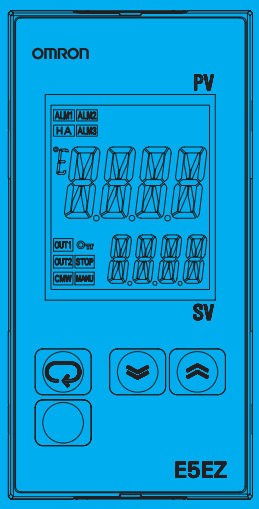
OMRON

E5CZ
E5CZ-U
E5AZ
E5EZ

Digital Temperature Controller
with 11-segment Display



User's Manual

Cat. No. H207-E1-01

E5CZ/E5CZ-U/E5AZ/E5EZ
Digital Temperature Controller

User's Manual

Produced September 2008

Preface

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

The E5CZ, E5CZ-U, E5AZ, and E5EZ are Digital Temperature Controllers. The E5CZ and E5CZ-U are both compact temperature controllers, with the E5CZ featuring screw terminal connections, and the E5CZ-U featuring socket pin connections. The main functions and characteristics of these Digital Temperature Controllers are as follows:

- Any of the following types of input can be used: thermocouple, platinum resistance thermometer, infrared sensor, analog voltage, or analog current.
- Depth of only 78mm
- Either standard or heating/cooling control can be performed.
- Both auto-tuning and self-tuning are supported.
- Event inputs can be used to switch set points (multi-SP function), switch between RUN and STOP status, and switch between automatic and manual operation. (Event input are not applicable to the E5CZ-U.)
- Heater burnout detection and HS alarms are supported. (Applicable to E5CZ, E5AZ, and E5EZ models with heater burnout detection function.)
- Communications are supported. (Applicable to E5CZ, E5AZ, and E5EZ models with communications.)
- The structure of the E5CZ,E5AZ, and E5EZ is waterproof (IP66: indoor use). (Not applicable to the E5CZ-U).
- Conforms to UL, CSA, and IEC safety standards and EMC Directive.

  When using the E53-AZB, E53-AZ01 or E53-AZ03 Option Unit with the E5AZ-□3□M□□ to satisfy the immunity burst requirements in the EN61326 standard, always connect a ZCAT2035-0930 Clamlp Filter (manufactured by TDK) to the cable for terminals 11,12 and 13.

This manual describes the E5CZ, E5CZ-U, E5AZ, and E5EZ. Read this manual thoroughly and be sure you understand it before attempting to use the Digital Temperature Controller and use the Digital Temperature Controller correctly according to the information provided. Keep this manual in a safe place for easy reference. Refer to the following manual for further information on communications: *E5CZ/E5AZ/E5EZ Digital Temperature Controller Communications Manual* (Cat. No. H208).

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.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

■Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the product.

The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.

The following notation is used.

⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, is likely to result in minor or moderate injury or in property damage.

■Symbols

Symbol		Meaning
Caution		**General Caution** Indicates non-specific general cautions, warnings, and dangers.
		**Electrical Shock Caution** Indicates possibility of electric shock under specific conditions.
Prohibition		**General Prohibition** Indicates non-specific general prohibitions.
Mandatory Caution		**General Caution** Indicates non-specific general cautions, warnings, and dangers.

■Safety Precautions

⚠ CAUTION	
Do not touch the terminals while power is being supplied. Doing so may occasionally result in minor injury due to electric shock.	
Do not allow pieces of metal, wire clippings, or fine metallic shavings or filings from installation to enter the product. Doing so may occasionally result in electric shock, fire, or malfunction.	
Do not use the product where subject to flammable or explosive gas. Otherwise, minor injury from explosion may occasionally occur.	
Never disassemble, modify, or repair the product or touch any of the internal parts. Minor electric shock, fire, or malfunction may occasionally occur.	
CAUTION - Risk of Fire and Electric Shock a) This product is UL recognized as Open Type Process Control Equipment. It must be mounted in an enclosure that does not allow fire to escape externally. b) More than one disconnect switch may be required to de-energize the equipment before servicing the product. c) Signal inputs are SELV, limited energy.*1 d) Caution: To reduce the risk of fire or electric shock, do not interconnect the outputs of different Class 2circuits.*2	
If the output relays are used past their life expectancy, contact fusing or burning may occasionally occur. Always consider the application conditions and use the output relays within their rated load and electrical life expectancy. The life expectancy of output relays varies considerably with the output load and switching conditions.	

*1 A SELV circuit is one separated from the power supply with double insulation or reinforced insulation, that does not exceed 30 V r.m.s. and 42.4 V peak or 60 VDC.

*2 A class 2 power supply is one tested and certified by UL as having the current and voltage of the secondary output restricted to specific levels.

⚠ CAUTION	
Tighten the terminal screws to between 0.74 and 0.90 N·m. Loose screws may occasionally result in fire. (See note.)	
Set the parameters of the product so that they are suitable for the system being controlled. If they are not suitable, unexpected operation may occasionally result in property damage or accidents.	
A malfunction in the Temperature Controller may occasionally make control operations impossible or prevent alarm outputs, resulting in property damage. To maintain safety in the event of malfunction of the Temperature Controller, take appropriate safety measures, such as installing a monitoring device on a separate line.	
When inserting the body of the Temperature Controller into the case,confirm that the hooks on the top and bottom are securely engaged with the case. If the body of the Temperature Controller is not inserted properly, faulty contact in the terminal section or reduced water resistance may occasionally result in fire or mal-function.	

Note The tightening torque for E5CZ-U is 0.5 N·m.

Precautions for Safe Use

Be sure to observe the following precautions to prevent operation failure, malfunction, or adverse affects on the performance and functions of the product. Not doing so may occasionally result in unexpected events.

1) The product is specifically designed for indoor use only. Do not use the product outdoors or in any of the following places.
   - Places directly subject to heat radiated from heating equipment.
   - Places subject to splashing liquid or oil atmosphere.
   - Places subject to direct sunlight.
   - Places subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).
   - Places subject to intense temperature change.
   - Places subject to icing and condensation.
   - Places subject to vibration and large shocks.
2) Use and store the Digital Temperature Controller within the rated ambient temperature and humidity.
   Gang-mounting two or more temperature controllers, or mounting temperature controllers above each other may cause heat to build up inside the temperature controllers, which will shorten their service life. In such a case, use forced cooling by fans or other means of air ventilation to cool down the Digital Temperature Controllers.
3) To allow heat to escape, do not block the area around the product. Do not block the ventilation holes on the product.
4) Be sure to wire properly with correct polarity of terminals.
5) Use the specified size (M3.5, width 7.2 mm or less) crimped terminals for wiring. For open-wired connection, use stranded or solid copper wires with a gage of AWG24 to AWG14 (equal to a cross-sectional area of 0.205 to 2.081 mm^2). (The stripping length is 5 to 6 mm.) Up to two wires of the same size and type or two crimp terminals can be inserted into a single terminal.
6) Do not wire the terminals which are not used.
7) To avoid inductive noise, keep the wiring for the Digital Temperature Controller's terminal block away from power cables carry high voltages or large currents. Also, do not wire power lines together with or parallel to Digital Temperature Controller wiring. Using shielded cables and using separate conduits or ducts is recommended.
   Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular, motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component).
   When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the temperature controller.
   Allow as much space as possible between the Digital Temperature Controller and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.
8) Use this product within the rated load and power supply.
9) Make sure that the rated voltage is attained within 2 seconds of turning ON the power by using a switch or relay contact. If the voltage is applied gradually, the power may not be reset or output malfunctions may occur.
10) Make sure that the Temperature Controller has 30 minutes or more to warm up after turning ON the power before starting actual control operations to ensure the correct temperature display.
11) When executing self-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Digital Temperature Controller. If power is turned ON for the Digital Temperature Controller before turning ON power for the load, self-tuning will not be performed properly and optimum control will not be achieved.
12) A switch or circuit breaker should be provided close to this unit. The switch or circuit breaker should be within easy reach of the operator, and must be marked as a disconnecting means for this unit.
13) Always turn OFF the power supply before pulling out the interior of the product, and never touch nor apply shock to the terminals or electronic components. When inserting the interior of the product, do not allow the electronic components to touch the case.

14) Do not use paint thinner or similar chemical to clean with. Use standard grade alcohol.
15) Design system (control panel, etc) considering the 2 seconds of delay that the controller's output to be set after power ON.
16) The output may turn OFF when shifting to certain levels. Take this into consideration when performing control.
17) The number of EEPROM write operations is limited. Therefore, use RAM write mode when frequently overwriting data during communications or other operations.
18) Always touch a grounded piece of metal before touching the Digital Temperature Controller to discharge static electricity from your body.
19) Control output that is voltage output is not isolated from the internal circuits.When using a grounded thermocouple,do not connect any of the control output terminals to ground. (Doing so may result in an unwanted circuit path, causing error in the measured temperature.)
20) When replacing the body of the Digital Temperature Controller, check the condition of the terminals. If corroded terminals are used, contact failure in the terminals may cause the temperature inside the Digital Temperature Controller to increase, possibly resulting in fire. If the terminals are corroded, replace the case as well.
21) Use suitable tools when taking the Digital Temperature Controller apart for disposal. Sharp parts inside the Digital Temperature Controller may cause injury.
22) Check the orientation of the connectors on the Conversion Cable before connecting the Conversion Cable. Do not force a connector if it does not connect smoothly. Using excessive force may damage the connector.
23) Do not place heavy object on the Conversion Cable, bend the cable past its natural bending radius, or pull on the cable with undue force.
24) Do not connect or disconnect the Conversion Cable while communications are in progress. Product faults or malfunction may occur.
25) Make sure that the Conversion Cable's metal components are not touching the external power terminals.
26) Do not touch the connectors on the Conversion Cable with wet hands. Electrical shock may result.

● Service Life

Use the Temperature Controller within the following temperature and humidity ranges:
Temperature: −10 to 55°C (with no icing or condensation), Humidity: 25% to 85%

If the Controller is installed inside a control board, the ambient temperature must be kept to under 55°C, including the temperature around the Controller.

The service life of electronic devices like Temperature Controllers is determined not only by the number of times the relay is switched but also by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature, the shorter the service life and, the lower the temperature, the longer the service life. Therefore, the service life can be extended by lowering the temperature of the Temperature Controller.

When two or more Temperature Controllers are mounted horizontally close to each other or vertically next to one another, the internal temperature will increase due to heat radiated by the Temperature Controllers and the service life will decrease. In such a case, use forced cooling by fans or other means of air ventilation to cool down the Temperature Controllers. When providing forced cooling, however, be careful not to cool down the terminals sections alone to avoid measurement errors.

● Ambient Noise

To avoid inductive noise, keep the wiring for the Digital Temperature Controller's terminal block wiring away from power cables carrying high voltages or large currents. Also, do not wire power lines together with or parallel to Digital Temperature Controller wiring. Using shielded cables and using separate conduits or ducts is recommended.
Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular, motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component). When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the Temperature Controller.
Allow as much space as possible between the Digital Temperature Controller and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.

● Ensuring Measurement Accuracy

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

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

Mount the Temperature Controller so that it is horizontally level.

If the measurement accuracy is low, check to see if input shift has been set correctly.

● Waterproofing

The degree of protection is as shown below. Sections without any specification on their degree of protection or those with IP□0 are not waterproof.

E5CZ E5AZ E5EZ	Front panel: IP66 (Indoor Use). Rear case: IP20, Terminal section: IP00
E5CZ-U	Front panel: Equivalent to IP50, rear case: IP20, Terminals: IP00

Precautions for Operation

1) It takes approximately 2 seconds for the outputs to turn ON from after the power supply is turned ON. Due consideration must be given to this time when incorporating Temperature Controllers into a control panel or similar device.
2) Make sure that the Temperature Controller has 30 minutes or more to warm up after turning ON the power before starting actual control operations to ensure the correct temperature display.
3) When executing self-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature Controller before turning ON power for the load, self-tuning will not be performed properly and optimum control will not be achieved. When starting operation after the Temperature Controller has warmed up, turn OFF the power and then turn it ON again at the same time as turning ON power for the load. (Instead of turning the Temperature Controller OFF and ON again, switching from STOP mode to RUN mode can also be used.)
4) Avoid using the Controller in places near a radio, television set, or wireless installing. The Controller may cause radio disturbance for these devices.

Preparations for Use

Be sure to thoroughly read and understand the manual provided with the product, and check the following points.

Timing	Check point	Details
Purchasing the product	Product appearance	After purchase, check that the product and packaging are not dented or otherwise damaged. Damaged internal parts may prevent optimum control.
	Product model and specifications	Make sure that the purchased product meets the required specifications.
Setting the Unit	Product installation location	Provide sufficient space around the product for heat dissipation. Do not block the vents on the product.
Wiring	Terminal wiring	Do not subject the terminal screws to excessive stress (force) when tightening them. Make sure that there are no loose screws after tightening terminal screws to the specified torque of 0.74 to 0.90 N·m.(See note.)
		Be sure to confirm the polarity for each terminal before wiring the terminal block and connectors.
	Power supply inputs	Wire the power supply inputs correctly. Incorrect wiring will result in damage to the internal circuits.
Operating environment	Ambient temperature	The ambient operating temperature for the product is −10 to 55°C (with no condensation or icing). To extend the service life of the product, install it in a location with an ambient temperature as low as possible. In locations exposed to high temperatures, if necessary, cool the products using a fan or other cooling method.
	Vibration and shock	Check whether the standards related to shock and vibration are satisfied at the installation environment. (Install the product in locations where the conductors will not be subject to vibration or shock.)
	Foreign particles	Install the product in a location that is not subject to liquid or foreign particles entering the product.

Note The tightening torque for E5CZ-U is 0.5 N·m.

■Upgraded Functions

The functions of the Controller have been upgraded in models manufactured in October 2008 or later. The design of the front panel can be used to differentiate between the previous and upgraded models.

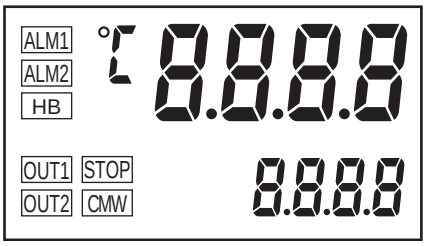
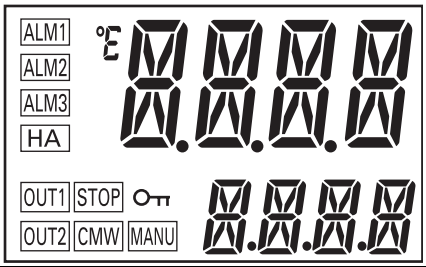
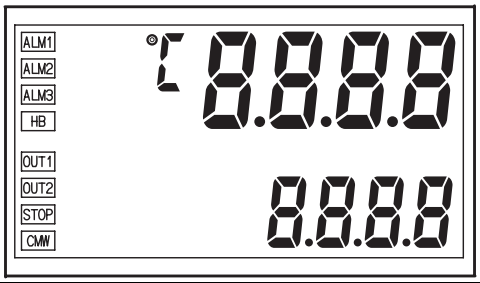
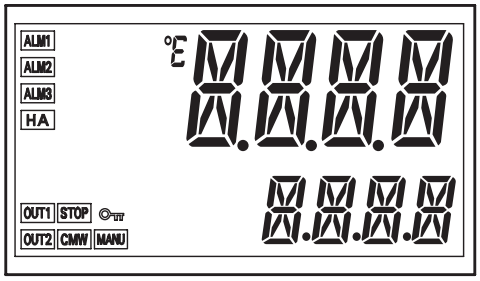
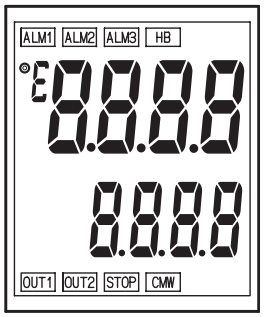
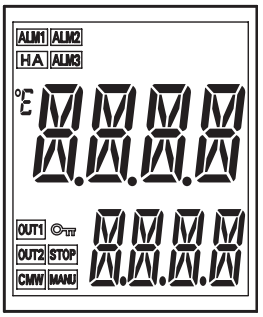
• E5CZ

The upgraded Controllers are basically compatible with the previous Controllers. Terminal arrangements, terminal sizes, and panel mounting depth have not been changed. The E5CZ-U plug-in type is newly released.

• E5AZ/EZ

Although the upgraded Controllers are compatible with the previous Controllers, terminal arrangements have been changed. Terminal sizes and panel mounting depth have not been changed.

Other changes outlined in the following tables. Refer to relevant pages in the manual for details.

	Previous models	Improved function models
E5CZ/CZ-U		
E5AZ		
E5EZ		

■Ratings

Item		Previous models	Improved models
Power consumption	E5CZ	7 VA (100 to 240 VAC, 50/60 Hz) 4 VA/3 W (24 VAC, 50/60 Hz or 24 VDC)	7.5 VA (100 to 240 VAC, 50/60 Hz) 5.5 VA/3.5 W (24 VAC, 50/60 Hz or 24 VDC)
	E5CZ-U	(No models with plug-in type)	6 VA (100 to 240 VAC, 50/60 Hz) 4.5 VA/2.5 W (24 VAC, 50/60 Hz or 24 VDC)
	E5AZ	9 VA (100 to 240 VAC, 50/60 Hz) 5 VA/4 W (24 VAC, 50/60 Hz or 24 VDC)	8.5 VA 6 VA/4 W
	E5EZ	9 VA (100 to 240 VAC, 50/60 Hz) 5 VA/4 W (24 VAC, 50/60 Hz or 24 VDC)	8.5 VA 6 VA/4 W
Sensor input		(No models with analog inputs)	E5□Z-□□□□L□(Models with analog inputs added.) Current input: 4 to 20 mA or 0 to 20 mA Voltage input: 1 to 5 V, 0 to 5 V, or 0 to 10 V

Item		Previous models	Improved models
Control output 1	Relay	E5CZ-R□□□ SPST-NO, 250 VAC, 3 A (resistive load) Electrical life: 100,000 operations.	E5CZ-R□□□□ SPST-NO, 250 VAC, 3 A (resistive load) Electrical life: 100,000 operations.
		(No models with plug-in type)	E5CZ-R□□□U SPDT, 250 VAC, 3 A (resistive load) Electrical life: 100,000 operations.
		E5AZ-R□□□ SPST-NO, 250 VAC, 5 A (resistive load) Electrical life: 100,000 operations.	E5AZ-R□□□□□ SPST-NO, 250 VAC, 5 A (resistive load) Electrical life: 100,000 operations.
		E5EZ-R□□□ SPST-NO, 250 VAC, 5 A (resistive load) Electrical life: 100,000 operations.	E5EZ-R□□□□□ SPST-NO, 250 VAC, 5 A (resistive load) Electrical life: 100,000 operations.
	Voltage	E5CZ-Q□□□ 12 VDC ±15% (PNP) Max. load current: 21 mA With short-circuit protection	E5CZ-Q□□□□ 12 VDC ±15% (PNP) Max. load current: 21 mA With short-circuit protection
		(No models with plug-in type)	E5CZ-Q□□□U 12 VDC ±15% (PNP) Max. load current: 21 mA With short-circuit protection
		E5AZ-Q□□□ 12 VDC +15%/−20% (PNP) Max. load current: 40 mA With short-circuit protection	E5AZ-Q□□□□□ 12 VDC +15%/−20% (PNP) Max. load current: 40 mA With short-circuit protection
		E5EZ-Q□□□ 12 VDC +15%/−20% (PNP) Max. load current: 40 mA With short-circuit protection	E5EZ-Q□□□□□ 12 VDC +15%/−20% (PNP) Max. load current: 40 mA With short-circuit protection
	Current	E5CZ-C□□□ 4 to 20 mA DC Load: 600 Ω max. Resolution: Approx. 2,600	E5CZ-C□□□□ 4 to 20 mA DC,0 to 20 mA DC. Load: 600 Ω max. Resolution: Approx. 2,700
		E5AZ-C□□□ 4 to 20 mA DC Load: 600 Ω max. Resolution: Approx. 2,600	E5AZ-C□□□□ 4 to 20 mA DC,0 to 20 mA DC. Load: 600 Ω max. Resolution: Approx. 2,700
		E5EZ-C□□□ 4 to 20 mA DC Load: 600 Ω max. Resolution: Approx. 2,600	E5EZ-C□□□□ 4 to 20 mA DC,0 to 20 mA DC. Load: 600 Ω max. Resolution: Approx. 2,700
Display method	E5CZ/CZ-U	7-segment digital display and single-LED indicators	11-segment digital display and single-LED indicator (Improved visibility) (A 7-segment digital display also possible.)
	E5AZ/EZ	7-segment digital display and single-LED indicators	11-segment digital display and single-LED indicator (Improved visibility) (A 7-segment digital display also possible.)
Transfer output		(No models with transfer outputs)	E5□Z-C□□□□ Allocated to current output 4 to 20 mA DC,0 to 20 mA DC. Load: 600 Ω max. Resolution: Approx. 2,700 (4 to 20 mA DC)

■Other Functions

Item	Previous models	Improved models
Display	---	Display character switch (7-segment/11-segment)
Input	Temperature input shift (1-point shift for temperature input)	Temperature input shift (2-point shift also possible for temperature input)
Output	---	Manual outputs
	---	Loop break alarm
Control	Control period: 1 to 99 s	Control period: 0.5 or 1 to 99 s
Alarm	---	Alarm delays

■Characteristics

Item	Previous models	Improved models
Sampling period	500 ms	250 ms

■Communications Specifications

Item	Previous models	Improved models
Communications protocols	CompoWay/F (SYSWAY)	CompoWay/F (SYSWAY), Modbus
Communications baud rate	1200, 2400, 4800, 9600, 19200 bps	1200, 2400, 4800, 9600, 19200, 38400 bps

■Heater Burnout/HS Alarm Characteristics

Item		Previous models	Improved models
Maximum heater current	E5CZ	E5CZ-□□M□ with E53-CNH□N Single-phase 50 A AC	E5CZ-□□M□□ with E53-CZH□ Single-phase 50 A AC
	E5AZ/EZ	E5□Z-A3 + E53-AZM + E53-AZH, E5□Z-R3 + E53-AZM + E53-AZH, E5□Z-Q3 + E53-AZM + E53-AZH Single-phase 50 A AC	E5□Z-□□H□□□ Single-phase 50 A AC
HS alarm		---	HS alarm

Conventions Used in This Manual

Meanings of Abbreviations

The following abbreviations are used in parameter names, figures and in text explanations. These abbreviations mean the following:

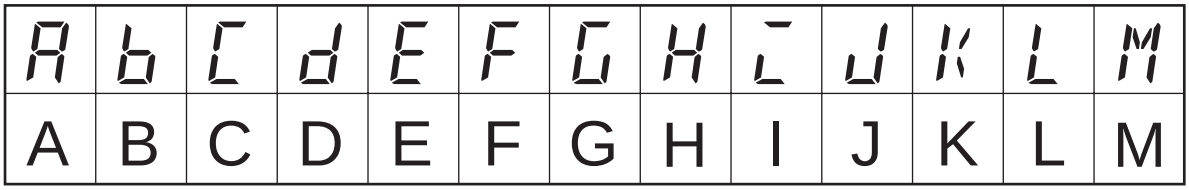
Symbol	Term
PV	Process value
SP	Set point
SV	Set value
AT	Auto-tuning
ST	Self-tuning
HB	Heater burnout
HS	Heater short (See note 1.)
LBA	Loop burnout alarm
EU	Engineering unit (See note 2.)

Note: (1) A heater short indicates that the heater remains ON even when the control output from the Temperature Controller is OFF because the SSR has failed or for any other reason.

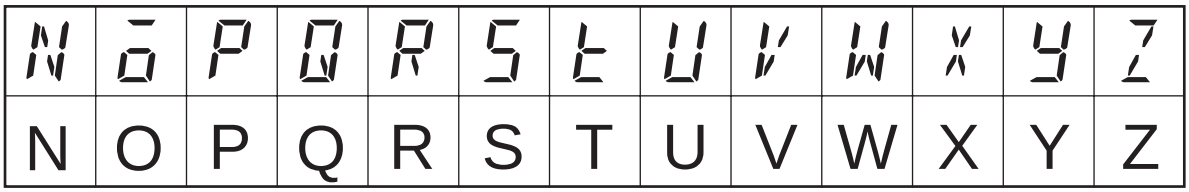
(2) "EU" stands for Engineering Unit. EU is used as the minimum unit for engineering units such as °C, m, and g. The size of EU varies according to the input type.
For example, when the input temperature setting range is –200 to +1300°C, 1 EU is 1°C, and when the input temperature setting range is –20.0 to +500.0°C, 1 EU is 0.1°C.
For analog inputs, the size of EU varies according to the decimal point position of the scaling setting, and 1 EU becomes the minimum scaling unit.

How to Read Display Symbols

The following tables show the correspondence between the symbols displayed on the displays and alphabet characters. The default is for 11-segment displays.

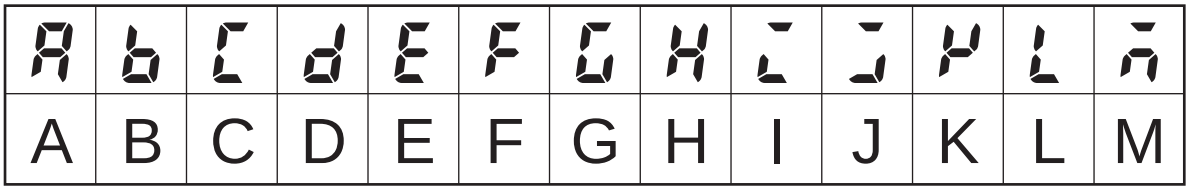


A	B	C	D	E	F	G	H	I	J	K	L	M

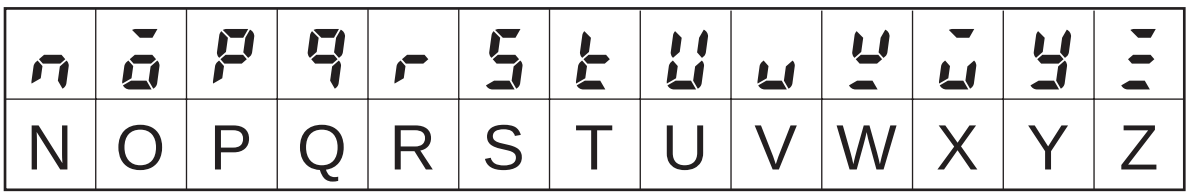


N	O	P	Q	R	S	T	U	V	W	X	Y	Z

The “character select” parameter in the advanced function setting level can be turned OFF to display the following 7-segment characters.



A	B	C	D	E	F	G	H	I	J	K	L	M



N	O	P	Q	R	S	T	U	V	W	X	Y	Z

TABLE OF CONTENTS

TABLE OF CONTENTS

About this Manual:

This manual describes the E5CZ/CZ-U/AZ/EZ Digital Temperature Controllers and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to set up or operate an E5CZ/CZ-U/AZ/EZ Digital Temperature Controller.

• Overview

Section 1 introduces the features, components, and main specifications of the E5CZ/CZ-U/AZ/EZ Digital Temperature Controllers.

• Setup

Section 2 describes the work required to prepare the E5CZ/CZ-U/AZ/EZ Digital Temperature Controllers for operation, including installation and wiring.

• Basic Operations

Section 3 describes the basic operation of the E5CZ/CZ-U/AZ/EZ Digital Temperature Controllers, including key operations to set parameters and descriptions of display elements based on specific control examples.

Section 5 describes the individual parameters used to set up, control, and monitor operation.

• Operations for Applications

Section 4 describes scaling, the SP ramp function, and other special functions that can be used to make the most of the functionality of the E5CZ/CZ-U/AZ/EZ Digital Temperature Controllers.

Section 5 describes the individual parameters used to setup, control, and monitor operation.

• Appendices

The ***Appendix*** provides information for easy reference, including lists of parameters and settings.

⚠ **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.

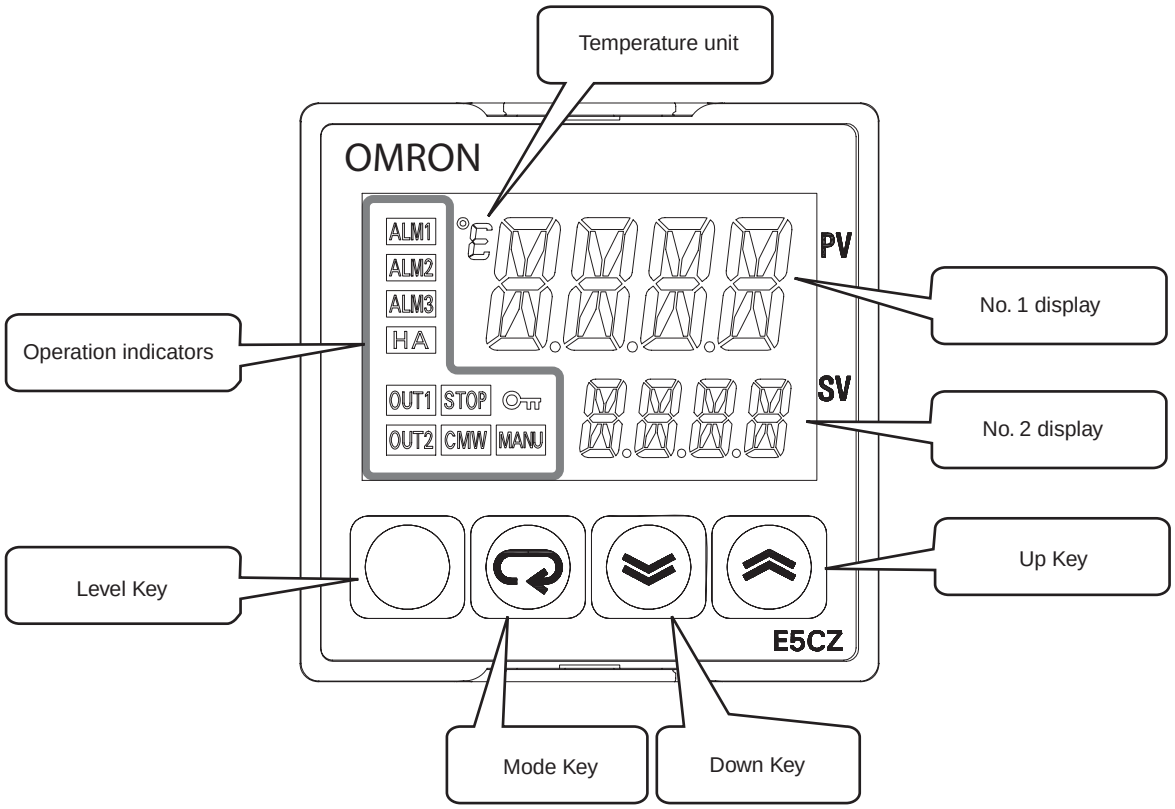
SECTION 1
Introduction

This section introduces the features, components, and main specifications of the E5CZ and E5CZ-U Digital Temperature Controllers.

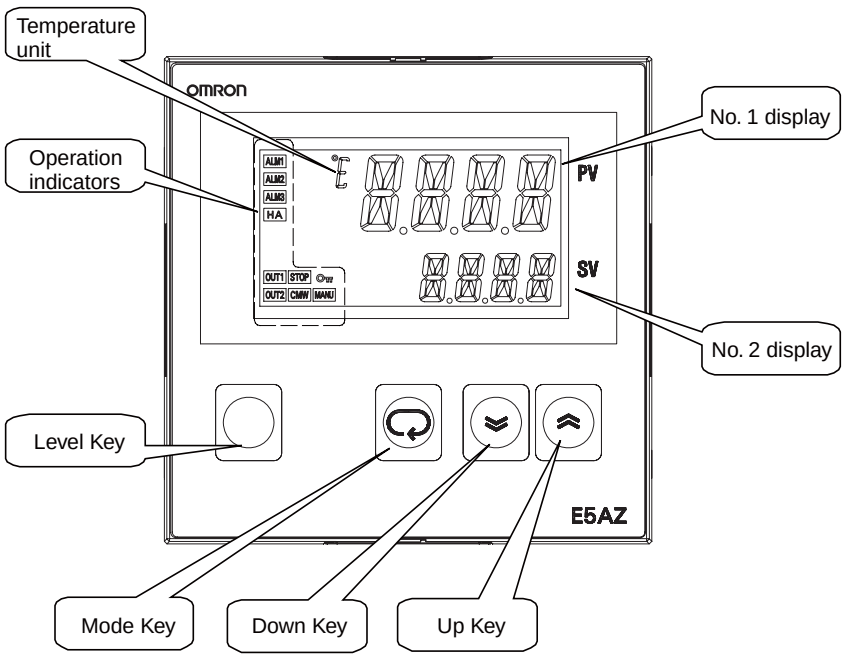
1-1 Names of Parts

1-1-1 Front Panel

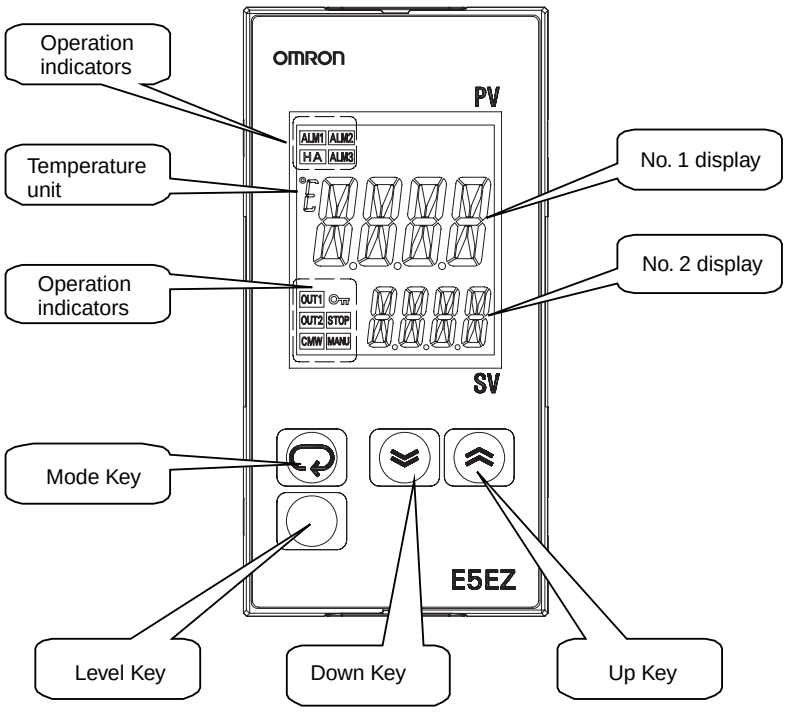
E5CZ/CZ-U The front panel is the same for the E5CZ and E5CZ-U.



E5AZ



E5EZ



1-1-2 Meanings of Indicators

No. 1 Display Displays the process value or parameter type.

Lights for approximately one second during startup.

No. 2 Display Displays the set point, parameter operation read value, or the variable input value.

Lights for approximately one second during startup.

Operation Indicators

1,2,3...

1. ALM1 (Alarm 1)
   Lights when the alarm 1 output is ON.
   ALM2 (Alarm 2)
   Lights when the alarm 2 output is ON.
   ALM3 (Alarm 3)
   Lights when the alarm 3 output is ON.
2. HA (Heater burnout and HS indicator)
   Lights when a heater burnout or HS occurs.
3. OUT1, OUT2 (control output 1, heating/cooling output (It depends on the assigned function.)
   Lights when control output 1 or heating/cooling output (It depends on the assigned function.) is ON.
   For a current output, however, OFF for a 0% output only.
4. STOP
   Lights when operation is stopped.
   During operation, this indicator lights when operation is stopped by an event or by using the RUN/STOP function.
5. CMW (Communications Writing)
   Lights when communications writing is enabled and is not lit when it is disabled.

6. MANU (Manual Mode)
   Lights when the auto/manual mode is set to manual mode.
7. (Key)
   Lights when settings change protect is ON (i.e., when the U and D keys are disabled by protected status.

Temperature Unit

The temperature unit is displayed when parameters are set to display a temperature. The display is determined by the currently selected "temperature unit" parameter set value. c indicates °C and f indicates °F.

Flashes during ST operation.

1-1-3 Using the Keys

This section describes the basic functions of the front panel keys.

O Key

Press this key to move between setting levels. The setting level is selected in the following order: operation level: adjustment level, initial setting level, communications setting level.

M Key

Press this key to change parameters within a setting level.

The parameters can be reversed by holding down the key (moving one per second in reverse order).

U Key

Each press of this key increments the value displayed on the No. 2 display or advances the setting. Holding the key down speeds up the incrementation.

D Key

Each press of this key decrements values displayed on the No. 2 display or reverses the setting. Holding the key down speeds up the incrementation.

O + M Keys

Press these keys to change to the protect level. For details on operations involving holding these keys down simultaneously, refer to *1-3 Setting Level Configuration and Key Operations*. For details on the protect level, refer to *SECTION 5 Parameters*.

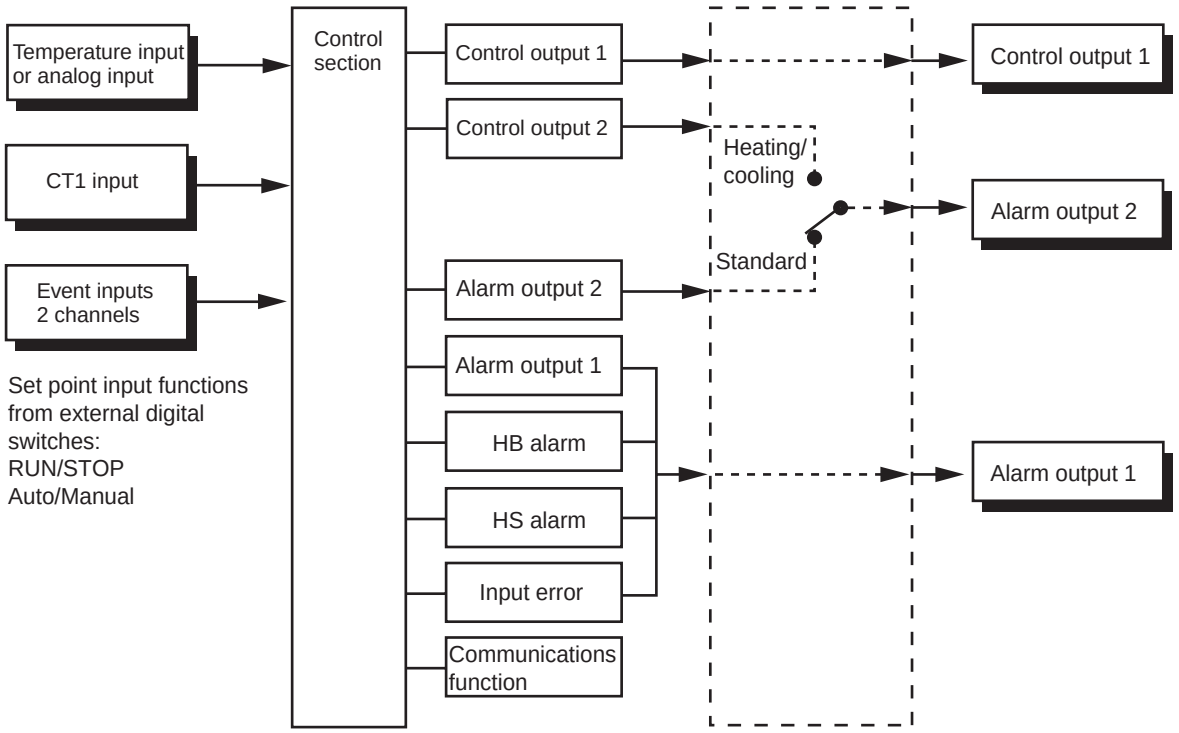
O + U Keys
O + D Keys

To restrict set value changes (in order to prevent accidental or incorrect operations), these key operations require simultaneously pressing the O key along with U or D key.

1-2 I/O Configuration and Main Functions

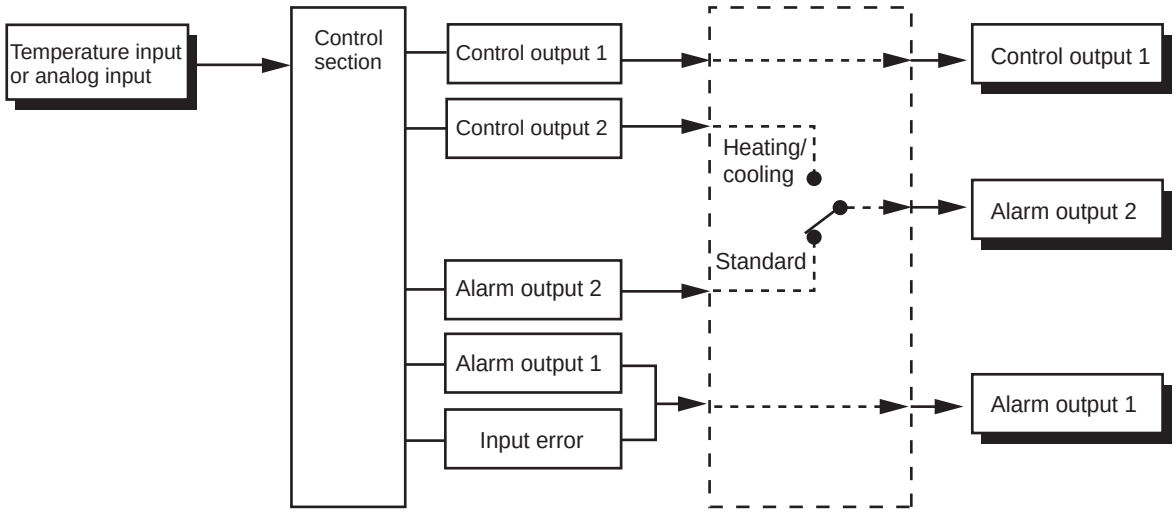
1-2-1 I/O Configuration

E5CZ



Note Functions can be assigned individually for each output by changing the set values for the control output 1 assignment, the alarm output 1 assignment, and the alarm output 2 assignment in the advanced function setting level.

E5CZ-U



Note Functions can be assigned individually for each output by changing the set values for the control output 1 assignment, the alarm output 1 assignment, and the alarm output 2 assignment in the advanced function setting level

Model Number Structure

Model Number Legend

Controllers

E5CZ-□ 2 M □ □

1 2 3 4 5

1. Control Output 1
R: Relay output
Q: Voltage output (for driving SSR)
C: Current output

2. Number of Alarms
2: Two alarms

3. Option
M: Option Unit can be mounted.

4. Input Type
T: Thermocouple, infrared sensor /platinum resistance thermometer
L: Analog current/voltage input

5. Power Supply Voltage
Blank: 100 to 240 VAC
D: 24 VAC/VDC

E5CZ-□ 2 T □ U

1 2 3 4 5

1. Output Type
R: Relay output
Q: Voltage ouput (for driving SSR)

Option Units

E53-CZ □ □

1 2 3

1. Applicable Controller
CZ: E5CZ

2. Function 1
Blank: None
H: Heater burnout/Heater short detection(CT1)

3. Function 2
B: Two event inputs
03: RS-485 communications

2. Number of Alarms

2: Two alarms

3. Input Type

T: Thermocouple, infrared sensor
/platinum resistance thermometer

4. Power Supply Voltage

Blank: 100 to 240 VAC

D: 24 VAC/VDC

5. Plug-in type

U: Plug-in type

Note Not all combinations of function 1 and function 2 specifications are possible for Option Units (E53-CZ□□**).**

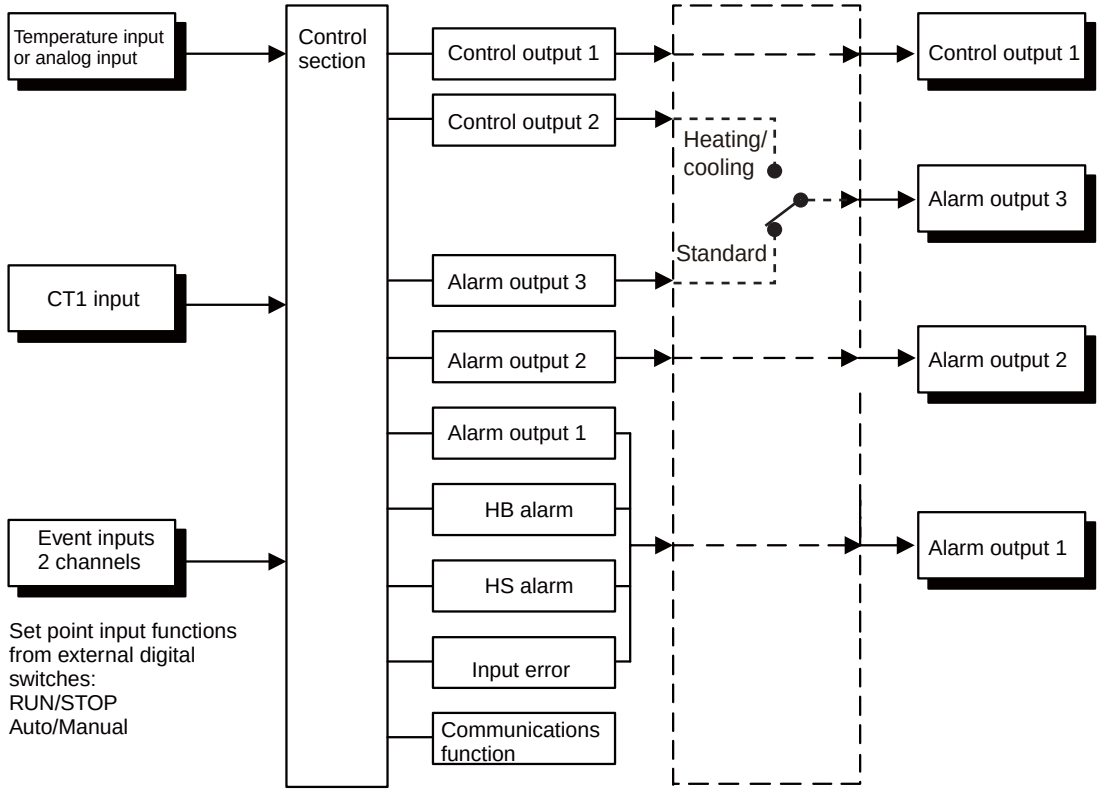
A functional explanation is provided here for illustration, but models are not necessarily available for all possible combinations. Refer to the catalog when ordering.

Examples:

Communications function E5CZ-□2MT with E53-CZ03

Alarm output (with 2 alarm outputs, HB alarm, and event inputs): E5CZ-□2MT with E53-CZHB

E5AZ/EZ



Note Functions can be assigned individually for each output by changing the set values for the control output 1 assignment, the alarm output 1 assignment, the

alarm output 2 assignment, and the alarm output 3 assignment in the advanced function setting level.

Model Number Structure

Model Number Legend

Controllers

E5AZ/EZ- □ 3 □ □ □ □
1 2 3 4 5 6

1. Control Output 1
R: Relay output
Q: Voltage output (for driving SSR)
C: Current output

2. Number of Alarms
3: Three alarms

3. Heater Burnout/Heater Short
Blank: None
H: Heater burnout/Heater short detection(CT1)

4. Option
Blank: None
M: Option Unit can be mounted.

5. Input Type
T: Thermocouple, infrared sensor /platinum resistance thermometer
L: Analog current/voltage input

6. Power Supply Voltage
Blank: 100 to 240 VAC
D: 24 VAC/VDC

Option Units

E53-AE □
1 2

1. Applicable Controller
AZ: E5AZ/E5EZ

2. Function
01: RS-232C communications
03: RS-485 communications
B: Two event inputs

1-2-2 Main Functions

This section introduces the main E5CZ/CZ-U/AZ/EZ functions. For details on particular functions and how to use them, refer to *SECTION 3 Basic Operation* and following sections.

Input Sensor Types

- The following input sensors can be connected for temperature input:
  Thermocouple: K, J, T, E, L, U, N, R, S, B
  Infrared temperature sensor: ES1B
  10 to 70°C 60 to 120°C, 115 to 165°C, 140 to 260°C
  Platinum resistance thermometer: Pt100, JPt100
  Analog input: 0 to 50 mV
- Inputs with the following specifications can be connected for analog input.
  Current input: 4 to 20 mA DC, 0 to 20 mA DC
  Voltage input: 1 to 5 VDC, 0 to 5 V DC, 0 to 10 V DC

Control Outputs

- A control output can be relay, voltage, or current output, depending on the model.
- With the E5CZ-□2M□□, alarm output 2 is used as control output (cooling) when heating/cooling control is selected. Therefore, use alarm 1 if an alarm is required while using heating/cooling control.
- With the E5AZ/E5EZ-□3□□□□, alarm output 3 is used as control output (cooling) when heating/cooling control is selected. Therefore, use alarms 1 and 2 if an alarm is required while using heating/cooling control.

Alarms

- Alarms can be used with the E5CZ-□2M□□,or E5CZ-□2T□U. Set the alarm classification and alarm value or the alarm's upper and lower limits.
- If necessary, a more comprehensive alarm function can be achieved by setting the standby sequence, alarm hysteresis, close in alarm/open in alarm, and alarm latch parameters.
- When the “input error output” parameter is set to ON, alarm output 1 turns ON when an input error occurs.

Control Adjustment

- Optimum PID constants can be set easily by performing AT (auto-tuning) or ST (self-tuning).

Event Inputs

- The following functions can be executed using event inputs: switching set points (multi-SP, 4 pts. max.), and switching RUN/STOP status, and switching between automatic and manual operation.
  E5CZ-□2M□□ with E53-CZB or E53-CZHB
  E5AZ-□3□M□□ with E53-AZB
  E5EZ-□3□M□□ with E53-AZB

Heater Burnout and HS Alarms

- The heater burnout detection function and the HS alarm function can be used.
  E5CZ-□2M□□ with E53-CZH03 or E53-CZHB
  E5AZ-□3HM□□
  E5EZ-□3HM□□

Communications Functions

- Communications functions utilizing CompoWay/F (See note 1.), SYSWAY (See note 2.), or Modbus (See note 3.) can be used.
  RS-485 Interface
  E5CZ-□2M□□ with E53-CZH03 or E53-CZ03
  E5AZ-□3□M□□ with E53-AZ03
  E5EZ-□3□M□□ with E53-AZ03
  RS-232C Interface.(See note 4.)
  E5AZ-□3□M□□ with E53-AZ01
  E5EZ-□3□M□□ with E53-AZ01

Note

(1) CompoWay/F is an integrated general-purpose serial communications protocol developed by OMRON. It uses commands compliant with the well-established FINS, together with a consistent frame format on OMRON Programmable Controllers to facilitate communications between personal computers and components.

(2) SYSWAY communications do not support alarm 3 output.

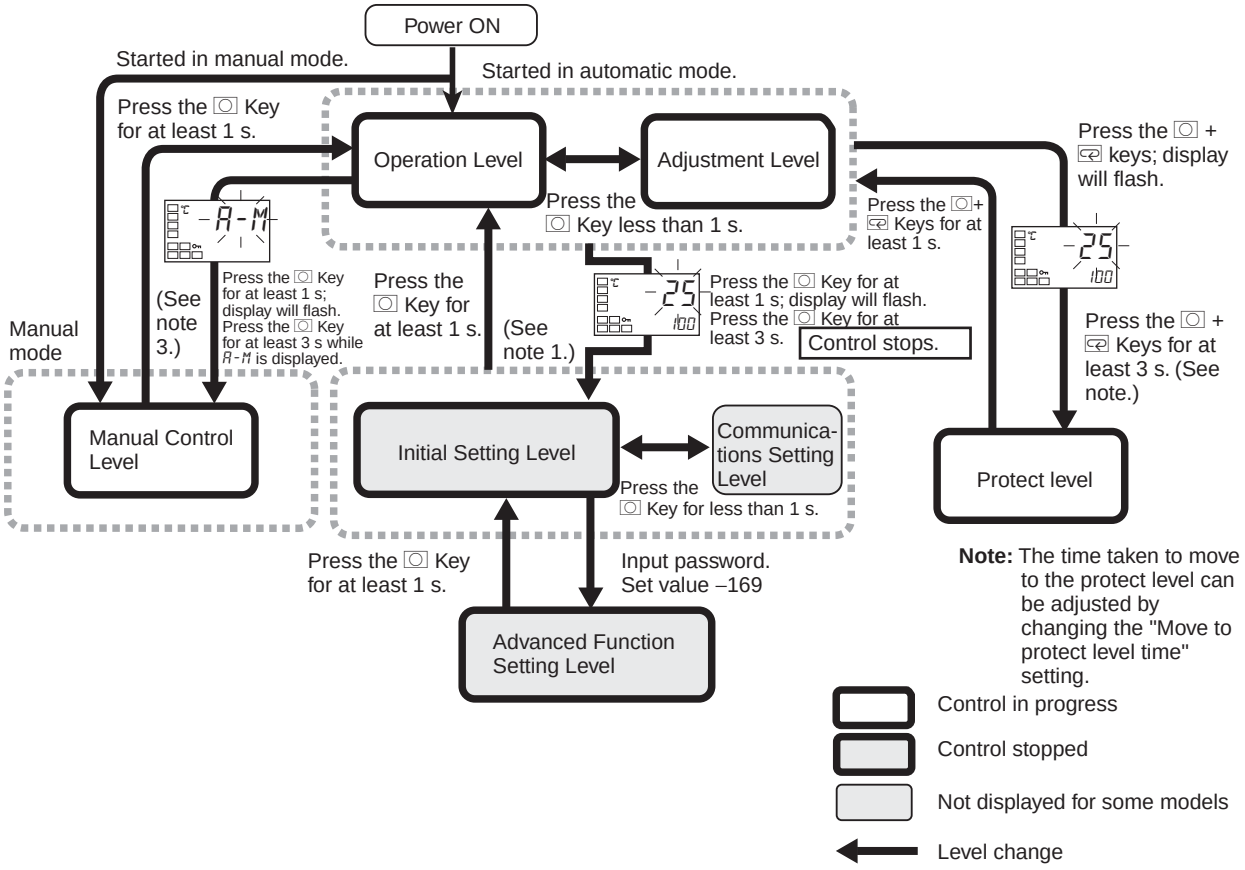
(3) Modbus is a communications control method conforming to the RTU Mode of Modicon Inc.'s Modbus Protocol.

(4) The E5CZ and E5CZ-U do not support the RS-232C interface.

1-3 Setting Level Configuration and Key Operations

Parameters are divided into groups, each called a “level.” Each of the set values (setting items) in these levels is called a “parameter.” The parameters on the E5CZ/CZ-U/AZ/EZ are divided into the following seven levels.

When the power is turned ON, all of the display lights for approximately 1 second.



Note (1) Operation level entered for software reset.

(2) From the manual control level, key operations can be used to move to the operation level only.

Level	Control in progress	Control stopped
Protect level	Can be set.	---
Operation level	Can be set.	---
Adjustment level	Can be set.	---
Manual control level	Can be set.	---
Initial setting level	---	Can be set.
Advanced function setting level	---	Can be set.
Communications setting level	---	Can be set.

Of these levels, the initial setting level, communications setting level, and advanced function setting level can be used only when control is stopped. Control outputs are stopped when any of these three levels is selected.

Protect Level

- To switch to the protect level from either the operation level or the adjustment level, simultaneously hold down the O and M keys for at least 3 seconds. (See note.) This level is for preventing unwanted or accidental modification of parameters. Protected levels will not be displayed, and so the parameters in that level cannot be modified.

  Note The key pressing time can be changed in “move to protect level time” parameter (advanced function setting level).

Operation Level

- The operation level is displayed when the power is turned ON. You can move to the protect level, initial setting level, or adjustment level from this level.
- Normally, select this level during operation. While operation is in progress, items such as the PV and manipulated variable (MV) can be monitored, and the set points, alarm values, and alarm upper and lower limits can be monitored and changed.

Adjustment Level

- To move to the adjustment level, press the O key once (for less than 1 s).
- This level is for entering set values and offset values for control. In addition to AT (auto-tuning), communications write enable/disable switching, hysteresis settings, multi-SP settings, and input offset parameters, it includes HB alarm, HS alarm, and PID constants. From the adjustment level, it is possible to move to the top parameter of the initial setting level, protect level, or operation level.

Manual Control Level

- When the O key is pressed for at least 3 seconds from the operation level's auto/manual switching display, the manual control level will be displayed. (The MANU indicator will light.)
- This is the level for changing the MV in manual mode.
- To return to the operation level, press the O key for at least 1 second.

Initial Setting Level

- To move to the initial setting level from the operation level or the adjustment level, press the O key for at least 3 seconds. The PV display flashes after 1 second. This level is for specifying the input type and selecting the control method, control period, setting direct/reverse action, and setting the alarm types. You can move to the advanced function setting level or communications setting level from this level. To return to the operation level, press the O key for at least 1 second. To move to the communications setting level, press the O key for less than 1 second. (When moving from the initial setting level to the operation level, all the indicators will light.)

  Note Pressing the O key for at least 3 seconds in the operation level's auto/manual switching display will move to the manual control level, and not the initial setting level.

Advanced Function Setting Level

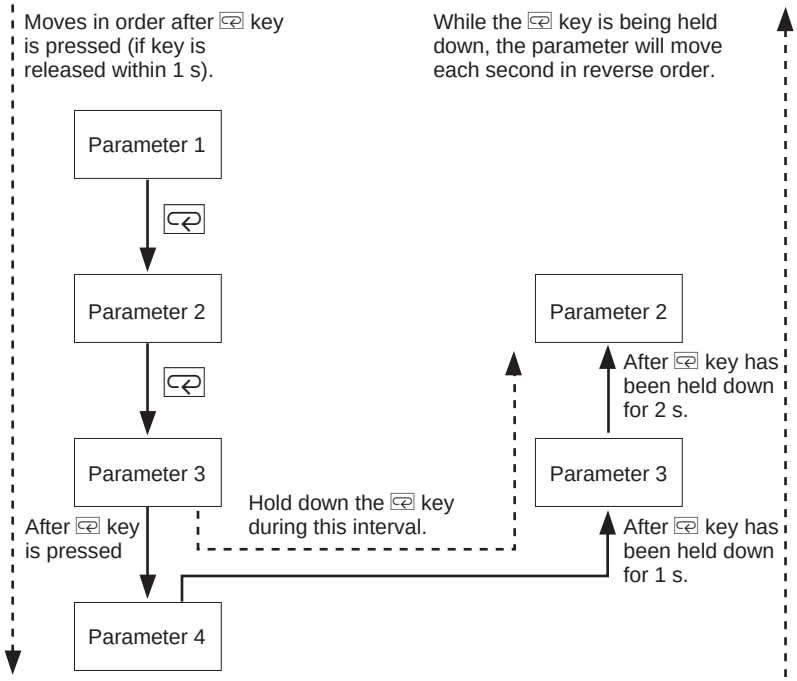
- To move to the advanced function setting level, set the “initial setting/communications protect” parameter in the protect level to 0 and then, in the initial setting level, input the password (−169).
- From the advanced function setting level, it is possible to move to the initial setting level.
- This level is for setting the automatic display return time, event input assignments, standby sequence, and alarm hysteresis.

Communications Setting Level

- To move to the communications setting level from the initial setting level, press the O key once (for less than 1 s). When using the communications function, set the communications conditions in this level. Communicating with a personal computer (host computer) allows set points to be read and written, and manipulated variables (MV) to be monitored.

1-3-1 Selecting Parameters

- Within each level, the parameter is changed in order (or in reverse order) each time the M key is pressed. For details, refer to *SECTION 5 Parameters*.



1-3-2 Fixing Settings

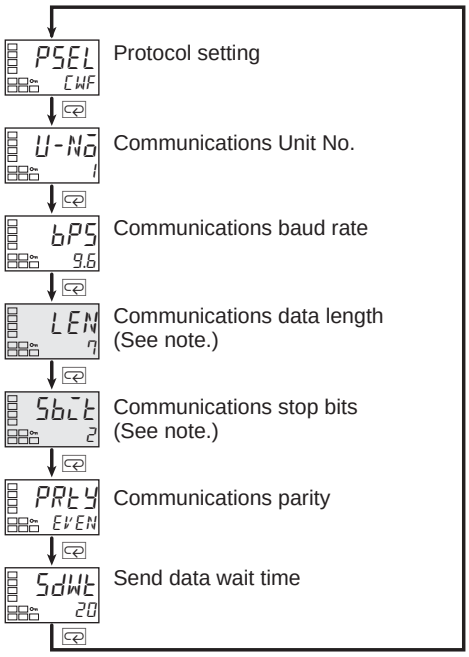
- If you press the M key at the final parameter, the display returns to the top parameter for the current level.
- To change parameter settings, specify the setting using the U or D key, and either leave the setting for at least 2 seconds or press the M key. This fixes the setting.
- When another level is selected after a setting has been changed, the contents of the parameter prior to the change are fixed.
- When you turn the power OFF, you must first fix the settings (by pressing the M key). The settings are sometimes not changed by merely pressing the U or D keys.

1-4 Communications Function

The E5CZ/AZ/EZ is provided with a communications function that enables parameters to be checked and set from a host computer. If the communications function is required, use a model that has that function (E5CZ-□2M□□ with E53-CZH03 or E53-CZ03, E5AZ-□3□M□□ with E53-AZ01 or E53-AZ03, E5EZ-□3□M□□ with E53-AZ01 or E53-AZ03). For details on the communications function, see the separate *Communications Manual*. Use the following procedure to move to the communications setting level.

1,2,3...

1. Press the O key for at least 3 seconds to move from the operation level to the initial setting level.
2. Press the O key for less than 1 second to move from the initial setting level to the communications setting level.
3. Select the parameters as shown below by pressing the M key.
4. Press the U or D key to change the parameter setting.



Note The "protocol setting" parameter is displayed only when CompoWay/F communications are being used.

Setting Communications Data

Match the communications specifications of the E5CZ/AZ/EZ and the host computer. If a 1:N connection is being used, ensure that the communications specifications for all devices in the system (except the communications Unit No.) are the same.

Parameter	Symbol	Setting (monitor) value	Selection symbols	Default	Unit
Protocol setting	psel	CompoWay/F (SYSWAY), Modbus	cwf, mod	CompoWay/F (SYSWAY)	None
Communications Unit No.	u-no	0 to 99		1	None

Parameter	Symbol	Setting (monitor) value	Selection symbols	Default	Unit
Communications baud rate	bps	1.2, 2.4, 4.8, 9.6, 19.2, 38.4	1.2, 2.4, 4.8, 9.6, 19.2, 38.4	9.6	kbps
Communications data length	len	7, 8		7	Bits
Communications stop bits	sbit	1, 2		2	Bits
Communications parity	prty	None, Even, Odd	none, even, odd	Even	None
Send data wait time	sdwe	0 to 99		20	ms

SECTION 2
Preparations

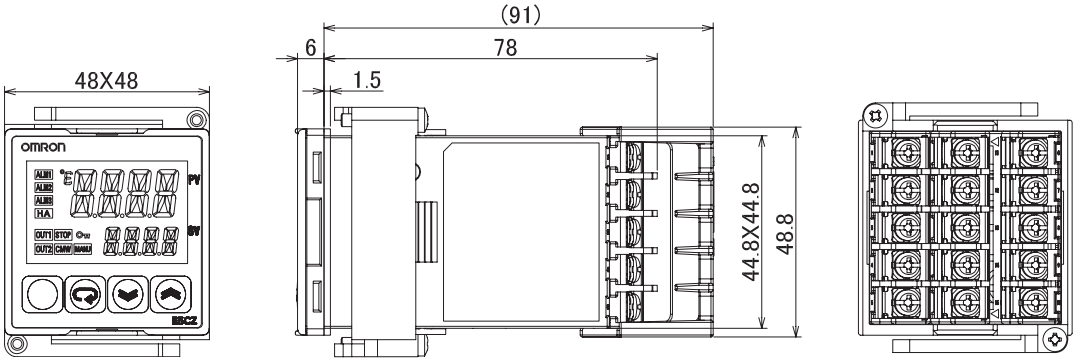
This section describes the work required to prepare the E5CZ and E5CZ-U Digital Temperature Controllers for operation, including installation and wiring.

2-1 Installation

2-1-1 Dimensions

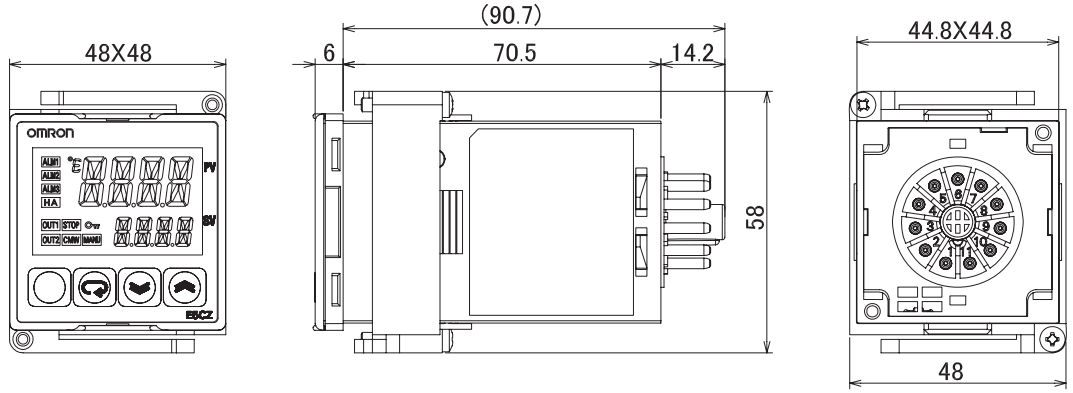
Unit: mm

E5CZ

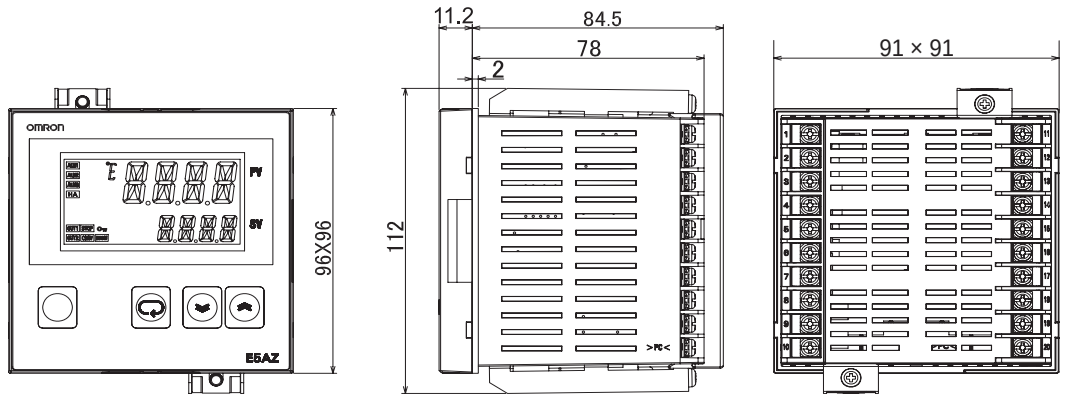


Note: Do not remove the terminal block. Doing so may result in failure or malfunction.

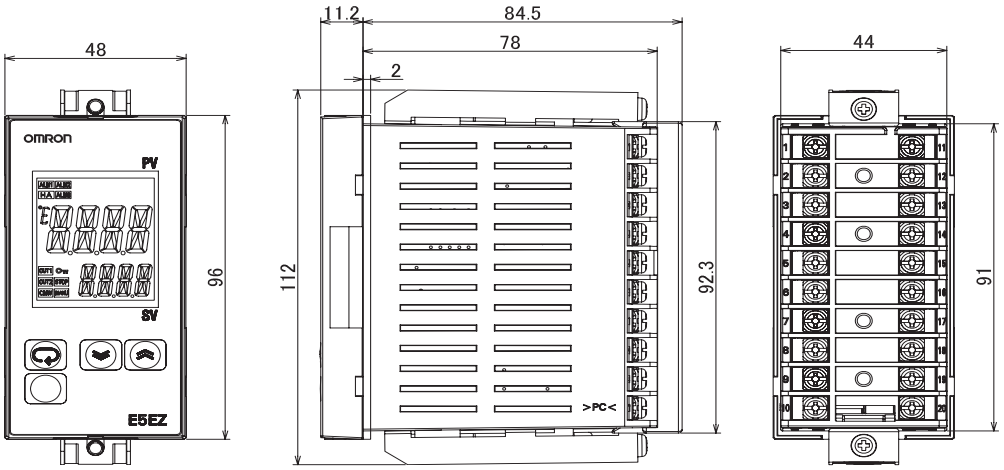
E5CZ-U



E5AZ



E5EZ

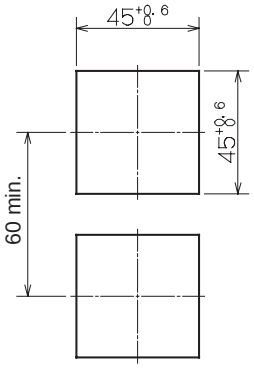


2-1-2 Panel Cutout

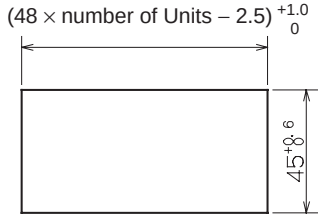
Unit: mm

E5CZ/CZ-U

Individual Mounting

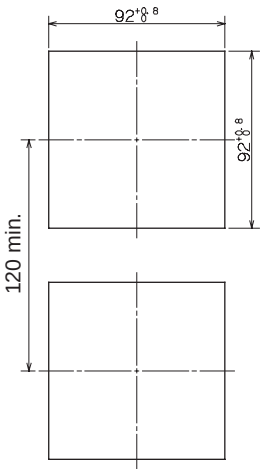


Group Mounting

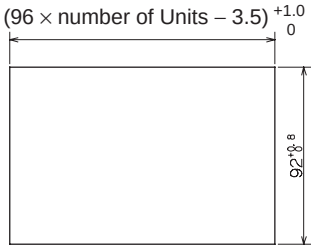


E5AZ

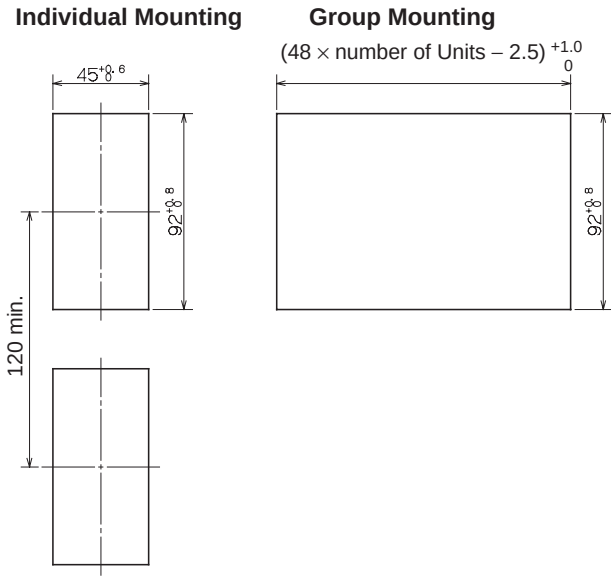
Individual Mounting



Group Mounting



E5EZ

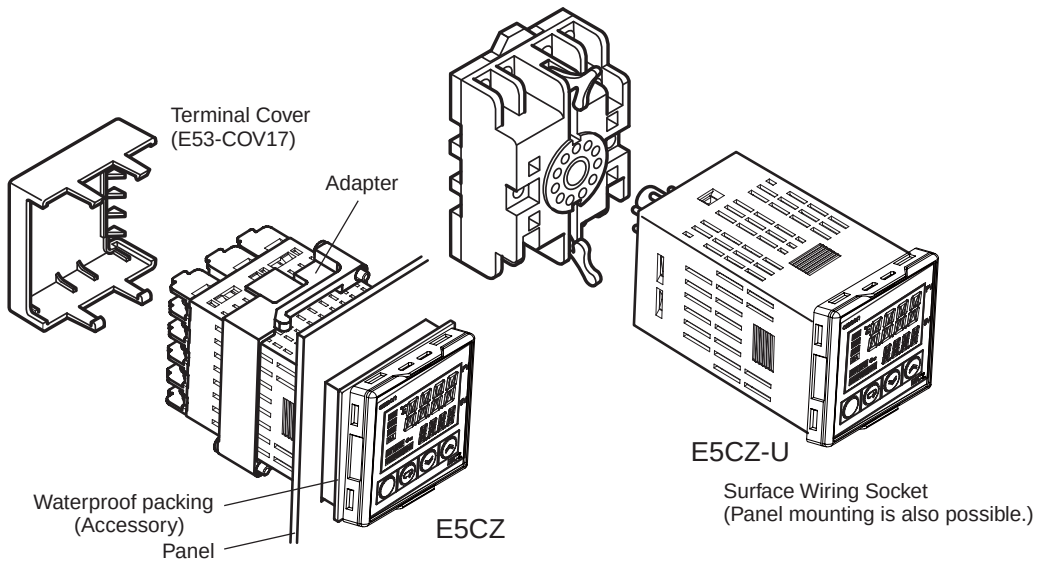


- Waterproofing is not possible when group mounting several Controllers.
- The recommended panel thickness is 1 to 5 mm for E5CZ/E5CZ-U, and 1 to 8 mm for E5AZ/E5EZ.
- Units must not be closely mounted vertically. (Observe the recommended mounting space limits.)
- When group mounting several Controllers, ensure that the surrounding temperature does not exceed the ambient operating temperature listed in the specifications.

2-1-3 Mounting

For the Wiring Socket, purchase the P2CF-11 or PG3A-11 separately.

E5CZ/CZ-U



Mounting to the Panel

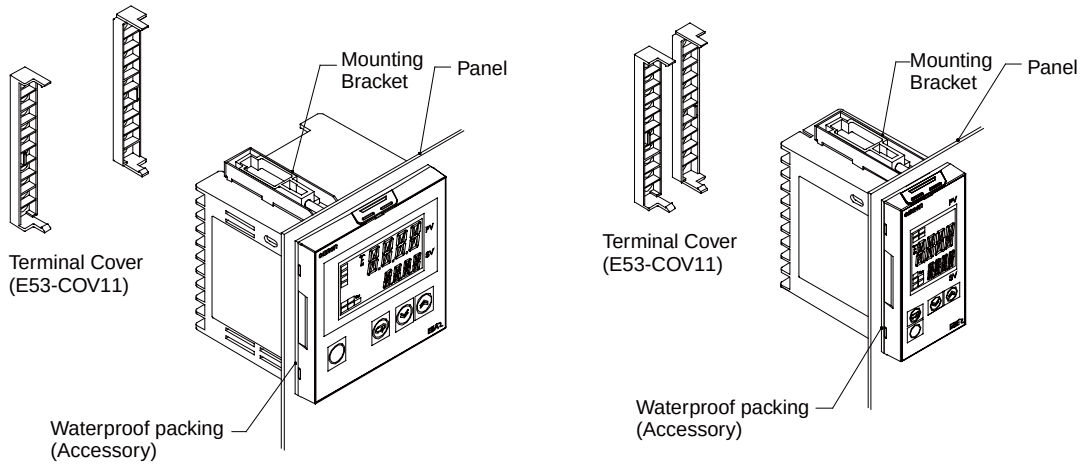
1,2,3...

1. For waterproof mounting, waterproof packing must be installed on the Controller. Waterproofing is not possible when group mounting several Controllers. Waterproof packing is not necessary when there is no need for the waterproofing function. There is no waterproof packing included with the E5CZ-U.
2. Insert the E5CZ/E5CZ-U into the mounting hole in the panel.
3. Push the adapter from the terminals up to the panel, and temporarily fasten the E5CZ/E5CZ-U.
4. Tighten the two fastening screws on the adapter. Alternately tighten the two screws little by little to maintain a balance. Tighten the screws to a torque of 0.29 to 0.39 N·m.

Mounting the Terminal Cover

For the E5CZ, make sure that the "UP" mark is facing up, and then fit the terminal cover into the holes on the top and bottom.

E5AZ/EZ



E5AZ E5EZ

Mounting to the Panel

1,2,3...

1. For waterproof mounting, waterproof packing must be installed on the Controller. Waterproofing is not possible when group mounting several Controllers. Waterproof packing is not necessary when there is no need for the waterproofing function.
2. Insert the E5AZ/E5EZ into the square mounting hole in the panel (thickness: 1 to 8 mm). Attach the Mounting Brackets provided with the product to the mounting grooves on the top and bottom surfaces of the rear case.
3. Use a ratchet to alternately tighten the screws on the top and bottom Mounting Brackets little by little to maintain balance, until the ratchet turns freely.

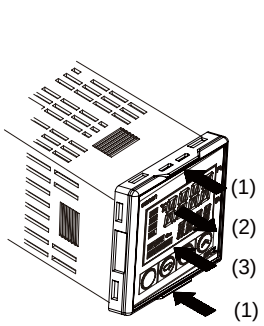
Mounting the Terminal Cover

Fit the E53-COV11 Terminal Cover over the upper hook. Mount it in the direction shown in the above diagram. If the terminal cover is mounted in the opposite direction, proper mounting of the fixtures may not be possible.

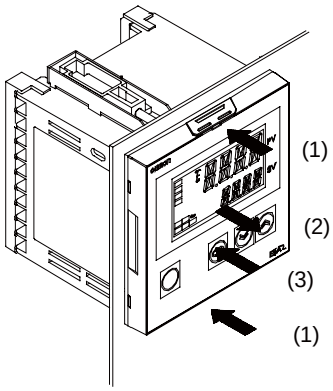
2-1-4 Removing the Temperature Controller from the Case

The Temperature Controller can be removed from the case to perform maintenance without removing the terminal leads. This is possible for only the E5CZ, E5AZ, and E5EZ, and not for the E5CZ-U. Check the specifications of the case and Temperature Controller before removing the Temperature Controller from the case.

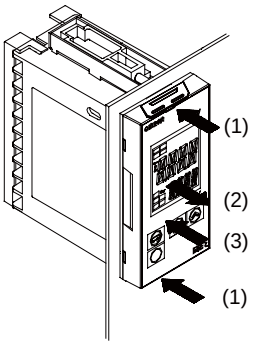
E5CZ/AZ/EZ



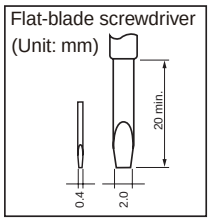
E5CZ/CZ-U



E5AZ



E5EZ



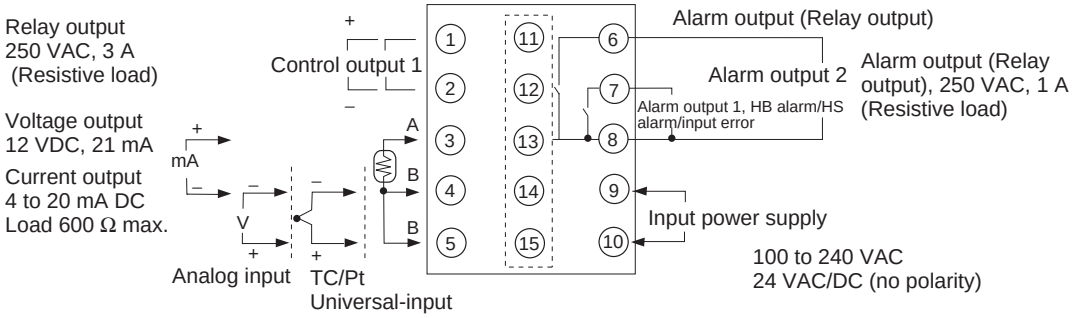
1,2,3...

1. Insert a flat-blade screwdriver into the two tool insertion holes (one on the top and one on the bottom) to release the hooks.
2. Insert the flat-blade screwdriver in the gap between the front panel and rear case, and pull out the front panel slightly. Hold the top and bottom of the front panel and carefully pull it out toward you, without applying unnecessary force.
3. When inserting the E5CZ/AZ/EZ, check to make sure that the sealing rubber is in place and push the E5CZ/AZ/EZ toward the rear case until it snaps into position. While pushing the E5CZ/AZ/EZ into place, push down on the hooks on the top and bottom surfaces of the rear case so that the hooks are securely locked in place. Be sure that electronic components do not come into contact with the case.

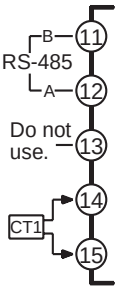
2-2 Wiring Terminals

2-2-1 Terminal Arrangement

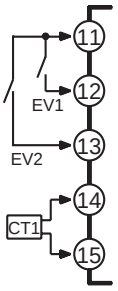
E5CZ



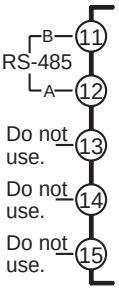
E53-CZH03
Communications/
CT



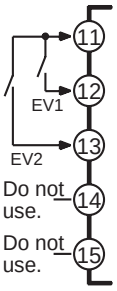
E53-CZHB
Event inputs/
CT



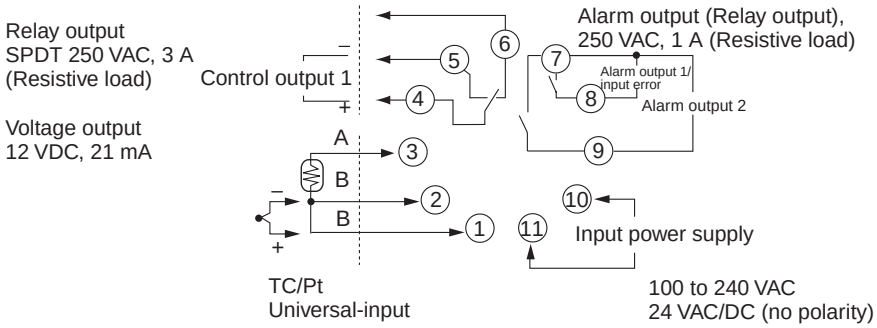
E53-CZ03
Communications



E53-CZB
Event inputs

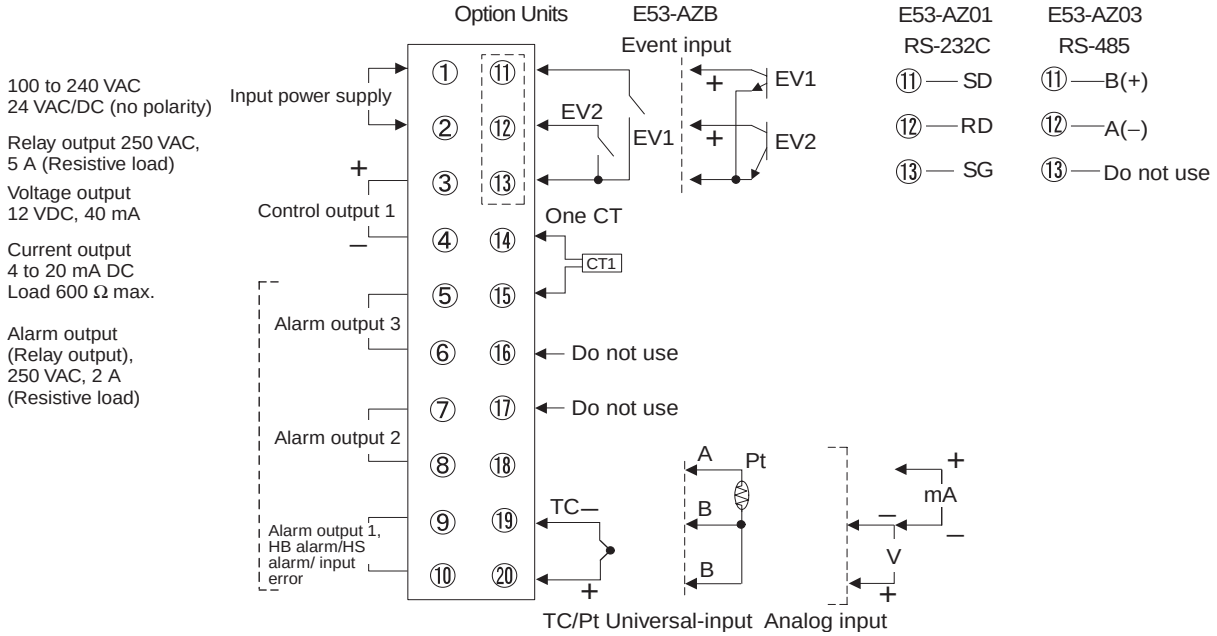


E5CZ-U



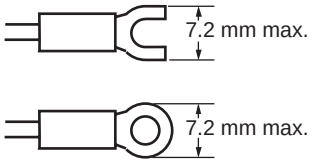
Note For the Wiring Socket, purchase the P2CF-11 or PG3A-11 separately.

E5AZ/EZ



2-2-2 Precautions when Wiring

- Separate input leads and power lines in order to prevent external noise.
- Use AWG24 (cross-sectional area: 0.205 mm^2) to AWG14 (cross-sectional area: 2.081 mm^2) twisted-pair cable (stripping length: 5 to 6 mm).
- Use crimp terminals when wiring the terminals.
- Tighten the terminal screws to a torque of 0.74 to 0.90 N·m, except for the E5CZ-U, which is 0.5 N·m.
- Use the following types of crimp terminals for M3.5 screws.



Note Do not remove the terminal block. Doing so may result in malfunction or failure.

2-2-3 Wiring

In the connection diagrams, the left side of the terminal numbers represents the inside of the Controller and the right side represents the outside.

Power supply

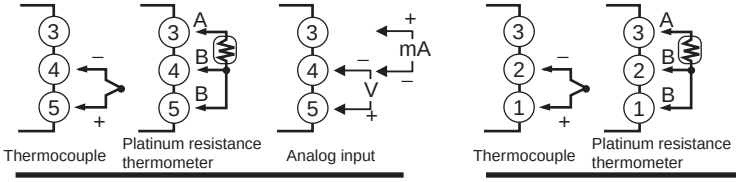
- With the E5CZ, connect to terminals 9 and 10; with the E5CZ-U, connect to pins 10 and 11; with the E5AZ and E5EZ, connect pins 1 and 2. The following table shows the specifications.

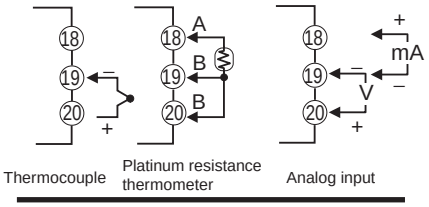
Input power supply	E5CZ	E5CZ-U	E5AZ/EZ
100 to 240 VAC, 50/60 Hz	7.5 VA	6 VA	8.5 VA
24 VAC, 50/60 Hz	5.5 VA	4.5 VA	6 VA
24 VDC (no polarity)	3.5 W	2.5 W	4 W

- Reinforced insulation is applied between the input power supply, the relay outputs, and other terminals.

Input

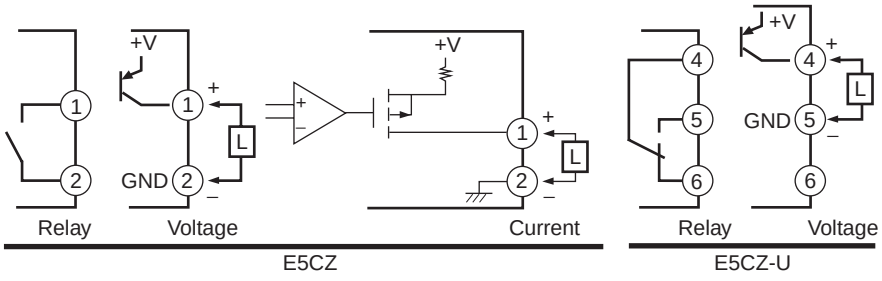
- Make the connections as shown below, using terminals 3 to 5 for the E5CZ, pins 1 to 3 for the E5CZ-U, and pins 18 to 20 for the E5AZ/EZ, and matching the input types.

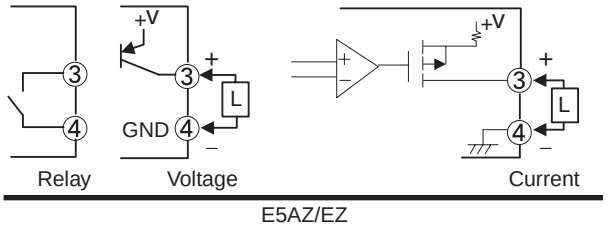




Control Output 1

- Outputs are sent from terminals 1 and 2 with the E5CZ, from pins 4 to 6 with the E5CZ-U, and from pins 3 and 4 with the E5AZ/EZ. The following diagrams show the available outputs and their internal equalizing circuits.





- The following table shows the specifications for each output type.

E5CZ/CZ-U

Output type	Specifications
Relay	250 VAC, 3 A (resistive load), electrical durability: 100,000 operations
Voltage (PNP)	PNP type, 12 VDC ±15%, 21 mA (with short-circuit protection)
Current (Not for E5CZ-U)	DC 4 to 20 mA, resistive load: 600 Ω max. Resolution: Approx. 2,700

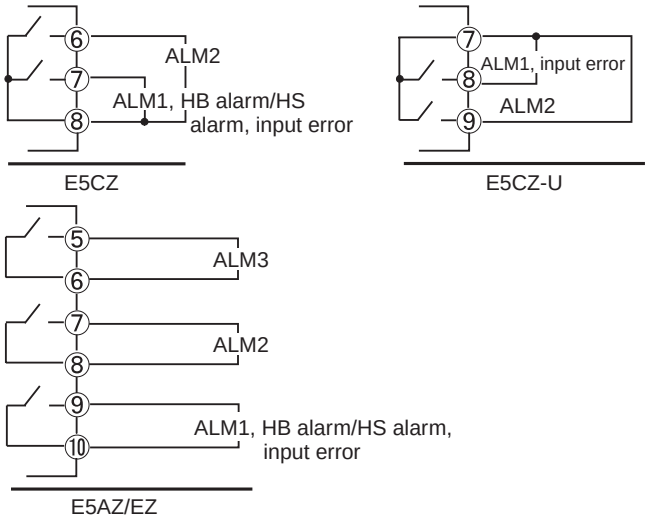
E5AZ/EZ

Output type	Specifications
Relay	250 VAC, 5 A (resistive load), electrical durability: 100,000 operations
Voltage (PNP)	PNP type, 12 VDC +15%/−20%, 40 mA (with short-circuit protection)
Current	DC 4 to 20 mA, resistive load: 600 Ω max. Resolution: Approx. 2,700

- A voltage output (control output) is not electrically isolated from the internal circuits. When using a grounding thermocouple, do not connect any of the control output terminals to the ground. If control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.
- Control output 1 (Voltage output) is not isolated.

Alarm Outputs 1, 2, and 3

- On the E5CZ-□2M□□, alarm output 1 (ALM1) is output across terminals 7 and 8, and alarm output 2 (ALM2) is output across terminals 6 and 8.
- On the E5CZ-□2T□U, alarm output 1 (ALM1) is output across terminals 7 and 8, and alarm output 2 (ALM2) is output across terminals 7 and 9.
- On the E5AZ/EZ-□3□□□□, alarm output 1 (ALM1) is output across terminals 9 and 10, alarm output 2 (ALM2) is output across terminals 7 and 8, and alarm output 3 (ALM3) is output across terminals 5 and 6.
- When the “input error output” parameter is set to ON, alarm output 1 turns ON when an input error occurs.
- When the HB alarm or the HS alarm is used with the E5CZ-□2M□□ with E53-CZH03 or E53-CZHB alarms are output across terminals 7 and 8.
- When the HB alarm or the HS alarm is used with the E5AZ-□3H□□□or the E5EZ-□3H□□□, alarms are output across terminals 9 and 10.
- On the E5CZ and E5CZ-U, when heating/cooling control is used, alarm output 2 becomes control output (cooling).
- On the E5AZ and E5EZ, when heating/cooling control is used, alarm output 3 becomes control output (cooling).
- For models that have a heater burnout alarm, an OR of alarm output 1 and the HB alarm/HS alarm is output. If ALM1 is to be used for HB alarm only, set the alarm 1 type to 0 and do not use alarm output 1.
- The following diagrams show the internal equalizing circuits for alarm outputs 1, 2, and 3.



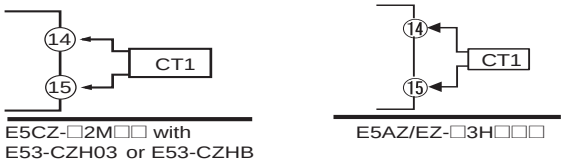
ALM 1, 2, 3 can be output to alarm output 1, 2, 3, or changed with the advanced function setting level.

- The relay specifications are as follows:

E5CZ/CZ-U	SPST-NO 250 VAC 1 A
E5AZ/EZ	SPST-NO 250 VAC 2 A

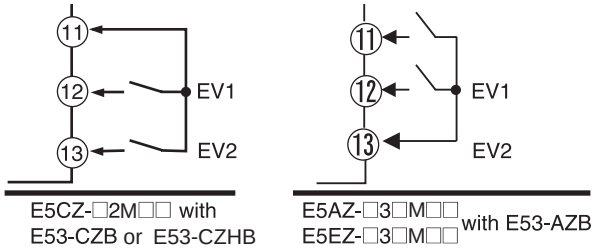
CT Inputs

- When the HB alarm or the HS alarm is to be used with the E5CZ-□2M□□ with E53-CZH03 or E53-CZHB, connect a current transformer (CT1) across terminals 14 and 15 (no polarity).
- When the HB alarm or the HS alarm is to be used with the E5AZ/EZ-□3H□□□, connect a current transformer (CT1) across terminals 14 and 15 (no polarity).



Event Inputs

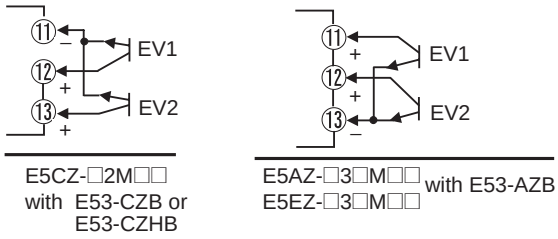
- When event inputs are to be used with the following models, connect to terminals 11 to 13. Option unit with two event inputs is required to be mounted.



- Use event inputs under the following conditions:
- The outflow current is approximately 7 mA.

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

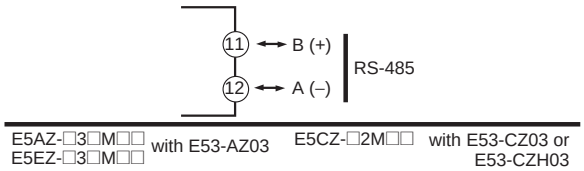
Polarities during no-contact input are as follows:



Communications

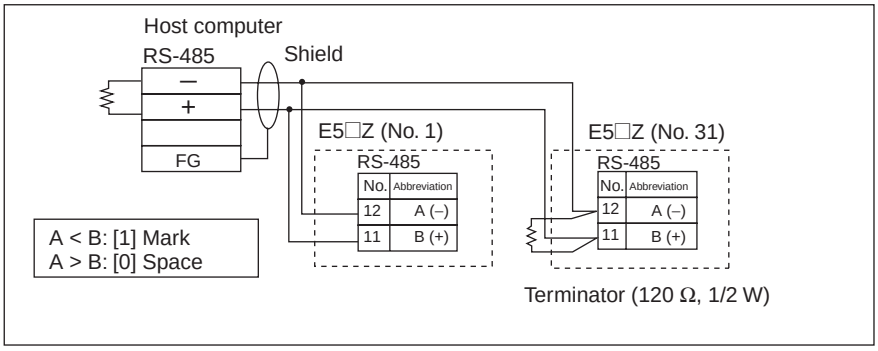
RS-485

- When communications are to be used with the following models, connect communications cable across terminals 11 and 12. Option unit with RS-485 communications is required to be mounted.

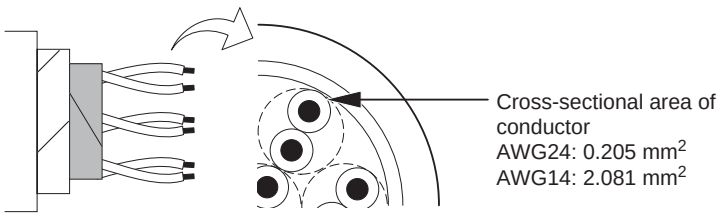


Specify both ends of the transmission path including the host computer as end nodes (that is, connect terminators to both ends).
The minimum terminal resistance is 54 Ω.

Communications Unit Connection Diagram

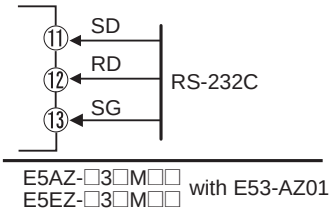


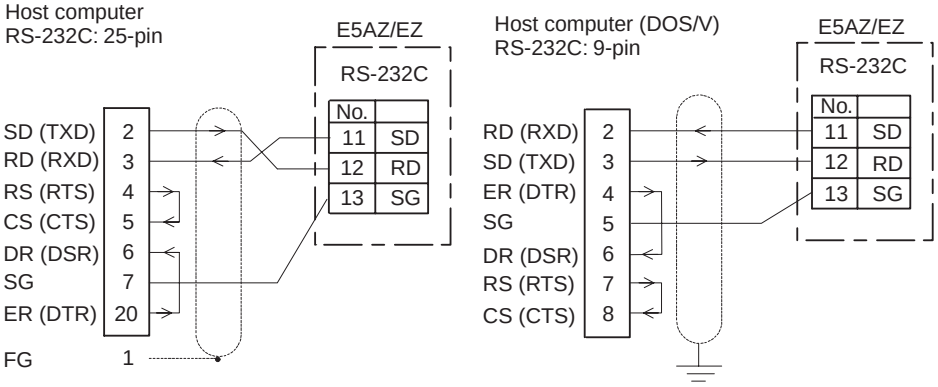
- The RS-485 connection can be either one-to-one or one-to-N. A maximum of 32 Units (including the host computer) can be connected in one-to-N systems. The maximum total cable length is 500 m. Use AWG24 (cross-sectional area: 0.205 mm^2) to AWG14 (cross-sectional area: 2.081 mm^2) shielded twisted-pair cable.



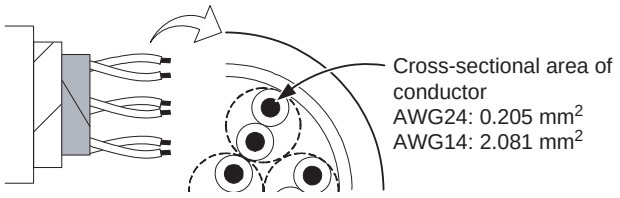
RS-232C (E5AZ/E5EZ Only)

- When communications are to be used with the following models , connect communications cable across terminals 11 to 13. Option unit with RS-232C communications is required to be mounted.





- A 1:1 connection is used. The maximum cable length is 15 m. To extend the transmission path, use the OMRON Z3R RS-232C Optical Interface.
- Use AWG24 (cross-sectional area: 0.205 mm^2) to AWG14 (cross-sectional area: 2.081 mm^2) shielded twisted-pair cable.



2-3 Using the Support Software Port

Use the communications port for Support Software to connect the personal computer to the Temperature Controller when using Thermo-Mini or other Support Software. The E58-CIFQ1 USB-Serial Conversion Cable is required to make the connection.

For information concerning the models that can be used with Thermo-Mini, contact your OMRON sales representative.

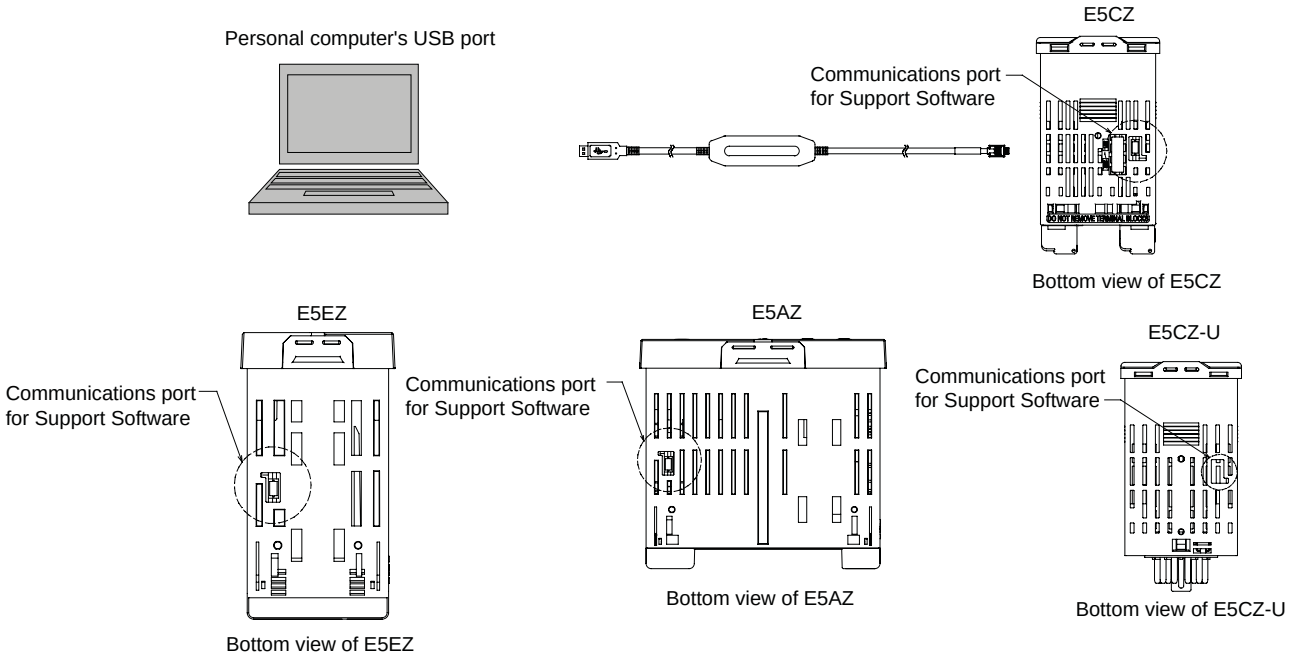
Procedure

Use the following procedure to connect the Temperature Controller to the personal computer using the USB-Serial Conversion Cable. The USB-Serial Conversion Cable is used to communicate with the COM port of the personal computer. To perform communications using USB-Serial Conversion Cable, set the communications port (COM port) number to be used for the software to the COM port assigned to the Cable.

1,2,3... 1. Turn ON the power to the Temperature Controller.

Note If the Cable is connected when the power to the Temperature Controller is OFF, power will be supplied from the personal computer and impose a load on the internal circuits of the Temperature Controller.

2. Connect the Cable.
   Connect the personal computer's USB port with the Support Software port on the Temperature Controller using the Cable.
   - Temperature Controller Connection Method



Note Hold the connector when inserting or disconnecting the Cable.

3. Install the driver.
   Install the driver to enable the Cable to be used with the personal computer.
   - Installation
     When the Cable is connected with the personal computer, the OS detects the product as a new device. At this time, install the driver using the installation wizard. For details on installation methods, refer to the user's manual for the E58-CIFQ1 USB-Serial Conversion Cable.
4. Setting Setup Tool Communications Conditions
   Set the communications port (COM port) number to be used for the Thermo-Mini Setup Tool to the COM port number assigned to the USB-Serial Conversion Cable.
   Refer to the E58-CIFQ1 USB-Serial Conversion Cable *Instruction Manual and Setup Manual* for details on how to check the COM port assigned to the USB-Serial Conversion Cable.

   The communications conditions for Setup Tool COM ports are fixed as shown in the table below. Set the communications conditions for the Thermo-Mini Setup Tool according to the following table.

- Models without communications

Parameter	Set value
Communications Unit No	01
Communications baud rate	9.6 (kbps)
Communications data length	7 (bits)
Communications stop bits	2 (bits)
Communications parity	Even

- Models with communications
  The communications conditions for Setup Tool COM ports are not fixed. Set the communications conditions for the Thermo-Mini Setup Tool according to the set value of the Temperature controller.

SECTION 3
Basic Operation

This section describes the basic operation of the E5CZ and E5CZ-U Digital Temperature Controllers, including key operations to set parameters and descriptions of display elements based on specific control examples.

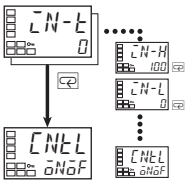
3-1 Initial Setting Examples

Initial hardware setup, including the sensor input type, alarm types, control periods, and other settings is done using parameter displays. The O and M keys are used to switch between parameters, and the amount of time that you press the keys determines which parameter you move to.

This section describes two typical examples.

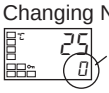
Explanation of Examples

Changing Parameters



A ▭ image means that there are parameters. Continue pressing the ↵ key to change parameters until you reach the intended parameter.

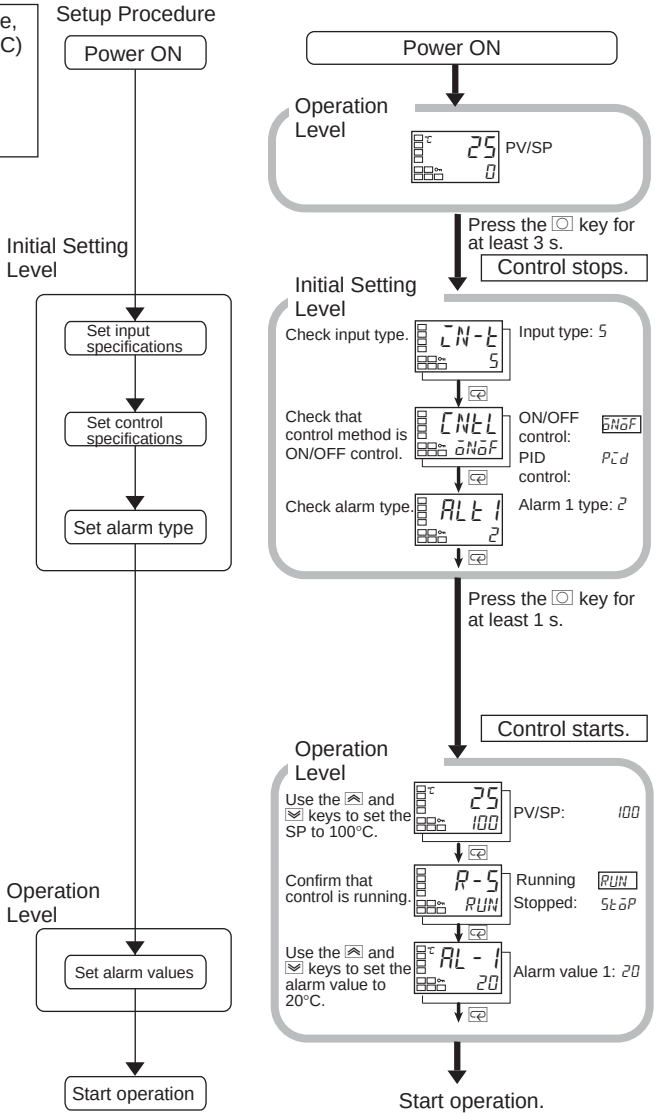
Changing Numbers



Numeric data and selections in each screen can be changed by using the ▲ and ▼ keys.

Example 1

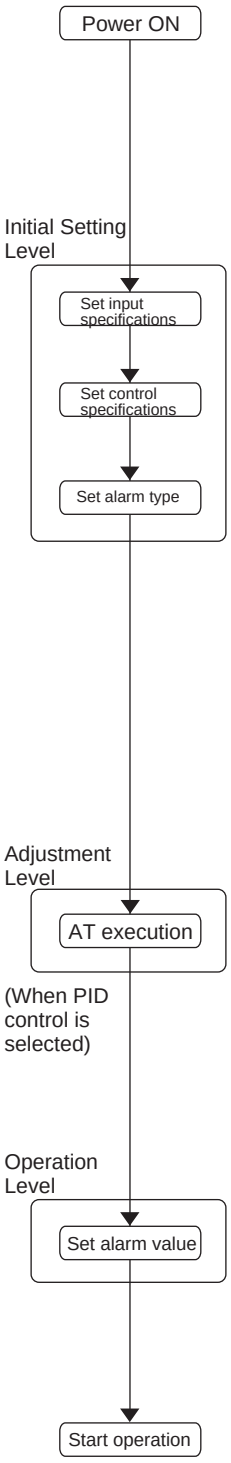
Input type:	5 (K thermocouple, –200°C to 1,300°C)
Control method:	ON/OFF control
Alarm type:	2 (upper limit)
Alarm value 1:	20°C (deviation)
Set point:	100°C

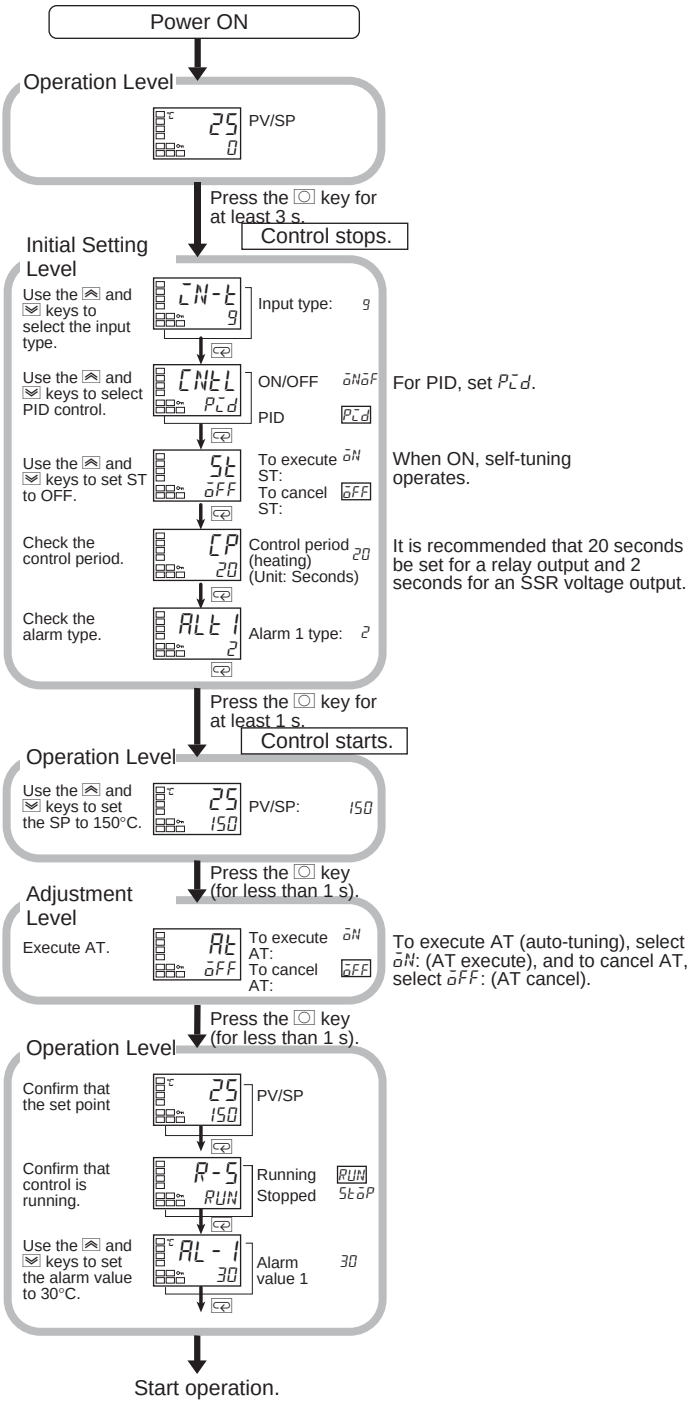


Example 2

Input type:	9 (T thermocouple, −200°C to 400°C)
Control method:	PID control
PID constants found using auto-tuning (AT).	
Alarm type:	2 upper limit
Alarm value 1:	30°C
Set point:	150°C

Setup Procedure





3-2 Setting the Input Type

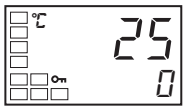
The Controller supports four input types: platinum resistance thermometer, thermocouple, infrared temperature sensor, and analog inputs. Set the input type that matches the sensor that is used. In the product specifications, there are models with thermocouple/resistance thermometer inputs (universal-input) and models with analog input. The settings differ depending on the model. Check to make sure which model you are using.

3-2-1 Input Type

The following example shows how to set a K thermocouple for −20.0 to 500.0°C.

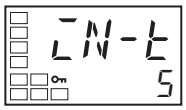
Operating Procedure

Operation Level



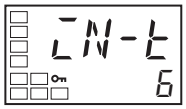
1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level



Input type

2. Press the U key to enter the set value of the desired sensor.
   When you use a K thermocouple (−20.0 to 500.0°C), enter 6 as the set value.



Hint: The key operation is fixed two seconds after the change, or by pressing the O or M key.

List of Input Types

	Input type	Specifications	Set value	Input temperature setting range
Controllers with Thermocouple/ Resistance Thermometer Universal-input	Platinum resistance thermometer	Pt100	0	–200 to 850 (°C)/–300 to 1,500 (°F)
			1	–199.9 to 500.0 (°C)/–199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)
		JPt100	3	–199.9 to 500.0 (°C)/–199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)
	Thermocouple	K	5	–200 to 1,300 (°C)/–300 to 2,300 (°F)
			6	–20.0 to 500.0 (°C)/0.0 to 900.0 (°F)
		J	7	–100 to 850 (°C)/–100 to 1,500 (°F)
			8	–20.0 to 400.0 (°C)/0.0 to 750.0 (°F)
		T	9	–200 to 400 (°C)/–300 to 700 (°F)
			10	–199.9 to 400.0 (°C)/–199.9 to 700.0 (°F)
		E	11	0 to 600 (°C)/0 to 1,100 (°F)
		L	12	–100 to 850 (°C)/–100 to 1,500 (°F)
		U	13	–200 to 400 (°C)/–300 to 700 (°F)
			14	–199.9 to 400.0 (°C)/–199.9 to 700.0 (°F)
		N	15	–200 to 1,300 (°C)/–300 to 2,300 (°F)
		R	16	0 to 1,700 (°C)/0 to 3,000 (°F)
		S	17	0 to 1,700 (°C)/0 to 3,000 (°F)
		B	18	100 to 1,800 (°C)/300 to 3,200 (°F)
	Infrared temperature sensor ES1B	10 to 70°C	19	0 to 90 (°C)/0 to 190 (°F)
		60 to 120°C	20	0 to 120 (°C)/0 to 240 (°F)
		115 to 165°C	21	0 to 165 (°C)/0 to 320 (°F)
		140 to 260°C	22	0 to 260 (°C)/0 to 500 (°F)
	Analog input	0 to 50 mV	23	Either of the following ranges, by scaling: –1,999 to 9,999 –199.9 to 999.9

- The default is 5.
- If a platinum resistance thermometer is mistakenly connected while a setting for other than a platinum resistance thermometer is in effect, S.ERR will be displayed. To clear the S.ERR display, check the wiring and then turn the power OFF and back ON.

	Input type	Specifications	Set value	Input temperature setting range
Models with analog input	Current input	4 to 20 mA	0	Either of the following ranges, by scaling: –1,999 to 9,999 –199.9 to 999.9 –19.99 to 99.99 –1.999 to 9.999
		0 to 20 mA	1	
	Voltage input	1 to 5 V	2	
		0 to 5 V	3	
		0 to 10 V	4	

- The default is 0.

3-3 Selecting the Temperature Unit

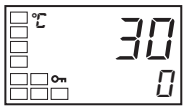
3-3-1 Temperature Unit

- Either °C or °F can be selected as the temperature unit.
- Set the temperature unit in the “temperature unit” parameter of the initial setting level. The default is c (°C).

Operating Procedure

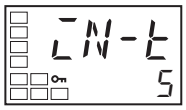
The following example shows how to select °C as the temperature unit.

Operation Level



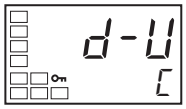
1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level



Input type

2. Select the “temperature unit” parameter by pressing the M key. Press the U or D key to select either °C or °F.
   c: °C
   f: °F



Temperature unit

3. To return to the operation level, press the O key for at least one second.

3-4 Selecting PID Control or ON/OFF Control

Two control methods are supported: 2-PID control and ON/OFF control. Switching between 2-PID control and ON/OFF control is executed by means of the “PID ON/OFF” parameter in the initial setting level. When this parameter is set to pid, 2-PID control is selected, and when set to onof, ON/OFF control, is selected. The default is onof.

2-PID Control

PID control is set by AT (auto-tuning), ST (self-tuning), or manual setting.

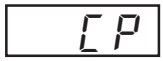
For PID control, set the PID constants in the “proportional band” (P), “integral time” (I), and “derivative time” (D) parameters.

ON/OFF Control

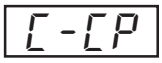
In ON/OFF control, the control output is turned ON when the process value is lower than the current set point, and the control output is turned OFF when the process value is higher than the current set point (reverse operation).

3-5 Setting Output Specifications

3-5-1 Control Periods



Control period (heating)

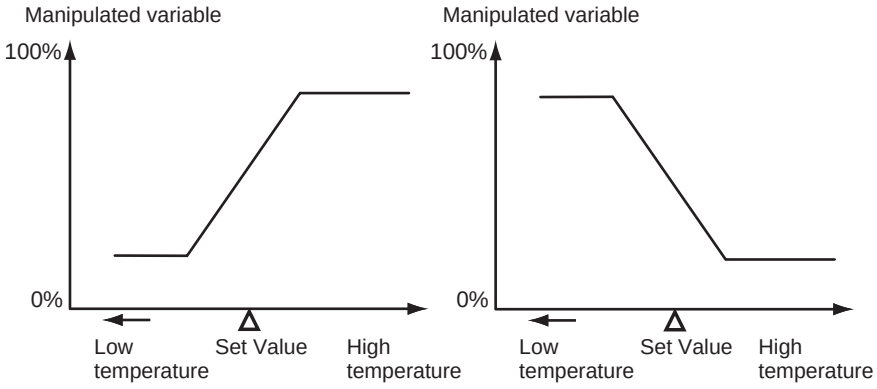


Control period (cooling)

- Set the output periods (control periods). Though a shorter period provides better control performance, it is recommended that the control period be set to 20 seconds or longer for a relay output to preserve the service life of the relay. After the settings have been made in the initial setup, readjust the control period, as required, by means such as trial operation.
- Set the control periods in the “control period (heating)” and “control period (cooling)” parameters in the initial setting level. The default is 20 seconds.
- The “control period (cooling)” parameter is used only for heating/cooling control.
- When control output 1 is used as a current output, “control period (heating)” cannot be used.

3-5-2 Direct and Reverse Operation

- "Direct operation" increases the manipulated variable whenever the process value increases. "Reverse operation" decreases the manipulated variable whenever the process value increases.



For example, when the process value (PV) is lower than the set point (SP) in a heating control system, the manipulated variable increases according to the difference between the PV and SP. Accordingly, reverse operation is used in a heating control system. Direct operation is used in a cooling control system, in which the operation is the opposite of a heating control system.

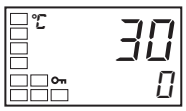
- Direct/reverse operation is set in the "direct/reverse operation" parameter in the initial setting level. The default is o r - r (reverse operation).

Operating Procedure

In this example, the input type, temperature unit, direct/reverse operation, and control period (heating) parameters are checked.

Input type = s (K thermocouple)
Temperature unit = c (°C)
Direct/reverse operation = o r - r (reverse operation)
Control period (heating) = 20 (seconds)

Operation Level

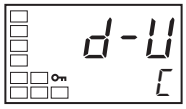


1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level

Input type

2. The input type is displayed. When the input type is being set for the first time, s (K thermocouple) is set. To select a different sensor, press the U or D key.



Temperature unit

3. Select the "temperature unit" parameter by pressing the M key. The default is c (°C). To select f (°F), press the U key.

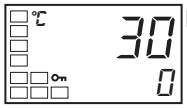
Control period (heating)

4. Select the "control period (heating)" parameter by pressing the M key. The default is 20.

Direct/reverse operation

5. Select the “direct/reverse operation” parameter by pressing the M key. The default is or-r (reverse operation). To select or-d (direct operation), press the U key.

Operation Level



PV/SP

6. To return to the operation level, press the O key for at least one second.

3-5-3 Assigned Output Functions

- Function assignments can be changed by changing the settings for control and alarm assignments.
- The default function assignments for each output are shown below.

Parameter name	Symbol	Initial status
Control output 1 assignment	out1	Control output (heating)
Alarm output 1 assignment	alm1	Alarm 1
Alarm output 2 assignment	alm2	Alarm 2
Alarm output 3 assignment (E5AZ/EZ only)	alm3	Alarm 3

- Each output is automatically initialized as shown below by changing the control mode.

Example: E5CZ

Parameter name	Symbol	Standard	Heating/cooling
Control output 1 assignment	out1	Control output (heating)	Control output (heating)
Alarm output 1 assignment	alm1	Alarm 1	Alarm 1
Alarm output 2 assignment	alm2	Alarm 2 (See note.)	Control output (cooling) (See note.)

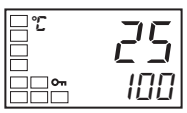
Note For the E5AZ/EZ, alarm 3 is assigned for control output (cooling) (alarm output 2 is assigned for alarm 2).

In this manual, assigned control outputs and alarm outputs are indicated as follows: “Control output 1 must be assigned” or “Alarm 1 must be assigned.”

Operating Procedure

The following example sets the following control and alarm assignments.
Control output 1: Control output (heating); Alarm output 1: Alarm 1; Alarm output 2: Control output (cooling).

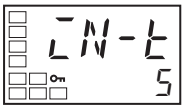
Operation Level



PV/SP

1. Press the O key for at least 3 seconds to move from the operation level to the initial setting level.

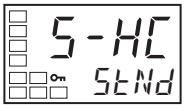
Initial Setting Levell



Input type

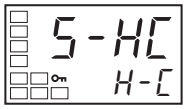
2. Select the “standard or heating/cooling” parameter by pressing the M key.

Initial Setting Level



Standard or heating/cooling

Initial Setting Level



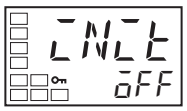
3. Press the U key to set the parameter to h-c.

Note The following output assignments do not need to be set because they are set automatically by changing the control mode, but they are shown here as a reference for checking the assignments for each output.

Move to advanced function setting level

4. Select the "move to advanced function setting level" parameter by pressing the M key.

Advanced Function Setting Level



Parameter initialization

5. Press the D key to enter the password ("–169"), and move from the initial setting level to the advanced function setting level.

Advanced Function Setting Level

Control output 1 assignment

6. Select the "alarm output 1 assignment" parameter by pressing the M key.

7. Press the U or D key to set o.
(The default is o.)

Advanced Function Setting Level

Alarm output 1 assignment

8. Select the "alarm output 1 assignment" parameter by pressing the M key.

9. Press the U or D key to set alm1.
(The default is alm1.)

Advanced Function Setting Level
E5CZ

Alarm output 2 assignment

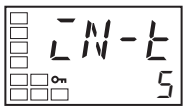
10. Select the "alarm output 2 assignment" parameter by pressing the **M** key.
(The default of the E5CZ is **c-o**.)

E5AZ/EZ

(The default of the E5AZ/EZ is alm2.)

11. Press the U or D key to set **c-o**.

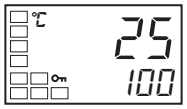
Initial Setting Level



Input type

12. Press the O key for at least one second to move from the advanced function setting level to the initial setting level.

Operation Level

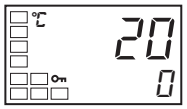


PV/SP

13. Press the O key for at least one second to move from the initial setting level to the operation level.

3-6 Setting the Set Point (SP)

Operation Level



The operation level is displayed when the power is turned ON. The process value (PV) is at the top of the display, and the set point (SP) is at the bottom.

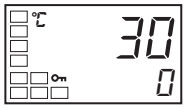
3-6-1 Changing the SP

- The set point cannot be changed when the “operation/adjustment protect” parameter is set to 3. For details, refer to *4-9 Using the Key Protect Level*.
- To change the set point, press the U or D key in the “process value/set point” parameter (in the operation level), and set the desired set value. The new set point is selected two seconds after you have specified the new value.
- Multi-SP is used to switch between two or four set points. For details, refer to *4-5 Using Event Inputs* for details.

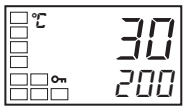
Operating Procedure

In this example, the set point is changed from 0°C to 200°C.

Operation Level



1. Normally, the “process value/set point” parameter is displayed. The set point is 0°C.



2. Use the U and D keys to set the set point to 200°C.

3-7 Using ON/OFF Control

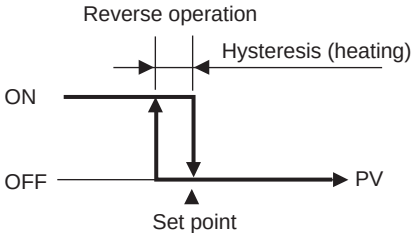
In ON/OFF control, the control output turns OFF when the temperature being controlled reaches the preset set point. When the manipulated variable turns OFF, the temperature begins to fall and the control turns ON again. This operation is repeated over a certain temperature range. At this time, how much the temperature must fall before control turns ON again is determined by the “hysteresis (heating)” parameter. Also, what direction the manipulated variable must be adjusted in response to an increase or decrease in the process value is determined by the “direct/reverse operation” parameter.

3-7-1 ON/OFF Control

- Switching between 2-PID control and ON/OFF control is performed using the “PID ON/OFF” parameter in the initial setting level. When this parameter is set to pid, 2-PID control is selected, and when it is set to onof, ON/OFF control is selected. The default is onof.

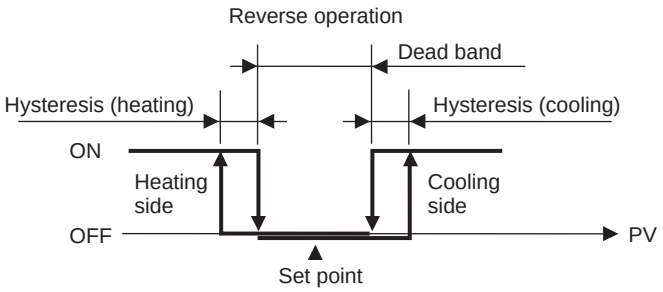
Hysteresis

- With ON/OFF control, hysteresis is used to stabilize operation when switching between ON and OFF. The control output (heating) and control output (cooling) functions are set in the “hysteresis (heating)” and “hysteresis (cooling)” parameters, respectively.
- In standard control (heating or cooling control), the setting of the “hysteresis (heating)” parameter in the adjustment level is used as the hysteresis regardless of whether the control type is heating control or cooling control.



Three-position Control

- In heating/cooling control, a dead band (an area where both control outputs are 0) can be set to either the heating or cooling side. This makes it possible to use 3-position control.



Parameters

Symbol	Parameter: Level	Application
s-hc	Standard or heating/cooling: Initial setting level	Specifying control method
cntl	PID ON/OFF: Initial setting level	Specifying control method
orev	Direct/reverse operation: Initial setting level	Specifying control method
c-db	Dead band: Adjustment level	Heating/cooling control
c-sc	Cooling coefficient: Adjustment level	Heating/cooling control
hys	Hysteresis (heating): Adjustment level	ON/OFF control
chys	Hysteresis (cooling): Adjustment level	ON/OFF control

3-7-2 Settings

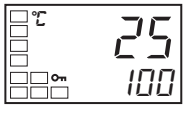
To execute ON/OFF control, set the “set point,” “PID ON/OFF,” and “hysteresis” parameters.

Setting the “PID ON/OFF” Parameter

Operating Procedure

Confirm that the “PID ON/OFF” parameter is set to onof in the initial setting level.

Operation Level



1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level

Input type

2. The “input type” parameter is displayed in the initial setting level.

PID ON/OFF

3. Select the “PID ON/OFF” parameter by pressing the M key.

4. Check that the set value is onof (i.e., the default).
5. To return to the operation level, press the O key for at least one second.

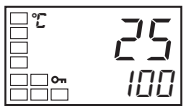
Next, set the set point value.

Setting the SP

Operating Procedure

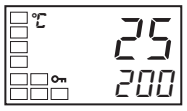
In this example, the set point is set to 200. The set value (i.e., the SP) is shown at the bottom of the display.

Operation Level



PV/SP

1. Select the “process value/set point” parameter in the operation level.



2. Use the U and D keys to set the SP. (In this example, it is set to 200.) The new set value can be fixed by pressing the M key, or it will go into effect after two seconds have elapsed.

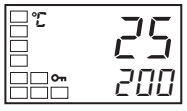
Next, set the hysteresis.

Setting the Hysteresis

Operating Procedure

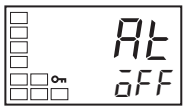
Set the hysteresis to 2.0°C.

Operation Level



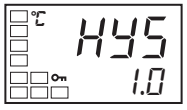
PV

1. Press the O key to move from the operation level to the adjustment level.



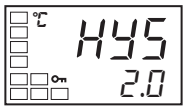
AT execute/ cancel

2. The “AT execute/cancel” parameter will be displayed in the adjustment level.



Hysteresis (heating)

3. Select the “Hysteresis (heating)” parameter by pressing the M key.

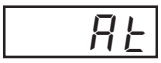


4. Press the U and D keys to set the hysteresis (2.0 in this example). Either press the M key or wait for at least two seconds after setting the hysteresis value to confirm the setting.

5. To return to the operation level, press the O key for at least one second.

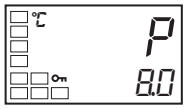
3-8 Determining PID Constants (AT, ST, Manual Setup)

3-8-1 AT (Auto-tuning)

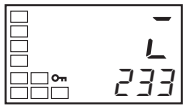


- When AT is executed, the optimum PID constants for the set point at that time are set automatically. A method (called the limit cycle method) for forcibly changing the manipulated variable and finding the characteristics of the control object is employed.
- To execute AT, specify on (AT execute), and to cancel AT, specify off (AT cancel).
- AT cannot be executed when control has stopped or during ON/OFF control.
- The results of AT are reflected in the "proportional band" (P), "integral time" (I), and "derivative time" (D) parameters in the adjustment level.

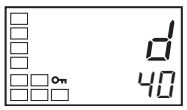
Adjustment Level



Proportional band



Integral time

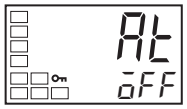


Derivative time

AT Operations

AT is started when the "AT execute/cancel" parameter is set to ON. During execution, the "AT execute/cancel" parameter on the No. 1 display flashes. When AT ends, the "AT execute/cancel" parameter turns OFF, and the No. 1 display stops flashing.

AT execute/cancel

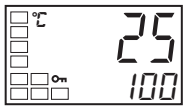


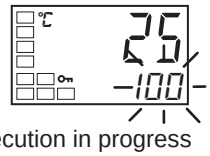
No. 1 display

AT execution in progress

If you move to the operation level during AT execution, the No. 2 display flashes to indicate that AT is being executed.

PV/SP





No. 2 display

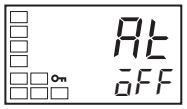
AT execution in progress

Only the "communications writing," "RUN/STOP," and "AT execution/cancel" parameters can be changed during AT execution. Other parameters cannot be changed.

Operating Procedure

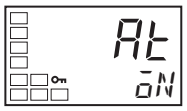
This procedure executes auto-tuning (AT).

Adjustment Level

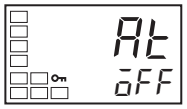


AT execute/ cancel

1. Press the O key to move from the operation level to the adjustment level.

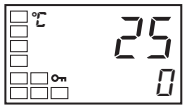


2. Press the U key to start execution of AT (auto-tuning). on will be displayed during AT execution.



3. o f f will be displayed when AT ends.

Operation Level



PV

4. To return to the operation level, press the O key.

3-8-2 ST (Self-tuning)

ST (auto-tuning) is a function that finds PID constants by using step response tuning (SRT) when Controller operation begins or when the set point is changed.

Once the PID constants have been calculated, ST is not executed when the next control operation is started as long as the set point remains unchanged.

ST (self-tuning) is enabled when the “ST” parameter is set to ON in the initial setting level.

When the ST function is in operation, be sure to turn the power supply of the load connected to the control output ON simultaneously with or before starting Controller operation.

When executing self-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Digital Temperature Controller. If power is turned ON for the Digital Temperature Controller before turning ON power for the load, self-tuning will not be performed properly and optimum control will not be achieved.

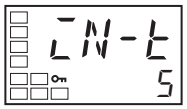
Note PID Constants

When control characteristics are already known, PID constants can be set directly to adjust control. PID constants are set in the “proportional band” (P), “integral time” (I), and “derivative time” (D) parameters in the adjustment level.

Operating Procedure

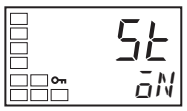
This procedure executes self-tuning (ST).

Initial Setting Level



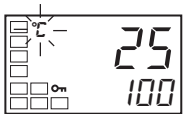
Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.



ST

2. Select the “ST” parameter by pressing the M key.
3. Press the U key to select on. ON is the default.



4. To return to the operation level, press the O key. The temperature display flashes during self-tuning (ST) execution.

Startup Conditions

Self-tuning by step response tuning (SRT) is started when the following conditions are met after program execution is started and the set point is changed.

At start of operation	When set point is changed
1. The set point at the start of operation differs from the set point when the previous SRT was executed. (See note 1.) 2. The difference between the temperature at the start of operation and the set point is greater both of the following: (Present proportional band × 1.27 + 4°C) and the ST stable range. 3. The temperature at the start of operation is lower than the set point during reverse operation, and is larger than the set point during direct operation. 4. There is no reset from input errors.	1. The new set point differs from the set point used when the previous SRT was executed. (See note 1.) 2. The set point change width is greater both of the following: (Present proportional band × 1.27 + 4°C) and the ST stable range. 3. During reverse operation, the new set point is larger than the set point before the change; and during direct operation, the new set point is smaller than the set point before the change. 4. The temperature is stable. (See note 2.) (Equilibrium with the output amount at 0% when the power is turned ON is also all right.) (See note 3.)

Note

(1) The previous SRT-implemented set point is the set point that was used for calculating the PID constants for the previous SRT.

(2) In this state, the measurement point is within the ST stable range.

(3) In this state, the change width of the PV every 60 seconds is within the ST stable range or less.

In the following instances, PID constants are not changed by self-tuning (ST) for the present set point.

1,2,3...

1. When the PID constants have been changed manually with ST set to ON.
2. When auto-tuning (AT) has been executed.

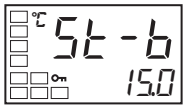
ST Stable Range

Operating Procedure

The ST stable range determines the condition under which ST (self-tuning) functions.

This procedure sets the ST stable range to 20°C..

Advanced Function Setting Level



1. Select the “ST stable range” parameter by pressing the M key in the advanced function setting level.

2. Use the U key to set the parameter to 20°C.

3-8-3 Manual Setup

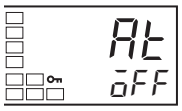
Individual PID constants can be manually set in the “proportional band,” “integral time,” and “derivative time” parameters in the adjustment level.

Operating Procedure

In this example, the “proportional band” parameter is set to 10.0, the “integral time” parameter to 250, and the “derivative time” parameter to 45.

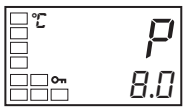
Adjustment Level

1. Press the O key to move from the operation level to the adjustment level.



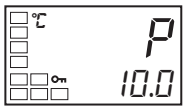
AT execute/ cancel

2. Press the M key to select the “proportional band” parameter.

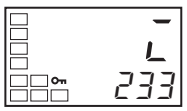


Proportional band

3. Use the U and D keys to set 10.0.

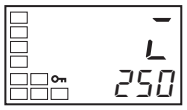


4. Press the M key to select the “integral time” parameter.



Integral time

5. Use the U and D keys to set 250.



6. Select the “derivative time” operation by pressing the M key.

Derivative time

7. Use the U and D keys to set 45.

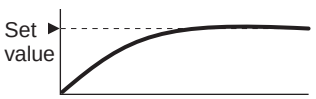
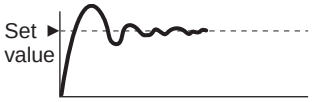
8. To return to the operation level, press the O key.

Note Proportional Action

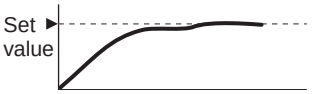
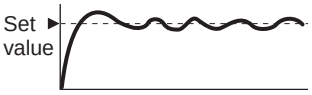
When PID constants I (integral time) and D (derivative time) are set to 0, control is executed according to proportional action. As the default, the center value of the proportional band becomes the set point.

Related parameter: Manual reset value (adjustment level)

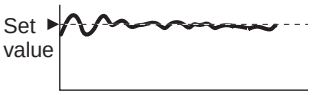
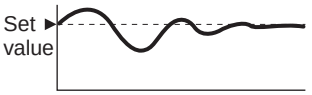
When P (Proportional Band) Is Adjusted

Increased		The curve rises gradually, and a long stabilization time is created, but overshooting is prevented.
Decreased		Overshooting and hunting occur, but the set value is quickly reached and the temperature stabilizes.

When I (Integral Time) Is Adjusted

Increased		It takes a long time to reach the set point. It takes time to achieve a stable state, but overshooting, undershooting, and hunting are reduced.
Decreased		Overshooting and undershooting occur. Hunting occurs. The Controller starts up faster.

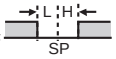
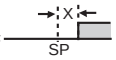
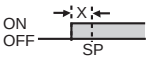
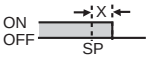
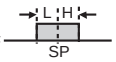
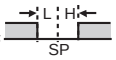
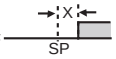
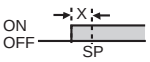
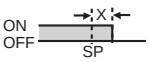
When D (Derivative Time) Is Adjusted

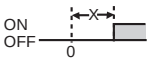
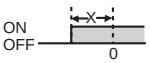
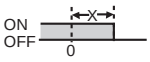
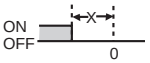
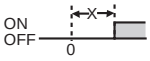
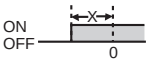
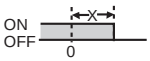
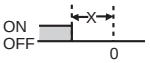
Increased		Overshooting, undershooting, and stabilization times are reduced, but fine hunting occurs on changes in the curve itself.
Decreased		Overshooting and undershooting increase, and it takes time to return to the set point.

3-9 Alarm Outputs

- Alarms can be used by the E5CZ-□2M□□ (2 alarm outputs), E5AZ/EZ-□3□□□□ (3 alarm outputs), or the E5CZ-□2T□U (2 alarm outputs). Alarm outputs are determined by a combination of “alarm type,” “alarm value,” and “alarm hysteresis” alarm output conditions. For details, refer to *4-2 Alarm Hysteresis*.
- This section describes the “alarm type,” “alarm value,” “upper-limit alarm” and “lower-limit alarm” parameters.

3-9-1 Alarm Types

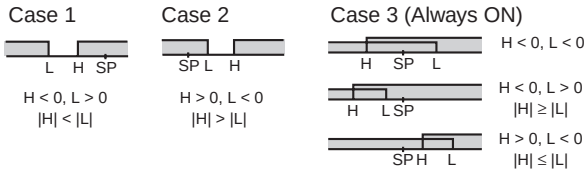
Set value	Alarm type	Alarm output operation	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1(See note 1.)	Upper- and lower-limit		See note 2.
2	Upper-limit		
3	Lower-limit		
4 (See note 1.)	Upper- and lower-limit range		See note 3.
5 (See note 1.)	Upper- and lower-limit with standby sequence	 See note 5.	See note 4.
6	Upper-limit with standby sequence		
7	Lower-limit with standby sequence		

Set value	Alarm type	Alarm output operation	
		When alarm value X is positive	When alarm value X is negative
8	Absolute-value upper-limit		
9	Absolute-value lower-limit		
10	Absolute-value upper-limit with standby sequence		
11	Absolute-value lower-limit with standby sequence		
12	LBA (alarm 1 type only)	---	

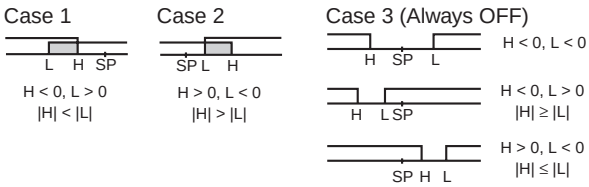
Note

(1) With set values 1, 4, and 5, the upper- and lower-limit values can be set independently for each alarm type, and are expressed as “L” and “H.”

(2) Set value: 1 (Upper- and lower-limit alarm)



(3) Set value: 4 (Upper-and lower- limit range)



(4) Set value: 5 (Upper- and lower-limit with standby sequence)

- For the upper-and lower-limit alarms in cases 1 and 2 above, the alarm is always OFF if upper- and lower-limit hysteresis overlaps.
- In case 3, the alarm is always OFF.

(5) Set value: 5 (Upper- and lower-limit with standby sequence)

- The alarm is always OFF if upper- and lower-limit hysteresis overlaps.

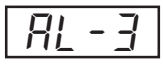
- Set the alarm type independently for each alarm in the “alarm 1 to 3 type” parameters in the initial setting level. The default is 2 (Upper-limit alarm).

3-9-2 Alarm Values

Alarm lower limit value

Alarm upper limit value

Alarm value



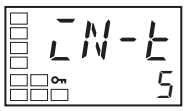
- Alarm values are indicated by “X” in the table on the previous page. When the upper and lower limits are set independently, “H” is displayed for upper limit values, and “L” is displayed for lower limit values.
- To set the alarm value upper and lower limits for deviation, set the upper and lower limits in each of the “alarm 1 to 3 upper limit,” and “alarm 1 to 3 lower limit” parameters in the operation level.

Operating Procedure

This procedure sets alarm 1 as an upper-limit alarm. The related parameters and settings are shown below. The alarm is output when the set point exceeds 10°C. (In this example, the temperature unit is °C.)

Alarm 1 type = 2 (Upper-limit alarm)
Alarm value 1= 10

Initial Setting Level

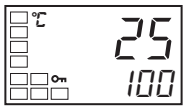


Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

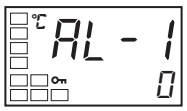
Alarm 1 type

2. Select the “alarm 1 type” parameter by pressing the M key. Confirm that the set value is 2. The default value is 2 (Upper-limit alarm).



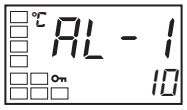
PV/SP

3. To return to the operation level, press the O key for at least one second.



Alarm value 1

4. Select the “alarm value 1” parameter by pressing the M key.



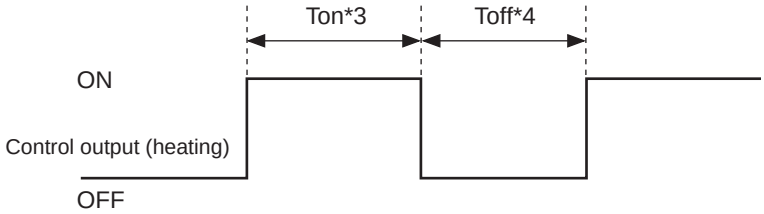
5. Use the U key to set the parameter to 10.

3-10 Using HB and HS Alarms

3-10-1 HB and HS Alarm Operations

- Heater burnout detection is executed by measuring heater current while the control output for heating is ON, and HS detection is executed by measuring heater current while it is OFF. For details, refer to the following table.
  (Heater burnout detection and HS detection cannot be used with the control output for cooling.)

Heating control output status		Power to heater	HB alarm output	HS alarm output
Control output (heating)	Operation indicator			
ON	Lit	Yes (Normal) (See note 1.)	OFF	---
		No (Heater burnout)	ON	---
OFF	Not lit	Yes (HS alarm)	---	ON
		No (Normal) (See note 2.)	---	OFF



Note

(1) In the above diagram, power is considered to be ON (normal) if the heater current is greater than the heater burnout detection current during the Ton interval. If the heater is burned out, the measured current decreases and falls below the heater burnout detection value. The output is then activated as the heater burnout alarm.

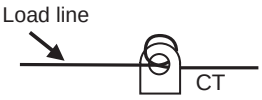
(2) In the above diagram, power is considered to be OFF (normal) if the leakage current is less than the HS alarm current during the Toff interval. If the SSR output is short-circuited, the measured current increases beyond the HS alarm value. The output is then activated as the HS alarm.

(3) Heater burnouts are not detected if the control output (heating) ON time (Ton) is 190 ms or less.

(4) HS are not detected if the control output (heating) OFF time (Toff) is 190 ms or less.

- For models with HB and HS alarms, an OR output is established between the ALM 1 function and the HB/HS alarm. If the ALM1 function is to be used for HB and HS alarms only, set 0 as the ALM1 type and do not use ALM1.
- Turn the heater power ON simultaneously or before turning ON the E5□Z power. If the heater power is turned ON after turning ON the E5□Z power, the HB alarm will be activated.
- Control is continued even when the HB or HS alarm is active.
- The rated current value may sometimes differ slightly from the actual current flowing to the heater.
  Use the “heater current 1 value monitor,” and “leakage current 1 monitor,” parameters to check the actual current being used.

- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through once will double the detection current.

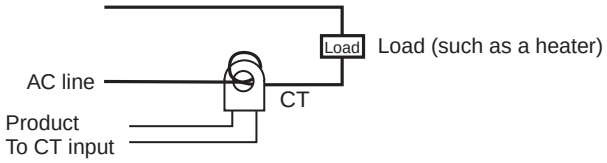


3-10-2 Installing Current Transformers (CT)

- This function can be used with E5□Z models that have the HB alarm and HS alarm.
  For the E5CZ, connect the CT in advance to terminals 14 and 15 (CT1). For the E5AZ/EZ, connect the CT in advance to terminals 14 and 15 (CT1). Then pass the heater power line through the CT's hole.
  For specifications, models and dimensions of current transformers that can be used with this Controller, see *Appendix A Current Transformer (CT)* page 153.

Single-phase Heaters

For single-phase heaters, install the CT in the position shown in the following diagram.



3-10-3 Calculating Detection Current Values

- Calculate the set value using the following equation:

$$\text{Heater Burnout Detection 1 set value} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

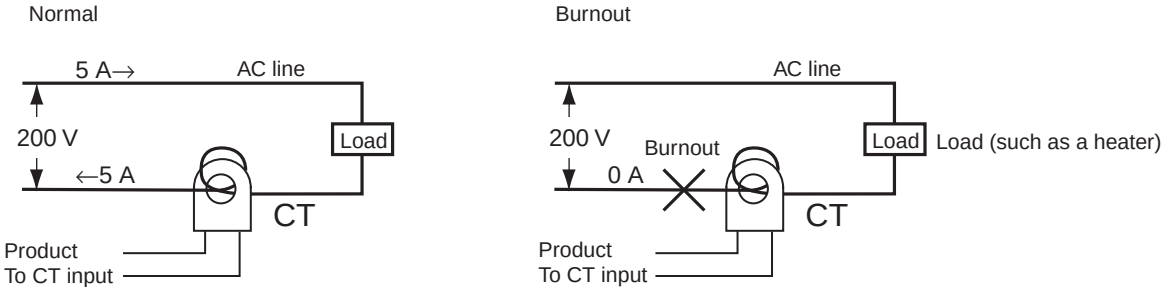
$$\text{HS Alarm 1 set value} = \frac{\text{Leakage current value (output OFF)} + \text{HS current value}}{2}$$

- To set the current for heater burnout when two or more heaters are connected through the CT, use the value from when the heater with the smallest current burns out. If all of the heaters have the same current, use the value from when any one of them burns out.
- Make sure that the following conditions are satisfied:
  Heater with a current of less than 10.0 A:
  (Current value at normal operation) − (Current value at heater burnout) ≥ 1 A
  When the difference is less than 1 A, detection is unstable.
  Heater with a current of 10.0 A or more:
  (Current value at normal operation) − (Current value at heater burnout) ≥ 2.5 A
  When the difference is less than 2.5 A, detection is unstable.

- The setting range is 0.1 to 49.9 A. Heater burnout and HS are not detected when the set value is 0.0 or 50.0.
  When the set value is 0.0, the heater burnout alarm is always OFF, and the HS alarm is always ON.
  When the set value is 50.0, the heater burnout alarm is always ON, and the HS alarm is always OFF.
- Set the total current value for normal heater operation to 50 A or less. When a current value of 55.0 A is exceeded, f f f f is displayed in the "heater current 1 value monitor" and "leakage current 1 monitor" parameters.

3-10-4 Application Examples

Single-phase Heaters Example: Using a 200-VAC, 1-kW Heater

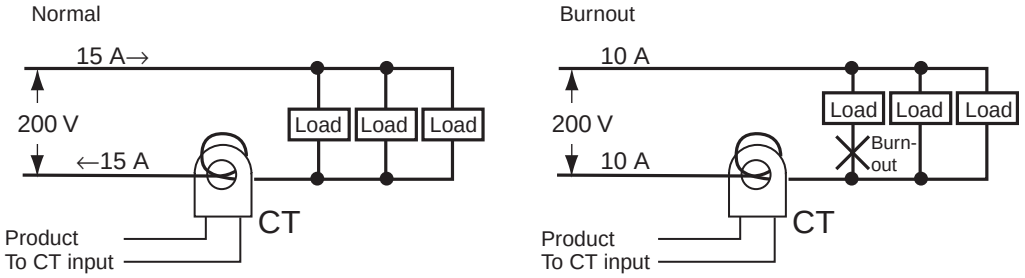


The heater power supply provides 5 A when the current is normal, and 0 A when there is a burnout, so the heater burnout detection current is calculated as follows:

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

$$= \frac{5 + 0}{2} = 2.5\ [\text{A}]$$

Example: Using Three 200-VAC, 1-kW Heaters



The heater power supply provides 15 A when the current is normal, and 10 A when there is a burnout, so the heater burnout detection current is calculated as follows:

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

$$= \frac{15 + 10}{2} = 12.5\ [\text{A}]$$

3-10-5 Settings (HB alarm)

To activate the heater burnout alarm, set the "heater burnout detection" parameter to ON in the advanced function setting level and set the "heater burnout detection 1" parameter in the adjustment level.

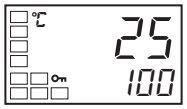
Operating Procedure

This procedure sets the "heater burnout detection 1" parameter to 2.5.

■ **Moving to the Advanced Function Setting Level**

The "heater burnout detection" parameter setting is already ON by default, so set the "heater burnout detection 1" parameter.

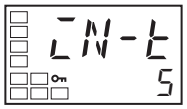
Operation Level



PV/SP

1. Move to the advanced function setting level.
   Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level



Input type

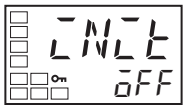
2. Select "move to advanced function setting level" by pressing the M key.

Initial Setting Level

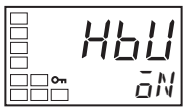
Moves to advanced function setting level

3. Press the D key to enter the password (−169), and move from the initial setting level to the advanced function setting level.

Advanced Function Setting Level



The top parameter in the advanced function setting level is displayed.

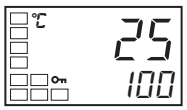


Heater burnout detection

4. Select the "heater burnout detection" parameter by pressing the M key. Check that this parameter is set to ON (the default).
   Next, set the "heater current 1 value monitor" parameter.

■ **Setting Heater Burnout Detection**

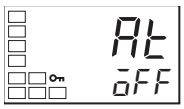
Operation Level



PV/SP

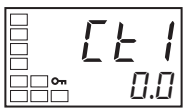
5. Press the O key for at least one second to move from the advanced function setting level to the initial setting level and then to the operation level.

Adjustment Level



AT execute/ cancel

6. Press the O key for less than one second to move from the operation level to the adjustment level.

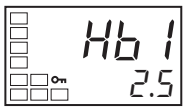


Heater current 1 value monitor

7. Select the "heater current 1 value monitor" parameter by pressing the M key. Check the current value. Next, set the "heater burnout detection 1" parameter.

Heater burnout detection 1

8. Select the "heater burnout detection 1" parameter by pressing the M key. Refer to *3-10-3 Calculating Detection Current Values* on page 51 when making the settings.



9. For this example, set 2.5. To return to the operation level, press the O key for less than one second.

3-10-6 Settings (HS Alarm)

To activate the HS alarm, set the “HS alarm use” parameter to ON in the advanced function setting level and set the “HS alarm 1” parameter in the adjustment level.

Operating Procedure

This procedure sets the “HS alarm 1” parameter to 2.5.

■ **Moving to the Advanced Function Setting Level**

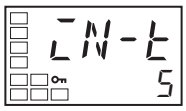
The “HS alarm use” parameter setting is already ON by default, so set the “HS alarm 1” parameter.

Operation Level

PV/SP

1. Move to the advanced function setting level.
   Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level



Input type

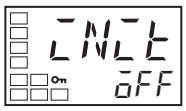
2. Select “move to advanced function setting level” by pressing the M key.

Initial Setting Level

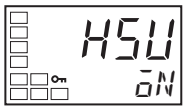
Moves to advanced function setting level

3. Press the D key to enter the password (−169), and move from the initial setting level to the advanced function setting level.

Advanced Function Setting Level



The top parameter in the advanced function setting level is displayed.

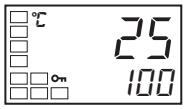


HS alarm use

4. Select the “HS alarm use” parameter by pressing the M key.
   Check that this parameter is set to ON (the default).
   Next, set the “leakage current 1 monitor” parameter.

■ HS Alarm Settings

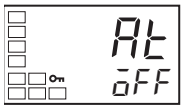
Operation Level



PV/SP

5. Press the O key for at least one second to move from the advanced function setting level to the initial setting level and then to the operation level.

Adjustment Level

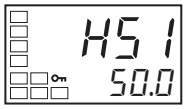


AT execute/ cancel

6. Press the O key for less than one second to move from the operation level to the adjustment level.

Leakage current 1 monitor

7. Select the “leakage current 1 monitor” parameter by pressing the M key. Check the current value. Next, set the “HS alarm 1” parameter.



HS alarm 1

8. Select the “HS alarm 1” parameter by pressing the M key. Refer to *3-10-3 Calculating Detection Current Values* on page 51 when setting the values.

9. For this example, set 2.5. To return to the operation level, press the O key for less than one second.

SECTION 4
Applications Operations

This section describes scaling, the SP ramp function, and other special functions that can be used to make the most of the functionality of the E5CZ and E5CZ-U Digital Temperature Controllers.

4-1 Shifting Input Values

4-1-1 Shifting Inputs

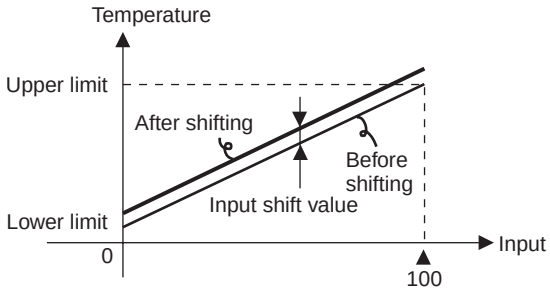
The input shift matched to the sensor currently selected in the “input type” parameter is displayed.

- A 2-point shift is applied for infrared temperature sensors. A 2-point shift can also be used if the “input shift type” parameter (advanced function setting level) is set to INS2 for a thermocouple or platinum resistance thermometer.
- There is no shift for analog inputs. Use scaling for fine adjustments.

One-point shift

Temperature input shift

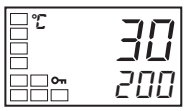
- With a 1-point shift, the value set for the “temperature input shift” parameter (adjustment level) is applied to each point in the entire temperature input range. For example, if the input shift value is set to 1.2°C, the process value is treated as 201.2°C after the input shift is applied when the measured process value is 200°C.



Operating Procedure

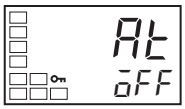
In this example, the input from a K sensor is shifted by 1°C using a 1-point input shift.

Operation Level



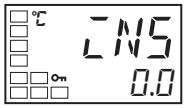
Operation Level

Adjustment Level



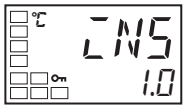
AT execute/ cancel

1. Press the O key to move from the operation level to the adjustment level.



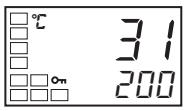
Temperature input shift

2. Select the “temperature input shift” parameter by pressing the M key.



3. Press the U or D key to set 1.0.

Operation Level

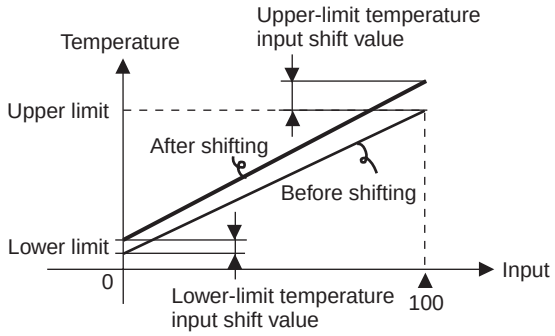


4. To return to the operation level, press the O key. The process value is 1°C larger than before the shift was applied.

Two-point shift

INSH	Upper-limit temperature input shift value
INSL	Lower-limit temperature input shift value

- Separate shift values can be set for the upper limit and lower limit of the sensor input range for an infrared sensor as well as for a thermocouple or platinum resistance thermometer with the “input shift type” set to INS2. If different shift values are set for the upper limit and lower limit, then the slope of the line will be different before and after applying the input shift. For example, if the upper-limit value is set to 2°C and the lower-limit value is set to 1°C, the input temperature will be shifted by 1.5°C for a 50% input, i.e., by the average of the upper-limit and lower-limit values.
- Set the upper-limit value in the “upper-limit temperature input shift value” parameter and the lower-limit value in the “lower-limit temperature input shift value” parameter.



4-1-2 How to Calculate Input Shift Values for a 2-point Shift

When an ES1B Infrared Temperature Sensor is connected to the E5CZ, an offset of several degrees to several tens of a degree can occur.

For this reason, offset the readout value using a 1-point or 2-point shift as described in this section. This offset occurs because a bias current for detecting a Controller sensor error flows to the output impedance of the infrared temperature sensor.

Preparations

1,2,3...

1. Set a temperature range matching the input specifications of the infrared temperature sensor. (The ES1B can be used with the E5AZ only for a thermocouple/resistance thermometer Universal-input type input.)
2. Prepare a thermometer capable of measuring the temperature of the control target as shown in *Figure 1* so that a 1-point shift or 2-point shift can be carried out.
3. When ES1B is used, provide a separate power supply for the Infrared Temperature Sensors.

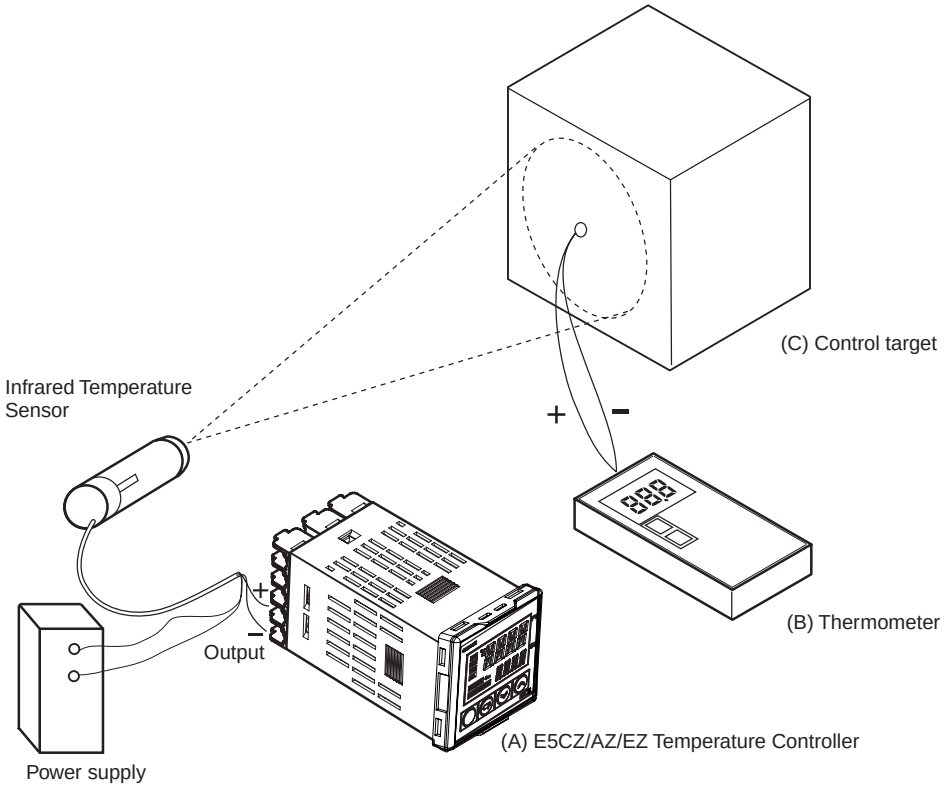
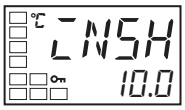


Figure 1 Offset Configuration for an Infrared Temperature Sensor

Method for a 1-point Shift

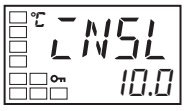
1,2,3...

1. In the configuration shown in *Figure 1*, bring the set point to near the value at which the temperature of the control target is to be controlled. Assume that the control target temperature (C) and the thermocouple temperature (B) are the same.



Upper-limit temperature input shift value

2. Check the control target temperature (B) and the Controller readout (A). Subtract the Controller readout temperature (A) from the control target temperature (B), and set insl and insh to the result as the input shift value. The shift is illustrated in *Figure 2*.



Lower-limit temperature input shift value

3. After setting the input shift values, check the Controller readout (A) and the control target temperature (B). If they are almost the same, this completes shifting the temperature input.

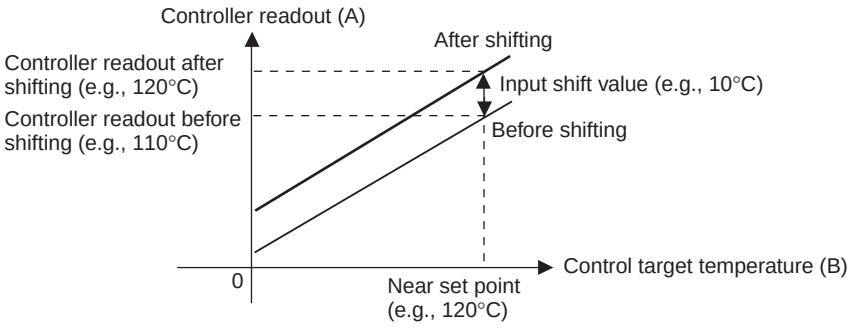


Figure 2 Illustration of 1-Point Shift

Method for a 2-point Shift

Use a 2-point input shift if you want to increase the accuracy of the readout values across the range of the sensor.

1,2,3...

1. Shift the Controller readout at two points, near room temperature and near the value at which the temperature of the control target is to be controlled. For this reason, check the control target temperature (B) and Controller readout (A) with the control object temperature near room temperature and near the set point.
2. Use the following formulas with the readouts checked above and the desired temperature values to calculate the input shift values for the upper-limit and lower-limit temperatures of the measurement range and set the upper-limit and lower-limit temperature input shift values.
   The shift is illustrated in *Figure 3*.

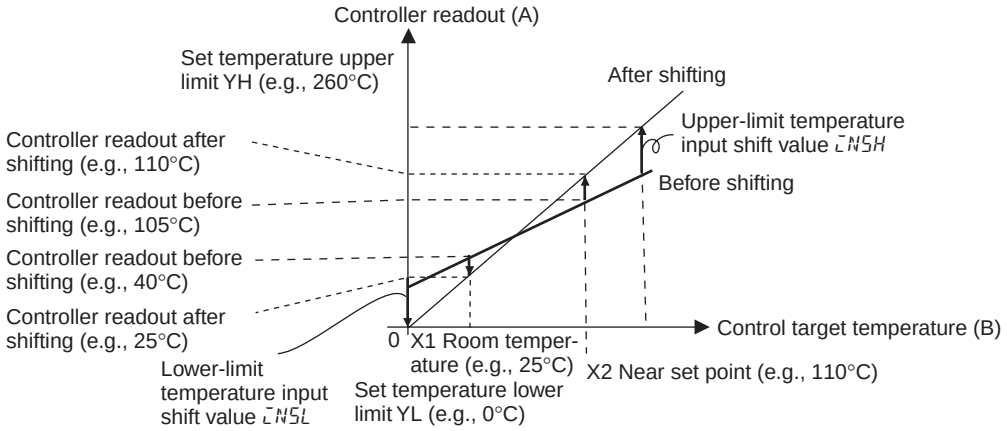


Figure 3 Illustration of 2-Point Shift

a. Lower-limit temperature input shift value

$$inSL = \frac{YL - Y1}{Y2 - Y1} \times \{(X2 - Y2) - (X1 - Y1)\} + (X1 - Y1)$$

b. Upper-limit temperature input shift value

$$inSH = \frac{YH - Y1}{Y2 - Y1} \times \{(X2 - Y2) - (X1 - Y1)\} + (X1 - Y1)$$

3. After setting the calculated values to `insl` and `insh`, check the Controller readout (A) and control target temperature (B).
4. Here, offsets are set at two points, near room temperature and near the set point. To improve accuracy within the measurement temperature range, another point in the measurement temperature range other than the set point should be set instead of room temperature.

Example of a 2-point Temperature Input Shift

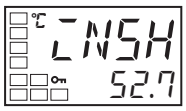
In this example, we use the ES1B K 140 to 260°C specification. In equations 1 and 2, the set temperature lower limit YL is 0°C and the set temperature upper limit YH is 260°C. Check the temperature of the control target.

The temperature input offset values can be calculated as shown below when the Controller readout Y1 is 40°C for a room temperature X1 of 25°C and when the Controller readout Y2 is 105°C for a set point temperature X2 of 110°C.

Lower-limit Temperature Input Shift Value

$$\text{-N5L} = \frac{0 - 40}{105 - 40} \times \{(110 - 105) - (25 - 40)\} + (25 - 40) = -27.3\ (°C)$$

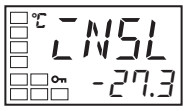
Upper-limit Temperature Input Shift Value



Upper-limit temperature input shift value

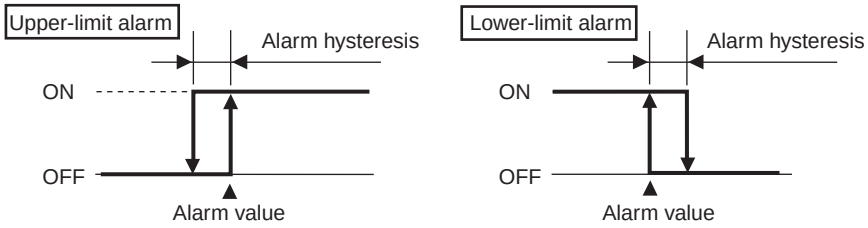
$$\text{-N5H} = \frac{260 - 40}{105 - 40} \times \{(110 - 105) - (25 - 40)\} + (25 - 40) = 52.7\ (°C)$$

4-2 Alarm Hysteresis



Lower-limit temperature input shift value

- The hysteresis of alarm outputs when alarms are switched ON/OFF can be set as follows:



- Alarm hysteresis is set independently for each alarm in the “alarm hysteresis 1" to “alarm hysteresis 3” parameters (advanced function setting level).
- The default is 0.2 (°C/°F) for Controllers with Thermocouple/Resistance Thermometer Universal-inputs and 0.02% FS for Controllers with Analog Inputs.

4-2-1 Standby Sequence

- The standby sequence can be used so that an alarm will not be output until the process value leaves the alarm range once and then enters it again.
- For example, with a lower limit alarm, the process value will normally be below the set point, i.e., within the alarm range, when the power supply is turned ON, causing an alarm to be output.
  If the lower limit alarm with a standby sequence is selected, an alarm will not be output until the process value increases above the alarm set value, i.e., until it leaves the alarm range, and then falls back below the alarm set value.

Restart

- The standby sequence is canceled when an alarm is output. It is, however, restarted later by the “standby sequence reset” parameter (advanced function setting level). For details, refer to the “standby sequence reset” parameter in *SECTION 5 Parameters*.

4-2-2 Alarm Latch

- The alarm latch can be used to keep the alarm output ON regardless of the temperature once the alarm output has turned ON. The alarm output will turn OFF when the power is turned OFF.
- The alarm output can also be turned OFF by switching to the initial setting level, communications setting level, or advanced function setting level.

4-2-3 Close in Alarm/Open in Alarm

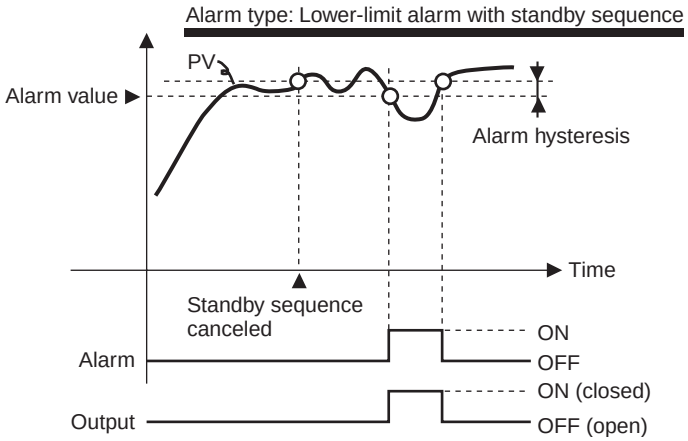
- When “close in alarm” is set, the status of the alarm output function will be output as is. When “open in alarm” is set, the status of the alarm output function will be reversed before being output.
- Close in alarm/open in alarm can be set separately for each alarm.
- Close in alarm/open in alarm is set in the “alarm 1 open in alarm” to “alarm 3 open in alarm” parameters (advanced function setting level).
- The default is n-o (close in alarm).
- When “alarm 1 open in alarm” (advanced function setting level) is set to “open in alarm,” the heater burnout alarm and input error output are also set to “open in alarm.”

Setting	Alarm output function	Alarm output	Alarm indicator
Close in alarm	ON	ON	Lit
	OFF	OFF	Not lit
Open in alarm	ON	OFF	Lit
	OFF	ON	Not lit

- The alarm outputs will turn OFF (i.e., the relay contacts will open) when power is interrupted and for about two seconds after the power is turned ON regardless of the close in alarm/open in alarm setting.

Summary of Alarm Operation

The following figure summarizes the operation of alarms when the alarm type is set to “lower-limit alarm with standby sequence” and “close in alarm” is set.



Parameters

Symbol	Parameter: Level	Description
alh*	Alarm 1 to 3 hysteresis: Advanced function setting level	Alarm
rest	Standby sequence: Advanced function setting level	Alarm
al*n	Alarm 1 to 3 open in alarm: Advanced function setting level	Alarm

Note * = 1 to 3

4-3 Setting Scaling Upper and Lower Limits for Analog Inputs

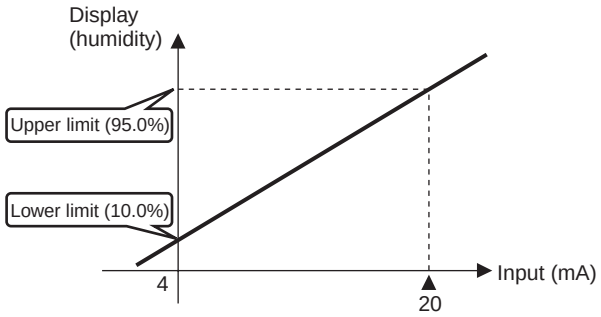
4-3-1 Analog Input

Scaling upper limit

Scaling lower limit

Decimal point

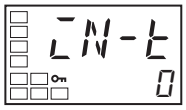
- When an analog input is selected, scaling can be performed as needed by the control application.
- Scaling is set in the “scaling upper limit,” “scaling lower limit,” and “decimal point” parameters (initial setting level). These parameters cannot be used when a temperature input is selected.
- The “scaling upper limit” parameter sets the physical quantity to be expressed by the upper limit value of input, and the “scaling lower limit” parameter sets the physical quantity to be expressed by the lower-limit value of input. The “decimal point” parameter specifies the number of digits below the decimal point.
- The following figure shows a scaling example for a 4 to 20 mV input. After scaling, the humidity can be directly read. Here, one place below the decimal point is set.



Operating Procedure

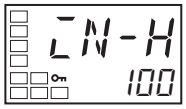
In this example scaling is set to display 4 to 20 mA as 10.0% to 95.0%.

Initial Setting Level



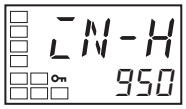
Input type

1. Press the O key for three seconds to move from the operation level to the initial setting level.

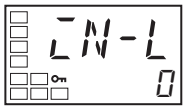


Scaling upper limit

2. Select “scaling upper limit” by pressing the M key.

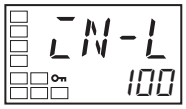


3. Use the U and D keys to set the parameter to 950.

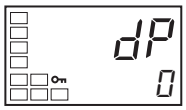


Scaling lower limit

4. Select the “scaling lower limit” parameter by pressing the M key.

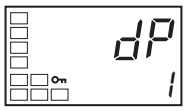


5. Press the U and D keys to set 100.



Decimal point

6. Select the “decimal point” parameter by pressing the M key.



7. Press the U and D keys to set 1.

8. To return to the operation level, press the O key for one second.

4-4 Executing Heating/Cooling Control

4-4-1 Heating/Cooling Control

Heating/cooling control operates when h-c (heating/cooling) is selected for the “standard or heating/cooling” parameter.

The following functions are assigned to outputs in the initial status.

Parameter name	Symbol	Initial status
Control output 1 assignment	out1	Control output for heating
Alarm output 1 assignment	alm1	Alarm 1
Alarm output 2 assignment	alm2	Alarm 2
Alarm output 3 assignment (E5AZ/EZ only)	alm3	Alarm 3

Each output is automatically initialized as shown below when the control mode is changed.

Example: E5CZ

Parameter name	Symbol	Standard	Heating/cooling
Control output 1 assignment	out1	Control output for heating	Control output for heating
Alarm output 1 assignment	alm1	Alarm 1	Alarm 1
Alarm output 2 assignment	alm2	Alarm 2 (See note.)	Control output for cooling (See note.)

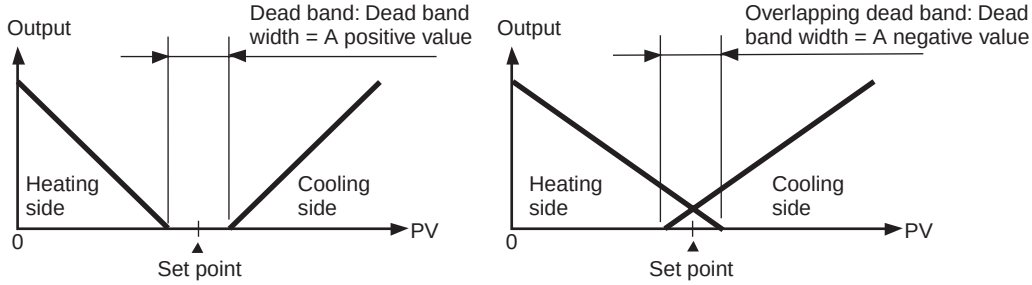
Note For the E5AZ/EZ, alarm 3 is assigned for control output (cooling) (alarm output 2 is assigned for alarm 2).

- The heating/cooling operation of the control outputs will switch when the “direct/reverse operation” parameter is set to “direct.”
- When heating/cooling control is selected, the “dead band” and “cooling coefficient” parameters can be used.

In this manual, assigned control outputs and alarm outputs are indicated as follows: “Control output 1 must be assigned” or “Alarm 1 must be assigned.”

Dead Band

- For heating/cooling control, the dead band is set with the set point as its center. The dead band width is the set value of the “dead band” parameter (adjustment level). Setting a negative value produces an overlapping band.
- If an overlapping band is set, the bumpless function may not operate when switching between manual operation and automatic operation.
- The default is 0.0 EU for Controllers with Thermocouple/Resistance Thermometer Universal-inputs and 0.00% FS for Controllers with Analog Inputs.



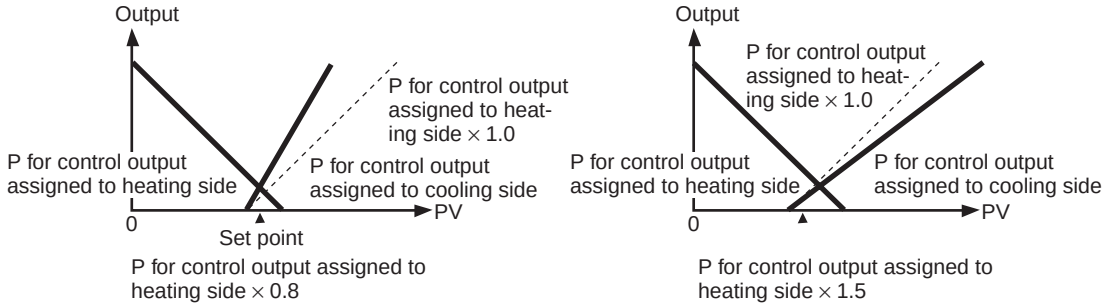
Cooling Coefficient

If the heating characteristics and cooling characteristics of the control object are very different and good control characteristics cannot be achieved with the same PID constants, the cooling coefficient can be used to adjust the proportional band (P) for the control output assigned to the cooling side. Use this to achieve balanced control between the heating side and cooling side. The proportional bands (P) for the control outputs assigned to the heating/cooling sides can be calculated using the following equations.

P for control output assigned to heating side = P

P for control output assigned to cooling side = P for control output assigned to heating side × cooling coefficient

The cooling coefficient is multiplied by the P for the control output assigned to the heating side to obtain control with characteristics that differ from those of the control output assigned to the heating side.



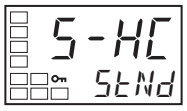
4-4-2 Settings

To set heating/cooling control, set the “standard or heating/cooling,” “dead band,” and “cooling coefficient” parameters.

Setting Heating/Cooling Control

Operating Procedure Standard or heating/cooling = Heating/cooling

Initial Setting Level



Standard or heating/cooling

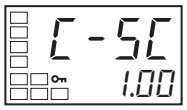
1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

2. Select “heating/cooling control” in the initial setting level.
   stnd: Standard control
   h-c: Heating/cooling control

Setting the Cooling Coefficient

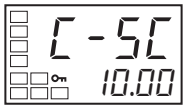
Operating Procedure Cooling Coefficient = 10

Adjustment Level



Cooling coefficient

1. Select the “cooling coefficient” in the adjustment level.



2. Use the U key to set the parameter to 10.00.

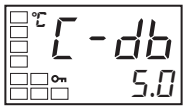
Setting the Dead Band

Operating Procedure Dead Band = 5

Adjustment Level

Dead band

1. Select the “dead band” parameter in the adjustment level.



2. Use the U key to set the parameter to 5.0.

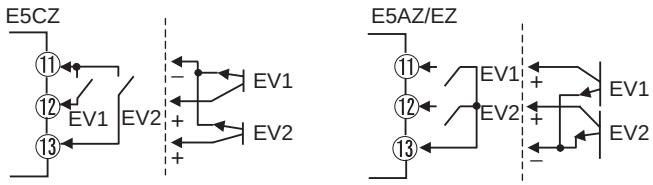
4-5 Using Event Inputs

4-5-1 Event Input Settings

- Event inputs can be used for the multi-SP function, starting/stopping operation (RUN/STOP), and switching between auto/manual.
- Of these, the multi-SP function, event inputs are used only for the number (0 to 2) set in the “number of multi-SP uses” parameter (advanced function setting level).
- Event inputs (1 and 2) that are not used for the multi-SP function are assigned using the “event input assignment 1” and “event input assignment 2” parameters (advanced function setting level).
- Event inputs can be used on the following Controllers:
  E5CZ-□2M□□ with E53-CZB or E53-CZHB
  E5AZ-□3□M□□ with E53-AZB
  E5EZ-□3□M□□ with E53-AZB

Parameter		Setting		Event inputs	
		Event input assignment 1	Event input assignment 2	Function of event input 1	Function of event input 2
Number of multi-SP uses	0 (See note.)	NONE, STOP, MANU		None, or switching RUN/STOP, or switching auto/manual	
	1	(Not displayed.)	NONE, STOP, MANU	Multi-SP, 2 points (switching set points 0 and 1)	None, or switching RUN/STOP, or auto/manual
	2	(Not displayed.)		Multi-SP, 4 points (switching set points 0, 1, 2, 3)	

Note If the “number of multi-SP uses” is set to 0, and both input assignments 1 and 2 can be set. Once “STOP” (RUN/STOP), or “MANU” (auto/manual) has been assigned to one event input, the other event can be assigned only to either of the remaining two settings.



When you are setting two externally input set points, set in the “number of multi-SP uses” parameter.

- Switching is possible between two set points (0 and 1) by setting the “number of multi-SP uses” parameter to 1.
  The default setting is 1 and does not need to be changed to switch between two set points.
  Set point 0 or 1 is specified by the ON/OFF state of event input 1.

4-5-2 How to Use the Multi-SP Function

The multi-SP function allows you to set up to four set points (SP 0 to 3) in the adjustment level. The set point can be switched by operating the keys on the front panel or by using external input signals (event inputs).

Using Event Inputs Event inputs can be used if the Controller supports the event input function and if the “number of multi-SP uses” parameter is set to 1 or 2.

■ **Number of Multi-SP Uses = 1**

Event input 1	Selected set point
OFF	Set point 0
ON	Set point 1

■ **Number of Multi-SP Uses = 2**

Event input 1	Event input 2	Selected set point
OFF	OFF	Set point 0
ON	OFF	Set point 1
OFF	ON	Set point 2
ON	ON	Set point 3

Note Event inputs can be used on the following Controllers. E5CZ-□2M□□ with E53-CZB or E53-CZHB,E5AZ-□3□M□□ with E53-AZB,E5EZ-□3□M□□ with E53-AZB.Turn the event inputs ON or OFF while the E5AZ is turned ON. Event input ON/OFF changes are detected for inputs of 50 ms or longer.

Using Key Operations

You can select any of the set points 0 to 3 by changing the set value of the "multi-SP uses" parameter. The "multi-SP uses" display conditions are as follows:

- If the Controller does not support event inputs, the "multi-SP uses" parameter must be set to ON.
- If the Controller supports event inputs, the "number of multi-SP uses" parameter must be set to 0 and the "multi-SP uses" parameter must be set to ON.

The following table shows the relationship between the "multi-SP uses" parameter set value and the selected set point.

Multi-SP	Selected set point
0	Set point 0
1	Set point 1
2	Set point 2
3	Set point 3

Note The set point can also be switched using communications.

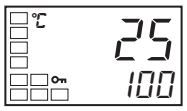
4-5-3 Settings

Switching between Set Points 0, 1, 2, and 3

Operating Procedure

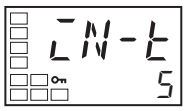
The following example sets the “number of multi-SP uses” parameter to 2.

Operation Level



1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level



2. Select the “move to advanced function setting level” parameter by pressing the M key.

3. Use the D key to enter “−169” (the password).

Advanced Function Setting Level

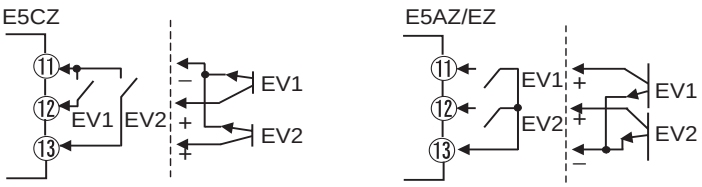
Move to the advanced function setting level by pressing the M key or leaving the setting for at least two seconds.

Number of Multi-SP Uses Setting

4. Select the “number of multi-SP uses” parameter by pressing the M key.

5. Use the U key to set the parameter to 2.
6. To return to the initial setting level, press the O key for at least one second.
7. To return to the operation level, press the O key for at least one second.

Set points 0, 1, 2 and 3 will be set according to the ON/OFF states of event inputs 1 and 2.



Event input assignments 1 and 2 are as follows according to the setting of the "number of multi-SP uses" parameter:

Parameter		Setting		Event inputs	
		Event input assignment 1	**Event input assignment 2**	**Function of event input 1**	**Function of event input 2**
Number of multi-SP uses	0	Event input assignment (See note.)	Event input assignment (See note.)	Specified event input function	Specified event input function
		NONE	Event input assignment	None	Specified event input function
		Event input assignment	NONE	Specified event input function	None
		NONE	NONE	None	None
	1	--- (Setting data not displayed.)	Event input assignment	Multi-SP, 2 points (switching set points 0 and 1)	Specified event input function
		--- (Setting data not displayed.)	NONE	Multi-SP, 2 points (switching set points 0 and 1)	None
	2	--- (Setting data not displayed.)	--- (Setting data not displayed.)	Multi-SP, 4 points (switching set points 0, 1, 2, 3)	

Note One of the settings.

4-5-4 Executing Run/Stop Control

When the "event input assignment 1" or "event input assignment 2" parameter is set to STO (RUN/STOP), control is started when event input 1 or 2 turns OFF. Control is stopped when the input turns ON. Alarm outputs, however, will be according to the process value.

The STOP indicator will light while control is stopped.

Setting	Input contact	Status
Event input 1 or 2	ON	STOP
Event input 1 or 2	OFF	RUN

4-5-5 Switching between Auto and Manual Control

When the "event input assignment 1" or "event input assignment 2" parameter is set to MANU (auto/manual), manual control will start when event input 1 or 2 turns ON. Auto control will start when the input turns OFF.

The MANU indicator will light during manual control.

Setting	Input contact	Status
Event input 1 or 2	OFF	Automatic
Event input 1 or 2	ON	Manual

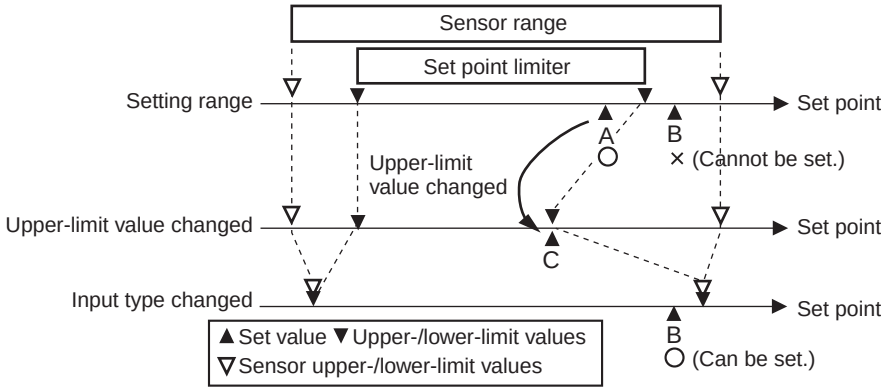
Parameters

Symbol	Parameter: Level	Description
ev-1	Event input assignment 1: Advanced function setting level	Function of event input function
ev-2	Event input assignment 2: Advanced function setting level	
ev-m	Number of multi-SP uses: Advanced function setting level	

4-6 Setting the SP Upper and Lower Limit Values

4-6-1 Set Point Limiter

The setting range of the set point is limited by the set point limiter. The set point limiter is used to prevent the control target from reaching abnormal temperatures. The upper- and lower-limit values of the set point limiter are set using the “set point upper limit” and “set point lower limit” parameters in the initial setting level. When the set point limiter is reset, the set point is forcibly changed to the upper- or lower-limit value of the set point limiter if the set point is out of the limiter range. Also, when the input type and temperature unit are changed, the set point limiter is forcibly reset to the sensor setting range.

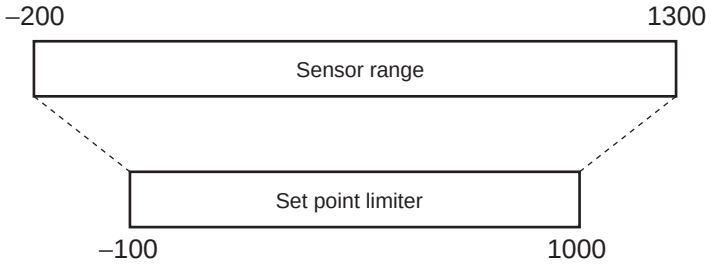


Parameters

Symbol	Parameter: Level	Description
s l - h	Set point upper limit: Initial setting level	To limit the SP setting
s l - l	Set point lower limit: Initial setting level	To limit the SP setting

4-6-2 Setting

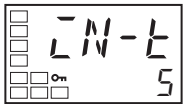
Set the set point upper and lower limits in the “set point upper limit” and “set point lower limit” parameters in the initial setting level. In this example, it is assumed that the input type is set to a K thermocouple with a temperature range of −200 to 1300°C.



Setting the Set Point Upper-limit Value

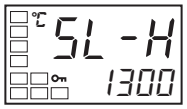
Operating Procedure

Set Point Upper Limit = 1000



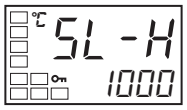
Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.



Set point upper-limit

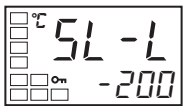
2. Select the “set point upper limit” parameter.



3. Use the U and D keys to set the parameter to 1000.

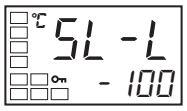
Setting the Set Point Lower-limit Value

Operating Procedure Set Point Lower Limit = −100



Set point lower limit

1. Select the “set point lower limit” parameter in the initial setting level.



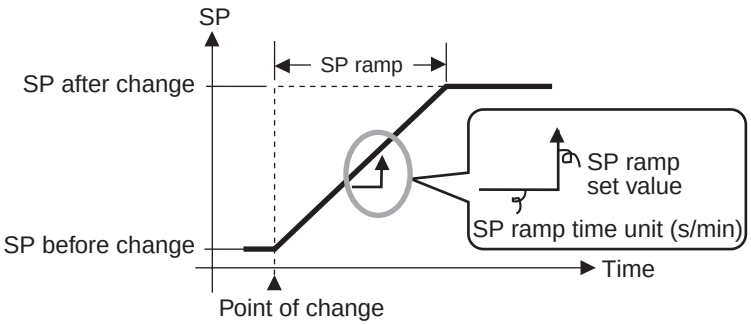
2. Use the U and D keys to set the parameter to −100.

4-7 Using the SP Ramp Function to Limit the SP Change Rate

4-7-1 SP Ramp

The SP ramp function is used to restrict the width of changes in the set point as a rate of change. When the SP ramp function is enabled and the change width exceeds the specified rate of change, an area where the set point is restricted will be created, as shown in the following diagram.

During the SP ramp, control will be performed not for the specified set point but rather for the set point restricted by the rate of change set for the SP ramp function.



The rate of change during SP ramp is specified using the “SP ramp set value” and “SP ramp time unit” parameters. The “SP ramp set value” parameter is set to OFF by default, i.e., the SP ramp function is disabled.

Changes in the set point during SP ramp can be monitored in the “Set point during SP ramp” parameter (operation level). Use this parameter when monitoring SP ramp operation.

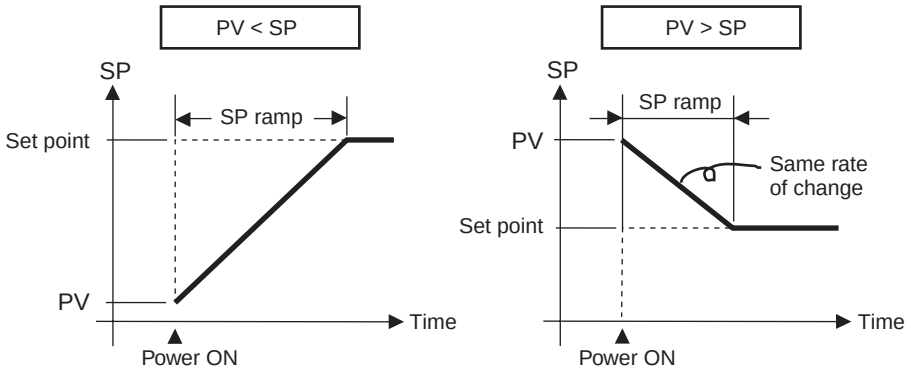
The SP ramp function operates in the same way when switching the set point using the multi-SP function.

Parameters

Symbol	Parameter: Level	Description
o l - h	MV upper limit: Adjustment level	To limit the manipulated variable
o l - l	MV lower limit: Adjustment level	To limit the manipulated variable
s l - h	Set point upper limit: Initial setting level	To limit the SP setting
s l - l	Set point lower limit: Initial setting level	To limit the SP setting
s p r t	SP ramp set value: Adjustment level	To limit the SP rate of change
s p r u	SP ramp time unit: Advanced function setting level	Unit for setting the SP

Operation at Startup

If the SP ramp function is enabled when the Controller is turned ON or when switching from STOP to RUN mode, the process value reaches the set point using the SP ramp function in the same way as when the set point is changed. In this case, operation is carried out with the process value treated as the set point before the change was made. The direction of the SP ramp changes according to the relationship between the process value and the set point.

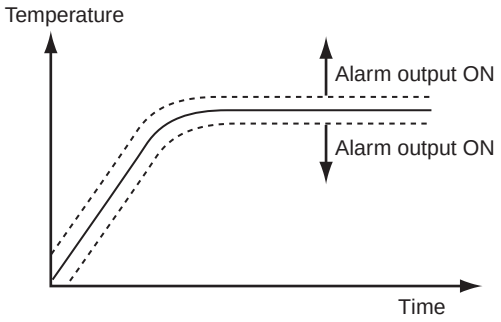


Restrictions during SP Ramp Operation

- Execution of auto-tuning starts after the end of the SP ramp.
- When control is stopped or an error occurs, the SP ramp function is disabled.

Alarms during SP Ramp Operation

The operation of alarms during SP ramp operation is illustrated as follows.



4-8 Moving to the Advanced Function Setting Level

To move to the advanced function setting level, you must first cancel the protection applied by the “initial setting/communications protect” parameter.

In the default setting, the advanced function setting level is protected and you cannot move to this setting level.

1,2,3...

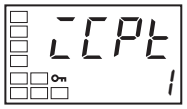
1. Press the O and M keys simultaneously for at least three seconds in operation level.

   Note The key pressing time can be changed in the “move to protect level time” parameter (advanced function setting level).

Protect Level

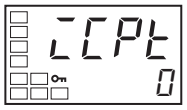
Operation/adjustment protect

2. The Controller moves to the protect level, and the “operation/adjustment protect” parameter is displayed.



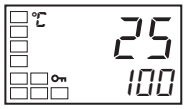
Initial setting/communications protect

3. Press the M key once to move to the “initial setting/communications protect” parameter.



4. Set the set value to 0.

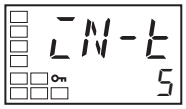
Operation Level



PV/SP

5. Press the O and M keys simultaneously for at least one second to return to the operation level.

Initial Setting Level



Input type

6. Move to the advanced function setting level.
   Press the O key for at least three seconds to move to the operation level to the initial setting level.

Initial Setting Level

Move to advanced function setting level

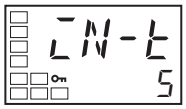
7. Select the “move to advanced function setting level” parameter by pressing the M key.

Advanced function setting level

Parameter initialization

8. Press the D key, enter the password (–169), and then either press the M key or leave the setting for at least two seconds to move to the advanced function setting level from the initial setting level.

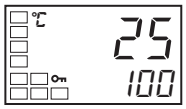
Initial Setting Level



Input type

9. To return to the initial setting level, press the O key for at least one second.

Operation Level



PV/SP

10. To return to the operation level, press the O key for at least one second.

4-9 Using the Key Protect Level

4-9-1 Protection

- To move to the protect level, press the O and M keys simultaneously for at least three seconds in operation level or adjustment level. (See note.)

  Note The key pressing time can be changed in the “move to protect level time” parameter (advanced function setting level).

- The protect level protects parameters that are not changed during Controller operation until operation is started to prevent them from being modified unintentionally.
  There are three types of protection: operation/adjustment protect, initial setting/communications protect, and setting change protect.
- The protect level settings restrict the range of parameters that can be used.

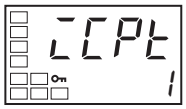
Operation/Adjustment Protect

The following table shows the relationship between set values and the range of protection.

Level		Set value			
		0	1	2	3
Operation level	PV	Can be displayed	Can be displayed	Can be displayed	Can be displayed
	PV/SP	Can be displayed and changed	Can be displayed and changed	Can be displayed and changed	Can be displayed
	Others	Can be displayed and changed	Can be displayed and changed	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible
Adjustment level		Can be displayed and changed	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible

- Parameters are not protected when the set value is set to 0.
- The default is 0.

Initial Setting/ Communications Protect

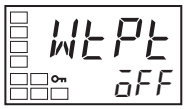


This protect level restricts movement to the initial setting level, communications setting level, and advanced function setting level.

Set value	Initial setting level	Communications setting level	Advanced function setting level
0	Movement possible	Movement possible	Movement possible
1	Movement possible	Movement possible	Movement not possible
2	Movement not possible	Movement not possible	Movement not possible

- The default is 1.

Setting Change Protect



This protect level restricts key operations.

Set value	Description
OFF	Settings can be changed using key operations.
ON	Settings cannot be changed using key operations. (The protect level settings, however, can be changed.)

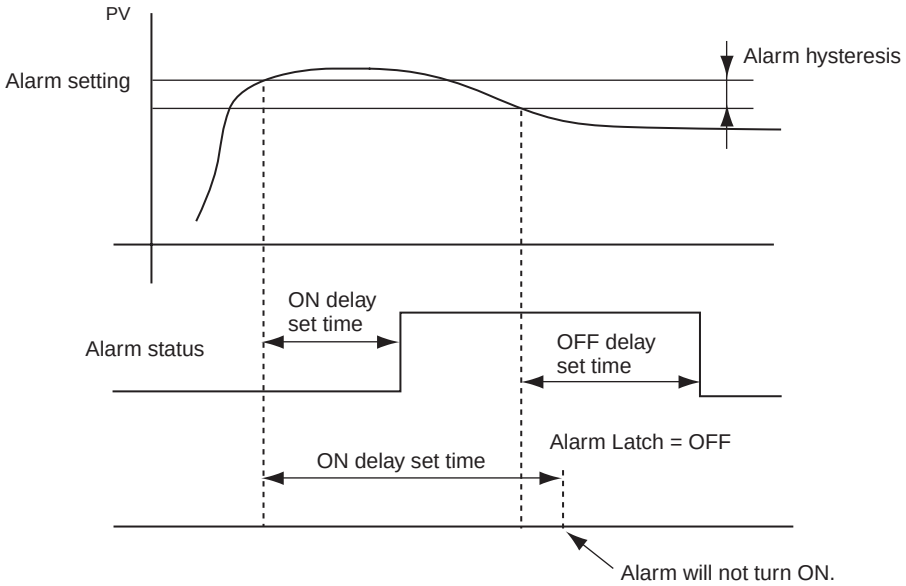
- The default is OFF.
- The all protect indication (O-) will light when setting change protect is set.

4-10 Alarm Delays

4-10-1 Alarm Delays

- Delays can be set for the alarm outputs. ON and OFF delays can be set separately for alarms 1, 2, and 3. The ON and OFF delays for alarm 1 function only for the alarm function. If the alarm output 1 is set to be output as an OR with other alarm functions (i.e., the heater burnout alarm, HS alarm, or input error output alarm), the delays will not function for the other alarms. The ON and OFF delays for alarms 1, 2, and 3 also apply to the individual ALM1, ALM2, and ALM3 indicators and to communications status. The alarm ON delays will also function when power is turned ON or when moving from initial setting level to operation level (i.e., to software resets). All outputs will turn OFF and the OFF delays will not function when moving to the initial setting level or when an alarm is output for a heater burnout error.

Operation of Alarm ON and OFF Delays (for an Upper-limit Alarm)



- The alarm will not turn ON if the time that the alarm is ON is equal to or less than the ON delay set time. Also, the alarm will not turn OFF if the time that the alarm is OFF is equal to or less than the OFF delay set time.
- If an alarm turns OFF and then back ON during the ON delay time, the time will be remeasured from the last time the alarm turns ON. Also, if an alarm turns ON and then back OFF during the OFF delay time, the time will be remeasured from the last time the alarm turns OFF.

Parameters Related to Alarm Delays

Parameter name	Symbol	Set (monitor) values
Alarm 1 ON delay	a1on	0 to 999 (s)
Alarm 2 ON delay	a2on	0 to 999 (s)
Alarm 3 ON delay	a3on	0 to 999 (s)
Alarm 1 OFF delay	a1of	0 to 999 (s)
Alarm 2 OFF delay	a2of	0 to 999 (s)
Alarm 3 OFF delay	a3of	0 to 999 (s)

Note

(1) The defaults are 0, i.e., the ON and OFF delays are disabled.

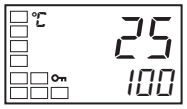
(2) The parameters are displayed when alarm outputs are assigned and when the alarm type is set to any type but 0 (none).

Operating Procedure

Use the following procedure to set ON and OFF delays for the alarm 1 output.

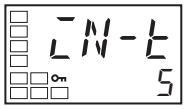
An ON delay of 5 seconds and an OFF delay of 10 s will be set.

Operation Level



PV/SP

Initial Setting Level



Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level

Move to advanced function setting level

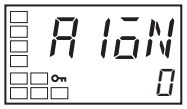
2. Select the “move to advanced function setting level” parameter by pressing the M key.

Advanced Function Setting Level

Parameter initialization

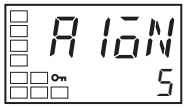
3. Press the D key to enter the password (–169) and move from the initial setting level to the advanced function setting level.

Advanced Function Setting Level



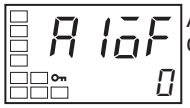
Alarm 1 ON delay

4. Press the M key to select the “alarm 1 ON delay” parameter.



5. Press the U key to set the parameter to 5.

Advanced Function Setting Level

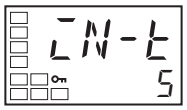


Alarm 1 OFF delay

6. Press the M key to select the “alarm 1 OFF delay” parameter.

7. Press the U key to set the parameter to 10.

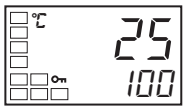
Initial Setting Level



Input type

8. Press the O key for at least one second to move from the advanced function setting level to the initial setting level.

Operation Level



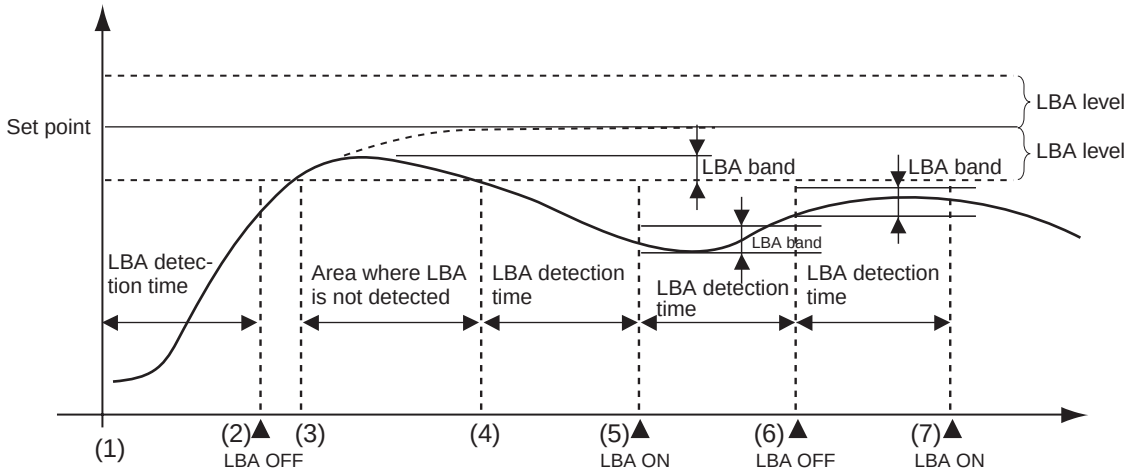
PV/SP

9. Press the O key for at least one second to move from the initial setting level to the operation level.

4-11 Loop Break Alarm

4-11-1 Loop Break Alarm (LBA)

- With a loop break alarm, there is assumed to be an error in the control loop if the control deviation (SP − PV) is greater than the threshold set in the “LBA level” parameter and if the control deviation is not reduced by at least the value set in the “LBA detection band” parameter within the LBA detection time.
- Loop break alarms are detected at the following times.



If the control deviation is reduced in the area between 1 and 2 (i.e., the set point is approached) and the amount the control deviation is reduced is at least equal to the LBA band, the loop break alarm will remain OFF.

The process value is within the LBA level between 3 and 4, and thus loop break alarms will not be detected. (The loop break alarm will remain OFF.)

If the process value is outside the LBA level between 4 and 5 and the control deviation is not reduced by at least the LBA band within the LBA detection time, the loop break alarm will turn ON.

If the control deviation is reduced in the area between 5 and 6 (i.e., the set point is approached) and the amount the control deviation is reduced is at least equal to the LBA band, the loop break alarm will turn OFF.

If the control deviation is reduced in the area between 6 and 7 (i.e., the set point is approached) and the amount the control deviation is reduced is less than the LBA band, the loop break alarm will turn ON.

- If the LBA detection time, LBA level, LBA detection band, and PID settings are not appropriate, alarms may be detected inappropriately or alarms may not be output when necessary.
- Loop break alarms may be detected if unexpectedly large disturbances occur continuously and a large deviation does not decrease.
- If a loop break occurs when the set point is near the ambient temperature, the temperature deviation in a steady state may be less than the LBA level, preventing detection of the loop break.
- If the set point is so high or low that it cannot be reached even with a saturated manipulated variable, a temperature deviation may remain even in a steady state and a loop break may be detected.

- Detection is not possible if a fault occurs that causes an increase in temperature while control is being applied to increase the temperature (e.g., an SSR short-circuit fault).
- Detection is not possible if a fault occurs that causes a decrease in temperature while control is being applied to decrease the temperature (e.g., a heater burnout fault).

Parameters Related to Loop Break Alarms

Parameter name	Symbol	Setting range		Remarks
LBA detection time	l ba	0 to 9999 (s)		Setting 0 disables the LBA function.
LBA level	l ba l	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9 (°C/°F) (See note.)	Default: 8.0 (°C/°F)
		Controllers with Analog Inputs	0.01 to 99.99 (%FS)	Default: 10.00% FS
LBA band	l bab	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.0 to 999.9 (°C/°F) (See note.)	Default: 3.0 (°C/°F)
		Controllers with Analog Inputs	0.00 to 99.99 (%FS)	Default: 0.20% FS

Note Set “none” as the unit for analog inputs.

- A loop break alarm can be output by setting the alarm 1 type to 12 (LBA).
- The ALM1 indicator will light when a loop break is detected.
- Loop breaks are not detected during SP ramp operation.
- Loop breaks are not detected during auto-tuning, manual operation, or while stopped.
- If the alarm 1 latch is set to ON, the latch will be effective for the loop break alarm.

Automatically Setting the LBA Detection Time

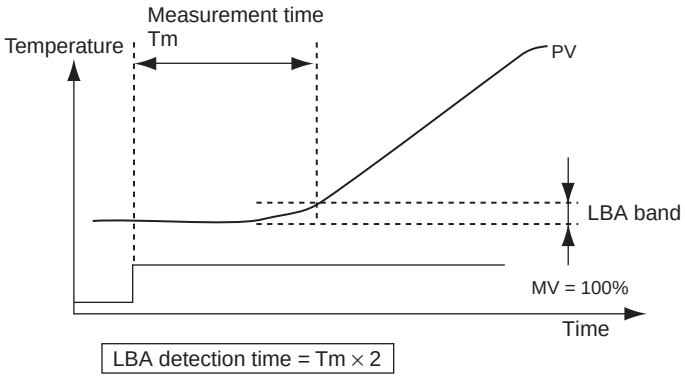
- The LBA detection time is automatically set by auto-tuning.
  (It is not set automatically, however, for heating/cooling control.)
- If the optimum LBA detection time is not obtained by auto-tuning, set the “LBA detection time” parameter (advanced function setting level).

Determining the LBA Detection Time

- To manually set the LBA detection time, set the “LBA detection time” parameter to twice the LBA reference time given below.

1,2,3...

1. Set the output to the maximum value.
2. Measure the time required for the width of change in the input to reach the LBA band.



LBA detection time = Tm × 2

3. Set the “LBA detection time” parameter to two times the measured time.

LBA Level

- Set the control deviation when the control loop is working properly.
- The default is 8.0 (°C/°F) for Controllers with Thermocouple/Resistance Thermometer Universal-inputs and 10.00% FS for Controllers with Analog Inputs.

LBA Band

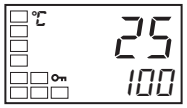
- There is assumed to be an error in the control loop if the control deviation is greater than the threshold set in the “LBA level” parameter and if the control deviation does not change by at least the value set in the “LBA band” parameter.
- The default is 3.0 (°C/°F) for Controllers with Thermocouple/Resistance Thermometer Universal-inputs and 0.20% FS for Controllers with Analog Inputs.

Operating Procedure

Perform the following procedure to use the loop break alarm.

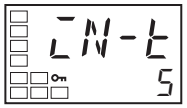
In this example, the LBA detection time is set to 10, the LBA level is set to 8.0, and the LBA band is set to 3.0.

Operation Level



PV/SP

Initial Setting Level



Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

Initial Setting Level

Alarm 1 type

2. Select the “alarm 1 type” parameter by pressing the M key.

Initial Setting Level

3. Press the U key to set the parameter to 12.

Move to advanced function setting level

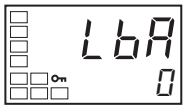
4. Select the “move to advanced function setting level” parameter by pressing the M key.

Advanced Function Setting Level

Parameter initialization

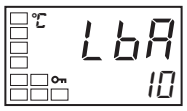
5. Press the D key to enter the password (–169), and move from the initial setting level to the advanced function setting level.

Advanced Function Setting Level



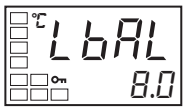
LBA detection time

6. Select the “LBA detection time” parameter by pressing the M key.



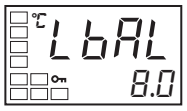
7. Press the U key to set the parameter to 10.

Advanced Function Setting Level



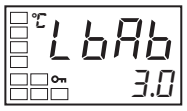
LBA level

8. Select the “LBA level” parameter by pressing the M key.



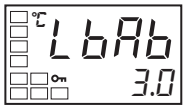
9. Press the U key to set the parameter to 8.0. (The default is 8.0.)

Advanced Function Setting Level



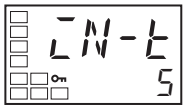
LBA band

10. Select the “LBA band” parameter by pressing the M key.



11. Press the U or D key to set the parameter to 3.0. (The default is 3.0.)

Initial Setting Level



Input type

12. Press the O key for at least one second to move from the advanced function setting level to the initial setting level.

Operation Level

PV/SP

13. Press the O key for at least one second to move from the initial setting level to the operation level.

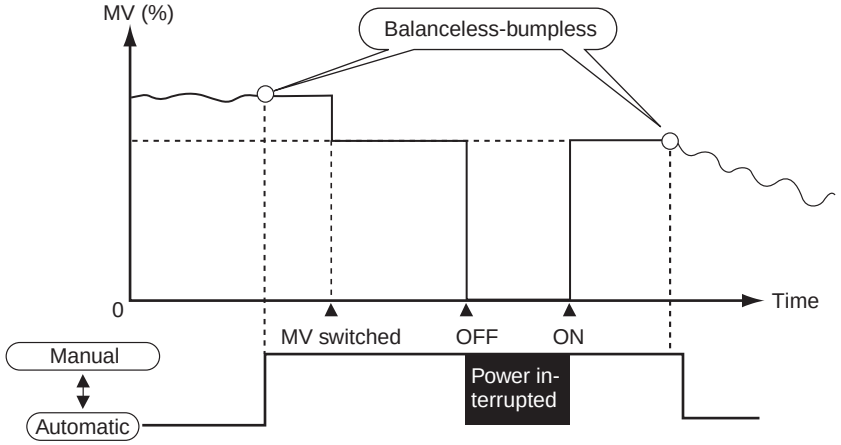
4-12 Performing Manual Control

4-12-1 Manual Operation

- The manipulated variable can be set in manual mode if the “PV/MV” parameter is displayed in the manual control level. The final MV used in automatic mode will be used as the initial manual MV when moving from automatic mode to manual mode. In manual mode, the change value will be fixed immediately and reflected in the actual MV.
- The automatic display return function will not operate in manual mode.
- Balanceless-bumpless operation will be performed for the MV when switching from manual operation to automatic operation. (See note.)
- If a power interruption occurs during manual operation, manual operation will be restarted when power is restored using the same MV as when power was interrupted.
- Switching between automatic and manual operation is possible for a maximum of one million times.
- Manual operation can be used only for PID control.

Note In balanceless-bumpless operation, the MV before switching is used initially after the switch and then gradually changed to achieve the proper value after switch to prevent radical changes in the MV after switching operation.

The overall manual operation is illustrated in the following figure.



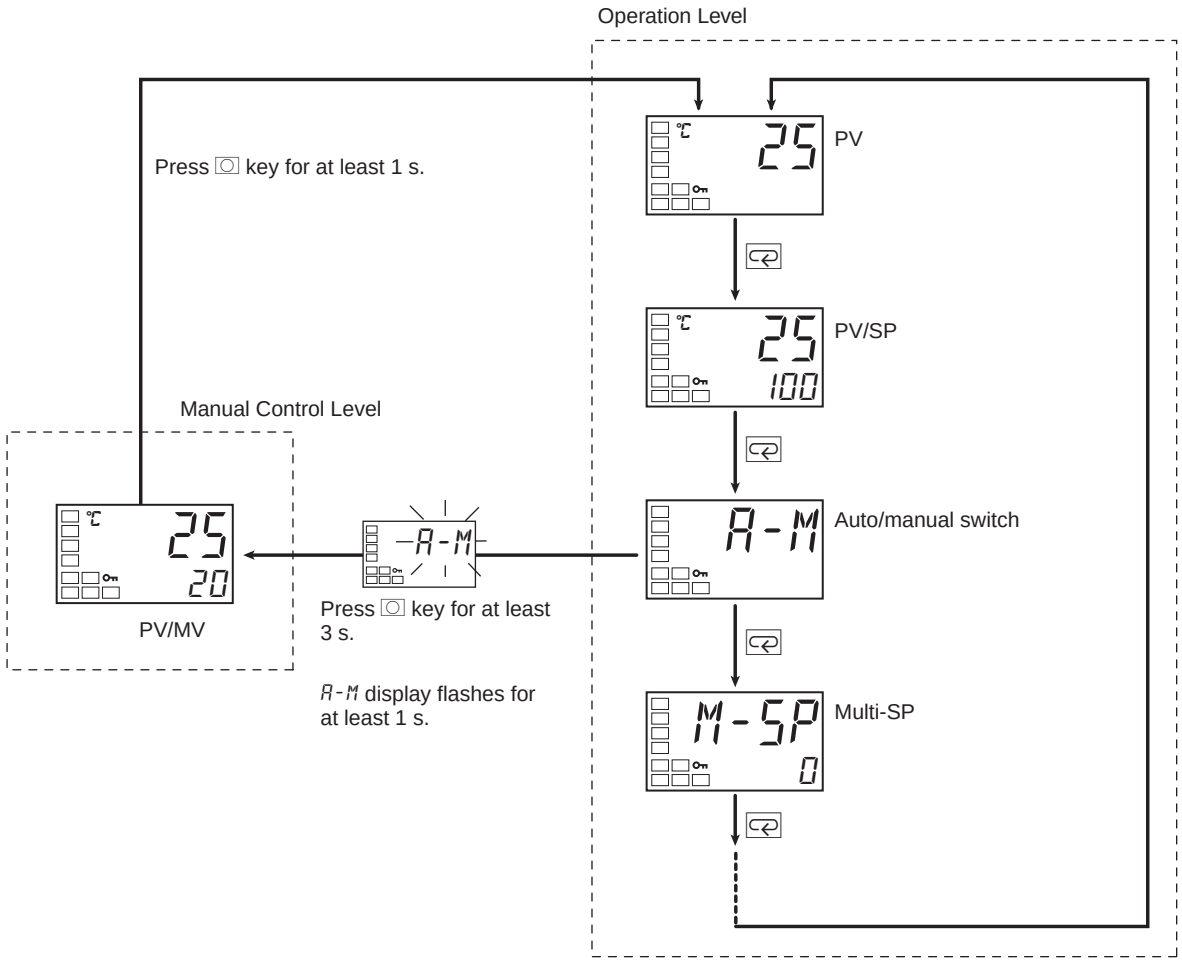
Related Displays and Parameters

Parameter name	Symbol	Level	Remarks
PV/MV (manual MV)	---	Manual Control Level	−5.0 to 105.0 (heating/cooling control: −105.0 to 105.0)
Auto/manual switch	a-m	Operation Level	Switches between automatic and manual modes.
Auto/manual select addition	amad	Advanced Function Setting Level	Enables switching between automatic and manual modes.

Note Refer to *4-14 Output Adjustment Functions* for information on the priority for the MV.

Moving to the Manual Control Level

- When the O key is pressed for at least 3 seconds in the operation level's auto/manual switching display, the manual mode will be entered and the manual control level will be displayed. It is not possible to move to any displays except for the “PV/MV” parameter during manual operation. Press the O key for at least one section from the “PV/MV” display in manual control level to return to automatic mode and display the top parameter in the operation level.



- If an event input is set to “MANU” (auto/manual), the “auto/manual switch” parameter will not be displayed. Use the event input to switch between automatic and manual modes.

Auto/Manual Select Addition

- The “auto/manual select addition” parameter must be set to ON in the advanced function setting level before it is possible to move to manual mode. The default is OFF.

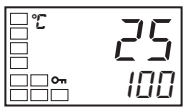
Note

(1) Priority of Manual MV and Other Functions
Even when operation is stopped, the manual MV is given priority.
Auto-tuning and self-tuning will stop when manual mode is entered.

(2) Manual MV and SP Ramp
If operating, the SP ramp function will continue even when manual mode is entered.

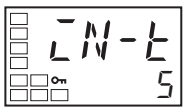
Operating Procedure Use the following procedure to set the manipulated variable in manual mode.

Operation Level



PV/SP

Initial Setting Level



Input type

1. Press the O key for at least three seconds to move from the operation level to the initial setting level.

2. Select the “PID ON/OFF” parameter by pressing the M key.

Initial Setting Level

Move to advanced function setting level

3. Select the “move to advanced function setting level” parameter by pressing the M key.

Advanced Function Setting Level

Parameter initialization

4. Press the D key to enter the password (−169), and move from the initial setting level to the advanced function setting level.

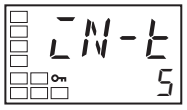
Advanced Function Setting Level

Auto/manual select addition

5. Select the “auto/manual select addition” parameter by pressing the M key.

6. Use the U key to set the parameter to ON.

Initial Setting Level

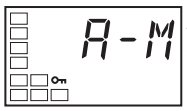


Input type

7. Press the O key for at least one second to move from the advanced function setting level to the initial setting level.

8. Press the O key for at least one second to move from the initial setting level to the operation level.

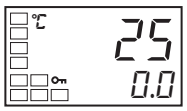
Operation Level



Auto/manual switch

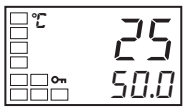
9. Select the “auto/manual switch” parameter by pressing the M key.

Manual Control Level



PV/MV

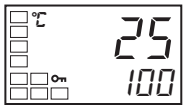
10. Press the O key for at least three seconds to move from the operation level to the manual control level.



11. Press the U or D key to set the manual MV. (In this example, the MV is set to 500%.)

Note The manual MV setting must be fixed (see page 12), but values changed with key operations are reflected in the control output immediately.

Operation Level



PV/SP

12. Press the O key for at least one second to move from the manual control level to the operation level.

4-13 Using the Transfer Output

4-13-1 Transfer Output Function

- If a control output is a linear current output it can be used as a transfer output. To use the transfer output, set the “transfer output type” parameter to any setting other than OFF.
  (When the “transfer output type” parameter is set to any setting other than OFF, the “transfer output upper limit” and “transfer output lower limit” parameters will be enabled.)

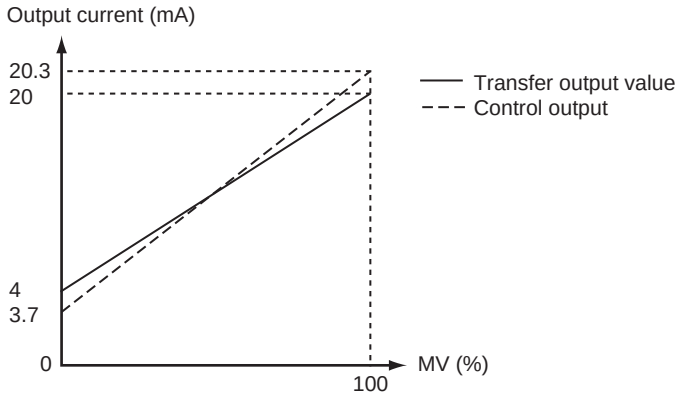
Transfer Output Type

Transfer output type	Symbol	Setting range
OFF (See note 1.)	off	---
Set point	sp	SP lower limit to SP upper limit
Set point during SP ramp	sp-m	SP lower limit to SP upper limit
PV	pv	Sensor setting range lower limit to Sensor setting range upper limit or Scaling lower limit to Scaling upper limit
MV monitor (heating)	mv	–5.0 to 105.0 (heating/cooling control: 0.0 to 105.0) (See note 2.)
MV monitor (cooling)	c-mv	0.0 to 105.0 (See note 2.)

Note

(1) The default is OFF. If the transfer type is set to OFF, the item assigned in the “control output 1 assignment” parameter will be output on control output 1.

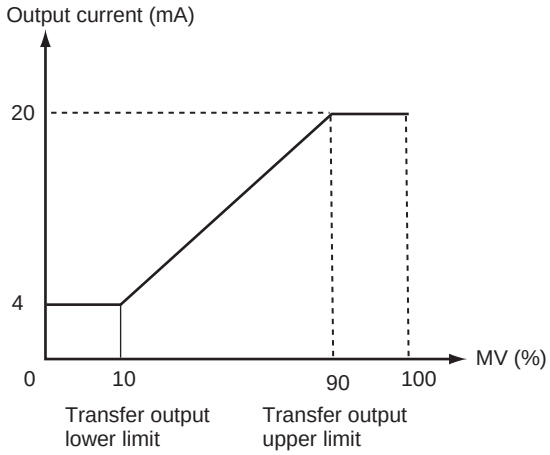
(2) The difference between the transfer output value and the linear current output value is illustrated in the following figure.
If the linear output is used as the transfer output when the linear current output type is set to 4 to 20 mA, 4.0 mA will be output for 0% and 20.0 mA will be output for 100%.
When a linear output is used for the control output, 3.7 mA is output for 0% and 20.3 mA is output for 100% when the control output for heating is selected to ensure that the control object is controlled at 0% and 100%.



(The above graph is for when the linear current output type is set to 4 to 20 mA.)

Transfer Scaling

- Reverse scaling is possible by setting the “transfer output lower limit” parameter larger than the “transfer output upper limit” parameter. If the “transfer output lower limit” and “transfer output upper limit” parameters are set to the same value when 4 to 20 mA is set, the transfer output will be output continuously at 0% (4 mA).
- If the SP, SP during SP ramp, or PV is selected, the “transfer output lower limit” and “transfer output upper limit” parameters will be forcibly initialized to the respective upper and lower setting limits for changes in the upper and lower limits of the SP limiter and the temperature unit.
  If the MV for heating or MV for cooling is selected, the “transfer output lower limit” and “transfer output upper limit” parameters will be initialized to 100.0 and 0.0, respectively, when a switch is made between standard control and heating/cooling control using the “standard or heating/cooling” parameter.
- The output current when the linear current type is set to 4 to 20 mA, the transfer output upper limit is set to 90.0, and the transfer output lower limit is set to 10.0 is shown in the following graph.
- For scaling from 0.0% to 100.0%, the output for −5.0 to 0.0 will be the same value as for 0.0%, and the output for 100.0 to 105.0 will be the same value as for 100.0%

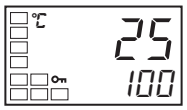


(The above graph is for when the linear current output type is set to 4 to 20 mA.)

Operating Procedure

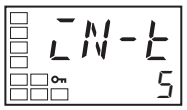
The following procedure sets the transfer output for an SP range of −50 to 200.

Operation Level



PV/SP

Initial Setting Level



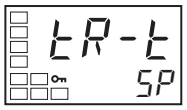
Input type

1. Press the O key for at least 3 seconds to move from the operation level to the initial setting level.

Initial Setting Level

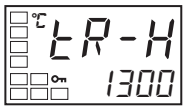
Transfer output type

2. Select the “transfer output type” parameter by pressing the M key.



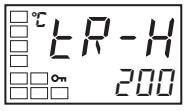
3. Press the U key to select sp (set point).

Initial Setting Level



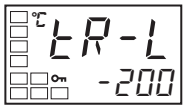
Transfer output upper limit

4. Select the “transfer output upper limit” parameter by pressing the M key.



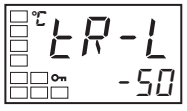
5. Use the D key to set the parameter to 200. The default is 1300.

Initial Setting Level



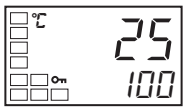
Transfer output lower limit

6. Select the “transfer output lower limit” parameter by pressing the M key.



7. Use the U key to set the parameter to −50. The default is −200.

Operation Level



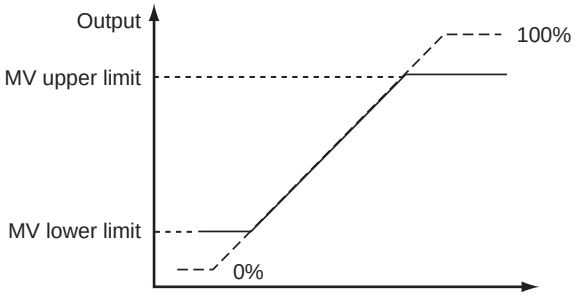
PV/SP

8. To return to the operation level, press the O key for at least 1 second.

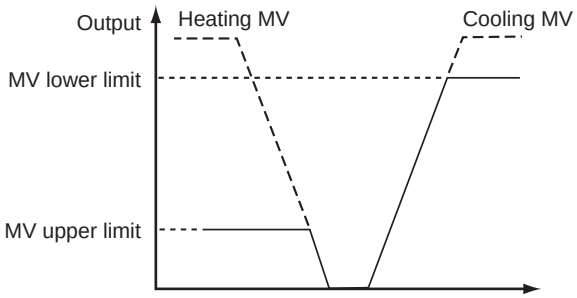
4-14 Output Adjustment Functions

4-14-1 Output Limits

- Output limits can be set to control the output using the upper and lower limits to the calculated MV.
- The following MV takes priority over the MV limits.
  Manual MV



- For heating/cooling control, upper and lower limits are set of overall heating/cooling control. (They cannot be set separately for heating/cooling.)



SECTION 5
Parameters

This section describes the individual parameters used to setup, control, and monitor operation.

5-1 Conventions Used in this Section

5-1-1 Meanings of Icons Used in this Section


Function

Describes the functions of the parameter.


Setting

Describes the setting range and default of the parameter.


Monitor

Used to indicate parameters used only for monitoring.

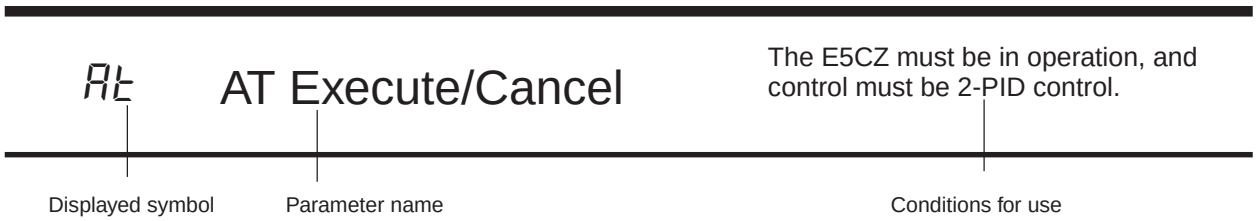

Operation

Describes the parameter settings, such as those for Operation Commands, and procedures.

Used to indicate information on descriptions in which the parameter is used or the names of related parameters.

5-1-2 About Related Parameter Displays

Parameters are displayed only when the conditions for use given on the right of the parameter heading are satisfied. Protected parameters are not displayed regardless of the conditions for use, but the settings of these parameters are still valid.



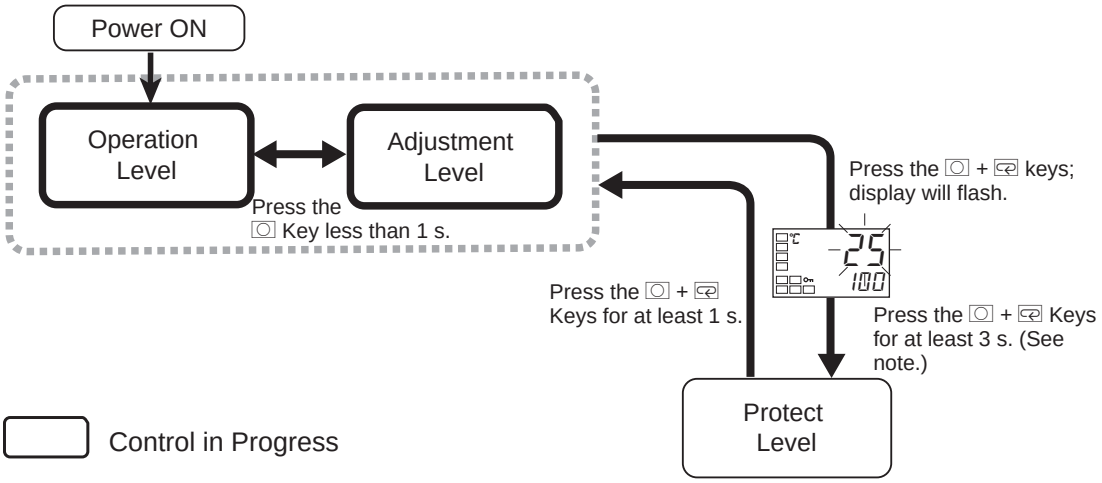
5-1-3 About the Order in Which Parameters Are Described in This Section

Parameters are described level by level.

The first page of each level describes the parameters in the level and the procedure to switch between parameters.

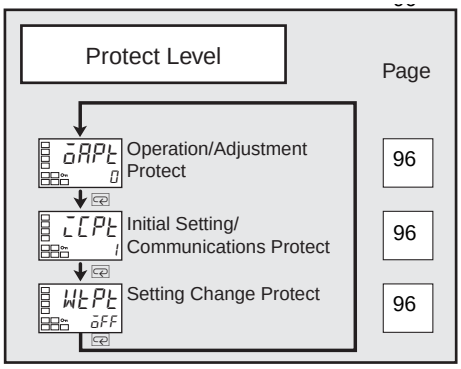
5-2 Protect Level

Three levels of protection are provided on the E5CZ, operation/adjustment protect, initial setting/communications protect, and setting change protect. These protect levels prevent unwanted operation of the keys on the front panel in varying degrees.



To move from the operation level to the protect level, press O and M keys for three seconds (See note.) or more.

Note The time taken to move to the protect level can be adjusted by changing the "Move to protect level time" parameter setting.



Parameters that are protected will not be displayed and their settings cannot be changed.

oapt Operation/Adjustment Protect
icpt Initial Setting/Communications Protect
wtpt Setting Change Protect

These parameters specify the range of parameters to be protected. Shaded settings indicate the defaults.


Function


Setting

■ Operation/Adjustment Protect

The following table shows the relationship between set values and the range of protection.

Level		Set value			
		0	1	2	3
Operation Level	PV	Can be displayed	Can be displayed	Can be displayed	Can be displayed
	PV/SP	Can be displayed and changed	Can be displayed and changed	Can be displayed and changed	Can be displayed
	Others	Can be displayed and changed	Can be displayed and changed	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible
Adjustment Level		Can be displayed and changed	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible

- Parameters are not protected when the set value is set to 0.

■ Initial Setting/Communications Protect

This protect level restricts movement to the initial setting level, communications setting level, and advanced function setting level.

Set value	Initial setting level	Communications setting level	Advanced function setting level
0	Movement possible	Movement possible	Movement possible
1	Movement possible	Movement possible	Movement not possible
2	Movement not possible	Movement not possible	Movement not possible

■ Setting Change Protect

Changes to settings using key operations are restricted.

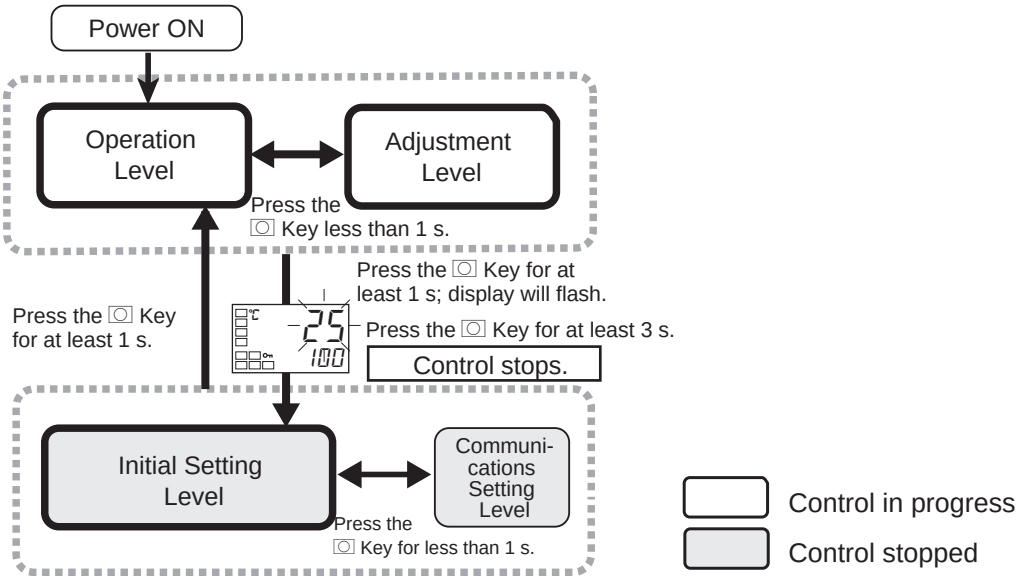
Set value	Description
OFF	Settings can be changed using key operations.
ON	Settings cannot be changed using key operations. (The protect level settings, however, can be changed.)

- The all protect indication ( ) will light when setting is ON.

5-3 Operation Level

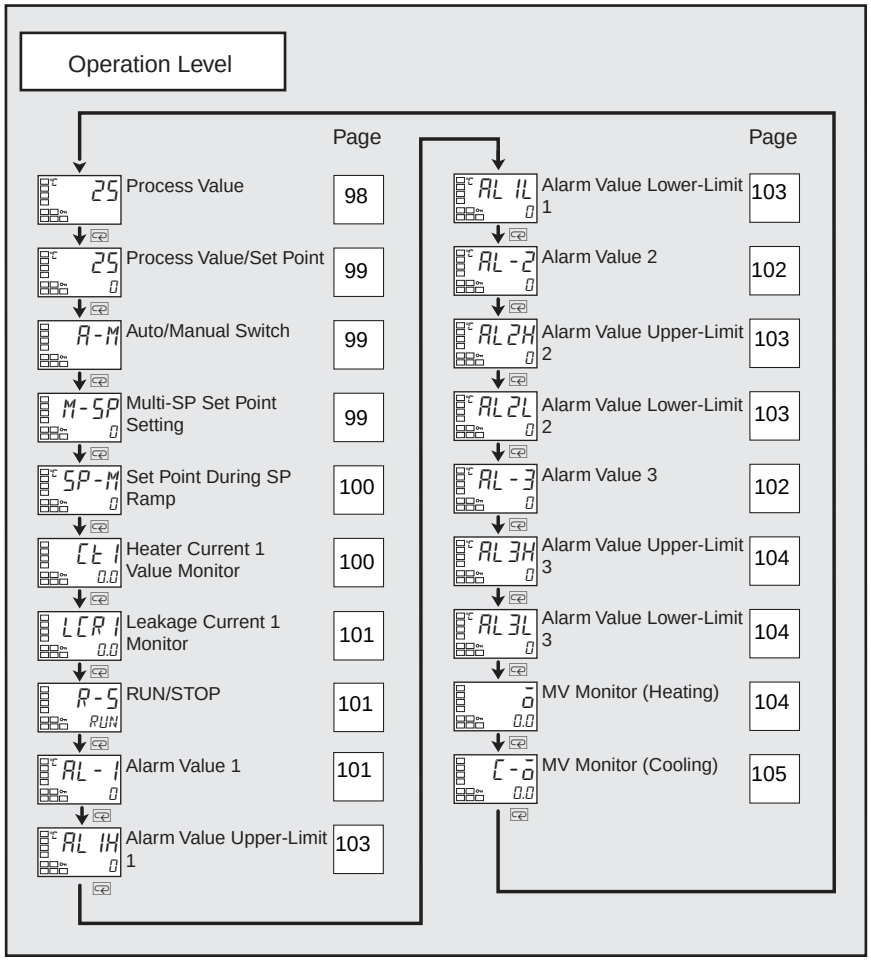
Display this level to perform control operations on the E5CZ. You can set alarm values, monitor the manipulated variable, and perform other operations in this level.

In the advanced function setting level, you can set a parameter to hide or show the set points.



This level is displayed immediately after the power is turned ON.

To move to other levels, press the O key or the O and M keys.



Process Value

The “additional PV display” parameter must be set to ON.

Function

The process value is displayed on the No. 1 display, and nothing is displayed (blank) on the No. 2 display.

Monitor

	Monitor range	Unit
Process value	Input indication range (See page 172.)	EU

During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.

See

■ **Related Parameters**

Input type: Page 119, Set point upper limit, Set point lower limit: Page 122 (initial setting level)

Process Value/Set Point


Function

The process value is displayed on the No. 1 display, and the set point is displayed on the No. 2 display.

	Monitor range	Unit
Process value	Input indication range (See page 172.)	EU

	Setting range	Unit
Set point	SP lower limit to SP upper limit	EU

During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.

Refer to the “process value” parameter.

a-m Auto/Manual Switch

The “event input assignment 1/2” parameters must not be set to “auto/manual” and the “auto/manual select addition” parameter must be set to ON.
The control must be set to 2-PID control.


Function

- This parameter switches the Controller between automatic and manual modes.
- If the O key is pressed for at least 3 seconds when the “auto/manual switch” parameter is displayed, the manual mode will be entered and the manual control level will be displayed.
- This parameter will not be displayed if an event input is set to “MANU” (auto/manual).

■ **Related Parameters**

PID ON/OFF (initial setting level): Page 122

Auto/manual select addition (advanced function setting level): Page 143

m-sp Multi-SP Set Point Setting (Set Points 0 to 3)

The “multi-SP uses” parameter must be set to ON.


Function

To use the multi-SP function, preset the four set points (SP 0 to 3) in the adjustment level, and then switch the set point either by operating the keys or by using external input signals (event inputs).

This parameter is used to select set points 0 to 3.

sp-m Set Point During SP Ramp

The “SP ramp set value” parameter must not be set to OFF.
The “ST” parameter must be set to OFF.


Function

This parameter monitors the set point during SP ramp operation.

A ramp is used to restrict the change width of the set point as a rate of change.

This parameter is displayed when a set value is input for the “SP ramp set value” (adjustment level).

When not in ramp operation, the set point will be the same as the one displayed for the “process value/set point” parameter.


Monitor

Monitor range	Unit
SP: SP lower limit to SP upper limit	EU


See

■ **Related Parameters**

Process value/set point (operation level): Page 99
SP ramp set value (adjustment level): Page 116
Set point upper limit, Set point lower limit (initial setting level): Page 122

ct1 Heater Current 1 Value Monitor

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “heater burnout detection” parameter must be set to ON.


Function

This parameter measures the heater current from the CT input used for detecting heater burnout.

This parameter measures and displays the heater current value.

- Heater burnouts are not detected if the control output (heating) ON time is 190 ms or less.


Monitor

Monitor range	Unit
0.0 to 55.0	A

- f f f f is displayed when 55.0 A is exceeded.
- If a heater burnout is detected, the HA indicator will light, and the relative setting level will flash on the No. 1 display.


See

■ **Related Parameters**

Heater burnout detection 1 (adjustment level): Page 110
HB ON/OFF (advanced function setting level): Page 135
Error Displays c t 1: Page 158

lcr1 Leakage Current 1 Monitor

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The "HS alarm use" parameter must be set to ON.


Function

This parameter measures the heater current from the CT input used for detecting SSR short-circuits.

The heater current is measured and the leakage current 1 monitor is displayed.

- HS are not detected if the control output (heating) OFF time is 190 ms or less.


Monitor

Monitor range	Unit
0.0 to 55.0	A

- ffff is displayed when 55.0 A is exceeded.
- If an SSR short-circuit is detected, the HA indicator will light, and the relative setting level will flash on the No. 1 display.


See

■ **Related Parameters**

HS alarm 1(adjustment level): Page 110
HS alarm use (advanced function setting level): Page 143
Error Displays lcr1: Page 156

r-s RUN/STOP

The run/stop function must not be set for the "event input assignment 1/2" parameter.


Function

This parameter starts and stops the control operation.

When run (RUN) is selected, control is started. When stop (STOP) is selected, control is stopped. The STOP indicator will light when control.

The default is run.


See

This parameter will not be displayed if an event input is set to "RUN/STOP."

al-1 Alarm Value 1

Alarm 1 must be assigned.
The "alarm 1 type" parameter must not be set to an upper/lower limit alarm and a loop break alarm must not be set.


Function

This parameter is set to one of the input values "X" in the alarm type list.

- This parameter sets the alarm value for alarm output 1.


Setting

- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.

Setting range	Unit	Default
–1999 to 9999	EU	0


See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point (initial setting level): Page 121

Alarm 1 type (initial setting level): Page 124

Standby sequence reset: Page 133, Alarm 1 open in alarm: Page 134, Alarm 1 hysteresis: Page 135, Alarm 1 latch: Page 139 (advanced function setting level)

---

a l - 2 Alarm Value 2

Alarm 2 must be assigned.
The alarm 2 type must be set to other than an upper and lower limit alarm.

This parameter is set to one of the input values “X” in the alarm type list.


Function

- This parameter sets the alarm value for alarm output 2.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.


Setting

Setting range	Unit	Default
–1999 to 9999	EU	0


See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point (initial setting level): Page 121

Alarm 2 type (initial setting level): Page 126

Standby sequence reset: Page 133, Alarm 2 open in alarm: Page 134, Alarm 2 hysteresis: Page 135, Alarm 2 latch: Page 139 (advanced function setting level)

---

a l - 3 Alarm Value 3

Alarm 3 must be assigned.
The alarm 3 type must be set to other than an upper and lower limit alarm.


Function

This parameter is set to one of the input values “X” in the alarm type list.

- This parameter sets the alarm value for alarm output 3.


Setting

- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.

Setting range	Unit	Default
–1999 to 9999	EU	0

See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point (initial setting level): Page 121

Alarm 3 type (initial setting level): Page 126

Standby sequence reset: Page 133, Alarm 3 open in alarm: Page 134, Alarm 3 hysteresis: Page 135, Alarm 3 latch: Page 139 (advanced function setting level)

---

a l 1h Alarm Value Upper Limit 1

a l 1 l Alarm Value Lower Limit 1

Alarm 1 must be assigned.
Alarm 1 type must be set to upper and lower limits, upper and lower limit range, or upper- and lower-limit with standby sequence.


Function

These parameters independently set the alarm value upper and lower limits when the mode for setting the upper and lower limits is selected for the “alarm 1 type” parameter (initial setting level).

- This parameter sets the upper and lower limit values of alarm 1.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.


Setting

Setting range	Unit	Default
–1999 to 9999	EU	0

See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point: Page 121, Alarm 1 type: Page 124 (initial setting level), Standby sequence reset: Page 133, Alarm 1 open in alarm: Page 134, Alarm 1 hysteresis: Page 135, Alarm 1 latch: Page 139 (advanced function setting level).

---

a l 2h Alarm Value Upper Limit 2

a l 2 l Alarm Value Lower Limit 2

Alarm 2 must be assigned.
Alarm 2 type must be set to upper and lower limits, upper and lower limit range, or upper- and lower-limit alarm with standby sequence.


Function

These parameters independently set the alarm value upper and lower limits when the mode for setting the upper and lower limits is selected for the “alarm 2 type” parameter (initial setting level).

- This parameter sets the upper and lower limit values of alarm 2.


Setting

- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.

Setting range	Unit	Default
–1999 to 9999	EU	0


See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point: Page 121, Alarm 2 type: Page 126 (initial setting level), Standby sequence reset: Page 133, Alarm 2 open in alarm: Page 134, Alarm 2 hysteresis: Page 135, Alarm 2 latch: Page 139 (advanced function setting level)

---

a l 3h Alarm Value Upper Limit 3

a l 3 l Alarm Value Lower Limit 3

Alarm 3 must be assigned.
Alarm 3 type must be set to upper and lower limits, upper and lower limit range, or upper- and lower-limit alarm with standby sequence.

These parameters independently set the alarm value upper and lower limits when the mode for setting the upper and lower limits is selected for the “alarm 3 type” parameter (initial setting level).


Function

- This parameter sets the upper and lower limit values of alarm 3.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.


Setting

Setting range	Unit	Default
–1999 to 9999	EU	0


See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point: Page 121, Alarm 3 type: Page 126 (initial setting level), Standby sequence reset: Page 133, Alarm 3 open in alarm: Page 134, Alarm 3 hysteresis: Page 135, Alarm 3 latch: Page 139 (advanced function setting level)

---

o MV Monitor (Heating)

The “MV display” parameter must be set to ON.

This parameter is used to check the manipulated variable for the heating control output during operation.


Function

- This parameter cannot be set.
- During standard control, the manipulated variable is monitored. During heating/cooling control, the manipulated variables on the heating control output is monitored.
- The default is OFF and the manipulated variable is not displayed.


Monitor

Control	Monitor range	Unit
Standard	–5.0 to 105.0	%
Heating/cooling	0.0 to 105.0	%

■ **Related Parameters**

MV display (advanced function setting level): Page 138

---

c-o

MV Monitor (Cooling)

The control system must be set to heating/cooling control.
The “MV display” parameter must be set to ON.


Function

This parameter is used to check the manipulated variable for the cooling control output during operation.

- This parameter cannot be set.
- During heating/cooling control, the manipulated variable on the cooling control output is monitored.
- The default is OFF and the manipulated variable is not displayed.


Monitor

Control	Monitor range	Unit
Heating/cooling	0.0 to 105.0	%

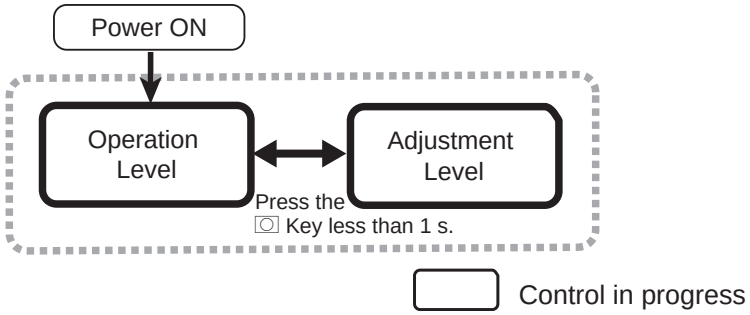
■ **Related Parameters**

Standard or heating/cooling (initial setting level): Page 123
MV display (advanced function setting level): Page 138

5-4 Adjustment Level

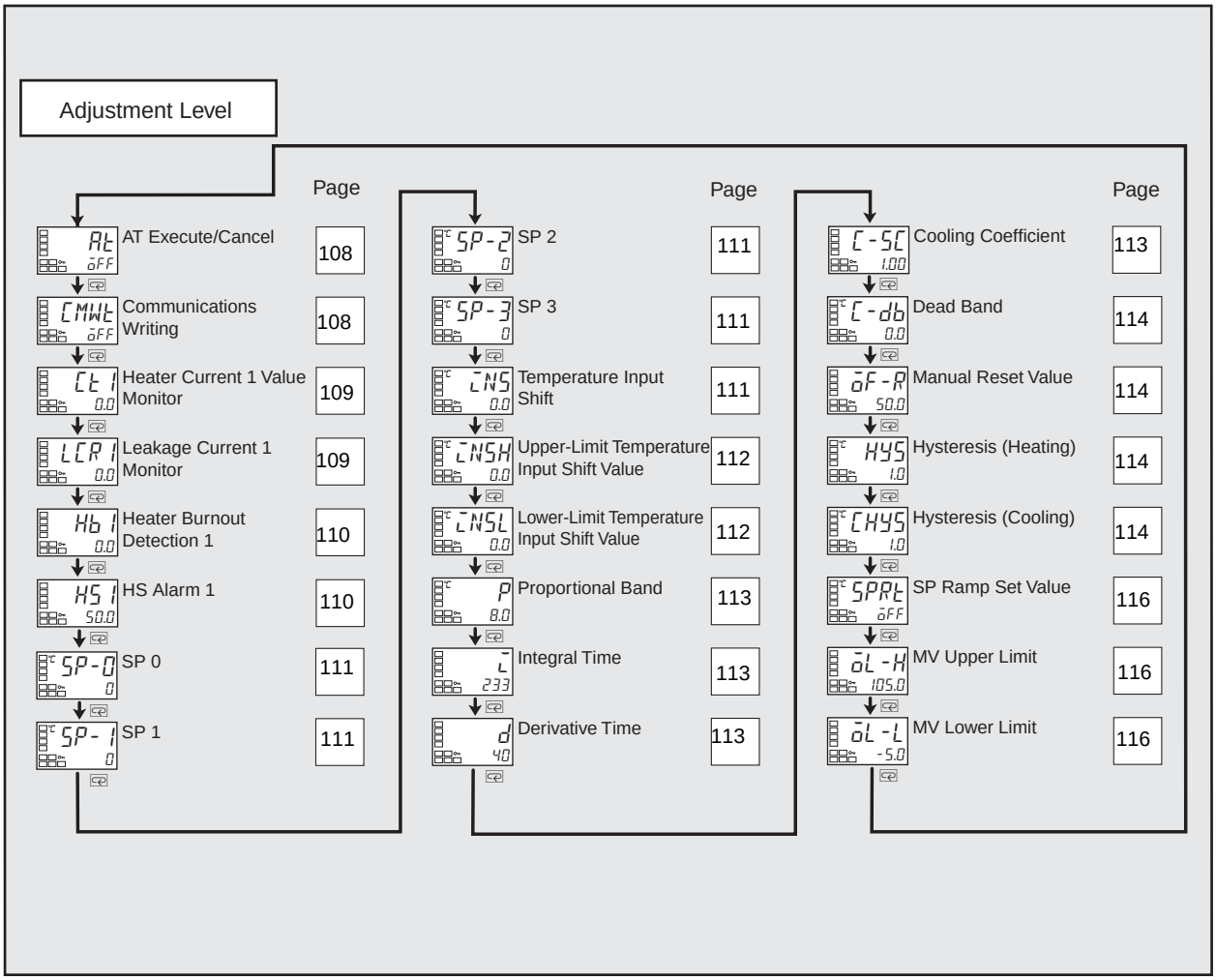
This level is for executing AT (auto-tuning) and other operations, and for set control parameters.

This level provides the basic Controller parameters for PID control (proportional band, integral time, derivative time) and heating/cooling control.



To move to the adjustment level from the operation level, press the O key once.

- The set points 0 to 3 in the adjustment level are the set values for switching the set point during multi-SP input.
- The following parameters are displayed for Controllers with CT Inputs: Heater current monitors, Leakage current monitors, heater burnout detections, and HS alarms.
- Adjustment level parameters can be changed after setting the “operation/adjustment protect” parameter to 0. Displays and changing levels are not possible if the “operation/adjustment protect” parameter is set to 1 to 3. Protection is set in the protect level.


Adjustment Level
Page
AT Execute/Cancel 108
Communications Writing 108
Heater Current 1 Value Monitor 109
Leakage Current 1 Monitor 109
Heater Burnout Detection 1 110
HS Alarm 1 110
SP 0 111
SP 1 111
Page
SP 2 111
SP 3 111
Temperature Input Shift 111
Upper-Limit Temperature Input Shift Value 112
Lower-Limit Temperature Input Shift Value 112
Proportional Band 113
Integral Time 113
Derivative Time 113
Page
Cooling Coefficient 113
Dead Band 114
Manual Reset Value 114
Hysteresis (Heating) 114
Hysteresis (Cooling) 114
SP Ramp Set Value 116
MV Upper Limit 116
MV Lower Limit 116

at AT Execute/Cancel

The E5CZ must be in operation, and control must be 2-PID control.


Function

This parameter executes auto-tuning (AT).

- The MV is forcibly increased and decreased around the set point to find the characteristics of the control object. From the results, the PID constants are automatically set in the “proportional band” (P), “integral time” (I), and “derivative time” (D) parameters.
- This parameter is normally o f f. If you press the U key, the parameter is turned ON and AT is executed. AT cannot be executed when control is stopped or during ON/OFF control.
- When AT execution ends, the parameter setting automatically returns to o f f.


Operation


See

■ **Related Parameters**

Proportional band, Integral time, Derivative time (adjustment level): Page 113

PID ON/OFF (initial setting level): Page 122

cmwt Communications Writing

Communications must be supported.


Function

This parameter enables/disables writing of parameters to the E5CZ from the host (personal computer) using communications.


Setting

ON: Writing enabled

OFF: Writing disabled

- Default: OFF


See

■ **Related Parameters**

MB command logic switching (advanced function setting level): Page 141

Communications Unit No., Communications baud rate, Communications data length, Communications parity, Communications stop bits (communications setting level): Page 149

c t 1 Heater Current 1 Value Monitor

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “heater burnout detection” parameter must be set to ON.


Function


Monitor

This parameter measures the heater current from the CT input used for detecting heater burnout.

This parameter measures and displays the heater current value.

- Heater burnouts are not detected if the control output (heating) ON time is 190 ms or less.

Monitor range	Unit
0.0 to 55.0	A

- f f f f is displayed when 55.0 A is exceeded.
- If a heater burnout is detected, the HA indicator will light, and the relative setting level will flash on the No. 1 display.


See

■ **Related Parameters**

Heater burnout detection 1 (adjustment level): Page 110
HB ON/OFF (advanced function setting level): Page 135
Error Displays c t 1: Page 158

l c r 1 Leakage Current 1 Monitor

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “HS alarm” parameter must be set to ON.


Function


Monitor

This parameter measures the heater current from the CT input used for detecting SSR short-circuits.

This parameter measures and displays the heater current when the heater is OFF.

- HS are not detected if the control output (heating) OFF time is 190 ms or less.

Monitor range	Unit
0.0 to 55.0	A

- f f f f is displayed when 55.0 A is exceeded.
- If an SSR short-circuit is detected, the HA indicator will light, and the relative setting level will flash on the No. 1 display.


See

■ **Related Parameters**

HS alarm 1 (adjustment level): Page 110
HS alarm use (advanced function setting level): Page 143
Error Displays l c r 1: Page 158

hb1 Heater Burnout Detection 1

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “heater burnout detection” parameter must be set to ON.


Function


Setting


See

This parameter sets the current for the heater burnout alarm to be output.

- The heater burnout alarm is output when the heater current value falls below the setting of this parameter.
- When the set value is 0.0, the heater burnout alarm is turned OFF. When the set value is 50.0, the heater burnout alarm will turn ON.

Setting range	Unit	Default
0.0 to 50.0	A	0.0

■ **Related Parameters**

Heater current 1 value monitor (adjustment level): Page 109

HB ON/OFF: Page 135, Heater burnout latch, Heater burnout hysteresis: Page 136 (advanced function setting level)

hs1 HS Alarm 1

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “HS alarm” parameter must be set to ON.


Function


Setting


See

This parameter sets the current for the HS alarm to be output.

- The HS alarm is output when the leakage current value goes above the setting of this parameter.
- When the set value is 50.0, the HS alarm is turned OFF. When the set value is 0.0, the HS alarm will turn ON.

Setting range	Unit	Default
0.0 to 50.0	A	50.0

■ **Related Parameters**

Leakage current 1 monitor (adjustment level): Page 109

HS alarm use, HS alarm latch: Page 143, HS alarm hysteresis: Page 144 (advanced function setting level): Page 143

sp-0	**SP 0**	The “number of multi-SP uses” parameter must be set to 1 or 2. The “multi-SP uses” parameter must be set to ON.
sp-1	**SP 1**	
sp-2	**SP 2**	
sp-3	**SP 3**	


Function

These parameters set the set points when the multi-SP function is used.

The values set in these parameters can be selected by operating the keys on the front panel or by using event inputs.

- When the set point has been changed, the set value of the set point (0 to 3) selected by the multi-SP inputs is also changed to the same value.
- The decimal point position depends on the selected sensor. During analog input, it depends on the “decimal point” parameter setting.


Setting

Setting range	Unit	Default
SP lower limit to SP upper limit	EU	0


See

■ **Related Parameters**

Process value/set point (operation level): Page 99

Input type (initial setting level): Page 119

Number of multi-SP uses: Page 131, Event input assignment 1 and Event input assignment 2, Multi-SP uses: Page 132 (advanced function setting level)

ins	**Temperature Input Shift**	The “input type” parameter must be set for a thermocouple or resistance thermometer, and the “input shift type” parameter must be set to a one-point shift.


Function

Sometimes an error occurs between the set point and the actual temperature. To offset this, a compensated value can be obtained by adding an input shift value to the input. The compensated value is displayed as the measurement value and used for control.

The entire input range is shifted by a fixed rate (1-point shift). If the input shift value is set to −1°C, control will be performed for a value 1°C lower than the measured temperature.


Setting

Setting range	Unit	Default
−199.9 to 999.9	°C or °F	0.0


See

■ **Related Parameters**

Input type (initial setting level): Page 119

Input shift type (advanced function setting level): Page 142

inSh	**Upper-limit Temperature Input Shift Value**	The “input type” parameter must be set for a thermocouple or resistance thermometer and the “input shift type” parameter must be set to a 2-point shift, or the “input type” parameter must be set for an infrared sensor.
inSl	**Lower-limit Temperature Input Shift Value**	


Function

These parameters are used to shift the input temperature at two points: an upper-limit temperature and a lower-limit temperature (as opposed to the “temperature input shift” parameter, which shifts the input temperature by setting the shift for only one point). A 2-point shift enables more accurate offset of the input range compared with a 1-point shift if the input shift values at the upper and lower limits differ.

This parameter sets input shift values for the upper and lower limits (2-point shift) of the input range.


Setting

Setting range	Unit	Default
−199.9 to 999.9	°C or °F	0.0

■ **Related Parameters**

Input type (initial setting level): Page 119

Input shift type (advanced function setting level): Page 142

p / i / d — Proportional Band / Integral Time / Derivative Time

The control must be set to 2-PID control.

These parameters set PID control constants. PID constants are automatically set when AT or ST is executed.


Function

P action: Refers to control in which the MV is proportional to the deviation (control error).

I action: Refers to a control action that is proportional to the time integral of the deviation. With proportional control, there is normally an offset (control error). Proportional action is thus used in combination with integral action. As time passes, this control error disappears, and the control temperature (process value) comes to agree with the set point.

D action: Refers to a control action that is proportional to the time derivative of the control error. The proportional control and integral control correct for errors in the control result, and thus the control system is late in responding to sudden changes in temperature. The derivative action increases the MV in proportion to the slope of the change in the temperature as a corrective action.


Setting

Parameters	Models	Setting range	Unit	Default
Proportional band	Controllers with Thermocouple/ Resistance Thermometer Universal-inputs	0.1 to 999.9	°C or °F (See note.)	8.0
	Controllers with Analog Inputs		%FS	10.0
Integral time		0 to 3999	Second	233
Derivative time		0 to 3999	Second	40

Note Set “none” as the unit for Controllers with Analog Inputs.


See

■ **Related Parameters**

AT execute/cancel (adjustment level): Page 108

c-sc — Cooling Coefficient

The control must be heating/cooling control and 2-PID control.

If the heating characteristics and cooling characteristics of the control object are very different and good control characteristics cannot be achieved with the same PID constants, the cooling coefficient can be used to adjust the proportional band (P) for the control output assigned to the cooling side.


Function

In heating/cooling control, the proportional band P for the cooling control output is calculated using the following formula to set the cooling coefficient:

Cooling control output side P = Cooling coefficient × P (proportional band)


Setting

Setting range	Unit	Default
0.01 to 99.99	None	1.00

■ **Related Parameters**

Proportional band (adjustment level): Page 113

c-db Dead Band

The control system must be set to heating/cooling control.


Function

This parameter sets the output dead band width for heating/cooling control. A negative setting sets an overlapping band.

- This parameter sets an area in which the control output is 0 centering around the set point for a heating/cooling control.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the "decimal point" parameter setting.


Setting

Model	Setting range	Unit	Default
Controllers with Thermocouple/Resistance Thermometer Universal-inputs	–199.9 to 999.9	°C or °F (See note.)	0.0
Controllers with Analog Inputs	–19.99 to 99.99	%FS	0.00

Note Set "none" as the unit for Controllers with Analog Inputs.

of-r Manual Reset Value

The control must be standard control and 2-PID control.
The "integral time" parameter must be set to 0.


Function

- This parameter sets the required manipulated variable to remove offset during stabilization of P or PD control.


Setting

Setting range	Unit	Default
0.0 to 100.0	%	50.0

■ **Related Parameters**

Integral time (adjustment level): Page 113
PID ON/OFF (initial setting level): Page 122

hys Hysteresis (Heating)
chys Hysteresis (Cooling)

The control must be ON/OFF control. For the "hysteresis (cooling)" parameter, the control must be heating/cooling control.


Function

This parameter sets the hysteresis for ensuring stable operation at the ON/OFF switching point.

- For standard control, use the "hysteresis (heating)" parameter. The "hysteresis (cooling)" parameter cannot be used.


Setting

- For heating/cooling control, the hysteresis can be set independently for heating/cooling. The “hysteresis (heating)” parameter is used for the heating side, and the “hysteresis (cooling)” parameter is used for the cooling side.

Parameters	Model	Setting range	Unit	Default
Hysteresis (heating)	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9	°C or °F (See note.)	1.0
	Controllers with Analog Inputs	0.01 to 99.99	%FS	0.10
Hysteresis (cooling)	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9	°C or °F (See note.)	1.0
	Controllers with Analog Inputs	0.01 o 99.99	%FS	0.10

Note Set “none” as the unit for Controllers with Analog Inputs.

■ **Related Parameters**

PID ON/OFF:Page 122, Standard or heating/cooling: Page 123 (initial setting level)

sprt SP Ramp Set Value

The "ST" parameter must be set to OFF.


Function

- This parameter sets the rate of change during SP ramp operation. Set the maximum permissible change width per unit of time as the SP ramp set value. The SP ramp function is disabled if this parameter is set to OFF.
- During temperature input, the decimal point position of the SP ramp set value is dependent on the currently selected sensor, and during analog input it is dependent on scaling.


Setting

Setting range	Unit	Default
OFF or 1 to 9999	EU/s or EU/minute	off


See

■ **Related Parameters**

Input type: Page 119, Scaling upper limit, Scaling lower limit, Decimal point (initial setting level): Page 121, ST: Page 123 (initial setting level)

SP ramp time unit (advanced function setting level): Page 132

olmh MV Upper Limit
olml MV Lower Limit

The control must be set to 2-PID control.
The "ST" parameter must be set to OFF.


Function


Setting

- The "MV upper limit" and "MV lower limit" parameters set the upper and lower limits of the manipulated variable. When the calculated manipulated variable exceeds the upper or lower limit value, the upper or lower limit value will be the output level.
- MV Upper Limit
  The setting ranges during standard control and heating/cooling control are different.
  The manipulated variable for the cooling control output side during heating/cooling control is expressed as a negative value.

Control method	Setting range	Unit	Default
Standard	MV lower limit + 0.1 to 105.0	%	105.0
Heating/cooling	0.0 to 105.0		

- MV Lower Limit
  The setting ranges during standard control and heating/cooling control are different. The manipulated variable for the cooling control output side during heating/cooling control is expressed as a negative value.

Control method	Setting range	Unit	Default
Standard	–5.0 to MV upper limit – 0.1	%	–5.0
Heating/cooling	–105.0 to 0.0		–105.0


See

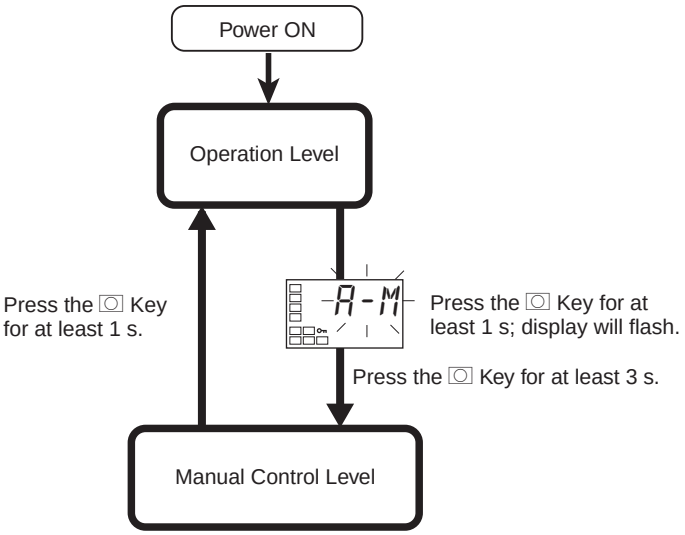
■ **Related Parameters**

PID ON/OFF: Page 122, ST: Page 123 (initial setting level)

5-5 Manual Control Level

The manipulated variable can be set in manual mode if the “PV/MV” parameter is displayed.

The final MV used in automatic mode will be used as the initial manual MV when moving from automatic mode to manual mode. In manual mode, the change value will be fixed immediately and reflected in the actual MV.



To move from the operation level to the manual control level, press the O key for at least three seconds with the “auto/manual switch” parameter displayed.

- The MANU indicator will light during manual control.
- It is not possible to move to any displays except for the “PV/MV” parameter during manual operation.
- To return to the operation level, press the O key in the manual control level for at least one second.

PV/MV (Manual MV)

Function

The process value is displayed on the No. 1 display, and the manipulated variable (manual MV) is displayed on the No. 2 display.

	Monitor range	Unit
Process value	Input indication range (See page 172.)	EU

	Setting range		Unit
MV (manual MV)	Standard control	–5.0 to 105.0	%
	Heating/cooling control	–105.0 to 105.0	

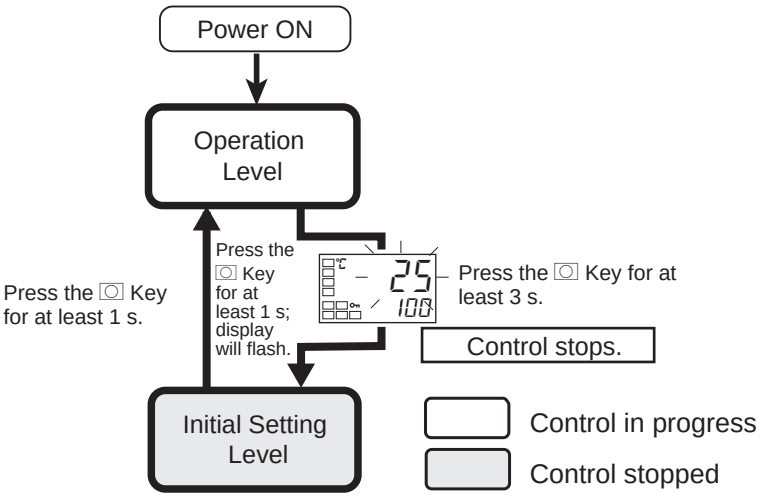
See

■ **Related Parameters**

Standard or heating/cooling (initial setting level): Page 123

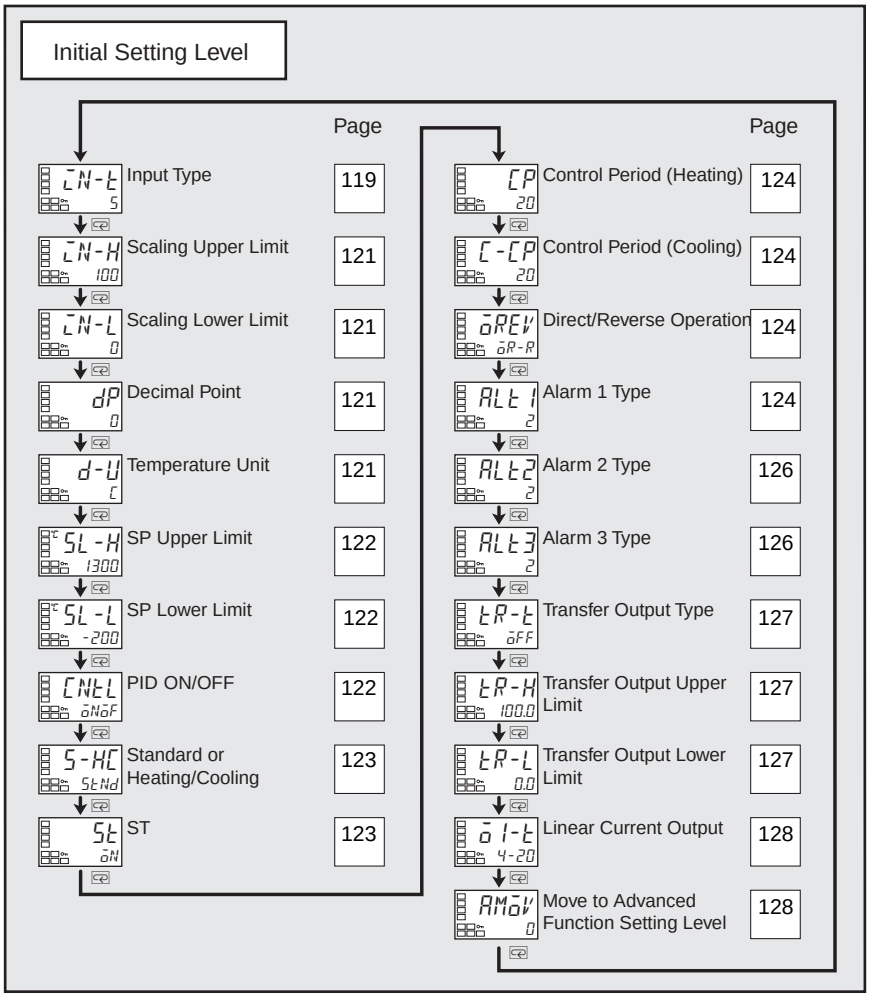
5-6 Initial Setting Level

This level is used to set up the basic Temperature Controller specifications. In this level, you can set the “input type” parameter to set the sensor input to be connected, limit the setting range of set points, set the alarm modes, and perform other operations.



To move from the operation level to the initial setting level, press the O key for at least 3 seconds with any parameter displayed except for the “auto/manual switch” parameter.

- The initial setting level is not displayed when the “initial/communications protect” parameter is set to 2. It can be used when the “initial/communications protect” parameter is set to 0 or 1.
- If the “input type” parameter is set for an analog input, the following parameters will be set: Scaling upper limit, Scaling lower limit, and Decimal point.



in-t Input Type

Function

Setting

- This parameter sets the type of sensor.
- When this parameter is changed, the set point limiter is changed to the defaults. If the input type must be changed, set the “SP upper limit” and “SP lower limit” parameters (initial setting level).
- Set one of the set values from the following table.
  The defaults are as follows:
  Controllers with Thermocouple/Resistance Thermometer Universal-inputs:
  5 (K thermocouple)
  Controllers with Analog Inputs: 0 (current input, 4 to 20 mA)
- If a platinum resistance thermometer is mistakenly connected while a setting for other than a platinum resistance thermometer is in effect, S.ERR will be displayed. To clear the S.ERR display, check the wiring and then cycle the power.

	Input type	Specifications	Set value	Input temperature range
Controllers with Thermocouple/ Resistance Thermometer Universal-inputs	Platinum resistance thermometer	Pt100	0	–200 to 850 (°C)/–300 to 1500 (°F)
			1	–199.9 to 500.0 (°C)/–199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)
		JPt100	3	–199.9 to 500.0 (°C)/–199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)
	Thermocouple	K	5	–200 to 1300 (°C)/–300 to 2300 (°F)
			6	–20.0 to 500.0 (°C)/0.0 to 900.0 (°F)
		J	7	–100 to 850 (°C)/–100 to 1500 (°F)
			8	–20.0 to 400.0 (°C)/0.0 to 750.0 (°F)
		T	9	–200 to 400 (°C)/–300 to 700 (°F)
			10	–199.9 to 400.0 (°C)/–199.9 to 700.0 (°F)
		E	11	0 to 600 (°C)/0 to 1100 (°F)
		L	12	–100 to 850 (°C)/–100 to 1500 (°F)
		U	13	–200 to 400 (°C)/–300 to 700 (°F)
			14	–199.9 to 400.0 (°C)/–199.9 to 700.0 (°F)
		N	15	–200 to 1300 (°C)/–300 to 2300 (°F)
		R	16	0 to 1700 (°C)/0 to 3000 (°F)
		S	17	0 to 1700 (°C)/0 to 3000 (°F)
		B	18	100 to 1800 (°C)/300 to 3200 (°F)
	Infrared Temperature Sensor ES1B	10 to 70 (°C)	19	0 to 90 (°C)/0 to 190 (°F)
		60 to 120 (°C)	20	0 to 120 (°C)/0 to 240 (°F)
		115 to 165 (°C)	21	0 to 165 (°C)/0 to 320 (°F)
		140 to 260 (°C)	22	0 to 260 (°C)/0 to 500 (°F)
	Analog input	0 to 50 mV	23	One of the following ranges depending on the scaling. –1999 to 9999 –199.9 to 999.9

	Input type	Specifications	Set value	Input temperature range
Controllers with Analog Inputs	Current input	4 to 20 mA	0	One of the following ranges depending on the scaling. –1999 to 9999 –199.9 to 999.9 –19.99 to 99.99 –1.999 to 9.999
		0 to 20 mA	1	
	Voltage input	1 to 5 V	2	
		0 to 5 V	3	
		0 to 10 V	4	

■ **Related Parameters**

Temperature unit: Page 121, SP upper limit, SP lower limit: Page 122 (initial setting level)

in-h Scaling Upper Limit
in-l Scaling Lower limit
dp Decimal Point

The input type must be set for an analog input.


Function

- These parameters can be used when the input type is set for an analog input.
- When an analog input is used, scaling is performed. Set the upper limit in the “scaling upper limit” parameter and the lower limit in the “scaling lower limit” parameter.
- The “decimal point” parameter specifies the decimal point position of parameters (set point, etc.) whose unit is EU.


Setting

- Scaling Upper Limit, Scaling Lower Limit

Parameters	Setting range	Unit	Default
Scaling upper limit	Scaling lower limit + 1 to 9999	None	100
Scaling lower limit	−1999 to scaling upper limit − 1	None	0

- Decimal Point

Parameters	Model	Setting range	Default
Decimal Point	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0 to 1	0
	Controllers with Analog Inputs	0 to 3	0

Set value	Settings	Example
0	0 digits past decimal point	1234
1	1 digits past decimal point	123.4
2	2 digits past decimal point	12.34
3	3 digits past decimal point	1.234

■ **Related Parameters**

Input type (initial setting level): Page 119

d-u Temperature Unit

The input type must be set for a temperature input.


Function

- Set the temperature input unit to either °C or °F.


Setting

Setting range	Default
c: °C, f: °F	c

■ **Related Parameters**

Input type (initial setting level): Page 119

sl-h SP Upper Limit
sl-l SP Lower Limit


Function

- These parameters set the upper and lower limits of the set points. A set point can be set within the range defined by the upper and lower limit set values in the “SP upper limit” and “SP lower limit” parameters. If these parameters are reset, any set point that is outside of the new range will be forcibly changed to either the upper limit or the lower limit.
- When the temperature input type and temperature unit have been changed, the set point upper limit and set point lower limit are forcibly changed to the upper and lower limits of the sensor.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the “decimal point” parameter setting.


Setting

Controllers with Thermocouple/Resistance Thermometer Universal-inputs

Parameters		Setting range	Unit	Default
Set point upper limit	Temperature	SP lower limit + 1 to Input range upper limit	EU	1300
	Analog	SP lower limit + 1 to scaling upper limit	EU	100
Set point lower limit	Temperature	Input range lower limit to SP upper limit − 1	EU	−200
	Analog	Scaling lower limit to SP upper limit − 1	EU	0

Controllers with Analog Inputs

Parameters	Setting range	Unit	Default
Set point upper limit	SP lower limit + 1 to scaling upper limit	EU	100
Set point lower limit	Scaling lower limit to SP upper limit − 1	EU	0


See

■ **Related Parameters**

Input type: Page 119, Temperature unit: Page 121 (initial setting level)

cntl PID ON/OFF


Function

- This parameter selects 2-PID control or ON/OFF control.
- The auto-tuning and self-tuning functions can be used in 2-PID control.


Setting

Setting range	Default
pid: 2-PID, onof: ON/OFF	onof

See

■ **Related Parameters**

AT execute/cancel: Page 108, Manual reset value, Hysteresis (heating), and Hysteresis (cooling): Page 114 (adjustment level)

ST stable range (advanced function setting level): Page 137

s-hc Standard or Heating/Cooling

Function

Setting

- This parameter selects standard control or heating/cooling control.
- With the E5CZ and E5CZ-U, when heating/cooling control is selected, alarm output 2 terminal (ALM2) is used as a control output (cooling), so alarm 2 cannot be used.
- With the E5AZ and E5EZ, when heating/cooling control is selected, alarm output 3 terminal (ALM3) is used as a control output (cooling), so alarm 3 cannot be used.

Setting range	Default
stnd: Standard, h-c: Heating/cooling	stnd

See

■ **Related Parameters**

MV monitor (heating): Page 104, MV monitor (cooling): Page 105 (operation level)

Cooling coefficient: Page 113, Dead band, Hysteresis (heating), Hysteresis (cooling): Page 114 (adjustment level)

Control period (heating), Control period (cooling) (initial setting level): Page 124

Control output 1 assignment: Page 146, Alarm output 1 assignment: Page 146, Alarm output 2 assignment: Page 147, Alarm output 3 assignment: Page 148 (advanced function setting level)

st ST (self-tuning)

The control must be set to a temperature input, standard control, and 2-PID control.

Function

- The ST (self-tuning) function executes tuning from the start of program execution to calculate PID constants matched to the control target. When the ST function is in operation, be sure to turn ON the power supply of the load connected to the control output simultaneously with or before starting Controller operation.
- Auto-tuning can be started during self-tuning.

Setting

Parameter	Setting range	Unit	Default
ST	off: ST function OFF, on: ST function ON	None	on

■ **Related Parameters**

Input type: Page 119, PID ON/OFF: Page 122 (initial setting level), ST stable range (advanced function setting level): Page 137

cp Control Period (Heating)

c-cp Control Period (Cooling)

The cooling control output and heating control output must be assigned to relay/voltage outputs.
The control must be set to 2-PID control.
For the “control period (cooling)” parameter, the control must be set to heating/cooling control.


Function

- These parameters set the output periods. Set the control periods taking the control characteristics and the electrical durability of the relay into consideration.
- For standard control, use the “control period (heating)” parameter. The “control period (cooling)” parameter cannot be used.
- Whenever the heating control output is a current output, the “control period (heating)” parameter cannot be used.
- For heating/cooling control, the control period can be set independently for heating and cooling. The “control period (heating)” parameter is used for the heating control output, and the “control period (cooling)” parameter is used for the cooling control output.


Setting

Parameters	Setting range	Unit	Default
Control period (heating)	0.5 or 1 to 99	Second	20
Control period (cooling)	0.5 or 1 to 99	Second	20

■ **Related Parameters**

PID ON/OFF (initial setting level): Page 122

orev Direct/Reverse Operation


Function

- “Direct operation” refers to control where the manipulated variable is increased when the process value increases. Alternatively, “reverse operation” refers to control where the manipulated variable is increased when the process value decreases.


Setting

Setting range	Default
or-r: Reverse operation, or-d: Direct operation	or-r

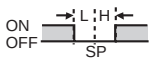
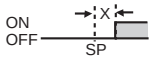
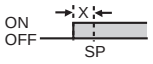
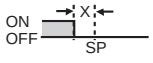
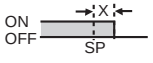
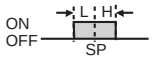
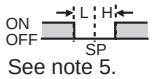
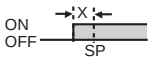
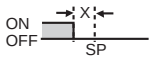
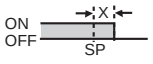
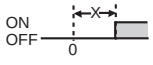
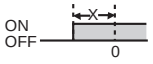
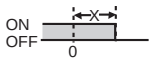
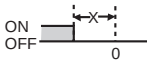
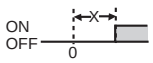
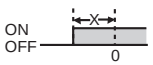
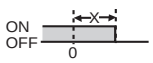
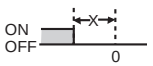
alt1 Alarm 1 Type

Alarm 1 must be assigned.


Function

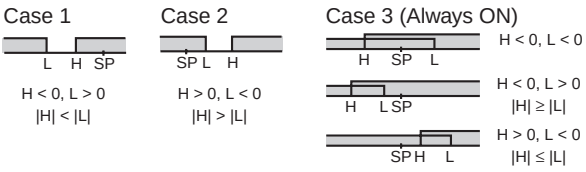
- Select one of the following three alarm 1 types:
  Deviation, Deviation range, or Absolute value

Setting

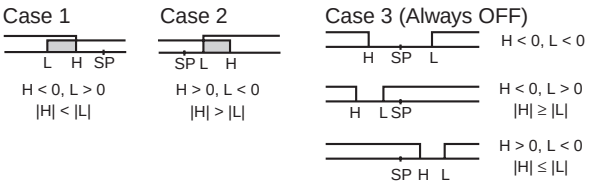
Set values	Alarm type	Alarm output operation	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1 (See note 1.)	Upper- and lower-limit		See note 2.
2	Upper-limit		
3	Lower-limit		
4 (See note 1.)	Upper- and lower-limit range		See note 3.
5 (See note 1.)	Upper- and lower-limit with standby sequence	 See note 5.	See note 4.
6	Upper-limit with standby sequence		
7	Lower-limit with standby sequence		
8	Absolute-value upper-limit		
9	Absolute-value lower-limit		
10	Absolute-value upper-limit with standby sequence		
11	Absolute-value lower-limit with standby sequence		
12	LBA (alarm 1 type only)	---	

Note (1) With set values 1, 4 and 5, the upper- and lower- limit values can be set independently for each alarm type, and are expressed as “L” and “H.”

(2) Set value: 1 (Upper- and lower-limit alarm)



(3) Set value: 4 (Lower limit range)



(4) Set value: 5 (Upper- and lower-limit with standby sequence)

- For the lower-limit alarms in cases 1 and 2 above, the alarm is normally OFF if upper- and lower-limit hysteresis overlaps.
- In case 3, the alarm is always OFF.

(5) Set value: 5 (The alarm is always OFF if upper- and lower-limit alarm hysteresis with standby sequence overlaps.)

- Set the alarm type independently for each alarm in the “alarm 1 to 3 type” parameters in the initial setting level. The default is 2 (Upper-limit alarm).

■ **Related Parameters**

Alarm value 1: Page 101, Alarm value upper limit 1, Alarm value lower limit 1: Page 103 (operation level)

Standby sequence reset: Page 133, Alarm 1 open in alarm: Page 134, Alarm 1 hysteresis: Page 135, Alarm 1 latch: Page 139 (advanced function setting level)

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alt2 Alarm 2 Type

Alarm 2 must be assigned.

- Select one of the following three alarm 2 types: Deviation, Deviation range, or Absolute value

Refer to the alarm 1 type list.

■ **Related Parameters**

Alarm value 2: Page 102, Alarm value upper limit 2, Alarm value lower limit 2: Page 103 (operation level)

Standby sequence reset: Page 133, Alarm 2 open in alarm: Page 134, Alarm 2 hysteresis: Page 135, Alarm 2 latch: Page 139 (advanced function setting level)

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alt3 Alarm 3 Type

Alarm 3 must be assigned.

- Select one of the following three alarm 3 types: Deviation, Deviation range, or Absolute value

Refer to the alarm 1 type list.

■ **Related Parameters**

Alarm value 3: Page 102, Alarm value upper limit 3, Alarm value lower limit 3: Page 104 (operation level)

Standby sequence reset: Page 133, Alarm 3 open in alarm: Page 134, Alarm 3 hysteresis: Page 135, Alarm 3 latch: Page 139 (advanced function setting level)

t r - t Transfer Output Type

A current output must be assigned.


Function

- When current output is to be used as transfer output, this parameter sets the transfer output type.
- If current output is not to be used as transfer output, set this parameter to OFF.


Setting

Transfer output type		Default
OFF	o f f	o f f
Set point	sp	
Set point during SP ramp	sp-m	
PV	pv	
MV monitor (heating)	mv	
MV monitor (cooling)	c-mv	


See

■ **Related Parameter**

Transfer output upper limit, Transfer output lower limit (initial setting level): Page 127

t r - h Transfer Output Upper Limit
t r - l Transfer Output Lower Limit

A current output must be assigned. The transfer output type must not be set to OFF.


Function

- This parameter sets the upper and lower limit values of transfer outputs.


Setting

Transfer output type	Setting range		Default		Unit
			Transfer output lower limit	Transfer output upper limit	
Set point	SP lower limit to SP upper limit		SP lower limit	SP upper limit	EU
Set point during SP ramp	SP lower limit to SP upper limit				
PV	Temperature	Senor setting range lower limit to sensor setting range upper limit	Sensor setting range lower limit	Sensor setting range upper limit	
	Analog	Analog scaling lower limit to analog scaling upper limit	Scaling lower limit	Scaling upper limit	
MV monitor (heating)	Standard	–5.0 to 105.0	0.0	100.0	%
	Heating/ cooling	0.0 to 105.0			
MV monitor (cooling)	0.0 to 105.0				


See

■ **Related Parameter**

Transfer output type (initial setting level): Page 127

o1-t Linear Current Output

A current output must be assigned.


Function

This parameter selects the output type for linear current outputs.

- Select either 4 to 20 mA or 0 to 20 mA when control output 1 is a current output.


Setting

Linear current output	Default
4-20: 4 to 20 mA 0-20: 0 to 20 mA	4-20

Note Even when control output 1 is used as a control output or a simple transfer output, 0 to 20 mA can be used.


See

■ **Related Parameter**

Transfer output type (initial setting level): Page 127

amov Move to Advanced Function Setting Level

The “initial setting/communications protect” parameter must be set to 0.


Function

- Set the “move to advanced setting level” parameter set value to “−169.”
- Move to the advanced setting level either by pressing the M key or O key or by waiting for 2 seconds to elapse.


See

■ **Related Parameter**

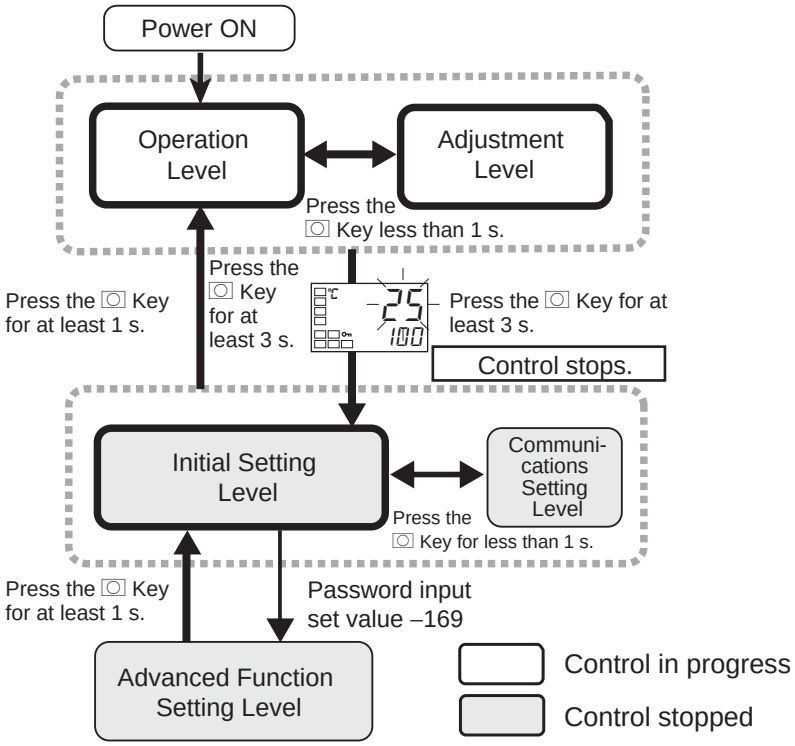
Initial setting/communications protect (protect level): Page 96

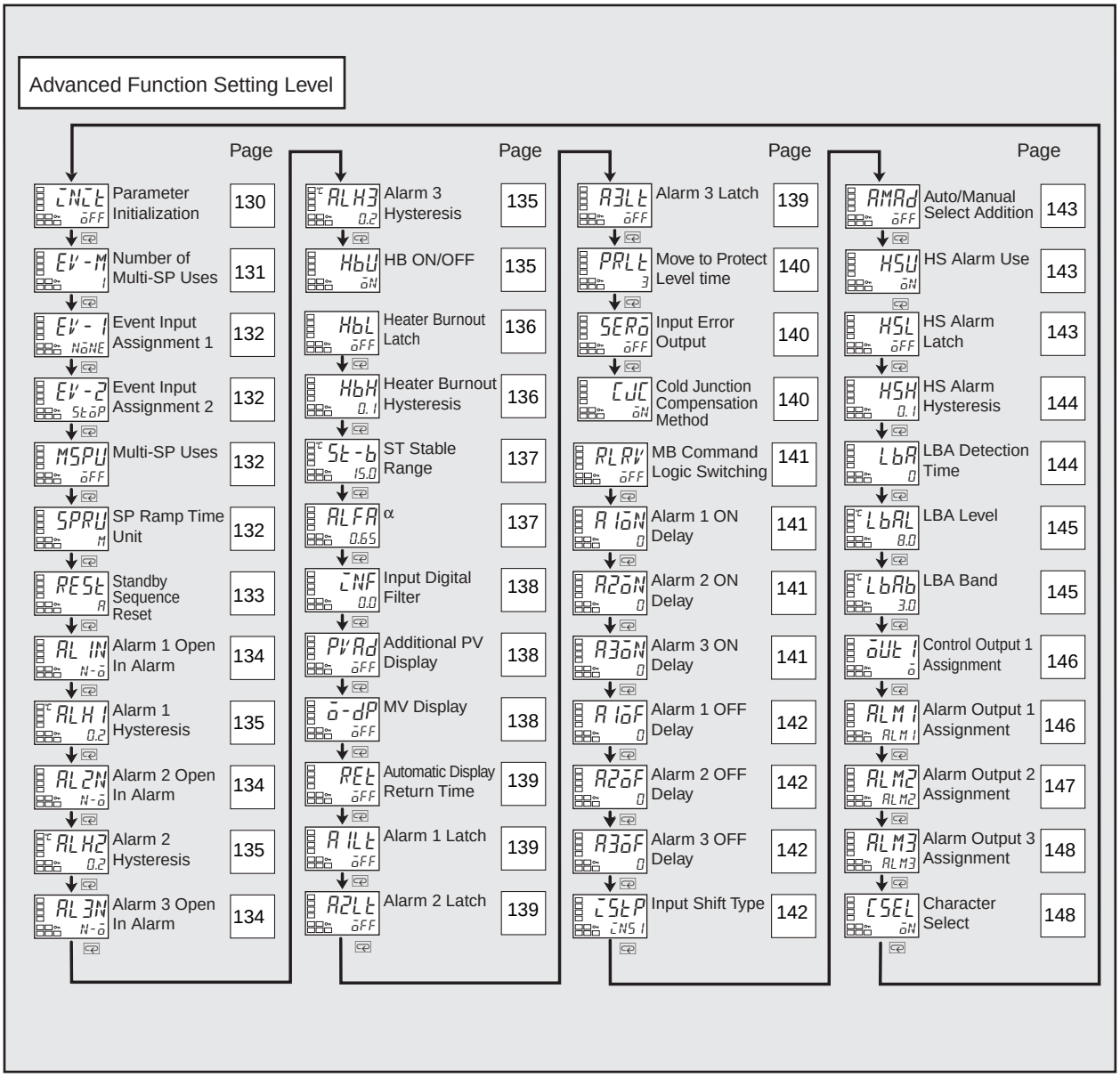
5-7 Advanced Function Setting Level

The advanced function setting level is used for optimizing Controller performance. To move to this level, input the password ("–169") from the initial setting level.

To be able to enter the password, the "initial setting/communications protect" parameter in the protect level must be set to 0.

- The parameters in this level can be used when the "initial setting/communications protect" parameter is set to 0.
- To switch between setting levels, press the O key.
- To change set values, press the U and D keys.





init Parameter Initialization

Function

- This parameter returns all parameter settings to their defaults.
- After the initialization, the set value automatically turns o f f.

Setting

Setting range	Default
o f f: Initialization is not executed.	o f f
f ac t: Initializes to the factory settings described in the manual.	

ev-m Number of Multi-SP Uses

Event inputs must be supported.


Function

Multi-SP is a function for setting set points 0 to 3 in advance, and switching between these set points using the ON/OFF combinations of event inputs 1 and 2.

The "number of multi-SP uses" parameter is used when the number of preset set points is either two or four.

This parameter determines whether the "event input assignment 1" and "event input assignment 2" parameters are displayed.


Setting

The "number of multi-SP uses" parameter displays which functions are assigned to event inputs 1 and 2.

		Settings		Event inputs	
		Event input assignment 1	**Event input assignment 2**	**Function of event input 1**	**Function of event input 2**
Number of multi-SP uses	0 (See note.)	NONE, STOP, MANU		None, or switching RUN/ STOP, or auto/manual	
	1	(Not dis-played.)	NONE, STOP, MANU	Multi-SP, 2 points (switch-ing set points 0 and 1)	None, or switching RUN/STOP, or auto/man-ual
	2	(Not displayed.)		Multi-SP, 4 points (switching set points 0, 1, 2, 3)	

Note If the "number of multi-SP uses" parameter is set to 0, both input assignments 1 and 2 can be set. Once "STOP" (RUN/STOP), or "MANU" (auto/manual) has been assigned to one event input, the other event can be assigned only to either of the remaining two settings.

- Default: 1

Multi-SP switching by event inputs can be used with Controllers that have event inputs, when the "number of multi-SP uses" parameter is set to 1 or 2.

The following tables show the relationships between ON/OFF combinations of event inputs 1 and 2 and selected set points.

Number of Multi-SP Uses: 1

Event input 1	Selected set point
OFF	Set point 0
ON	Set point 1

Number of Multi-SP Uses: 2

Event input 1	Event input 2	Selected set point
OFF	OFF	Set point 0
ON	OFF	Set point 1
OFF	ON	Set point 2
ON	ON	Set point 3

Note Event inputs can be used on the following Controllers. E5CZ-□2M□□ with E53-CZB or E53-CZHB,E5AZ-□3□M□□ with E53-AZB,E5EZ-□3□M□□ with E53-AZB.Turn the event inputs ON or OFF while the power is turned ON. Event input ON/OFF changes are detected for inputs of 50 ms or longer.

■ **Related Parameters**

SP 0 to SP 3 (adjustment level): Page 111

Event input assignment 1, Event input assignment 2, Multi-SP uses: Page 132 (advanced function setting level)

---

ev-1 Event Input Assignment 1
ev-2 Event Input Assignment 2

Event inputs must be supported. The "number of multi-SP uses" parameter must be set to 0 or 1.


Function


Setting

- The following functions are assigned for event input 1 and event input 2.
  RUN/STOP
  Auto/manual switch
- Defaults: Event input assignment 1: none
  Event input assignment 2: stop

Settings	Function
none	None
stop	RUN/STOP
manu	Auto/manual switch

■ **Related Parameters**

SP 0 to SP 3 (adjustment level): Page 111,

Number of multi-SP uses (advanced function setting level): Page 131

---

mspu Multi-SP Uses

The model must not support event inputs, or the number of multi-SP uses must be 0.


Function

This parameter enables switching between set points 0 to 3 by operating the keys on the front panel.

Prerequisites

- A model without event inputs
- The "number of multi-SP uses" parameter set to 0 on a model with event inputs


Setting

on: Set points 0 to 3 can be selected.

off: Set points 0 to 3 cannot be selected.

- Default : OFF

■ **Related Parameters**

Multi-SP set point setting (operation level): Page 99

Number of multi-SP uses (advanced function setting level): Page 131

---

spru SP Ramp Time Unit

The "ST" parameter must be set to OFF.


Function

- This parameter sets the time unit for the rate of change during SP ramp operation.

Setting

Setting range	Default
s: EU/s, m: EU/min	m

See

■ **Related Parameters**

Set point during SP ramp (operation level): Page 100

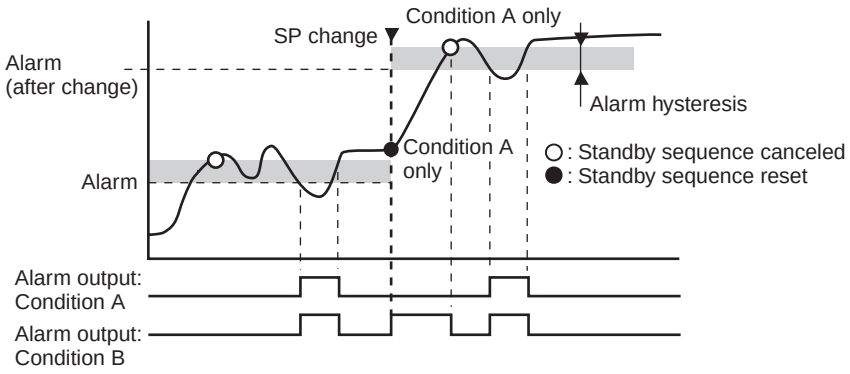
SP ramp set value (adjustment level): Page 116

rest Standby Sequence Reset

The alarm 1/2/3 type must be set to a type with a standby sequence.

Function

- This parameter selects the conditions for enabling reset after the standby sequence of the alarm has been canceled.
- Output is turned OFF when switching to the initial setting level, communications setting level, or advanced function setting level.
- Condition A
  Control started (including power ON), and set point, alarm value (alarm value upper/lower limit), or input shift value (upper/lower-limit temperature input shift value) changed.
- Condition B
  Power ON
- The following example shows the reset action when the alarm type is lower-limit alarm with standby sequence.



Setting

Setting range	Default
a: Condition A, b: Condition B	a

See

■ **Related Parameters**

Alarm 1 to 3 type (initial setting level): Page 124 to 126

Alarm 1 to 3 latch (advanced function setting level): Page 139

a l 1n Alarm 1 Open in Alarm

Alarm 1 must be assigned.


Function

- This parameter sets the output status for alarm 1.
- When “close in alarm” is set, the status of the alarm output function will be output as is. When “open in alarm” is set, the status of the alarm output function will be reversed before being output. The following table shows the relationship between alarm output functions, alarm output and output LCDs.
- When “open in alarm” is set, the “open in alarm” status is also applied to heater burnout and HS alarm outputs, and to input error outputs.


Setting

	Alarm output operation	Alarm output	Output LCDs
Close in alarm	ON	ON	Lit
	OFF	OFF	Not lit
Open in alarm	ON	OFF	Lit
	OFF	ON	Not lit

Setting range	Default
n - o: Close in alarm, n - c: Open in alarm	n - o


See

■ **Related Parameters**

Alarm value 1: Page 101, Alarm value upper limit 1, Alarm value lower limit 1: Page 103 (operation level)

Alarm 1 type (initial setting level): Page 124

Standby sequence reset: Page 133, Alarm 1 hysteresis: Page 135, Alarm 1 latch: Page 139 (advanced function setting level)

a l 2n Alarm 2 Open in Alarm

Alarm 2 must be assigned.

a l 3n Alarm 3 Open in Alarm

Alarm 3 must be assigned.


Function

- These parameters set the output status for alarm 2 and alarm 3 settings.
- When “close in alarm” is set, the status of the alarm output function will be output as is. When “open in alarm” is set, the status of the alarm output function will be reversed before being output. The following table shows the relationship between alarm output functions, alarm output and output LCDs.


Setting

	Alarm output operation	Alarm output	Output LCDs
Close in alarm	ON	ON	Lit
	OFF	OFF	Not lit
Open in alarm	ON	OFF	Lit
	OFF	ON	Not lit

Setting range	Default
n - o: Close in alarm, n - c: Open in alarm	n - o

See

■ **Related Parameters**

Alarm value 2 and 3: Page 102, Alarm value upper limit 2 and 3, Alarm value lower limit 2 and 3: Page 103 to 104 (operation level)

Alarm 2 to 3 type (initial setting level): Page 126

Alarm 2 and 3 hysteresis: Page 135, Standby sequence reset: Page 133, Alarm 2 and 3 latch: Page 139 (advanced function setting level)

---

alh1	**Alarm 1 Hysteresis**	Alarm 1 must be assigned, and the alarm 1 type must not be 0 or 12.
alh2	**Alarm 2 Hysteresis**	Alarm 2 must be assigned, and the alarm 2 type must not be 0.
alh3	**Alarm 3 Hysteresis**	Alarm 3 must be assigned, and the alarm 3 type must not be 0.


Function


Setting

- These parameters set alarm 1, 2, and 3 hysteresis.

Models	Setting range	Unit	Default
Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9	°C or °F (See note.)	0.2
Controllers with Analog Inputs	0.01 to 99.99	%FS	0.02

Note Set “none” as the unit for Controllers with Analog Inputs.

See

■ **Related Parameters**

Alarm value 1 to 3: Page 101 to 102, Alarm value upper limit 1 to 3: Page 103 to 104, Alarm value lower limit 1 to 3: Page 103 to 104 (operation level)

Alarm 1 to 3 type (initial setting level): Page 124 to 126

Standby sequence reset: Page 133, Alarm 1 to 3 open in alarm: Page 134, Alarm 1 to 3 latch: Page 139 (advanced function setting level)

---

hbu	**HB ON/OFF**	Heater burnout and HS alarms must be supported. Alarm 1 must be assigned.


Function


Setting

- Set to use the heater burnout alarm.

Setting range	Default
on: Enabled, off: Disabled	on

hbl Heater Burnout Latch

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “heater burnout detection” parameter must be set to ON.


Function

- When this parameter is set to ON, the heater burnout alarm is held until either of the following conditions is satisfied.
  - a Heater burnout detection is set to 0.0 A.
  - b The power is turned OFF then back ON again (i.e., power is reset).
- Output is turned OFF when switching to the initial setting level, communications setting level, or advanced function setting level.


Setting

Setting range	Default
on: Enabled, oFF: Disabled	oFF

■ **Related Parameter**

HB ON/OFF (advanced function setting level): Page 135

hbh Heater Burnout Hysteresis

The “heater burnout” parameter must be set to ON.
The “heater burnout latch” parameter must be set to OFF.
Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.


Function

- This parameter sets hysteresis for heater burnout detection.


Setting

Setting range	Unit	Default
0.1 to 50.0	A	0.1

■ **Related Parameter**

HB ON/OFF (advanced function setting level): Page 135

st-b ST Stable Range

ST must be ON and temperature input, standard control, 2-PID control must be set.

Function

- The setting of this parameter determines when ST operates. This parameter cannot be used when ST is set to OFF.

Setting

Setting range	Unit	Default
0.1 to 999.9	°C or °F	15.0

See

■ **Related Parameters**

Input type: Page 119, PID ON/OFF: Page 122, ST: Page 123 (initial setting level)

alfa α

ST must be OFF and 2-PID control must be set.

Function

- Normally, use the default for this parameter.
- This parameter sets the 2-PID control α constant.

Setting

Setting range	Unit	Default
0.00 to 1.00	None	0.65

See

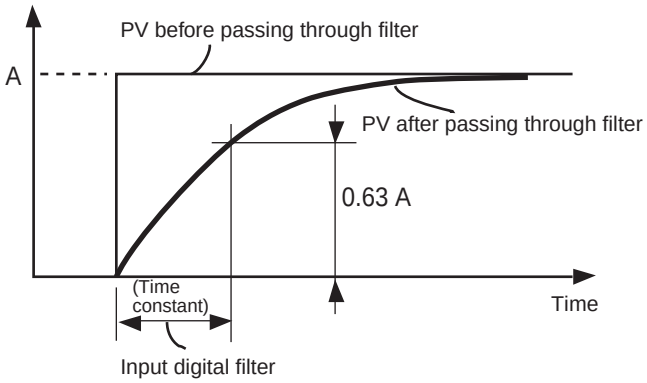
■ **Related Parameters**

PID ON/OFF: Page 122, ST: Page 123 (initial setting level)

inf Input Digital Filter

Function

- This parameter sets the time constant for the input digital filter. The following diagram shows the effect on data after passing through the digital filter:



Setting

Setting range	Unit	Default
0.0 to 999.9	Second	0.0

pvad Additional PV Display

Function

This parameter adds a display at the beginning of the operation level for the process value (PV). If there is no need to display the set point, use this to display only the present temperature.

Set to ON to display, and OFF to not display.

Setting

Setting range	Default
on: Displayed, off: Not displayed	off

o-dp MV Display

Function

This parameter is used to display the manipulated variable (MV).

The manipulated variable is displayed when the “MV monitor (heating) and (cooling)” parameters are set to ON, and not displayed when these parameters are set to OFF.

Setting

Setting range	Default
on: Displayed, off: Not displayed	off

See

■ **Related Parameters**

MV monitor (heating): Page 104, MV monitor (cooling): Page 105 (operation level)

ret Automatic Display Return Time


Function

- In the operation level or adjustment level, the display automatically returns to the PV/SP if there are no key operations for the time set for this parameter.
- The automatic display return time is disabled when the parameter is set to OFF. (In that case, the display will not be automatically switched.)


Setting

Setting range	Unit	Default
OFF, 1 to 99	Second	off

a1lt Alarm 1 Latch

Alarm 1 must be assigned, and the alarm 1 type must not be 0.

a2lt Alarm 2 Latch

Alarm 2 must be assigned, and the alarm 2 type must not be 0.

a3lt Alarm 3 Latch

Alarm 3 must be assigned, and the alarm 3 type must not be 0.


Function

- When a parameter is set to ON, once the alarm function has turned ON it is held until the power is turned OFF. The latch can be canceled, however, by switching to the initial setting level, communications setting level, or advanced function setting level.
- If alarm outputs are set to “close in alarm,” the outputs are kept closed. If they are set to “open in alarm,” they are kept open.


Setting

Setting range	Default
on: Enabled, off: Disabled	off

■ **Related Parameters**

Alarm value 1 to 3: Page 101 to 102, Alarm value upper limit 1 to 3: Page 103 to 104, Alarm value lower limit 1 to 3: Page 103 to 104 (operation level)

Alarm 1 to 3 type (initial setting level): Page 124 to 126

Standby sequence reset: Page 133, Alarm 1 to 3 open in alarm: Page 134, Alarm 1 to 3 hysteresis: Page 135 (advanced function setting level)

prlt Move to Protect Level Time


Function

- This parameter sets the key pressing time required to move to the protect level from the operation level or the adjustment level.


Setting

Setting range	Unit	Default
1 to 30	Second	3


See

■ **Related Parameters**

Operation/adjustment protect, initial setting/communications protect, setting change protect (protect level): Page 96

sero Input Error Output

Alarm 1 must be assigned.


Function

- When this parameter is set to ON, alarm 1 output turns ON for input errors.
  The alarm 1 operation indicator will not light.
  Note For details on input errors, refer to *Error Displays* on page 156.
- The alarm 1 output is an OR output of alarm 1, HB alarm burnout/HS alarm, and input error.
- Output is turned OFF when switching to the initial setting level, communications setting level, or advanced function setting level.


Setting

Setting range	Default
on: Enabled, off: Disabled	off

cjc Cold Junction Compensation Method

Input type must be thermocouple or infrared temperature sensor


Function

- Specifies whether cold junction compensation is to be performed internally by the Controller or to be performed externally when the input type setting is to between 5 and 22.
- The cold junction compensation external setting is enabled when the temperature difference is measured using two thermocouples or two ES1B Sensors.


Setting

Setting range	Default
on: Internally, off: Externally	on


See

■ **Related Parameter**

Input type (initial setting level): Page 119

rlrv MB Command Logic Switching

Communications must be supported. CompoWay/F must be selected as the protocol.


Function

- .This parameter switches the logic of the MB command (communications writing switch) for the SYSWAY communications protocol
- The MB command (communications writing switch) is the equivalent of the MB command (remote/local switch) of the E5□J.


Setting

- The setting indicated by the shaded area is the default (same logic as E5□J).

Set value	Text data of MB command	
	0000	0001
OFF	Communications writing enabled (remote mode selection)	Communications writing disabled (local mode selection)
ON	Communications writing disabled (local mode selection)	Communications writing enabled (remote mode selection)

(Terms in parentheses () are the terms used on the E5□J.)


See

■ **Related Parameters**

Communications writing (adjustment level): Page 108
Protocol setting (communications setting level): Page 149

a1on Alarm 1 ON Delay
a2on Alarm 2 ON Delay
a3on Alarm 3 ON Delay

Alarm 1 must be assigned, and the alarm 1 type must not be 0 or 12.
Alarm 2 must be assigned, and the alarm 2 type must not be 0.
Alarm 3 must be assigned, and the alarm 3 type must not be 0.

Alarm 1, 2, or 3 outputs are prevented from turning ON until after the delay times set in these parameters have elapsed.


Function

- Set the time for which the ON delay is to be enabled.
- To disable the ON delay, set 0.


Setting

Setting range	Unit	Default
0 to 999	Second	0


See

■ **Related Parameters**

Alarm 1 to 3 type (initial setting level): Page 124 to 126

a1of	**Alarm 1 OFF Delay**	Alarm 1 must be assigned, and the alarm 1 type must not be 0 or 12.
a2of	**Alarm 2 OFF Delay**	Alarm 2 must be assigned, and the alarm 2 type must not be 0.
a3of	**Alarm 3 OFF Delay**	Alarm 3 must be assigned, and the alarm 3 type must not be 0.


Function


Setting

Alarm 1, 2, or 3 outputs are prevented from turning OFF until after the delay times set in these parameters have elapsed.

- Set the time for which the OFF delay is to be enabled.
- To disable the OFF delay, set 0.

Setting range	Unit	Default
0 to 999	Second	0


See

■ **Related Parameters**

Alarm 1 to 3 type (initial setting level): Page 124 to 126

istp	**Input Shift Type**	The input type must be thermocouple or resistance thermometer.


Function


Setting

This parameter sets the shift method for thermocouple or resistance thermometer inputs.

- When the input type is thermocouple or resistance thermometer, set either a 1-point shift or a 2-point shift.

Setting range	Default
ins1: 1-point shift, ins2: 2-point shift	ins1


See

■ **Related Parameters**

Temperature input shift: Page 111, Upper-limit temperature input shift value, Lower-limit temperature input shift value: Page 112 (adjustment level)

Input type (initial setting level): Page 119

amad Auto/Manual Select Addition

The control must be set to 2-PID control.

This parameter sets whether the “auto/manual switch” parameter is to be displayed.


Function

- Set whether the “auto/manual switch” parameter is to be displayed.


Setting

Setting range	Default
on: Displayed, oFF: Not displayed	oFF


See

■ **Related Parameter**

Auto/manual switch (operation level): Page 99

hsu HS Alarm Use

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.


Function

- Set this parameter to use HS alarms.


Setting

Setting range	Default
on: Enabled, oFF: Disabled	on

hsl HS Alarm Latch

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The “HS alarm” parameter must be set to ON.


Function

- When this parameter is set to ON, the HS alarm is held until either of the following conditions is satisfied.
  a The HS alarm current is set to 50.0 A.
  b The power is turned OFF then back ON again (i.e., power is reset).
- Output is turned OFF when switching to the initial setting level, communications setting level, or advanced function setting level.


Setting

Setting range	Default
on: Enabled, oFF: Disabled	oFF


See

■ **Related Parameter**

HS alarm use (advanced function setting level): Page 143

hsh HS Alarm Hysteresis

Heater burnout and HS alarms must be supported.
Alarm 1 must be assigned.
The "HS alarm" parameter must be set to ON.
The "HS alarm latch" must be set to OFF.


Function

- This parameter sets the hysteresis for HS alarm.


Setting

Setting range	Unit	Default
0.1 to 50.0	A	0.1


See

■ **Related Parameter**

HS alarm use (advanced function setting level): Page 143

lba LBA Detection Time

Alarm 1 must be assigned.
The alarm type must be set to 12 (LBA).

This parameter enables or disables the LBA function and sets the detection time interval.


Function

- Set the time interval for detecting loop burnouts.
- To disable the LBA function, set 0.


Setting

Setting range	Unit	Default
0 to 9999	Second	0


See

■ **Related Parameters**

Alarm 1 type (initial setting level): Page 124

LBA level, LBA band: Page 145 (advanced function setting level)

lbal LBA Level

Alarm 1 must be assigned.
The alarm type must be set to 12 (LBA).
The LBA detection time must not be 0.


Function

- This parameter sets the LBA level.
- If the deviation between the SP and PV exceeds the LBA level, a loop burnout is detected.


Setting

Models	Setting range	Unit	Default
Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9	°C or °F (See note.)	8.0
Controllers with Analog Inputs	0.01 to 99.99	%FS	10.00

Note Set “none” as the unit for Controllers with Analog Inputs.


See

■ **Related Parameters**

Process value/set point (operation level): Page 99

Alarm 1 type (initial setting level): Page 124

LBA detection time: Page 144, LBA band: Page 145 (advanced function setting level)

lbab LBA Band

Alarm 1 must be assigned.
The alarm type must be set to 12 (LBA).
The LBA detection time must not be 0.


Function

- This parameter sets the LBA band.
- If a control deviation greater than the LBA band is not reduced when the LBA level is exceeded, an loop burnout is detected.


Setting

Models	Setting range	Unit	Default
Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.0 to 999.9	°C or °F (See note.)	3.0
Controllers with Analog Inputs	0.00 to 99.99	%FS	0.20

Note Set “none” as the unit for Controllers with Analog Inputs.


See

■ **Related Parameters**

Process value/set point (operation level): Page 99

Alarm 1 type (initial setting level): Page 124

LBA detection time: Page 144, LBA level: Page 145 (advanced function setting level)

out1 Control Output 1 Assignment

The transfer output type must be set to OFF when the control output is a current output.


Function


Setting

- This parameter sets the function to be assigned to control output 1.

Setting range	Default
none: No function is assigned to control output 1.	o
o: Heating control output is output.	
c-o: Cooling control output is output. (See note 1.)	
alm1: Alarm 1 is output. (See note 2.)	
alm2: Alarm 2 is output. (See note 2.)	
alm3: Alarm 3 is output. (See note 2.)	

Note (1) If c-o is assigned for standard control, a value equivalent to 0% is output.
(2) Can be selected for relay and voltage outputs only.


See

■ **Related Parameters**

Standard or heating/cooling: Page 123, Transfer output type: Page 127 (initial setting level)

alm1 Alarm output 1 Assignment

Alarm output 1 must be assigned.


Function


Setting

- This parameter sets the function to be assigned to alarm output 1.

Setting range	Default
none: No function is assigned to alarm output 1.	alm1
o: Heating control output is output.	
c-o: Cooling control output is output. (See note.)	
alm1: Alarm 1 is output.	
alm2: Alarm 2 is output.	
alm3: Alarm 3 is output.	

Note If c-o is assigned for standard control, a value equivalent to 0% will be output.

alm2 Alarm output 2 Assignment

Alarm output 2 must be assigned.

- This parameter sets the function to be assigned to alarm output 2.

Setting range	Default
none: No function is assigned to alarm output 2.	alm2 (See note 2.)
o: Heating control output is output.	
c-o: Cooling control output is output. (See note 1.)	
alm1: Alarm 1 is output.	
alm2: Alarm 2 is output.	
alm3: Alarm 3 is output.	

Note

(1) If c-o is assigned for standard control, a value equivalent to 0% will be output.

(2) If the “standard or heating/cooling” parameter is set to heating/cooling control when there is E5CZ/CZ-U, control automatically switches to c-o.

■ **Related Parameters**

See Standard or heating/cooling: Page 123, (initial setting level)

alm3 Alarm output 3 Assignment

Alarm output 3 must be assigned (E5AZ and E5EZ only).


Function


Setting

- This parameter sets the function to be assigned to alarm output 3.

Setting range	Default
none: No function is assigned to alarm output 3.	alm3 (See note 2.)
o: Heating control output is output.	
c-o: Cooling control output is output. (See note 1.)	
alm1: Alarm 1 is output.	
alm2: Alarm 2 is output.	
alm3: Alarm 3 is output.	

Note

(1) If c-o is assigned for standard control, a value equivalent to 0% will be output.

(2) If the "standard or heating/cooling" parameter is set to heating/cooling control when there is E5AZ/EZ, control automatically switches to c-o.


See

■ **Related Parameters**

Standard or heating/cooling: Page 123, (initial setting level)

csel Character Select


Function


Setting

- This parameter switches the characters to be displayed.
  The following two types of characters can be displayed.
  11-segment display
  7-segment display

Setting range	Default
on: 11-segment display, off: 7-segment display	on

When set to on, an 11-segment display is used.

5-8 Communications Setting Level

psel	**Protocol Setting**	Communications must be supported.
u-no	**Communications Unit No.**	
bps	**Communications Baud Rate**	
len	**Communications Data Length**	CompoWay/F must be selected as the protocol.
sbit	**Communications Stop Bits**	CompoWay/F must be selected as the protocol.
prty	**Communications Parity**	
sdwt	**Send Data Wait Time**	


Function

- Each parameter is enabled when the power is reset.
- Match the communications specifications of the E5□Z and the host computer. If multiple devices are connected, ensure that the communications specifications for all devices in the system (except the Communications unit number) are the same.


Setting

Item	Symbol	Set values	Settings	Default
Protocol setting	psel	cwf, mod	CompoWay/F (SYSWAY), Modbus	cwf
Communications Unit No.	u-no	0 to 99	0 to 99	1
Communications baud rate	bps	1.2, 2.4, 4.8, 9.6, 19.2, or 38.4 (kbps)	1.2, 2.4, 4.8, 9.6, 19.2, or 38.4 (kbps)	9.6
Communications data length	len	7, 8 (bits)	7, 8 (bits)	7
Communications stop bits	sbit	1, 2	1, 2	2
Communications parity	prty	none, even, odd	None, Even, Odd	even
Send data wait time	sdwt	0 to 99	0 to 99 (ms)	20

■ **Related Parameter**

Communications writing (adjustment level): Page 108

Appendix A

Specifications

Ratings

Supply voltage		100 to 240 VAC, 50/60 Hz		24 VAC, 50/60 Hz/24 VDC
Operating voltage range		85 to 110% of rated supply voltage		
Power consumption	E5CZ	7.5 VA		5.5 VA/3.5W
	E5CZ-U	6 VA		4.5VA/2.5W
	E5AZ	8.5 VA		6 VA/4 W
	E5EZ	8.5 VA		6 VA/4 W
Sensor input (See note 1.)		Temperature input type Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C Voltage input: 0 to 50 mV		
		Controllers with Analog Inputs Current input: 4 to 20 mA, 0 to 20 mA (Input impedance: 150 Ω max.) Voltage input: 1 to 5 V, 0 to 5 V, 0 to 10 V (Input impedance: 1 MΩ max.) (See note 2.)		
Control output		Relay output	E5CZ	Relay output: SPST-NO, 250 VAC, 3 A (resistive load), electrical durability: 100,000 operations Min. applicable load: 5 V, 10 mA
			E5CZ-U	SPDT, 250 VAC, 3A (resistive load), electrical durability: 100,000 operations Min. applicable load 5 V 10 mA
			E5AZ E5EZ	Relay output: SPST-NO, 250 VAC, 5 A (resistive load), electrical durability: 100,000 operations Min. applicable load: 5 V, 10 mA
		Voltage output	E5CZ E5CZ-U	Output voltage 12 VDC ±15% (PNP), max. load current 21 mA, with short-circuit protection circuit
			E5AZ E5EZ	Output voltage 12 VDC +15%/−20% (PNP), max. load current 40 mA, with short-circuit protection circuit
		Current output	4 to 20 mA DC, 0 to 20 mA DC, Load: 600 Ω max., Resolution: approx. 2,700	
Alarm output		E5CZ E5CZ-U	SPST-NO, 250 VAC, 1 A (resistive load), electrical durability: 100,000 operations Min. applicable load: 5 V, 10 mA	
		E5AZ E5EZ	SPST-NO, 250 VAC, 2 A (resistive load), electrical durability: 100,000 operations Min. applicable load: 5 V, 10 mA	
Control method		2-PID or ON/OFF control		
Setting method		Digital setting using front panel keys		
Indication method		11-segment/7-segment digital display and single-lighting indicator		
Other functions		Depend on the model		
Ambient temperature		−10 to 55°C (with no condensation or icing)		
Ambient humidity		25% to 85%		
Storage temperature		−25 to 65°C (with no condensation or icing)		
Altitude		2,000 m or less		
Recommended fuse		T2A, 250 VAC, time lag, low shut-off capacity		
Installation environment		Installation Category II, Pollution Class 2 (IEC 61010-1 compliant)		

Note (1) For the setting ranges for each sensor input, see page 172.

(2) When connecting the ES2, connect it 1:1.

HB and HS Alarms (for Controller with Heater Burnout and HS Alarms)

Max. heater current	50 A AC
Input current indication accuracy	±5% FS ±1 digit max.
Heater burnout alarm setting range	0.1 to 49.9 A (in units of 0.1A) 0.0 A: Heater burnout alarm output turns OFF. 50.0 A: Heater burnout alarm output turns ON. Min. detection ON time: 190 ms (See note 1.)
HS alarm setting range	0.1 to 49.9 A (in units of 0.1A) 0.0 A: HS alarm output turns ON. 50.0 A: HS alarm output turns OFF. Min. detection OFF time: 190 ms (See note 2.)

Note (1) When the control output 1 ON time is less than 190 ms, heater burnout detection and heater current measurement are not performed.

(2) When the control output 1 OFF time is less than 190 ms, HS alarm and leakage current measurement are not performed.

Characteristics

Indication accuracy (ambient temperature of 23°C)	Thermocouple (See note 1.): E5CZ/AZ/EZ: (±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max. E5CZ-U: (±1% of indication value or ±2°C, whichever is greater) ±1 digit max. Platinum resistance thermometer: (±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max. Analog input: ±0.5% FS ±1 digit max. CT input: ±5% FS ±1 digit max.	
Temperature variation influence (See note 2.)	Thermocouple (R, S, B) (±1% of PV or ±10°C, whichever is greater) ±1 digit max. (E5CZ) (±2% of PV or ±10°C, whichever is greater) ±1 digit max. (E5CZ-U) Other thermocouples: (±1% of PV or ±4°C, whichever is greater) ±1 digit max. (E5CZ) (±2% of PV or ±4°C, whichever is greater) ±1 digit max. (E5CZ-U) *K thermocouple at −100°C max: ±10°C max. Platinum resistance thermometer: (±1% of PV or ±2°C, whichever is greater) ±1 digit max. Analog input: ±1% FS ±1 digit max. (See note 2.)	
Voltage variation influence (See note 2.)		
Hysteresis	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9°C or °F) (in units of 0.1°C or °F) (See note 3.)
	Controllers with Analog Inputs	0.01% to 99.99% FS (in units of 0.01% FS)
Proportional band (P)	Controllers with Thermocouple/Resistance Thermometer Universal-inputs	0.1 to 999.9°C or °F) (in units of 0.1 EU) (See note 3.)
	Controllers with Analog Inputs	0.1% to 999.9% FS (in units of 0.1% FS)
Integral time (I)	0 to 3,999 s (in units of 1 s)	
Derivative time (D)	0 to 3,999 s (in units of 1 s)	
Control Period	0.5, 1 to 99 s (in units of 1 s)	
Manual reset value	0.0% to 100.0% (in units of 0.1%)	
Alarm setting range	−1,999 to 9,999 (decimal point position depends on input type)	
Sampling period	250 ms	
Affect of signal source resistance	Thermocouple:0.1°C/ Ω max.(100 Ω max.)(See note 4.) Platinum resistance thermometer:0.4°C/ Ω max.(10 Ω max.)	
Insulation resistance	20 MΩ min. (at 500 VDC)	
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min between terminals of different charge	
Malfunction vibration	10 to 55 Hz, 20 m/s^2 for 10 min each in X, Y and Z directions	
Vibration resistance	10 to 55 Hz, peak height amplitude of 0.75 mm for 2 hr each in X, Y, and Z directions	
Malfunction shock	100 m/s^2, 3 times each in X, Y, and Z directions	

Shock resistance		300 m/s^2, 3 times each in X, Y, and Z directions		
Weight	E5CZ	Approx. 150 g	Adapter: approx. 10 g	Terminal cover: approx. 10 g
	E5CZ-U	Approx. 110 g		---
	E5AZ	Approx. 300 g	Adapter: approx. 100 g	Terminal cover: approx. 20 g
	E5EZ	Approx. 250 g		
Degree of protection	E5CZ	Front panel: IP66 (Indoor Use),rear case: IP20, terminals: IP00		
	E5AZ	Front panel: IP66 (Indoor Use), rear case: IP20, terminals: IP00		
	E5EZ			
	E5CZ-U	Front panel: equivalent to IP50, rear case: IP20, terminals: IP00 (See note 5.)		
Memory protection		EEPROM (non-volatile memory) (number of writes: 1,000,000)		

Note (1) The indication of K thermocouples in the −200 to 1,300°C range, T and N thermocouples at a temperature of −100°C or less, and U and L thermocouples at any temperature is ±2°C ±1 digit maximum. The indication of B thermocouples at a temperature of 400°C or less is not specified. The indication of R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.

(2) Ambient temperature: −10°C to 23°C to 55°C
Voltage range: −15 to +10% of rated voltage

(3) Set “none” as the unit for Controllers with Analog Inputs.

(4) B,R, and S sensors: 0.2°C/ Ω max.(100 Ω max.)

(5) There is no waterproof function for the E5CZ-U.

Current Transformer (CT)

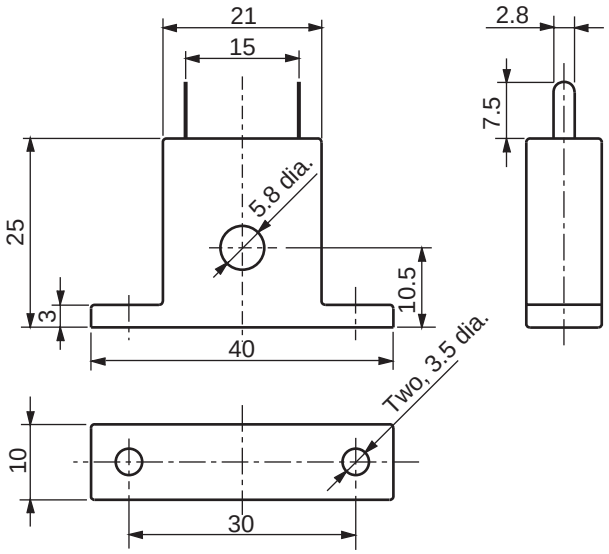
Specifications

Item	Specifications	
Model number	E54-CT1	E54-CT3
Max. continuous current	50 A	120 A (See note.)
Dielectric strength	1,000 VAC (for 1 min)	
Vibration resistance	50 Hz, 98 m/s^2	
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	None	Armature (2) Plug (2)

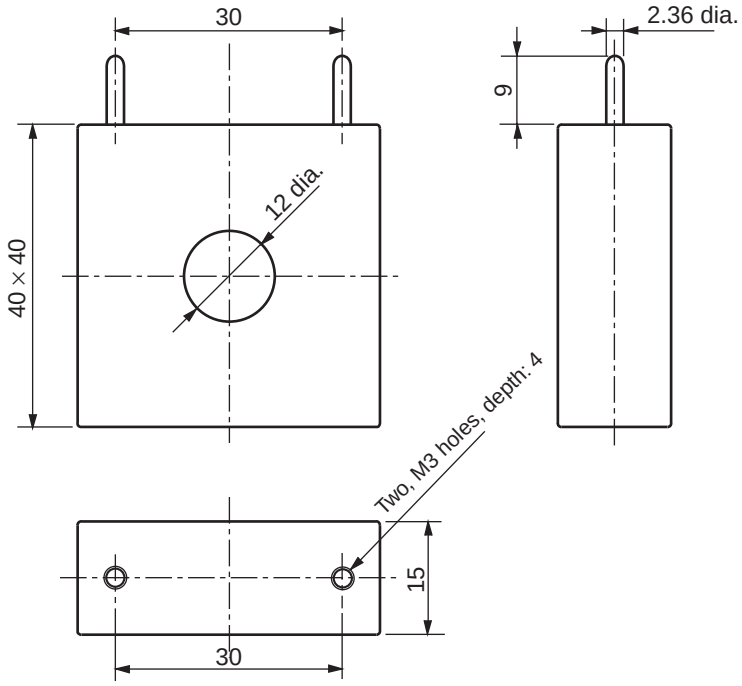
Note The maximum continuous current of the E5□Z is 50 A.

External Dimensions

E54-CT1



E54-CT3



E58-CIFQ1 USB-Serial Conversion Cable

Specifications

Item	Specifications
Applicable OS	Windows 2000/XP/vista
Applicable software	Thermo Mini
Applicable models	OMRON E5CZ/CZ-U Digital Temperature Controllers
USB interface rating	Conforms to USB Specification 1.1
DTE speed	38,400 bps
Connector specifications	Computer end: USB (type A plug) Temperature Controller end: setup tool port (on bottom of controller)
Power supply	Bus power (5 VDC supplied from USB host controller)
Current consumption	70 mA
Ambient operating temperature	0 to 55°C (with no condensation or icing)
Ambient operating humidity	10% to 80%
Storage temperature	−20 to 60°C (with no condensation or icing)
Storage humidity	10% to 80%
Altitude	2,000 m max.
Weight	Approx. 100 g

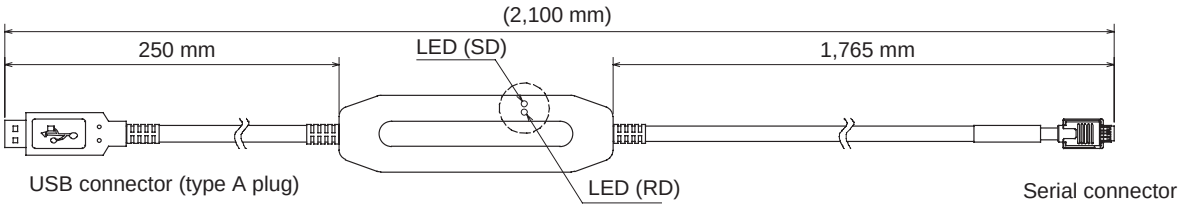
Compatible Operating Environment

A personal computer that includes the following specifications is required.

- USB port
- CD-ROM drive
- Windows 2000/XP/Vista

Appearance and Nomenclature

Appearance



LED Indicator Display

Indicator	Color	Status	Meaning
SD	Yellow	Lit	Sending data from USB-Serial Conversion Cable
		Not lit	Not sending data from USB-Serial Conversion Cable
RD	Yellow	Lit	Sending data from USB-Serial Conversion Cable
		Not lit	Not sending data from USB-Serial Conversion Cable

Error Displays

When an error occurs, the error contents are shown on the No. 1 display.

This section describes how to check error codes on the display, and the actions to be taken to remedy the problems.

Input Error

Meaning

The input value has exceeded the control range. (See note.)

Note Control Range

Resistance thermometer, thermocouple input:	Temperature setting lower limit − 20°C to temperature setting upper limit + 20°C (Temperature setting lower limit − 40°F to temperature setting upper limit + 40°F)
ES1B input:	Same as input indication range
Analog input	−5% to +105% of scaling range

Action

Check the wiring of inputs for miswiring, disconnections, and short-circuits and check the input type.

If no abnormality is found in the wiring and input type, turn the power OFF then back ON again.

If the display remains the same, the Controller must be replaced. If the display is restored, then the probable cause is electrical noise affecting the control system. Check for electrical noise.

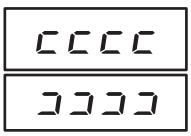
Operation at Error

After an error occurs, the error is displayed and the alarm outputs function as if the upper limit has been exceeded.

When the “input error output” parameter in the advanced function setting level is set to ON, the alarm 1 output turns ON whenever an input error occurs.

An error message is displayed when the PV, PV/SP, or PV/MV is displayed.

Note When the manual MV is set, the control output corresponds to the set value.



Display Range Exceeded

Meaning

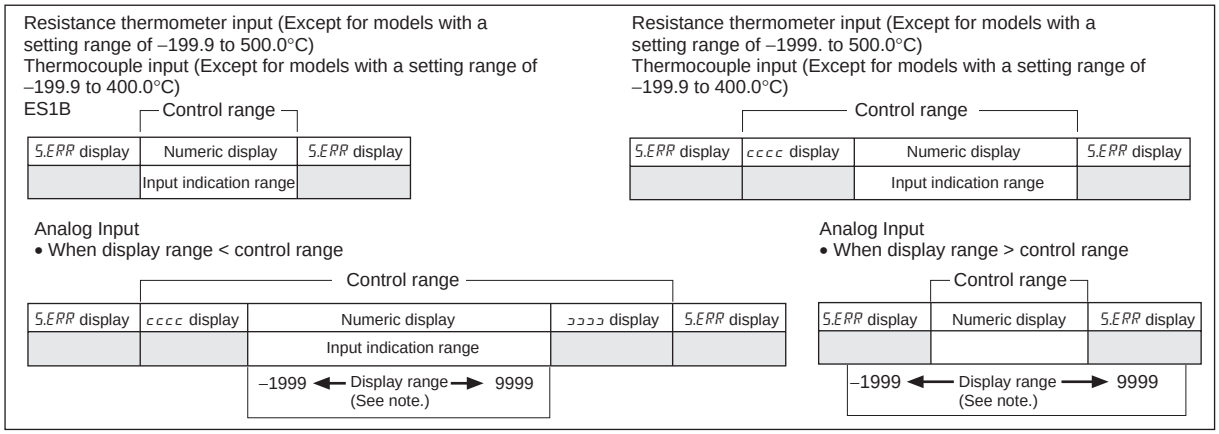
Though this is not an error, it is displayed if the process value exceeds the display range when the control range is larger than the display range.

The display ranges are shown below (with decimal points omitted).

- When less than −1999 [[[[
- When more than 9999]]]]

Action

Control continues, allowing normal operation. The message is displayed when the PV, PV/SP, or PV/MV is displayed.



Note: The display range is shown in numbers with decimal points omitted.

H.ERR HB Error (See note.)

Meaning

There is an error in internal circuits.

Action

First, turn the power OFF then back ON again. If the display remains the same, the Controller must be repaired. If the display is restored, then the probable cause is electrical noise affecting the control system. Check for electrical noise.

Operation at Error

The control outputs and alarm outputs turn OFF. An error message is displayed when the PV, PV/SP, or PV/MV is displayed.

When the manual MV is set, the control output corresponds to the set value.

For alarm outputs, the operation indicators and status normally turn OFF, but they will turn ON if the “Open in alarm” parameter for alarms 1, 2, or 3 in the advanced function setting level is set to n-c (Open in alarm).

Note Applies to the E5CZ-□2M□□ with E53-CZH03 or E53-CZHB, E5AZ-□3HM□□**,** E5EZ-□3HM□□.

E111 Memory Error

Meaning

Internal memory operation is in error.

Action

First, turn the power OFF then back ON again. If the display remains the same, the Controller must be repaired. If the display is restored, then the probable cause is electrical noise affecting the control system. Check for electrical noise.

Operation at Error

Control output and alarm output turn OFF. (Current output is approx. 0 mA).

Current Value Exceeds

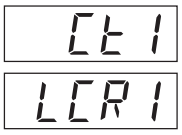
Meaning

This error is displayed when the heater current value exceeds 55.0 A.

Action

Control continues, allowing normal operation. An error message is displayed when the following items are displayed.

Heater current 1 value monitor
Leakage current 1 monitor



Heater Burnout
HS Alarm

Meaning

When heater burnout or an HS alarm occurs, the No. 1 display in the applicable setting level flashes.

Action

When either heater burnout or HS is detected, the HA indicator lights and the No. 1 display flashes for the applicable “heater current 1 value monitor,” or “leakage current 1 monitor” parameters in the operation level and adjustment level. Control continues, allowing normal operation.

Troubleshooting

Checking Problems

If the Temperature Controller is not operating normally, check the following points before requesting repairs. If the problem persists, contact your OMRON representative for details on returning the product.

Timing	Status	Meaning	Countermeasures	Page
Turning ON the power for the first time	Temperature unit (°C/°F) is flashing.	ST (self-tuning) is in progress (default setting: ON).	This is not a product fault. The temperature unit (°C/°F) flashes while ST (self-tuning) is being performed	44
	Temperature error is large. Input error (S.Err display)	Input type mismatch	Check the sensor type and reset the input type correctly.	34
		Thermometer is not installed properly.	Check the thermometer installation location and polarity and install correctly.	21
	Communications are not possible.	Non-recommended adapter is being used.	Make sure that the connected device is not faulty.	Section 1 of *Communications Manual*

Timing	Status	Meaning	Countermeasures	Page
During operation	Overshooting Undershooting Hunting	ON/OFF control is enabled (default: ON/OFF control selected).	Select PID control and execute either ST (self-tuning) or AT (auto-tuning). When using self-tuning, turn ON the power supply to the Temperature Controller and load (heater, etc.) at the same time, or turn ON the load power supply first. Accurate self-tuning and optimum control will not be possible if the power supply to the load is turned ON after turning ON the power supply to the Temperature Controller.	43
		Control cycle is longer compared with the speed of rise and fall in temperature	Shorten the control cycle. A shorter control cycle improves control performance, but a cycle of 20 ms minimum is recommended in consideration of the service life of the relays.	36
		Unsuitable PID constant	Set appropriate PID constants using either of the following methods. • Execute AT (autotuning). • Set PID constants individually using manual settings.	43
		HS alarm operation fault	Use breeder resistance if the problem is due to leakage current. Also investigate the errors detected by the HS alarm function.	50
	Temperature is not rising	Specified operation is unsuitable for required control (default: Reverse operation)	Select either direct or reverse operation depending on the required control. Reverse operation is used for heating operations.	36
		Heater is burnt out or deteriorated.	Check whether heater burnout or deterioration have occurred. Also investigate the errors detected by the heater burnout alarm.	50
		Insufficient heater capacity	Check whether the heater's heating capacity is sufficient.	---
		Cooling system in operation.	Check whether a cooling system is operating.	---
		Peripheral devices have heat prevention device operating.	Set the heating prevention temperature setting to a value higher than the set temperature of the Temperature Controller.	---
	Output will not turn ON	Set to STOP (default: RUN)	Set the RUN/STOP mode to RUN. If STOP is lit on the display, control is stopped.	101
		Specified operation is unsuitable for required control (default: Reverse operation)	Select either direct or reverse operation depending on the required control. Reverse operation is used for heating operations.	37
		A high hysteresis is set for ON/OFF operation (default: 1.0°C)	Set a suitable value for the hysteresis.	41
	Temperature Controller will not operate	Set to STOP (default: RUN)	Set the RUN/STOP mode to RUN. If STOP is lit on the display, control is stopped.	101

Timing	Status	Meaning	Countermeasures	Page
During operation (continued)	Temperature error is large Input error (S.err display)	Thermometer has burnt out or short-circuited.	Check whether the thermometer has burnt out or short-circuited	---
		Thermometer lead wires and power lines are in the same conduit, causing noise from the power lines (generally, display values will be unstable).	Wire the lead wires and power lines in separate conduits, or wiring using a more direct path.	---
		Connection between the Temperature Controller and thermocouple is using copper wires.	Connect the thermocouple's lead wires directly, or connect a compensating conductor suitable for the thermocouple.	---
		Installation location of thermometer is unsuitable.	Check whether the location of the thermometer is suitable.	---
		Input shift is not set correctly (default: 0°C)	Set a suitable input shift. If input shift is not required, set the input shift value to 0.0.	59
	Keys will not operate	Setting change protect is ON.	Turn OFF setting change protect.	78
	Cannot shift levels	Operations limited due to protection.	Set the operation/adjustment protect, initial setting/communications protect, and setting change protect values as required.	78
After long service life	Control is unstable	Terminal screws may be loose.	Retighten terminal screws to a torque of 0.74 to 0.90 N·m. (See Note.)	22
		The internal components have reached the end of their service life.	The Temperature Controller's internal electrolytic capacitor depends on the ambient temperature, and load rate. The structural life depends on the ambient environment (shock, vibration). The life expectancy of the output relays varies greatly with the switching capacity and other switching conditions. Always use the output relays within their rated load and electrical life expectancy. If an output relay is used beyond its life expectancy, its contacts may become welded or burned. Replace the Temperature Controller and all other Temperature Controllers purchased in the same time period.	---

Note The tightening torque for E5CZ-U is 0.5 N·m.

Symptom: Cannot Communicate or a Communications Error Occurs

Meaning	Countermeasures
The communications wiring is not correct.	Correct the wiring.
The communications line has become disconnected	Correct the communications line securely and tighten the screws.
The communications cable is broken.	Replace the cable.
The communications cable is too long.	The total cable length is 500 m maximum for RS-485 and 15 m maximum for RS-232C communications.To extend the communications distance for RS-232C communications, use OMRON's Z3R Optical Interface.
The wrong communications cable has been used.	Use a shielded, twisted-pair AWG24 to AWG14(cross-sectional area of 0.205 to 2.081 mm^2)cable for the communications cable.
More than the specified number of communications devices are connected to the same communications path for RS-485 communications.	When 1:N RS-485 communications are used, a maximum of 32 nodes(including the host node) can be connected.
An end node has not been set at each end of the communications line for RS-485 communications.	Set or connect terminating resistance at each end of the line. If the E5CZ, E5AZ,or E5EZ is the end node, use 120- Ω (1/2-W) terminating resistance. The combined terminating resistance with the host device must be at least 54 Ω
The specified power supply voltage is not being supplied to the Controller.	Supply the specified power supply voltage.
The specified power supply voltage is not being supplied to an Interface Converter (such as the K3SC) .	Supply the specified power supply voltage.
The same baud rate and communications method are not being used by all of the Controllers, host devices, and other devices on the same communications line.	Set the same values for the baud rate, protocol, data length, stop bits, and parity on all nodes.
The unit number specified in the command frame is different from the unit number set by the Controller.	Use the same unit number.
The same unit number as the Controller is being used for another node on the same communications line for RS-485 communications.	Set each unit number for only one node.
There is a mistake in programming the host device.	Use a line monitor to check the commands. Check operation using a sample program.
The host device is detecting the absence of a response as an error before it receives the response from the Controller.	Shorten the send data wait time in the Controller or increase the response wait time in the host device.
The host device is detecting the absence of a response as an error after broadcasting a command(except for SYSWAY).	The Controller does not return responses for broadcast commands.
The host device sent another command before receiving a response from the Controller.	The response must always be read after sending a command (except for broadcast commands).
The host device sent the next command too soon after receiving a response from the Controller.	After receiving a response, wait at least 2 ms before sending the next command.

Meaning	Countermeasures
The communications line became unstable when Controller power was turned ON or interrupted, and the host device read the unstable status as data.	Initialize the reception buffer in the host device before sending the first command and after turning OFF the power to the Controller.
The communications data was corrupted from noise from the environment.	Try using a slower baud rate. Separate the communications cable from the source of noise. Use a shielded, twisted-pair cable for the communications cable. Use as short a communications cable as possible, and do not lay or loop extra cable. To prevent inductive noise, do not run the communications cable parallel to a power line. If noise countermeasures are difficult to implement, use an Optical Interface.

Note For details on errors, refer to *E5CZ/E5AZ/E5EZ Digital Temperature Controllers Communications Manual*(Cat. No. H208).

Parameter Operation Lists

Universal-input:Controllers with Thermocouple/Resistance Thermometer Universal-inputs
Analog input:Controllers with Analog Inputs

Operation Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Process Value		Sensor input indication range			EU	
Set Point		SP lower limit to SP upper limit		0	EU	
Auto/Manual Switch	a-m					
Multi-SP Set Point Setting	m-sp	0 to 3		0	None	
Set Point During SP Ramp	sp-m	SP lower limit to SP upper limit			EU	
Heater Current 1 Value Monitor	ct1	0.0 to 55.0			A	
Leakage Current 1 Monitor	lcr1	0.0 to 55.0			A	
RUN/STOP	r-s	RUN/STOP	run, stop	Run	None	
Alarm Value 1	al-1	–1999 to 9999		0	EU	
Alarm Value Upper-Limit 1	al1h	–1999 to 9999		0	EU	
Alarm Value Lower-Limit 1	al1l	–1999 to 9999		0	EU	
Alarm Value 2	al-2	–1999 to 9999		0	EU	
Alarm Value Upper-Limit 2	al2h	–1999 to 9999		0	EU	
Alarm Value Lower-Limit 2	al2l	–1999 to 9999		0	EU	
Alarm Value 3	al-3	–1999 to 9999		0	EU	
Alarm Value Upper-Limit 3	al3h	–1999 to 9999		0	EU	
Alarm Value Lower-Limit 3	al3l	–1999 to 9999		0	EU	
MV Monitor (Heating)	o	–5.0 to 105.0 (standard) 0.0 to 105.0 (heating/cooling)			%	
MV Monitor (Cooling)	c-o	0.0 to 105.0			%	

Adjustment Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
AT Execute/Cancel	at	OFF, ON	off, on	OFF	None	
Communications Writing	cmwt	OFF, ON	off, on	OFF	None	
Heater Current 1 Value Monitor	ct1	0.0 to 55.0			A	
Leakage Current 1 Monitor	lcr1	0.0 to 55.0			A	
Heater Burnout Detection 1	hb1	0.0 to 50.0		0.0	A	
HS Alarm 1	hs1	0.0 to 50.0		50.0	A	
SP 0	sp-0	SP lower limit to SP upper limit		0	EU	
SP 1	sp-1	SP lower limit to SP upper limit		0	EU	
SP 2	sp-2	SP lower limit to SP upper limit		0	EU	
SP 3	sp-3	SP lower limit to SP upper limit		0	EU	
Temperature Input Shift	ins	−199.9 to 999.9		0.0	°C or °F	
Upper-Limit Temperature Input Shift Value	insh	−199.9 to 999.9		0.0	°C or °F	
Lower-Limit Temperature Input Shift Value	insl	−199.9 to 999.9		0.0	°C or °F	
Proportional Band	p	Universal-input: 0.1 to 999.9		8.0	°C or °F (See note.)	
		Analog input: 0.1 to 999.9		10.0	%FS	
Integral Time	i	0 to 3,999		233	Second	
Derivative Time	d	0 to 3,999		40	Second	
Cooling Coefficient	c-sc	0.01 to 99.99		1.00	None	
Dead Band	c-db	Universal-input: −199.9 to 999.9		0.0	°C or °F (See note.)	
		Analog input: −19.99 to 99.99		0.00	%FS	
Manual Reset Value	of-r	0.0 to 100.0		50.0	%	
Hysteresis (Heating)	hys	Universal-input: 0.1 to 999.9		1.0	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		0.10	%FS	
Hysteresis (Cooling)	chys	Universal-input: 0.1 to 999.9		1.0	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		0.10	%FS	
SP Ramp Set Value	sprt	OFF or 1 to 9,999	off, 1 to 9999	OFF	EU/s, EU/min	
MV Upper Limit	ol-h	MV lower limit +0.1 /105.0 (standard) 0.0 to 105.0 (heating/cooling)		105.0	%	
MV Lower Limit	ol-l	−5.0 to MV upper limit −0.1 (standard) −105.0 to 0.0 (heating/cooling)		−5.0 (standard) −105.0 (heating/cooling)	%	

Note Set “none” as the unit for Controllers with Analog Inputs.

Initial Setting Level

Parameters	Characters	Setting (monitor) value		Display	Default	Unit	Set value
Input Type	in-t	Univer-sal-input	0: Pt100 1: Pt100 2: Pt100 3: JPt100 4: JPt100		5	None	
			5: K 6: K 7: J 8: J 9: T 10: T 11: E 12: L 13: U 14: U 15: N 16: R 17: S 18: B 19: 10 to 70°C 20: 60 to 120°C 21: 115 to 165°C 22: 140 to 260°C 23: 0 to 50 mV				
		Analog input	0: 4 to 20 mA 1: 0 to 20 mA 2: 1 to 5 V 3: 0 to 5 V 4: 0 to 10 V		0	None	
Scaling Upper Limit	in-h	Scaling lower limit + 1 to 9,999			100	None	
Scaling Lower Limit	in-l	−1,999 to scaling upper limit −1			0	None	
Decimal Point	dp	Universal-input: 0 to 1			0	None	
		Analog input: 0 to 3			0	None	
Temperature Unit	d-u	°C, °F		c, f	°C	None	
SP Upper Limit	sl-h	SP lower limit + 1 to input range upper limit (temperature)			1300	EU	
		SP lower limit + 1 to scaling upper limit (analog)			100		
SP Lower Limit	sl-l	Input range lower limit to SP upper limit − 1 (temperature)			−200	EU	
		Scaling lower limit to SP upper limit − 1 (analog)			0		
PID ON/OFF	intl	ON/OFF 2-PID		onof, pid	ON/OFF	None	
Standard or Heating/ Cooling	s-hc	Standard or heating/cooling		stnd, h-c	Standard	None	
ST	st	OFF, ON		off, on	ON	None	
Control Period (Heating)	cp	0.5 or 1 to 99		0.5, 1 to 99	20	Second	
Control Period (Cooling)	c-cp	0.5 or 1 to 99		0.5, 1 to 99	20	Second	
Direct/Reverse Operation	orev	Reverse operation, direct operation		or-r, or-d	Reverse operation	None	

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Alarm 1 Type	a l t 1	0: Alarm function OFF 1: Upper and lower-limit alarm 2: Upper-limit alarm 3: Lower-limit alarm 4: Upper and lower-limit range alarm 5: Upper and lower-limit alarm with standby sequence 6: Upper-limit alarm with standby sequence 7: Lower-limit alarm with standby sequence 8: Absolute-value upper-limit alarm 9: Absolute-value lower-limit alarm 10: Absolute-value upper-limit alarm with standby sequence 11: Absolute-value lower-limit alarm with standby sequence 12: LBA (Loop Break Alarm)		2	None	
Alarm 2 Type	a l t 2	0: Alarm function OFF 1: Upper and lower-limit alarm 2: Upper-limit alarm 3: Lower-limit alarm 4: Upper and lower-limit range alarm 5: Upper and lower-limit alarm with standby sequence 6: Upper-limit alarm with standby sequence 7: Lower-limit alarm with standby sequence 8: Absolute-value upper-limit alarm 9: Absolute-value lower-limit alarm 10: Absolute-value upper-limit alarm with standby sequence 11: Absolute-value lower-limit alarm with standby sequence		2	None	
Alarm 3 Type	a l t 3	Same settings as the alarm 2 type		2	None	
Transfer Output Type	t r - t	OFF: OFF SP: Set point SP-M: Set point during SP ramp PV: Process value MV: Manipulated variable (heating) C-MV: Manipulated variable (cooling)	o f f s p s p - m p v m v c - m v	OFF	None	
Transfer Output Upper Limit	t r - h	See note.		See note.	See note.	
Transfer Output Lower Limit	t r - l	See note.		See note.	See note.	

Note

Transfer output type	Setting (monitor) range	Default (transfer output upper/lower limits) (See note 1)	Unit
Set point	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
Set point during SP ramp	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
PV	Temperature: Sensor setting range lower limit to sensor setting range upper limit	Sensor setting range upper/ lower limit	EU
	Analog: Scaling lower limit to scaling upper limit	Scaling upper/lower limit	EU
MV monitor (heating)	Standard: −5.0 to 105.0 Heating/cooling: 0.0 to 105.0	100.0/0.0	%
MV monitor (cooling)	0.0 to 105.0	100.0/0.0	%

(1) Initialized when the transfer output type is changed.
Initialized if the input type, temperature unit, scaling upper/lower limit, or SP upper/ lower limit is changed when the transfer output type is SP, ramp SP, or PV.
(When initialized by the initializing settings, it is initialized to 100.0/0.0.)

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Linear Current Output	o1-t	4-20: 4 to 20 mA 0-20: 0 to 20 mA	4-20, 0-20	4-20	None	
Move to Advanced Function Setting Level	amov	−1999 to 9,999		0	None	

Manual Control Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Manual MV		−5.0 to 105.0 (standard) −105.0 to 105.0 (heating/cooling)		0.0	%	

Advanced Function Setting Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Parameter Initialization	init	OFF, FACT	off, fact	OFF	None	
Number of Multi-SP Uses	ev-m	0 to 2		1	None	
Event Input Assignment 1	ev-1	NONE: None STOP: RUN/STOP MANU: Auto/manual switch	none, stop, manu	NONE	None	
Event Input Assignment 2	ev-2	NONE: None STOP: RUN/STOP MANU: Auto/manual switch	none, stop, manu	STOP	None	
Multi-SP Uses	mspu	OFF, ON	off, on	OFF	None	
SP Ramp Time Unit	spru	S: EU/second M: EU/minute	s, m	M	None	
Standby Sequence Reset	rest	Condition A, Condition B	a, b	Condition A	None	
Alarm 1 Open In Alarm	al1n	N-O: Close in alarm N-C: Open in alarm	n-o, n-c	N-O	None	
Alarm 1 Hysteresis	alh1	Universal-input: 0.1 to 999.9		0.2	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		0.02	%FS	
Alarm 2 Open In Alarm	al2n	N-O: Close in alarm N-C: Open in alarm	n-o, n-c	N-O	None	
Alarm 2 Hysteresis	alh2	Universal-input: 0.1 to 999.9		0.2	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		0.02	%FS	
Alarm 3 Open In Alarm	al3n	N-O: Close in alarm N-C: Open in alarm	n-o, n-c	N-O	None	
Alarm 3 Hysteresis	alh3	Universal-input: 0.1 to 999.9		0.2	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		0.02	%FS	
HB ON/OFF	hbu	OFF, ON	off, on	ON	None	
Heater Burnout Latch	hbl	OFF, ON	off, on	OFF	None	
Heater Burnout Hysteresis	hbh	0.1 to 50.0		0.1	A	
ST Stable Range	st-b	0.1 to 999.9		15.0	°C or °F	
α	alfa	0.00 to 1.00		0.65	None	
Input Digital Filter	inf	0.0 to 999.9		0.0	Second	
Additional PV Display	pvad	OFF, ON	off, on	OFF	None	
MV Display	o-dp	OFF, ON	off, on	OFF	None	

Note Set “none” as the unit for Controllers with Analog Inputs.

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Automatic Display return Time	ret	OFF or 1 to 99	off, 1 to 99	OFF	Second	
Alarm 1 Latch	a1lt	OFF, ON	off, on	OFF	None	
Alarm 2 Latch	a2lt	OFF, ON	off, on	OFF	None	
Alarm 3 Latch	a3lt	OFF, ON	off, on	OFF	None	
Move to Protect Level Time	prlt	1 to 30		3	Second	
Input Error Output	sero	OFF, ON	off, on	OFF	None	
Cold Junction Compensation Method	cjc	OFF, ON	off, on	ON	None	
MB Command Logic Switching	rlrv	OFF, ON	off, on	OFF	None	
Alarm 1 ON Delay	a1on	0 to 999 (0: ON delay disabled)		0	Second	
Alarm 2 ON Delay	a2on	0 to 999 (0: ON delay disabled)		0	Second	
Alarm 3 ON Delay	a3on	0 to 999 (0: ON delay disabled)		0	Second	
Alarm 1 OFF Delay	a1of	0 to 999 (0: OFF delay disabled)		0	Second	
Alarm 2 OFF Delay	a2of	0 to 999 (0: OFF delay disabled)		0	Second	
Alarm 3 OFF Delay	a3of	0 to 999 (0: OFF delay disabled)		0	Second	
Input Shift Type	istp	INS1: Temperature input 1-point shift INS2: Temperature input 2-point shift	ins1, ins2	INS1	None	
Auto/Manual Select Addition	amad	OFF, ON	off, on	OFF	None	
HS Alarm Use	hsu	OFF, ON	off, on	ON	None	
HS Alarm Latch	hsl	OFF, ON	off, on	OFF	None	
HS Alarm Hysteresis	hsh	0.1 to 50.0		0.1	A	
LBA Detection Time	lba	0 to 9999 (0: LBA function disabled)		0	Second	
LBA Level	lbal	Universal-input: 0.1 to 999.9		8.0	°C or °F (See note.)	
		Analog input: 0.01 to 99.99		10.00	%FS	
LBA Band	lbab	Universal-input: 0.0 to 999.9		3.0	°C or °F (See note.)	
		Analog input: 0.00 to 99.99		0.20	%FS	

Note Set “none” as the unit for Controllers with Analog Inputs.

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Control Output 1 Assignment	out1	When control output 1 is a pulse output (See note.): NONE: No assignment O: Control output (heating) C-O: Control output (cooling) ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3	 none o c-o alm1 alm2 alm3	O	None	
		When control output 1 is a linear output (See note.): NONE: No assignment O: Control output (heating) C-O: Control output (cooling)	 none o c-o			
Alarm Output 1 Assignment	alm1	NONE: No assignment O: Control output (heating) C-O: Control output (cooling) ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3	none o c-o alm1 alm2 alm3	ALM1	None	
Alarm Output 2 Assignment	alm2	NONE: No assignment O: Control output (heating) C-O: Control output (cooling) ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3	none o c-o alm1 alm2 alm3	ALM2	None	
Alarm Output 3 Assignment (E5AZ / E5EZ Only)	alm3	NONE: No assignment O: Control output (heating) C-O: Control output (cooling) ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3	none o c-o alm1 alm2 alm3	ALM3	None	
Character Select	csel	OFF, ON	off, on	ON	None	

Note The setting range depends on whether control output 1 is a linear output or pulse output.

Protect Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Operation/Adjustment Protect	oapt	0 to 3		0	None	
Initial Setting/Communications Protect	icpt	0 to 2		1	None	
Setting Change Protect	wtpt	OFF, ON	off, on	OFF	None	

Communications Setting Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Protocol Setting	psel	CompoWay/F (SYSWAY), Modbus (See note.)	cwf, mod	CompoWay/F (SYSWAY)	None	
Communications Unit No.	u-no	0 to 99		1	None	

Note When setting CWF, either CompoWay/F or SYSWAY can be used as the communications protocol. (CompoWay/F and SYSWAY are automatically identified by the command frames.)

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	Set value
Communications Baud Rate	bps	1.2, 2.4, 4.8, 9.6, 19.2, or 38.4	1.2, 2.4, 4.8, 9.6, 19.2, 38.4	9.6	kbps	
Communications Data Length	len	7, 8		7	Bit	
Communications Stop Bits	sbit	1, 2		2	Bit	
Communications Parity	prty	None, Even, Odd	none, even, odd	Even	None	
Send Data Wait Time	sdwt	0 to 99		20	ms	

Sensor Input Setting Range, Indication Range, Control Range

	Input type	Specifications	Set value	Input temperature range	Input indication range
Controllers with Thermocouple/ Resistance Thermometer Universal-inputs	Resistance thermometer	Pt100	0	−200 to 850 (°C)/−300 to 1,500 (°F)	−220 to 870 (°C)/−340 to 1,540 (°F)
			1	−199.9 to 500.0 (°C)/−199.9 to 900.0 (°F)	−199.9 to 520.0 (°C)/−199.9 to 940.0 (°F)
			2	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)	−20.0 to 120.0 (°C)/−40.0 to 250.0 (°F)
		JPt100	3	−199.9 to 500.0 (°C)/−199.9 to 900.0 (°F)	−199.9 to 520.0 (°C)/−199.9 to 940.0 (°F)
			4	0.0 to 100.0 (°C)/0.0 to 210.0 (°F)	−20.0 to 120.0 (°C)/−40.0 to 250.0 (°F)
	Thermocouple	K	5	−200 to 1,300 (°C)/−300 to 2,300 (°F)	−220 to 1,320 (°C)/−340 to 2,340 (°F)
			6	−20.0 to 500.0 (°C)/0.0 to 900.0 (°F)	−40.0 to 520.0 (°C)/−40.0 to 940.0 (°F)
		J	7	−100 to 850 (°C)/−100 to 1,500 (°F)	−120 to 870 (°C)/−140 to 1,540 (°F)
			8	−20.0 to 400.0 (°C)/0.0 to 750.0 (°F)	−40.0 to 420.0 (°C)/−40.0 to 790.0 (°F)
		T	9	−200 to 400 (°C)/−300 to 700 (°F)	−220 to 420 (°C)/−340 to 740 (°F)
			10	−199.9 to 400.0 (°C)/−199.9 to 700.0 (°F)	−199.9 to 420.0 (°C)/−199.9 to 740.0 (°F)
		E	11	0 to 600 (°C)/0 to 1,100 (°F)	−20 to 620 (°C)/−40 to 1,140 (°F)
		L	12	−100 to 850 (°C)/−100 to 1,500 (°F)	−120 to 870 (°C)/−140 to 1,540 (°F)
		U	13	−200 to 400 (°C)/−300 to 700 (°F)	−220 to 420 (°C)/−340 to 740 (°F)
			14	−199.9 to 400.0 (°C)/−199.9 to 700.0 (°F)	−199.9 to 420.0 (°C)/−199.9 to 740.0 (°F)
		N	15	−200 to 1,300 (°C)/−300 to 2,300 (°F)	−220 to 1,320 (°C)/−340 to 2,340 (°F)
		R	16	0 to 1,700 (°C)/0 to 3,000 (°F)	−20 to 1,720 (°C)/−40 to 3,040 (°F)
		S	17	0 to 1,700 (°C)/0 to 3,000 (°F)	−20 to 1,720 (°C)/−40 to 3,040 (°F)
		B	18	100 to 1,800 (°C)/300 to 3,200 (°F)	0 to 1,820 (°C)/0 to 3,240 (°F)
	ES1B Infrared Temperature Sensor	10 to 70°C	19	0 to 90 (°C)/0 to 190 (°F)	−20 to 130 (°C)/−40 to 270 (°F)
		60 to 120°C	20	0 to 120 (°C)/0 to 240 (°F)	−20 to 160 (°C)/−40 to 320 (°F)
		115 to 165°C	21	0 to 165 (°C)/0 to 320 (°F)	−20 to 205 (°C)/−40 to 400 (°F)
		140 to 260°C	22	0 to 260 (°C)/0 to 500 (°F)	−20 to 300 (°C)/−40 to 580 (°F)
	Analog input	0 to 50 mV	23	Any of the following ranges, by scaling: −1,999 to 9,999 −199.9 to 999.9	−5% to 105% of setting range. The display shows -1999 to 9999 (numeric range with decimal point omitted).

	Input type	Specifications	Set value	Input temperature range	Input indication range
Controllers with Analog Inputs	Current input	4 to 20 mA	0	Any of the following ranges, by scaling: −1999 to 9999 −199.9 to 999.9 −19.99 to 99.99 −1.999 to 9.999	−5% to 105% of setting range. The display shows −1999 to 9999 (numeric range with decimal point omitted).
		0 to 20 mA	1		
	Voltage input	1 to 5 V	2		
		0 to 5 V	3		
		0 to 10 V	4		

- The default is 5 (°C/°F) for Controllers with Thermocouple/Resistance Thermometer Universal-inputs and 0 for Controllers with Analog Inputs.
- The applicable standards for each of the above input ranges are as follows:
  K, J, T, E, N, R, S, B: JIS C1602-1995, IEC 584-1
  L: Fe-CuNi, DIN 43710-1985
  U: Cu-CuNi, DIN 43710-1985
  JPt100: JIS C 1604-1989, JIS C 1606-1989
  Pt100: IEC 751

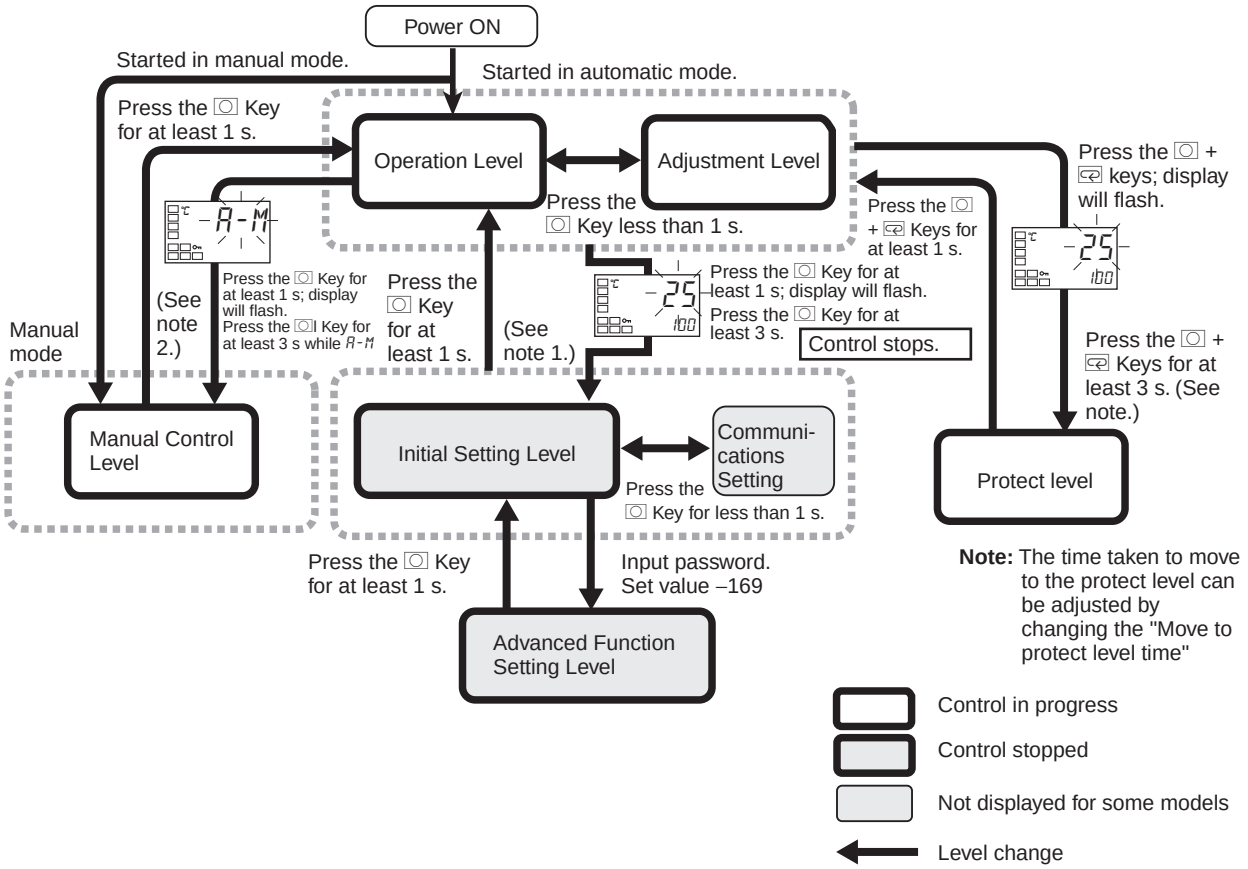
Control Range

- Resistance thermometer and thermocouple input
  Temperature lower limit − 20°C to temperature upper limit + 20°C, or temperature lower limit − 40°C to temperature upper limit + 40°C
- ES1B input:
  Same as input indication range
- Analog input
  −5% to +105% of scaling range

Setting Levels Diagram

This diagram shows all of the setting levels. To move to the advanced function setting level , you must enter passwords. Some parameters are not displayed depending on the protect level setting and the conditions of use.

Control stops when you move from the operation level to the initial setting level.

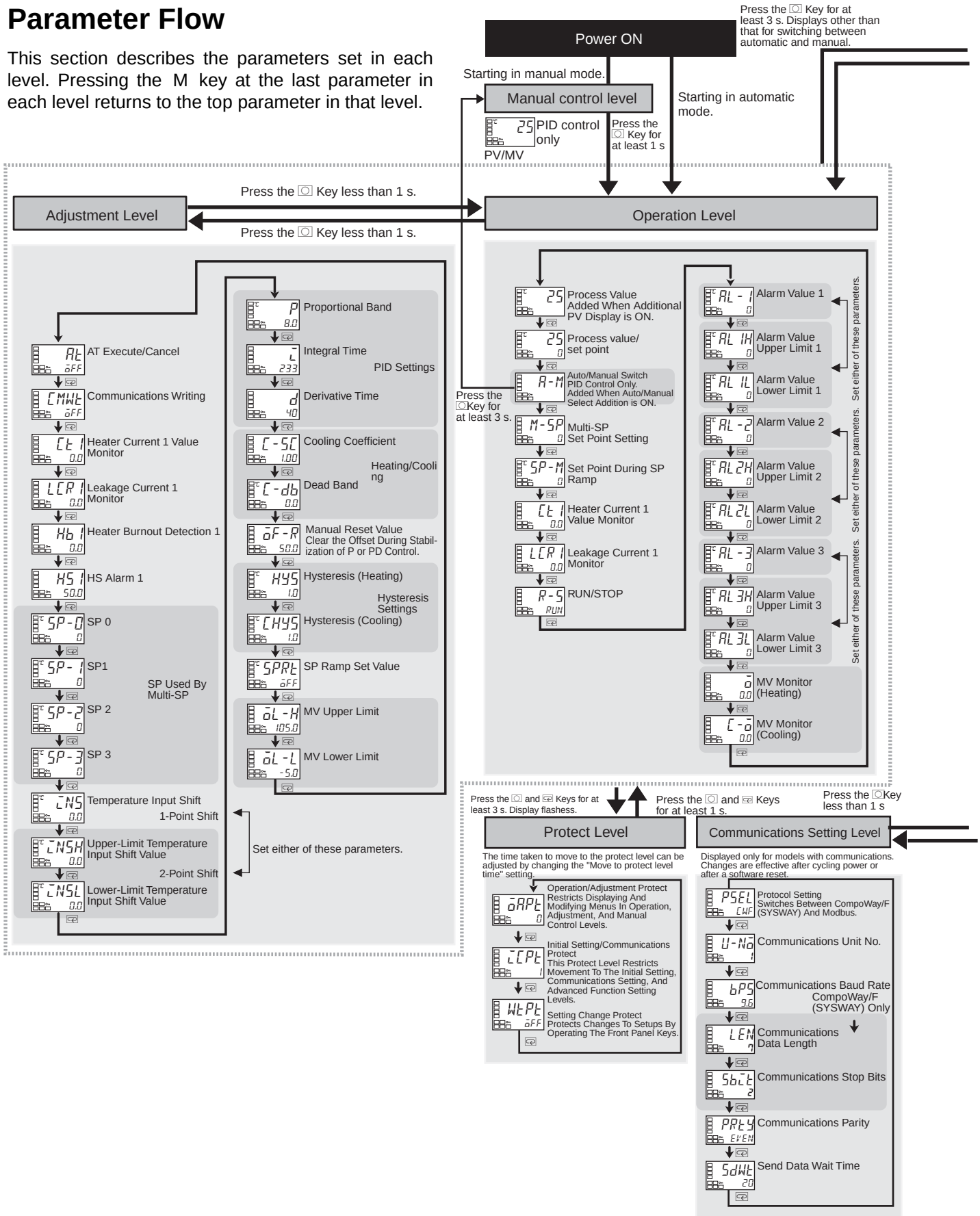


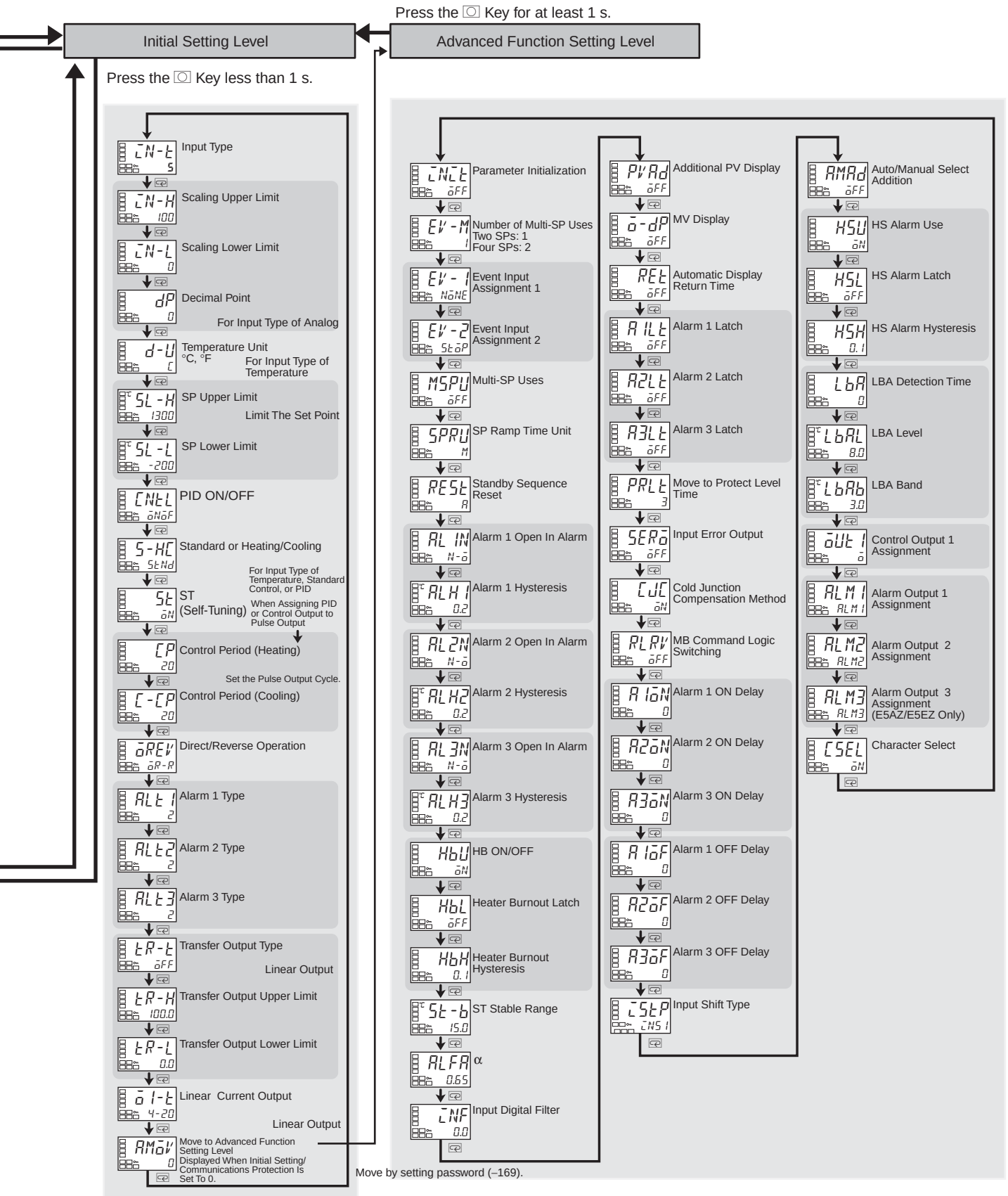
Note (1) Moves to operation level by software reset.

(2) From the manual control level, key operations can be used to move to the operation level only.

Parameter Flow

This section describes the parameters set in each level. Pressing the M key at the last parameter in each level returns to the top parameter in that level.




Press the ○ Key for at least 1 s.
Initial Setting Level
Advanced Function Setting Level
Press the ○ Key less than 1 s.
Input Type
Scaling Upper Limit
Scaling Lower Limit
Decimal Point
For Input Type of Analog
Temperature Unit °C, °F
For Input Type of Temperature
SP Upper Limit
Limit The Set Point
SP Lower Limit
PID ON/OFF
Standard or Heating/Cooling
For Input Type of Temperature, Standard Control, or PID
ST (Self-Tuning)
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Transfer Output Type
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Linear Current Output
Linear Output
Move to Advanced Function Setting Level
Displayed When Initial Setting/ Communications Protection Is Set To 0.
Parameter Initialization
Number of Multi-SP Uses
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Alarm 1 Open In Alarm
Alarm 1 Hysteresis
Alarm 2 Open In Alarm
Alarm 2 Hysteresis
Alarm 3 Open In Alarm
Alarm 3 Hysteresis
HB ON/OFF
Heater Burnout Latch
Heater Burnout Hysteresis
ST Stable Range
α
Input Digital Filter
Additional PV Display
MV Display
Automatic Display Return Time
Alarm 1 Latch
Alarm 2 Latch
Alarm 3 Latch
Move to Protect Level Time
Input Error Output
Cold Junction Compensation Method
MB Command Logic Switching
Alarm 1 ON Delay
Alarm 2 ON Delay
Alarm 3 ON Delay
Alarm 1 OFF Delay
Alarm 2 OFF Delay
Alarm 3 OFF Delay
Input Shift Type
Auto/Manual Select Addition
HS Alarm Use
HS Alarm Latch
HS Alarm Hysteresis
LBA Detection Time
LBA Level
LBA Band
Control Output 1 Assignment
Alarm Output 1 Assignment
Alarm Output 2 Assignment
Alarm Output 3 Assignment (E5AZ/E5EZ Only)
Character Select
Move by setting password (–169).

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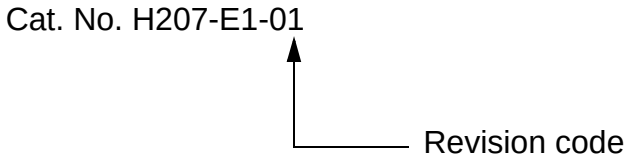
Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	September 2008	Original production