



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

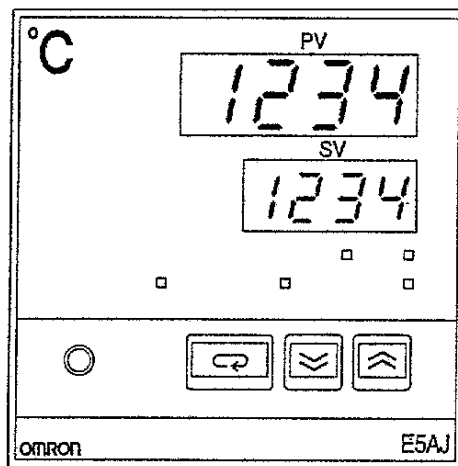
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# E5□J Temperature Controller

## Operation Manual


Cat. No. Z103-E3-1





## Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to the product.

 **DANGER** Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

 **WARNING** Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

 **Caution** Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

## OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

## Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

**Note** Indicates information of particular interest for efficient and convenient operation of the product.

**1, 2, 3...** 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

## © OMRON, 1998

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of OMRON.

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

# TABLE OF CONTENTS

<b>SECTION 1</b>	
<b>Introduction</b> .....	<b>1</b>
1-1 Features .....	2
1-2 Models .....	2
1-3 Specifications .....	4
<b>SECTION 2</b>	
<b>Sensor and Mode Settings</b> .....	<b>9</b>
2-1 Disassembly .....	10
2-2 Output Units .....	10
2-3 Internal Switch Settings .....	11
<b>SECTION 3</b>	
<b>Settings Before Operation</b> .....	<b>17</b>
3-1 Nomenclature .....	18
3-2 Setting Flowchart .....	19
3-3 List of Parameters .....	20
3-4 Parameters on Display Level 0 .....	22
3-5 Parameters on Display Level 1 .....	23
<b>SECTION 4</b>	
<b>Fuzzy Self-tuning</b> .....	<b>27</b>
4-1 Fuzzy Self-tuning Operation .....	28
4-2 Troubleshooting .....	31
4-3 Terminology .....	32
<b>SECTION 5</b>	
<b>Installation and Wiring</b> .....	<b>35</b>
5-1 Installation .....	36
5-2 Wiring .....	37
5-3 Terminal Arrangement .....	38
<b>SECTION 6</b>	
<b>Troubleshooting</b> .....	<b>41</b>
6-1 Error Display and Output .....	42
6-2 Troubleshooting .....	42
<b>SECTION 7</b>	
<b>Event Input Function</b> .....	<b>45</b>
7-1 Event Input Function .....	46
<b>SECTION 8</b>	
<b>Heater Burnout Detection</b> .....	<b>49</b>
8-1 Heater Burnout Detection .....	50
8-2 Heater Burnout Procedures .....	50
8-3 Wiring the Current Transformer .....	51
8-4 Heater Burnout Alarm Value .....	51
<b>SECTION 9</b>	
<b>Engineering Level Settings</b> .....	<b>55</b>
9-1 Engineering Level .....	56
9-2 Engineering Level Parameter List .....	56
9-3 Engineering Level Parameters .....	58

# TABLE OF CONTENTS

<b>SECTION 10</b>	
<b>Auto-tuning</b> .....	<b>63</b>
10-1 Starting Auto-tuning .....	64
10-2 Conditions that Prevent Auto-tuning .....	64
10-3 Force-ending Auto-tuning .....	64
10-4 Changing Parameters during Auto-tuning .....	64
<b>Appendices</b>	
A Dimensions/Mounting Holes .....	65
<b>Index</b> .....	<b>69</b>
<b>Revision History</b> .....	<b>71</b>

## About this Manual:

This manual describes the installation and operation of the Thermac E5□J Temperature Controller and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the Thermac E5□J Temperature Controller.

**Section 1** describes the specifications and basic features of the Thermac E5□J Temperature Controller.

**Section 2** describes the sensor and mode settings of the Thermac E5□J Temperature Controller that are necessary before turning on the Thermac E5□J Temperature Controller.

**Section 3** describes the settings of the Thermac E5□J Temperature Controller that are necessary before operating the Thermac E5□J Temperature Controller.

**Section 4** provides the procedures required to adjust all PID constants using fuzzy self-tuning according to the characteristics of the device for ideal temperature control.

**Section 5** describes the installation and wiring of the Thermac E5□J Temperature Controller.

**Section 6** describes the troubleshooting of the Thermac E5□J Temperature Controller.

**Section 7** describes how the event input function of the Thermac E5□J Temperature Controller works.

**Section 8** describes the basic features of heater burnout detection and necessary steps that should be taken at the time of heater burnout, as well as the method of obtaining heater burnout alarm values.

**Section 9** describes the parameters that can be changed on the engineering level. These parameters should be changed only when the values set before shipping do not suit the application. After these parameters are changed on the engineering level, record the contents of the changes for your future reference.

**Section 10** describes how to execute auto-tuning.

The **Appendix** provides the dimensions and mounting specifications for the various Thermac E5□J Temperature Controller Units.



**WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

# SECTION 1

## Introduction

This section describes the specifications and basic features of the Thermanc E5□J Temperature Controller.

- 1-1 Features ..... 2
- 1-2 Models ..... 2
- 1-3 Specifications ..... 4
  - 1-3-1 Ratings ..... 4
  - 1-3-2 Characteristics ..... 6

# 1-1 Features

The basic features of the Thermac E5□J Temperature Controller are outlined below.

## Fuzzy Self-tuning

When using a conventional temperature controller for ideal temperature control, it is necessary to adjust the PID constants of the temperature controller according to the controlled device. The Thermac E5□J Temperature Controller incorporates a fuzzy self-tuning function, thus allowing ideal temperature control without any adjustment of the PID constants. The user needs only to set the E5□J to the desired temperature for ideal temperature control.

## Auto-tuning

Auto-tuning is also available. It is useful when appropriate results are not obtained through fuzzy self-tuning. (Refer to *Section 10 Auto-tuning*.)

## Event Input Function

It is possible to select a set point out of a maximum of two set values on the E5CJ-□B and four set values on the E5AJ-□B via their event input terminals from the PCs connected to these Temperature Controllers. The control operation of the E5AJ-□B via can be stopped with an event input signal.

## Watertight Construction

The E5□J can be used in places where water is sprayed onto the E5□J, because the front panel of the E5□J assures IP54 when the E5□J is panel-mounted (except for front panel of the E5CJ, which assures IP50). If greater watertightness is required, use the Y92A-□□N, a dedicated watertight cover (sold separately).

## Advanced PID

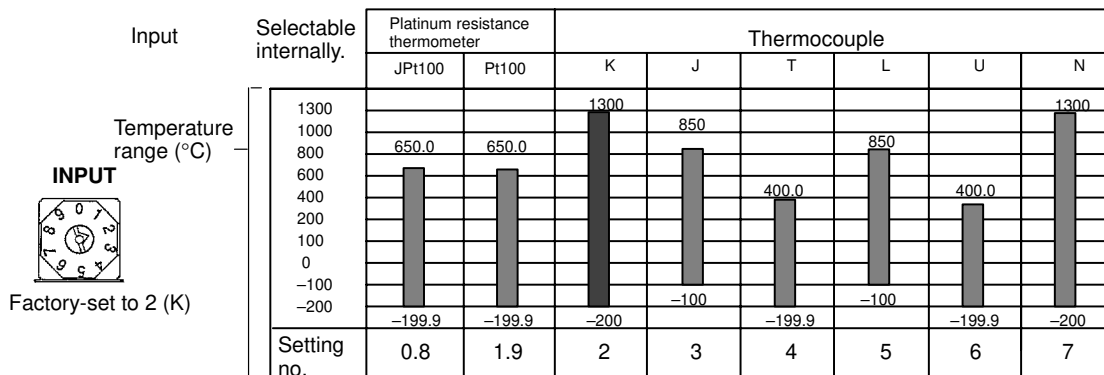
The E5□J incorporates an advanced PID function, which is also incorporated by the Thermac X Temperature Controller. The advanced PID function prevents temperature overshooting the moment the Temperature Controller starts operating, assures a short startup time, and performs ideal temperature control by quickly responding to external disturbances.

## Output Units

The E53-R Relay Unit, E53-Q, E53-Q3, and E53-Q4 Voltage Output Units for driving SSRs, and E53-C3, E53-C3D, E53-V34, and E53-V35 Linear Output Unit can be connected to any E5□J Temperature Controller (except the E5CJ) with ease according to the desired output configuration and application.

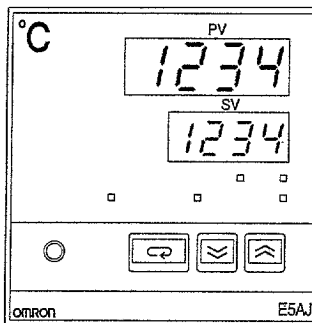
# 1-2 Models

The thermocouples and platinum resistance thermometers listed in the following table can be connected to any Thermac E5□J Temperature Controller.





**E5AJ (Standard Model with Communications Function)**

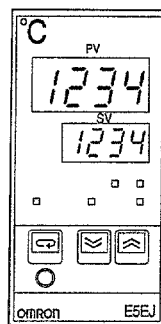


96 X 96mm

Alarm		2 relay output points with heater burnout alarm (see note 1)	
Event input		2 points (set point selection, RUN/STOP) (see note 2)	
Control output		Replaceable Output Unit (sold separately)	
Model	Communications function	---	E5AJ-A2HB
		RS-232C	E5AJ-A2H01
		RS-422	E5AJ-A2H02
		RS-485	E5AJ-A2H03
	Communications Board add-on model		E5AJ-A2HM

- Note**
1. No heater burnout alarm is output if the E53-C3 Current Output Unit is used with the E5AJ.
  2. The event input function is not incorporated by models that have a communications function.

**E5EJ (Standard Model with Communications Function)**

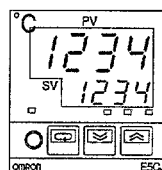


48 X 96mm

Alarm		2 relay output points with heater burnout alarm (see note 1)	
Event input		2 points (set point selection, RUN/STOP) (see note 2)	
Control output		Replaceable Output Unit (sold separately)	
Model	Communications function	---	E5EJ-A2HB
		RS-232C	E5EJ-A2H01
		RS-422	E5EJ-A2H02
		RS-485	E5EJ-A2H03
	Communications Board add-on model		E5EJ-A2HM

- Note**
1. No heater burnout alarm is output if the Linear Output Unit is used with the E5EJ.
  2. The event input function is not incorporated by models that have a communications function.

E5CJ (Simple and Standard Models)



48 X 48mm

Type	Simple model type		Standard model type		
Alarm	---		2 relay output points with the same common. (see note 1)		
Heater burnout alarm	---		Yes (see note)		
Event input	---		1 point (set point selection)		
Model	Control output	Relay output	E5CJ-R	E5CJ-R2	E5CJ-R2HB
		Voltage output	E5CJ-Q	E5CJ-Q2	E5CJ-Q2HB
		Current output	E5CJ-C	E5CJ-C2	E5CJ-C2B

**Note** No heater burnout alarm is output if a current control output is used.

Communications Boards

Communications	RS-232C	RS-422	RS-485
Model	E53-J01	E53-J02	E53-J03

**Note** For details, refer to the *E5AJ/E5EJ Communications Manual (Z102)*.

## 1-3 Specifications

### 1-3-1 Ratings

E5□J

Item		Specification	
Supply voltage		100 to 240 VAC, 50 or 60 Hz	24 V AC/DC, 50 or 60 Hz
Operating voltage range		85 to 110% of supply voltage	
Power consumption	E5AJ	10 VA (at 100 VAC) to 14 VA (at 240 VAC)	10 VA (at 24 VAC) 6 W (at 24 VDC)
	E5EJ	10 VA (at 100 VAC) to 14 VA (at 240 VAC)	
	E5CJ	10 VA (at 100 VAC) to 12 VA (at 240 VAC)	
Input		Thermocouples (K, J, T, L, U, and N) and platinum resistance thermometers (JPt100 and Pt100)	
CT input		Dedicated CT (E54-CT1 or E54-CT3)	
Control output	E5AJ/E5EJ		Replaceable Output Unit (sold separately)
	E5CJ	Relay output	SPST-NO, 3 A at 250 VAC (resistive load)
		Voltage output	20 mA at 12 VDC (with short-circuit protection)
E5CJ	Current output	4 to 20 mA DC with a load of 600 Ω max. and a resolution of approx. 2600	
Control mode		ON/OFF or advanced PID with fuzzy self-tuning and auto-tuning	
Alarm output	E5AJ/E5EJ		2 SPST-NO relay output points, 3 A at 250 VAC (resistive load)
	E5CJ		2 SPST-NO relay output points (with the same common), 1 A at 250 VAC (resistive load)
Setting method		Digital setting with Up Key and Down Key	

Item		Specification
Indication method	E5AJ	All digital indication (PV: Red, 15 mm; SV: Green, 10.5 mm)
	E5EJ	All digital indication (PV: Red, 14 mm; SV: Green, 9.5 mm)
	E5CJ	All digital indication (PV: Red, 12 mm, SV: Green 8.0 mm)
Event input		Contact input: ON: 1 kΩ max. OFF: 100 kΩ min. No-contact input: ON: residual voltage of 3 V max; OFF: current leakage of 1 mA max.
Other function		<ul style="list-style-type: none"> <li>• Key protect</li> <li>• Cooling operation/Heating operation</li> <li>• Heater burnout alarm</li> </ul> Model with event input (E5□J-□B) <ul style="list-style-type: none"> <li>• Set point selection (set point x 2)</li> <li>• RUN/STOP (E5AJ-□B and E5EJ-□B only)</li> </ul>
Ambient operating temperature		-10°C to 55°C (with no condensation)
Ambient operating humidity		35 to 85%
Storage temperature		-25°C to 65°C (with no condensation)

**Output Units**

Model	Specification
E53-R Relay Output Unit	SPDT (SPST-NO when used with the E5□J), 5 A at 250 VAC (resistive load)
E53-Q Voltage Output Unit	NPN, 40 mA at 12 VDC (with short-circuit protection)
E53-Q3 Voltage Output Unit	NPN, 20 mA at 24 VDC (with short-circuit protection)
E53-Q4 Voltage Output Unit	PNP, 20 mA at 24 VDC (with short-circuit protection)
E53-C3 Linear Output Unit	4 to 20 mA DC with a load of 600 Ω max. (with a resolution of approximately 2600 when used with the E5□J) (see note)
E53-C3D Linear Output Unit	0 to 20 mA DC with a load of 600 Ω max. (with a resolution of approximately 2600 when used with the E5□J)
E53-V34 Linear Output Unit	0 to 10 VDC with a load of 1 kΩ min. (with a resolution of approximately 2600 when used with the E5□J)
E53-V35 Linear Output Unit	0 to 5 VDC with a load of 1 kΩ min. (with a resolution of approximately 2600 when used with the E5□J)

**Note** The E53-C cannot be used.

**Current Transformer (CT)**

Item	Specification
Maximum continuous heater current	50 A
Dielectric strength	1,000 VAC
Vibration resistance	50 Hz, approx. 98 m/s <sup>2</sup> (10G)
Weight	E54-CT1: Approx. 11.5 g E54-CT3: Approx. 50 g

## 1-3-2 Characteristics

## E5□J

Item		Specification
Indication accuracy		±0.5% or ±1°C whichever is larger ± 1 digit max. Thermocouple K, T, or N at a temperature of –100°C; thermocouple U at ± 2°C ± 1 digit max.
Hysteresis (for ON/OFF control)		0.1 to 999.9°C/°F (in units of 0.1°C/°F)
Proportional band		0.1 to 999.9°C/°F (in units of 0.1°C/°F)
Integral time		0 to 3999 s (in units of 1 s)
Derivative time		0 to 3999 s (in units of 1 s)
Control period		Relay or voltage output: 1 to 99 s (in units of 1 s)
Manual reset value (I = 0)		0.0 to 100.0% (in units of 0.1%)
Alarm setting range		With K, J, L, or N input: –1999 to 9999° C/°F (in units of 1°C/°F) With JPt100, Pt100, T, or U input: –199.9 to 999.9° C/°F (in units of 0.1°C/°F)
Sampling period		500 ms
Output refresh period		500 ms
Display refresh period		500 ms
Insulation resistance		20 MΩ min. at 500 VDC (measured with an Output Unit)
Dielectric strength		2000 VAC, 50/60 Hz for 1 min. between charged terminals different from each other in polarity
Vibration resistance	Malfunction	10 to 55 Hz, 9.8 m/s <sup>2</sup> (1G) 10 min. in X, Y, and Z directions
	Destruction	10 to 55 Hz, 19.6 m/s <sup>2</sup> (2G) 2 hr. in X, Y, and Z directions
Shock resistance	Malfunction	196 m/s <sup>2</sup> (20G) 3 times each in 3-axis 6 directions (98 m/s <sup>2</sup> (10G) for the relay)
	Destruction	294 m/s <sup>2</sup> (30G) 3 times each in 3-axis 6 directions
Weight	E5AJ	Approx. 360 g; mounting bracket: approx. 65 g
	E5EJ	Approx. 280 g; mounting bracket: approx. 65 g
	E5CJ	Approx. 170 g; adapter: approx. 10 g
Enclosure rating		Front panel: E5AJ/E5EJ: IEC standard IP54 E5CJ: IEC standard IP50 (see note 1)  Rear case: IEC standard IP20  Terminals: IEC standard IP00
Memory Protection		Non-volatile memory
EMC		Emission Enclosure: EN55011 Group 1 class A Emission AC Mains: EN55011 Group 1 class A Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz) Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3) Immunity Burst: EN61000-4-4: 2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
Approved standards		UL1092, CSA C22.2 No. 142 Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC1010-1) (see note 2) Conforms to VDE0106/part 100 (Finger Protection), when the separately-ordered terminal cover is mounted.

- Note**
1. The model numbers of the exclusive watertight covers conforming to IP66, NEMA4 are as follows:  
For E5AJ: Y92A-96N; For E5CJ: Y92A-48N; For E5EJ: Y92A-49N
  2. Basic insulation is between the input and output.

**Output Unit**

Model	Life expectancy	
E53-R Relay Output Unit	Mechanical	10,000,000 times min.
	Electrical	100,000 times min.

**Heater Burnout Alarm**

Item	Specification
Max. heater current	Single-phase 50 A VAC (see note 1)
Heater current value display accuracy	±5% FS ± 1 digit max.
Heater burnout alarm setting range	0.1 to 49.9 A (in units of 0.1 A) (see note 2)
Min. detection ON time	190 ms (see note 3)

- Note**
1. Use the K2CU-F□□A-□GS (with gate input terminals) for the detection of three-phase heater burnout.
  2. The heater burnout alarm is always OFF if the alarm is set to 0.0 A and always ON if the alarm is set to 50.0 A.
  3. No heater burnout detection or heater current value measurement is possible if the control output is ON for less than 190 ms.

**Model with Communications Function**

Refer to the *E5AJ/E5EJ Communications Manual (Z102)* for details.

Item		Specification
Interface		RS-232C, RS-422, RS-485
Communications method		Half duplex
Synchronization method		Start-stop synchronization (non-synchronization)
Communications speed		1200, 2400, 4800, 9600, and 19200 bps
Communications item	Writing to Thermac J	Set point, alarm value, heater burnout alarm value, proportional band, derivative time, integral time, and input shift value
	Reading from Thermac J	Process value, set point, alarm value, heater burnout alarm value, heater current value, proportional band, derivative time, integral time, output value, input shift and error code

## SECTION 2

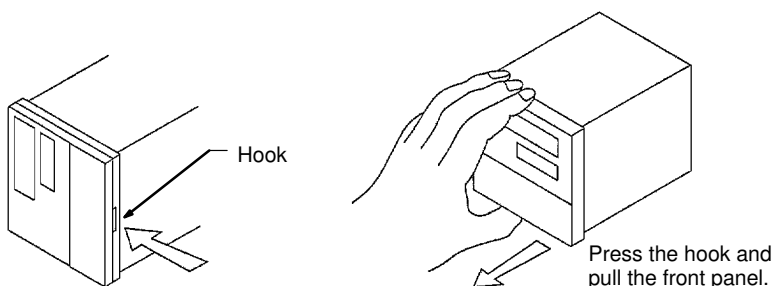
# Sensor and Mode Settings

This section describes the sensor and mode settings of the Thermac E5□J Temperature Controller that are necessary before turning on the Thermac E5□J Temperature Controller.

2-1	Disassembly .....	10
2-2	Output Units .....	10
2-3	Internal Switch Settings .....	11
2-3-1	Internal Switch Positions .....	11
2-3-2	Input Type Selector Setting .....	12
2-3-3	Alarm Mode Setting .....	13
2-3-4	Standby Sequence .....	14
2-3-5	Function Selector Settings .....	14
2-3-6	Key Protection Switch Settings .....	15

## 2-1 Disassembly

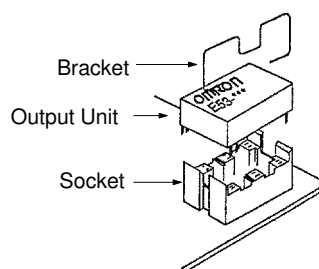
Before turning on the E5□J, set its sensor type and control mode with the internal selectors. Refer to the following illustrations for disassembling the E5□J to access the internal switch settings.



After setting the internal switches, insert the internal mechanism into the case until the front panel snaps with the hook.

## 2-2 Output Units

Select the Output Unit according to the application and mount the Output Unit into the socket on the E5□J PCB of the as shown in the following illustration. The E5CJ does not require an Output Unit. Refer to *1-3 Specifications* for the output ratings of the E5□J.



### Output Units

The following Output Units are available.

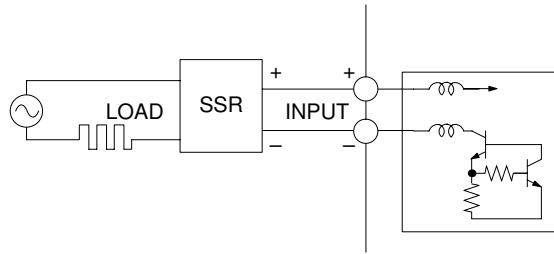
Model	Rating
E53-R Relay Output Unit	SPDT, 5 A at 250 VAC (resistive load)
E53-Q Voltage Output Unit	NPN model, 40 mA at 12 VDC (with short-circuit protecting circuit)
E53-Q3 Voltage Output Unit	NPN model, 20 mA at 24 VDC (with short-circuit protecting circuit)
E53-Q4 Voltage Output Unit	PNP model, 20 mA at 24 VDC (with short-circuit protecting circuit)
E53-C3 Linear Output Unit	4 to 20 mA DC with a load of 600 $\Omega$ max.
E53-C3D Linear Output Unit	0 to 20 mA DC with a load of 600 $\Omega$ max.
E53-V34 Linear Output Unit	0 to 10 VDC with a load of 1 k $\Omega$ min.
E53-V35 Linear Output Unit	0 to 5 VDC with a load of 1 k $\Omega$ min.

After mounting the Output Unit, be sure to secure it with the mounting bracket provided with the Output Unit.

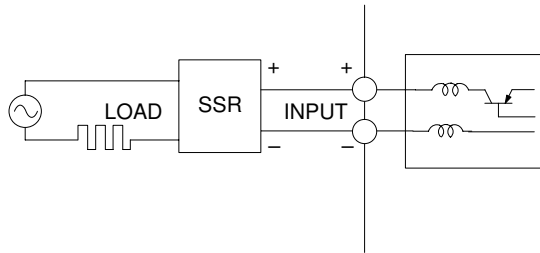
If the E53-C3, E53-C3D, E53-V34, and E53-V35 Linear Output Unit is used for control output, no heater burnout alarm is available.

Each Voltage Output Unit is used for driving an SSR as shown in the following illustrations.

NPN Model: E53-Q (40 mA at 12 VDC) and E53-Q3 (20 mA at 24 VDC)



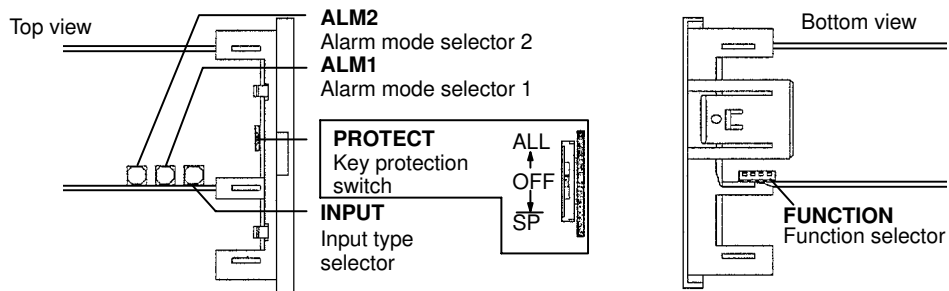
PNP Model: E53-Q4 (20 mA at 24 VDC)



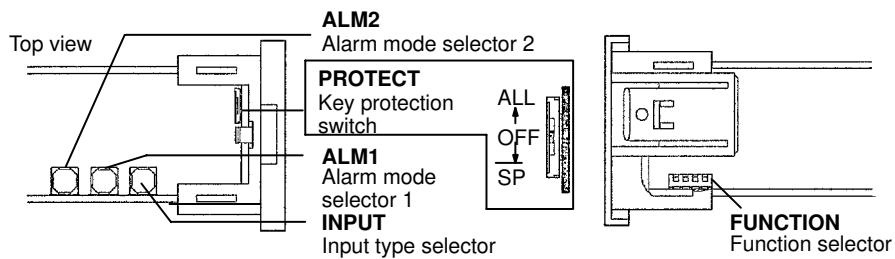
## 2-3 Internal Switch Settings

### 2-3-1 Internal Switch Positions

E5AJ

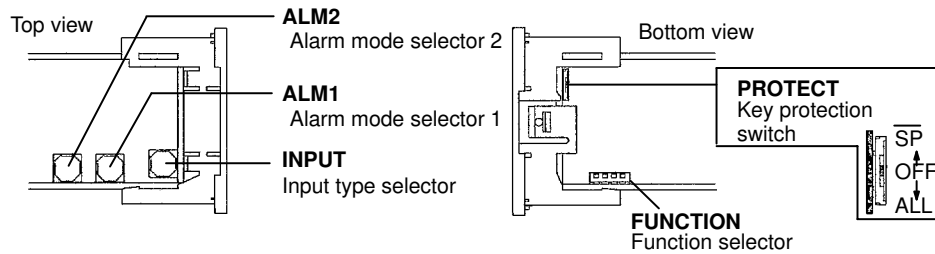


E5EJ





E5CJ



**Note** The E5CJ with no alarm does not incorporate ALM1 or ALM2.

### 2-3-2 Input Type Selector Setting

The input type selector is factory-set to 2 (K). Refer to the following table for the selection of the desired sensor.



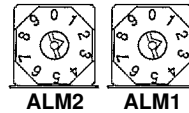
Selector no.	Input	Set temperature range		Specified temperature range	
		°C	°F	°C	°F
0, 8	JPt100	-199.9 to 650.0	-199.9 to 999.9	-199.9 to 735.0	-199.9 to 999.9
1, 9	Pt100	-199.9 to 650.0	-199.9 to 999.9	-199.9 to 735.0	-199.9 to 999.9
2	K	-200 to 1300	-300 to 2300	-350 to 1450	-560 to 2560
3	J	-100 to 850	-100 to 1500	-195 to 945	-260 to 1660
4	T	-199.9 to 400.0	-199.9 to 700.0	-199.9 to 460.0	-199.9 to 790.0
5	L	-100 to 850	-100 to 1500	-195 to 945	-260 to 1660
6	U	-199.9 to 400.0	-199.9 to 700.0	-199.9 to 460.0	-199.9 to 790.0
7	N	-200 to 1300	-300 to 2300	-350 to 1450	-560 to 2560

**Note** The resistance of the JPt100 at a temperature of 100°C is 139.16 Ω and that of the Pt100 at a temperature of 100°C is 138.50 Ω.

- 1, 2, 3...**
1. To use Fahrenheit, set function selector 4 to ON, which is usually set to OFF.
  2. Insert the internal mechanism into the case.
  3. Turn on the E5□J so that d-u will be displayed on the process value display. Then press the Up Key so that f will be displayed on the set value display.
  4. Turn off the power in two seconds.
  5. Draw the internal mechanism from the case and set function selector 4 to OFF and turn on the E5□J.

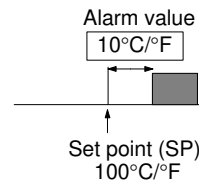
### 2-3-3 Alarm Mode Setting

ALM1 and ALM2 are both factory-set to 2 (upper limit alarm). Refer to the following table for the selection of the desired alarm mode.

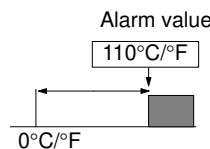


Selector no.	Alarm mode	Alarm output		Setting range
		Positive alarm set value	Negative alarm set value	
0	No alarm function	OFF		---
1	Upper and lower limit alarm (deviation)		Always ON	-1999 to 9999 or -199.9 to 999.9 (the decimal position varies with the input type)
2	Upper limit alarm (deviation)			
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			

If the alarm mode switch is set to 1 to 7, the alarm value is set with the deviation width from the set point as shown in the following diagram.

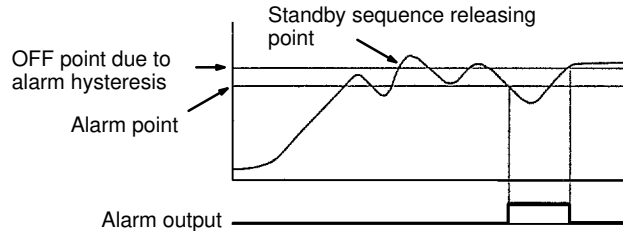


If the alarm mode switch is set to 8 or 9, the alarm value is set with the absolute value from 0°C/°F as shown in the following diagram.



### 2-3-4 Standby Sequence

The alarm output is ON the moment the E5□J is turned on because the process value is within the alarm range. To prevent this, select a mode with a standby sequence. If a mode with a await sequence is selected, the alarm output will not be ON even if the process value is within the alarm range unless the process value once goes out of the alarm range. The following diagram shows the operation of the E5□J in lower limit alarm mode with a standby sequence.



It is possible to change the alarm hysteresis (set to 0.2°C before shipping) on the engineering level.

### 2-3-5 Function Selector Settings

All the function selector pins are factory-set to OFF.



Refer to the following table for function switch setting.

		Pin no.	1	2	3	4
Output operation	Cooling operation (Normal)		ON	---	---	---
	Heating operation (Reverse)		OFF			
Control mode	ON/OFF control		---	ON	See note	
	Advanced PID		---	OFF	ON	
	Advanced PID with fuzzy self-tuning		---	OFF	OFF	
Level	Engineering level		---	---	---	ON
	Normal operation		---	---	---	OFF

**Note** The E5□J will be in ON/OFF control mode regardless of the setting of pin 3 if pin 2 is set to ON.

#### Output Operation (Pin 1)

##### Heating Operation

If pin 1 of the E5□J is set to OFF, when the process temperature is lower than the set point, the E5□J will operate so that the heater output will increase.

##### Cooling Operation

If pin 1 of the E5□J is set to ON, when the process temperature is higher than the set point, the E5□J will operate so that the output of cooling water will increase.

#### Control Mode (Pins 2 and 3)

##### ON/OFF Control

The ON/OFF control is also called two-position operation.

##### Advanced PID

Set the E5□J in this mode for P, PI, or PD control or if the most suitable PID constants for the controlled device are already known.

##### Advanced PID with Fuzzy Self-tuning

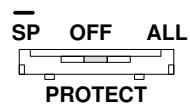
Set the E5□J in this mode so that Fuzzy self-tuning adjusts the PID constants to the most suitable values according to the controlled device for ideal temperature control. Refer to *Section 4 Fuzzy Self-tuning* for details.

#### Level (Pin 4)

Set pin 4 to ON if it is necessary to change any parameter on the engineering level. Set this pin to OFF for normal operation.

## 2-3-6 Key Protection Switch Settings

The key protection switch is used to prohibit parameter changes as shown in the following table. The key protection switch is factory-set to OFF.



Mode	Protection
$\overline{\text{SP}}$	Prohibits all set value changes except the set point. The Level Key is not available. The Down Key and Up Key are available only for set point setting.
OFF	All keys are available.
ALL	Prohibits all set value changes. The Level Key, Down Key, and Up Key are not available.

# SECTION 3

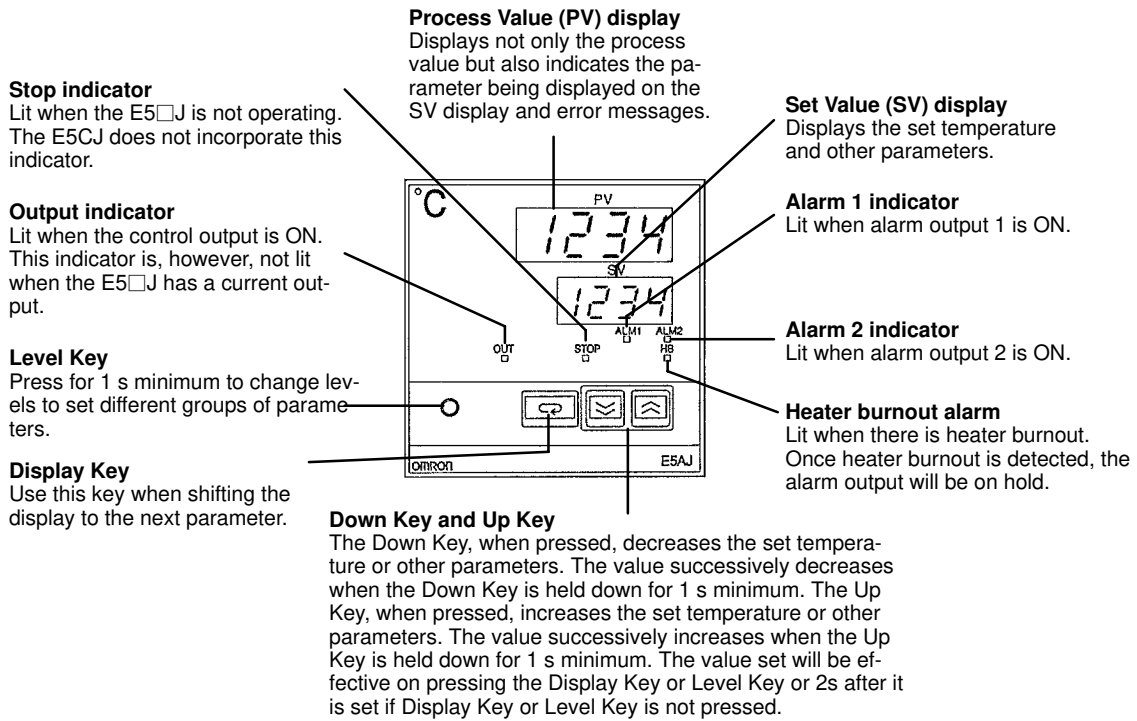
## Settings Before Operation

This section describes the settings of the Thermac E5□J Temperature Controller that are necessary before operating the Thermac E5□J Temperature Controller.

3-1	Nomenclature .....	18
3-2	Setting Flowchart .....	19
3-3	List of Parameters .....	20
3-4	Parameters on Display Level 0 .....	22
3-5	Parameters on Display Level 1 .....	23

### 3-1 Nomenclature

The following is the front panel of the E5AJ-A2HB. The front panels of the E5EJ and E5CJ are similar to the front panel of the E5AJ-A2HB.



**Note** Refer to the *E5AJ/E5EJ Communications Manual* for the operation of E5□J models incorporating a communications function.

### 3-2 Setting Flowchart

The Thermac E5□J Temperature Controller starts control at the set point and continues controlling even while set values are being input for each display level. Therefore, when operating the E5□J after inputting all the set values, turn the power supply to the Temperature Controller off and then on again.

All parameters for the E5□J Temperature Controller are divided into three levels according to how frequently they are used.

**Display Level 0**

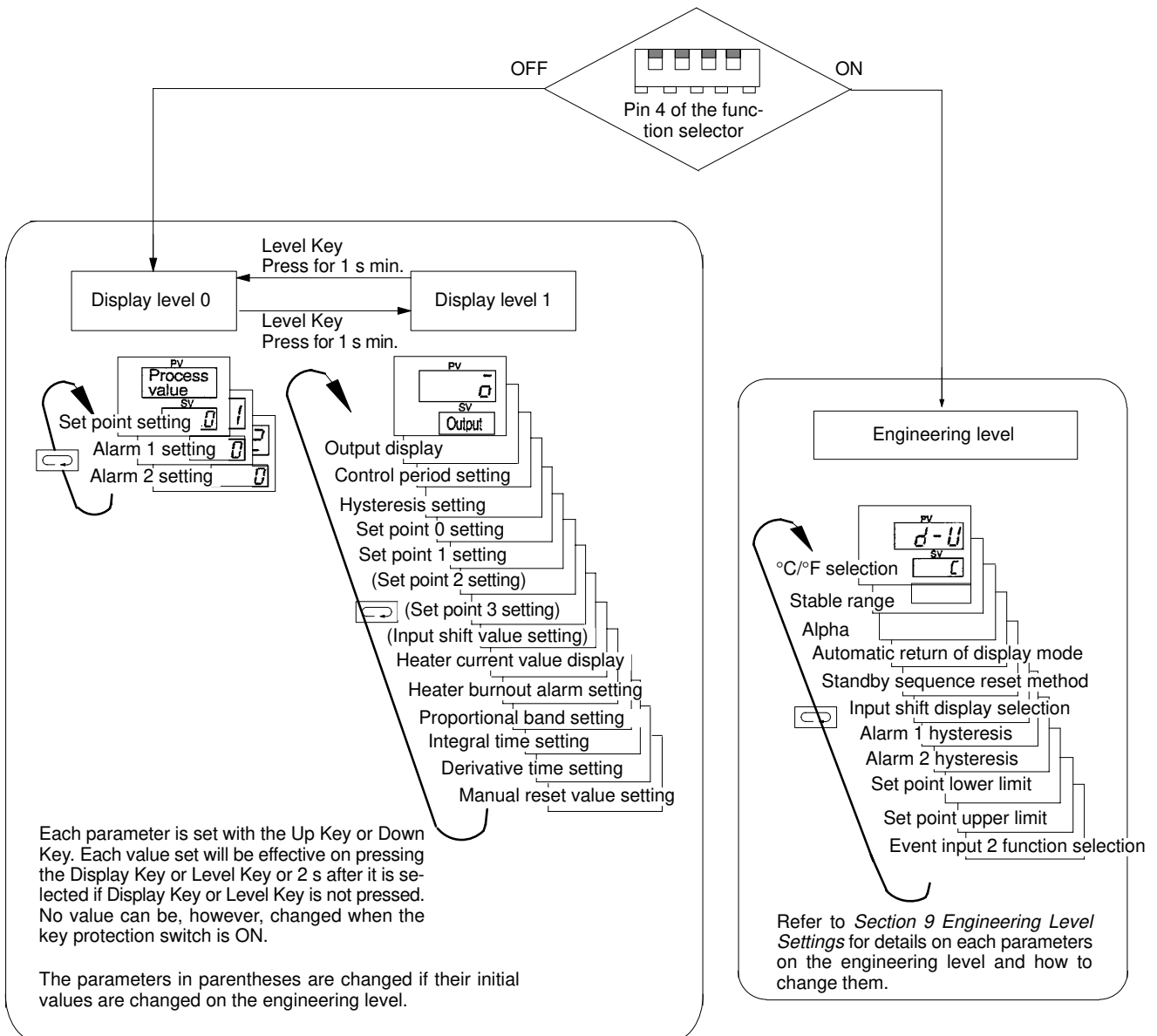
Parameters that are changed frequently are ranked as display level 0 parameters.

**Display level 1**

Parameters that are not changed frequently are ranked as display level 1 parameters.




**Engineering Level**

Parameters that are changed with only a few applications are ranked as engineering level parameters.



### 3-3 List of Parameters









#### Display Level 0

Display	Name	Setting range	Setting before shipping	Remarks	
	---	Process value display and set point setting	Set point lower limit to set point upper limit (°C/°F)	0	The present set point is displayed and can be changed if the E5□J incorporates an event input function
	AL-1	Alarm set value 1	-1999 to 9999 °C/°F The decimal position varies with the kind of input.	0	Not displayed if alarm mode switch 1 is set to 0.
	AL-2	Alarm set value 2	-1999 to 9999 °C/°F The decimal position varies with the kind of input.	0	Not displayed if alarm mode switch 2 is set to 0.







To go to the next level, press the Level Key for 1 s min.

**Note** The values shown in Fahrenheit are applicable only for E5□J-□□□□-F Models.

#### Display Level 1

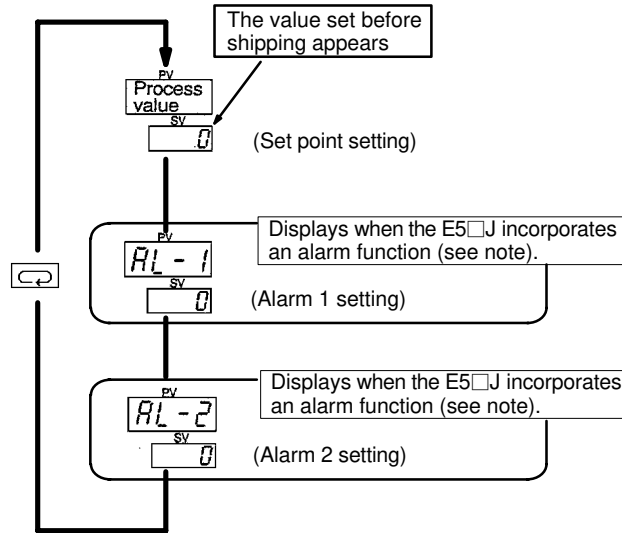
Display	Name	Setting/Display Range	Setting before shipping	Remarks	
	0	Output value display	0.0 to 100.0 %		
	CP	Control period	1 to 99 s	20	Displayed and can be set if the E5□J in PID control operation has relay control output or voltage control output.
	HYS	Hysteresis	0.1 to 999.9 °C/°F	1.0 (1.8)	Displayed and can be set when the E5□J is in ON/OFF control operation.
	SP-0	Set point 0	Set point lower limit to set point upper limit (°C/°F)	0	For models incorporating an event input function.
	SP-1	Set point 1	Set point lower limit to set point upper limit (°C/°F)	0	For models incorporating an event input function.
	SP-2	Set point 2	Set point lower limit to set point upper limit (°C/°F)	0	For models incorporating an event input 2 function. Displayed and can be set if the default value is changed on the engineering level.
	SP-3	Set point 3	Set point lower limit to set point upper limit (°C/°F)	0	For models incorporating an event input 2 function. Displayed and can be set if the default value is changed on the engineering level.
	in-S	Input shift value	-199.9 to 999.9 °C/°F	0.0	Displayed and can be set if the default value is changed on the engineering level.



Display	Name		Setting/Display Range	Setting before shipping	Remarks
	Ct	Heater current value display	0.0 to 55.0 A If the current exceeds 55.0 A, ffff will be displayed on the set value display.		For models incorporating a heater burnout alarm. Nothing is displayed if the E5□J has current control output.
	Hb	Heater burnout alarm value	0.0 to 50.0 A 0.0: Always OFF 50.0: Always ON	0.0	For models incorporating a heater burnout alarm. Nothing is displayed if the E5□J has current control output.
	P	Proportional band	0.1 to 999.9 °C/°F	8.0 (14.4)	Displayed and can be set when the E5□J is in advanced PID operation.
	i	Integral time	0 to 3999 s 0: No integral operation	233	Displayed and can be set when the E5□J is in advanced PID operation.
	d	Derivative time	0 to 3999 s 0: No derivative operation	40	Displayed and can be set when the E5□J is in advanced PID operation.
	oFr	Manual reset value	0.0 to 100.0 %	50.0	Displayed and can be set if the integral time is set to 0 when the E5□J is in advanced PID operation.

**Note** The value in the parentheses is the E5□J-□□□□-F setting before shipping.

### 3-4 Parameters on Display Level 0



**Note:** The process value will not be displayed if the alarm mode switch is set to 0 or if the E5□J does not incorporate any alarm.

#### Set Point Setting (°C or °F)

It is possible to alter the present set point (SP0 or SP1).

#### AL-1 and AL-2 (°C or °F)

The alarm mode is factory-set to the upper limit alarm (deviation). It is possible to change the alarm mode with the alarm mode selector. Refer to 2-3-3 Alarm Mode Setting. The alarm value can be set with the deviation width or absolute value according to the alarm mode.

Deviation alarm	Absolute value alarm
Upper and lower limit alarm, upper limit alarm, lower limit alarm and upper and lower limit range alarm.	Absolute value upper limit alarm and absolute value lower limit alarm.
Set with the deviation width from the set point Alarm value 10°C/°F Set point (SP) 100°C/°F	Set with the absolute value from 0°C/°F. Alarm value 110°C/°F 0°C/°F