OMRON



# Digital Temperature Controllers (Simple Type)

## User's Manual

## E5CC-800
## E5EC-800


H211-E1-02

# Preface

The E5CC and E5EC are Digital Controllers. The main functions and characteristics of these Digital 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.
- 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, switch between automatic and manual operation, and perform other operations.
- Heater burnout detection and heater short (HS) alarms functions are supported. (Applicable models with heater burnout detection function.)
- Communications are supported. (Applicable to models with communications.)
- The structure is waterproof (IP66).
- Conforms to UL, CSA, and IEC safety standards and EMC Directive.

Read this manual thoroughly and be sure you understand it before attempting to use the Digital Controller and use the Digital Controller correctly according to the information provided. Keep this manual in a safe place for easy reference.
There are two types of E5CC/E5EC Digital Controllers: The E5CC/E5EC-□-0□□ Standard-type Digital Controllers and the Simple-type E5CC/E5EC-□-8□□ Digital Controllers. This manual describes how to use the E5CC/E5EC-□-8□□ Simple-type Digital Controllers. For detailed specifications of functions, refer to the *E5CC/E5EC Digital Temperature Controllers User's Manual* (Cat. No. H174). In this manual, "E5CC/E5EC" or "E5CC-800/E5EC-800" is used to indicated the E5CC/E5EC-□-8□□ Simple-type Digital Controllers. Refer to the following manual for further information on communications: *E5CC/E5EC Digital Temperature Controllers Communications Manual* (Cat. No. H175).

# Read and Understand this Manual

Please read and understand this manual before using the products. 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 manual 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, may result in minor or moderate injury or in property damage. |

## Symbols

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

## ● Safety Precautions

**⚠ CAUTION**

Minor injury due to electric shock may occasionally occur.
Do not touch the terminals while power is being supplied.

Electric shock, fire, or malfunction may occasionally occur.
Do not allow metal objects, conductors, cuttings from installation work, or moisture to enter the Digital Controller.

Minor injury from explosion may occasionally occur.
Do not use the product where subject to flammable or explosive gas.

Minor electric shock, fire, or malfunction may occasionally occur.
Never disassemble, modify, or repair the product or touch any of the internal parts.

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.

(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 2 circuits.*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

Loose screws may occasionally result in fire.
Tighten the terminal screws to the specified torque of 0.43 to 0.58 N·m.

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 Digital 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 Digital Controller, take appropriate safety measures, such as installing a monitoring device on a separate line.

# 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. Use the product within the specifications.

- The product is designed for indoor use only. Do not use or store the product outdoors or in any of the following locations.
  Locations directly subject to heat radiated from heating equipment.
  Locations subject to splashing liquid or oil atmosphere.
  Locations subject to direct sunlight.
  Locations subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).
  Locations subject to intense temperature change.
  Locations subject to icing and condensation.
  Locations subject to vibration and large shocks.
- Use and store the Digital Controller within the rated ambient temperature and humidity.
  Gang-mounting two or more Digital Controllers, or mounting Digital Controllers above each other may cause heat to build up inside the Digital 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 Controllers.
- To allow heat to escape, do not block the area around the product. Do not block the ventilation holes on the product.
- Be sure to wire properly with correct polarity of terminals.
- Use the specified size of crimped terminals (M3, width of 5.8 mm or less) for wiring. To connect bare wires to the terminal block, use copper braided or solid wires with a gage of AWG24 to AWG18 (equal to a cross-sectional area of 0.205 to 0.8231 $mm^2$). (The stripping length is 6 to 8 mm.) Up to two wires of the same size and type, or two crimped terminals can be inserted into a single terminal.
- Do not wire the terminals that are not used.
- To avoid inductive noise, keep the wiring for the Digital Controller's terminal block away from power cables that carry high voltages or large currents. Also, do not wire power lines together with or parallel to Digital 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 Digital Controller.
  Allow as much space as possible between the Digital Controller and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.
- Use this product within the rated load and power supply.
- Make sure that the rated voltage is attained within 2 seconds of turning ON the power using a switch or relay contact. If the voltage is applied gradually, the power may not be reset or output malfunctions may occur.
- Make sure that the Digital 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.
- 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 Controller. If power is turned ON for the Digital Controller before turning ON power for the load, self-tuning will not be performed properly and optimum control will not be achieved.

- A switch or circuit breaker should be provided close to Digital Controller. The switch or circuit breaker should be within easy reach of the operator, and must be marked as a disconnecting means for Digital Controller.
- Wipe off any dirt from the Digital Controller with a soft dry cloth. Never use thinners, benzine, alcohol, or any cleaners that contain these or other organic solvents. Deformation or discoloration may occur.
- Design the system (e.g., control panel) considering the 2 seconds of delay in setting the Digital Controller's output after the power supply is turned ON.
- The output will turn OFF when you move to the Initial Setting Level. Take this into consideration when performing control.
- The number of non-volatile memory write operations is limited. Therefore, use RAM write mode when frequently overwriting data during communications or other operations.
- Use suitable tools when taking the Digital Controller apart for disposal. Sharp parts inside the Digital Controller may cause injury.
- Do not exceed the communications distance that is given in the specifications. Use the specified communications cable.

# Installation Precautions

## Service Life

Use the Digital Controller within the following temperature and humidity ranges:
Temperature: –10 to 55°C (with no icing or condensation), Humidity: 25% to 85%
If the Digital 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 Digital 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 Digital Controller.
When two or more Digital 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 Digital 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 Digital 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 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 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 Digital Controller.
Allow as much space as possible between the Digital 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 Digital 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.

Front panel: IP66

Rear case: IP20, Terminal section: IP00

When waterproofing is required, insert the Waterproof Packing on the backside of the front panel. The degree of protection when the Waterproof Packing is used is IP66. To maintain an IP66 degree of protection, the Waterproof Packing must be periodically replaced because it may deteriorate, shrink, or harden depending on the operating environment. The replacement period will vary with the operating environment. Check the required period in the actual application. Use 3 years or sooner as a guideline. If the Waterproof Packing and Port Cover are not periodically replaced, waterproof performance may not be maintained. If a waterproof structure is not required, then the Waterproof Packing does not need to be installed.

# Precautions for Operation

- It takes approximately two 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 Digital Controllers into a control panel or similar device.
- Make sure that the Digital 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.
- When using self-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Digital Controller. If power is turned ON for the Digital 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 Digital 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 Digital Controller OFF and ON again, switching from STOP Mode to RUN Mode can also be used.)
- Avoid using the Digital Controller in places near a radio, television set, or wireless installing. The Digital Controller may cause radio disturbance for these devices.

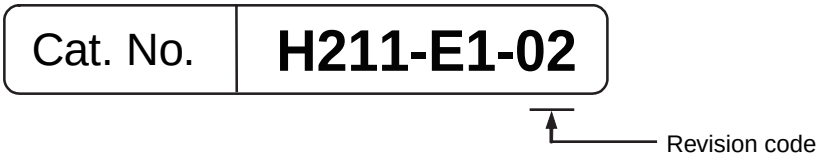
# Preparations for Use

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.<br>Make sure that there are no loose screws after tightening terminal screws to the specified torque of 0.43 to 0.58 N·m. |
| | | 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 contactors 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. |

# Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.




| Revision code | Date | Revised content |
|---|---|---|
| 01 | March 2012 | Original production |
| 02 | June 2012 | Added information on the E5CC/E5EC-□-8□□. |

# Conventions Used in This Manual

## Differences between Standard-type and Simple-type Digital Controllers

In this manual, “E5CC/E5EC” or “E5CC-800/E5EC-800” is used to indicated the E5CC/E5EC-□-8□□ Simple-type Digital Controllers.

### ● Differences in I/O Configurations

| | | E5CC | | E5EC | |
|---|---|---|---|---|---|
| | | Simple type | Standard type | Simple type | Standard type |
| Control outputs 1 and 2 | RX (1 relay output) | Supported. | Supported. | Supported. | Supported. |
| | QX (1 voltage output (for driving SSR)) | Supported. | Supported. | Supported. | Supported. |
| | CX (1 current output) | Supported. | Supported. | Supported. | Supported. |
| | QQ (2 voltage outputs (for driving SSRs)) | Not supported. | Supported. | Not supported. | Supported. |
| | QR (1 voltage output (for driving SSR) and 1 relay output) | Not supported. | Not supported. | Supported. | Supported. |
| | RR (2 relay outputs) | Not supported. | Not supported. | Supported. | Supported. |
| | CC (2 current outputs) | Not supported. | Not supported. | Not supported. | Supported. |
| | CR (1 current output and 1 relay output) | Not supported. | Not supported. | Supported. | Not supported. |
| No. of auxiliary outputs | 0 | Not supported. | Supported. | Not supported. | Not supported. |
| | 2 | Supported. | Supported. | Supported. | Supported. |
| | 3 | Not supported. | Supported. | Not supported. | Not supported. |
| | 4 | Not supported. | Not supported. | Not supported. | Supported. |
| Power supply voltage | 100 to 240 VAC | Supported. | Supported. | Supported. | Supported. |
| | 24 VAC/DC | Supported. | Supported. | Supported. | Supported. |
| Terminal type | Screw terminals | Supported. | Supported. | Supported. | Supported. |
| | Screw terminals (with cover) | Not supported. | Supported. | Not supported. | Supported. |
| Input type | Universal input | Supported. | Supported. | Supported. | Supported. |
| Option | Event inputs | Supported. | Supported. | Supported. | Supported. |
| | Communications (RS-485) | Supported. | Supported. | Supported. | Supported. |
| | Remote SP input | Not supported. | Supported. | Not supported. | Supported. |
| | HB alarm and HS alarm | Supported. | Supported. | Supported. | Supported. |
| | Transfer output | Not supported. | Supported. | Not supported. | Supported. |
| Top-panel Setup Tool port | | Not supported. | Supported. | Not supported. | Supported. |
| Front-panel Setup Tool port | | Not supported. | Not supported. | Not supported. | Supported. |

### ● Differences in Main Functions

The Simple-type Digital Controllers do not support the following functions.

- Remote SP Input
- Transfer Output
- Simple Program Function
- Extraction of Square Root
- MV at Stop and Error
- MV Change Rate Limit
- User Calibration
- Logic Operations
- Setup Tool: CX-Thermo (EST2-2C-MV4)
- USB-Serial Conversion Cable

## Model Notation

| | Event inputs | Communications | HB alarm and HS alarm |
|---|---|---|---|
| E5CC/EC-□-800 | --- | --- | --- |
| E5CC-□-801 | 2 | --- | 1 |
| E5CC-□-802 | --- | RS-485 | 1 |
| E5CC/EC-□-804 | 2 | RS-485 | --- |
| E5EC-□-808 | 2 | RS-485 | 1 |
| E5EC-□-810 | 4 | --- | 1 |

## Meanings of Abbreviations

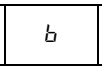
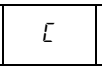
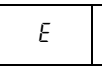
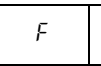
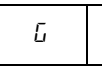
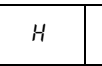
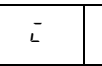
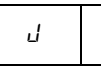
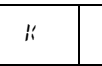
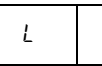
The following abbreviations are used in parameter names, figures, and other descriptions. These abbreviations mean the following:

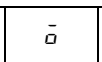
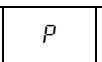
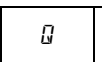
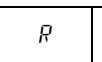
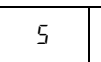
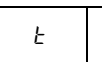
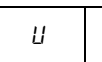
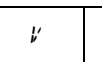
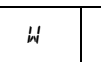
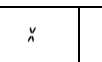
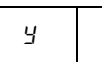
| Symbol | Term |
|---|---|
| PV | Process value |
| SP | Set point |
| SV | Set value |
| AT | Auto-tuning |
| ST | Self-tuning |
| EU | Engineering unit* |
| LBA | Loop burnout alarm |
| HB | Heater burnout |
| HS | Heater short |

* "EU" stands for Engineering Unit. EU is used as the minimum unit for engineering units such as °C, m, and g. The size of the EU depends on the input type. For example, when the input temperature setting range is –200 to 1,300°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 the EU depends on the decimal point position of the scaling setting, and 1 EU is 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.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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** |

## How This Manual is Organized

| Goal | Related sections | Contents |
|---|---|---|
| ● **Learning about the appearance, features, functions, and model numbers of the E5CC/E5EC** | *Section 1 Introduction* | This section shows the appearance and describes the features, functions, and model numbers of the E5CC/E5EC. |
| ● **Setting up the E5CC/E5EC** | *Section 2 Preparations* | This section describes the steps that are required before turning ON the power supply to the E5CC/E5EC (including installation, terminal usage, wiring, and isolation/insulation block diagram). |
| ● **Learning the basic procedures from turning ON the power supply to the E5CC/E5EC to starting actual operation** | *Section 3 Part Names and Basic Procedures* | This section describes the basic procedures from turning ON the power supply to the E5CC/E5EC to starting actual operation. It also gives the names of the parts of the E5CC/E5EC. This section serves as a basic tutorial for first-time users of the E5CC/E5EC. |
| ● **Learning the specifications and parameters of the E5CC/E5EC** | *Appendices* | The appendices list the specifications and parameters of the E5CC/E5EC. |

## Related Manuals

The following manual is also related to the E5CC/E5EC.

| Manual name | Cat. No. | Contents |
|---|---|---|
| ● **E5CC/E5EC Digital Temperature Controllers User's Manual** | H174 | This is the user's manual for the E5CC/E5EC Series. Refer to this manual for detailed specifications of the functions of the E5CC/E5EC-800 Simple-type Digital Controllers. |
| ● **E5CC/E5EC Digital Temperature Controllers Communications Manual** | H175 | This manual describes the command text and communications procedures to use the CompoWay/F and Modbus-RTU protocols for serial communications between the E5CC/E5EC and a host device (e.g., a PLC). |

# Sections in this Manual

# CONTENTS

## Section 3 Part Names and Basic Procedures



## Section A Appendices



## Index

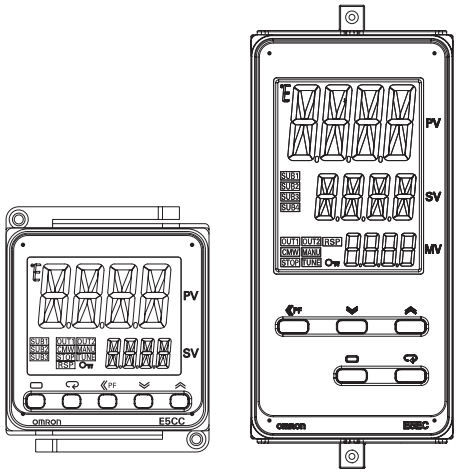
# 1



# Introduction

# 1-1 Appearance, Features, and Functions of the E5CC/E5EC

## 1-1-1 Appearance




E5CC-800 E5EC-800

- A stylish design that gives a new look to control panels.
- Large display characters and white backlight for better visibility.
- A compact size to help downsize control panels.
- Much faster sampling and greater expandability than expected in this class of Controller.
- Even easier to use than previous models.

## 1-1-2 Features

This section compares the features of the E5CC/E5EC with the previous E5CN/E5EN Controllers.

### High-speed Control Capability

Input sampling cycle: 50 ms
Control period: 0.1 s and 0.2 s have been added.
Integral/differential time unit: Setting in increments of 0.1 s has been added.

### Universal Input Capability

Universal input: The input sensor can be selected freely from the following for any model of the E5CC or E5EC: Thermocouple, resistance thermometer, ES1B Infrared Temperature Sensor, current, and voltage.

### Easier Numeric Inputs with a Digit Shift Key

Digit shift: When setting the SP or other parameters, you can use a Shift Key (assigned to the PF Key) to shift the digit that is being set to aid changing the set values.

## 1-1-3 Main Functions

This section introduces the main E5CC/E5EC functions. For details on particular functions and how to use them, refer to *Section 3 Part Names and Basic Procedures* and following sections.

### ● Input Sensor Types

You can connect the following sensors and signals to the universal input.

| | |
|---|---|
| Thermocouple: | K, J, T, E, L, U, N, R, S, B, W, PLII |
| Resistance thermometer: | Pt100, JPt100 |
| Infrared temperature sensor: | ES1B<br>10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C |
| 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 a relay, voltage (for driving SSR), or current output, depending on the model.

### ● Adjusting PID Constants

- You can easily set the optimum PID constants by performing AT (auto-tuning) with the limit cycle method or by performing ST (self-tuning) with the step response method.

### ● Alarms

#### Standard Alarms

- You can output an alarm when the deviation, process value, set point, or manipulated value reaches a specified value.
- You can also output alarms for the PV rate of change and for loop burnouts.
- If necessary, a more comprehensive alarm function can be achieved by setting a standby sequence, alarm hysteresis, auxiliary output close in alarm/open in alarm, alarm latch, alarm ON delay, and alarm OFF delay.

#### HB and HS Alarms

- With models with the optional HB and HS alarms, you can detect heater burnout and heater short alarms based on CT inputs.

#### Integrated Alarm

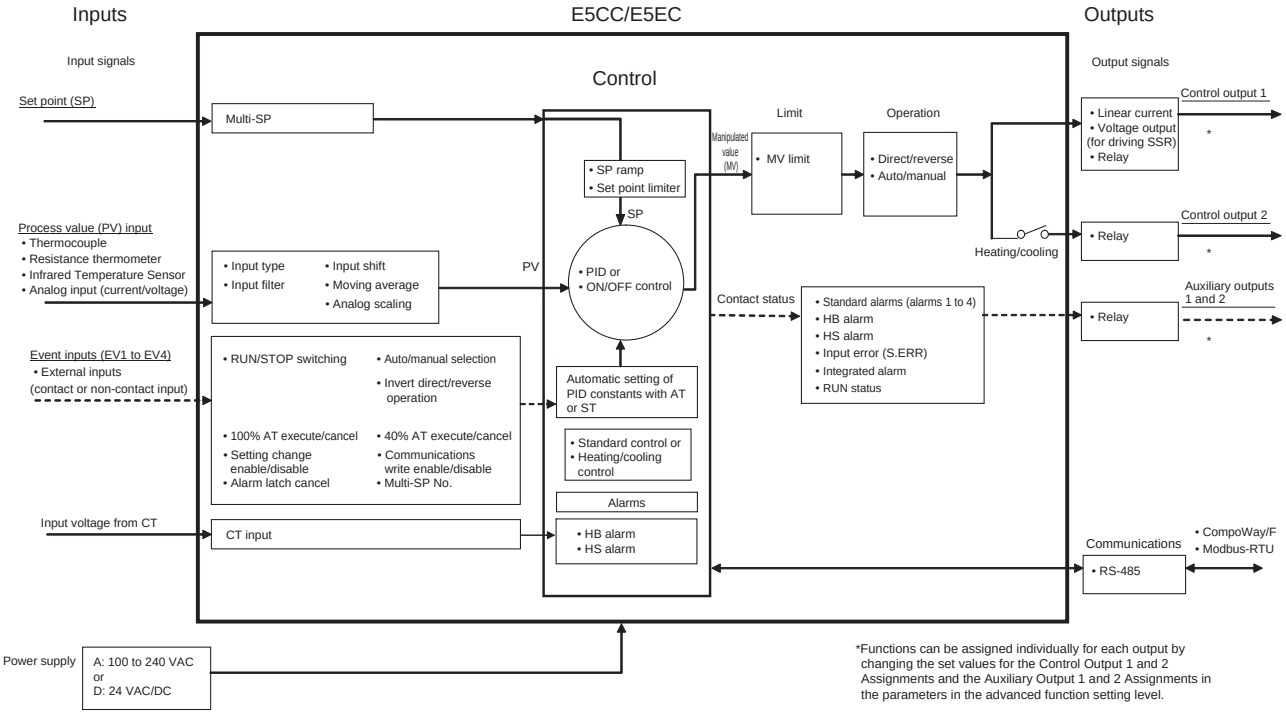
- You can output an integrated alarm if a standard alarm, HB alarm, or HS alarm turns ON.

### ● Event Inputs

- With any E5CC/E5EC model that supports event inputs, you can use external contact or non-contact inputs to achieve any of the following functions: Switching set points (Multi-SP No. Switch, 8 points max.), switching RUN/STOP, switching between automatic and manual operation, inverting direct/reverse operation, 100% AT execute/cancel, 40% AT execute/cancel, setting change enable/disable, communications write enable/disable, and canceling the alarm latch.

# 1-2 I/O Configuration and Model Number Legend

## 1-2-1 I/O Configuration




Note: Not all models support these functions. For details, refer to *1-2-2 Model Number Legends*.

## 1-2-2 Model Number Legends

● **E5CC**

**E 5 C C - □□ 2 □ S M - 8□□**
(1) (2) (3) (4) (5) (6) (7)

| (1) Size | (2) Control Outputs 1 and 2 | | (3) No. of auxiliary outputs | (4) Power supply voltage | (5) Terminal type | (6) Input type | (7) Options | Meaning | |
|---|---|---|---|---|---|---|---|---|---|
| C | | | | | | | | 48 × 48 mm | |
| | | | | | | | | **Control output 1** | **Control output 2** |
| | R | X | | | | | | Relay output | None |
| | Q | X | | | | | | Voltage output (for driving SSR) | None |
| * | C | X | | | | | | Linear current output | None |
| | | | 2 | | | | | 2 | |
| | | | | A | | | | 100 to 240 VAC | |
| | | | | D | | | | 24 VAC/DC | |
| | | | | | S | | | Screw terminals | |
| | | | | | | M | | Universal input | |

| | Event inputs | Communications | HB alarm and HS alarm | *For RX or QX | *For CX |
|---|---|---|---|---|---|
| 800 | --- | --- | --- | Provided. | Provided. |
| 801 | 2 | --- | 1 | Provided. | --- |
| 802 | --- | RS-485 | 1 | Provided. | --- |
| 804 | 2 | RS-485 | --- | --- | Provided. |

* The control output cannot be used as a transfer output.

## ● E5EC

**E 5 E C - □□ 2 □ S M - 8□□**

(1) (2) (3) (4) (5) (6) (7)

| (1) | (2) | | (3) | (4) | (5) | (6) | (7) | Meaning |
|---|---|---|---|---|---|---|---|---|
| Size | Control Outputs 1 and 2 | | No. of auxiliary outputs | Power supply voltage | Terminal type | Input type | Options | |
| E | | | | | | | | 48 × 96 mm |
| | | | | | | | | Control output 1 / Control output 2 |
| | R | X | | | | | | Relay output / None |
| | Q | X | | | | | | Voltage output (for driving SSR) / None |
| * | C | X | | | | | | Linear current output / None |
| | Q | R | | | | | | Voltage output (for driving SSR) / Relay output |
| | R | R | | | | | | Relay output / Relay output |
| * | C | R | | | | | | Linear current output / Relay output |
| | | | 2 | | | | | 2 |
| | | | | A | | | | 100 to 240 VAC |
| | | | | D | | | | 24 VAC/DC |
| | | | | | S | | | Screw terminals |
| | | | | | | M | | Universal input |

| | Event inputs | Communications | HB alarm and HS alarm | *For RX, QX or CX | *For RR or QR | *For CR |
|---|---|---|---|---|---|---|
| 800 | --- | --- | --- | Provided. | Provided. | Provided. |
| 804 | 2 | RS-485 | --- | --- | --- | Provided. |
| 808 | 2 | RS-485 | 1 | --- | Provided. | --- |
| 810 | 4 | --- | 1 | --- | Provided. | --- |

* The control output cannot be used as a transfer output.

# 2

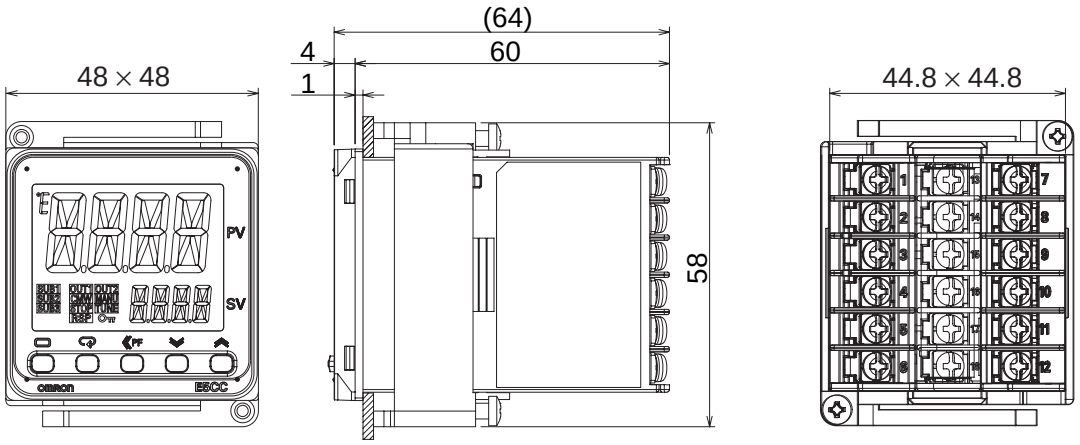


# Preparations

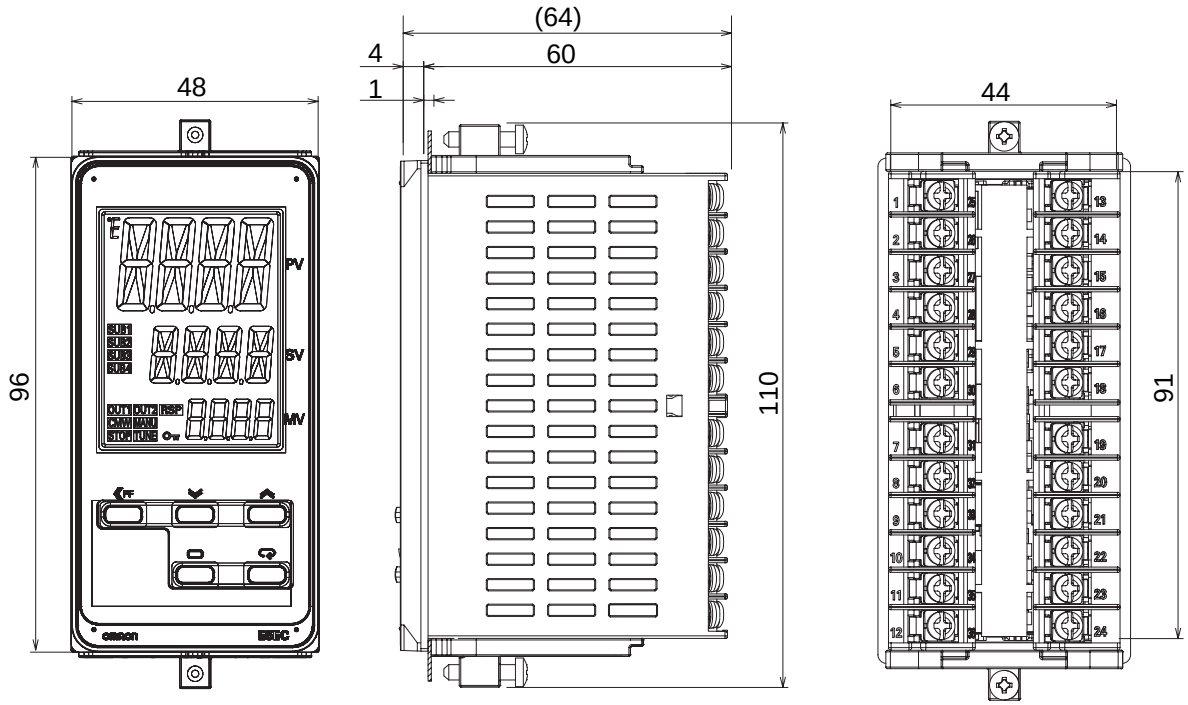
# 2-1 Installation

## 2-1-1 Dimensions (Unit: mm)

- **E5CC**

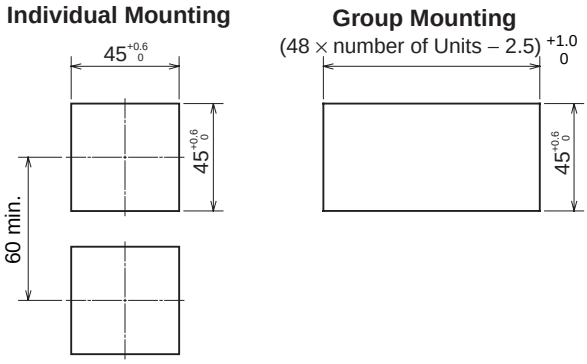



- **E5EC**



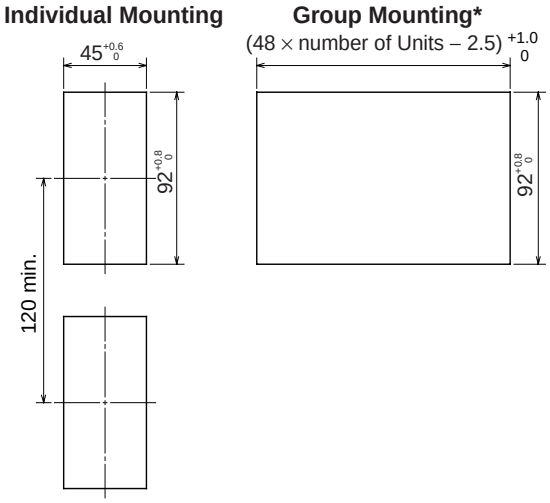
## 2-1-2 Panel Cutout (Unit: mm)

### ● E5CC




- Waterproofing is not possible when group mounting several Controllers.
- The recommended panel thickness is 1 to 5 mm for the E5CC.
- Controllers 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.

### ● E5EC

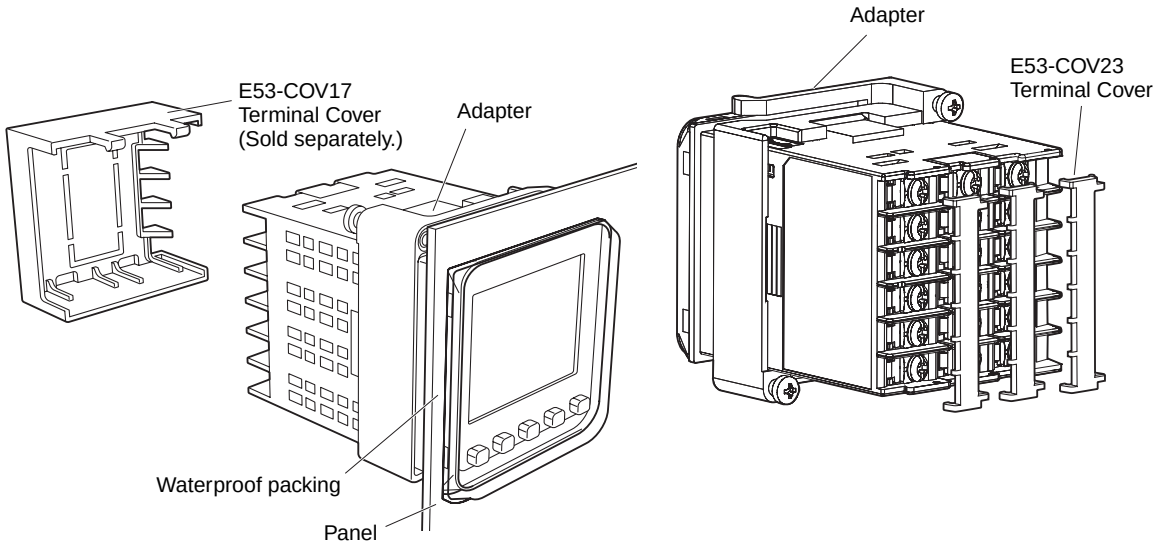



- Waterproofing is not possible when group mounting several Controllers.
- The recommended panel thickness is 1 to 8 mm for the E5EC.
- Controllers must not be closely mounted vertically. (Observe the recommended mounting space limits.)
- When group mounting several Controllers, ensure that the surrounding temperature does not exceed the ambient operating temperature listed in the specifications.

## 2-1-3 Mounting

### ● E5CC

There are two models of Terminal Covers that you can use with the E5CC.




### Mounting to the Panel

(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 E5CC into the mounting hole in the panel.

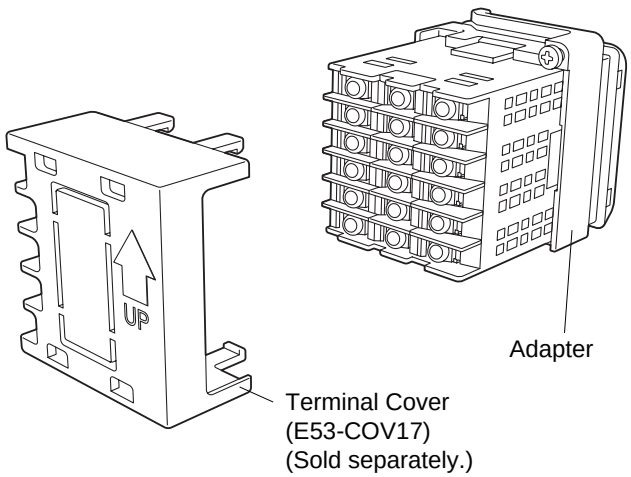
(3) Push the adapter from the terminals up to the panel, and temporarily fasten the E5CC.

(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.

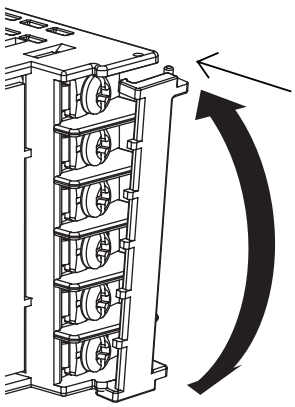
### Mounting the Terminal Cover

Slightly bend the E53-COV23 Terminal Cover to attach it to the terminal block as shown in the following diagram. The Terminal Cover cannot be attached in the opposite direction. Or, you can use the E53-COV17 Terminal Cover. Make sure that the “UP” mark is facing up, and then attach the E53-COV17 Terminal Cover to the holes on the top and bottom of the Digital Controller.

• E53-COV17

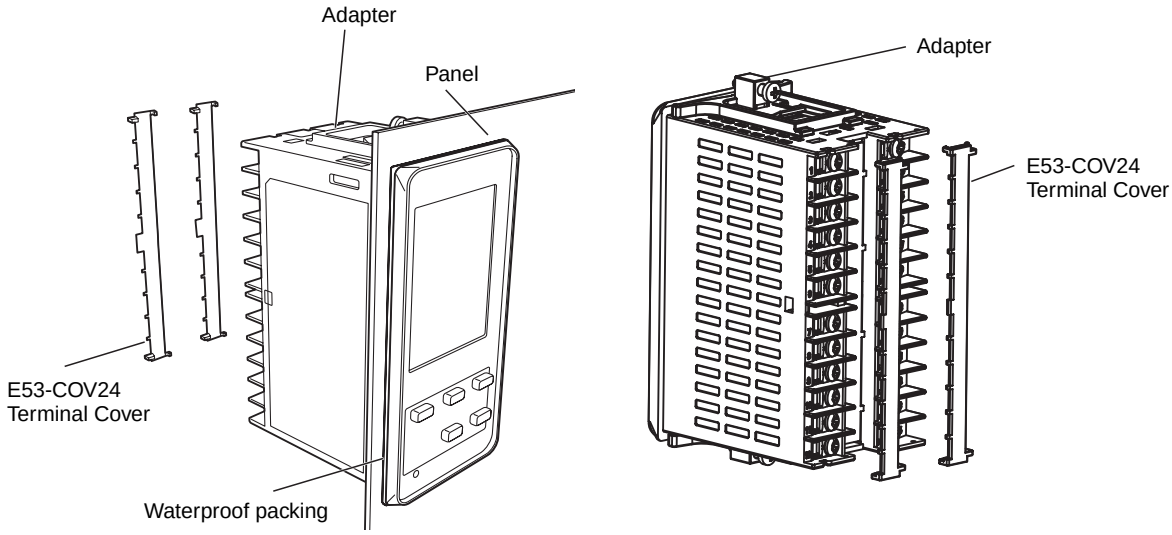



• E53-COV23



Enlarged Illustration of Terminal Section

## ● E5EC




### Mounting to the Panel

(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.

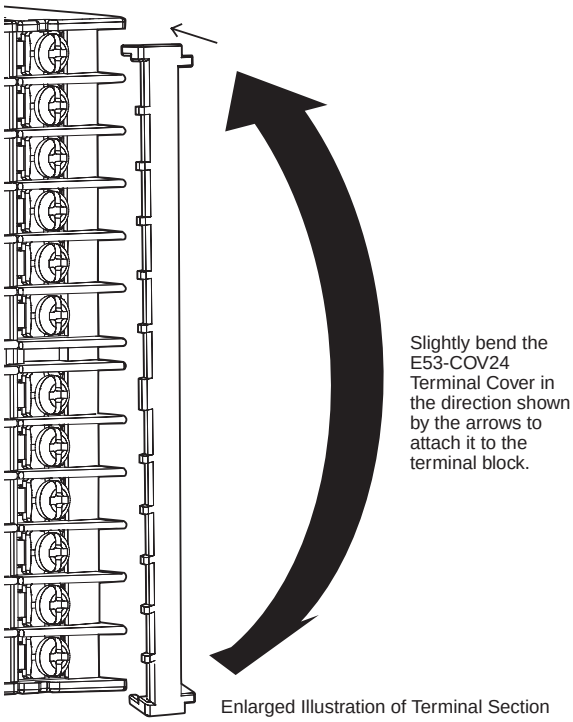
(2) Insert the E5EC into the mounting hole in the panel.

(3) Push the adapter from the terminals up to the panel, and temporarily fasten the E5EC.

(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

Slightly bend the E53-COV24 Terminal Cover to attach it to the terminal block as shown in the following diagram. The Terminal Cover cannot be attached in the opposite direction.




Enlarged Illustration of Terminal Section

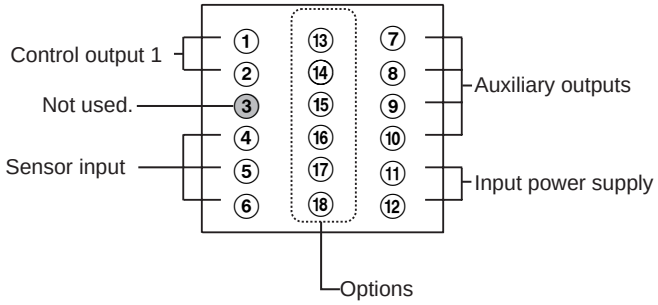
# 2-2 Using the Terminals

The terminal arrangements of the E5CC/E5EC are described in this section.

## 2-2-1 E5CC Terminal Block Wiring Example

### ● Terminal Arrangement

The terminals block of the E5CC is divided into five types of terminals: control output 1, sensor input, auxiliary outputs, input power supply, and options.




**Precautions for Correct Use**

When you purchase the Digital Controller, it will be set for a K thermocouple (input type = 5) by default. If a different sensor is used, an input error (5.ERR) will occur. Check the setting of the Input Type parameter.

## Control Output 1

### ● Model Numbers

The specification for control output 1 is given in the following location in the model number.

E5CC-□□ 2 □ S M-8□□

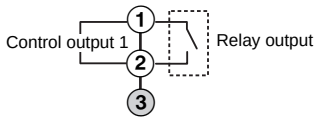
Control output 1

| Code | Output type | Specification |
|---|---|---|
| RX | 1 relay output | 250 VAC, 3 A (resistive load) |
| QX | 1 voltage output (for driving SSR) | 12 VDC, 21 mA |
| CX | 1 current output | 4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max. |

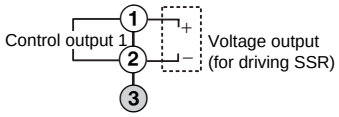
### ● Terminal Details

Do not connect anything to the terminals that are shaded gray.

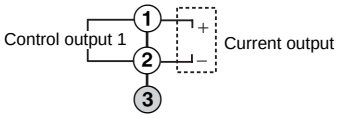
**RX**




**QX**




**CX**




## Sensor Input

### ● Model Numbers

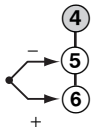
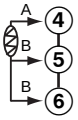
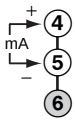
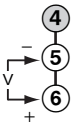
All E5CC models have universal sensor inputs, so the code in the model number is always “M.”

E5CC-□□ 2 □ S M-8□□

└ Sensor input

### ● Terminal Details

Do not connect anything to the terminals that are shaded gray.

| TC (thermocouple) | Pt (resistance thermometer) | I (current) | V (voltage) |
|---|---|---|---|
|  |  |  |  |









**Precautions for Correct Use**

When complying with EMC standards, the line connecting the sensor must be 30 m or less. If the cable length exceeds 30 m, compliance with EMC standards will not be possible.

## Auxiliary Outputs

### Model Numbers

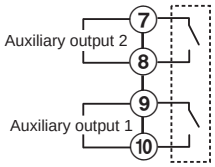
All E5CC models have two auxiliary outputs, so the code in the model number is always “2.”

E5CC-□□ 2 □ S M-8□□

No. of auxiliary outputs

| Code | Auxiliary outputs | Specification |
|---|---|---|
| 2 | 2 auxiliary outputs | SPST-NO, 250 VAC, 3 A |

### Terminal Details

| Model with 2 auxiliary outputs |
|---|
|  |



## Input Power Supply

### Model Numbers

The input power supply specification of the E5CC is given in the following location in the model number.

E5CC-□□ 2 □ S M-8□□

Input power supply

| Code | Specification | Power consumption |
|---|---|---|
| A | 100 to 240 VAC, 50/60 Hz | Option number 800: 5.2 VA max.<br>Other option numbers: 6.5 VA max. |
| D | 24 VAC, 50/60 Hz<br>24 VDC (no polarity) | Option number 800: 3.1 VA max./1.6 W max.<br>Other option numbers: 4.1 VA max./2.3 W max. |

### Terminal Details

| 100 to 240 VAC | 24 VAC/DC |
|---|---|
|  |  (No polarity) |

# Options

## Model Numbers

The options specification of the E5CC is given in the following location in the model number.

E5CC-□□ □ □ □ M-8□□

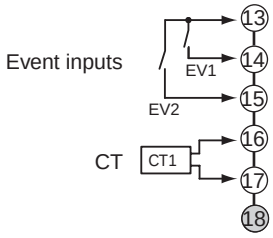
Options

| Code | Specification | Remarks |
|---|---|---|
| 800 | None | |
| 801 | Event inputs 1 and 2, and CT1 | |
| 802 | Communications (RS-485) and CT1 | The communications protocol is CompoWay/F or Modbus-RTU. |
| 804 | Communications (RS-485), and event inputs 3 and 4 | The communications protocol is CompoWay/F or Modbus-RTU. |

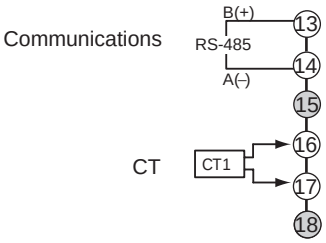
## Terminal Details

Do not connect anything to the terminals that are shaded gray.

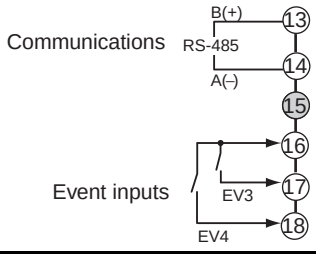
**801**




**802**



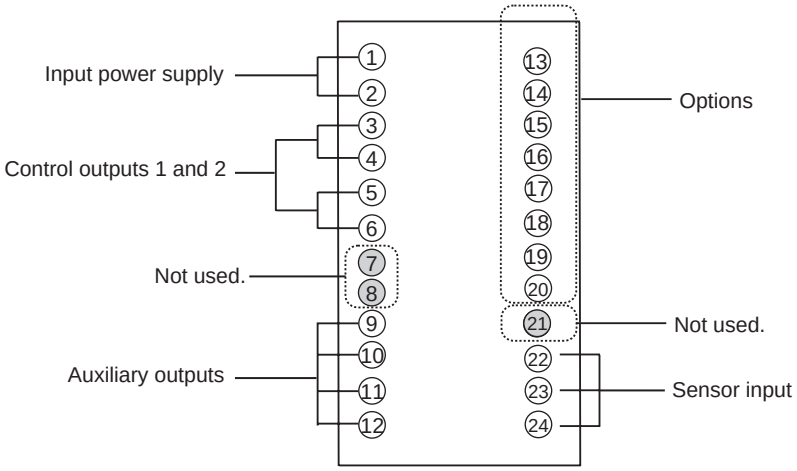

**804**



## 2-2-2 E5EC Terminal Block Wiring Example

### ● Terminal Arrangement

The terminals block of the E5EC is divided into five types of terminals: control outputs 1 and 2, sensor input, auxiliary outputs, input power supply, and options.




**Precautions for Correct Use**

- When you purchase the Digital Controller, it will be set for a K thermocouple (input type = 5). If a different sensor is used, an input error (5.ERR) will occur. Check the setting of the Input Type parameter.

## Control Outputs 1 and 2

### ● Model Numbers

The specifications for control outputs 1 and 2 are given in the following location in the model number.

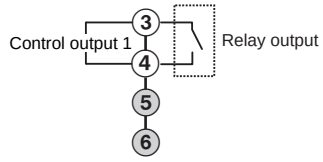
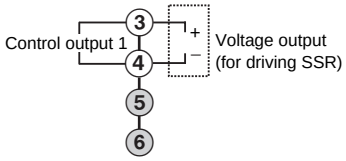
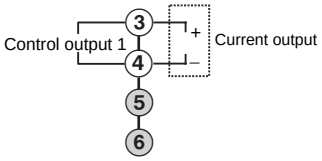
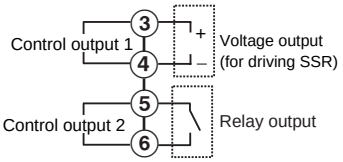
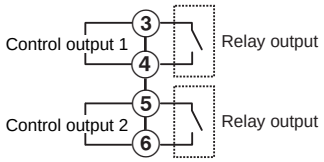
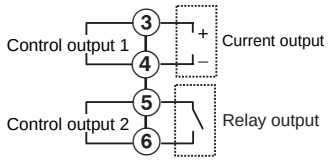
E5EC-□□ 2 □ S M-8□□

Control outputs 1 and 2

| Code | Output type | Specification |
|---|---|---|
| RX | 1 relay output | 250 VAC, 5 A (resistive load) |
| QX | 1 voltage output (for driving SSR) | 12 VDC, 40 mA |
| CX | 1 current output | 4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max. |
| QR | 1 voltage output (for driving SSR) and 1 relay output | 12 VDC, 21 mA for voltage output<br>250 VAC, 5 A (resistive load) for relay output |
| RR | 2 relay outputs | 250 VAC, 5 A (resistive load) |
| CR | 1 current output and 1 relay output | 4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.<br>250 VAC, 5 A (resistive load) for relay output |

### ● Terminal Details

Do not connect anything to the terminals that are shaded gray.

| RX | QX | CX |
|---|---|---|
|  |  |  |
| **QR** | **RR** | **CR** |
|  |  |  |

## Sensor Input

### ● Model Numbers

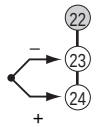
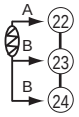
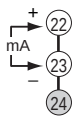
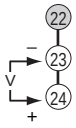
All E5EC models have universal sensor inputs, so the code in the model number is always “M.”

E5EC-□□ 2 □ S M-8□□

└ Sensor input

### ● Terminal Details

Do not connect anything to the terminals that are shaded gray.

| TC (thermocouple) | Pt (resistance thermometer) | I (current) | V (voltage) |
|---|---|---|---|
|  |  |  |  |

**Precautions for Correct Use**

When complying with EMC standards, the line connecting the sensor must be 30 m or less. If the cable length exceeds 30 m, compliance with EMC standards will not be possible.

## Auxiliary Outputs

### Model Numbers

All E5EC models have two auxiliary outputs, so the code in the model number is always “2.”

E5EC-□□ 2 □ S M-8□□

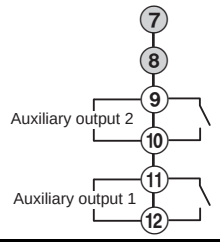
No. of auxiliary outputs

| Code | Auxiliary outputs | Specification |
|---|---|---|
| 2 | 2 auxiliary outputs | SPST-NO, 250 VAC, 3 A |

### Terminal Details

Do not connect anything to the terminals that are shaded gray.

**2 auxiliary outputs**




## Input Power Supply

### Model Numbers

The input power supply specification of the E5EC is given in the following location in the model number.

E5EC-□□ 2 □ S M-8□□

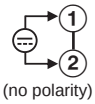
Input power supply

The codes that are given in the following table show the specification.

| Code | Specification | Power consumption |
|---|---|---|
| A | 100 to 240 VAC (50/60 Hz) | Option number 800: 6.6 VA max.<br>Other option numbers: 8.3 VA max. |
| D | 24 VAC, 50/60 Hz<br>24 VDC (no polarity) | Option number 800: 4.1 VA max./2.3 W max.<br>Other option numbers: 5.5 VA max./3.2 W max. |

### Terminal Details

Details on the input power supply terminals are shown below.

| 100 to 240 VAC | 24 VAC/DC |
|---|---|
|  |  (no polarity) |

# Options

## Model Numbers

The options specification of the E5EC is given in the following location in the model number.

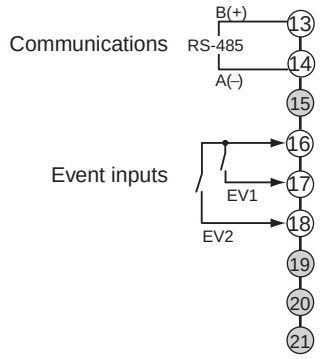
E5EC-□□ □ □ □ M-8□□
Options

| Code | Specification | Remarks |
|---|---|---|
| 800 | None | |
| 804 | Communications (RS-485), and event inputs 1 and 2 | The communications protocol is CompoWay/F or Modbus-RTU. |
| 808 | Communications (RS-485), event inputs 1 and 2, and CT1 | The communications protocol is CompoWay/F or Modbus-RTU. |
| 810 | Event inputs 1 to 4, and CT1 | |

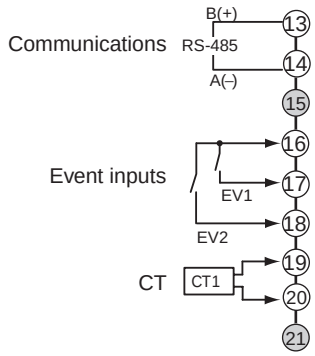
## Terminal Details

Do not connect anything to the terminals that are shaded gray.

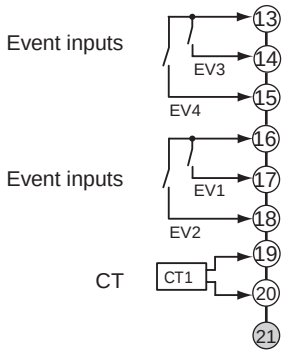
**804**




**808**

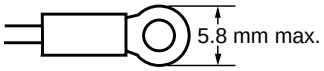



**810**



## 2-2-3 Precautions when Wiring

- Separate input leads and power lines in order to prevent external noise.
- Use a shielded, AWG24 to AWG18 (cross-sectional area of 0.205 to 0.823 $mm^2$) twisted-pair cable. The stripping length is 6 to 8 mm.
- Use crimp terminals when wiring the terminals.
- Use the suitable wiring material and crimp tools for crimp terminals.
- Tighten the terminal screws to a torque of 0.43 to 0.58 N·m.
- Use the following types of crimp terminals for M3.0 screws.


## 2-2-4 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

#### Power Consumption

| Input Power Supply | E5CC | | E5EC | |
|---|---|---|---|---|
| | Options No.: 800 | Options No.: Not 800 | Options No.: 800 | Options No.: Not 800 |
| 100 to 240 VAC, 50/60 Hz | 5.2 VA max. | 6.5 VA max. | 6.6 VA max. | 8.3 VA max. |
| 24 VAC, 50/60 Hz | 3.1 VA max. | 4.1 VA max. | 4.1 VA max. | 5.5 VA max. |
| 24 VDC (no polarity) | 1.6 W max. | 2.3 W max. | 2.3 W max. | 3.2 W max. |

- These models have reinforced insulation between the input power supply, the relay outputs, and other terminals.

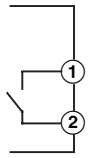
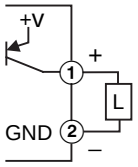
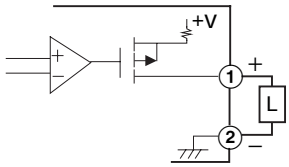
### ● Inputs

Refer to *2-2-1 E5CC Terminal Block Wiring Example* or *2-2-2 E5EC Terminal Block Wiring Example* for the terminal arrangement. When extending the thermocouple lead wires, be sure to use compensating wires that match the thermocouple type. When extending the lead wires of a resistance thermometer, be sure to use wires that have low resistance and keep the resistance of the three lead wires the same.

## ● Control Outputs 1 and 2

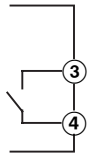
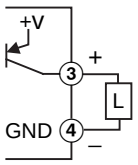
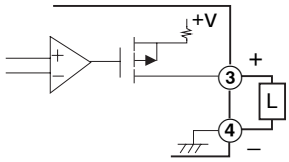
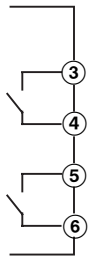
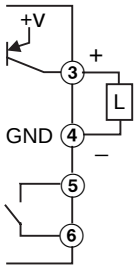
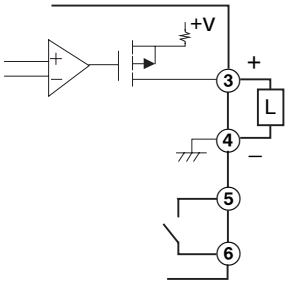
The following diagrams show the applicable outputs and their internal equivalent circuits.

### E5CC

| RX (relay output) | QX (voltage output (for driving SSR)) | CX (current output) |
|---|---|---|
|  |  |  |

| Output type | | Specification |
|---|---|---|
| RX | Relay output | SPST-NO, 250 VAC, 3 A (resistive load), Electrical durability: 100,000 operations |
| QX | Voltage output (for driving SSR) | PNP, 12 VDC ±20%, 21 mA (with short-circuit protection) |
| CX | Current output | 4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution: Approx. 10,000 |

### E5EC

| RX (relay output) | QX (voltage output (for driving SSR)) | CX (current output) |
|---|---|---|
|  |  |  |
| **RR (2 relay outputs)** | **QR (voltage output (for driving SSR) and relay output)** | **CR (current output and relay output)** |
|  |  |  |

| Output type | | Specification |
|---|---|---|
| RX | Relay output | SPST-NO, 250 VAC, 5 A (resistive load),<br>Electrical durability: 100,000 operations |
| QX | Voltage output (for driving SSR) | PNP, 12 VDC ±20%, 40 mA (with short-circuit protection) |
| CX | Current output | 4 to 20 or 0 to 20 mA DC, Load: 500 Ω max.,<br>Resolution: Approx. 10,000 |
| RR | 2 relay outputs | SPST-NO, 250 VAC, 5 A (resistive load),<br>Electrical durability: 100,000 operations |
| QR | Voltage output (for driving SSRs) (control output 1) | PNP, 12 VDC ±20%, 21 mA (with short-circuit protection) |
| | Relay output (control output 2) | SPST-NO, 250 VAC, 5 A (resistive load),<br>Electrical durability: 100,000 operations |
| CR | Current output | 4 to 20 or 0 to 20 mA DC, Load: 500 Ω max.,<br>Resolution: Approx. 10,000 |
| | Relay output | SPST-NO, 250 VAC, 5 A (resistive load),<br>Electrical durability: 100,000 operations |

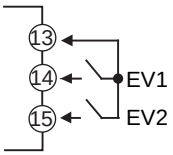
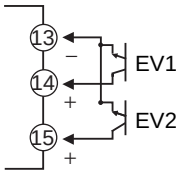
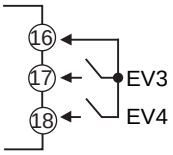
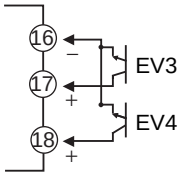
## ● Auxiliary Outputs 1 and 2

When heating/cooling control is used on the E5CC/E5EC, auxiliary output 2 is the control output for cooling.

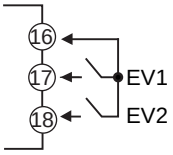
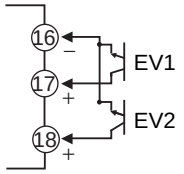
## ● Event Inputs

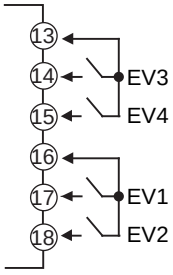
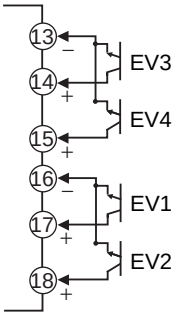
E5CC/E5EC models with an option number of 801, 804, 808, or 810 have event inputs.

### E5CC

| Contact inputs | Non-contact inputs |
|---|---|
| Option number: 801<br>  |  |
| Option number: 804<br>  |  |

### E5EC

| Contact inputs | Non-contact inputs |
|---|---|
| Option number: 804, 808<br>  |  |

| Contact inputs | Non-contact inputs |
|---|---|
| Option number: 810  |  |



- 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 of 1.5 V max.; OFF: Leakage current of 0.1 mA max. |

## ● CT Input

E5CC/E5EC models with an option number of 801, 802, 808, or 810 have one CT input.

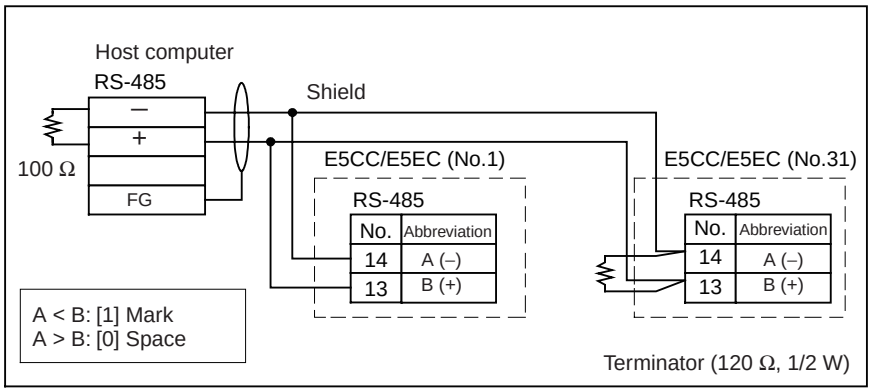
## ● Communications

### RS-485

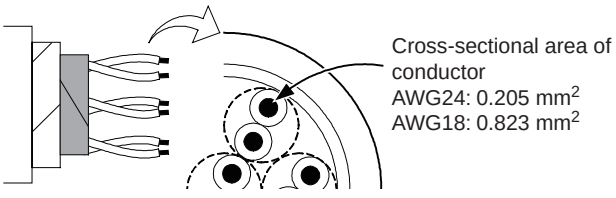
E5CC/E5EC models with an option number of 802, 804, 808, or 810 support communications. Connect the communications cable to terminals 13 and 14 to use communications with the E5CC/E5EC.

**Communications Unit Connection Diagram**

● E5CC/E5EC

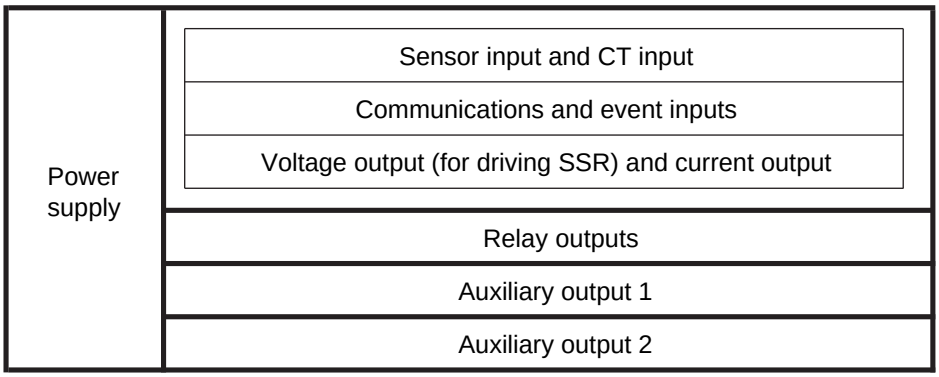



- The RS-485 connection can be either one-to-one or one-to-N. A maximum of 32 Units (including the host computer) can be connected in one-to-N systems. The maximum total cable length is 500 m. Use a shielded, AWG24 to AWG18 (cross-sectional area of 0.205 to 0.823 $mm^2$) twisted-pair cable.



# 2-3 Insulation Block Diagrams

The insulation block diagram for the E5CC/E5EC is provided in this section.




: Reinforced insulation

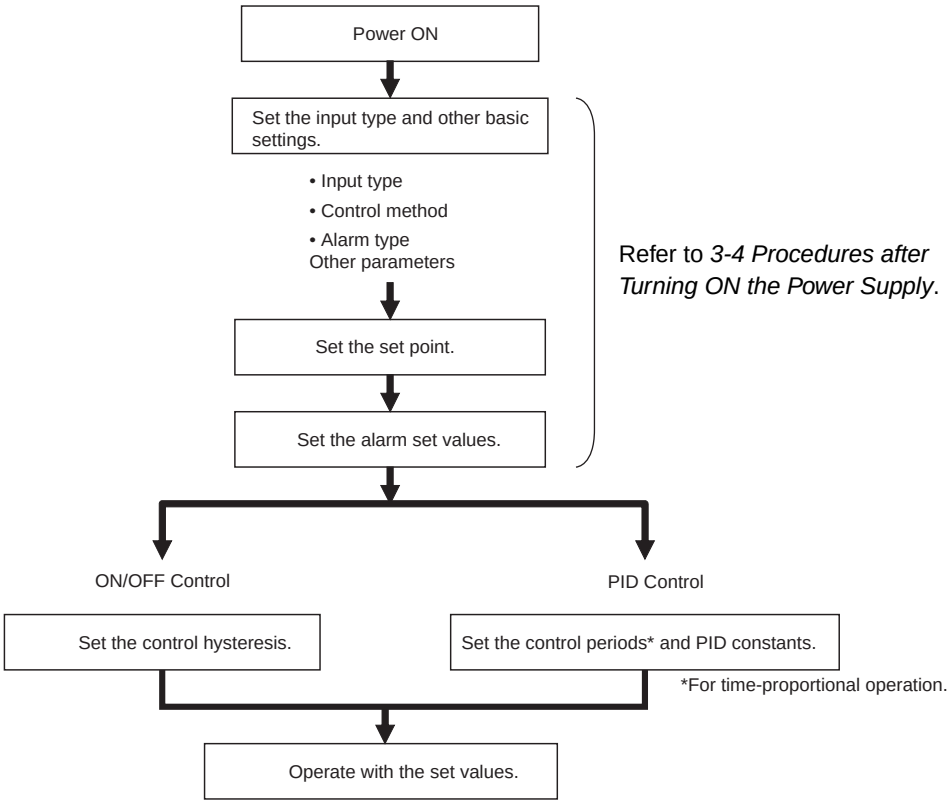
: Functional insulation

# 3

# Part Names and Basic Procedures

# 3-1 Basic Application Flow

The following figure shows the basic flow for using the Digital Controller.



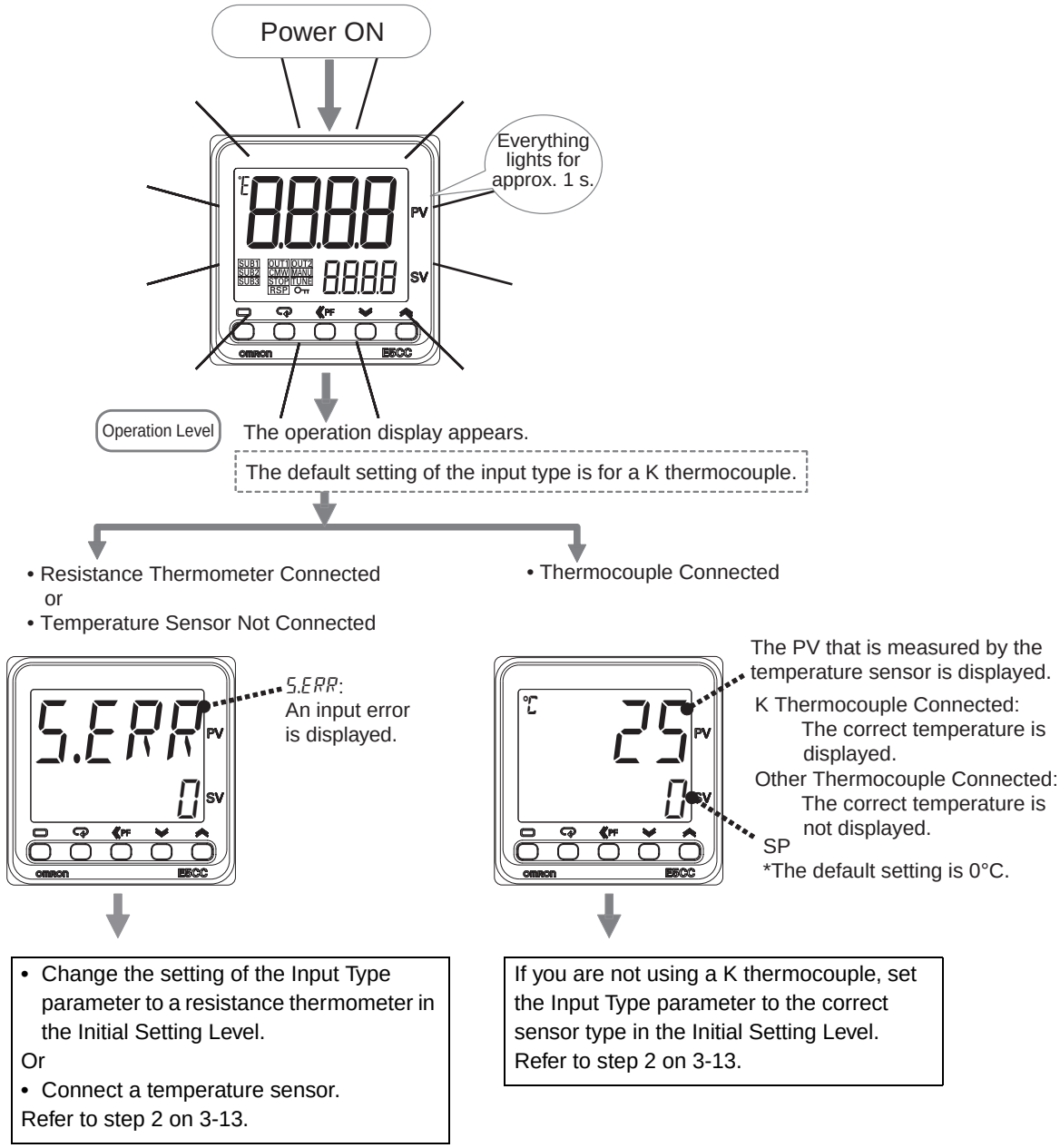
# 3-2 Power ON

Operation will start as soon as you turn ON the power supply to the E5CC/E5EC.
The following default settings will be used when operation starts.

- Input type 5: K thermocouple
- ON/OFF control
- Alarm: Upper-limit alarm*
- Set point: 0°C

* If the Controller is equipped with HB/HS alarm detection, it is set by default to detect heater alarms.

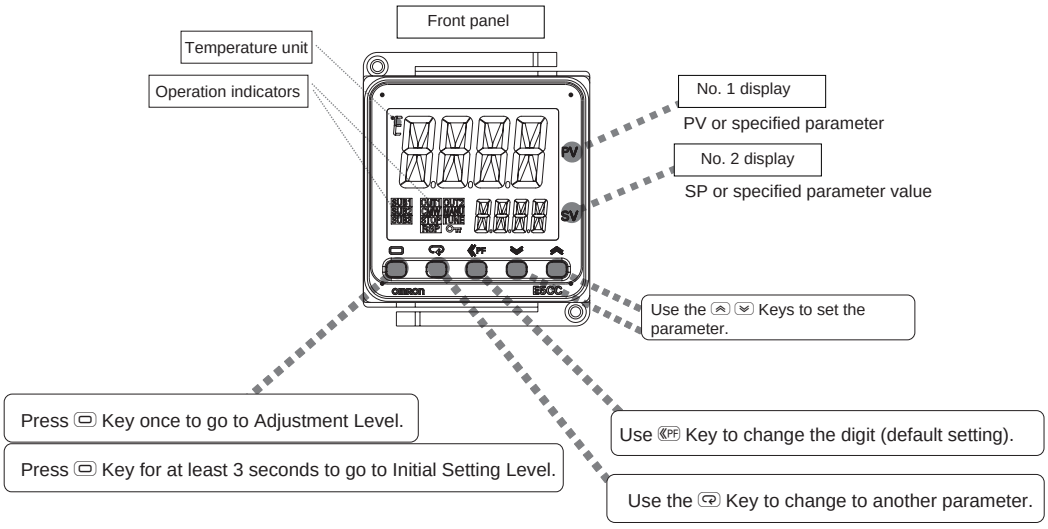
After the power comes ON, all indicators and displays will light for approximately 1 second, and then the operation display will appear.
The top display will show the PV and the bottom display will show the SP.



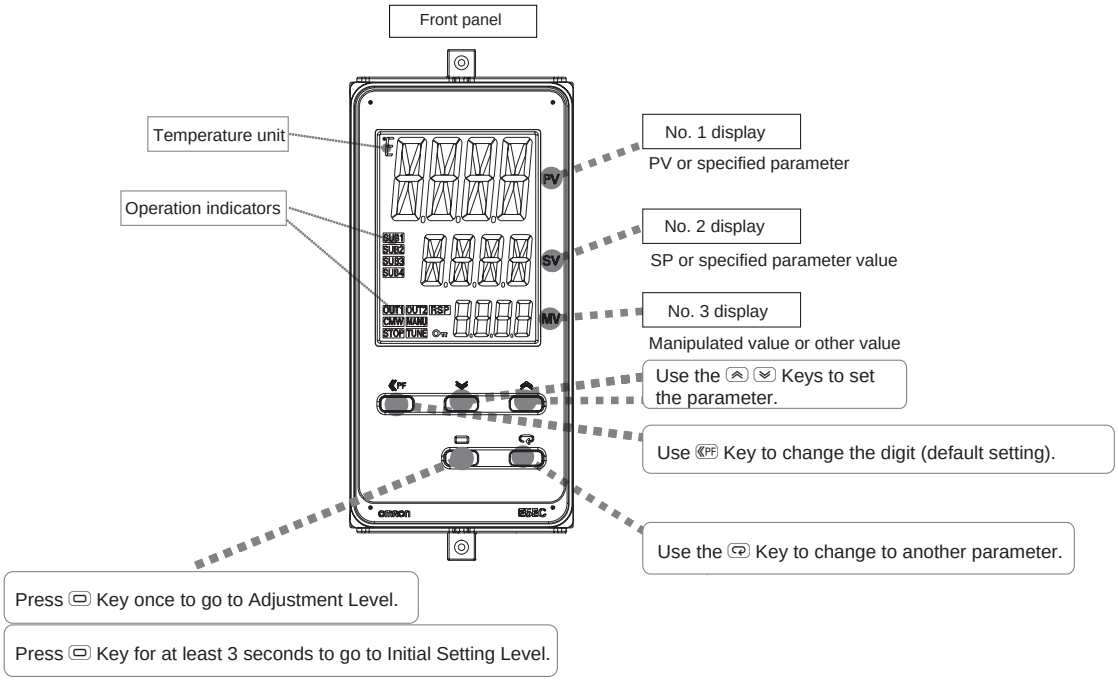
# 3-3 Part Names, Part Functions, and Setting Levels

## 3-3-1 Part Names and Functions

### E5CC




### E5EC



## Displays

| Display | Name | Description |
|---|---|---|
| E5CC: Top display<br>E5EC: Top display | No. 1 display | Displays the process value or a monitor/setting item. |
| E5CC: Bottom display<br>E5EC: Middle display | No. 2 display | Displays the set point or the value of a monitor/setting item. |
| E5CC: None<br>E5EC: Bottom display | No. 3 Display (E5EC only) | Displays the manipulated variable, remaining soak time*, multi-SP No., internal SP (ramp SP), or alarm value 1. (The value that is displayed is set in the PV/SP Display Selection parameter in the Advanced Function Setting Level.) |
| ℃ or ℉ | Temperature unit | Displays the temperature unit. |

* Any settings that are entered will be ignored.

## Indicators

| Operation indicators | Name | Description |
|---|---|---|
| SUB1<br>SUB2 | Auxiliary outputs 1 and 2 | Each indicator lights when the function that is assigned to the corresponding auxiliary output (1 and 2) is ON. |
| OUT1<br>OUT2 | Control outputs 1 and 2 | Each indicator lights when the function that is assigned to the corresponding control output (1 or 2) is ON. (For a current output, the indicator is not lit only for a 0% output.) |
| CMW | Communications writing control | This indicator lights when writing with communications is enabled. |
| MANU | Manual | This indicator is lit in Manual Mode. |
| STOP | Stop | This indicator is lit while operation is stopped. |
| TUNE | AT/ST in progress | This indicator is lit during autotuning.<br>This indicator flashes during self-tuning. |
|  | Setting change protection | This indicator is lit while setting change protection is ON. |

## Keys

| Key | Name | Overview | Description |
|---|---|---|---|
|  | Level Key | Selects the setting level.<br><br>The next setting level depends on how long the key is pressed. | • In Operation Level<br>  • Press once for less than 1 second to go to Adjustment Level.<br>  • Press for at least 3 seconds to go to Initial Setting Level.<br>• In Adjustment Level<br>  • Press once for less than 1 second to go to Operation Level.<br>  • Press for at least 3 seconds to go to Initial Setting Level.<br>• In Initial Setting Level<br>  • Press for at least 1 second to go to Operation Level.<br>  • Display AMOV (Move to Advanced Function Setting Level) and then enter –169 to go to Advanced Function Setting Level. |
|  | Mode Key | Changes the parameter that is displayed within a setting level. | • Press once to go to the next parameter.<br>• Hold to go to the previous parameter. |
|  <br>  | Down Key and Up Key | Set the value. | • Hold the key to increment or decrement the value quickly.<br>• Any changes in settings are applied at the following times:<br>  • After 3 seconds elapse<br>  • When the  Key is pressed<br>  • When the level is changed with the  Key |
|  | Shift Key (PF Key) | Operates as a user-defined function key. | • Press the  to select the digit to change.<br>You can change the PF Setting parameter to assign any of the following functions.<br>• Press the  Key for at least 1 second and then specify one of the following functions:<br>RUN/STOP, auto/manual, autotuning, or canceling an alarm latch<br><br>The PF Key operates as a Digit Shift Key by default.<br><br>Example: If you set the PF Setting parameter to STOP, operation will stop when you press the PF Key for at least 1 second. |

## 3-3-2 Entering Numeric Values

### Applying Changes to Numeric Values

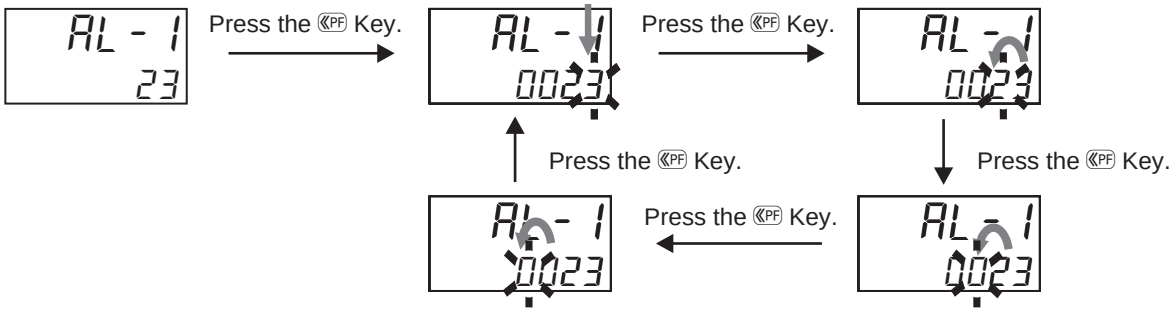
After you change a numeric value with the ▲ ▼ Keys, the changes are applied 1) when 3 seconds elapses, 2) when the ◀ Key is pressed, or 3) when the level is changed with the M Key.

**Precautions for Correct Use**

Always make sure that any changes to numeric values are applied for one of the three methods that are given above before you turn OFF the power supply to the E5CC/E5EC.
If you only change the values with the ▲ ▼ Keys and turn OFF the power supply before 3 seconds has elapsed, the changes will not be applied.

### Moving between Digits (Digit Shift Key)

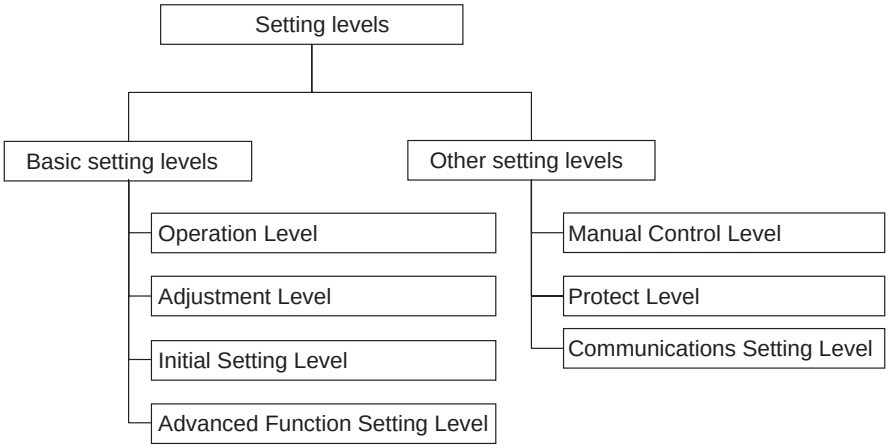
Press the Shift Key (PF Key) to select the digit to change.
This is useful when entering a numeric value with many digits.
Use this key to change levels: The digit to change will move as follows: 1s digit, 10s digit, 100s digit, 1000s digit, and then back to the 1s digit. Press the ▲ + ▼ Keys to change the value of a digit.



## 3-3-3 Setting Levels

### What Are Setting Levels?

On the E5CC/E5EC, the parameters are classified into levels according to their applications. These levels are called setting levels. The setting levels consist of some basic setting levels and other setting levels.




The setting levels are described in more detail in the following tables.

#### ● Basic Setting Levels

The basic setting levels are the levels that are used most frequently.

| Application of the parameters | Setting level name | Operation status |
|---|---|---|
| Level that is used for operation | Operation Level | Operating |
| Level that is used for adjustments | Adjustment Level | Operating |
| Level that is used for initial settings | Initial Setting Level | Stopped |
| | Advanced Function Setting Level | |

#### ● Other Setting Levels

The other setting levels are used as required.

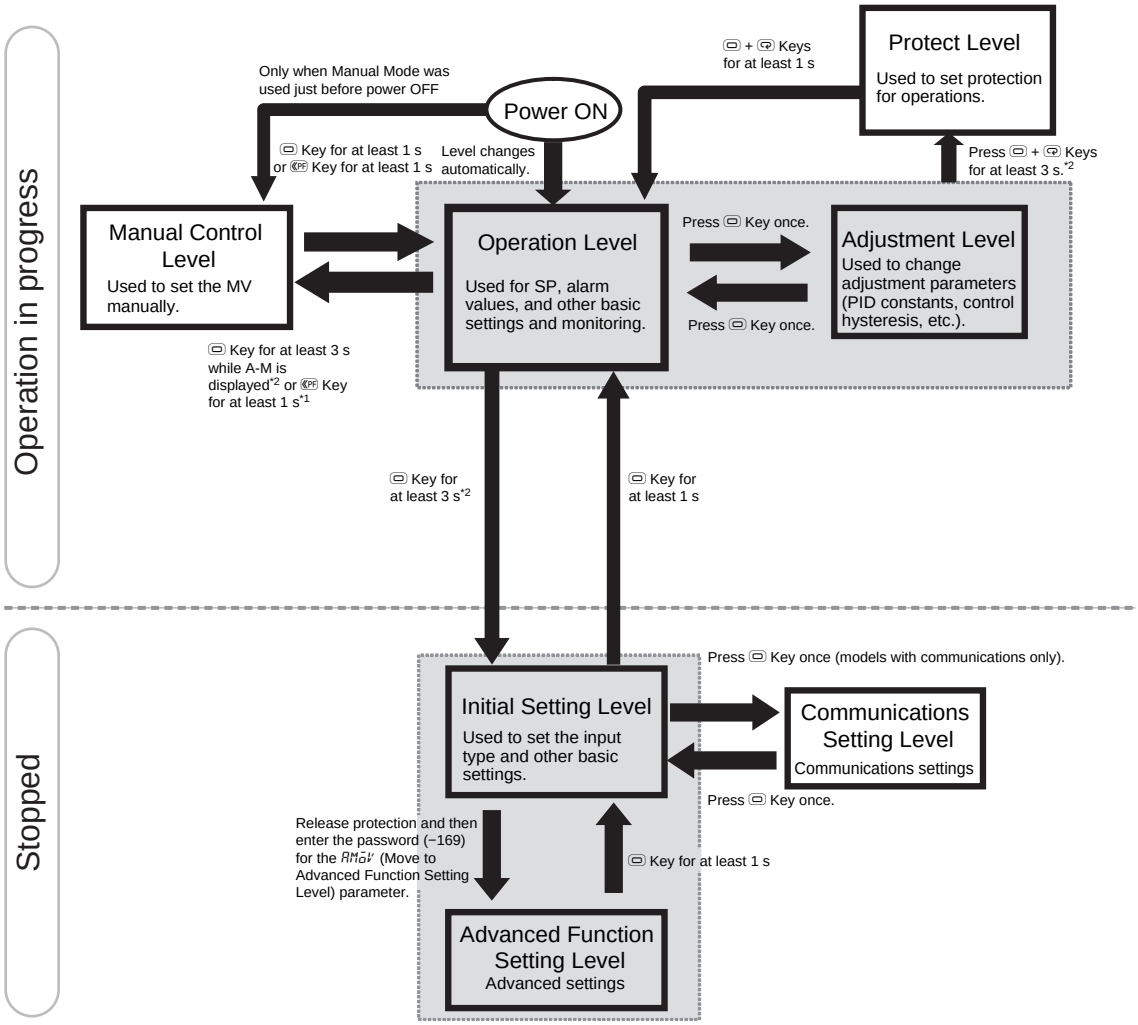
| Application of the parameters | Setting level name | Operation status |
|---|---|---|
| Level that is used for communications settings | Communications Setting Level | Stopped |
| Level that is used for manual operation | Manual Control Level | Operating |
| Level that is used to set protection | Protect Level | Operating |

The Operation Level, Adjustment Level, Initial Setting Level, and Advanced Function Setting Level are used most commonly. They are therefore described separately from the other setting levels under Basic Setting Levels, below.

## 3-3-4 E5CC/E5EC Setting Levels

### Moving between Setting Levels

The following figure gives an overall image of the setting levels. The setting levels consist of the basic setting levels (shaded below) and the other setting levels (not shaded).

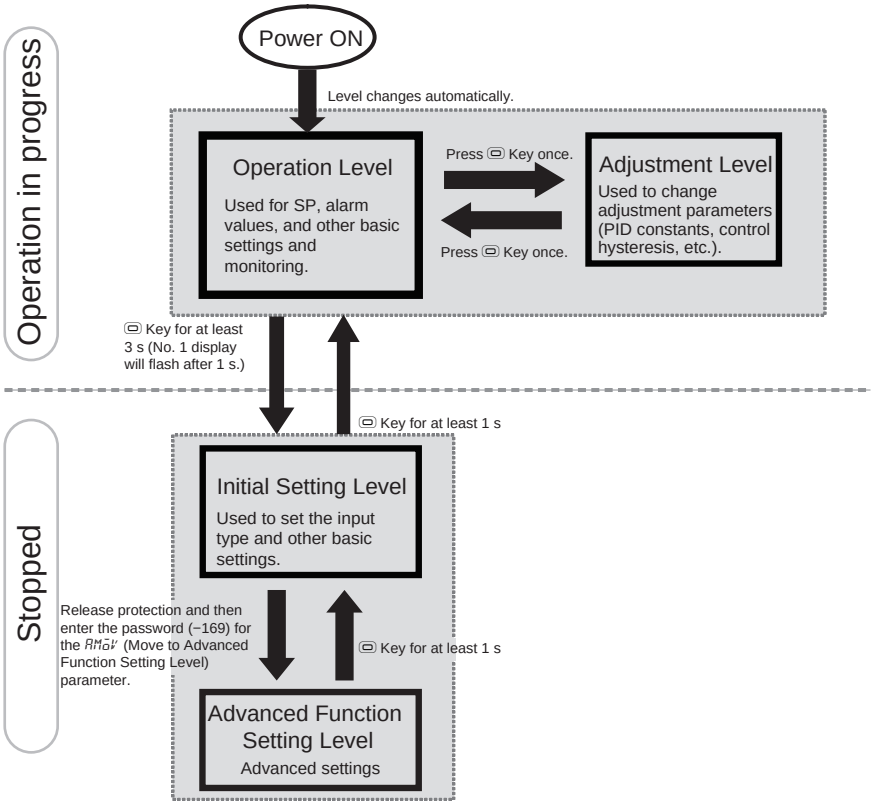



*1 To use a key procedure to move to Manual Control Level, set the Auto/Manual Select Addition parameter to ON and set the PF Setting parameter to A-M (Auto/Manual).

*2 The No. 1 display will flash when the keys are pressed for 1 s or longer.

## Basic Setting Levels

The following figure shows the basic setting levels (shaded).




### ● Operation Level

This level is displayed automatically when the power supply is turned ON.
This level is used for the SP, alarm values, and other basic settings and monitoring.
Normally, select this level for operation.

### ● Adjustment Level

This level is used to set the PID constants and to perform tuning, such as autotuning.
In Adjustment Level, the settings of the parameters can be changed during operation. This is not possible in the Initial Setting Level or Advanced Function Setting Level.

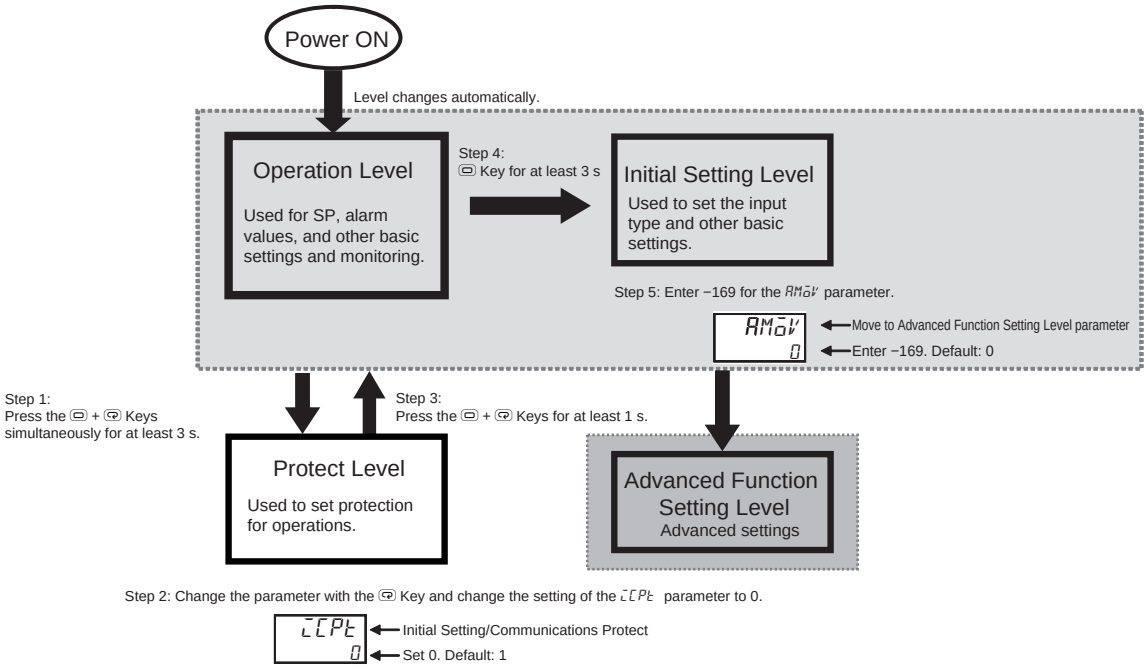
### ● Initial Setting Level

This level is used for the most basic settings.
It is used to set the input type and other parameters.
Use it to set the input type, alarm type, and other basic settings.

### ● Advanced Function Setting Level

This level is used for advanced settings.
Use it to assign functions to the control outputs and auxiliary outputs.
You will not be able to enter the Advanced Function Setting Level with the default settings.
To enter the Advanced Function Setting Level, first disable Initial Setting/Communications Protection and then enter the password (–169) at the AMOV (Move to Advanced Function Setting Level) parameter in the Initial Setting Level.

Use the following procedure to move to Advanced Function Setting Level.




Step 1: Move to Protect Level.

Step 2: Display CCPT (Initial Setting/Communications Protect) and set it to 0.

Step 3: Return to Operation Level.

Step 4: Return to Initial Setting Level.

Step 5: Display AMOV (Move to Advanced Function Setting Level) and then enter –169.

Steps 1 to 3 are necessary only the first time. Perform only steps 4 and 5 to move to Advanced Function Setting Level.

## Other Setting Levels

There are three other setting levels: Manual Control Level, Protect Level, and Communications Setting Level.

### ● Manual Control Level

This level is used to set the MV manually. With the default settings, you cannot move to the Manual Control Level.

- To use the PF Key to move to the Manual Control Level, change the setting of the PF Setting parameter to A-M.
- To use the Level Key on the Auto/Manual Switch Display to move to the Manual Control Level, set the Auto/Manual Switch Display Addition parameter in the Advanced Function Setting Level to ON.
- To use an event input to move to the Manual Control Level, change the setting of the Event Input Assignment 1 to 4 parameter to MANU.

### ● Protect Level

This level is used to restrict the operations that can be performed and the parameters that can be displayed with the front-panel keys. For example, you can prohibit changing the SP and other parameters in the Operation Level and Adjustment Level. You can move to the Protect Level from the Operation Level or the Adjustment Level. To move to the Advanced Function Setting Level, you must first cancel the protection that is set in the Protect Level.

## ● Communications Setting Level

This level is used to set the communications parameters. You can move to the Communications Setting Level from the Initial Setting Level.

# 3-4 Procedures after Turning ON the Power Supply

## 3-4-1 Basic Flow of Operations

The basic flow of operations after you turn ON the power supply is shown below.

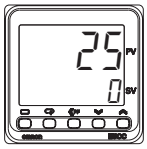
1. Turn ON the power supply.
↓
2. Set the input type.
↓
3. Set the control method.
↓
4. Set the alarm type.
↓
5. Set the set point.
↓
6. Set the alarm set values.

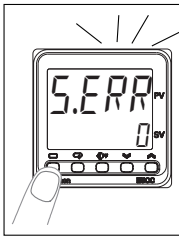
## 3-4-2 Basic Procedure

The basic procedure is given below.

### *1* Turn ON the power supply.

Operation Level

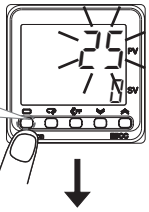



←S.ERR (input error) flashes on the display if a sensor is not connected or if the connected sensor is different from input type. Connect a sensor if one is not already connected.

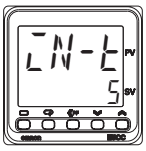
### *2* Set the input type.

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




←The display flashes.

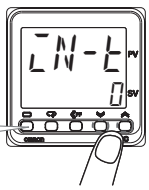
Initial Setting Level




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

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

Initial Setting Level




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

←Input Type: 0 (Pt100 resistance thermometer at −200 to 850 °C) (example)

Press the ▲ (Up) and ▼ (Down) Keys to change the value.

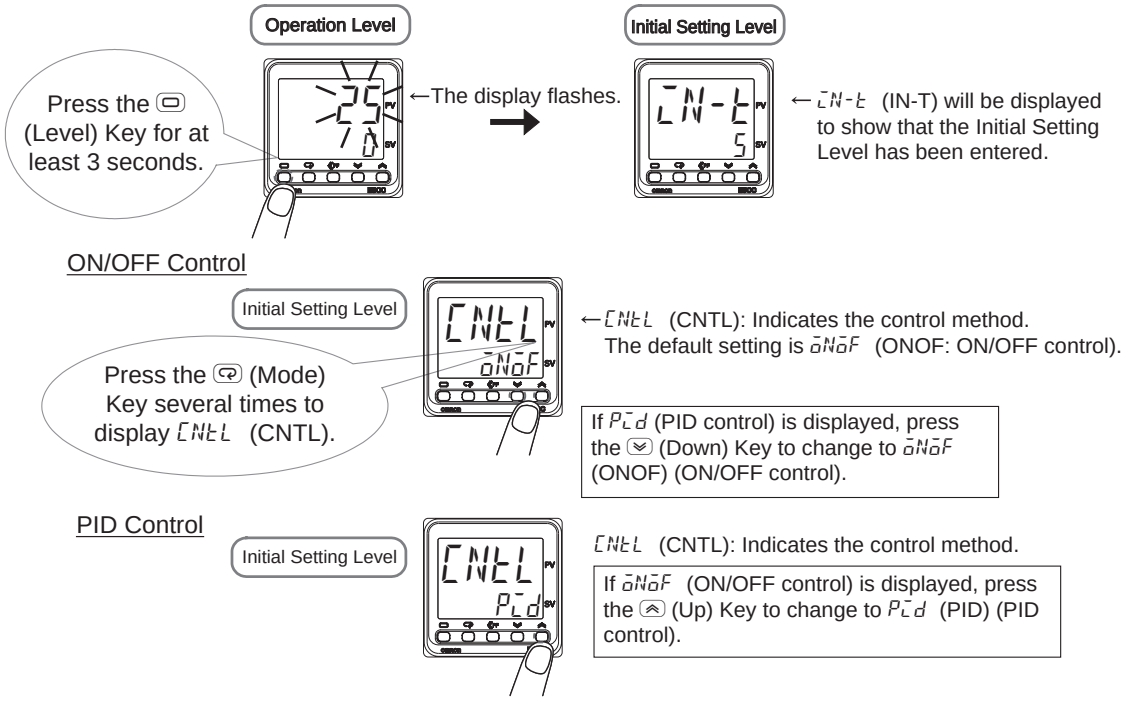
When you are finished, press the ▭ (Level) Key for at least 1 second to return to the operation display.

## List of Input Types

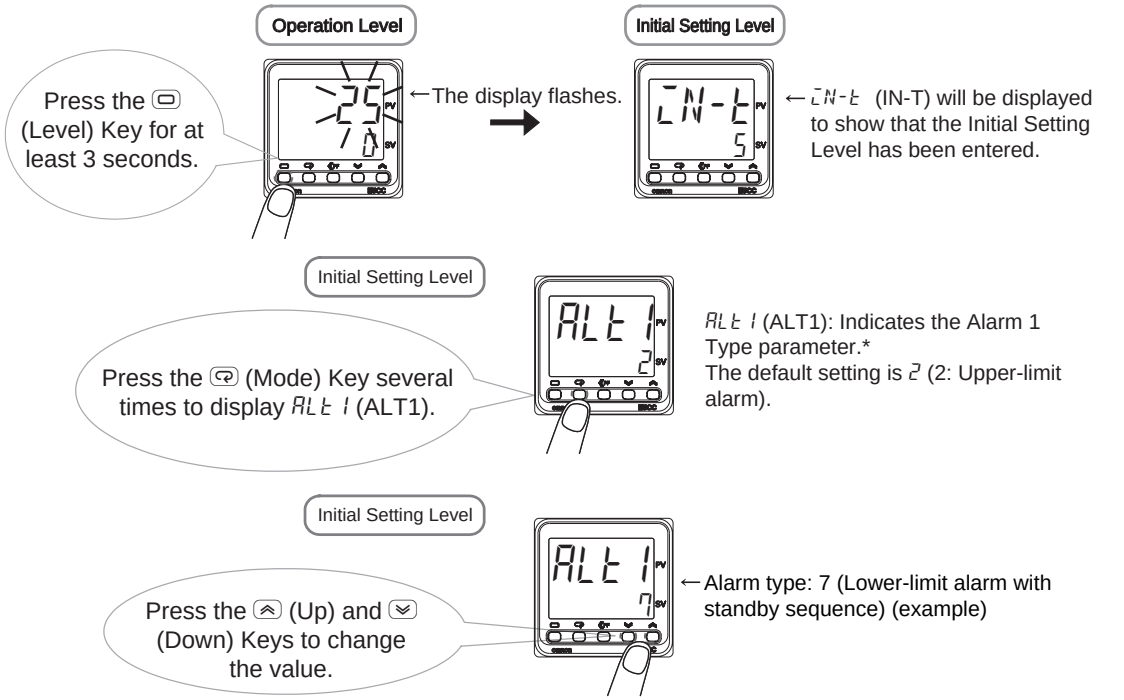
| Input type | Specifications | Set value | Temperature range in °C | Temperature range in °F |
|---|---|---|---|---|
| Resistance thermometer | Pt100 | 0 | –200 to 850 | –300 to 1500 |
| | | 1 | –199.9 to 500.0 | –199.9 to 900.0 |
| | | 2 | 0.0 to 100.0 | 0.0 to 210.0 |
| | JPt100 | 3 | –199.9 to 500.0 | –199.9 to 900.0 |
| | | 4 | 0.0 to 100.0 | 0.0 to 210.0 |
| Thermocouple | K | 5* | –200 to 1300 | –300 to 2300 |
| | | 6 | –20.0 to 500.0 | 0.0 to 900.0 |
| | J | 7 | –100 to 850 | –100 to 1500 |
| | | 8 | –20.0 to 400.0 | 0.0 to 750.0 |
| | T | 9 | –200 to 400 | –300 to 700 |
| | | 10 | –199.9 to 400.0 | –199.9 to 700.0 |
| | E | 11 | –200 to 600 | –300 to 1100 |
| | L | 12 | –100 to 850 | –100 to 1500 |
| | U | 13 | –200 to 400 | –300 to 700 |
| | | 14 | –199.9 to 400.0 | –199.9 to 700.0 |
| | N | 15 | –200 to 1300 | –300 to 2300 |
| | R | 16 | 0 to 1700 | 0 to 3000 |
| | S | 17 | 0 to 1700 | 0 to 3000 |
| | B | 18 | 100 to 1800 | 300 to 3200 |
| | W | 19 | 0 to 2300 | 0 to 3200 |
| | PLII | 20 | 0 to 1300 | 0 to 2300 |
| Infrared temperature sensor ES1B | 10 to 70°C | 21 | 0 to 90 | 0 to 190 |
| | 60 to 120°C | 22 | 0 to 120 | 0 to 240 |
| | 115 to 165°C | 23 | 0 to 165 | 0 to 320 |
| | 140 to 260°C | 24 | 0 to 260 | 0 to 500 |
| Current input | 4 to 20 mA | 25 | One of the following ranges according to the scaling:<br>–1999 to 9999<br>–199.9 to 999.9<br>–19.99 to 99.99<br>–1.999 to 9.999 | |
| | 0 to 20 mA | 26 | | |
| Voltage input | 1 to 5 V | 27 | | |
| | 0 to 5 V | 28 | | |
| | 0 to 10 V | 29 | | |

* The default is 5.

## 3 Set the control method.




## 4 Set the alarm type.

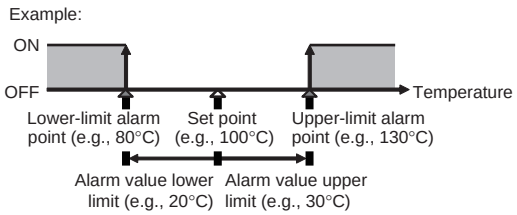
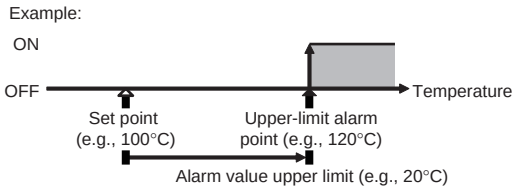
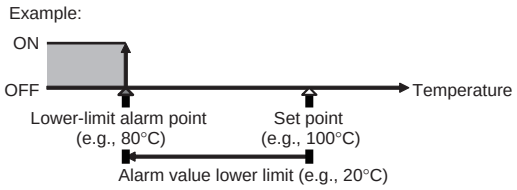
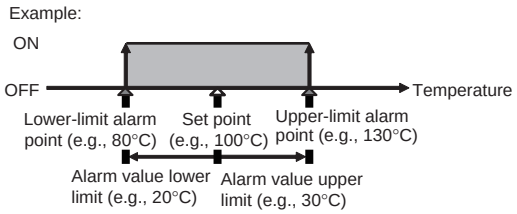
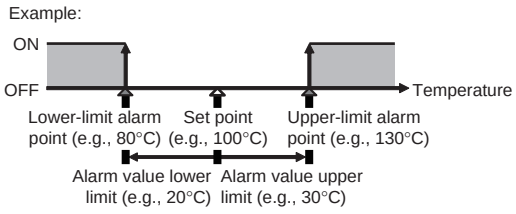
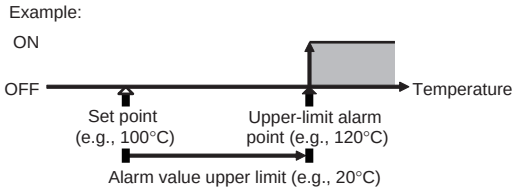
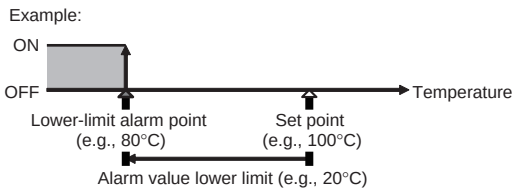


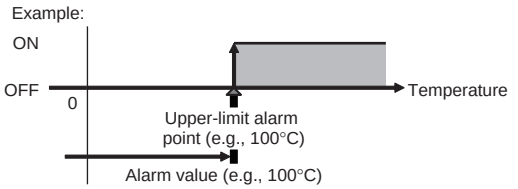
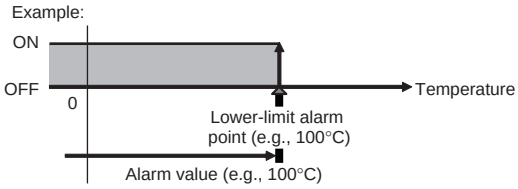
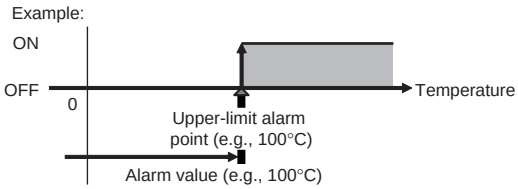
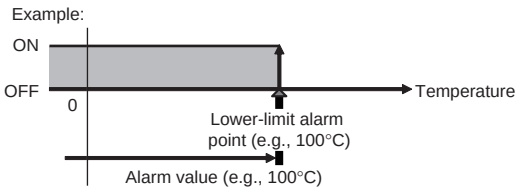
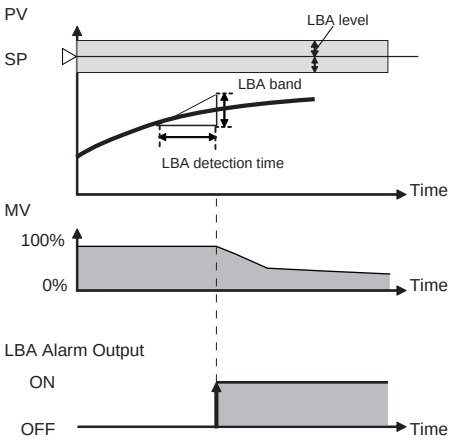

* If the Controller is equipped with HB/HS alarm detection, the Alarm 1 Type is not displayed for the default settings. To use alarm 1, set an output assignment to alarm 1.

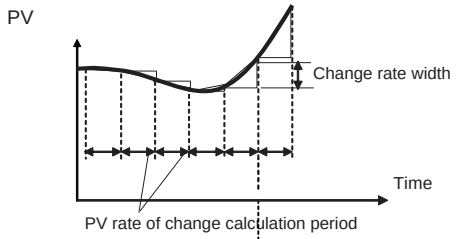
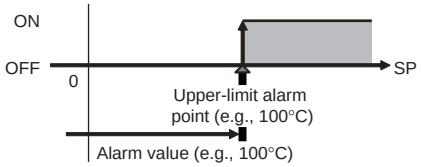
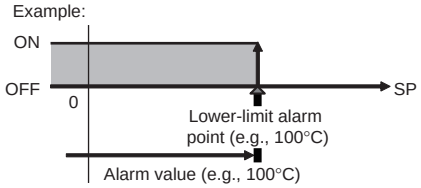
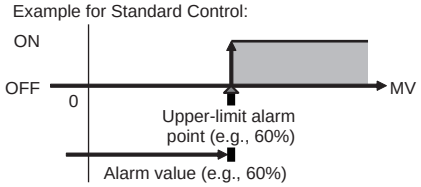
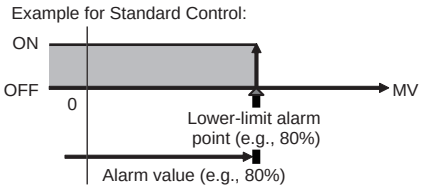
If required, use the (Mode) Key and the (Up) and (Down) Keys to repeat the procedure to set alarm types for AL2 (ALT2).

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

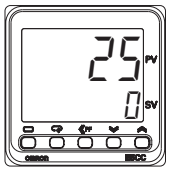
## Alarm Type Numbers

| Alarm type No. | Alarm type | Description | Operation |
|---|---|---|---|
| 0 | Alarm function OFF | There will be no alarm outputs. | --- |
| 1 | Upper- and lower-limit alarm | The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point or while the PV is equal to or lower than the lower-limit alarm point. |  |
| 2 | Upper-limit alarm | The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point. |  |
| 3 | Lower-limit alarm | The alarm output is ON while the PV is equal to or lower than the lower-limit alarm point. |  |
| 4 | Upper- and lower-limit range alarm | The alarm output is ON while the PV is equal to or lower than the upper-limit alarm point or equal to or higher than the lower-limit alarm point. |  |
| 5 | Upper- and lower-limit alarm with standby sequence | This alarm provides a standby sequence.<br>The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point or while the PV is equal to or lower than the lower-limit alarm point. |  |
| 6 | Upper-limit alarm with standby sequence | This alarm provides a standby sequence.<br>The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point. |  |
| 7 | Lower-limit alarm with standby sequence | This alarm provides a standby sequence.<br>The alarm output is ON while the PV is equal to or lower than the lower-limit alarm point. |  |

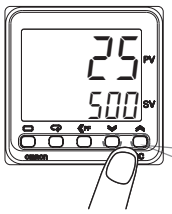
| Alarm type No. | Alarm type | Description | Operation |
|---|---|---|---|
| 8 | Absolute-value upper-limit alarm | The alarm output is ON while the PV is equal to or higher than the alarm value. |  |
| 9 | Absolute-value lower-limit alarm | The alarm output is ON while the PV is equal to or lower than the alarm value. |  |
| 10 | Absolute-value upper-limit alarm with standby sequence | This alarm provides a standby sequence.<br>The alarm output is ON while the PV is equal to or higher than the alarm value. |  |
| 11 | Absolute-value lower-limit alarm with standby sequence | This alarm provides a standby sequence.<br>The alarm output is ON while the PV is equal to or lower than the alarm value. |  |
| 12 | Loop Burnout Alarm (LBA) (Valid only for alarm 1.) | The alarm output turns ON when the control loop is broken. | There is assumed to be a loop burnout alarm if the control deviation (SP – PV) is greater than the threshold set in the LBA Level parameter and if the PV is not reduced by at least the value set in the LBA Band parameter within a specific period of time. The LBA detection time and LBA band are set in parameters.<br>  |

| Alarm type No. | Alarm type | Description | Operation |
|---|---|---|---|
| 13 | PV change rate alarm | The alarm output turns ON if the change in the PV within the specified calculation period exceeds a specific width. |  <br>PV Change Rate Alarm Output<br>  <br>The PV rate of change calculation period and the alarm value are set in parameters. |
| 14 | SP absolute-value upper-limit alarm | The alarm output is ON while the SP is equal to or higher than the alarm value. | Example:<br>  |
| 15 | SP absolute-value lower-limit alarm | The alarm output is ON while the SP is equal to or lower than the alarm value. | Example:<br>  |
| 16 | MV absolute-value upper-limit alarm | The alarm output is ON while the MV is equal to or higher than the alarm value. | Example for Standard Control:<br>  |
| 17 | MV absolute-value lower-limit alarm | The alarm output is ON while the MV is equal to or lower than the alarm value. | Example for Standard Control:<br>  |

## 5 Set the set point.




Operation Display




Set point: 500°C (example)

Press the ▲ (Up) and ▼ (Down) Keys and the PF (Shift) Key to change the value.

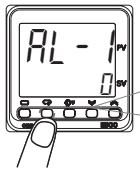
*Hold the ▲ (Up) or ▼ (Down) Key to increment or decrement the value quickly.

## 6 Set the alarm set value or values.

Change the parameter that is displayed with the ↺ (Mode) Key.

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

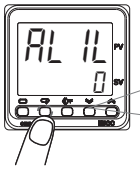
Operation Level




Press the ↺ (Mode) Key several times to display AL - 1 (AL-1).

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


To set the alarm value upper limit, press the ↺ (Mode) Key several times to display AL 1H (AL1H).




To set the alarm value lower limit, press the ↺ (Mode) Key several times to display AL 1L (AL1L).

This concludes the procedure to set the input type, alarm type, control method, set point, and alarm set values.

# A

# Appendices

# A-1 Specifications

## A-1-1 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** | **E5CC** | | Option number 800: 5.2 VA max.<br>Other option numbers: 6.5 VA max. | Option number 800: 3.1 VA max./1.6 W max.<br>Other option numbers: 4.1 VA max./2.3 W max. |
| | **E5EC** | | Option number 800: 6.6 VA max.<br>Other option numbers: 8.3 VA max. | Option number 800: 4.1 VA max./2.3 W max.<br>Other option numbers: 5.5 VA max./3.2 W max. |
| **Sensor input** *1 | | | Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII<br>Platinum resistance thermometer: Pt100, JPt100<br>Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C<br>Current input *2: 4 to 20 mA, 0 to 20 mA (Input impedance: 150 Ω max.)<br>Voltage input *2: 1 to 5 V, 0 to 5 V, 0 to 10 V (Input impedance: 1 MΩ min.) | |
| **Control output 1/2** | **Relay output** | **E5CC** | SPST-NO, 250 VAC, 3 A (resistive load), electrical durability: 100,000 operations<br>Min. applicable load: 5 V, 10 mA | |
| | | **E5EC** | SPST-NO, 250 VAC, 5 A (resistive load), electrical durability: 100,000 operations<br>Min. applicable load: 5 V, 10 mA | |
| | **Voltage output** | **E5CC** | Output voltage 12 VDC ±20% (PNP), max. load current 21 mA, with short-circuit protection circuit | |
| | | **E5EC** | Output voltage 12 VDC ±20% (PNP), max. load current 40 mA, with short-circuit protection circuit (21 mA if there are two control outputs) | |
| | **Current output** | | 4 to 20 mA DC, 0 to 20 mA DC, Load: 500 Ω max.<br>Resolution: Approx. 10,000 | |
| **Auxiliary output** | **Relay outputs** | | SPST-NO, 250 VAC, 3 A (resistive load), electrical durability: 100,000 operations<br>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 digital displays and individual indicators | |
| **Other functions** | | | Depend on the model | |
| **Ambient temperature** | | | –10 to 55°C (with no condensation or icing); with 3-year guarantee: –10 to 50°C | |
| **Ambient humidity** | | | 25% to 85% | |
| **Storage temperature** | | | –25 to 65°C (with no condensation or icing) | |
| **Altitude** | | | 2,000 m max. | |
| **Recommended fuse** | | | T2A, 250 VAC, time lag, low shut-off capacity | |
| **Installation environment** | | | Installation Category II, Pollution Class 2 (IEC 61010-1 compliant) | |

*1 For input setting ranges, refer to *A-6 Sensor Input Setting Range, Indication Range, Control Range*.

*2 When connecting the ES2-HB/THB, connect it 1:1.

### ● HB and HS Alarms

(E5CC/E5EC Models with HB and HS Alarms)

| | |
|---|---|
| **Max. heater current** | 50 A AC |
| **Input current readout accuracy** | ±5% FS ±1 digit max. |
| **Heater burnout alarm setting range** | 0.1 to 49.9 A (0.1 A units)<br>0.0 A: Heater burnout alarm output turns OFF.<br>50.0 A: Heater burnout alarm output turns ON.<br>Min. detection ON time *1: 30 ms for a control period of 0.1 s or 0.2 s<br>100 ms for a control period of 0.5 s or 1 to 99 s |
| **Heater short alarm setting range** | 0.1 to 49.9 A (0.1 A units)<br>0.0 A: Heater short alarm output turns ON.<br>50.0 A: Heater short alarm output turns OFF.<br>Min. detection OFF time *2: 35 ms for a control period of 0.1 s or 0.2 s<br>100 ms for a control period of 0.5 s or 1 to 99 s |

*1 HB alarms are not detected and the heater power is not measured if the ON time for the control output for heating is 100 ms or less (30 ms or less if the control period is 0.1 or 0.2 s).

*2 HS alarms are not detected and the leakage power is not measured if the ON time for the control output for heating is 100 ms or less (35 ms or less if the control period is 0.1 or 0.2 s).

## A-1-2 Characteristics

| | | | | |
|---|---|---|---|---|
| **Indication accuracy (ambient temperature of 23°C)** | **Thermocouple** *1 | (±0.3% of PV or ±1°C, whichever is greater) ±1 digit max. | | |
| | **Resistance thermometer** | (±0.2% of PV or ±0.8°C, whichever is greater) ±1 digit max. | | |
| | **Analog input** | ±0.2% FS ±1 digit max. | | |
| | **CT input** | ±5% FS ±1 digit max. | | |
| **Temperature variation influence** *2<br>**Voltage variation influence** *2 | **Thermocouple** | Thermocouple (R, S, B, W, PLII)<br>(±1% of PV or ±10°C, whichever is greater) ±1 digit max.<br>Other thermocouples:<br>(±1% of PV or ±4°C, whichever is greater) ±1 digit max.<br>*K thermocouple at –100°C max: ±10°C max. | | |
| | **Resistance thermometer** | (±1% of PV or ±2°C, whichever is greater) ±1 digit max. | | |
| | **Analog input** | ±1% FS ±1 digit max. | | |
| | **CT input** | ±5% FS ±1 digit max. | | |
| **Hysteresis** | **Temperature input** | 0.1 to 999.9°C or °F (in units of 0.1°C or °F) | | |
| | **Analog input** | 0.01% to 99.99% FS (in units of 0.01% FS) | | |
| **Proportional band (P)** | **Temperature input** | 0.1 to 999.9°C or °F (in units of 0.1°C or °F) | | |
| | **Analog input** | 0.1% to 999.9% FS (in units of 0.1% FS) | | |
| **Integral time (I)** *3 | | 0 to 9,999 s (in units of 1 s)<br>0.0 to 999.9 s (in units of 0.1 s) | | |
| **Derivative time (D)** *3 | | 0 to 9,999 s (in units of 1 s)<br>0.0 to 999.9 s (in units of 0.1 s) | | |
| **Control Period** | | 0.1, 0.2, 0.5, or 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 cycle** | | 50 ms | | |
| **Insulation resistance** | | 20 MΩ min. (at 500 VDC) | | |
| **Dielectric strength** | | 2,300 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, 20 $m/s^2$ 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** | **E5CC** | Approx. 120 g | Adapter:<br>Approx. 10 g | Terminal cover:<br>Approx. 0.5 g each |
| | **E5EC** | Approx. 210 g | Adapter:<br>Approx. 4 g × 2 | Terminal Cover:<br>Approx. 1 g each |
| **Degree of protection** | | Front panel: IP66, rear case: IP20, terminals: IP00 | | |
| **Memory protection** | | Non-volatile memory (number of writes: 1,000,000) | | |

*1 The indication accuracy of K, T, and N thermocouples at a temperature of –100°C or less is ±2°C ±1 digit maximum.
The indication accuracy of U and L thermocouples is ±2°C ±1 digit maximum.
The indication accuracy of B thermocouples at a temperature of 400°C or less is not specified.
The indication accuracy of B thermocouples at a temperature of 400 to 800°C is ±3°C maximum.
The indication accuracy of R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.
The indication accuracy of W thermocouples is (±0.3% of PV or ±3°C, whichever is greater) ±1 digit maximum.
The indication accuracy of PLII thermocouples is (±0.3% of PV or ±2°C, whichever is greater) ±1 digit maximum.

*2 Ambient temperature: –10°C to 23°C to 55°C
Voltage range: –15 to +10% of rated voltage

*3 The unit is determined by the setting of the Integral/Derivative Time Unit parameter.

## A-1-3 Rating and Characteristics of Options

| | |
|---|---|
| **Event inputs** | Contact Input<br>ON: 1 kΩ max., OFF: 100 kΩ min. |
| | Non-contact Input<br>ON: Residual voltage 1.5 V max.; OFF: Leakage current 0.1 mA max. |
| **Communications** | Transmission path: RS-485 |
| | Communications method: RS-485 (2-wire, half duplex) |
| | Synchronization: Start-stop |
| | Baud rate: 9.6, 19.2, 38.4, or 57.6 kbps |

## A-1-4 Waterproof Packing

If the Waterproof Packing is lost or damage, order one of the following models.

| **Y92S-P8 (for DIN 48 × 48)** | **Y92S-P9 (for DIN 48 × 96)** |
|---|---|
|  |  |

# A-2 Current Transformer (CT)

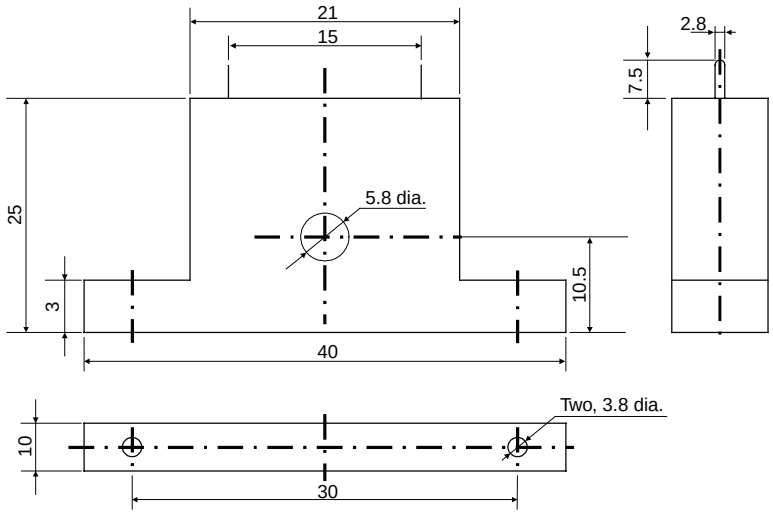
## A-2-1 Specifications

| Item | Specifications | |
|---|---|---|
| **Model number** | **E54-CT1** | **E54-CT3** |
| **Max. continuous current** | 50 A | 120 A *1 |
| **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) |

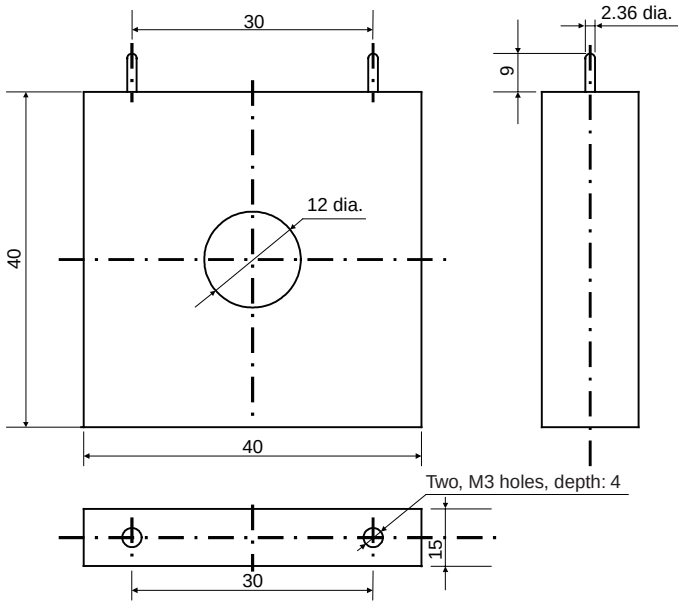
*1 The maximum continuous current of the E5CC/E5EC is 50 A.

## A-2-2 Dimensions (Unit: mm)

- E54-CT1




- E54-CT3



# A-3 Error Displays

When an error occurs, the error contents are shown on the No. 1 or the No. 2 display.
This section describes how to check error codes on the display, and the actions to be taken to remedy the problems.

## 5.ERR Input Error

### ● Meaning

The input value has exceeded the control range. *
The input type setting is not correct.
The sensor is disconnected or shorted.
The sensor wiring is not correct.
The sensor is not wired.

* 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.

Note: With resistance thermometer input, a break in the A, B, or B' line is regarded as a disconnection.

### ● Operation

After an error occurs, the error is displayed and the alarm outputs function as if the upper limit has been exceeded.
If an input error is assigned to a control output or auxiliary output, the output will turn ON when the input error occurs. The error message will appear in the display for the PV.

Note: The heating and cooling control outputs will turn OFF. When the manual MV is set, the control output is determined by the set value.

## cccc / ɔɔɔɔ — 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.

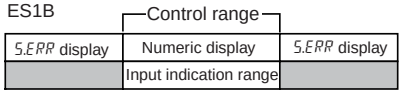
The display ranges are shown below (with decimal points omitted).

- When less than –1,999: cccc
- When more than 9,999: ɔɔɔɔ

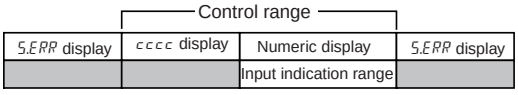
### ● Operation

Control continues, allowing normal operation. The value will appear in the display for the PV.

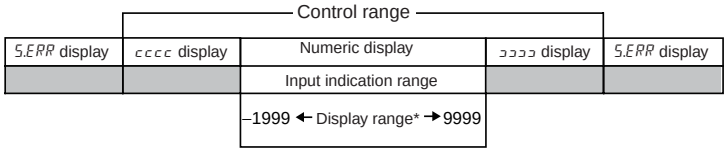
Resistance thermometer input (Except for models with a setting range of –199.9 to 500.0°C)
Thermocouple input (Except for models with a setting range of –199.9 to 400.0°C)
ES1B



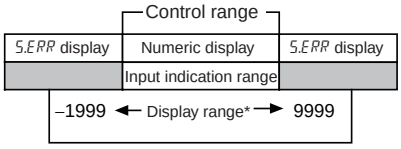

Resistance thermometer input (Except for models with a setting range of –1999. to 500.0°C)
Thermocouple input (Except for models with a setting range of –199.9 to 400.0°C)




Analog Input
• When display range < control range




Analog Input
• When display range ≥ control range




*The display range is shown in numbers with decimal points omitted.

## E333 — AD Converter Error

### ● 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

The control and auxiliary outputs turn OFF. (A current output will be approx. 0 mA.)

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

The control and auxiliary outputs turn OFF. (A current output will be approx. 0 mA.)

FFFF **Current Value Exceeds**

## ● Meaning

This error is displayed when the heater current value exceeds 55.0 A.

## ● Operation

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

CE1 **HB Alarm**
LCR1 **HS Alarm**

## ● Meaning

If there is an HB or HS alarm, the relevant parameter will flash on the No. 1 display.

## ● Operation

The relevant Heater Current 1 Value Monitor or Leakage Current 1 Monitor in the Operation or Adjustment Level will flash on the No. 1 display. However, control continues and operation is normal.

# A-4 Troubleshooting

## Checking Problems

If the Digital 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 |
|---|---|---|---|
| Turning ON the power for the first time | The TUNE indicator will flash. | ST (self-tuning) is in progress (default setting: ON). | This is not a product fault.<br>The TUNE indicator flashes during self-tuning. |
| | Temperature error is large.<br>Input error (S.Err display) | Input type mismatch | Check the sensor type and reset the input type correctly. |
| | | Thermometer is not installed properly. | Check the thermometer installation location and polarity and install correctly. |
| | Communications are not possible.* | Non-recommended adapter is being used. | Make sure that the connected device is not faulty. |
| During operation | Overshooting<br>Undershooting<br>Hunting | ON/OFF control is enabled (default: ON/OFF control selected). | Select PID control and execute either ST (self-tuning) or AT (auto-tuning).<br>When using self-tuning, turn ON the power supply to the Digital 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 Digital Controller. |
| | | Control period is longer compared with the speed of rise and fall in temperature. | Shorten the control period. A shorter control period improves control performance, but a cycle of 20 ms minimum is recommended in consideration of the service life of the relays. |
| | | Unsuitable PID constant | Set appropriate PID constants using either of the following methods.<br>• Execute AT (autotuning).<br>• Set PID constants individually using manual settings. |
| | | SSR operation fault | Use bleeder resistance if the problem is due to leakage current. Also investigate the errors detected by the HS alarm function. |
| | Temperature is not rising | Specified operation is unsuitable for required control (default: Reverse operation). | Select either forward or reverse operation depending on the required control. Reverse operation is used for heating operations. |
| | | Heater is burnt out or deteriorated. | Check whether heater burnout or deterioration have occurred. Also investigate the errors detected by the heater burnout alarm. |
| | | 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 Digital Controller. |

* Refer to the *E5CC/E5EC Digital Temperature Controllers Communications Manual* (Cat. No. H175) for details.

| Timing | Status | Meaning | Countermeasures |
|---|---|---|---|
| During operation (continued) | 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. |
| | | Specified operation is unsuitable for required control (default: Reverse operation). | Select either forward or reverse operation depending on the required control. Reverse operation is used for heating operations. |
| | | A high hysteresis is set for ON/OFF operation (default: 1.0°C) | Set a suitable value for the hysteresis. |
| | 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. |
| | 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 wire them using a more direct path. |
| | | Connection between the Digital 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. | Make sure that the location that is being measured with the temperature sensor 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. |
| | Keys will not operate | Setting change protect is ON. | Turn OFF setting change protect. |
| | Cannot shift levels | Operations limited due to protection. | Set the operation/adjustment protect, initial setting/communications protect, and setting change protect values as required. |
| After long service life | Control is unstable | Terminal screws may be loose. | Retighten terminal screws to a torque of 0.43 to 0.58 N·m. |
| | | The internal components have reached the end of their service life. | The Digital 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 Digital Controller and all other Digital Controllers purchased in the same time period. |

### 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. | Connect 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 for RS-485 is 500 m max. |
| The wrong communications cable has been used. | Use a shielded, AWG24 to AWG18 (cross-sectional area of 0.205 to 0.823 $mm^2$) twisted-pair cable for the communications cable. |
| More than the specified number of communications devices are connected to the same communications path. | When 1:N communications are used, a maximum of 32 nodes may be connected, including the host node. |
| An end node has not been set at each end of the communications line. | Set or connect terminating resistance at each end of the line. If the E5CC/E5EC is the end node, 120-Ω (1/2-W) terminating resistance is used. Be sure that the combined resistance with the host device is 54 Ω minimum. |
| 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. | 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. | 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. |
| 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.<br>Separate the communications cable from the source of noise.<br>Use a shielded, twisted-pair cable for the communications cable.<br>Use as short a communications cable as possible, and do not lay or loop extra cable.<br>To prevent inductive noise, do not run the communications cable parallel to a power line.<br>If noise countermeasures are difficult to implement, use an Optical Interface. |

* Refer to the *E5CC/E5EC Digital Temperature Controllers Communications Manual* (Cat. No. H175) for details.

# A-5 Parameter Operation Lists

## A-5-1 Operation Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Process Value | | Temperature: According to indication range for each sensor.<br>Analog: Scaling lower limit<br>–5% FS to Scaling upper limit +5% FS | | | EU |
| Set Point | | SP lower limit to SP upper limit | | 0 | EU |
| Multi-SP Set Point Selection | M-SP | 0 to 7 | | 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 | All alarms except for MV absolute-value upper-limit or lower-limit alarms: –1,999 to 9,999 | | 0 | EU |
| | | MV absolute-value upper-limit or lower-limit alarms: –199.9 to 999.9 | | 0.0 | % |
| Alarm Value Upper Limit 1 | AL1H | –1,999 to 9,999 | | 0 | EU |
| Alarm Value Lower Limit 1 | AL1L | –1,999 to 9,999 | | 0 | EU |
| Alarm Value 2 | AL-2 | All alarms except for MV absolute-value upper-limit or lower-limit alarms: –1,999 to 9,999 | | 0 | EU |
| | | MV absolute-value upper-limit or lower-limit alarms: –199.9 to 999.9 | | 0.0 | % |
| Alarm Value Upper Limit 2 | AL2H | –1,999 to 9,999 | | 0 | EU |
| Alarm Value Lower Limit 2 | AL2L | –1,999 to 9,999 | | 0 | EU |
| Alarm Value 3 | AL-3 | All alarms except for MV absolute-value upper-limit or lower-limit alarms: –1,999 to 9,999 | | 0 | EU |
| | | MV absolute-value upper-limit or lower-limit alarms: –199.9 to 999.9 | | 0.0 | % |
| Alarm Value Upper Limit 3 | AL3H | –1,999 to 9,999 | | 0 | EU |
| Alarm Value Lower Limit 3 | AL3L | –1,999 to 9,999 | | 0 | EU |
| Alarm Value 4 | AL-4 | All alarms except for MV absolute-value upper-limit or lower-limit alarms: –1,999 to 9,999 | | 0 | EU |
| | | MV absolute-value upper-limit or lower-limit alarms: –199.9 to 999.9 | | 0.0 | % |
| Alarm Value Upper Limit 4 | AL4H | –1,999 to 9,999 | | 0 | EU |
| Alarm Value Lower Limit 4 | AL4L | –1,999 to 9,999 | | 0 | EU |
| MV Monitor (Heating) | o | –5.0 to 105.5 (standard)<br>0.0 to 105.0 (heating/cooling) | | | % |
| MV Monitor (Cooling) | C-o | 0.0 to 105.0 | | | % |

## A-5-2 Adjustment Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| AT Execute/Cancel | AT | OFF, AT Cancel<br>AT-2: 100%AT Execute<br>AT-1: 40%AT Execute | OFF, AT-2, AT-1 | OFF | None |
| Communications Writing | CMWT | OFF, ON | OFF, ON | OFF | None |
| Heater Current 1 Value Monitor | CT1 | 0.0 to 55.0 | | | A |
| Heater Burnout Detection 1 | HB1 | 0.0 to 50.0 | | 0.0 | A |
| Leakage Current 1 Monitor | LCR1 | 0.0 to 55.0 | | | 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 |
| SP 4 | SP-4 | SP lower limit to SP upper limit | | 0 | EU |
| SP 5 | SP-5 | SP lower limit to SP upper limit | | 0 | EU |
| SP 6 | SP-6 | SP lower limit to SP upper limit | | 0 | EU |
| SP 7 | SP-7 | SP lower limit to SP upper limit | | 0 | EU |
| Process Value Input Shift | INS | Temperature input: –199.9 to 999.9 | | 0.0 | °C or °F |
| | | Analog input: –1,999 to 9,999 | | 0 | EU |
| Proportional Band | P | Temperature input: 0.1 to 999.9 | | 8.0 | °C or °F |
| | | Analog input: 0.1 to 999.9 | | 10.0 | %FS |
| Integral Time | I | Integral/Derivative Time Unit of 1 s: 0 to 9,999<br>Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9 | | 233<br>233.0 | Seconds |
| Derivative Time | d | Integral/Derivative Time Unit of 1 s: 0 to 9,999<br>Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9 | | 40<br>40.0 | Seconds |
| Proportional Band (Cooling) | C-P | Temperature input: 0.1 to 999.9 | | 8.0 | °C or °F |
| | | Analog input: 0.1 to 999.9 | | 10.0 | %FS |
| Integral Time (Cooling) | C-I | Integral/Derivative Time Unit of 1 s: 0 to 9,999<br>Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9 | | 233<br>233.0 | Seconds |
| Derivative Time (Cooling) | C-d | Integral/Derivative Time Unit of 1 s: 0 to 9,999<br>Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9 | | 40<br>40.0 | Seconds |
| Dead Band | C-db | Temperature input: –199.9 to 999.9 | | 0.0 | °C or °F |
| | | 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 | Temperature input: 0.1 to 999.9 | | 1.0 | °C or °F |
| | | Analog input: 0.01 to 99.99 | | 0.10 | %FS |
| Hysteresis (Cooling) | CHYS | Temperature input: 0.1 to 999.9 | | 1.0 | °C or °F |
| | | Analog input: 0.01 to 99.99 | | 0.10 | %FS |
| SP Ramp Set Value | SPRT | OFF, 1 to 9,999 | OFF, 1 to 9999 | OFF | EU/s, EU/min, EU/h |
| MV Upper Limit | oL-H | MV lower limit +0.1 to 105.0 (standard)<br>0.0 to 105.0 (heating/cooling) | | 100.0 | % |
| MV Lower Limit | oL-L | –5.0 to MV upper limit –0.1 (standard)<br>–105.0 to 0.0 (heating/cooling) | | 0.0 (standard)<br>–100.0 (heating/cooling) | % |

## A-5-3 Initial Setting Level

| Parameters | Characters | Setting (monitor) value | | Display | Default | Unit |
|---|---|---|---|---|---|---|
| Input Type | in-t | Temperature input | 0: Pt100<br>1: Pt100<br>2: Pt100<br>3: JPt100<br>4: JPt100<br>5: K<br>6: K<br>7: J<br>8: J<br>9: T<br>10: T<br>11: E<br>12: L<br>13: U<br>14: U<br>15: N<br>16: R<br>17: S<br>18: B<br>19: W<br>20: PLII<br>21: 10 to 70°C<br>22: 60 to 120°C<br>23: 115 to 165°C<br>24: 140 to 260°C | | 5 | None |
| | | Analog input | 25: 4 to 20 mA<br>26: 0 to 20 mA<br>27: 1 to 5 V<br>28: 0 to 5 V<br>29: 0 to 10 V | | 5 | 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 | 0 to 3 | | | 0 | None |
| Temperature Unit | d-U | °C, °F | | C, F | °C | None |
| SP Upper Limit | SL-H | Temperature input: SP lower limit + 1 to Input setting range upper limit | | | 1300 | EU |
| | | Analog input: SP lower limit + 1 to scaling upper limit | | | 100 | |
| SP Lower Limit | SL-L | Temperature input: Input setting range lower limit to SP upper limit – 1 | | | –200 | EU |
| | | Analog input: Scaling lower limit to SP upper limit – 1 | | | 0 | |
| PID ON/OFF | CNTL | 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 | 0.1, 0.2, 0.5, or 1 to 99 | | 0.1, 0.2, 0.5, 1 to 99 | Relay output: 20<br>Voltage output (for driving SSR): 2 | Seconds |
| Control Period (Cooling) | C-CP | 0.1, 0.2, 0.5, or 1 to 99 | | 0.1, 0.2, 0.5, 1 to 99 | Relay output: 20<br>Voltage output (for driving SSR): 2 | Seconds |
| Direct/Reverse Operation | oREV | Reverse operation, direct operation | | oR-R, oR-d | Reverse operation | None |

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Alarm 1Type | AL1t | 0: Alarm function OFF<br>1: Upper and lower-limit alarm<br>2: Upper-limit alarm<br>3: Lower-limit alarm<br>4: Upper and lower-limit range alarm<br>5: Upper- and lower-limit alarm with standby sequence<br>6: Upper-limit alarm with standby sequence<br>7: Lower-limit alarm with standby sequence<br>8: Absolute-value upper-limit alarm<br>9: Absolute-value lower-limit alarm<br>10: Absolute-value upper-limit alarm with standby sequence<br>11: Absolute-value lower-limit alarm with standby sequence<br>12: LBA (Loop Burnout Alarm)<br>13: PV change rate alarm<br>14: SP absolute-value upper-limit alarm<br>15: SP absolute-value lower-limit alarm<br>16: MV absolute-value upper-limit alarm<br>17: MV absolute-value lower-limit alarm | | 2 | None |
| Alarm 1 Hysteresis | AL1H | Temperature input: 0.1 to 999.9 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.2 | °C or °F |
| | | Analog input: 0.01 to 99.99 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.02 | %FS |
| | | 0.01 to 99.99 for MV absolute-value upper-limit or MV lower-limit alarms | | 0.50 | % |
| Alarm 2 Type | AL2t | Same as Alarm 1 Type except that 12 (LBA) cannot be set. | | 2 | None |
| Alarm 2 Hysteresis | AL2H | Temperature input: 0.1 to 999.9 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.2 | °C or °F |
| | | Analog input: 0.01 to 99.99 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.02 | %FS |
| | | 0.01 to 99.99 for MV absolute-value upper-limit or MV lower-limit alarms | | 0.50 | % |
| Alarm 3 Type | AL3t | Same as Alarm 1 Type except that 12 (LBA) cannot be set. | | 2 | None |
| Alarm 3 Hysteresis | AL3H | Temperature input: 0.1 to 999.9 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.2 | °C or °F |
| | | Analog input: 0.01 to 99.99 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.02 | %FS |
| | | 0.01 to 99.99 for MV absolute-value upper-limit or MV lower-limit alarms | | 0.50 | % |
| Alarm 4 Type | AL4t | Same as Alarm 1 Type except that 12 (LBA) cannot be set. | | 2 | None |
| Alarm 4 Hysteresis | AL4H | Temperature input: 0.1 to 999.9 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.2 | °C or °F |
| | | Analog input: 0.01 to 99.99 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms | | 0.02 | %FS |
| | | 0.01 to 99.99 for MV absolute-value upper-limit or MV lower-limit alarms | | 0.50 | % |
| Control Output 1 Signal | o15t | 4-20: 4-20 mA<br>0-20: 0-20 mA | 4-20, 0-20 | 4-20 | None |

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Event Input Assignment 1 | EV-1 | NONE: None<br>STOP: RUN/STOP<br>MANU: Auto/Manual Switch<br>PRST: Program Start *1<br>DRS: Invert Direct/Reverse Operation<br>AT-2: 100% AT Execute/Cancel<br>AT-1: 40% AT Execute/Cancel *2<br>WTPT: Setting Change Enable/Disable<br>CMWT: Communications write enable/disable*3<br>LAT: Alarm Latch Cancel<br>MSP0: Multi-SP No. switching bit 0<br>MSP1: Multi-SP No. switching bit 1<br>MSP2: Multi-SP No. switching bit 2 | NONE<br>STOP<br>MANU<br>PRST<br>dRS<br>AT-2<br>AT-1<br>WTPT<br>CMWT<br>LAT<br>MSP0<br>MSP1<br>MSP2 | MSP0 | None |
| Event Input Assignment 2 | EV-2 | Same as Event Input Assignment 1. | Same as Event Input Assignment 1. | STOP | None |
| Event Input Assignment 3 | EV-3 | Same as Event Input Assignment 1. | Same as Event Input Assignment 1. | NONE | None |
| Event Input Assignment 4 | EV-4 | Same as Event Input Assignment 1. | Same as Event Input Assignment 1. | NONE | None |
| Move to Advanced function Setting Level | AMOV | –1,999 to 9,999 | | 0 | None |

*1 Any settings that are entered will be ignored.

*2 This function can be set for heating/cooling control, but the function will be disabled.

*3 These settings can be used only for models with communications.

## A-5-4 Manual Control Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Manual MV | | –5.0 to 105.0 (standard)<br>–105.0 to 105.0 (heating/cooling) | | 0.0 | % |

## A-5-5 Advanced Function Setting Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Parameter Initialization | INIT | OFF, FACT | OFF, FACT | OFF | None |
| Number of Multi-SP Points | MSPU | OFF(1), 2 to 8 | OFF, 2 to 8 | OFF | None |
| SP Ramp Time Unit | SPRU | S: EU/second<br>M: EU/minute<br>H: EU/hour | S, M, H | M | None |
| Standby Sequence Reset | RESE | Condition A, condition B | A, b | Condition A | None |
| Auxiliary Output 1 Open in Alarm | Sb 1N | N-O: Close in alarm<br>N-C: Open in alarm | N-O, N-C | N-O | None |
| Auxiliary Output 2 Open in Alarm | Sb2N | N-O: Close in alarm<br>N-C: Open in alarm | N-O, N-C | N-O | None |
| 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 |
| Integral/Derivative Time Unit | tIdU | 1, 0.1 | 1, 0.1 | 1 | Second |
| Input Digital Filter | INF | 0.0 to 999.9 | | 0.0 | Second |
| Moving Average Count | MAV | OFF, 2, 4, 8, 16, or 32 | | OFF | Times |
| MV Display | o-dP | OFF, ON | OFF, ON | OFF | None |
| Automatic Display Return Time | RET | OFF, 1 to 99 | OFF, 1 to 99 | OFF | Second |
| Alarm 1 Latch | A1LE | OFF, ON | OFF, ON | OFF | None |
| Alarm 2 Latch | A2LE | OFF, ON | OFF, ON | OFF | None |
| Alarm 3 Latch | A3LE | OFF, ON | OFF, ON | OFF | None |
| Alarm 4 Latch | A4LE | OFF, ON | OFF, ON | OFF | None |
| Move to Protect Level Time | PRLE | 1 to 30 | | 3 | Second |
| Cold Junction Compensation Method | CJC | OFF, ON | OFF, ON | ON | 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 4 ON Delay | A4ON | 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 |
| Alarm 4 OFF Delay | A4oF | 0 to 999 (0: OFF delay disabled) | | 0 | Second |
| Auto/Manual Select Addition | AMAd | OFF, ON | OFF, ON | OFF | None |
| Manual Output Method | MANE | HOLD or INIT | HOLd, INIt | HOLD | None |
| Manual MV Initial Value | MANI | –5.0 to 105.0 for standard control<br>–105.0 to 105.0 for heating/cooling control | | 0.0 | % |
| 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 |

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| LBA Level | LbAL | Temperature input: 0.1 to 999.9 | | 8.0 | °C or °F |
| | | Analog input: 0.01 to 99.99 | | 10.00 | %FS |
| LBA Band | LbAb | Temperature input: 0.0 to 999.9 | | 3.0 | °C or °F |
| | | Analog input: 0.00 to 99.99 | | 0.20 | %FS |
| Control Output 1 Assignment | oUt1 | Relay Output or Voltage Output (for Driving SSR) *2<br>NONE: No assignment<br>O: Control output (heating)<br>C-O: Control output (cooling)<br>ALM1: Alarm 1<br>ALM2: Alarm 2<br>ALM3: Alarm 3<br>ALM4: Alarm 4<br>HA: Heater alarm (HB + HS)<br>HB: Heater burnout alarm (HB)<br>HS: Heater short alarm (HS)<br>S.ERR: Input error<br>RS.ER: Remote SP input error *1<br>P.END: Program End output *1<br>RUN: RUN output<br>ALM: Integrated alarm<br>Current Output *2<br>NONE: Not assigned.<br>O: Control output (heating)<br>C-O: Control output (cooling) | <br>NONE<br>o<br>C-o<br>ALM1<br>ALM2<br>ALM3<br>ALM4<br>HA<br>Hb<br>HS<br>S.ERR<br>RS.ER<br>P.END<br>RUN<br>ALM<br><br>NONE<br>o<br>C-o | O | None |
| Control Output 2 Assignment | oUt2 | Same as the Control Output 1 Assignment parameter. | Same as the Control Output 1 Assignment parameter. | NONE | None |
| Auxiliary Output 1 Assignment | Sub1 | NONE: No assignment<br>O: Control output (heating)<br>C-O: Control output (cooling)<br>ALM1: Alarm 1<br>ALM2: Alarm 2<br>ALM3: Alarm 3<br>ALM4: Alarm 4<br>HA: Heater alarm (HB + HS)<br>HB: Heater burnout alarm (HB)<br>HS: Heater short alarm (HS)<br>S.ERR: Input error<br>RS.ER: RSP input error *1<br>P.END: Program end output *1<br>RUN: RUN output<br>ALM: Integrated alarm | NONE<br>o<br>C-o<br>ALM1<br>ALM2<br>ALM3<br>ALM4<br>HA<br>Hb<br>HS<br>S.ERR<br>RS.ER<br>P.END<br>RUN<br>ALM | ALM1<br>*Controllers without HB and HS alarm detection: HA | None |
| Auxiliary Output 2 Assignment | Sub2 | Same as the Auxiliary Output 1 Assignment parameter. | Same as the Auxiliary Output 1 Assignment parameter. | ALM2 | None |
| Integrated Alarm Assignment | ALMA | 0 to 255<br>Alarm 1: +1<br>Alarm 2: +2<br>Alarm 3: +4<br>Alarm 4: +8<br>HB alarm: +16<br>HS alarm: +32<br>Input error: +64<br>RSP input error: +128 *1 | | 49 | None |

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| PV Rate of Change Calculation Period | PVRP | 1 to 999 | | 20 | Sampling period |
| Heating/Cooling Tuning Method | HCTM | 0: Same as heating control<br>1: Linear<br>2: Air cooling<br>3: Water cooling | | 0 | None |
| Minimum Output ON/OFF Band | OMPW | 0.0 to 50.0 | | 1.0 | % |
| PF Setting | PF | OFF: OFF<br>RUN: RUN<br>STOP: STOP<br>R-S: RUN/STOP<br>AT-2: 100% AT execute/cancel<br>AT-1: 40% AT execute/cancel<br>LAT: Alarm Latch Cancel<br>A-M: Auto/manual<br>PFDP: Monitor/setting item *3<br>SHFT: Digit Shift Key | OFF<br>RUN<br>STOP<br>R-S<br>AT-2<br>AT-1<br>LAT<br>A-M<br>PFDP<br>SHFT | SHFT | None |
| PV/SP No. 1 Display Selection | SPD1 | 0: Nothing is displayed.<br>1: PV/SP/Nothing displayed<br>2: PV/Nothing displayed/Nothing displayed<br>3: SP/SP (character display)/Nothing displayed<br>4: PV/SP/MV<br>5: PV/SP/Multi-SP No.<br>6: PV/SP/Soak time remain *1<br>7: PV/SP/Internal SP (ramp SP)<br>8: PV/SP/Alarm value 1 | | 1*4 | None |
| PV/SP No. 2 Display Selection | SPD2 | Same as PV/SP No. 1 Display Selection. | | 0 | None |
| MV Display Selection | ODSL | O: MV (Heating)<br>C-O: MV (Cooling) | O, C-O | 0 | None |
| PV Status Display Function | PVST | OFF: OFF<br>MANU: Manual<br>STOP: Stop<br>ALM1: Alarm 1<br>ALM2: Alarm 2<br>ALM3: Alarm 3<br>ALM4: Alarm 4<br>ALM: OR of alarms 1 to 4<br>HA: Heater alarm *1 | OFF<br>MANU<br>STOP<br>ALM1<br>ALM2<br>ALM3<br>ALM4<br>ALM<br>HA | OFF | None |
| SV Status Display Function | SVST | OFF: OFF<br>MANU: Manual<br>STOP: Stop<br>ALM1: Alarm 1<br>ALM2: Alarm 2<br>ALM3: Alarm 3<br>ALM4: Alarm 4<br>ALM: OR of alarms 1 to 4<br>HA: Heater alarm *1 | OFF<br>MANU<br>STOP<br>ALM1<br>ALM2<br>ALM3<br>ALM4<br>ALM<br>HA | OFF | None |
| Display Refresh Period | D.REF | OFF, 0.25, 0.5, 1.0 | OFF, 0.25, 0.5, 1.0 | 0.25 | Second |

*1 Any settings that are entered will be ignored.
*2 The setting ranges are different for relay and voltage outputs (for driving SSR) and for current outputs.
*3 Do not set this value.
*4 The default setting is 4 when the settings are initialized.

## A-5-6 Protect Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Operation/Adjustment Protect | OAPT | 0 to 3 | | 0 | None |
| Initial Setting/Communications Protect | CCPT | 0 to 2 | | 1 | None |
| Setting Change Protect | WTPT | OFF, ON | OFF, ON | OFF | None |
| PF Key Protect | PFPT | OFF, ON | OFF, ON | OFF | None |
| Changed Parameters Only | CHGP | OFF, ON | OFF, ON | OFF | None |

## A-5-7 Communications Setting Level

| Parameters | Characters | Setting (monitor) value | Display | Default | Unit |
|---|---|---|---|---|---|
| Protocol Setting | PSEL | CWF: CompoWay/F<br>MOD: Modbus | CWF, Mod | CompoWay/F | None |
| Communications Unit No. | U-No | 0 to 99 | | 1 | None |
| Communications Baud Rate | bPS | 9.6, 19.2, 38.4, or 57.6 | 9.6, 9.2, 38.4, 57.6 | 9.6 | kbps |
| Communications Data Length | LEN | 7, 8 | | 7 | Bit |
| Communications Stop Bits | Sbit | 1, 2 | | 2 | Bit |
| Communications Parity | PRTY | NONE: None<br>EVEN: Even<br>ODD: Odd | NONE, EVEN, odd | Even | None |
| Send Data Wait Time | SdWt | 0 to 99 | | 20 | ms |

# A-6 Sensor Input Setting Range, Indication Range, Control Range

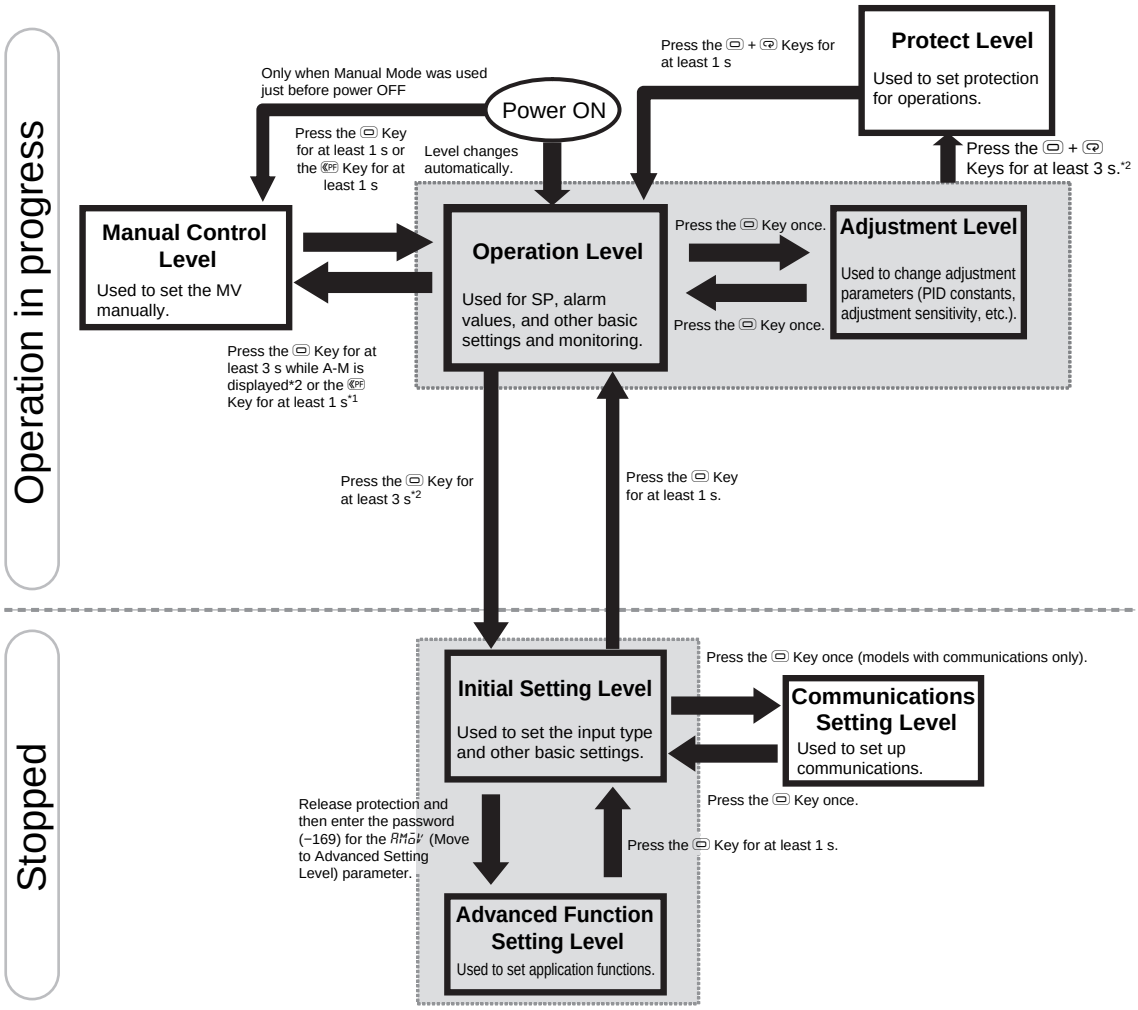
| | Specifications | Set value | Input setting range | Input indication range |
|---|---|---|---|---|
| Resistance thermometer | Pt100 | 0 | –200 to 850 (°C)/–300 to 1500 (°F) | –220 to 870 (°C)/–340 to 1540 (°F) |
| | | 1 | –199.9 to 500.0 (°C)/–199.9 to 900.0 (°F) | –199.9 to 520.0 (°C)/–199.9 to 940.0 (°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 1300 (°C)/–300 to 2300 (°F) | –220 to 1320 (°C)/–340 to 2340 (°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 1500 (°F) | –120 to 870 (°C)/–140 to 1540 (°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 | –200 to 600 (°C)/–300 to 1100 (°F) | –220 to 620 (°C)/–340 to 1140 (°F) |
| | L | 12 | –100 to 850 (°C)/–100 to 1500 (°F) | –120 to 870 (°C)/–140 to 1540 (°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 (°F) |
| | N | 15 | –200 to 1300 (°C)/–300 to 2300 (°F) | –220 to 1320 (°C)/–340 to 2340 (°F) |
| | R | 16 | 0 to 1700 (°C)/0 to 3000 (°F) | –20 to 1720 (°C)/–40 to 3040 (°F) |
| | S | 17 | 0 to 1700 (°C)/0 to 3000 (°F) | –20 to 1720 (°C)/–40 to 3040 (°F) |
| | B | 18 | 100 to 1800 (°C)/300 to 3200 (°F) | 0 to 1820 (°C)/0 to 3240 (°F) |
| | W | 19 | 0 to 2300 (°C)/0 to 3200 (°F) | –20 to 2320 (°C)/–40 to 3240 (°F) |
| | PLII | 20 | 0 to 1300 (°C)/0 to 2300 (°F) | –20 to 1320 (°C)/–40 to 2340 (°F) |
| ES1B Infrared Temperature Sensor | 10 to 70°C | 21 | 0 to 90 (°C)/0 to 190 (°F) | –20 to 130 (°C)/–40 to 270 (°F) |
| | 60 to 120°C | 22 | 0 to 120 (°C)/0 to 240 (°F) | –20 to 160 (°C)/–40 to 320 (°F) |
| | 115 to 165°C | 23 | 0 to 165 (°C)/0 to 320 (°F) | –20 to 205 (°C)/–40 to 400 (°F) |
| | 140 to 260°C | 24 | 0 to 260 (°C)/0 to 500 (°F) | –20 to 300 (°C)/–40 to 580 (°F) |
| Current input | 4 to 20 mA | 25 | Any of the following ranges, by scaling:<br>–1999 to 9999<br>–199.9 to 999.9<br>–19.99 to 99.99<br>–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 | 26 | | |
| Voltage input | 1 to 5 V | 27 | | |
| | 0 to 5 V | 28 | | |
| | 0 to 10 V | 29 | | |

- The default is 5.
- 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 60584-1
  L: Fe-CuNi, DIN 43710-1985
  U: Cu-CuNi, DIN 43710-1985
  W: W5Re/W26Re, ASTM E988-1990
  JPt100: JIS C 1604-1989, JIS C 1606-1989
  Pt100: JIS C 1604-1997, IEC 60751
  PLII: According to Platinel II Electromotive Force Table by Engelhard Corp.

# A-7 Setting Levels Diagram

This diagram shows all of the setting levels. To move to the Advanced Function Setting Level, you must enter password. 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.

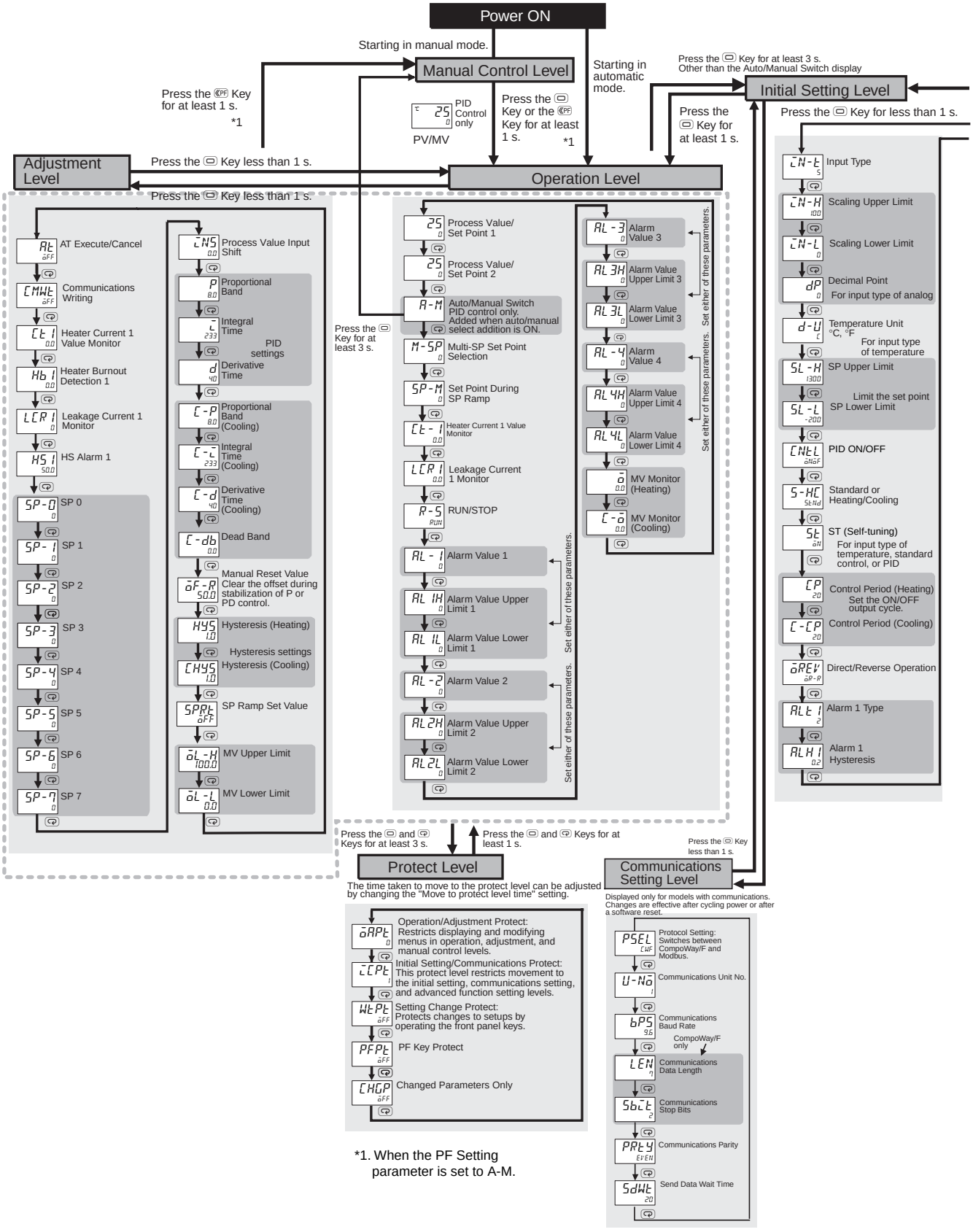



*1 To use a key procedure to move to Manual Control Level, set the Auto/Manual Select Addition parameter to ON and set the PF Setting parameter to A-M (Auto/Manual).

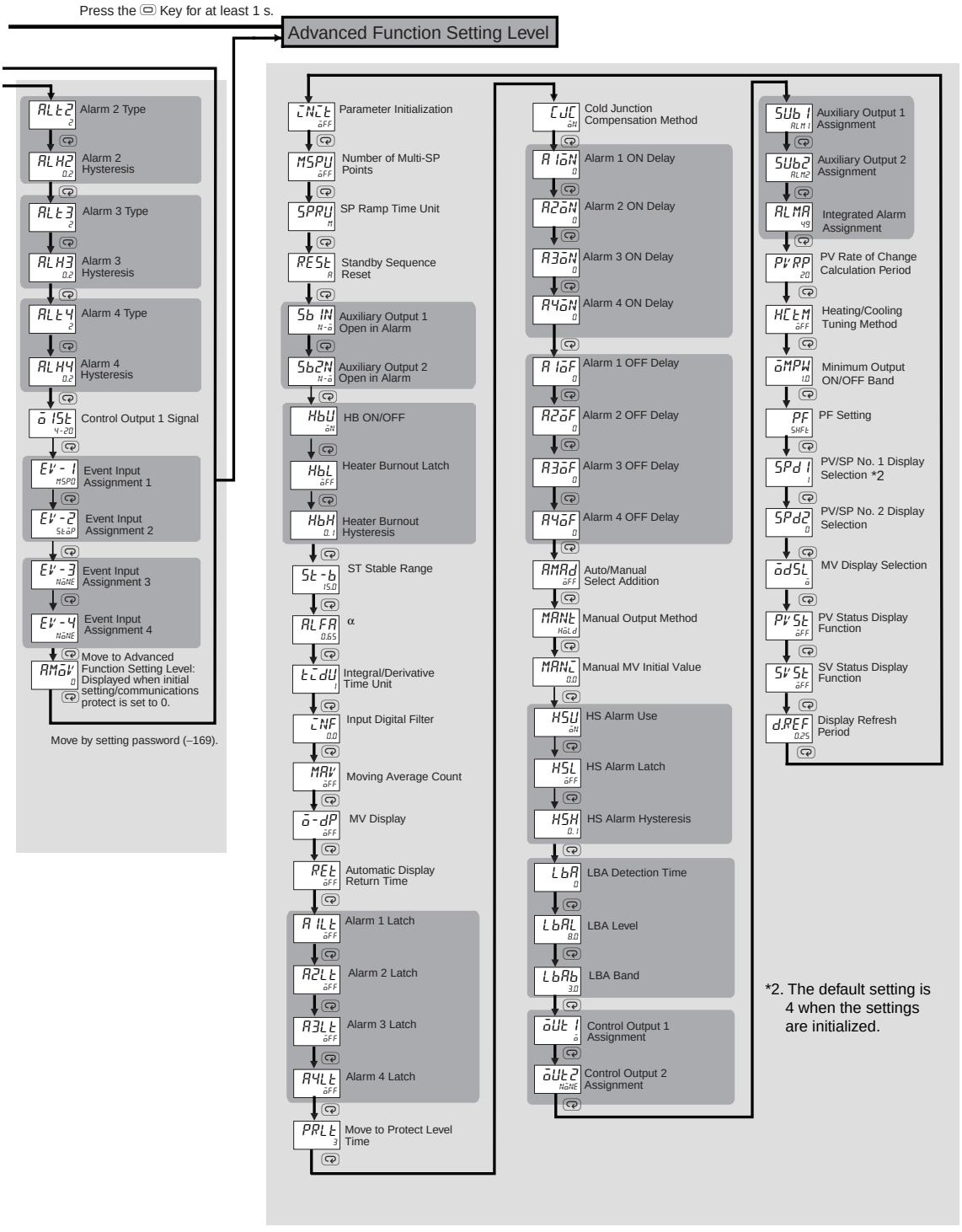
*2 The No. 1 display will flash when the keys are pressed for 1 s or longer.

# A-8 Parameter Flow

This section describes the parameters set in each level. Pressing the Key at the last parameter in each level returns to the top parameter in that level.




*1. When the PF Setting parameter is set to A-M.


Press the Key for at least 1 s.
Advanced Function Setting Level
Alarm 2 Type
Alarm 2 Hysteresis
Alarm 3 Type
Alarm 3 Hysteresis
Alarm 4 Type
Alarm 4 Hysteresis
Control Output 1 Signal
Event Input Assignment 1
Event Input Assignment 2
Event Input Assignment 3
Event Input Assignment 4
Move to Advanced Function Setting Level: Displayed when initial setting/communications protect is set to 0.
Move by setting password (–169).
Parameter Initialization
Number of Multi-SP Points
SP Ramp Time Unit
Standby Sequence Reset
Auxiliary Output 1 Open in Alarm
Auxiliary Output 2 Open in Alarm
HB ON/OFF
Heater Burnout Latch
Heater Burnout Hysteresis
ST Stable Range
α
Integral/Derivative Time Unit
Input Digital Filter
Moving Average Count
MV Display
Automatic Display Return Time
Alarm 1 Latch
Alarm 2 Latch
Alarm 3 Latch
Alarm 4 Latch
Move to Protect Level Time
Cold Junction Compensation Method
Alarm 1 ON Delay
Alarm 2 ON Delay
Alarm 3 ON Delay
Alarm 4 ON Delay
Alarm 1 OFF Delay
Alarm 2 OFF Delay
Alarm 3 OFF Delay
Alarm 4 OFF Delay
Auto/Manual Select Addition
Manual Output Method
Manual MV Initial Value
HS Alarm Use
HS Alarm Latch
HS Alarm Hysteresis
LBA Detection Time
LBA Level
LBA Band
Control Output 1 Assignment
Control Output 2 Assignment
Auxiliary Output 1 Assignment
Auxiliary Output 2 Assignment
Integrated Alarm Assignment
PV Rate of Change Calculation Period
Heating/Cooling Tuning Method
Minimum Output ON/OFF Band
PF Setting
PV/SP No. 1 Display Selection *2
PV/SP No. 2 Display Selection
MV Display Selection
PV Status Display Function
SV Status Display Function
Display Refresh Period
*2. The default setting is 4 when the settings are initialized.

# I

# Index

## R



## S



## T



## U



## W

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