedure to output heater burnout alarms is given step by step in this section.

A heater burnout alarm operates by detecting the heater current with a current transformer (CT). If the detected current is less than the specified heater burnout detection current even though the control output is ON, a heater burnout will be assumed and an alarm will be output.

Heater burnout alarm: Turns ON if the heater current is below the set value of the heater burnout detection current.
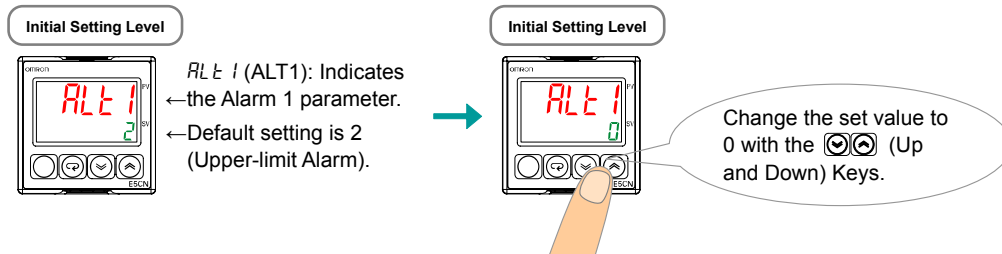
E5☐N

SSR

CT
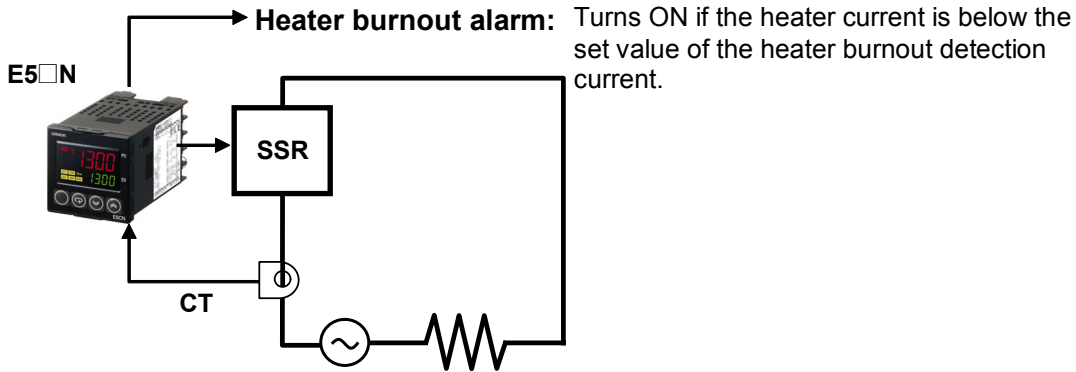
1 Set the Alarm 1 Type parameter to 0.

You can use only alarm 1 for the heater burnout alarm.
To output only the heater burnout alarm from auxiliary output 1, set the alarm type for alarm 1 to 0 (no alarm).
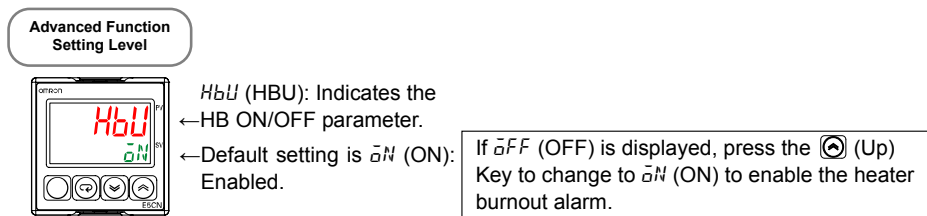If the alarm type is set to any other value, alarm 1 will turn ON both for the heater burnout alarm and a temperature alarm.
You set this parameter in the Initial Setting Level. The parameter is set to 2 (Upper-limit Alarm) by default.

Initial Setting Level

ALt1 (ALT1): Indicates
←the Alarm 1 parameter.
←Default setting is 2
(Upper-limit Alarm).

Initial Setting Level

Change the set value to 0 with the ⊙⊙ (Up and Down) Keys.

2 Confirm that the heater burnout alarm is enabled.

Confirm that the HB ON/OFF parameter in the Advanced Function Setting Level is set to ON (enabled). The default setting is ON.
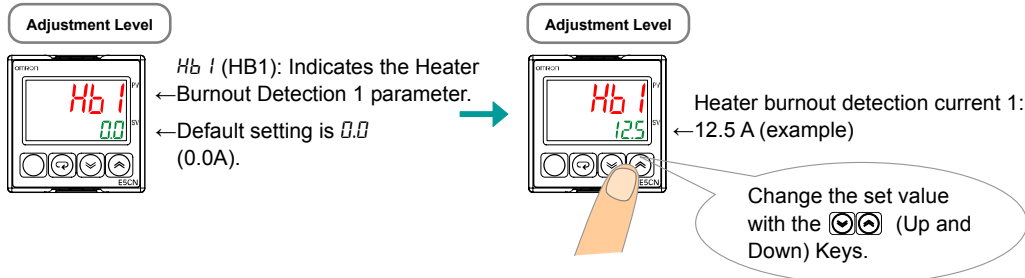
Advanced Function Setting Level

HbU (HBU): Indicates the
←HB ON/OFF parameter.
←Default setting is *oN* (ON):
Enabled.

If *oFF* (OFF) is displayed, press the ⊙ (Up) Key to change to *oN* (ON) to enable the heater burnout alarm.

Setting Heater Burnout Alarms

5-1

Setting Heater Burnout Alarms

3 Set the heater current to treat as a heater burnout.

Set the Heater Burnout Detection 1 parameter in the Adjustment Level to the heater current to treat as a heater burnout.
You set this parameter in the Adjustment Level. The parameter is set to 0.0 A by default.

Adjustment Level

Hb 1 (HB1): Indicates the Heater
←Burnout Detection 1 parameter.

←Default setting is *0.0*
  (0.0A).

Adjustment Level

Heater burnout detection current 1:
←12.5 A (example)

Change the set value with the ⊙⊙ (Up and Down) Keys.
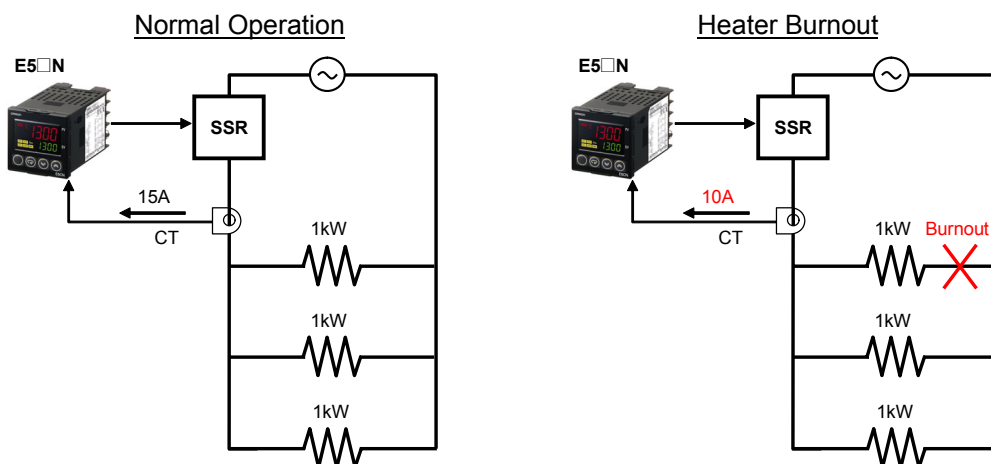
Reference

Calculate the heater burnout detection current as follows:

$$\text{Heater burnout detection current} = \frac{\text{Normal current} + \text{Heater burnout current}}{2}$$

Example: Using Three 200-V, 1-kW Heaters Connected in Parallel
Here, the normal heater current is 15 A, and the heater current for a burnout is 10 A.

$$\text{Heater burnout detection current} = \frac{\text{Normal current 15 A} + \text{Heater burnout current}}{2}$$

$$= \frac{25A}{2} = 25\text{ A}/2 = 12.5\text{ A}$$

Normal Operation

E5☐N

SSR

15A
CT

1kW

1kW

1kW

Heater Burnout

E5☐N

SSR

10A
CT

1kW   Burnout

1kW

1kW

MEMO