OMRON

Digital Temperature Controllers

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Preface

Thank you for purchasing an E5□C Digital Controller.

This manual describes how to use the E5 \square C. 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. Refer to the *E5\squareC Digital Controllers Communications Manual* (Cat. No. H175) for information on communications.

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Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the $E5\square C$ Digital Controllers.

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.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Symbols

Sym	nbol	Meaning
Caution	\triangle	General Caution Indicates non-specific general cautions, warnings, and dangers.
		Electrical Shock Caution Indicates possibility of electric shock under specific conditions.
Drobibition		General Prohibition Indicates non-specific general prohibitions.
Prohibition		Disassembly Prohibition Indicates prohibitions when there is a possibility of injury, such as from electric shock, as the result of disassembly.
Mandatory Caution	0	General Caution 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, moisture, or other foreign matter to enter the Digital Controller, the Setup Tool ports, or between the pins on the connectors on the Setup Tool cable.



Attach the cover to the front-panel Setup Tool port whenever you are not using it to prevent foreign objects from entering the port.

Minor injury from explosion may occasionally occur.

Do not use the product where subject to flammable or explosive gas.



Fire may occasionally occur.

Do not allow dirt or other foreign objects to enter a Setup Tool port, or between the pins on the connectors on the Setup Tool cable.



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 listed 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.



- (d) Caution: To reduce the risk of fire or electric shock, do not interconnect the outputs of different Class 2 circuits. *2
- (e) Use wires with heat resistance of 75°C min to wire the terminals because the maximum terminal temperature is 75°C.



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 An SELV (separated extra-low voltage) system is one with a power supply that has double or reinforced insulation between the primary and the secondary circuits and has an output voltage of 30 V r.m.s. max. and 42.4 V peak max. or 60 VDC max.
- *2 A class 2 circuit is one tested and certified by UL as having the current and voltage of the secondary output restricted to specific levels.

⚠ CAUTION

If you replace only the Main Unit of the E5DC or E5DC-B, check the condition of the Terminal Unit.

If corroded terminals are used, contact failure in the terminals may cause the temperature inside the Digital Controller to increase, possibly resulting in fire.



If the terminals are corroded, replace the Terminal Unit as well.

Loose screws may occasionally result in fire.

Tighten the terminal screws to the specified torque of 0.43 to 0.58 $N \cdot m.^{\star}$



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.



^{*} The specified torque is 0.5 N·m for the E5CC-U.

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 specifications.

 The product is designed for indoor use only. Do not use or store the product outdoors or in any of the following places.

Places directly subject to heat radiated from heating equipment.

Places subject to splashing liquid or oil atmosphere.

Places subject to direct sunlight.

Places subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).

Places subject to intense temperature change.

Places subject to icing and condensation.

Places subject to vibration and large shocks.

- 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 Digital Controller. Do not block the ventilation holes on the Digital Controller.
- Be sure to wire properly with the correct signal name and polarity of terminals.
- To connect bare wires, use copper stranded or solid wires.
 Use the wire sizes and stripping lengths given in the following table to prevent smoking and firing of the wiring material.

Recommended Wires

Model	Recommended wires	Stripping length
E5CC, E5EC, E5AC, E5DC, or E5GC	AWG24 to AWG18 (0.21 to 0.82 mm ²)	6 to 8 mm
(models with screw terminal blocks)	Copper stranded or solid wires	
E5GC (models with screwless clamp		8 to 12 mm
terminal blocks)		
E5CC-U (plug-in models)	AWG24 to AWG14 (0.21 to 2.08 mm ²)	5 to 6 mm
	Copper stranded or solid wires	
E5□C-B (models with Push-In Plus	0.25 to 1.5 mm ² (equivalent to AWG24 to	With ferrules: 10 mm
terminal blocks) *1	AWG16)	Without ferrules: 8 mm
	Copper stranded or solid wires	

^{*1} Use Ferrules with UL certification (R/C).

Connect only one wire to each terminal.

Use the specified size of crimped terminals to wire the E5CC, E5EC, E5AC, E5DC, and E5GC (models with screw terminal blocks) as well as the E5CC-U (plug-in models).

Crimp Terminal Sizes

Model	Crimp terminal size
E5CC, E5EC, E5AC, E5DC, or E5GC	M3, Width: 5.8 mm max.
(models with screw terminal blocks)	
E5CC-U (plug-in models)	M3.5, Width: 7.2 mm max.

For the E5□D-B (models with Push-In Plus terminal blocks), connect only one wire to each terminal. For the E5□C (models with screw terminals), you can connect up to two wires of the same size and type, or two crimped terminals, to a single terminal.

When connecting two wires to one terminal on the E5GC (models with screwless clamp terminal blocks), use two crimped ferrules with a diameter of 0.8 to 1.4 mm and an exposed conductor length of 8 to 12 mm.^{*1}

- *1 The E5GC (models with screwless clamp terminal blocks) underwent UL testing with one stranded wire connected.
- 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 the Digital Controller 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 must be provided close to the Digital Controller. The switch or circuit breaker must be within easy reach of the operator, and must be marked as a disconnecting means for the 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, e.g., through communications.
- Always touch a grounded piece of metal before touching the Digital Controller to discharge static electricity from your body.
- Use suitable tools when taking the Digital Controller apart for disposal. Sharp parts inside the Digital Controller may cause injury.

- For compliance with Lloyd's standards, the E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, E5AC, and E5DC must be installed under the conditions that are specified in *Shipping Standards*.
- On models with two Setup Tool ports (E5EC, E5EC-B, E5AC, E5DC, E5DC-B, and E5GC), do not connect cables to both ports at the same time. The Digital Controller may be damaged or may malfunction.
- Do not exceed the communications distance that is given in the specifications and use the specified communications cable.
- Do not turn the power supply to the Digital Controller ON or OFF while the USB-Serial Conversion Cable is connected. The Digital Controller may malfunction.
- Do not bend the communications cables past their natural bending radius. Do not pull on the communications cables.
- For the E5DC and E5DC-B, when you attach the Main Unit to the Terminal Unit, make sure that the hooks on the Main Unit are securely inserted into the Terminal Unit.
- For the E5CC-U, when you attach the Main Unit to the socket, make sure that the hooks on the socket are securely inserted into the Main Unit.
- Install the DIN Track vertically to the ground.
- For the E5DC and E5DC-B, always turn OFF the power supply before connecting the Main Unit to or disconnecting the Main Unit from the Terminal Unit, and never touch nor apply shock to the terminals or electronic components. When connecting or disconnecting the Main Unit, do not allow the electronic components to touch the case.
- Observe the following precautions when you remove the terminal block or pull out (draw out) the interior of the E5GC.
 - Follow the procedure given in *Drawing Out the Interior Body of the E5GC to Replace It* on page 2-21 of this manual.
 - Turn OFF the power supply before you start and never touch nor apply shock to the terminals or electric components.
 - When you insert the interior body of the Digital Controller, do not allow the electronic components to touch the case.
 - Check for any corrosion on the terminals.
 - When you insert the interior body into the rear case, confirm that the hooks on the top and bottom are securely engaged with the case.
- Observe the following precautions when wiring the E5□C-B.
 - Follow the procedures given in *E5*_C-B (Models with Push-In Plus Terminal Blocks) on page 2-58 of this manual.
 - Do not wire anything to the release holes.
 - Do not tilt or twist a flat-blade screwdriver while it is inserted into a release hole on the terminal block. The terminal block may be damaged.
 - Insert a flat-blade screwdriver into the release holes at an angle. The terminal block may be damaged if you insert the screwdriver straight in.
 - Do not allow the flat-blade screwdriver to fall out while it is inserted into a release hole.
 - Do not bend a wire past its natural bending radius or pull on it with excessive force. Doing so may cause the wire to break.
 - Do not use crossover wiring to the E5CC-B or E5EC-B except for the input power supply and communications.
 - Do not use crossover wiring to the E5DC-B.

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 Digital 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.

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.

■ Resistance to Water (E5CC, E5CC-B, E5EC, E5EC-B, E5AC, and E5GC Only)

The degree of protection is as shown below. Sections without any specification on their degree of protection or those with IP\(\text{IP} \) 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. Keep the Port Cover on the front-panel Setup Tool port of the E5EC, E5EC-B, and E5AC securely closed. The degree of protection when the Waterproof Packing is used is IP66. To maintain an IP66 degree of protection, the Waterproof Packing and the Port Cover for the front-panel Setup Tool port must be periodically replaced because they 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.

Precautions for Operation

- 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.

Shipping Standards

The E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, E5AC, and E5DC comply with Lloyd's standards. For compliance with these standards, install the Digital Controller in an installation location that meets the application conditions. Also, insert the Waterproof Packing on the Digital Controller.

Application Conditions

Installation Location

The E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, E5AC, and E5DC are applicable to installation category ENV1 or ENV2 of Lloyd's standards. The installation environment must be equipped with air conditioning. The installation environment must be equipped with air conditioning. They cannot be used on the bridge or decks, or in a location subject to strong vibration.

Preparations for Use

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

Timing	Check point	Details
Purchasing the product	Product appearance	After purchase, check that the product and packaging are not dented or otherwise damaged. Damaged internal parts may prevent optimum control.
	Product model and specifications	Make sure that the purchased product meets the required specifications.
Setting the Unit	Product installation location	Provide sufficient space around the product for heat dissipation. Do not block the vents on the product.
Wiring	Terminal wiring	Do not subject the terminal screws to excessive stress (force) when tightening them.
		Make sure that there are no loose screws after tightening terminal screws to the specified torque of 0.43 to 0.58 N·m.*1
		Be sure to confirm the polarity for each terminal before wiring the terminal block and connectors.
		For the E5□C-B (models with Push-In Plus terminal blocks), do not attempt to wire anything to the release holes.
		For the E5CC-B or E5DC-B (models with Push-In Plus terminal blocks), use crossover wiring only for the input power supply and communications. Do not exceed the maximum number of Digital Controllers given below if you
		use crossover wiring for the input power supply. 100 to 240 VAC Controllers: 16 max. 24 VAC/VDC Controllers: 8 max.
		Do not perform crossover wiring for the E5DC-B (models with Push-in Plus Terminal Blocks).
	Power supply inputs	Wire the power supply inputs correctly. Incorrect wiring will result in damage to the internal circuits.
Operating	Ambient	The ambient operating temperature for the Digital Controller is -10 to
environment	temperature	55°C*2 (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.

^{*1} The specified torque is 0.5 N·m for the E5CC-U.

Horizontal group mounting: -10 to 55°C

Vertical group mounting of two Digital Controllers: −10 to 45°C

Vertical group mounting of three or more Digital Controllers: -10 to 40°C

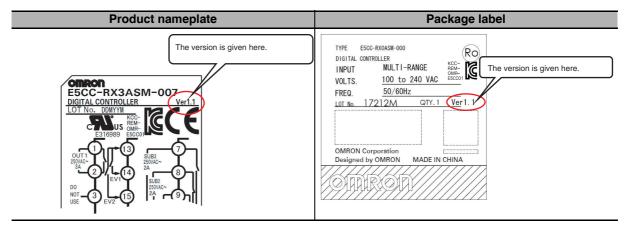
For vertical group mounting, use Digital Controllers with screwless clamp terminal blocks.

For E5EC models with two control outputs (QQ, QR, CQ, RR, CC, or PR) and 011, 012, 013, or 014 options, the ambient temperature for group mounting must be 45°C max.

^{*2} When two or more E5GC Digital Controllers are mounted, make sure that the ambient temperature of the Digital Controller does not exceed the allowable operating temperature range given below.

Versions

Check the version on the nameplate on the E5 \square C Digital Controller or on the label on the packing box. If the version is not given, the version of the E5 \square C Digital Controller is version 1.0.



Revision History

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

Cat. No. **H174-E1-15**

		Hevision code
Revision code	Date	Revised content
01	December 2011	Original production
02	January 2012	Page 9: Made correction in Precautions for Safe Use.
03	December 2012	 Made changes accompanying the addition of programless communications and component communications (version 1.1). Added E5EC/E5AC Digital Controllers with position-proportional control and E5AC Digital Controllers. (version 2.0). Corrected mistakes.
04	July 2013	Added version 1.0 of the E5DC.Corrected mistakes.
05	December 2013	 Added E5CC-U. Improved autotuning for heating/cooling control. Added Mitsubishi FX-series PLCs and Keyence PLCs to information on programless communications (version 2.1). Corrected mistakes.
06	April 2014	 Added version 2.2 of the E5GC. Added an analog input type and simple transfer function for the E5CC-U (version 2.2). Corrected mistakes.
07	July 2014	 Added E5DC-U. Added simple transfer function and status message function to the E5DC (version 2.2). Added seconds as the unit for the soak time (version 2.2). Added Lloyd's standards for the E5DC. Corrected mistakes.
08	August 2014	Added the Valve Opening Monitor Selection and FB Moving Average Count parameters for E5EC/E5AC-PR□-8□□ (version 2.2).
09	June 2015	Page 4-46: Changed figure for burnout at bottom of page. Pages 5-55 and 6-89: Added note *5 and references to it in table. Page 5-60: Changed level to Operation Level for Remote SP Monitor. Page 5-61: Changed level in first sentence of Remote SP Monitor to Operation Level. Page 6-5: Added note below table for Changed Parameters Only. Page 6-6: Added note above table for Parameter Mask Enable. Page 6-30: Changed conditions given to right of "Manual Reset Value." Page 6-56: Added note at bottom of page. Page 6-70: Added note above table. Page 6-93: Added note above table in Display Refresh Period.
10	March 2016	 Added information on version 2.1 of the E5□C-B. Corrected mistakes.
11	July 2016	Corrected mistakes and added explanations.
12	October 2017	 Added E5 C-B Digital Controllers with current outputs. Corrected mistakes.
13	March 2018	Added precautions for wiring of screw terminal block types.
14	April 2019	 Added information on version 2.2 of the E5DC-B. Corrected mistakes.
15	April 2019	Corrected mistakes.

Conventions Used in This Manual

Model Notation

"E5□C" is used to indicate information that is the same for the E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, E5AC, E5DC-B, and E5GC Digital Controllers. "E5□C-B" is used to indicate information that is the same for the E5CC-B, E5EC-B, and E5DC-B Digital Controllers. "E5EC/E5AC-PR□" or "Position-proportional Models" indicates the Digital Controllers with position-proportional control. "Standard Models" indicates other Digital Controllers.

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
НВ	Heater burnout
HS	Heater short
RSP	Remote SP
LSP	Local SP

^{* &}quot;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.

000 : Indicates items that can be used only with the E5□C-□-0□□.

800 : Indicates items that can be used only with the E5 C- -8 ...

How to Read Display Symbols

The following tables show the correspondence between the symbols displayed on the displays and alphabet characters.

Я	Ь	Е	В	Ε	F	Б	Н	Ĺ	Л	К	L	М
Α	В	С	D	E	F	G	н	ı	J	К	L	М
N	ō	Р	ū	R	5	Ł	Ц	l'	Н	X	У	7
N	0	Р	Q	R	s	Т	U	V	W	Х	Υ	Z

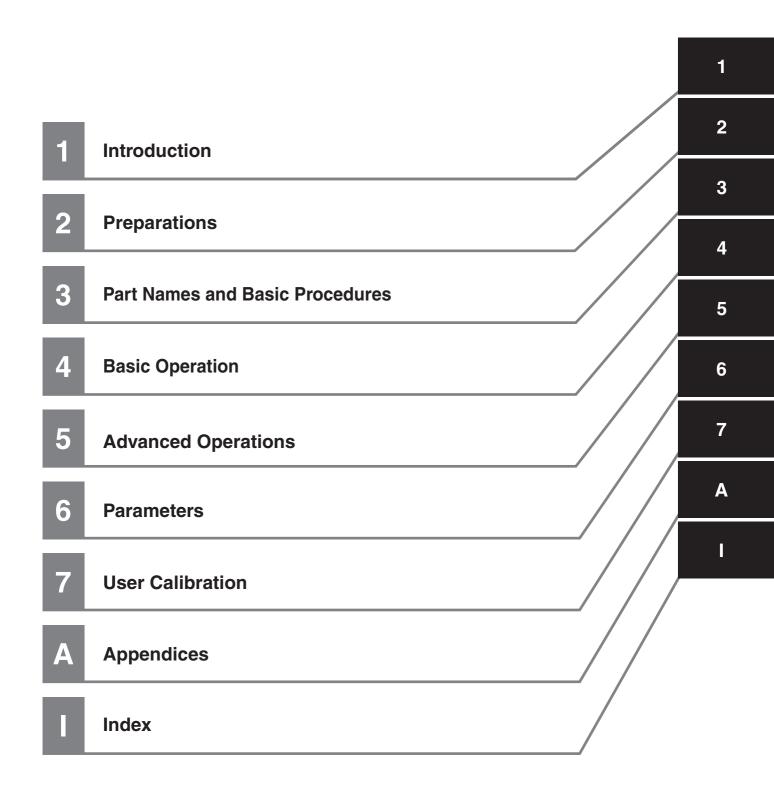
How This Manual is Organized

Goal	Related sections	Contents
Learning about the	Section 1 Introduction	
appearance, features,		
functions, and model numbers		
Setting up the E5□C	Section 2 Preparations	This section describes the steps that are
		required before turning ON the power supply
		(including installation, terminal usage, wiring,
		and isolation/insulation block diagram). It also
		describes how to use the Setup Tool ports.
Learning the basic procedures	Section 3 Part Names and	This section serves as a basic tutorial for
from turning ON the power	Basic Procedures	first-time users of the E5□C.
supply to starting actual		
operation		
Learning the basic operating	Section 4 Basic Operation	These sections describe basic operating
methods	Section 6 Parameters	methods.
Learning advanced operating	Section 5 Advanced	These sections describe advanced operating
methods	Operations	methods.
	Section 6 Parameters	
Calibrating the E5□C	Section 7 User Calibration	This section describes the procedures that you
		can use to calibrate the sensor or transfer
		output of the E5□C.
Learning the specifications	Appendices	
and parameters of the E5⊟C		

Related Manuals

Also refer to the *E5*_C Digital Controllers Communications Manual (Cat. No. H175) for information on communications.

Sections in this Manual



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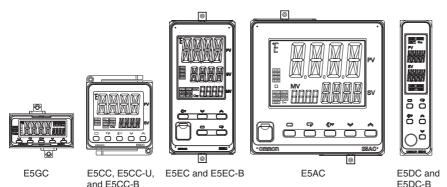


Introduction

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1-1 Appearance, Features, and Functions of the E5□C

1-1-1 **Appearance**



- 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 Digital Controller.
- Even easier to use than previous models.

1-1-2 **Features**

This section compares the features of the E5□C with the previous E5□N Digital 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.

I/O Expandability

• Number of event inputs: Increased from 2 to 4 for the E5CC and from 4 to 6 for the E5EC/E5AC.

The E5DC has only 1 event input.

The E5GC or E5CC-B has 2 event inputs.

The E5EC-B has 6 event inputs.

* The E5DC-B does not support event inputs.

• Number of auxiliary outputs: Increased from 2 to 3 for the E5CC and from 3 to 4 for the E5EC/E5AC.

The E5DC, E5DC-B, E5CC-U, E5GC, or E5CC-B has 2 auxiliary

outputs.

The E5EC-B has 4 auxiliary outputs.

· Remote SP inputs: A remote SP input that treats the external analog signal at the set point

(SP) has been added.

Universal Input Capability

The input sensor can be selected freely from the following: Thermocouple, resis-Universal input:

tance thermometer, ES1B Infrared Temperature Sensor, current, and voltage.

Easier Numeric Inputs with a Digit Shift Key

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.

Setup Tool Port on Front Panel of the E5EC, E5EC-B, E5AC, E5DC or E5DC-B 000

This port allows you to change or set parameters from the Setup Tool even when the Digital Controller is installed in a panel.

1-1-3 **Main 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.

K, J, T, E, L, U, N, R, S, B, W, PLII Thermocouple (temperature input):

Resistance thermometer (temperature input): Pt100, JPt100

Infrared Temperature Sensor (temperature input): ES1B

10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C

Current input (analog input): 4 to 20 mA DC, 0 to 20 mA DC

Voltage input (analog input): 1 to 5 VDC, 0 to 5 V DC, 0 to 10 V DC, 0 to 50 mVDC*

> This range can be used only for E5CC-U Digital Controllers and only if they are manufactured in

May 2014 or later (version 2.2 or higher).

Control Outputs

· A control output can be a relay output, voltage output (for driving SSR), or linear 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.
- You can also add RT (robust tuning) to give priority to controlling stability.

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 model that supports event inputs, you can use external contact or transistor 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, starting/resetting the program, inverting direct/reverse operation, switching the SP mode100% AT execute/cancel, 40% AT execute/cancel, setting change enable/disable, communications write enable/disable, and canceling the alarm latch.

Communications Functions

With any E5□C model that supports communications, you can use CompoWay/F, Modbus-RTU,*1 programless, and component communications.

- Modbus is a registered trademark of Schneider Electric.
- *2 The E5CC-U does not support communications.

Transfer Output

With any model that provides a transfer output, you can output the set point, process value, manipulated variable, or other values as a 4 to 20-mA or 1 to 5-V transfer output. The E5CC-U*, E5DC*, E5DC-B and E5GC do not have a transfer output, but if the control output is a linear current output, the control output can be used as a simple transfer output.

* The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).

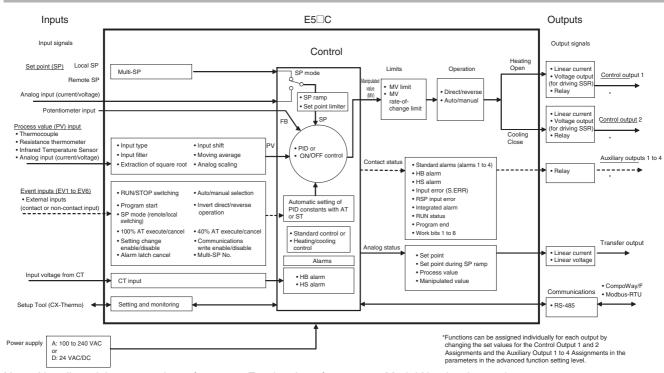
Remote SP Input

With any model that provides a remote SP input, you can set the set point with an analog input.

* The E5CC-U, E5DC, E5GC, E5CC-B, or E5DC-B does not have a remote SP input.

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 (Models with Screw Terminal Blocks)

(1)	(2	2)	(3)	(4)	(5)	(6)	(7)	(7) Meaning						
Size	Control Outputs 1 and 2		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options							
С								48 × 48 mm						
									Control output 1		Control ou			
	R	X							Relay output	000)	None			
+4	Q	X							ge output (for driving		None			
*1	С	X							Linear current output		None			
	Q	Q						Voltage output (for driving SSR) Voltage output (for driving SSR)						
	С	Q												
	C	Q						Linear current output Voltage output (for driving SSR)						
		*2*3	0					None			(IOI dilving	0011)		
		*3	2					2						
		O	3					3						
			Ū	Α				100 to 240 \	VAC					
				D				24 VAC/DC	.,,,					
					S			Screw termi	nals					
					5			Screw termi	nals (with cover)					
						М		Universal in						
					!			Event inputs	Communications	Remote SP Input	HB alarm and HS alarm	Transfer output		
							000							
							001	2			1			
						*3	002		RS-485		1			
							003		RS-485		2 (for 3-phase heaters)			
							004	2	RS-485					
							005	4						
							006	2				Provided.		
							007 2 Provided							

^{*1} Options with HB and HS alarms (001, 002, and 003) cannot be selected if a linear current output is selected for the control output.

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

^{*2} If no auxiliary outputs (none) is selected, 000 (none) must be selected for the options.

These cannot be selected if 5 (screw terminals with cover) is selected for the terminal type.

• E5CC-U (Plug-in Models)

E5CC -				U		- [
(1)	(2)	(3)	(4)	(5)	(6)		(7)	

(1)	(2	2)	(3)	(4)	(5)	(6)	(7)			Meaning	9			
Size	Control output 1		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options							
С								48 × 48 m	m					
								Control output 1						
	R	W								output (SPD				
	Q	Χ								e output (for o				
*1	С	Χ							L	inear current	output			
			0					None						
			1					1						
			2					2						
		!		Α				100 to 240	O VAC					
				D				24 VAC/D	C					
					U			Plug-in model						
				·		М		Universal input						
					·			Event inputs	Communications	Remote SP Input	HB alarm and HS alarm	Transfer output		
							000							

^{*1} The control output can be used as a simple transfer output for Digital Controllers manufactured in May 2014 or later (version 2.2 or higher).

• E5CC-B (Models with Push-In Plus Terminal Blocks)

(1)	(2	2)	(3)	(4)	(5)	(6)	(7)	(7) Meaning											
Size	Control output 1		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options												
С								48 × 48 mm Control output 1 Control output 2											
								Control output 1 Control output 2						-			Control output 2		
	R	Χ						Relay output None											
	Q	Χ						Voltage o	utput (for driv	ring SSR)	None								
*1	С	Χ						Linear current output			None								
			2					2 (one comr	mon)										
				Α				100 to 240 \	/AC										
				D				24 VAC/DC											
					В			Push-In Plus	s terminal blo	cks									
						М		Universal in	put										
					•			Event inputs	Communi cations	Remote SP input	HB alarm and HS alarm	Transfer output							
							000	0											
							001	2			1								
							002		RS-485		1								
							004	2	RS-485										
							006	2				Provided.							

Options with 001 and 002 cannot be selected if a linear current output is selected for the control output. The control output cannot be used as a simple transfer output.

• E5EC/AC (Models with Screw Terminal Blocks)

E 5 C	-				-		
(1)		(2)				(7)	

(1)	(2	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								
Е								48 × 96 n	nm						
Α								96 × 96 n					-		
ļ										trol output 1			С	ontrol output	2
*1	R	Χ								elay output				None	
*1	Q	Χ								put (for drivir			None		
*2*1	С	Χ								r current outp		None			
*1	Q	Q								put (for drivir		Voltage output (for driving SSR)			
*1	Q	R							Voltage out	put (for drivir			Relay output		
*1	R	R							Re	elay output	Relay output				
*2*1	С	С							Linear	Linear current output					
*2*1	С	Q							Linear	r current outp	out		Voltage output (for driving SSR)		
*1	Р	R							Position-pro	portional rela	ıy output		Position-p	proportional rel	ay output
		*3	2					2							
			4					4							
		-		Α				100 to 24	0 VAC						
				D				24 VAC/[OC .						
					S			Screw ter	rminals						
					5			Screw ter	rminals (with cover)						
						М		Universal	l input						
								Event inputs	Communications	Remote SP Input	HB alarm and HS alarm	Transfer output	For RX, QX, RR, QQ, QR, or CQ	For CX or CC	For PR
							000						Selectable	Selectable	Selectable
							004	2	RS-485					Selectable	Selectable
							005	4						Selectable	
						*3	008	2	RS-485		1		Selectable		
							009	2 RS-485 2 (for Selectable selectable heaters)							
							010	4			1		Selectable		
							011	6		Provided.	1	Provided.	Selectable		
						*3	012	4	RS-485	Provided.	1	Provided.	Selectable		
							013	6		Provided.		Provided.		Selectable	
							014	4							

^{*1} The options that can be selected depend on the type of control output.

^{*2} The control output cannot be used as a simple transfer output.

^{*3} These cannot be selected if 5 (screw terminals with cover) is selected for the terminal type.

• E5EC-B (Models with Push-In Plus Terminal Blocks)

E5EC	-		В	-	
(1)		(3)			(7)

(1)	(:	2)	(3)	(4)	(5)	(6)	(7) Meaning						
Size	Control Quitnuts 1 and 2		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options						
Е								48 × 96 mm					
								Control output 1 Control output 2					
*1	R	Х						Relay output None					
*1	Q	Х						Voltage output (for driving SSR) None					
*2	C	Χ						Linear current output None					
•			2					2					
			4					4					
				Α				100 to 240 VAC					
				D				24 VAC/DC					
					В			Push-In Plus te	rminal blocks				
						М		Universal input					
								Event inputs	Communicat ions	Remote SP input	HB alarm and HS alarm	Transfer output	
							000						
							004	2	RS-485				
							800	2	RS-485		1		
							010	4			1		
							011	6		Provided.	1	Provided.	
							014 4 RS-485 Provided. Provided.					Provided.	

^{*1} Options with 004 and 014 cannot be selected if a relay output or voltage output (for driving SSR) is selected for the control output.

Options with 008, 010 and 011 cannot be selected if a linear current output is selected for the control output. The control output cannot be used as a simple transfer output.

• E5DC

E5DC	-			- 🗆
(1)	(2)	(3) (4)	(5) (6)	(7)

(1)	(2	2)	(3)	(4)	(5)	(6)	(7)		Meaning				
Size	Control Output 1		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options						
D								22.5 mm wide and mounts	s to DIN Track				
									Control output 1				
*1	R	Χ						Relay output					
*1	Q	Χ						Voltage output (for driving SSR)					
*1*2	O	Χ						Linear current output					
•		*1	0					None					
		*1	2					2					
				Α				100 to 240 VAC					
				D				24 VAC/DC					
					S			Terminal screw block (Mai	in Unit and Terminal Unit to	ogether)			
					U			Main Unit only (no Termina	al Unit)				
						М		Universal input					
								Event inputs	Communications	HB alarm and HS alarm			
							000	0					
							002		RS-485	1			
							015		RS-485				
							016	1					
							017	017 1 1					

*1 The options that can be selected depend on the type of control output and number of auxiliary outputs.

Control output	No. of auxiliary	Options							
Control output	outputs	000	002	015	016	017			
RX or QX	0			Selectable					
	2	Selectable	Selectable			Selectable			
CX	0			Selectable					
	2	Selectable		Selectable	Selectable				

^{*2} The control output can be used as a simple transfer output for Digital Controllers manufactured in July 2014 or later (version 2.2 or higher).

• E5DC-B (Models with Push-In Plus Terminal Blocks)

(1)	(2	2)	(3)	(4)	(5)	(6)	(7)	Meaning				
Size	Control Output 1		No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options					
D								22.5 mm wide and mounts	s to DIN Track			
									Control output 1			
*1	R	Χ						Relay output				
*1	Q	Χ						Voltage output (for driving SSR)				
*1*2	С	Χ						Linear current output				
_		*1	0					None				
		*1	2					2				
				Α				100 to 240 VAC				
				D				24 VAC/DC				
					В			Push-In Plus terminal bloc	eks			
						М		Universal input				
								Event inputs Communications HB alarm and HS alar				
							000	0				
							002	RS-485 1		1		
							015	RS-485				

The options that can be selected depend on the type of control output and number of auxiliary outputs.

Control output	No. of auxiliary	Options					
Control output	outputs	000	002	015			
RX or QX	0			Selectable			
	2	Selectable	Selectable				
CX	0			Selectable			
	2	Selectable		Selectable			

The control output can be used as a simple transfer output.

• E5GC

E5GC	_						_		
(1)		(2)	(3)	(4)	(5)	(6)		(7)	

(1)	((2)	(3)	(4)	(5)	(6)	(7)		Meaning				
Size	t triation losters	onibar Onibar	No. of auxiliary outputs	Power supply voltage	Terminal type	Input type	Options						
G								48 × 24 mm					
									Control output 1				
	R	Χ						Relay output					
	Q	Χ						Voltage output (for driving	SSR)				
*1	O	Χ						Linear current output					
•		*2	0					None					
			1					1					
			2					2					
				Α				100 to 240 VAC					
				D				24 VAC/DC					
					6			Screw terminals (with cove	er)				
					С			Screwless clamp terminals	3				
						М		Universal input					
						_		Event inputs Communications Single-phase HB alarm and HS alarm					
							000						
							015	RS-485					
						*3	016	1					
						*3*4	023	3 1					
						*5	024	2					

^{*1} The control output can be used as a simple transfer output.

^{*2} If no auxiliary outputs (none) is selected, 000 (none) must be selected for the options.

^{*3} These options can be selected only if two auxiliary outputs are selected.

^{*4} The option for HB and HS alarms (023) cannot be selected if a linear current output is selected for the control output.

^{*5} This option can be selected only if one auxiliary output is selected.

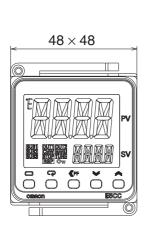
Preparations

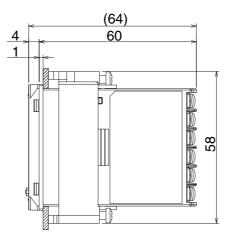
	1	all an	
2-1	Install 2-1-1 2-1-2 2-1-3	ation Dimensions (Unit: mm) Panel Cutout (Unit: mm) Mounting	2-2 2-6
2-2	Using 2-2-1 2-2-2 2-2-3 2-2-4 2-2-5 2-2-6 2-2-7 2-2-8 2-2-9 2-2-10	the Terminals E5CC Terminal Block Wiring Example E5CC-U Terminal Block Wiring Example E5CC-B Terminal Block Wiring Example E5EC/E5AC Terminal Block Wiring Example E5EC-B Terminal Block Wiring Example E5DC Terminal Block Wiring Example E5DC Terminal Block Wiring Example E5DC-B Terminal Block Wiring Example E5C-B Terminal Block Wiring Example E5C-B Terminal Block Wiring Example E7C-B Terminal Block Wiring Example	2-24 2-29 2-32 2-36 2-41 2-46 2-49 2-52
2-3	Insula	tion Block Diagrams2	2-73
2-4	Using 2-4-1 2-4-2 2-4-3	the Setup Tool Port	2-76 2-76

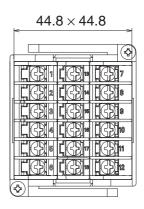
2-1 Installation

Dimensions (Unit: mm) 2-1-1

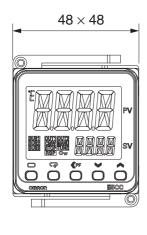
• E5CC

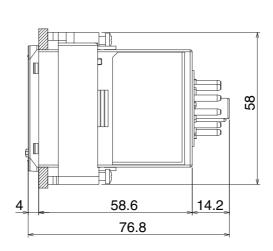


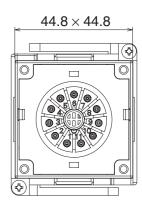




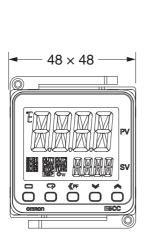
• E5CC-U

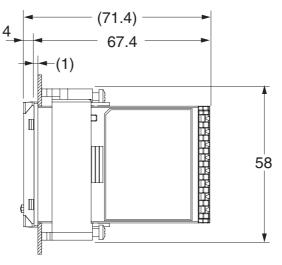


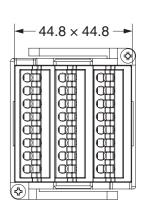




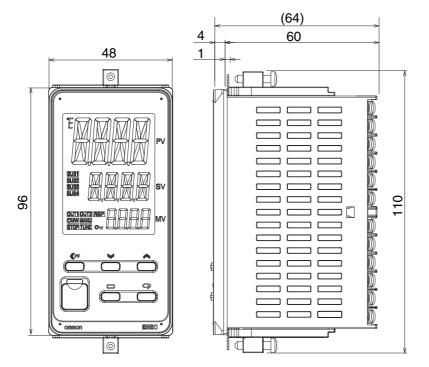
• E5CC-B

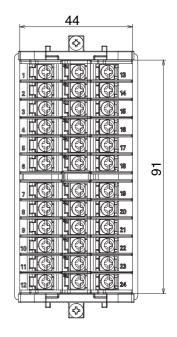




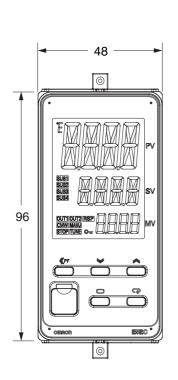


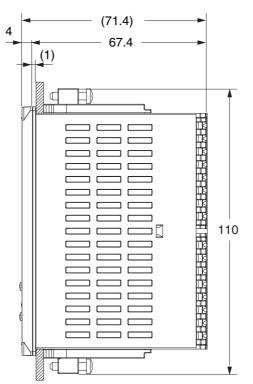
• E5EC

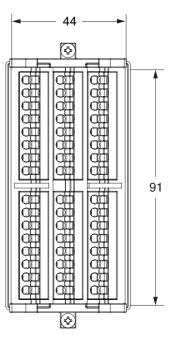




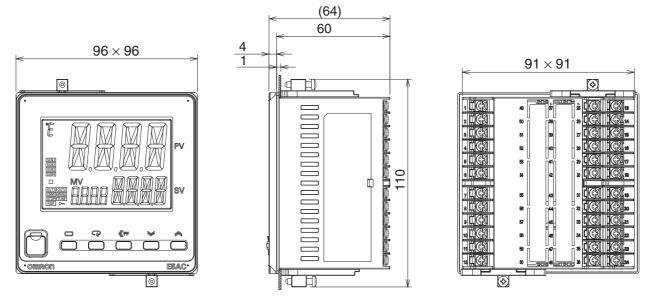
• E5EC-B





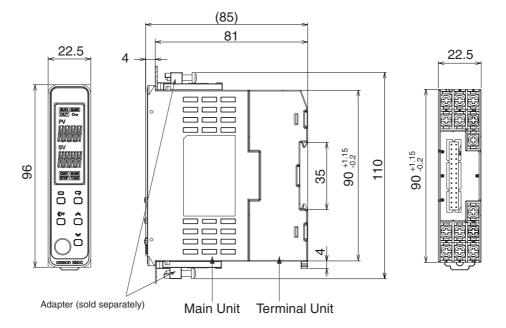


• E5AC



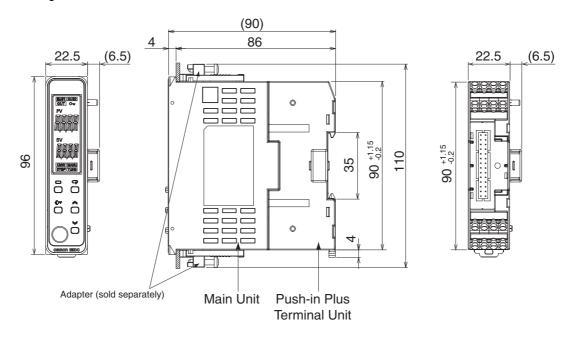
• E5DC

The following figure shows the Terminal Unit attached to the Main Unit.



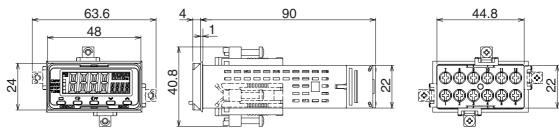
• E5DC-B

The figure below shows the Push-in Plus Terminal Unit attached to the Main Unit.

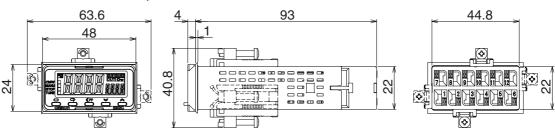


• E5GC

Models with Screw Terminal Blocks



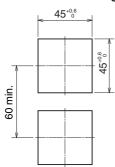
Models with Screwless Clamp Terminal Blocks

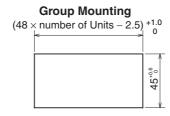


Panel Cutout (Unit: mm) 2-1-2

● E5CC/E5CC-U/E5CC-B

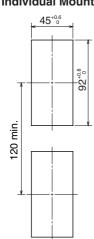
Individual Mounting



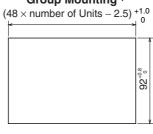


• E5EC/E5EC-B

Individual Mounting

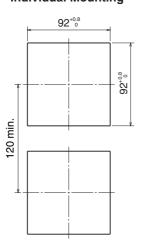




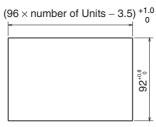


• E5AC

Individual Mounting

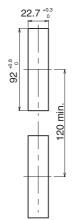


Group Mounting

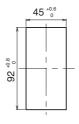


• E5DC/E5DC-B

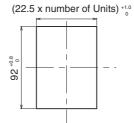
Individual Mounting



Two-Unit Mounting

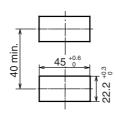


Group Mounting

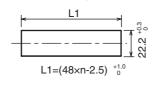


• E5GC

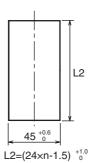
Individual Mounting



Horizontal Group
Mounting*2

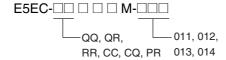


Vertical Group Mounting*2

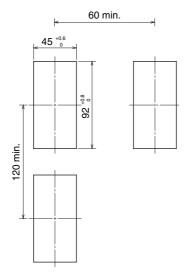


n: Number of mounted Controllers ($2 \le n \le 6$)

- The E5CC-U, E5DC, and E5DC-B cannot be waterproofed.
- Waterproofing is not possible when group mounting several Digital Controllers.
- The recommended panel thickness is 1 to 5 mm for the E5CC, E5CC-U, and E5CC-B, and 1 to 8 mm for E5EC, E5EC-B, E5AC, E5DC, E5DC-B, and E5GC.
- Except for the E5GC with a screwless clamp terminal block, Digital Controllers must not be group mounting vertically. (Observe the recommended mounting space limits.)
- When two or more Digital Controllers are mounted, make sure that the ambient temperature of the Digital Controllers does not exceed the allowable operating temperature specified in the specifications.
- *1 For E5EC models with two control outputs (QQ, QR, CQ, RR, CC, or PR) and 011, 012, 013, or 014 options (shown below), the ambient temperature for group mounting must be 45°C max.



To mount these models at an ambient temperature of 55°C, install them at the following intervals.



*2 When two or more E5GC Digital Controllers are mounted, make sure that the ambient temperature of the Controller does not exceed the allowable operating temperature range given below.

Horizontal group mounting: -10 to 55°C

Vertical group mounting of two Digital Controllers: −10 to 45°C

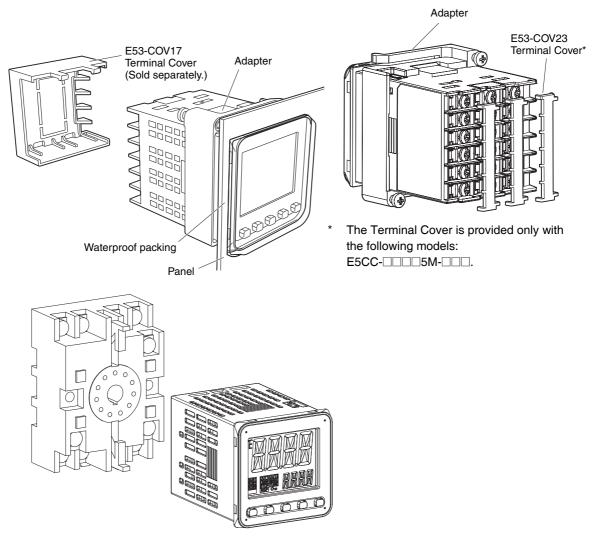
Vertical group mounting of three or more Digital Controllers: -10 to 40°C

Note: Use Digital Controllers with screwless clamp terminal blocks for vertical group mounting. If you use vertical group mounting, you cannot draw out the interior body of the Digital Controllers.

2-1-3 Mounting

E5CC, E5CC-B, and E5CC-U

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



For the Wiring Socket for the E5CC-U, purchase the P2CF-11 or PG3A-11 separately.

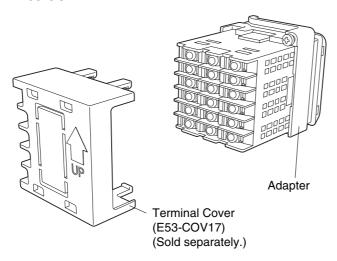
Mounting to the Panel

- (1) For waterproof mounting, waterproof packing must be installed on the Digital Controller. Waterproofing is not possible when group mounting several Digital Controllers. The E5CC-U cannot be waterproofed even if the Waterproof Packing is inserted.
- (2) Insert the E5CC, E5CC-B, or E5CC-U into the mounting hole in the panel.
- (3) Push the Adapter from the terminals up to the panel, and temporarily fasten the E5CC, E5CC-B, or E5CC-U.
- (4) Tighten the two fastening screws on the Adapter. Alternately tighten the two screws little by little to maintain a balance. Tighten the screws to a torque of 0.29 to 0.39 N·m.

Mounting the Terminal Cover (E5CC Only)

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

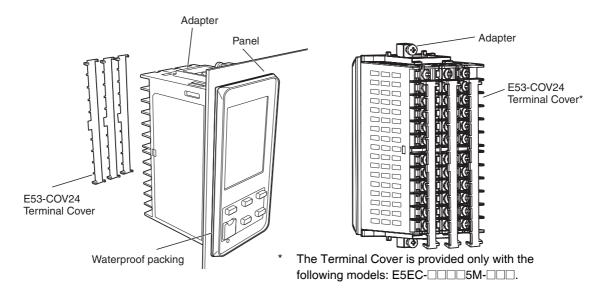


• E53-COV23



Enlarged Illustration of **Terminal Section**

E5EC, E5EC-B, or E5AC

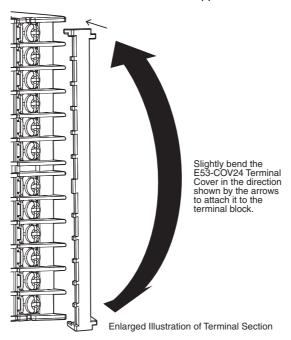


Mounting to the Panel

- (1) For waterproof mounting, waterproof packing must be installed on the Digital Controller. Waterproofing is not possible when group mounting several Digital Controllers.
- (2) Insert the E5EC, E5EC-B, or E5AC into the mounting hole in the panel.
- (3) Push the Adapter from the terminals up to the panel, and temporarily fasten the E5EC, E5EC-B, or E5AC.
- (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.

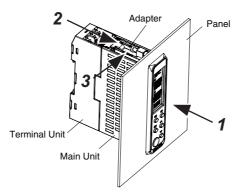
Mounting the Terminal Cover (E5EC or E5AC Only)

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.



Common Procedure of E5DC and E5DC-B

Mounting to the Panel



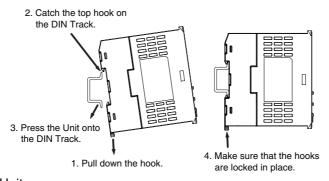
- Insert the E5DC or E5DC-B into the mounting hole in the panel. (Attach the Terminal Unit after you insert the Main Unit.)
- $oldsymbol{2}$ Push the Adapter from the Terminal Unit up to the panel, and temporarily fasten the E5DC or E5DC-B.
- 3 Tighten the two fastening screws on the Adapter. Alternately 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.

E₅DC

Mounting to and Removing from DIN Track

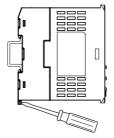
· Mounting a Unit

Pull down the DIN Track hook on the Terminal Unit and catch the top hook on the DIN Track. Press the Unit onto the DIN Track until the DIN Track hooks are locked in place.



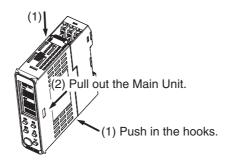
· Removing a Unit

Pull down on the DIN Track Hook with a flat-blade screwdriver and lift up the Unit.



Removing the Main Unit

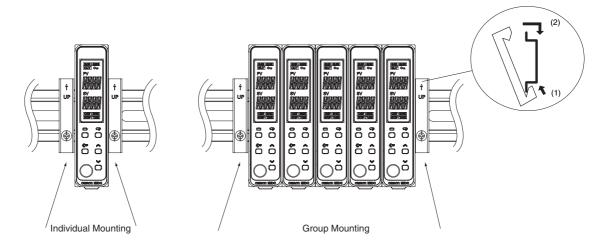
Press in the two hooks on the Main Unit and remove the Main Unit from the Terminal Unit.



End Plate Installation

Make sure to attach PFP-M End Plates to the ends of the Units.

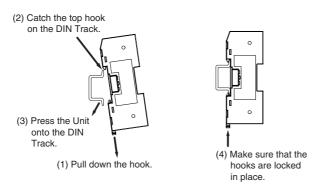
 End Plate (sold separately) PFP-M



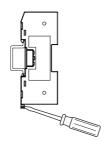
E5DC-B

Mounting to and Removing from DIN Track

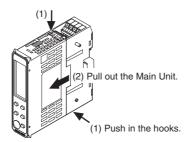
 Mounting a Unit Mount the Main Unit after first mounting the Terminal Unit on the DIN Track.



· Removing a Unit Pull down on the DIN Track Hook with a flat-blade screwdriver and lift up the Unit.

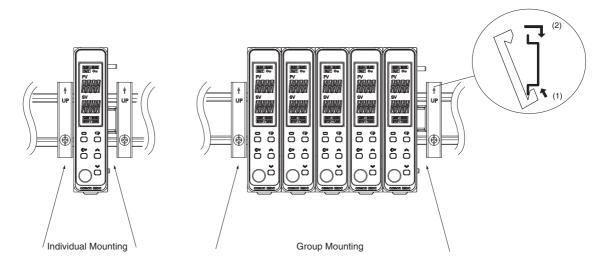


• Removing the Main Unit



• End Plate Installation

Make sure to attach PFP-M End Plates to the ends of the Units.

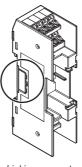


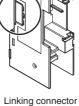
Mounting the DIN Track

Refer to Mounting the DIN Track on page 2-13.

Linked Mounting/Removal of the E5DC-B

A built-in connector for linking is provided in the E5DC-B that enables linked mounting of units together with DIN Track and panel mounting. As a result, crossover wiring is not required for communication and power supply. Up to 16 units can be linked.





(female side)

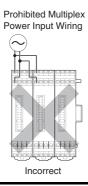
Linking connector (male side)

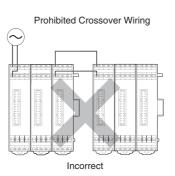


Precautions for Correct Use

Wiring

When linking the units together, connect the power cable only to the unit at the left end of the linkage block. Incorrect wiring can be shorted inside the unit resulting in damage to the unit. Do not perform crossover wiring between each linkage block, or to another device. This could result in a breakdown or incorrect operation.





Mounting the DIN Track

Attach the DIN Track to the inside of the control panel with screws to at least three locations.

• DIN Track (sold separately)/PFP-50N (50 cm) and PFP-100N (100 cm)



Install the DIN Track vertically to the ground.

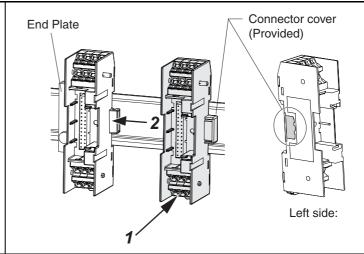


Vertical: OK

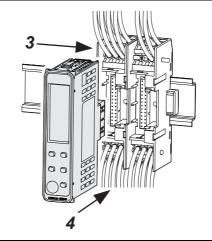
Horizontal: NG

Linked Mounting on DIN Track

- Remove the connector cover of the Terminal Unit from the side that is to be linked, and mount the Unit on the DIN Track.
- $\boldsymbol{2}$ Link the connectors of the **Terminal Units.**



- Wire the Terminal Units.
- Insert the Main Unit into the **Terminal Unit.**



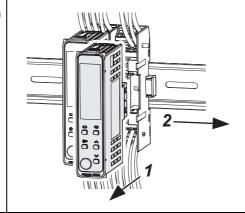


Precautions for Correct Use

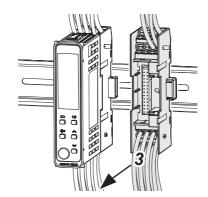
- When N units are linked together, the inrush current will be equal to N times that for 1 unit. Be sure to use the external fuse with the appropriate fusing characteristics, and the breaker with the appropriate tripping characteristics to ensure that the fuse does not melt and the breaker is not activated due to the inrush current. The inrush current per Unit is 30 A or less.
- · Do not remove the connector cover from connectors that are not to be linked. The connector covers have been mounted on the product during shipment.
- Do not add or separate the units during power-on.

Removing from the DIN Track

- **1** Remove the Main Unit from the Terminal Unit.
- **2** Remove the Terminal Units.



3 Remove the Terminal Units from the DIN Track.

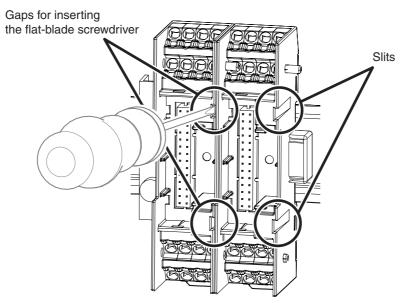




Additional Information

Removing the Terminal Unit Using a Flat-blade Screwdriver

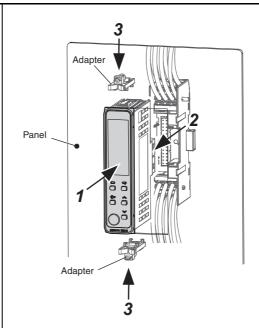
There are two slits on the right side of the Terminal Unit. When Terminal Units are linked, these
slits act as gaps for inserting a flat-blade screwdriver. The Terminal Units can be easily
removed by inserting a flat-blade screwdriver in these gaps. Perform this operation after
removing the Main Unit.

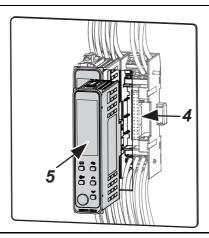


• For Recommended Flat-blade Screwdriver, refer to *Recommended Flat-blade Screwdriver* on page 2-61.

Linked Mounting on the Mounting Panel

- Push the Main Unit into the mounting holes on the mounting panel.
- Mount a wired Terminal Unit on the Main Unit.
- $oldsymbol{3}$ Push the Adapter from the Terminal Unit side up to the Mounting Panel, temporarily fasten the Main Tighten Unit. the fastening screws on the Adapter. Alternately tighten the two screws little by little maintain а balance. Tighten the screws to a torque of 0.29 to 0.39 N·m.
- **4** Remove the connector cover of the wired Terminal Unit from the side that is to be linked. and link the connectors.
- **5** Push the Main Unit into the mounting holes on the mounting panel, and attach it to the Terminal Unit.





6 Push the Adapter from the Terminal Unit up to the panel, and temporarily fasten the E5DC. Tighten the fastening screws on the Adapter. Alternately tighten the two screws little by little maintain balance. а Tighten the screws to a torque of 0.29 to 0.39 N·m.



Precautions for Correct Use

• Do not remove the connector cover from connectors that are not to be linked. The connector covers have been mounted on the product during shipment.

6

6

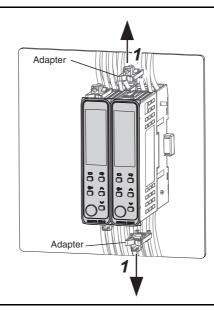
Adapter

Adapter

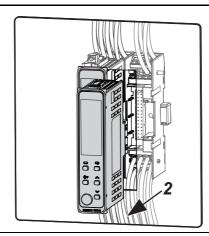
• Do not add or separate the units during power-on.

Removing from the Mounting Panel

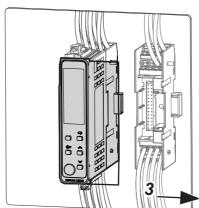
Remove the **Adapter** attached to the Main Unit.



2 Remove the Main Unit from the Terminal Unit.

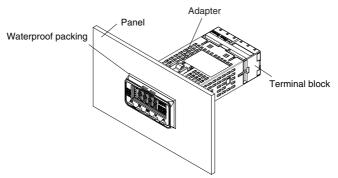


Remove the Terminal Units.



E5GC

Mounting to the Panel



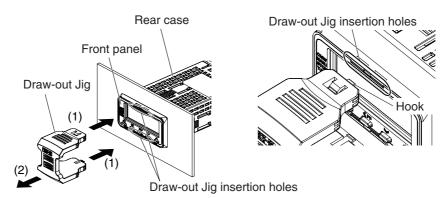
- (1) When waterproofing is required, insert the Waterproof Packing on the backside of the front panel. Digital Controllers cannot be waterproofed when they are mounted side by side.
- (2) Insert the E5GC into the mounting hole in the panel.
- (3) Use two Adapters, either on the top and bottom or on the right and left.
- (4) Push the Adapter from the terminals up to the panel, and temporarily fasten the Digital Controller.
- (5) Tighten the two fastening screws on each 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.

Drawing Out the Interior Body of the E5GC to Replace It

You can use the Y92F-55 Draw-out Jig to remove the interior body of the Digital Controller from the case to perform maintenance without removing the terminal leads. This is possible for only the E5GC. Check the specifications of the case and Digital Controller before removing the interior body from the case.

1. Drawing Out the Interior Body from the Rear Case

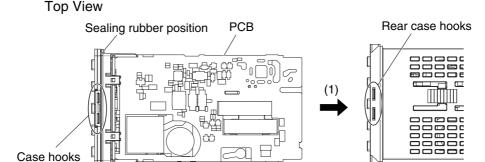
(1) Slowly insert the Draw-out Jig into the Draw-out Jig insertion holes laterally until it clicks into place. (There is a hole at both the top and bottom.) (If you attempt to draw out the interior body of the Digital Controller when only one hook is engaged, the Digital Controller may be damaged.)



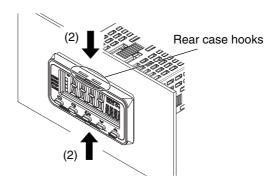
- (2) Pull out the Draw-out Jig together with the front panel. Do not pull with excessive force. Slowly pull out the Digital Controller laterally. (If you pull the interior body out at an angle, the Digital Controller may be damaged.)
- (3) After the interior body is free from the rear case, support the interior body with one hand and draw it out slowly in a horizontal direction.

2. Inserting the Interior Body into the Rear Case

- (1) When inserting the interior body back into the rear case, make sure the PCBs are parallel to each other, mount the sealing rubber, and press the interior body toward the rear case and into position, making sure that the sealing rubber does not move.
- (2) When you press the Digital Controller into position, press down on the rear case hooks so that the case hooks securely lock in place. (There are rear case hooks at both the top and bottom of the rear case.) If the Digital Controller is not correctly mounted into the rear case, the rear case may not be waterproof. When inserting the Digital Controller, do not allow the electronic components to touch the rear case.



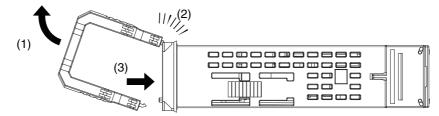
* Make sure that the top and bottom PCBs are parallel to each other, and then press the interior body toward the rear case.



Removing the Draw-out Jig when only one hook is caught in the Draw-out Jig insertion hole

- (1) Pull the Draw-out Jig slowly in the direction shown in the figure. (This step is the same even if the other hook is caught.)
- (2) Confirm that the Draw-out Jig is free of the Draw-out Jig insertion hole.
- (3) If the interior body separates from the rear case, slowly press the interior body into the rear case in a horizontal direction.

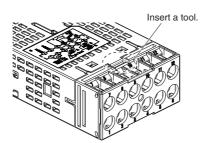
If you do not follow the procedures above, the Digital Controller may be damaged.

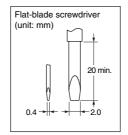


Removing the Terminal Block

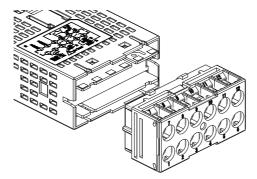
The terminal block can be removed from the E5GC. Doing so is not possible with the E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, or E5AC.

(1) Insert a flat-blade screwdriver into the tool holes (one on the top and one on the bottom) to release the hooks. Do not apply excessive force.





(2) Pull the terminal block out while the hooks are released.



Note: The method for removing the terminal block is the same for both screw terminal blocks and screwless clamp terminal blocks.

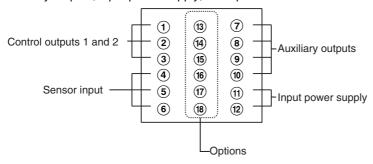
Do not connect the wrong type of terminal block to the Digital Controller. For example, do not connect a screwless clamp terminal block to a Digital Controller for a screw terminal block. Performance may be affected.

Using the Terminals 2-2

E5CC Terminal Block Wiring Example 2-2-1

Terminal Arrangement

The terminals block of the E5CC 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) by default. 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

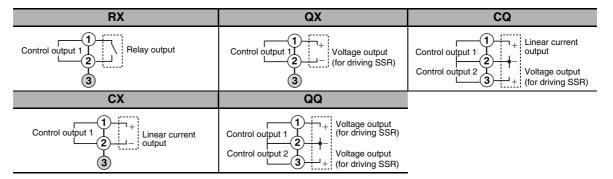
The specifications for control outputs 1 and 2 are given in the following location in the model number.



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 linear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω
		max.
QQ	2 voltage outputs (for driving SSRs)	12 VDC, 21 mA
CQ	1 linear current output and 1 voltage output (for driving SSRs)	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max. for current output and 12 VDC, 21 mA for voltage
	2.10)	output

Terminal Details

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



Sensor Input

Model Numbers

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



Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
+ (6) (6)	A 4 5 B 6	mA 5 6	(4) -(5) -(6) +



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

The number of auxiliary outputs on the E5CC is given in the following location in the model number.

-- No. of auxiliary outputs

Code	Auxiliary outputs	Specification
0*	None	None
2*	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 3 A
3	Model with 3 auxiliary outputs	SPST-NO, 250 VAC, 2 A

These cannot be selected if 5 (screw terminals with cover) is selected for the terminal type.

Terminal Details

Model with 2 auxiliary	Model with 3 auxiliary
outputs	outputs
Auxiliary output 2 Auxiliary output 1 Auxiliary output 1	Auxiliary output 3 Auxiliary output 2 Auxiliary output 2 Auxiliary output 1 Auxiliary output 1

Input Power Supply

Model Numbers

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

- Input power supply

Code	Specification	Power consumption
Α	100 to 240 VAC, 50/60 Hz	Option number 000: 5.2 VA max.
		Other option numbers: 6.5 VA max.
D	24 VAC, 50/60 Hz	Option number 000: 3.1 VA max./1.6 W max.
	24 VDC (no polarity)	Other option numbers: 4.1 VA max./2.3 W max.

• Terminal Details

100 to 240 VAC	24 VAC/DC
11) (2)	(No polarity)

Options

Model Numbers

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

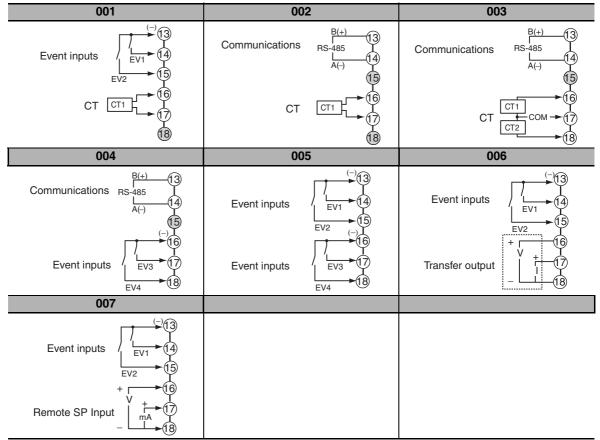
E5CC-

Code	Specification	Remarks
000	None	
001	Event inputs 1 and 2, and CT1	
002*	Communications (RS-485) and CT1	
003	Communications (RS-485), CT1, and CT2	
004	Communications (RS-485), and event inputs 3 and 4	
005	Event inputs 1 to 4	
006	Event inputs 1 and 2, and transfer output	Transfer output: Current: 4 to 20 mA DC Voltage: 1 to 5 VDC
007	Event inputs 1 and 2, and remote SP input	Remote SP input: Current: 4 to 20 or 0 to 20 mA DC Voltage: 1 to 5, 0 to 5, or 0 to 10 VDC

^{*} These cannot be selected if 5 (screw terminals with cover) is selected for the terminal type.

Terminal Details

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



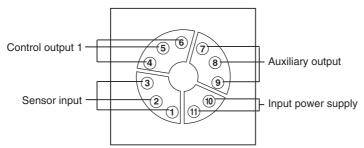
Note: Use non-voltage inputs for the event inputs.

The polarity for a non-contact input is indicated by "(-)."

2-2-2 E5CC-U Terminal Block Wiring Example

Terminal Arrangement

The terminals block of the E5CC-U is divided into four types of terminals: control output 1, sensor input, auxiliary output, and input power supply.





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 $(5.E\,PP)$ will occur. Check the setting of the Input Type parameter.

Control Output 1

Model Numbers

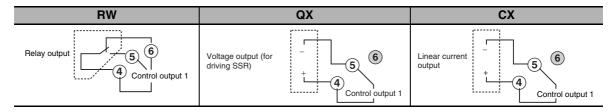
The specification for control output 1 is given in the following location in the model number.



Code	Output type	Specification
RW	1 relay output, SPDT contacts	250 VAC, 3 A (resistive load)
QX	1 voltage output (for driving SSR)	12 VDC, 21 mA
СХ	1 linear 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.



Sensor Input

Model Numbers

All E5CC-U models have universal sensor inputs, so the code in the model number is always "M."

Sensor input

Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
(3) (A 3 B 2 B 1	**************************************	(3) (2) +(1)



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

The number of auxiliary outputs on the E5CC-U is given in the following location in the model number.



Code	Auxiliary outputs	Specification
0	None	None
1	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 3 A
2	Model with 3 auxiliary outputs	SPST-NO, 250 VAC, 3 A

Terminal Details

Model with 1 auxiliary output	Model with 2 auxiliary outputs
Auxiliary output 1 7 8	Auxiliary output 1 Auxiliary output 2

Input Power Supply

Model Numbers

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



Code	Specification	Power consumption
Α	100 to 240 VAC, 50/60 Hz	5.2 VA max.
D	24 VAC, 50/60 Hz	3.1 VA max./1.6 W max.
	24 VDC (no polarity)	

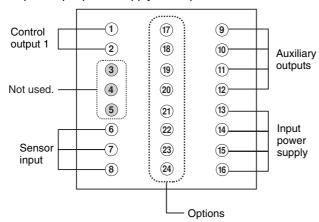
• Terminal Details

100 to 240 VAC	24 VAC/DC
(10) 11) 1 1	(No polarity)

E5CC-B Terminal Block Wiring Example 2-2-3

Terminal Arrangement

The terminals block of the E5CC-B 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). If a different sensor is used, an input error (5.EPP) 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.



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 linear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.

Terminal Details

RX	QX	СХ
Control output 1 Relay output	Control Output 1 Voltage output (for driving SSR)	Control output 1 + Linear current output

Sensor Input

Model Numbers

All E5CC-B models have universal sensor inputs, so the code in the model number is always "M."

E5CC-

Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
(a) (b) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d	A 6 7 B 8 8	**************************************	6 - 7 - 7 - 8 - 8



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.
- The sensor input is not electrically isolated from the internal circuits. If you use a grounded thermocouple, do not connect one of the sensor input terminals to ground. (If the sensor input terminals are connected to ground, errors will occur in the measured temperature as a result of leakage current.)

Auxiliary Outputs

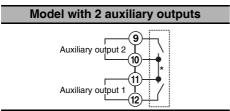
Model Numbers

The number of auxiliary outputs on the E5CC-B is given in the following location in the model number.

- No. of auxiliary outputs

Code	Auxiliary outputs	Specification
2	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 2 A

Terminal Details



Common terminals are indicated with asterisks (*).

Input Power Supply

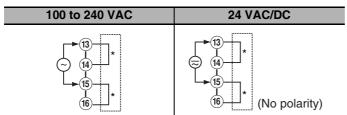
Model Numbers

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

- Input power supply

Code	Specification	Power consumption
Α	100 to 240 VAC, 50/60 Hz	Option number 000: 5.2 VA max.
		Other option numbers: 6.5 VA max.
D	24 VAC, 50/60 Hz	Option number 000: 3.1 VA max./1.6 W max.
	24 VDC (no polarity)	Other option numbers: 4.1 VA max./2.3 W max.

Terminal Details



Common terminals are indicated with asterisks (*). You can use them for crossover wiring. For crossover wiring, do not exceed the maximum number of Temperature Controllers given below. 100 to 240 VAC Controllers: 16 max. 24 VAC/VDC Controllers: 8 max.

Options

Model Numbers

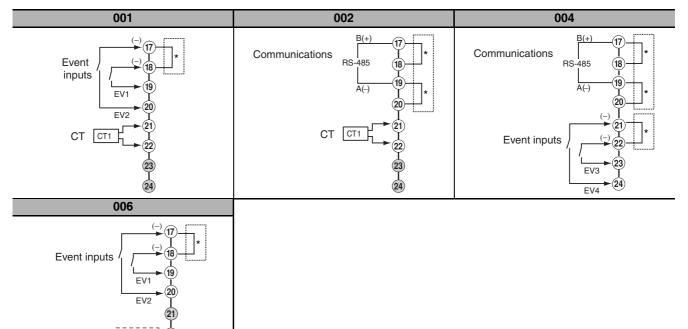
The options specification of the E5CC-B is given in the following location in the model number.



Code	Specification	Remarks
000	None	
001	Event inputs 1 and 2, and CT1	
002	Communications (RS-485) and CT1	
004	Communications (RS-485), and event inputs 3 and 4	
006	Event inputs 1 and 2, and transfer output	Transfer output: Current: 4 to 20 mA DC Voltage: 1 to 5 VDC

Terminal Details

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



^{*} Common terminals are indicated with asterisks (*).

You can use communications common terminals for crossover wiring.

Note: Use non-voltage inputs for the event inputs.

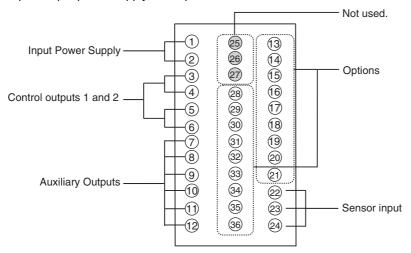
Transfer output

The polarity for a non-contact input is indicated by "(-)."

E5EC/E5AC Terminal Block Wiring Example 2-2-4

Terminal Arrangement

The terminals block 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.EPP) 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.



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 linear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω	
		max.	
QQ	2 voltage outputs (for driving SSRs)	12 VDC, 21 mA	
QR	voltage output (for driving SSR) and 12 VDC, 21 mA for voltage output		
	1 relay output	250 VAC, 5 A (resistive load) for relay output	
RR or PR	2 relay outputs	250 VAC, 5 A (resistive load)	
CC	2 linear current outputs 4 to 20 mA DC or 0 to 20 mA DC with load of		
		max.	
CQ	1 linear current output and 1 voltage	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω	
	output (for driving SSRs)	max. for current output and 12 VDC, 21 mA for voltage	
1		output	

Terminal Details

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

RX	QX	СХ
Control output 1 4 Relay output 5 6	Control output 1 + Voltage output (for driving SSR)	Control output 1 + Linear current output 5
QQ	QR	RR
Control output 1 4 + Voltage output (for driving SSR) Control output 2 6 + Voltage output (for driving SSR)	Control output 1	Control output 1 Relay output Control output 2 Relay output
CC	PR	CQ
Control output 1	Open 4 Relay output Close 6 Relay output	Control output 1 4 Linear current output Control output 2 6 4 Voltage output (for driving SSR)

Sensor Input

Model Numbers

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



Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
(2) - (3) + (4)	A (22) B (23) B (24)	→ (22) mA (23) - (24)	22 - 23 - 24 + 24



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

The number of auxiliary outputs is given in the following location in the model number.

No. of auxiliary outputs

Code	Auxiliary outputs	Specification
2*	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 3 A
4	Model with 4 auxiliary outputs	SPST-NO, 250 VAC, 2 A

These cannot be selected if 5 (screw terminals with cover) is selected for the terminal type.

Terminal Details

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

Model with 2 auxiliary outputs	Model with 4 auxiliary outputs
Auxiliary output 2 Auxiliary output 1 Auxiliary output 1 11 Auxiliary output 1	Auxiliary output 4 Auxiliary output 3 Auxiliary output 2 Auxiliary output 1 Auxiliary output 1

Input Power Supply

Model Numbers

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

Input power supply

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

		E5EC power consumption		E5AC power consumption	
Code	Specification	Option number 000	Other option numbers	Option number 000	Other option numbers
Α	100 to 240 VAC	6.6 VA max.	8.3 VA max.	7.0 VA max.	9.0 VA max.
,,	(50/60 Hz)	olo vytmax.	olo Trimaxi	7.0 V/ max.	olo tranical
D	24 VAC, 50/60 Hz	4.1 VA max.	5.5 VA max.	4.2 VA max.	5.6 VA max.
	24 VDC (no polarity)	2.3 W max.	3.2 W max.	2.4 W max.	3.4 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/E5AC is given in the following location in the model number.



Code	Specification
000	None or potentiometer input (Position-proportional Models only)
004	Communications (RS-485), and event inputs 1 and 2
	Potentiometer input (Position-proportional Models only)
005	Event inputs 1 to 4
008*	Communications (RS-485), event inputs 1 and 2, and CT1
009	Communications (RS-485), event inputs 1 and 2, CT1, and CT2
010	Event inputs 1 to 4, and CT1
011	Event inputs 1 to 6, CT1, transfer output, and remote SP input
012*	Communications (RS-485), event inputs 1, 2, 5, and 6, CT1, transfer output, and remote
	SP input
013	Event inputs 1 to 6, transfer output, and remote SP input
014	Communications (RS-485), event inputs 1, 2, 5, and 6, transfer output, and remote SP
	input
	Potentiometer input (Position-proportional Models only)

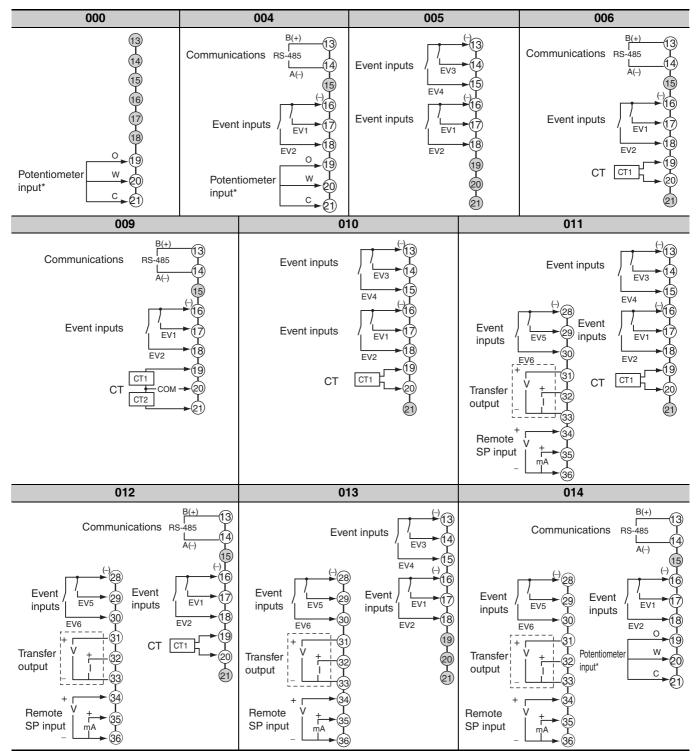
Transfer Output

Current: 4 to 20 mA DC Voltage: 1 to 5 VDC Remote SP Input

Current: 4 to 20 or 0 to 20 mA DC Voltage: 1 to 5, 0 to 5, or 0 to 10 VDC

Terminal Details

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



Can be used for a Position-proportional Model.

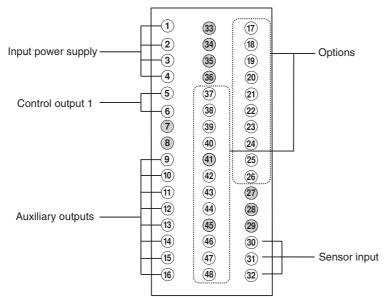
Note: Use non-voltage inputs for the event inputs.

The polarity for a non-contact input is indicated by "(-)."

2-2-5 E5EC-B Terminal Block Wiring Example

Terminal Arrangement

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



Note: The terminals that are shaded gray are not used.



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 Output 1

Model Numbers

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



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 linear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.

Terminal Details

RX	QX	CX
Control output 1 6 Relay output	Control output 1 Voltage output (for driving SSR)	Control output 1 6 + Linear current output

Sensor Input

Model Numbers

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

Sensor input

Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
30 	A 300 B 311 B 322	**************************************	300 - 31) - 32) + 4



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.
- The sensor input is not electrically isolated from the internal circuits. If you use a grounded thermocouple, do not connect one of the sensor input terminals to ground. (If the sensor input terminals are connected to ground, errors will occur in the measured temperature as a result of leakage current.)

Auxiliary Outputs

Model Numbers

The number of auxiliary outputs is given in the following location in the model number.

- No. of auxiliary outputs

Code	Auxiliary outputs	Specification
2	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 3 A
4	Model with 4 auxiliary outputs	SPST-NO, 250 VAC, 2 A

Terminal Details

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

Model with 2 auxiliary outputs	Model with 4 auxiliary outputs
9	Auxiliary output 4 10
Auxiliary output 2 12	Auxiliary output 3 12
13 14	Auxiliary output 2
Auxiliary output 1 16	Auxiliary output 1 16

Common terminals are indicated with asterisks (*).

Input Power Supply

Model Numbers

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

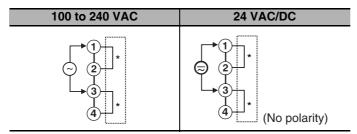
E5EC- S M- Input power supply

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

		Power consumption	
Code	Specification	Options No.: 000	Options No.: Not 000
А	100 to 240 VAC, 50/60 Hz	6.6 VA max.	8.3 VA max.
	24 VAC, 50/60 Hz	4.1 VA max.	5.5 VA max.
D	24 VDC (no polarity)	2.3 W max.	3.2 W max.

Terminal Details

Details on the input power supply terminals are shown below.



Common terminals are indicated with asterisks (*). You can use them for crossover wiring. For crossover wiring, do not exceed the maximum number of Digital Controllers given below.

100 to 240 VAC Controllers: 16 max. 24 VAC/VDC Controllers: 8 max.

Options

Model Numbers

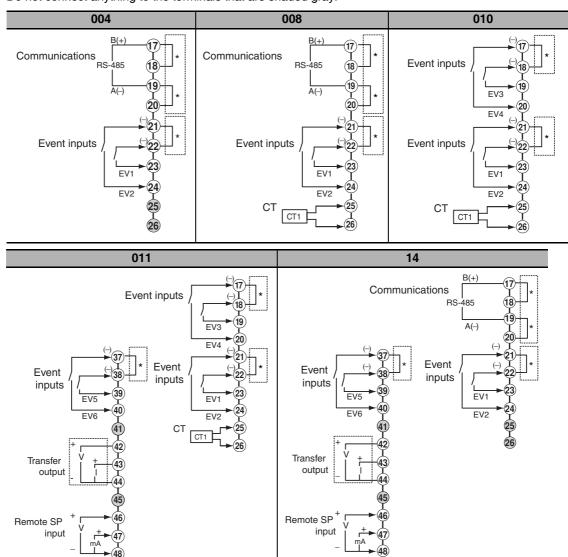
The options specification of the E5EC-B is given in the following location in the model number.



Code	Specification
000	None
004	Communications (RS-485), event inputs 1 and 2
800	Communications (RS-485)
	Event inputs 1 and 2
	CT1
010	Event inputs 1, 2, 3, and 4
	CT1
011	Event inputs 1, 2, 3, 4, 5, and 6
	CT1
	Transfer output
	Remote SP input
014	Communications (RS-485), event inputs 1, 2, 5, and 6, transfer output, and
	remote SP input

Terminal Details

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



^{*} Common terminals are indicated with asterisks (*).

You can use communications common terminals for crossover wiring.

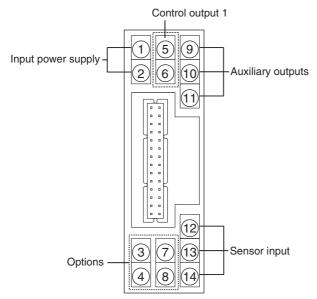
Note: Use non-voltage inputs for the event inputs.

The polarity for a non-contact input is indicated by "(-)."

E5DC Terminal Block Wiring Example 2-2-6

Terminal Arrangement

The terminals block of the E5DC is divided into five types of terminals: control output 1, sensor input, auxiliary outputs, input power supply, and options.





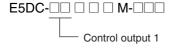
Precautions for Correct Use

- When you purchase the Digital Controller, it will be set for a K thermocouple (input type = 5). If a different sensor is used, an input error (5.ERR) will occur. Check the setting of the Input Type parameter.
- The terminal arrangement is different for the E5DC-B. Always check the terminal arrangement diagram before wiring.

Control Output 1

Model Numbers

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



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

Terminal Details

RX	QX	CX
Control Output 1 Relay output	Control output 1 + Voltage output (for driving SSR)	Control Output 1 Linear current output

Sensor input

Model Numbers

All E5DC models have universal sensor inputs, so the code in the model number is always "M."



Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
12 - 13 + 14	A (12) B (3) B (4)	1	(2) - (3) - (4)



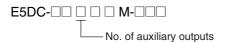
Precautions for Correct Use

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

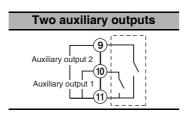
Model Numbers

The number of auxiliary outputs on the E5DC is given in the following location in the model number.



Code	Auxiliary outputs	Specifications
0	None	None
2	2 auxiliary outputs	SPST-NO, 250 VAC, 2 A

Terminal Details



Input power supply

Model Numbers

The input power supply specification of the E5DC is given in the following location in the model number.



Code	Specifications	Power consumption
Α	100 to 240 VAC (50/60 Hz)	4.9 VA max.
D	24 VAC (50/60 Hz) 24 VDC (no polarity)	2.8 VA max./1.5 W max.

Terminal Details

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

Options

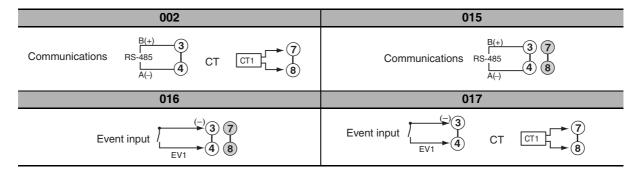
Model Numbers

The options specification of the E5DC is given in the following location in the model number.

Code	Specifications
000	None
002	Communications (RS-485)
	and CT1
015	Communications (RS-485)
016	Event input 1
017	Event input 1 and CT 1

Terminal Details

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



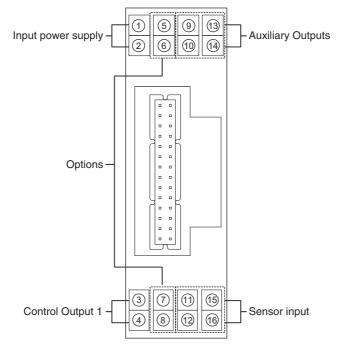
Note: Use a non-voltage input for the event input.

The polarity for a non-contact input is indicated by "(-)."

2-2-7 E5DC-B Terminal Block Wiring Example

Terminal Arrangement

The terminals block of the E5DC-B 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). If a different sensor is used, an input error (5.ERR) will occur. Check the setting of the Input Type parameter.
- The terminal arrangement is different for the E5DC. Always check the terminal arrangement diagram before wiring.

Control Output 1

Model Numbers

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



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

Terminal Details

RX	QX	CX
Control Output 1 Relay output	Control output 1 Voltage output (for driving SSR)	Control Output 1 Linear current output

Sensor input

Model Numbers

All E5DC-B models have universal sensor inputs, so the code in the model number is always "M."



Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
11 (15) - 12 (16) +	A B B B B B B B B B B B B B B B B B B B	11) (15) ————————————————————————————————————	11) 15) - 12) 16) +



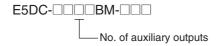
Precautions for Correct Use

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

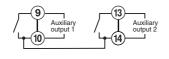
The number of auxiliary outputs on the E5DC-B is given in the following location in the model number.



Code	Auxiliary outputs	Specifications
0	None	None
2	2 auxiliary outputs	SPST-NO, 250 VAC, 2 A

Terminal Details

Two auxiliary outputs



Input power supply

Model Numbers

The input power supply specification of the E5DC-B is given in the following location in the model number.



Code	Specifications	Power consumption
Α	100 to 240 VAC (50/60 Hz)	4.9 VA max.
D	24 VAC (50/60 Hz)	2.8 VA max./1.5 W max.
	24 VDC (no polarity)	

Terminal Details

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

Options

Model Numbers

The options specification of the E5DC-B is given in the following location in the model number.



Code	Specifications
000	None
002	Communications (RS-485) and CT1
015	Communications (RS-485)

Terminal Details

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

002	015
Communications RS-485 $A(\cdot)$ $A(\cdot)$	Communications RS-485 $A(\cdot)$ $A(\cdot)$
CT CT1 (8)	7)-88

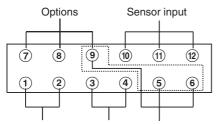
Note: Use a non-voltage input for the event input.

The polarity for a non-contact input is indicated by "(-)."

E5GC Terminal Block Wiring Example 2-2-8

Terminal Arrangement

The terminals block of the E5GC is divided into five types of terminals: control output 1, sensor input, auxiliary outputs, input power supply, and options.



Input power supply Control output 1 Auxiliary outputs



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.EPP) will occur. Check the setting of the Input Type parameter.

Control Output 1

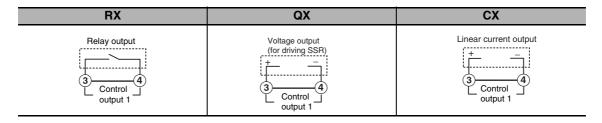
Model Numbers

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



Code	Output type	Specification
RX	1 relay output	250 VAC, 2 A (resistive load)
QX	1 voltage output (for driving SSR)	12 VDC, 21 mA
CX	1 linear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.

Terminal Details



Sensor Input

Model Numbers

All E5GC models have universal sensor inputs, so the code in the model number is always "M."



Terminal Details

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

TC (thermocouple)	Pt (resistance thermometer)	I (current)	V (voltage)
- + (1) (12)	(1) B B (1) (1) (12)	√+ mA	- V + + 12



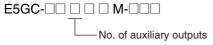
Precautions for Correct Use

When complying with EMC standards, the line connecting the sensor must be 30 m or less. If the cable is longer than 30 m, the EMC standards will not be satisfied.

Auxiliary Outputs

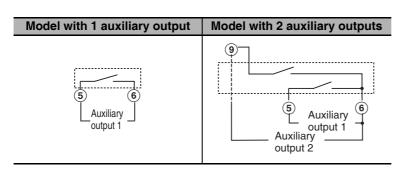
Model Numbers

The number of auxiliary outputs on the E5GC is given in the following location in the model number.



Code	Auxiliary outputs	Specification
0	None	None
1	Model with 1 auxiliary output	SPST-NO, 250 VAC, 2 A
2	Model with 2 auxiliary outputs	SPST-NO, 250 VAC, 2 A

Terminal Details



Input Power Supply

Model Numbers

The input power supply specification of the E5GC is given in the following location in the model number.

Input power supply

Code	Specification	Power consumption
Α	100 to 240 VAC (50/60 Hz)	5.9 VA max.
D	24 VAC (50/60 Hz)	3.2 VA max./1.8 W max.
	24 VDC (no polarity)	

Terminal Details

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

Options

Model Numbers

The options specification of the E5GC is given in the following location in the model number.



Code	Specification
000	None
015	Communications (RS-485)
016	Event input 1
023	CT1
024	Event inputs 1 and 2

Terminal Details

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

015	016
Communications $B(+) $	Event input EV1 7 8 9 *
023	024
7—8—9°	Event input EV2 (-) V

^{*} To use auxiliary output 2, connect to terminal 9.

Note: Use non-voltage inputs for the event inputs.

The polarity for a non-contact input is indicated by "(-)."

2-2-9 Precautions when Wiring

- Separate input leads and power lines in order to prevent external noise.
- · Use crimp terminals when wiring the screw 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. The specified torque is 0.5 N·m for the E5CC-U.

■ E5CC, E5EC, E5AC, E5DC, and E5GC (Models with Screw Terminal Blocks) and E5CC-U (Plug-in Models)

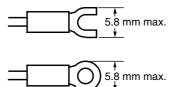
Wires

Use the wire specifications given in the following table.

Model	Recommended wires	Stripping length
E5CC, E5EC, E5AC, E5DC, and E5GC	AWG24 to AWG18 (0.21 to 0.82 mm ²)	6 to 8 mm (when crimp terminals are not used)
E5CC-U	AWG24 to AWG14 (0.21 to 2.08 mm ²)	5 to 6 mm (when crimp terminals are not used)

Crimp Terminals

For the E5CC, E5EC, E5AC, E5DC, or E5GC, use the following types of crimp terminals for M3 screws.



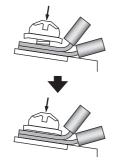
Although you can connect two crimp terminals with insulation sleeves to one terminal, you cannot do so if the diameter of the insulation sleeves is too large.

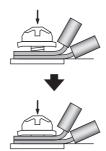
Select a crimp terminal that can be tightened as shown below. (Excluding the E5CC-U)

E5CC, E5EC, or E5AC

E5GC or E5DC

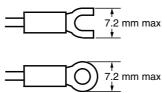
Note: Be careful in the tightening direction, as the terminal block is at an angle.



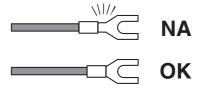


Some terminal blocks have a large crimp part. In this case, bend the terminal in advance as shown in the figure, and tighten slowly to ensure that the terminal screw is vertical to the terminal surface of the terminal block.

For the E5CC-U, use the following types of crimp terminals for M3.5 screws.



• If you use crimp terminals for the E5DC, use crimp terminals with insulation sleeves. If you use a bare crimp terminal with no insulation, the terminal may short with the terminal above or below it. If you use bare crimp terminals, cover the crimped sections with insulating marking tubes. Secure the marking tubes so that they do not move.



Recommended Crimp Terminals with Insulation Sleeves for the E5DC

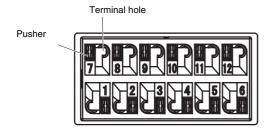
Manufacturer	Model number
J.S.T. Mfg. Co.	V1.25-B3A
	V0.5-3A

E5GC (Models with Screwless Clamp Terminal Blocks)

1. Connection Method for Screwless Clamp Terminal Blocks

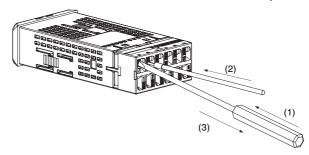
The same method is used to connect stranded wires, solid wires, and ferrules.

Terminal Block Part Names



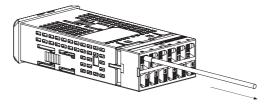
Connection Method

- (1) Press the pusher with a flat-blade screwdriver.
- (2) With the screwdriver still pressing the pusher, insert the wire into the terminal hole.
- (3) Remove the flat-blade screwdriver from the pusher.



Checking Connections

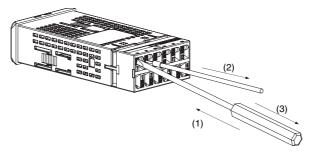
After insertion, pull gently on the wire to make sure that it will not come out (i.e., to confirm that it is held by the terminal block).



2. Removal Method for Screwless Clamp Terminal Blocks

The same method is used to remove stranded wires, solid wires, and ferrules.

- (1) Press the pusher with a flat-blade screwdriver.
- (2) With the screwdriver still pressing the pusher, pull the wire out of the terminal hole.
- (3) Remove the flat-blade screwdriver from the pusher.



3. Recommended Wires and Ferrules

Wires

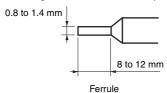
Use the wire specifications given in the following table.

Recommended wire	Stripping length
AWG24 to AWG18 (0.21 to 0.82 mm ²)	8 to 12 mm

Ferrules

Ferrules must be 0.8 to 1.4 mm in diameter

The length of the conductive portion inserted into the terminal must be 8 to 12 mm..



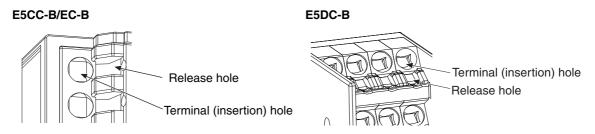
Recommended Ferrules

Manu	facturer	Model number
Altech Corp.		2623.0
Daido Solderless Terminal Mfg. Co.		AVA-0.5
J.S.T. Mfg. Co.		TUB-0.5
Nichifu Co., Ltd.	Single (1 wire)	TGNTC-1.25-9T,
		TGVTC-1.25-11T,
		TGNTC-1.25-11T,
		TC0.3-9.5, TC1.25-11S-ST,
		TC1.25-11S, and TC2-11S
	Double (2 wires)	TGWVTC-1.25-9T and
		TGWVTC-1.25-11T

E5 C-B (Models with Push-In Plus Terminal Blocks)

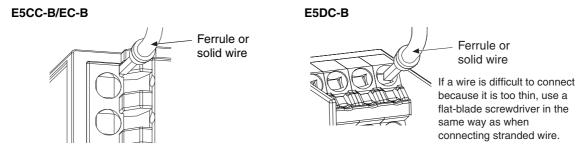
1. Connecting to the Push-In Plus Terminal Block

Part Names of the Terminal Block



Connecting Wires with Ferrules or Solid Wires

Insert the solid wire or ferrule straight into the terminal block until the end touches the terminal block.

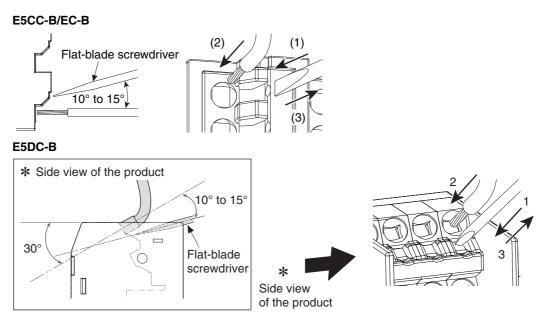


If a wire is difficult to connect because it is too thin, use a flat-blade screwdriver in the same way as when connecting stranded wire.

Connecting Stranded Wires

Use the following procedure to connect the wires to the terminal block.

- (1) Hold a flat-blade screwdriver at an angle and insert it into the release hole. The angle should be between 10° and 15°. If the flat-blade screwdriver is inserted correctly, you will feel the spring in the release hole.
- (2) With the flat-blade screwdriver still inserted into the release hole, insert the wire into the terminal hole until it strikes the terminal block.
- (3) Remove the flat-blade screwdriver from the release hole.



Checking Connections

- After the insertion, pull gently on the wire to make sure that it will not come off and the wire is securely fastened to the terminal block.
- If you use a ferrule with a conductor length of 10 mm, part of the conductor may be visible after the ferrule is inserted into the terminal block, but the product insulation distance will still be satisfied.

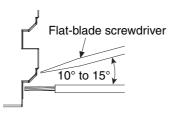
2. Removing Wires from the Push-In Plus Terminal Blocks

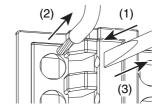
Use the following procedure to remove wires from the terminal block.

The same method is used to remove stranded wires, solid wires, and ferrules.

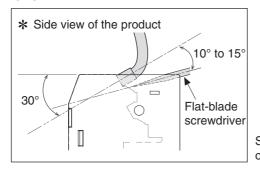
- (1) Hold a flat-blade screwdriver at an angle and insert it into the release hole.
- (2) With the screwdriver still inserted into the release hole, remove the wire from the terminal insertion hole.
- (3) Remove the flat-blade screwdriver from the release hole.

E5CC-B/EC-B

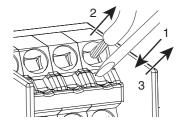




E5DC-B







3. Recommended Wires, Ferrules and Crimp Tools

• Recommended Wires (stranded or solid wires)

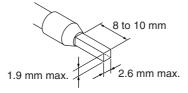
Recommended wires	Stripping length (ferrules not used)
AWG24 to AWG16 (0.25 to 1.5 mm ²)	8 mm

• Recommended Ferrules

Applica	ble wire	Ferrule	Stripping	Recommended ferrules		
(mm ²)	(AWG)	conductor length (mm)	length (mm) (ferrules used)	Manufactured by Phoenix Contact	Manufactured by Weidmuller	Manufactured by Wago
0.25	24	8	10	AI0,25-8	H0.25/12	FE-0.25-8N-YE
		10	12	AI0,25-10		
0.34	22	8	10	AI0,34-8	H0.34/12	FE-0.34-8N-TQ
		10	12	AI0,34-10		
0.5	20	8	10	AI0,5-8	H0.5/14	FE-0.5-8N-WH
		10	12	AI0,5-10	H0.5/16	FE-0.5-10N-WH
0.75	18	8	10	AI0,75-8	H0.75/14	FE-0.75-8N-GY
		10	12	AI0,75-10	H0.75/16	FE-0.75-10N-GY
1 or	18 or	8	10	Al1-8	H1.0/14	FE-1.0-8N-RD
1.25	17	10	12	Al1-10	H1.0/16	FE-1.0-10N-RD
1.25 or	17 or	8	10	Al1,5-8	H1.5/14	FE-1.5-8N-BK
1.5	16	10	12	Al1,5-10	H1.5/16	FE-1.5-10N-BK
	Recom	mended crimp	tool	CRIMPFOX6 CRIMPFOX6T-F CRIMPFOX10S	PZ6 roto	Variocrimp4

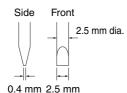
Note 1: Make sure that the outer diameter of the wire coating is smaller than the inner diameter of the insulation sleeve of the recommended ferrule.

2: Make sure that the ferrule processing dimensions conform to the following figures.



Recommended Flat-blade Screwdriver

Use a flat-blade screwdriver to connect and remove wires. Use the following flat-blade screwdriver.



Model	Manufacturer
ESD 0,40 × 2,5	Wera
SZS 0,4 × 2,5	Phoenix Contact
SZF 0-0,4 × 2,5 *	
$0.4 \times 2.5 \times 75\ 302$	Wiha
AEF.2,5 × 75	Facom
210-719	Wago
SDI 0.4 × 2.5 × 75	Weidmuller

You can purchase the SZF 0-0,4 \times 2,5 flat-blade screwdriver made by PHOENIX CONTACT with OMRON model XW4Z-00B.

2-2-10 Wiring

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

Power SupplyPower Consumption

	E5CC, E5	5CC-U, or C-B ^{*1}	e5EC or E5EC-B		E5AC		E5DC or	
Input Power Supply	Options No.: 000	Options No.: Not 000	Options No.: 000	Options No.: Not 000	Options No.: 000	Options No.: Not 000	E5DC-B	E5GC
100 to 240 VAC,	5.2 VA	6.5 VA	6.6 VA	8.3 VA	7.0 VA	9.0 VA	4.9 VA	5.9 VA
50/60 Hz	max.	max.	max.	max.	max.	max.	max.	max.
24 VAC, 50/60 Hz	3.1 VA	4.1 VA	4.1 VA	5.5 VA	4.2 VA	5.6 VA	2.8 VA	3.2 VA
	max.	max.	max.	max.	max.	max.	max.	max.
24 VDC (no polarity)	1.6 W	2.3 W	2.3 W	3.2 W	2.4 W	3.4 W	1.5 W	1.8 W
	max.	max.	max.	max.	max.	max.	max.	max.

^{*1} The only option number that is possible for the E5CC-U is 000.

 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, 2-2-2 E5CC-U Terminal Block Wiring Example, 2-2-3 E5CC-B Terminal Block Wiring Example, 2-2-4 E5EC/E5AC Terminal Block Wiring Example, 2-2-5 E5EC-B Terminal Block Wiring Example, 2-2-6 E5DC Terminal Block Wiring Example, 2-2-7 E5DC-B Terminal Block Wiring Example or 2-2-8 E5GC Terminal Block Wiring Example for the terminal arrangement.

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 (linear current output)	QQ (2 voltage outputs (for driving SSRs))	CQ (linear current and voltage output (for driving SSR))
	+V + + L - 2 -	1+V	1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +	+V +

Code	Output type	Specification
RX	Relay output	SPST-NO, 250 VAC, 3 A (resistive load), Electrical life:
		100,000 operations
QX	Voltage output (for driving SSR)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
CX	Linear current output	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution:
		Approx. 10,000
QQ*	2 voltage outputs (for driving SSRs)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
CQ*	Linear current output	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution:
	(control output 1)	Approx. 10,000
	Voltage output (for driving SSR)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
	(control output 2)	

^{*} Control output 1 and control output 2 are not isolated.

E5CC-U

RW (relay, SPDT)	QX (voltage output (for driving SSR))	CX (linear current)
4) —5 —6	4+ L	+V + + + + + + + + + + + + + + + + + +

Code	Output type	Specification	
RW	Relay (SPDT)	SPDT, 250 VAC, 3 A (resistive load), electrical life:	
		100,000 operations	
QX	Voltage (for driving SSR)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)	
CX	Linear current	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.	
		Resolution: Approx. 10,000	

E5CC-B

RX (relay)	QX (voltage output (for driving SSR))	CX (linear current output)
	1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +	+V 1 + L 2 -

Code	Output type	Specification
RX	Relay	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	Llinear current output	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.,
		Resolution: 10,000

E5EC/E5AC

RX (relay output)	QX (voltage output (for driving SSR))	CX (linear current output)	RR or PR (2 relays)
3	**************************************	3+ 4-	3 4 5 6
QQ (2 voltage outputs (for driving SSRs))	QR (voltage output (for driving SSR) and relay output)	CC (2 linear current outputs)	CQ (linear current and voltage output (for driving SSR))
**************************************		3+V 3+V 4- 5- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1-	3 + 1

Code	Output type	Specification
RX	Relay output	SPST-NO, 250 VAC, 5 A (resistive load), Electrical life:
		100,000 operations
QX	Voltage output (for driving SSR)	PNP, 12 VDC ±20%, 40 mA (with short-circuit protection)
CX	Linear current output	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution:
		Approx. 10,000
RR or	2 relay outputs	SPST-NO, 250 VAC, 5 A (resistive load), Electrical life:
PR		100,000 operations
QQ*	2 voltage outputs	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
	(for driving SSRs)	

Code	Output type	Specification
QR	Voltage output (for driving SSRs)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
	(control output 1)	
	Relay output (control output 2)	SPST-NO, 250 VAC, 5 A (resistive load), Electrical life:
		100,000 operations
CC*	2 linear current outputs	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution:
		Approx. 10,000
CQ*	Linear current output	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution:
	(control output 1)	Approx. 10,000
	Voltage output (for driving SSR)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
	(control output 2)	

^{*} Control output 1 and control output 2 are not isolated.

E5EC-B

RX (relay)	QX (voltage output (for driving SSR))	CX (linear current)
5	†V 5+ L	5 + L

Code	Output type	Specification
RX	Relay output	SPST-NO, 250 VAC, 5 A (resistive load), Electrical
		durability: 100,000 operations
QX	Voltage output (for driving SSR)	PNP, 12 VDC ±20%, 40 mA (with short-circuit protection)
CX	Linear current output	4 to 20 or 0 to 20 mA DC, Load: 500 Ω max., Resolution: Approx. 10,000

E5DC

RX (relay output)	QX (voltage output (for driving SSR))	CX (linear current output)
5	\$\frac{1}{4}\frac{1}{5}\frac{1}{1}\frac{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}\frac{1}{1}\frac{1}\frac{1}{1}\frac{1}\frac{1}{1}\frac{1}\frac{1}{1}\frac{1}	\$\frac{+V}{5} + \frac{L}{\frac{-}{2}}

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

E5DC-B

RX (relay output)	QX (voltage output (for driving SSR))	CX (linear current output)
3	3+ L	3+ 3+ 4-

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

E5GC

RX (relay output)	QX (voltage output (for driving SSR))	CX (linear current)
3	**************************************	3+ 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1-

Code	Output type	Specification
RX	Relay	SPST-NO, 250 VAC, 2 A (resistive load), Electrical
		durability: 100,000 operations
QX	Voltage (for driving SSR)	PNP, 12 VDC ±20%, 21 mA (with short-circuit protection)
CX	Linear current	4 to 20 mA DC or 0 to 20 mA DC with load of 500 Ω max.
		Resolution: Approx. 10,000

Auxiliary Outputs 1 to 4

- If heating/cooling control is selected for the E5CC, E5CC-U, E5CC-B, E5DC or E5DC-B when there is only one control output, the auxiliary output 2 terminal is assigned as the control output for cooling. (If the Digital Controller has only one auxiliary output, an output is not automatically allocated for the control output for cooling.)
- If heating/cooling control is selected for the E5EC, E5EC-B, or E5AC when there is only one
 control output, the auxiliary output 4 terminal is assigned as the control output for cooling. (If the
 Digital Controller has only two auxiliary outputs, auxiliary output 2 is allocated as the control
 output for cooling.)
- When heating/cooling control is selected for the E5GC, auxiliary output 1 is assigned as the control output for cooling.

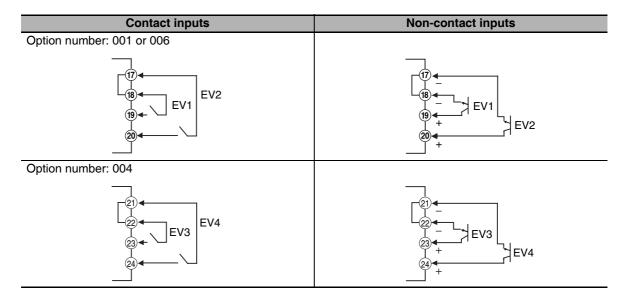
Event Inputs

Models with an option number of 001, 004 to 014, 016, 017, or 024 have one or more event inputs.

E5CC

Contact inputs	Non-contact inputs
Option number: 001, 006, or 007	
13 ← EV1 15 ← EV2	13 - EV1 14 + EV2
Option number: 004	
16 ← EV3 18 ← EV4	16 EV3
Option number: 005	
13	13 EV1 14 EV2 15 EV3 17 EV4

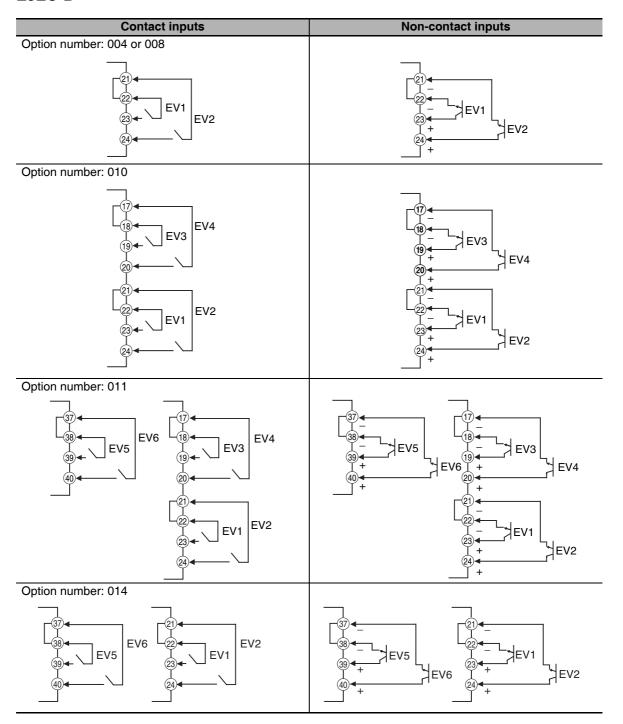
E5CC-B



E5EC/E5AC

Contact inputs	Non-contact inputs
Option number: 004, 008 or 009	
16 ← EV1 18 ← EV2	16 - EV1 17 + EV2
Option number: 005 or 010	
13 ← EV3 15 ← EV4 16 ← EV1 18 ← EV2	13 - EV3 14 + EV4 15 + EV1 16 - EV1 18 + EV2
Option number: 011 or 013	
13 + EV3 15 + EV4 28 + EV5 16 + EV1 29 + EV6 (18 + EV2	13 - EV3 14 + EV4 15 - EV1 17 + EV1 29 + EV6 18 + EV2
Option number: 012 or 014 28 29 EV5 17 EV1 EV2	EV5 (1) EV1 (2) EV2

E5EC-B



E5DC

Contact inputs	Non-contact inputs
Option number: 016 or 017	
3 ← EV1	3 ← EV1

E5DC-B

There are no event inputs.

E5GC

Contact inputs	Non-contact inputs
Option number: 016	
7) ← EV1	(7) ← EV1
Option number: 024	
8 ← EV1 9 ← EV2	(7) ← EV1 (8) + EV2 (9) ← EV2

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

Contact input ON: 1 k Ω max., OFF: 100 k Ω min.

No-contact input ON: Residual voltage of 1.5 V max.; OFF: Leakage current of 0.1 mA max.

Note: The E5CC-U does not have event inputs.

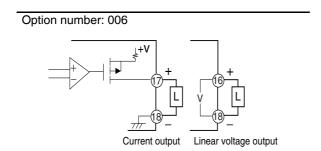
CT Inputs

Models with an option number of 001 to 003, 008 to 012, 017, or 023 have one or more CT inputs. Note: The E5CC-U does not have CT inputs.

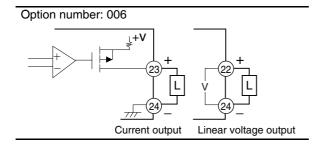
Transfer Output

Models with an option number of 006 or 011 to 014 have a transfer output.

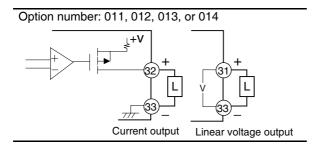
E5CC



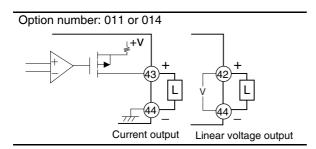
E5CC-B



E5EC/E5AC



E5EC-B



Output type	Specification
Current output	4 to 20 mA DC, Load: 500 Ω max., Resolution: 10,000
Linear voltage output	1 to 5 VDC, Load: 1 kΩ min., Resolution: 10,000

Note: The E5CC-U, E5DC, E5DC-B, and E5GC do not have a transfer output. However, if the control output is a linear current output, the control output can be used as a simple transfer output. For details on the operating procedure, refer to 5-13 Using the Transfer Output for the Process Value, Set Point, or other Data.

Remote SP Input

Models with an option number of 007 or 011 to 014 have a remote SP input.

Input type	Specification
Current input	4 to 20 or 0 to 20 mA DC with input impedance of 150 Ω max.
Linear voltage input	1 to 5, 0 to 5, or 0 to 10 VDC with input impedance of 1 M Ω min.

Note: The E5CC-U, E5CC-B, E5DC, E5DC-B, and E5GC do not have a remote SP input.

The remote SP input circuit is not electrically isolated from the internal circuits. Therefore, when using a grounded sensor input, do not connect the remote SP input terminals to ground. (If the remote SP input terminals are connected to ground, errors will occur in the measured temperature as a result of leakage current.)

Potentiometer Input

You can use this input for a Position-proportional Model. The maximum opening can be measured to between

Note: The E5CC, E5CC-U, E5CC-B, E5EC-B, E5DC, E5DC-B, and E5GC do not have a potentiometer input.

The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).

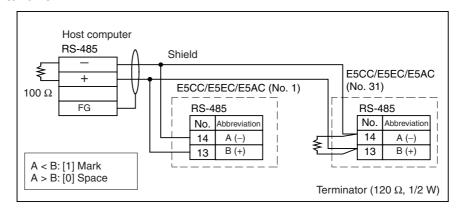
Communications

RS-485

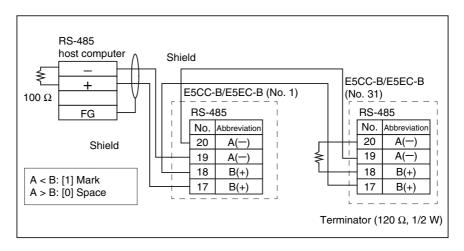
Models with an option number of 002 to 004, 008, 009, 012, 014, or 015 support RS-485 communications. To use communications with the E5CC, E5AC, or E5EC, connect the communications cable to terminals 13 and 14, with the E5CC-B or E5EC-B, to terminals 17 or 18 and 19 or 20, with the E5DC, to terminals 3 and 4, with the E5DC-B, to terminals 5 and 6, and with the E5GC, to terminals 7 and 8.

Communications Unit Connection Diagram

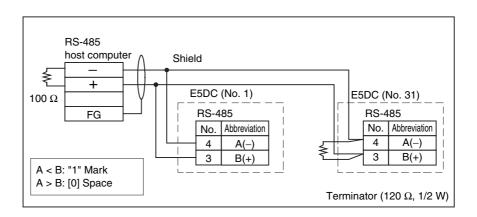
E5CC/E5EC/E5AC



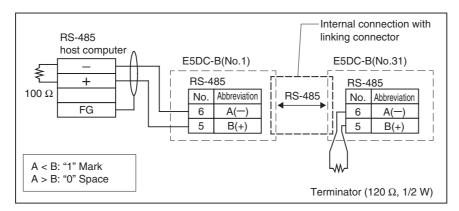
E5CC-B/EC-B



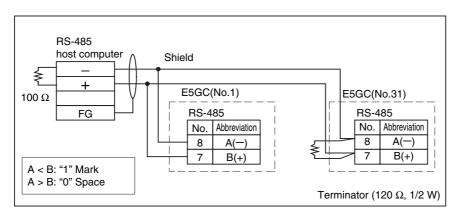
E₅DC



E5DC-B

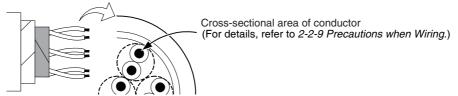


E5GC



• 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 shielded twisted-pair cable.

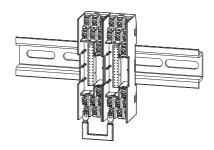


Note: The E5CC-U does not support communications.

Connecting Short Bars

On the E5DC, you can use a Y92S-P11 Short Bar to connect the power supply or communications. Connect the Short Bar to the power supply screw terminals or the screw terminals for communications.

 Short Bar (sold separately) Y92S-P11



2-3 Insulation Block Diagrams

The insulation block diagrams are provided in this section.

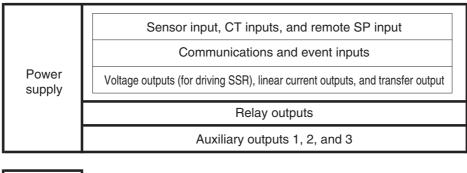
E5CC, E5EC, E5EC-B, or E5AC

Models with 2 Auxiliary Outputs

Power supply	Sensor input, CT inputs, potentiometer input, and remote SP input
	Communications and event inputs
	Voltage outputs (for driving SSR), linear current outputs, and transfer output
	Relay outputs
	Auxiliary output 1
	Auxiliary output 2
-	

: Reinforced insulation

• Model with 3 Auxiliary Outputs (E5CC Only)



: Reinforced insulation : Functional isolation

Models with 4 Auxiliary Outputs

	Sensor input, CT inputs, potentiometer input, and remote SP input Communications and event inputs Voltage outputs (for driving SSRs), linear current outputs, and transfer outputs.
Power supply	Voltage outputs (for driving SSRs), linear current outputs, and transfer output Relay outputs
	Auxiliary outputs 1 and 2
	Auxiliary outputs 3 and 4

: Reinforced insulation

E5CC-B

Power supply	Sensor input and CT inputs Communications and event inputs Voltage outputs (for driving SSRs), linear current outputs, and transfer output Relay outputs			
	Auxiliary outputs 1 and 2			
	: Reinforced insulation			
	: Functional insulation			

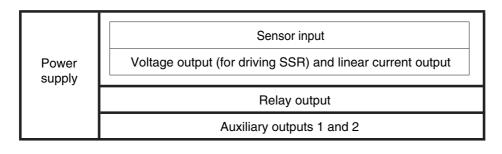
E5DC/E5GC

Power supply	Sensor input and CT input Communications and event input Voltage output (for driving SSR) and linear current output Relay output		
	Auxiliary outputs 1 and 2		
	: Reinforced insulation		
	: Reinforced insulation		

E5DC-B

	Sensor input and CT input		
	Communications		
Power supply	Voltage output (for driving SSR) and linear current output		
	Relay output		
	Auxiliary outputs 1 and 2		
	: Reinforced insulation		
	: Functional isolation		

E5CC-U



: Reinforced insulation

Using the Setup Tool Port 000

Use one of the Setup Tool ports to connect the computer to the Digital Controller when using the CX-Thermo (EST2-2C-MV4 or later) or other Support Software.

The E58-CIFQ2 USB-Serial Conversion Cable*1 is required for the connection. For information on the models that can be used with CX-Thermo, contact your OMRON sales representative.

The E58-CIFQ2-E is required to connect to the Setup Tool port on the front panel of the E5EC, E5EC-B, E5AC, E5DC, or E5DC-B, or to connect to the Setup Tool port on the bottom panel of the E5GC.

2-4-1 **Procedure**

When the USB-Serial Conversion Cable is connected to the Digital Controller, the following operations are possible even if the power supply to the Digital Controller is not turned ON.

- Setting up the Digital Controller from a computer (Special software is required.)
- Changing settings by using key operations on the Digital Controller
- Displaying the current temperature on the Digital Controller

The control outputs, alarm outputs, transfer output, event inputs, and external communications for the Digital Controller will not operate unless the power supply to the Digital Controller is turned ON.

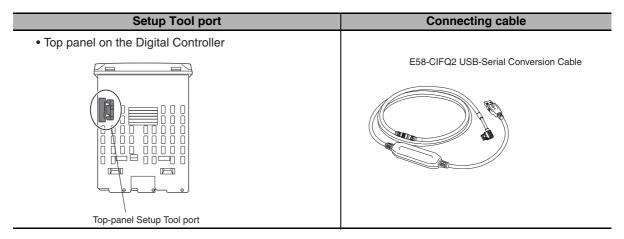
2-4-2 **Connection Method**

Use the E58-CIFQ2 USB-Serial Conversion Cable to connect the E5□C to the computer. The USB-Serial Conversion Cable is used to communicate with a USB port on a computer as a virtual COM port.

E5CC/E5CC-B/E5CC-U

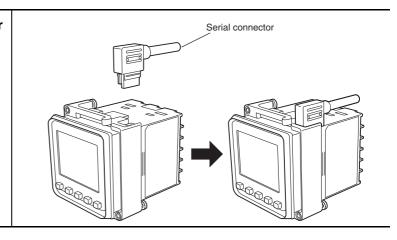
Setup Tool Port and Connecting Cable

The location of the Setup Tool port on the E5CC, E5CC-B, or E5CC-U and the required cable are shown below.



Connection Procedure

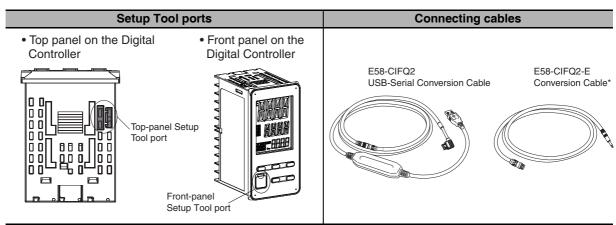
1 Connect the serial connector on the USB-Serial Conversion Cable to the Setup Tool port on the top panel of the Digital Controller.



E5EC/E5EC-B/E5AC

Setup Tool Ports and Connecting Cables

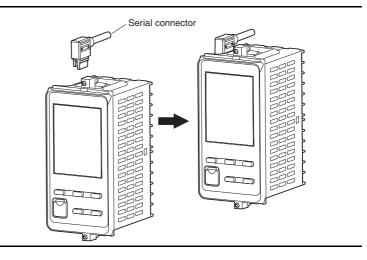
The location of the Setup Tool port on the E5EC, E5EC-B, or E5AC and the required cable are shown below. There are Setup Tool ports on both the top panel and front panel of the Digital Controller.



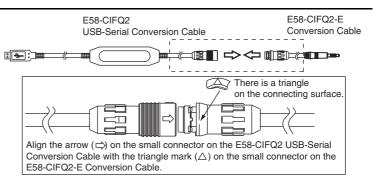
* This Cable is required only to connect to the front-panel Setup Tool port.

Connection Procedure

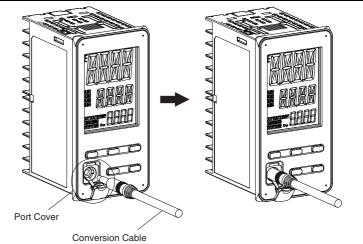
- · Top-panel Port
- 1 Connect the serial connector to the Setup Tool port on the top panel of the Digital Controller.



- Front-panel Port
- Connect the E58-CIFQ2 **USB-Serial Conversion Cable** to the E58-CIFQ2-E Conversion Cable.



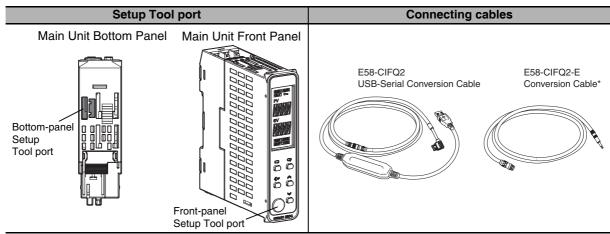
Remove the Port Cover from the front-panel Setup Tool port, and then plug in the Conversion Cable.



E5DC/E5DC-B

Setup Tool Port and Connecting Cable

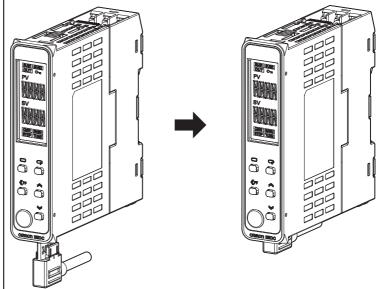
The locations of the Setup Tool ports on the E5DC or E5DC-B and the required cables are shown below. There are Setup Tool ports on both the bottom panel and front panel of the Digital Controller.



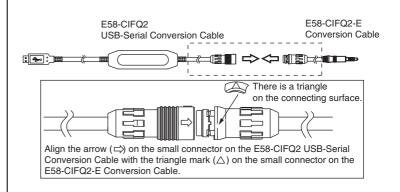
^{*} This Cable is required only to connect to the front-panel Setup Tool port.

Connection Procedure

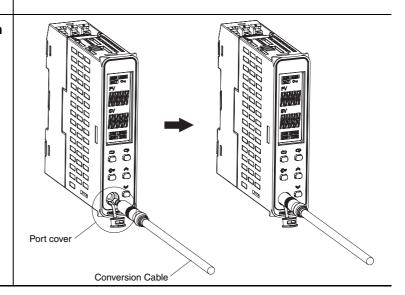
- · Bottom-panel Port
- Connect the serial connector to the Setup Tool port on the bottom panel of the Digital Controller.



- Front-panel Port
- Connect the E58-CIFQ2 **USB-Serial Conversion Cable** to the E58-CIFQ2-E Conversion Cable.



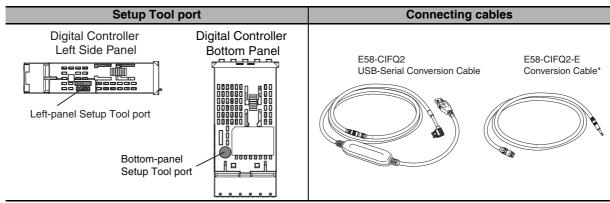
Remove the Port Cover from the front-panel Setup Tool port, and then plug in the Conversion Cable.



E5GC

Setup Tool Port and Connecting Cable

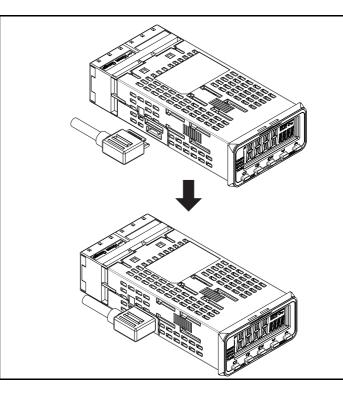
The locations of the Setup Tool ports on the E5GC and the required cables are shown below. There are Setup Tool ports on both the left side panel and bottom panel of the Digital Controller.



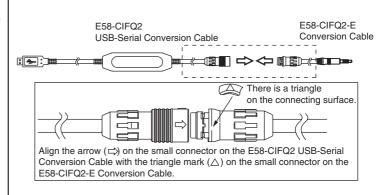
^{*} This Cable is required only to connect to the bottom-panel Setup Tool port.

Connection Procedure

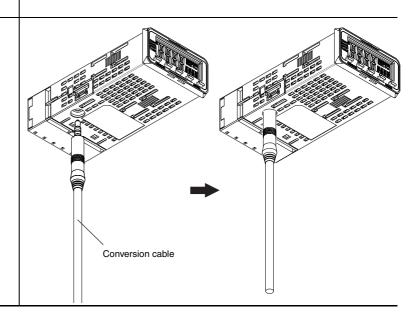
- · Left-panel Port
- 1 Connect the serial connector to the Setup Tool port on the left side panel of the Digital Controller.



- Bottom-panel Port
- Connect the E58-CIFQ2 **USB-Serial Conversion Cable** to the E58-CIFQ2-E Conversion Cable.



Connect the plug on the **Conversion Cable to the** bottom-panel Setup Tool port.





Precautions for Correct Use

- Hold the connector when inserting or disconnecting the Cable.
- When connecting a connector, always make sure that it is oriented correctly. Do not force the connector if it does not connect smoothly. Connectors may be damaged if they are connected with excessive force.
- · Do not connect cables to both ports at the same time. Damage or malfunction may occur.

2-4-3 Installing the Driver

1. Connect a USB connector on the computer with a Setup Tool port on the Digital Controller using the Cable or Cables.

2. Obtaining the Driver

When the CX-Thermo Support Software for the Digital Controller is installed, the driver for the USB-Serial Conversion Cable will be copied to the following folder.

C:\Program Files\OMRON\Drivers\USB\E58-CIF

3. Installing the Driver

Install the driver to enable the Cable to be used with the personal computer.

Installation

When the Cable is connected with the personal computer, the OS will detect the product as a new device. At this time, install the driver using the Installation Wizard.

- Note1: We recommend that you install the driver for each USB port on the computer at the start. The Digital Controller assigns a COM port number to each USB port on the computer. If the same USB port is used, you will be able to use the same COM port number even if you use a different Cable.
 - 2: Installation of the driver will not be completed if the installation is canceled before it is completed. Normal communications will not be possible unless the driver is installed completely. If the driver is not installed completely, uninstall it, and then install it correctly.

4. Setting Setup Tool Communications Conditions

Set the communications port (COM port) number to be used for the CX-Thermo Setup Tool to the COM port number assigned to the USB-Serial Conversion Cable.

Refer to the E58-CIFQ2 USB-Serial Conversion Cable Instruction Manual and Setup Manual for details on how to check the COM port assigned to the USB-Serial Conversion Cable.

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

Parameter	Set value
Communications Unit No.	01
Communications baud rate	38.4 (kbps)
Communications data length	7 (bits)
Communications stop bits	2 (bits)
Communications parity	Even

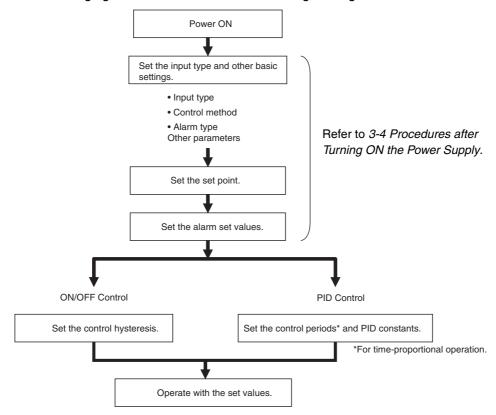


Part Names and Basic Procedures

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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 E5 C.

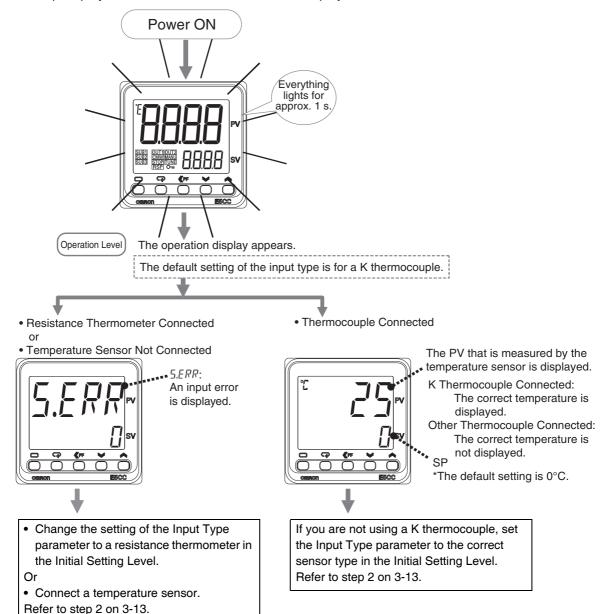
The following default settings will be used when operation starts.

Standard Models

- Input type 5: K thermocouple
- ON/OFF control *1
- Alarm: Upper-limit alarm*2
- Set point: 0°C
- *1 The default setting for Position-proportional Models is floating control operation.
- *2 If the Controller is equipped with HB/HS alarm detection, the default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1.

After the power comes ON, all indicators and displays will light for approximately 1 second, and then the operation display will appear.

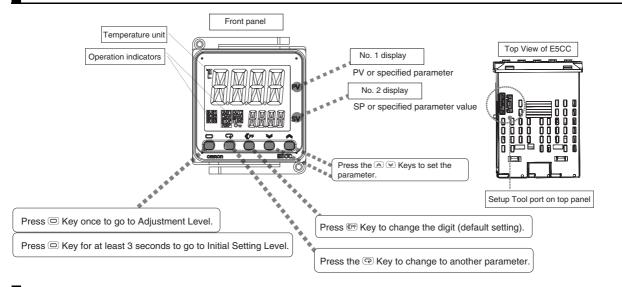
The top display will show the PV and the bottom display will show the SP.



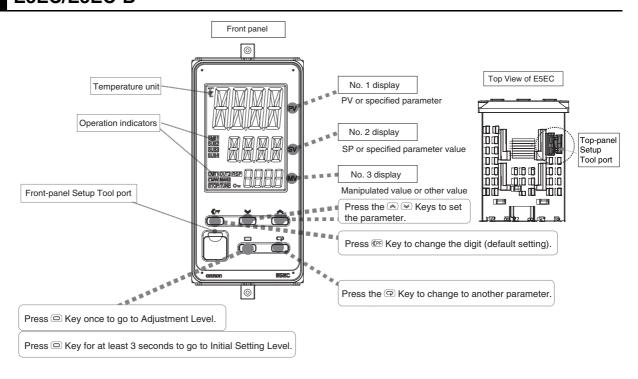
Part Names, Part Functions, and 3-3 **Setting Levels**

3-3-1 **Part Names and Functions**

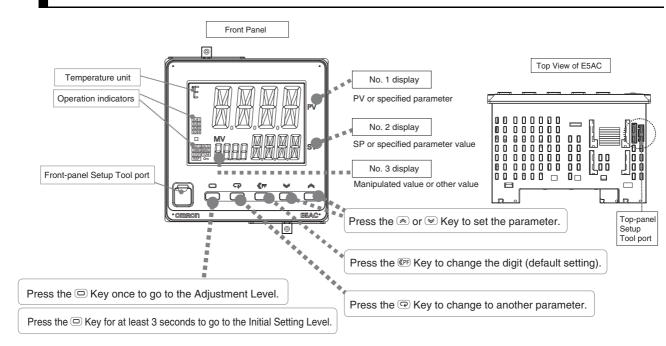
E5CC/E5CC-U/E5CC-B



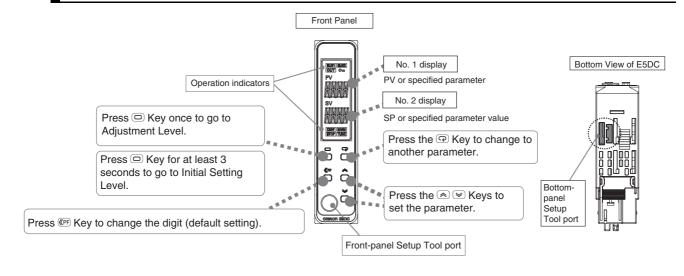
E5EC/E5EC-B



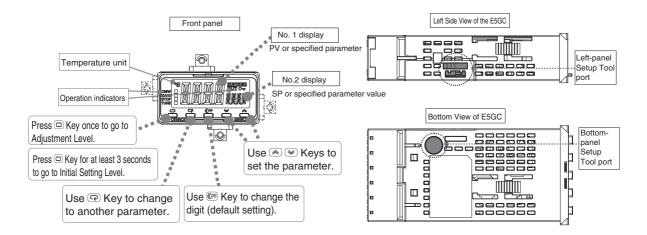
E5AC



E5DC/E5DC-B



E5GC



Displays

Name	Description			
No. 1 display	Displays the process value or a monitor/setting item.			
No. 2 display	Displays the set point or the value of a monitor/setting item.			
No. 3 Display	Displays the manipulated variable (valve opening), remaining soak time, multi-SP No.,			
(E5EC, E5EC-B, and	internal SP (ramp SP), or alarm value 1. (The value that is displayed is set in the PV/SP			
E5AC Only)	Display Selection parameter in the Advanced Function Setting Level.)			
Temperature unit*	Displays the temperature unit (°C or °F).			
(Not provided on the				
E5DC and E5DC-B.)				

You can use the Y92S-L2 Unit Labels (sold separately) with the E5DC/E5DC-B.

Indicators

Operation indicators	Name	Description
SUB1 SUB2 SUB3 SUB4	Auxiliary outputs 1 to 4 (Only the E5CC, E5EC, E5EC-B, and E5AC support auxiliary output 3.) (Only the E5EC, E5EC-B, and E5AC support auxiliary output 4.)	Each indicator lights when the function that is assigned to corresponding auxiliary output (1 to 4) is ON.
OUT1 OUT2	Control outputs 1 and 2 (Control output 1: E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, or E5AC only) (Control output 2: E5CC, E5EC, or E5AC only)	Each indicator lights when the function that is assigned to corresponding control output (1 or 2) is ON. (For a linear current output, the indicator is not lit for values below 0%.) For a Position-proportional Model, OUT1 lights when the open output is ON and OUT2 lights when the close output is ON.
OUT	Control output (E5DC, E5DC-B, or E5GC only)	Each indicator lights when the function that is assigned to corresponding control output is ON. (For a linear current output, the indicator is not lit for values below 0%.)
CMW	Communications writing	This indicator lights when wiring with communications is enabled.

Operation indicators Name		Description
MANU		This indicator is lit in Manual Mode.
STOP		This indicator is lit while operation is stopped.
TUNE	AT/ST in progress	This indicator is lit during autotuning. This indicator flashes during self-tuning.
RSP	Remote SP (E5CC, E5EC, E5EC-B, or E5AC)	This indicator is lit while the SP Mode parameter is set to Remote SP Mode. This indicator flashes when there is an RSP input error in Remote SP Mode.
Оп	Setting change protection	This indicator is lit while setting change protection is ON.

Keys

Key	Name	Overview	Description
	Level Key	Selects the setting level. The next setting level depends on how long the key is pressed.	 In Operation Level Press once for less than 1 second to go to Adjustment Level. Press for at least 3 seconds to go to Initial Setting Level. In Adjustment Level Press once for less than 1 second to go to Operation Level. Press for at least 3 seconds to go to Initial Setting Level. In Initial Setting Level Press for at least 1 second to go to Operation Level.
	Mode Key	Changes the parameter that is displayed within a setting level.	Press once to go to the next parameter.Hold to go to the previous parameter.
≫	Down Key and Up Key	Set the value.	 Hold the key to increment or decrement the value quickly. Any changes in settings are applied at the following times: After 3 seconds elapse When the Key is pressed When the level is changed with the Key

Key	Name	Overview	Description
《PF	Shift Key (PF Key)	Operates as a user-defined function key.	 Press the F Key for less than 1 second to select the digit to change. The key operates as a Shift Key to change the digit by one digit every time you press the key (default setting). You can change the PF Setting parameter in the Advanced Setting Level to assign any of the following functions to the F Key. Run/stop, auto/manual, autotune, cancel alarm latch, display monitor/setting item, or digit shift (default) Example: If you set the PF Setting parameter in the Advanced Setting Level to 5½āP, operation will be stopped when you press the F Key for 1 second or longer. If you set PFdF (monitor/setting items), each time you press the F Key for less than 1 second, the display is changed in order for the items that are set for the Monitor/Setting Item 1 to 5 parameters.

Setup Tool Ports 000

Setup Tool port	Name	Description
	Setup Tool port (card edge type)	Use the E58-CIFQ2 USB-Serial Conversion Cable to connect the E5□C to the computer (i.e., the CX-Thermo Support Software). E5CC, E5CC-B, E5EC, E5EC-B, or E5AC: On top panel E5DC or E5DC-B: On bottom panel E5GC: On left side panel
	Setup Tool port (pin jack)	Use the E58-CIFQ2 USB-Serial Conversion Cable and the E58-CIFQ2-E Conversion Cable to connect the E5EC, E5EC-B, or E5AC to the computer (i.e., the CX-Thermo Support Software). E5EC, E5EC-B, or E5AC: On front panel
	Setup Tool port (pin jack)	Use the E58-CIFQ2 USB-Serial Conversion Cable and the E58-CIFQ2-E Conversion Cable to connect the E5DC or E5GC to the computer (i.e., the CX-Thermo Support Software). E5DC or E5DC-B: On front panel E5GC: On bottom panel

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 🖾 Key.



Precautions for Correct Use

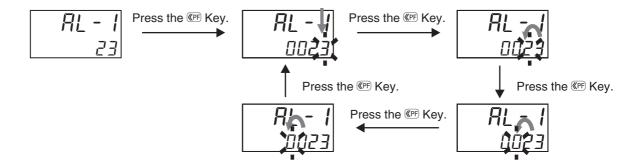
Always make sure that any changes to numeric values are applied for one of the three methods that are given above before you turn OFF the power supply to the E5 \square C. If you only change the values with the \bigcirc \bigcirc Keys and turn OFF the power supply before 3 seconds has elapsed, the changes 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.



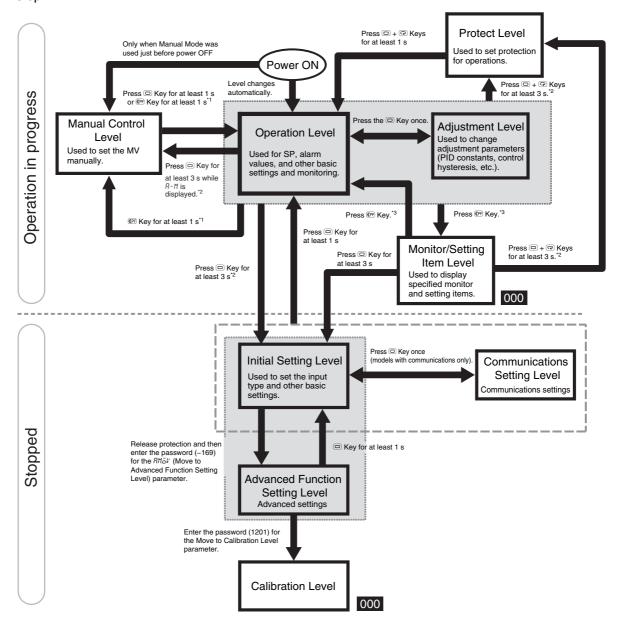
3-3-3 **Setting Levels**

On the E5 C, 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.

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).

The Initial Setting Level, Communications Setting Level, Advanced Function Setting Level, and Calibration Level can be used only when control is stopped. If you change to any of these levels, control will stop.



- *1 Set the Auto/Manual Select Addition parameter to ON and set the PF Setting parameter to R-M (Auto/Manual).
- *2 The No. 1 display will flash when the keys are pressed for 1 s or longer.
- *3 Set the PF Setting parameter to PF dP (monitor/setting items).

Basic Setting Levels

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

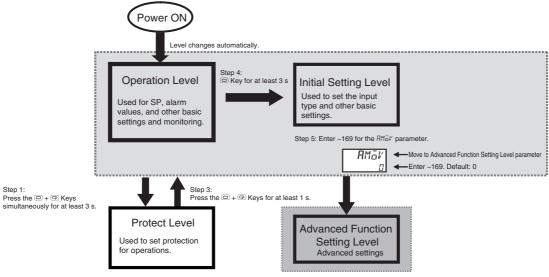
This level is used for advanced settings.

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 PMaV (Move to Advanced Function Setting Level) parameter in the Initial Setting Level.

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



Step 2: Change the parameter with the @ Key and change the setting of the <code>[[PE]</code> parameter to 0

← Initial Setting/Communications Protect

← Set 0. Default: 1

Step 1: Move to Protect Level.

Step 2: Display LEPE (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 PMaV (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 five other setting levels: Manual Control Level, Protect Level, Communications Setting Level, Calibration Level, and Monitor/Setting Item 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 F Key to move to the Manual Control Level, change the setting of the PF Setting parameter to R-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 6 parameter to MRNU.

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.

Calibration Level

This level is used to calibrate the Digital Controller. You can move to the Calibration Level from the Advanced Function Setting Level.

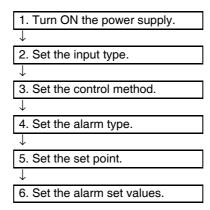
Monitor/Setting Item Level

To use the F Key to display the Monitor/Setting Items, change the setting of the PF Setting parameter to PFdP. The items that will be displayed in the Monitor/Setting Item Level are set using the Monitor/Setting Item 1 to 5 parameters.

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.

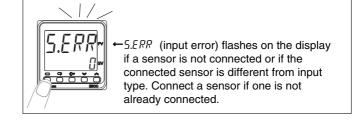


3-4-2 Basic Procedure

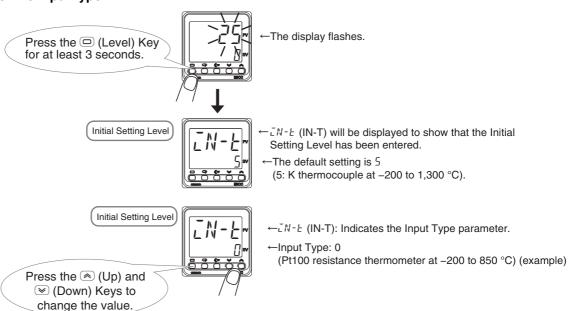
The basic procedure is given below.

1 Turn ON the power supply.





$oldsymbol{2}$ Set the input type.



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

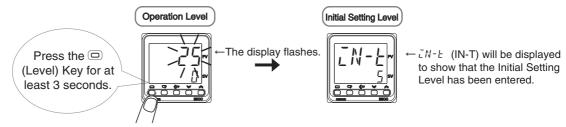
List of Input Types

Input type	Specifications	Set value	Temperature range in °C	Temperature range in °F
Resistance	Pt100	0	-200 to 850	-300 to 1500
thermometer		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
	Т	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
	В	18	100 to 1800	300 to 3200
	C/W	19	0 to 2300	0 to 3200
	PLII	20	0 to 1300	0 to 2300
Infrared temperature	10 to 70°C	21	0 to 90	0 to 190
sensor ES1B	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:	
	0 to 20 mA	26	-1999 to 9999	
Voltage input	1 to 5 V	27	-199.9 to 999.9	
	0 to 5 V	28	-19.99 to 99.99	
	0 to 10 V	29	-1.999 to 9.999	
	0 to 50 mV*	30	1	

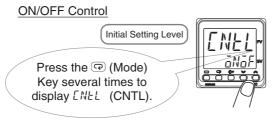
The default is 5.

^{*} This range can be used only for E5CC-U Digital Controllers and only if they are manufactured in May 2014 or later (version 2.2 or higher).

3 Set the control method.



Standard Models



← ENEL (CNTL): Indicates the control method. The default setting is $\bar{a}N\bar{a}F$ (ONOF: ON/OFF control).

If $P \bar{\iota} d$ (PID control) is displayed, press the (Down) Key to change to $\bar{a} N \bar{a} F$ (ONOF) (ON/OFF control).

PID Control



ENEL (CNTL): Indicates the control method.

If āNāF (ON/OFF control) is displayed, press the ⓐ (Up) Key to change to Pūd (PID) (PID control).

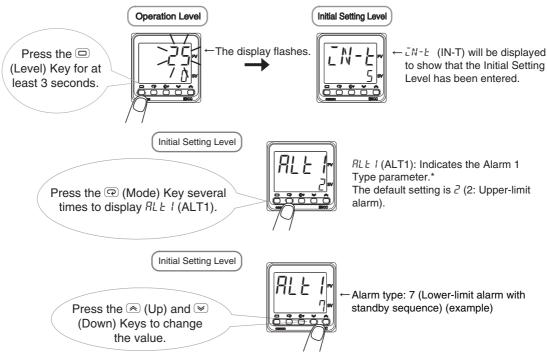
Position-proportional Models

Close/Floating Control



← £ŁFŁ (CLFL): Indicates either close or floating control.

4 Set the alarm type.



If the Digital 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. For details, refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).

If required, use the (Mode) Key and the (Up) and (Down) Keys to repeat the procedure to set alarm types for RLE2 (ALT2) (Alarm 2 Type), RLE3 (ALT3) (Alarm 3 Type), and RLE4 (ALT4) (Alarm 4 Type). (The number of alarms that is supported depends on the model of Digital Controller. Some of the alarm parameters may not be displayed.)

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

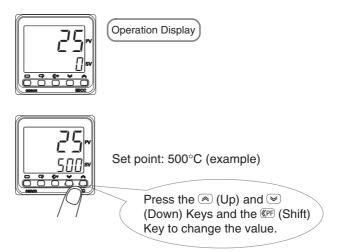
Alarm Type Numbers

Set value	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.	Example: ON OFF Lower-limit alarm Set point Upper-limit alarm point (e.g., 80°C) (e.g., 100°C) point (e.g., 130°C) Alarm value lower Alarm value upper limit (e.g., 20°C) limit (e.g., 30°C)
2	Upper-limit alarm	The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point.	Example: ON OFF Set point Upper-limit alarm (e.g., 100°C) point (e.g., 120°C) Alarm value upper limit (e.g., 20°C)
3	Lower-limit alarm	The alarm output is ON while the PV is equal to or lower than the lower-limit alarm point.	Example: ON OFF Lower-limit alarm point Set point (e.g., 80°C) (e.g., 100°C) Alarm value lower limit (e.g., 20°C)
Ч	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.	Example: ON OFF Lower-limit alarm Set point Upper-limit alarm point (e.g., 80°C) (e.g., 100°C) point (e.g., 130°C) Alarm value lower Alarm value upper limit (e.g., 20°C) limit (e.g., 30°C)
5	Upper- and lower-limit alarm with standby sequence	This alarm provides a standby sequence. 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.	Example: ON OFF Lower-limit alarm Set point Upper-limit alarm point (e.g., 80°C) (e.g., 100°C) point (e.g., 130°C) Alarm value lower Alarm value upper limit (e.g., 20°C) limit (e.g., 30°C)
6	Upper-limit alarm with standby sequence	This alarm provides a standby sequence. The alarm output is ON while the PV is equal to or higher than the upper-limit alarm point.	Example: ON OFF Set point Upper-limit alarm (e.g., 100°C) point (e.g., 120°C) Alarm value upper limit (e.g., 20°C)
7	Lower-limit alarm with standby sequence	This alarm provides a standby sequence. The alarm output is ON while the PV is equal to or lower than the lower-limit alarm point.	Example: ON OFF Lower-limit alarm point Set point (e.g., 80°C) (e.g., 100°C) Alarm value lower limit (e.g., 20°C)

Set value	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.	Example: ON OFF Upper-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)
9	Absolute-value lower-limit alarm	The alarm output is ON while the PV is equal to or lower than the alarm value.	ON OFF OFF OFF OFF Alarm value (e.g., 100°C) Alarm value (e.g., 100°C)
10	Absolute-value upper-limit alarm with standby sequence	This alarm provides a standby sequence. The alarm output is ON while the PV is equal to or higher than the alarm value.	Example: ON OFF Upper-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)
11	Absolute-value lower-limit alarm with standby sequence	This alarm provides a standby sequence. The alarm output is ON while the PV is equal to or lower than the alarm value.	ON OFF OFF OFF OFF OFF Alarm value (e.g., 100°C)
12	Loop Burnout Alarm (LBA) (Valid only for alarm 1 on a Standard Model.)	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. PV LBA level SP LBA detection time Time LBA Alarm Output ON OFF

Set			
value	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.	PV Change rate width PV rate of change calculation period PV Change Rate Alarm Output ON OFF Time 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.	ON OFF OUpper-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)
TS	SP absolute-value lower-limit alarm	The alarm output is ON while the SP is equal to or lower than the alarm value.	ON OFF Lower-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)
16	MV absolute-value upper-limit alarm	The alarm output is ON while the MV is equal to or higher than the alarm value.	ON OFF Upper-limit alarm point (e.g., 60%) Alarm value (e.g., 60%)
IN .	MV absolute-value lower-limit alarm	The alarm output is ON while the MV is equal to or lower than the alarm value.	OFF O Lower-limit alarm point (e.g., 80%) Alarm value (e.g., 80%)
18	RSP absolute-value upper-limit alarm (Valid only with a remote SP input.)	The alarm output is ON while the RSP is equal to or higher than the alarm value.	Example: ON OFF 0 Upper-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)
19 	RSP absolute-value lower-limit alarm (Valid only with a remote SP input.)	The alarm output is ON while the RSP is equal to or lower than the alarm value.	ON OFF Lower-limit alarm point (e.g., 100°C) Alarm value (e.g., 100°C)

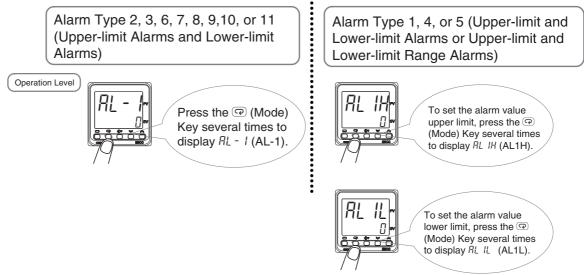
Set the set point.



*Hold the ♠ (Up) or ❤ (Down) Key to increment or decrement the value quickly.

Set the alarm set value or values.

Change the parameter that is displayed with the (2) (Mode) Key.



This concludes the procedure to set the input type, alarm type, control method, set point, and alarm set values. For information on the settings of the ON/OFF hysteresis, PID constants, HS alarm, HS alarm, and other parameters, refer to Section 4 Basic Operation or Section 5 Advanced Operations.



Basic Operation

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4-1 Moving between Setting Levels

The Operation Level is displayed first when the power supply to the Digital Controller is turned ON. To display the parameters, you must move to the following setting levels.

- Operation Level (Entered when the power supply is turned ON.)
- Initial Setting Level
- · Adjustment Level
- Protect Level
- · Advanced Function Setting Level
- · Communications Setting Level

The procedures to move between the setting levels starting from the Operation Level are provided below.

4-1-1 Moving to the Initial Setting Level

Moving from the Operation Level to the Initial Setting Level

1 Press the Key for at least 3 seconds in the Operation Level.

The No. 1 display will flash when the key is pressed for 1 s or longer.

The display will change from the Operation Level to the Initial Setting Level.

Operation Level

Initial Setting Level

Moving from the Initial Setting Level to the Operation Level

1 Press the Key for at least 1 second in the Initial Setting Level.

The display will change from the Initial Setting Level to the Operation Level.

Initial Setting Level

LIN - L

S

Operation Level

PV/SP

Moving from the Operation Level to the Adjustment Level

Level.

Operation Level

The display will change from the Operation Level to the Adjustment

Adjustment Level

L.Add will be displayed only once when you move to the Adjustment Level.



Moving from the Adjustment Level to the Operation Level

Press the Key for less than 1 second in the Adjustment

Adjustment Level

INS

Process Value Input Shift

The display will change from the Adjustment Level to the Operation Level.

Operation Level



4-1-3 **Moving to the Protect Level**

Moving from the Operation Level to the Protect Level

Press the and Keys simultaneously for at least 3 seconds* in the Operation Level.

Operation Level

The No. 1 display will flash when the keys are pressed for 1 s or longer. The key pressing time can be changed in the Move to Protect Level

Time parameter in the Advanced Function Setting Level. The display will change to the Protect Level.

Protect Level



Operation/ Adjustment Protect

Moving from the Protect Level to the Operation Level

Press the and Keys simultaneously for at least 1 second in the Protect Level.

Protect Level

The display will change from the Protect Level to the Operation Level.

Operation Level



PV/SP

4-1-4 Moving to the Advanced Function Setting Level

Moving to the Advanced Function Setting Level for the First Time (i.e., with the Default Settings)

To enter the Advanced Function Setting Level, you must first enter the Protect Level and change the setting of the $\bar{L}EPE$ (Initial Setting/Communications Protect) parameter to \bar{U} (enable moving to Advanced Function Setting Level) to clear the protection.

Clearing Protection

1	Press the and Keys simultaneously for at least 3	Operation Level
	seconds* in the Operation Level.	25
	The No. 1 display will flash when the key is pressed for 1 s or	
	longer.	
	* The key pressing time can be changed in the Move to Protect Level Time parameter in the Advanced Function Setting Level.	
	The display will change to the Protect Level.	
2	Press the	Protect Level
	parameter. The display will change to the Initial Setting/Communications Protect parameter.	Operation/ Adjustment Protect
3	Press the or Key at the Initial Setting/Communications Protect parameter to change the set value to 0 (enable moving	Initial Setting/ Communications Protect
	to Advanced Function Setting Level).	1
	Now the $BM\bar{\alpha}V$ (Move to Advanced Function Setting Level)	f: Moving to Advanced
	parameter can be displayed in the Initial Setting Level.	Function Setting
	The default is <i>l</i> (disable moving to Advanced Function Setting Level).	Level is disabled.
4	Press the and Keys simultaneously for at least 1 second	Protect Level
	in the Protect Level.	Initial Setting/ Communications Protect
	The display will change from the Protect Level to the Operation	Operation Level
	Level.	PV/SP

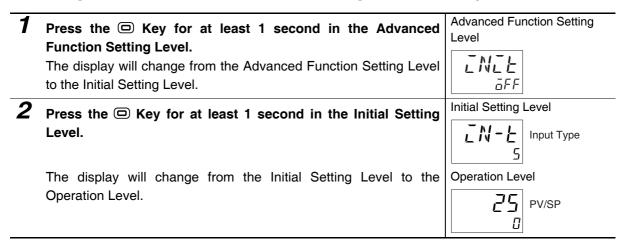
Moving to the Advanced Function Setting Level after Clearing **Protection**

After you have set the $\bar{L}PL$ (Initial Setting/Communications Protect) parameter to \bar{U} (enable moving to Advanced Function Setting Level), select ##ā\(\tilde{\Pi}\) (Move to Advanced Function Setting Level) in the Initial Setting Level.

Moving to the Advanced Function Setting Level

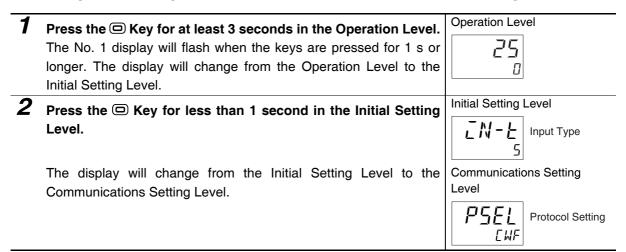
1	Press the Key for at least 3 seconds in the Operation Level.	Operation Level
	The No. 1 display will flash when the key is pressed for 1 s or	25
	longer. The display will change from the Operation Level to the Initial Setting Level.	
2	Press the Key several times in the Initial Setting Level to	Initial Setting Level
	display ਸਿਅੰਡੇਂਮ (Move to Advanced Function Setting Level).	Input Type
3	Press the ♥ and ♠ Keys at the Move to Advanced Function	Initial Setting Level
	Setting Level parameter and then enter - 159. * You can hold the (Up) or (Down) Key to increment or decrement the set value quickly.	Move to Advance Function Setting Level
4	Press	Move to Advanced Function Setting Level -169: Password to move to Advanced Function Setting Level
	The display will change to the Advanced Function Setting Level.	Advanced Function Setting Level
		Parameter Initialization

Moving from the Advanced Function Setting Level to the Operation Level

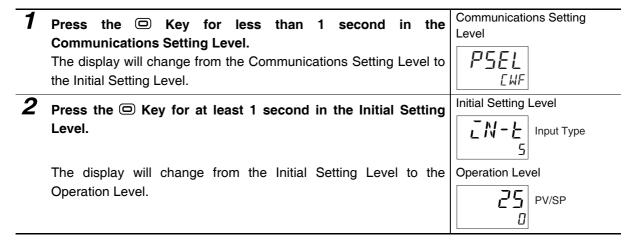


4-1-5 Moving to the Communications Setting Level

Moving from the Operation Level to the Communications Setting Level



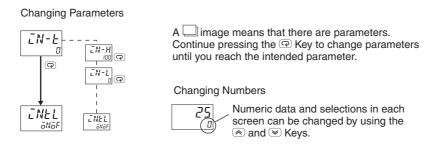
• Moving from the Communications Setting Level to the Operation Level



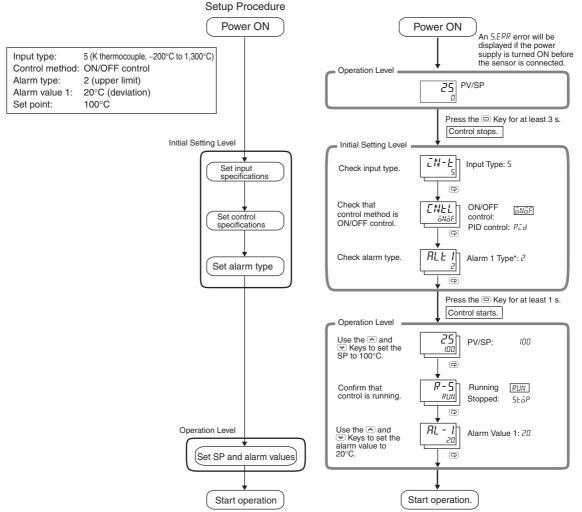
Initial Setting Examples

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

Explanation of Examples

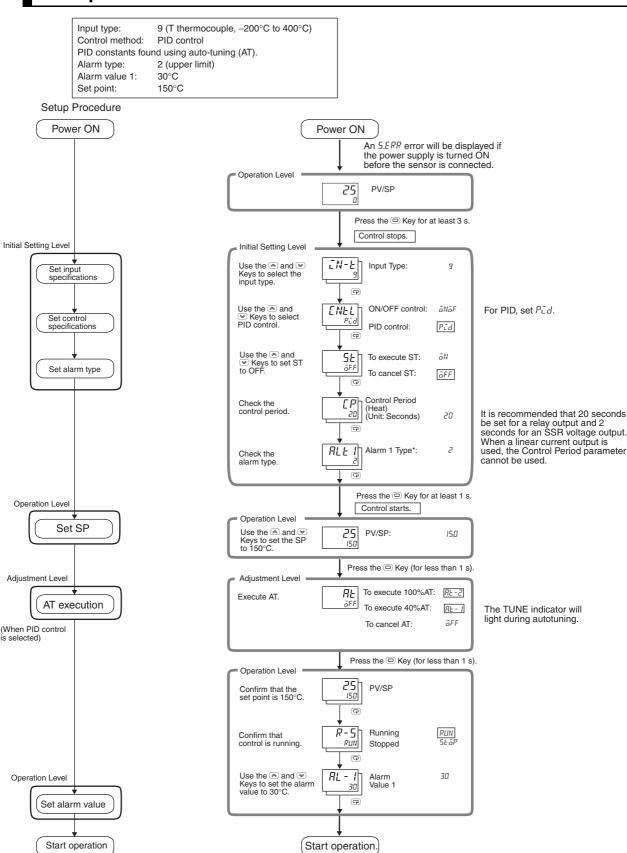


Example 1



If the Controller is equipped with HB/HS alarm detection, the default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1. For details, refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).

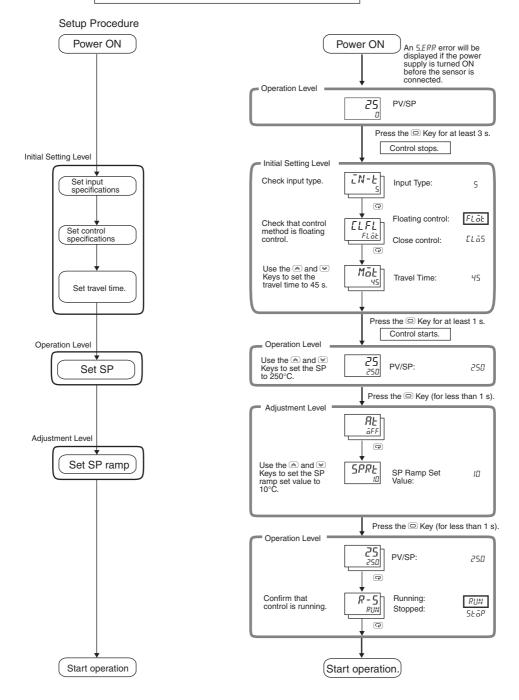
Example 2



* If the Controller is equipped with HB/HS alarm detection, the default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1. For details, refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).

Example 3 (E5EC/E5AC Position-proportional Models Only)

5 (K thermocouple, -200°C to 1,300°C) Input type: Control method: Floating control SP ramp time unit: EU/min Travel time: 45 s SP ramp set value: 10 EU (°C) Set point: 250°C



4-3 Setting the Input Type

The Digital Controller supports four input types: resistance thermometer, thermocouple, infrared temperature sensor, and analog inputs. Set the input type that matches the sensor that is used.

4-3-1 Input Type

The following example shows how to set a K thermocouple for -20.0 to 500.0° C (input type 6).

Operating Procedure

Press the \bigcirc Key for at least 3 seconds to move from the Operation Level to the Initial Setting Level. The $\bar{L}N^{-1}L$ (Input Type) parameter will be displayed.

Initial Setting Level
Input Type

2 Press the ♠ or ♥ Key to select 5 (K thermocouple at –20.0 to 500.0°C).

IN-E

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



Additional Information

Changes that are made with key operations are applied when the \bigcirc or \bigcirc Key is pressed. They are also applied if you do nothing for 3 seconds or longer.

List of Input Types

	Specifications	Set value	Temperature range in °C	Temperature range in °F
	Pt100	0	-200 to 850	-300 to 1500
		1	-199.9 to 500.0	-199.9 to 900.0
Resistance thermometer		2	0.0 to 100.0	0.0 to 210.0
thermometer	JPt100	3	-199.9 to 500.0	-199.9 to 900.0
		4	0.0 to 100.0	0.0 to 210.0
	К	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
	Т	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
Theorem	L	12	-100 to 850	-100 to 1500
Thermocouple	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
	В	18	100 to 1800	300 to 3200
	C/W	19	0 to 2300	0 to 3200
	PLII	20	0 to 1300	0 to 2300
	10 to 70°C	21	0 to 90	0 to 190
Infrared	60 to 120°C	22	0 to 120	0 to 240
temperature sensor ES1B	115 to 165°C	23	0 to 165	0 to 320
3030. 23.2	140 to 260°C	24	0 to 260	0 to 500
0	4 to 20 mA	25	One of the following ranges	according to the scaling:
Current input	0 to 20 mA	26	-1999 to 9999	
	1 to 5 V	27	199.9 to 999.9 -19.99 to 99.99	
Malka wa isana i	0 to 5 V	28	-1.999 to 9.999	
Voltage input	0 to 10 V	29		

The default is 5.

This range can be used only for E5CC-U Digital Controllers and only if they are manufactured in May 2014 or later (version 2.2 or higher).



Precautions for Correct Use

5.ERR (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.



4-4 Selecting the Temperature Unit

4-4-1 Temperature Unit

- Either °C or °F can be selected as the temperature unit.
- Set the temperature unit in the Temperature Unit (d-U) parameter of the Initial Setting Level. The default is \mathcal{L} (°C).

The following procedure selects °C.

Operating Procedure

1	Press the Key several times in the Initial Setting Level to display d-U (Temperature Unit).	Initial Setting Level
2	Press the \bigcirc or \bigcirc Key to select $^{\circ}$ C. The default is \mathcal{L} ($^{\circ}$ C). $\mathcal{L}: ^{\circ}$ C, $\mathcal{F}: ^{\circ}$ F	d-U

^{*} The temperature unit is not displayed by the E5DC and E5DC-B.

Selecting PID Control or ON/OFF 4-5 **Control (Not Supported for Position-proportional Models.)**

Two control methods are supported: 2-PID control and ON/OFF control. Switching between 2-PID control and ON/OFF control is executed by means of the PID ON/OFF parameter in the initial setting level. When this parameter is set to $P\bar{L}d$, 2-PID control is selected, and when set to $\bar{a}N\bar{a}F$, ON/OFF control, is selected. The default is $\bar{a}N\bar{a}F$.

2-PID Control

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

For PID control, set the PID constants in the Proportional Band (P), Integral Time (\bar{L}) , and Derivative Time (d) parameters.

For heating and cooling control, also set the Proportional Band (Cooling) (\mathcal{L} - \mathcal{P}), Integral Time (Cooling) $(\bar{L} - \bar{L})$, and Derivative Time (Cooling) $(\bar{L} - \bar{d})$.

ON/OFF Control

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

4-6 Setting Output Specifications

4-6-1 Control Periods (Not Supported for Position-proportional Models.)

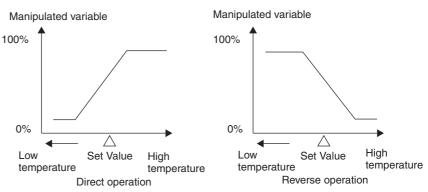


- Control Period (Cooling)
- Set the output periods (control periods). Though a shorter period provides
 better control performance, it is recommended that the control period be set to
 20 seconds or longer for a relay output to preserve the service life of the relay.
 After the settings have been made in the initial setup, readjust the control
 period, as required, by means such as trial operation.
- Set the control periods in the Control Period (Heating) and Control Period (Cooling) parameters in the Initial Setting Level. The default is 20 seconds for a relay output and 2 seconds for a voltage output (for driving SSR).
- · The control periods are used only for PID control.
- The Control Period (Cooling) parameter is used only for heating/cooling control.
- When control output is used as a linear current output, the Control Period parameter cannot be used.

4-6-2 Direct and Reverse Operation

āREV

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



For example, when the process value (PV) is lower than the set point (SP) in a heating control system, the manipulated variable increases according to the difference between the PV and SP. Accordingly, reverse operation is used in a heating control system. Direct operation is used in a cooling control system, in which the operation is the opposite of a heating control system. The Control Output 1 Assignment is set to \bar{a} (control output (heating)) for either direct or reverse operation.

• Direct/reverse operation is set in the Direct/Reverse Operation parameter in the Initial Setting Level. The default is $\bar{a}R - R$ (reverse operation).

In this example, direct/reverse operation, and control period (heating) parameters are checked.

Direct/reverse operation = $\bar{a}R - \bar{R}$ (reverse operation)

Control period (heating) = 20 (seconds)

Operating Procedure

• Setting the Control Period (Heating) Parameter

	S		
<u>1</u>	Press the Key several times in the Initial Setting Level to	Initial Setting Level	
	display [P (Control Period (Heating)).	Control Period (Heating)	
2	Press the ♠ or ❤ Key to set the value to 20.		
	The default for a relay output is 20 seconds.	20 L P	
• Se	etting Direct/Reverse Operation		
<u> 1</u>	Press the Key several times in the Initial Setting Level to	Initial Setting Level	
	display בּREV (Direct/Reverse Operation).	Direct/Reverse Operation	
2	Press the \bigcirc or \bigcirc Key to select $\stackrel{\circ}{a}R$ - $\stackrel{\circ}{R}$ (Reverse Operation). The default is $\stackrel{\circ}{a}R$ - $\stackrel{\circ}{R}$ (Reverse Operation).	āREV āR-R	

4-6-3 **Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.)**

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

Parameter name	Display	Initial status
Control Output 1 Assignment	ōUE I	Control output
		(heating)
Control Output 2 Assignment (E5CC, E5EC, and	ōUE2	Not assigned.
E5AC Only)		
Auxiliary Output 1 Assignment	5U6 I	Alarm 1*1
Auxiliary Output 2 Assignment	SU62	Alarm 2
Auxiliary Output 3 Assignment (E5CC, E5EC,	5063	Alarm 3
E5EC-B, and E5AC Only)		
Auxiliary Output 4 Assignment (E5EC, E5EC-B,	5064	Alarm 4
and E5AC Only)		

^{*1} If the Digital Controller is equipped with HB/HS alarm detection, it is set by default to detect heater alarms (HA). Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1. If the Program Pattern parameter is changed to a setting other than OFF, Auxiliary Output 1 Assignment parameter is set as the program end output.

- Refer to page 6-81 and page 6-82 for the functions that can be assigned to the outputs.
- Each output is automatically initialized as shown below by changing the control mode between standard and heating/cooling.

Assigned Output Functions

Digital Controllers with Three or Fewer Auxiliary Outputs

Parameter name	Display	Without control output 2		With control output 2		
Parameter mame	Display	Standard	Heating/cooling	Standard	Heating/cooling	
Control Output 1	ōUE I	Control output	Control output	Control output	Control output	
Assignment		(heating)	(heating)	(heating)	(heating)	
Control Output 2	ōUE2			Not assigned.	Control output	
Assignment					(cooling)	
Auxiliary Output 1	5Ub 1	Alarm 1*1	Alarm 1*1	Alarm 1*1	Alarm 1*1	
Assignment						
Auxiliary Output 2	5062	Alarm 2	Control output	Alarm 2	Alarm 2	
Assignment			(cooling)*2			
Auxiliary Output 3	SU63	Alarm 3	Alarm 3	Alarm 3	Alarm 3	
Assignment						

Digital Controllers with Four Auxiliary Outputs

Parameter name	Display	Without control output 2		With control output 2	
Parameter mame	Display	Standard	Heating/cooling	Standard	Heating/cooling
Control Output 1	ōUE I	Control output	Control output	Control output	Control output
Assignment		(heating)	(heating)	(heating)	(heating)
Control Output 2	ōUE2			Not assigned.	Control output
Assignment					(cooling)
Auxiliary Output 1	5Ub I	Alarm 1*1	Alarm 1*1	Alarm 1*1	Alarm 1*1
Assignment					
Auxiliary Output 2	5062	Alarm 2	Alarm 2	Alarm 2	Alarm 2
Assignment					
Auxiliary Output 3	5063	Alarm 3	Alarm 3	Alarm 3	Alarm 3
Assignment					
Auxiliary Output 4	5064	Alarm 4	Control output	Alarm 4	Alarm 4
Assignment			(cooling)		

^{*1} If the Digital Controller is equipped with HB/HS alarm detection, it is set by default to detect heater alarms (HA). Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1. If the Program Pattern parameter is changed to a setting other than OFF, Auxiliary Output 1 Assignment parameter is set as the program end output.

Alarms

It will be specified in this section when an alarm must be assigned, i.e., when an alarm must be set for the Control Output 1 or 2 Assignment parameters, or for the Auxiliary Output 1 to 4 Assignment parameters. For example, if alarm 1 is set for the Control Output 1 Assignment parameter, then alarm 1 has been assigned.

Assigning a work bit to either control output 1 or 2 or to auxiliary output 1 to 4 is also considered to be the same as assigning an alarm. For example, if work bit 1 is set for the Auxiliary Output 1 Assignment parameter, then alarms 1 to 4 have been assigned.

^{*2} When heating/cooling control is used on the E5GC, auxiliary output 1 is the control output for cooling.

Assign the control outputs and auxiliary outputs.

Control output 1: Control output (heating)

Control output 2: Control output (cooling)

Auxiliary output 1: Alarm 1 Auxiliary output 2: Alarm 2

Operating Procedure

• Se	etting Heating/Cooling Control	
1	Press the $\ \ \ \ $ Key several times in the Initial Setting Level to display 5-HE (Standard or Heating/Cooling).	Initial Setting Level 5 - HC Standard or Heating/Cooling
2	Press the ♠ or ❤ Key to set the parameter to H-L. The default is 5ŁNd (standard).	5-H [H-E
• Se	* Use the following procedures to check the output assignments. The output assignments are changed automatically when you change between standard and heating/cooling control. You do not have to set them. etting Control Output 1	
1	Press the	Advanced Function Setting Level Control Output 1 Assignment
2	Set the parameter to \bar{a} (Control Output (Heating)). The default is \bar{a} (Control Output (Heating)).	ōUŁ [
• Se	etting Control Output 2	_
1	Press the ^② Key several times in the Advanced Function Setting Level to display ¬ULZ (Control Output 2 Assignment).	Advanced Function Setting Level Control Output 2 Assignment
2	Set the parameter to \mathcal{L} - \bar{a} (Control Output (Cooling)). As soon as you select \mathcal{H} - \mathcal{L} (Heating/Cooling) for the Standard or Heating/Cooling parameter, the setting of this parameter is automatically changed to \mathcal{L} - \bar{a} (Control Output (Cooling)).	ōUŁZ [-ā
• Se	etting Auxiliary Output 1	
1	Press the	Advanced Function Setting Level Auxiliary Output 1 Assignment
2	Press the or Key to set the parameter to RLM I. The default is RLM I (Alarm 1). If the Digital Controller is equipped with HB/HS alarm detection, this parameter is set by default to HR (heater alarm).	SUB I BLM I

- Setting Auxiliary Output 2
- Press the

 Key several times in the Advanced Function Setting Level to display 5Ub2 (Auxiliary Output 2 Assignment).

 Press the
 or
 Key to set the parameter to RLM2.

 The default is RLM2 (Alarm 2).

 Advanced Function Setting Level

 Level

 Auxiliary Output 2 Assignment

 Advanced Function Setting Level

 Fig. 6

 Auxiliary Output 2 Assignment

4-6-4 Auxiliary Output Opening or Closing in Alarm

- When "close in alarm" is set, the status of the auxiliary output is output unchanged. When "open in alarm" is set, the status of the auxiliary output function is reversed before being output.
- Each auxiliary output can be set independently.
- These settings are made in the Auxiliary Output 1 to 4 Open in Alarm parameters (Advanced Function Setting Level).
- The default is N-a: Close in Alarm.

	Auxiliary output functions 1 to 4	Auxiliary output	Indicators (SUB1 to SUB4)
Close in Alarm	ON	ON	Lit
(N-ō)	OFF	OFF	Not lit
Open in Alarm	ON	OFF	Lit
(N-E)	OFF	ON	Not lit

• The alarm output will turn OFF (i.e., the relay contacts will open) when power is interrupted and for about two seconds after the power is turned ON regardless of the setting of the Auxiliary Output 1 to 4 Open in Alarm parameter.

Setting the Set Point (SP)

Operation Level



The Operation Level is displayed when the power is turned ON. For the default setting, the No. 1 display shows the PV, the No. 2 display shows the SP, and the No. 3 display (E5EC, E5EC-B, or E5AC only) shows the MV.

The contents that is set in the PV/SP Display Screen Selection parameter in the Advanced Function Setting Level are displayed.

For details, refer to 4-13-1 PV/SP Display Selections.

4-7-1 Changing the SP

50.0

- The set point cannot be changed when the Operation/Adjustment Protect parameter is set to 3. For details, refer to 5-7 Using the Key Protect Level.
- To change the set point, press the
 o
 o

 W

 Key in the PV/SP parameter (Operation Level) or for the SP/SP (character display) display in the Operation Level, and set the desired set value. The new set point is selected three seconds after you have specified the new value.
- Multi-SP is used to switch between eight set points. For details, refer to 5-4 Using Event Inputs for details.

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

Operating Procedure

Press the A or Key in the Operation Level to set the SP to 200. The default SP is 0°C.

Operation Level

30 200



Additional Information

• If there are a lot of digits in a numeric value, you can use the (F) (Shift Key) to select the digit to change before you change the value of the digit.

Example: Changing 1,000°C to 1,200°C

Press (PF) Key three times.

The third digit will flash.

Operation Level



Press the Key to set the value to 1200.

Operation Level 30

1200

4-8 Using ON/OFF Control (Not Supported for Position-proportional Models.)

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

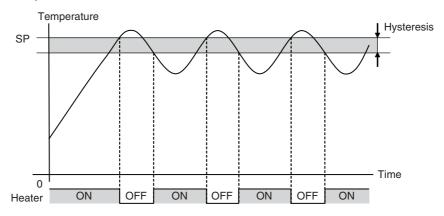
4-8-1 ON/OFF Control

Switching between 2-PID control and ON/OFF control is performed using the PID ON/OFF parameter in the Initial Setting Level. When this parameter is set to P̄L̄d, 2-PID control is selected, and when it is set to aNaF, ON/OFF control is selected. The default is aNaF.

Hysteresis

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

Reverse operation



Parameters

Display	Parameter	Application	Level
5-HE	Standard or	Specifying control	Initial Setting Level
	Heating/Cooling	method	
ENEL	PID ON/OFF	Specifying control method	Initial Setting Level
āREV	Direct/Reverse	Specifying control	Initial Setting Level
	Operation	method	
E-db	Dead Band	Heating/cooling control	Adjustment Level
HYS	Hysteresis (Heating)	ON/OFF control	Adjustment Level
CH42	Hysteresis (Cooling)	ON/OFF control	Adjustment Level

4-8-2 **Settings**

To execute ON/OFF control, set the Set Point, PID ON/OFF, and Hysteresis parameters.

Setting the PID ON/OFF Parameter

Confirm that the PID ON/OFF parameter is set to $\bar{a}N\bar{a}F$ in the Initial Setting Level.

Operating Procedure

1	Press the Key several times in the Initial Setting Level to	Initial Setting Level	
		ENEL anaf	PID ON/OFF

Setting the SP

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

Operating Procedure

1	Select PV/SP in the Operation Level.	Operation Level	
		25 100	
2	Press the or Key to set the SP to 200. The default is 0. The new set value can be saved by pressing the Key, or it will go into effect after 3 seconds has elapsed.	25 200	

Setting the Hysteresis

Set the hysteresis to 2.0°C.

۸n	orat	lina	Pro	ممط	IIFO
UD	era	una	PIO	cea	ure

1	Press the	Adjustment Level Hysteresis (Heating)
2	Press the or Key to set the hysteresis to 2.0. The default is 1.0. The new set value can be saved by pressing the Key, or it will go into effect after 3 seconds has elapsed.	H45 2.0

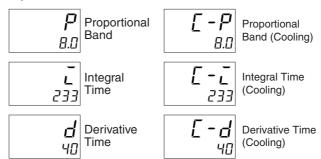
Determining PID Constants (AT, ST, Manual Setup)

4-9-1 AT (Auto-tuning)



- . When AT is executed, the optimum PID constants for the set point at that time are set automatically. A method (called the limit cycle method) for forcibly changing the manipulated variable and finding the characteristics of the control object is employed.
- Either 40% AT or 100% AT can be selected depending on the width of MV variation in the limit cycle. In the AT Execute/Cancel parameter, specify RE-2 (100% AT) or RE = 1 (40% AT). To cancel AT, specify $\overline{a}FF$ (AT cancel).
- Only 100% autotuning is supported for heating and cooling control or floating position-proportional control.
- If the Heating/Cooling Tuning Method parameter is set to any value other than 0 (same as heating control), the PID constants are set automatically for both heating control and cooling control.
- AT cannot be executed when control has stopped or during ON/OFF control.
- . The results of autotuning are saved in the following parameters in the Adjustment Level: Proportional Band (P), Integral Time (I), Derivative Time (D), Proportional Band (Cooling) (C-P), Integral Time (Cooling) (C-I), and Derivative Time (Cooling) (C-D).

Adjustment Level



AT Operations

AT is started when either RŁ - 2 (100% AT) or RŁ - 1 (40% AT) is specified for the AT Execute/Cancel parameter.

The TUNE indicator will light during execution.

Only the Communications Writing, RUN/STOP, AT Execution/Cancel, and Program Start parameters can be changed during AT execution. Other parameters cannot be changed.

AT Calculated Gain 000

The AT Calculated Gain parameter sets the gain for when PID values are calculated using AT. When emphasizing response, decrease the set value. When emphasizing stability, increase the set value.

AT Hysteresis 000

The AT Hysteresis parameter sets the hysteresis when switching ON and OFF for the limit cycle operation during auto-tuning.

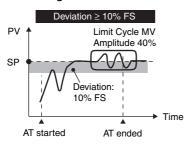
Limit Cycle MV Amplitude 000

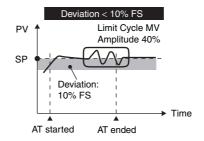
The Limit Cycle MV Amplitude parameter sets the MV amplitude for limit cycle operation during auto-tuning.

* This setting is disabled for 100% AT.

• 40% AT

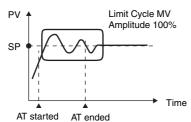
 The width of MV variation in the limit cycle can be changed in the Limit Cycle MV Amplitude parameter, but the AT execution time may be longer than for 100% AT. The limit cycle timing varies according to whether the deviation (DV) at the start of auto-tuning execution is less than 10% FS.





• 100% AT

 Operation will be as shown in the following diagram, regardless of the deviation (DV) at the start of AT execution. To shorten the AT execution time, select 100% AT.



* The Limit Cycle MV Amplitude parameter is disabled.

The 100% autotuning is executed.

Operating Procedure

Adjustment Level play RL (AT Execute/Cancel). H۲ AT Execute/ Cancel āFF Press the ♠ or ♥ Key to select #£-2 (100% AT execute). Aŀ The TUNE indicator will light during autotuning. RE-2 Adjustment Level When AT ends, the AT Execute/Cancel parameter is set to $\bar{a}FF$. ЯĿ AT Execute/ ōFF Cancel



Precautions for Correct Use

To execute autotuning, you must set the RUN/STOP parameter to RUN (default: RUN) and the PID ON/OFF parameter to PID (default: ON/OFF). If the RUN/STOP parameter is set to STOP or the PID ON/OFF parameter is set to ON/OFF, the settings for the AT Execute/Cancel parameter will not be displayed.

Supplemental Information on AT Operation

- Perform AT with the control set point set and the power supply to the output side (e.g., heater)
- You can start AT from any current temperature.



Additional Information

PID Constants

When control characteristics are already known, PID constants can be set directly to adjust control. The PID constants are set in the following parameters in the Adjustment Level: Proportional Band (P), Integral Time (I), Derivative Time (D), Proportional Band (Cooling) (C-P), Integral Time (Cooling) (C-I), and Derivative Time (Cooling) (C-D).

• Integral/Derivative Time Unit If the results of executing AT give a derivative time (D) of less than 10 seconds, we recommend that you set the Integral/Derivative Time Unit parameter (Advanced Setting Level) to 0.1 seconds and perform AT again.

4-9-2 ST (Self-tuning) (Not Supported for Position-proportional Models.)

5*E*

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

Once the PID constants have been calculated, ST is not executed when the next control operation is started as long as the set point remains unchanged. ST (self-tuning) is enabled when the ST parameter is set to ON in the Initial Setting Level.

When 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.

This procedure executes self-tuning (ST).

Operating Procedure

1	Press the Key several times in the Initial Setting Level to	Initial Setting Level
	display 5 <i>L</i> (ST).	5 <u>L</u> st
2	Press the ♠ or ❤ Key to select ōN (ST ON).	51
	The default is ON. * The TUNE indicator will flash during ST execution.	ōΝ



Additional Information

PID Constants

When control characteristics are already known, PID constants can be set directly to adjust control. The PID constants are set in the following parameters in the Adjustment Level: Proportional Band (P), Integral Time (I), Derivative Time (D), Proportional Band (Cooling) (C-P), Integral Time (Cooling) (C-I), and Derivative Time (Cooling) (C-D).

Startup Conditions

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

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

^{*1} The previous SRT-implemented set point is the set point that was used for calculating the PID constants for the previous SRT.

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

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

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

To execute self-tuning again after completing the above operations, set the ST parameter to OFF and then set it to ON again.

ST Stable Range

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

This procedure sets the ST stable range to 20.0°C.

Operating Procedure

1	Press the \bigcirc Key several times in the Advanced Function Setting Level to display the $5L-b$ (ST Stable Range) parameter.	Advanced Function Setting Level
	3	5L-b ST Stable Range
2	Press the or Key to set the value to 20.0. The default is 15.0.	5 <i>E</i> - <i>B</i>

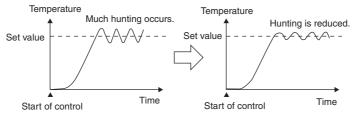
4-9-3 RT (Robust Tuning) (Used for AT or ST.) 000



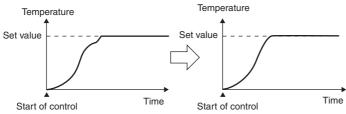
- When AT or ST is executed with RT selected, PID constants are automatically set that make it hard for control performance to deteriorate even when the characteristics of the controlled object are changed.
- RT can be set in the Advanced Function Setting Level when PID control has been set.
- The RT mode cannot be selected while an analog input is set.
- Selecting the RT mode in the following cases will help to prevent hunting from occurring.
 - When the set temperature is not constant and is changed in a wide range
 - When there are large variations in ambient temperatures due to factors such as seasonal changes or differences between day and night temperatures
 - When there are large variations in ambient wind conditions and air flow
 - When heater characteristics change depending on the temperature
 - When an actuator with disproportional I/O, such as a phase-control-type power regulator, is used
 - · When a rapidly heating heater is used
 - · When the control object or sensor has much loss time
 - When hunting occurs in normal mode for any reason
 - PID constants are initialized to the factory settings by switching to RT mode.
 - * When the RT mode is selected, the Integral/Derivative Time Unit parameter changes to 0.1 s.

RT Features

• Even when hunting occurs for PID constants when AT or ST is executed in normal mode, it is less likely to occur when AT or ST is executed in RT mode.



• When the temperature (PV) falls short of the set point for the PID constants when using AT or ST in normal mode, executing AT or ST in RT mode tends to improve performance.



• When the manipulated variable (MV) is saturated, the amount of overshooting may be somewhat higher in comparison to PID control based on AT or ST in normal mode.

This procedure selects RT mode.

Operating Procedure

1	Press the $\ \ $ Key several times in the Advanced Function Setting Level to display RE (RT: robust tuning).	Advanced Function Setting Level RT aFF
2	Press the \bigcirc or \bigcirc Key to select $\bar{a}N$ (RT ON). The default is $\bar{a}FF$.	RE āN

Manual Setup 4-9-4

Individual PID constants can be manually set in the Proportional Band, Integral Time, and Derivative Time parameters in the Adjustment Level.

In this example, the Proportional Band parameter is set to 10.0, the Integral Time parameter to 250, and the Derivative Time parameter to 45.

Operating Procedure

· Setting the Proportional Band

	A 1' 1 1 1
Press the Key several times in the Adjustment Level to display the P (Proportional Band) parameter.	Adjustment Level
	p p
, (Proportional Band
	Band Band
Press the (*) or (*) Key to set the value to 10.0.	
-	P
_	10.0
tting the Integral Time	
Press the @ Key several times in the Adjustment Level to	Adjustment Level
	- Into and Time
display the L (integral time) parameter.	Integral Time
	233
Press the ♠ or ❤ Key to set the value to 250.	_
	<u> </u>
G	250
•	
g	Adjustment Level
Press the Key several times in the Adjustment Level to	Adjustment Level
display the d (Derivative Time) parameter.	Derivative Time
	40
	10
Press the ♠ or ❤ Key to set the value to 45.	
The default settings are as follows:	<u> </u>
•	45
•	
	Press the ♠ or ❤ Key to set the value to 10.0. The default settings are as follows: • Temperature input (°C or °F): 8.0 • Analog input (%FS): 10.0 Itting the Integral Time Press the ♠ Key several times in the Adjustment Level to display the L (Integral Time) parameter. Press the ♠ or ❤ Key to set the value to 250. The default settings are as follows: • Integral/Derivative Time Unit of 1 s: 233 • Integral/Derivative Time Unit of 0.1 s: 233.0 Itting the Derivative Time Press the ♠ Key several times in the Adjustment Level to display the d (Derivative Time) parameter.



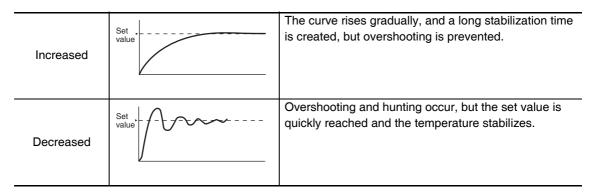
Additional Information

Proportional Action

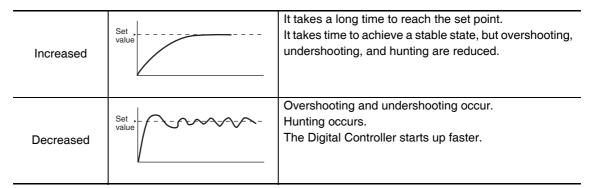
When PID constants I (integral time) and D (derivative time) are set to 0, control is executed according to proportional action. As the default, the center value of the proportional band becomes the set point.

Related parameter: Manual Reset Value (Adjustment Level)

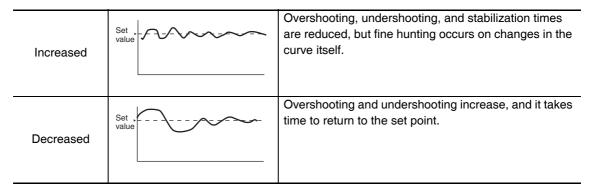
When P (Proportional Band) Is Adjusted



When I (Integral Time) Is Adjusted



When D (Derivative Time) Is Adjusted



4-10 Alarm Outputs

- Alarms are output from auxiliary outputs. For relay outputs or voltage outputs (for driving SSRs), alarms can also be used by setting the Control Output 1 Assignment or Control Output 2 Assignment parameter to any of the alarms from alarm 1 to 4. The alarm output condition is determined by a combination of the alarm type, alarm value, alarm hysteresis, and the standby sequence. For details, refer to 4-11 Alarm Hysteresis.
- This section describes the Alarm Type, Alarm Value, Upper-limit Alarm and Lower-limit Alarm parameters.

4-10-1 Alarm Types

ALL I Alarm 1 Type

RLE2 Alarm 2 Type

ALE3 Alarm 3 Type

81 74 Alarm 4 Type

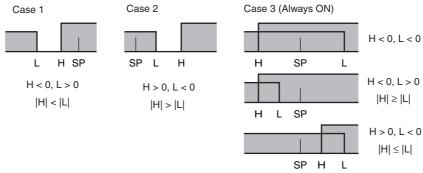
- Set the alarm type independently for each alarm in the Alarm 1 to 4 Type parameters in the Initial Setting Level.
- The alarms that can be set are listed in the following table.
- You can use an LBA (12) only for alarm 1. You cannot use an LBA on a Position-proportional Model.
- If the Controller is equipped with HB/HS alarm detection, the default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To use alarm 1, set an output assignment to alarm 1. (Refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).)

	Alarm outpo	ut operation	
Alarm type	When alarm value	When alarm value	Description of function
	X is positive	X is negative	
Alarm function	Outpu	t OFF	No alarm
OFF			
Upper- and	ON → L H ←	*2	Set the upward deviation in
lower-minit	OFF SP		the set point for the alarm upper limit (H) and the
			lower deviation in the set
			point for the alarm lower
			limit (L). The alarm is ON
			when the PV is outside this
			deviation range.
Upper-limit	ON → X ←	ON → X ←	Set the upward deviation in
	OFF SP PV	OFF SP PV	the set point by setting the
			alarm value (X). The alarm
			is ON when the PV is higher
			than the SP by the deviation
L avvar limit			or more. Set the downward deviation
Lower-limit	ON → X ←	ON → X ←	
	OFF SP PV	OFF SP PV	in the set point by setting the alarm value (X). The
			alarm is ON when the PV is
			lower than the SP by the
			deviation or more.
	Alarm function OFF	Alarm type When alarm value X is positive Output OFF Upper- and lower-limit*1 ON OFF ON OFF PV Lower-limit	Alarm function OFF Upper- and lower-limit*1 Upper-limit ON OFF OFF V SP PV N OFF OFF ON OFF OFF ON ON OFF ON ON OFF ON OT

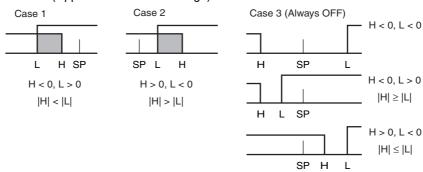
Set	Alarm type	When alarm value	ut operation When alarm value	Description of function
value		X is positive	X is negative	
4	Upper- and lower-limit range*1	ON OFF SP PV	*3	Set the upward deviation in the set point for the alarm upper limit (H) and the lower deviation in the set point for the alarm lower limit (L). The alarm is ON when the PV is inside this deviation range.
5	Upper- and lower-limit with standby sequence*1	ON OFF SP PV	*4	A standby sequence is added to the upper- and lower-limit alarm (1).*6
6	Upper-limit with standby sequence	ON X PV	ON OFF SP PV	A standby sequence is added to the upper-limit alarm (2).*6
7	Lower-limit with standby sequence	ON X PPV	ON SP PV	A standby sequence is added to the lower-limit alarm (3).*6
8	Absolute-value upper-limit	ON ← X → PV	ON ← X → O PV	The alarm will turn ON if the process value is larger than the alarm value (X) regardless of the set point.
9	Absolute-value lower-limit	ON → X → OFF 0 PV	ON OFF OPV	The alarm will turn ON if the process value is smaller than the alarm value (X) regardless of the set point.
10	Absolute-value upper-limit with standby sequence	ON OFF 0 PV	ON OFF 0 PV	A standby sequence is added to the absolute-value upper-limit alarm (8).*6
11	Absolute-value lower-limit with standby sequence	ON OFF 0 PV	ON OFF O PV	A standby sequence is added to the absolute-value lower-limit alarm (9).*6
12	LBA (alarm 1 type only)			*7
13	PV change rate alarm			*8
14	SP absolute-value upper-limit alarm	ON	ON OFF 0 SP	This alarm type turns ON the alarm when the set point (SP) is higher than the alarm value (X).
15	SP absolute-value lower-limit alarm	ON	U	This alarm type turns ON the alarm when the set point (SP) is lower than the alarm value (X).
16	MV absolute-value upper-limit alarm*9	Standard Control ON OFF O MV Heating/Cooling Control (Heating MV) ON OFF O MV	Standard Control ON OFF OFF ON OFF ON ON OFF ON	This alarm type turns ON the alarm when the manipulated variable (MV) is higher than the alarm value (X).

C-4		Alarm outpu	ut operation	
Set value	Alarm type	When alarm value	When alarm value	Description of function
value		X is positive	X is negative	
17	MV absolute-value	Standard Control	Standard Control	This alarm type turns ON
	lower-limit alarm*9	ON ← X → MV	ON X → MV	the alarm when the manipulated variable (MV) is lower than the alarm
		Heating/Cooling	Heating/Cooling	value (X).
		Control (Cooling	Control (Cooling	
		MV)	MV)	
		$\begin{array}{c c} ON & & \leftarrow X \rightarrow \\ OFF & & 0 \end{array}$ MV	Always ON	
18	RSP absolute-value upper-limit alarm	ON ← X → RSP	ON → X → RSP	This alarm type turns ON the alarm when the remote SP (RSP) is higher than the alarm value (X).
	*10 000			
19	RSP absolute-value lower-limit alarm *10 000	ON → X → RSP	ON X → RSP	This alarm type turns ON the alarm when the remote SP (RSP) is lower than the alarm value (X).

- *1 With set values 1, 4, and 5, the upper- and lower-limit values can be set independently for each alarm type, and are expressed as "L" and "H."
- *2 Set value: 1 (Upper- and lower-limit alarm)



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



- Set value: 5 (Upper- and lower-limit alarm with standby sequence)
 - For the upper- and lower-limit alarms in cases 1 and 2 above, the alarm is always OFF if upper- and lower-limit hysteresis overlaps.
 - In case 3, the alarm is always OFF.
- *5 Set value: 5 (Upper- and lower-limit alarm with standby sequence)
 - The alarm is always OFF if upper- and lower-limit hysteresis overlaps.
- Refer to Standby Sequence Reset on page 6-64 for information on the operation of the standby *6 sequence.
- Refer to 5-11-1 Loop Burnout Alarm (LBA).
- Refer to PV Change Rate Alarm on page 4-36. *8

- *9 When heating/cooling control is performed, the MV absolute-value upper-limit alarm functions only for the heating operation and the MV absolute-value lower-limit alarm functions only for the cooling operation.
- *10 This value is displayed only when a remote SP input is used. It functions in both Local SP Mode and Remote SP Mode.

values, and "L" is displayed for lower limit values.

Limit parameters in the Operation Level.

• Alarm values are indicated by "X" in the table on the previous page. When the

upper and lower limits are set independently, "H" is displayed for upper limit

• To set the alarm value upper and lower limits for deviation, set the upper and

lower limits in each of the Alarm 1 to 4 Upper Limit, and Alarm 1 to 4 Lower

4-10-2 Alarm Values



RL2L

AL 3L

AL YL

Alarm Upper Limit Value

RL2H

AL 3H

RL YX

Alarm Value

RL - 2

AL - 3

RL-4

This procedure sets alarm 1 as an upper-limit alarm. The alarm is output when the process value (PV) exceeds the set point (SP) by 10°C. (In this example, the temperature unit is °C.)

Alarm 1 type = 2 (Upper-limit alarm)

Alarm value 1= 10

Operating Procedure

• Selecting the Alarm 1 Type

1	Press the Key several times in the Initial Setting Level to display RLE / (Alarm 1 Type).*	Initial Setting Level Alarm 1 Type
2	Press the or Vec Key to set the set value to 2. The default is 2 (upper-limit alarm).	ALE 1

· Setting the Alarm Value

1	Press the $\ \ \ $ Key several times in the Operation Level to display $\ \ \ $ Level 1).	Operation Level Alarm Value 1
2	Press the ♠ or ❤ Key to set the set value to 10. The default is 10.	AL - 1

If the Controller is equipped with HB/HS alarm detection, the default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. To enable alarm 1, set an output assignment to alarm 1. For details, refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).

PV Change Rate Alarm

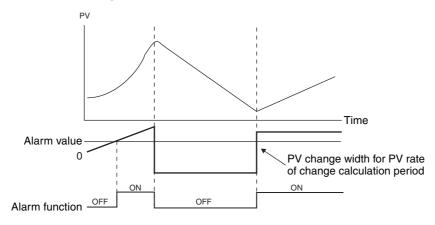
The change width can be found for PV input values in any set period. Differences with previous values in each set period are calculated, and an alarm is output if the result exceeds the alarm value. The PV rate of change calculation period can be set in units of 50 ms.

If a positive value is set for the alarm value, the PV will operate as a change rate alarm in the rising direction. If a negative value is set, the PV will operate as a change rate alarm in the falling direction.



Precautions for Correct Use

If a shorter PV rate of change calculation period is set, outputs set for the PV change rate alarm function may repeatedly turn ON and OFF for a short period of time. It is therefore recommended that the PV change rate alarm be used with the alarm latch turned ON.



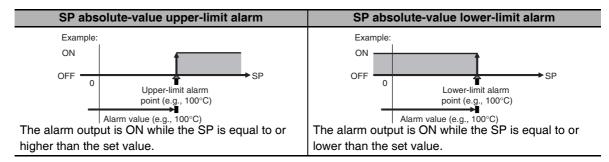
Parameter name	Setting range	Unit	Default
PV Rate of Change	1 to 999	Sampling cycle	20 (1 s)
Calculation Period			

SP Alarms

You can set an SP absolute-value upper-limit or SP absolute-value lower-limit alarm for the set point (SP).

The alarm point is set in the corresponding alarm value parameter. The Alarm SP Selection parameter is used to specify the alarm for either the ramp SP or the target SP.

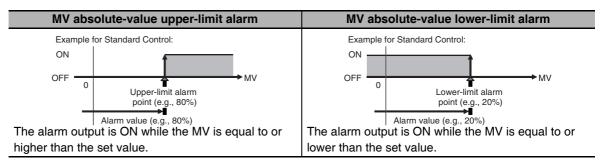
The corresponding alarm hysteresis setting is also valid.



MV Alarms

You can set an MV absolute-value upper-limit or MV absolute-value lower-limit alarm for the manipulated value (MV).

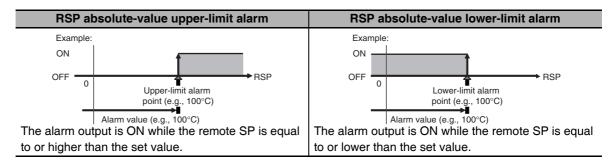
The alarm point is set in the corresponding alarm value parameter. The corresponding alarm hysteresis setting is also valid.



RSP Alarms 000

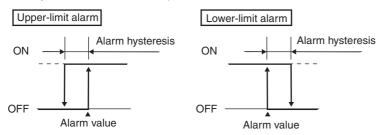
You can set an RSP absolute-value upper-limit alarm or RSP absolute-value lower-limit alarm for the remote SP input.

The alarm point is set in the corresponding alarm value parameter. The corresponding alarm hysteresis setting is also valid.



4-11 Alarm Hysteresis

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



- · Alarm hysteresis is set independently for each alarm in the Alarm 1 to 4 Hysteresis parameters (Initial Setting Level).
- For all alarms except for MV alarms, the default is 0.2 (°C/°F) for temperature inputs and 0.02% FS for analog inputs. The default is 0.50(%) for MV alarms.

4-11-1 Standby Sequence

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

Restart

• The standby sequence is canceled when an alarm is output. It is, however, restarted later by the Standby Sequence Reset parameter (Advanced Function Setting Level). For details, refer to the Standby Sequence Reset parameter in Section 6 Parameters.

4-11-2 Alarm Latch

• The alarm latch can be used to keep the alarm output ON until the latch is canceled regardless of the temperature once the alarm output has turned ON.

Any of the following methods can be used to clear the alarm latch.

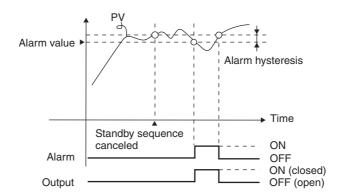
- Turn OFF the power supply. (The alarm latch is also cleared by switching to the Initial Setting Level, Communications Setting Level, Advanced Function Setting Level, or Calibration Level.)
- Use the PF Key.
- Use an event input.

For details on setting the PF Key, refer to *5-18 Setting the PF Key*. For details on setting events, refer to *5-4 Using Event Inputs*.

Summary of Alarm Operation

The following figure summarizes the operation of alarms when the Alarm Type parameter is set to "lower-limit alarm with standby sequence" and "close in alarm" is set.

Alarm type: Lower-limit alarm with standby sequence



Parameters

Display	Parameter	Description	Level
RLH *	Alarm 1 to 4 Hysteresis	Alarm	Initial Setting Level
RESE	Standby Sequence	Alarm	Advanced Function Setting Level

^{* *= /} to 4

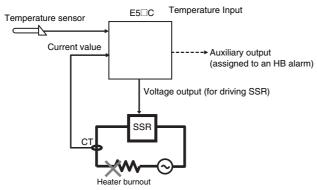
4-12 Using Heater Burnout (HB) and **Heater Short (HS) Alarms (Not Supported for Position-proportional** Models.)

These functions are supported for models that detect heater burnout (HB) and heater short (HS) alarms.

4-12-1 **HB Alarm**

What Is an HB Alarm?

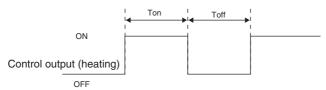
An HB alarm is detected by measuring the heater current with a current transformer (CT) when the control output is ON. If the measured heater current is lower than the setting of the Heater Burnout Detection parameter, an alarm is output.



This alarm cannot be used for the cooling control output. The default setting for the Auxiliary Output 1 Assignment is for heater alarms. Therefore, the alarm 1 function is disabled and the Alarm 1 Type is not displayed. You can use the output assignment parameters to change the alarm output location. For details, refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.) on page 4-16. You can use an integrated alarm to output an OR of alarms 1 to 4 and the other alarms. For details on the integrated alarm, refer to 5-9 OR Output of Alarms.

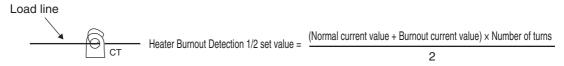
Parameters

Parameter	No. 1 display	Value	No. 2 display	Level
HB ON/OFF	НЬЦ	OFF or ON (default: ON)	ōFF, ōN	Advanced Function
Heater Burnout	HBL	OFF or ON (default: OFF)	ōFF, ōN	Setting Level
Latch				
Heater Burnout	НЬН	0.1 to 50.0 A (default: 0.1 A)	0.1 to 50.0	
Hysteresis				
Heater Burnout	НЬ І	0.0 to 50.0 A (default: 0.0 A)	0.0 to 50.0	Adjustment Level
Detection 1 or 2	HP5			
(alarm current)				
Heater Current 1 or	[0.0 to 55.0 A	0.0 to 55.0	
2 Value Monitor	[F5			
Auxiliary Output 1	5Ub / to 5UbY	HB: HB alarm or HA: Heater	HЬ or HЯ	Advanced Function
to 4 Assignment		alarm		Setting Level



In the above diagram, power is considered to be ON (normal) if the heater current is greater than $Hb\ l$ or $Hb\ l$ (heater burnout detection current) during the Ton interval. The HB alarm will be OFF in this case. If the heater current is less than $Hb\ l$ or $Hb\ l$ (heater burnout detection current) during the Ton interval, the HB alarm will turn ON. Heater burnout is not detected if the ON time (Ton) 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). Heater burnouts are not detected in the following cases.

- Turn ON the heater power supply simultaneously or before turning ON the E5\(\text{C}\) power supply. If the heater power supply is turned ON after turning ON the E5\(\text{C}\) power supply, the HB alarm will be output.
- · Control will be continued even when there is an HB alarm.
- The rated current may sometimes differ slightly from the actual current flowing to the heater. Use
 the Heater Current 1 Value Monitor and Heater Current 2 Value Monitor parameters to check the
 current during actual operation
- If there is little difference between the current in normal and abnormal states, detection may be unstable. To stabilize detection, set a current difference of at least 1.0 A for heaters lower than 10.0 A, and at least 2.5 A for heaters of 10.0 A or higher. If the heater current is too low, loop the load line several times through a CT, as shown in the following diagram. Looping it through once will double the detected current.





Precautions for Correct Use

Due to UL Listing requirements, use the E54-CT1L or E54-CT3L Current Transformer with the factory wiring (internal wiring). Use a UL category XOBA or XOBA7 current transformer that is UL Listed for field wiring (external wiring) and not the factory wiring (internal wiring).

Operating Procedure

Set the HB ON/OFF parameter in the Advanced Function Setting Level, and set the Heater Burnout Detection 1 parameter in the Adjustment Level.

Heater Burnout Detection 1 = 2.5

Operating Procedure

Checking the HB ON/OFF Parameter Setting

1	Press the	Advanced Function Setting Level HB ON/OFF
2	Check to see if the set value is ōN (enabled, default).	HLU āN

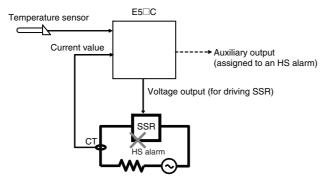
• Checking the Heater Current

1	Press the	Adjustment Level Heater Current 1 Value Monitor
2	Check the heater current from the CT input that is used to detect heater burnout. The monitoring range is 0.0 to 55.0 A.	
• Se	etting Heater Burnout Detection	
1	Press the	Adjustment Level Heater Burnout Detection 1
2	Press the ♠ or ❤ Key to set the set value to 2.5 Refer to 4-12-4 Calculating Detection Current Values when you set the value.	Hb 1 2.5

4-12-2 HS Alarm

• What Is an HS Alarm?

An HS alarm is detected by measuring the heater current with a current transformer (CT) when the control output is OFF. If the measured heater current is higher than the setting of the HS Alarm parameter, an alarm is output.

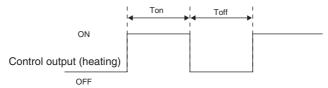


Control output (heating)	Power to heater	HS alarm output
OFF	Yes (HS alarm)	ON
OH	No (normal)	OFF

This alarm cannot be used for the cooling control output. With the default settings, the HS alarm is output on auxiliary output 1. You can use the output assignment parameters to change the output. You can use an integrated alarm to output an OR of alarms 1 to 4 and the other alarms. For details on the integrated alarm, refer to 5-9 OR Output of Alarms.

Parameters

Parameter	No. 1 display	Value	No. 2 display	Level
HS Alarm Use	H5U	OFF or ON	ōFF, ōN	Advanced Function
		(default: ON)		Setting Level
HS Alarm Latch	HSL	OFF or ON	äFF, äN	
		(default: OFF)		
HS Alarm Hysteresis	HSH	0.1 to 50.0 A	0.1 to 50.0	
		(default: 0.1 A)		
HS Alarm 1 or 2 (alarm	H5 I	0.0 to 50.0 A	0.0 to 50.0	Adjustment Level
current)	H52	(default: 50.0 A)		
Leakage Current 1 or	LERI	0.0 to 55.0 A	0.0 to 55.0	
2 Monitor	LER2			
Auxiliary Output 1 to 4	5Ub I to 5Ub4	HS: HS alarm or	HS or HR	Advanced Function
Assignment		HA: Heater alarm		Setting Level



In the above diagram, power is considered to be OFF (normal) if the leakage current is less than H5 f or H52 (heater short detection current) during the Toff interval. The HS alarm will be OFF in this case. If the leakage current is greater than H5 f or H52 (heater short detection current) during the Toff interval, the HS alarm will turn ON. Heater short are not detected if the OFF time (Toff) 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). Heater shorts are not detected in the following cases.

- Control will be continued even when there is an HS alarm.
- The rated current may sometimes differ slightly from the actual current flowing to the heater. Use
 the Leakage Current 1 Value Monitor and Leakage Current 2 Value Monitor parameters to check
 the leakage current during actual operation

Set the HS Alarm Use parameter to ON in the Advanced Function Setting Level and set the HS Alarm 1 parameter in the Adjustment Level. This procedure sets the HS Alarm 1 parameter to 2.5.

Operating Procedure

• Setting the HS Alarm Use Parameter

1	Press the @ Key several times in the Advanced Function Setting Level to display H5년 (HS Alarm Use).	Advanced Function Setting Level HS Alarm Use
2	Check to see if the set value is $\bar{o}N$ (enabled, default).	HSU āN

Setting the Leakage Current Value Monitor

1	Press the Key several times in the Adjustment Level to display LER I (Leakage Current 1 Value Monitor).	Adjustment Level
	play LLN / (Leakage Current i Value Mointor).	L [R] Leakage Current 1 Value Monitor
2	Check the leakage current from the CT input that is used to detect heater short.	LERI
	The monitoring range is 0.0 to 55.0 A.	[

Setting Heater Short Alarm Detection

1	Press the \textcircled{P} Key several times in the Adjustment Level to display $H5\ l$ (HS Alarm 1).	Adjustment Level HS Alarm 1 50.0
2	Press the or Key to set the set value to 2.5 Refer to 4-12-4 Calculating Detection Current Values when you set the value.	H5 1 2.5

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





Precautions for Correct Use

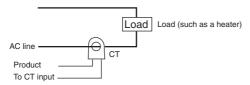
Due to UL Listing requirements, use the E54-CT1L or E54-CT3L Current Transformer with the factory wiring (internal wiring). Use a UL category XOBA or XOBA7 current transformer that is UL Listed for field wiring (external wiring) and not the factory wiring (internal wiring).

4-12-3 Installing Current Transformers (CT)

• CTs can be used for the heater burnout (HB) and heater short (HS) alarms. For the E5CC, connect the CT in advance to terminals 16 and 17 (CT1), or 17 and 18 (CT2). For the E5CC-B, connect the CT in advance to terminals 21 and 22 (CT1). For the E5EC or E5AC, connect the CT in advance to terminals 19 and 20 (CT1) or 20 and 21 (CT2). For the E5EC-B, connect the CT in advance to terminals 25 and 26 (CT1). For the E5DC, E5DC-B or E5GC, connect the CT in advance to terminals 7 and 8 (CT1). Then pass the heater power line through the hole in the CT. For specifications, models, and dimensions of the CTs that can be used with the Digital Controller, refer to A-2 Current Transformer (CT).

(1) Single-phase Heaters

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

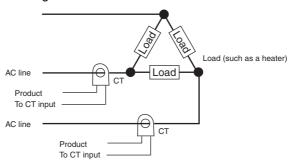


(2) Three-phase Heaters

When a 3-phase power supply is used, regardless of the types of connecting lines, two current transformers (CTs) are required to detect heater burnouts and heater shorts.

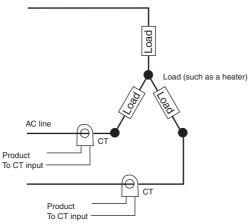
(a) Delta connecting lines: Refer to the following diagram for CT installation positions.

* Heater voltage fluctuations are not considered, so be sure to take that into account when setting the detection current.



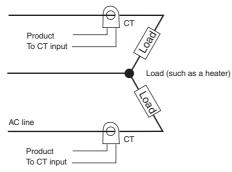
(b) Star connecting lines: Refer to the following diagram for CT installation positions.

* Heater voltage fluctuations are not considered, so be sure to take that into account when setting the detection current.



(c) V connecting lines: Refer to the following diagram for CT installation positions.

* Heater voltage fluctuations are not considered, so be sure to take that into account when setting the detection current.



4-12-4 Calculating Detection Current Values

Calculate the set value using the following equation:

• To set the current for heater burnout when two or more heaters are connected through the CT, use the value from when the heater with the smallest current burns out. If all of the heaters have the same current, use the value from when any one of them burns out.

• Make sure that the following conditions are satisfied:

Heater with a current of less than 10.0 A:

(Normal current value) – (Burnout current value) ≥ 1 A

When the difference is less than 1 A, detection is unstable.

Heater with a current of 10.0 A or more:

(Normal current value) – (Burnout current value) ≥ 2.5 A

When the difference is less than 2.5 A, detection is unstable.

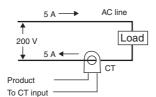
- The setting range is 0.1 to 49.9 A. Heater burnouts and heater shorts are not detected when the set value is 0.0 or 50.0. When the set value is 0.0, the HB alarm is always OFF and the HS alarm is always ON. When the set value is 50.0, the HB alarm is always ON and the HS alarm is always OFF.
- Set the total current value for normal heater operation to 50 A or less. When a current value of 55.0 A is exceeded, FFFF is displayed in the Heater Current 1 (or 2) Value Monitor and Leakage Current 1 (or 2) Monitor parameters.

4-12-5 Application Examples

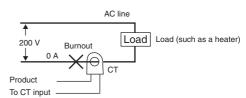
(1) Single-phase Heaters

Example: Using a 200-VAC, 1-kW Heater

Normal



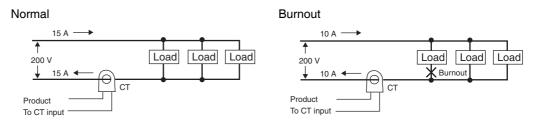
Burnout



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

Heater burnout detection current =
$$\frac{\text{(Normal current)} + \text{(Heater burnout current)}}{2}$$
$$= \frac{5+0}{2} = 2.5 \text{ [A]}$$

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



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

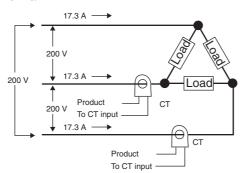
Heater burnout detection current =
$$\frac{\text{(Normal current)} + \text{(Heater burnout current)}}{2}$$
$$= \frac{15 + 10}{2} = 12.5 \text{ [A]}$$

(2) Three-phase Heaters

(a) Delta Connecting Lines

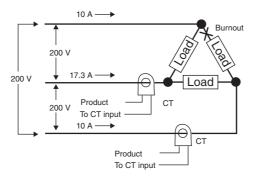
Example: Using Three 200-VAC, 2-kW Heaters

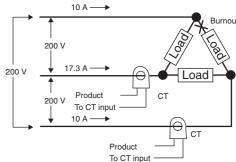
Normal



The current when each phase is normal is 17.3 A ($\approx \sqrt{3} \times 10$ A).

Normal Burnout





Current when there is a burnout = 10 A $\times \sqrt{3} \times (\sqrt{3}/2) = 15$ A

Current when there is a burnout = $10 \text{ A} \times \sqrt{3} \times (1/\sqrt{3}) = 10 \text{ A}$

The heater burnout current when there is a burnout at the load line is as follows: (Heater burnout detection current) = (17.3 + 15) / 2 = 16.15 [A]

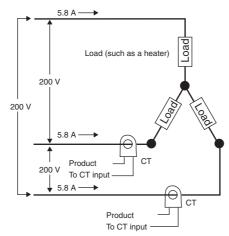
The heater burnout current when there is a burnout at the load is as follows: (Heater burnout detection current) = (17.3 + 10) / 2 = 13.65 [A]

To enable detection in either case, use 16.1 A as the heater burnout detection current.

(b) Star Connecting Lines

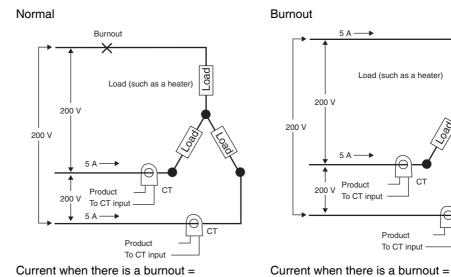
Example: Using Three 200-VAC, 2-kW Heaters





10 A × (1/ $\sqrt{3}$) × ($\sqrt{3}/2$) = 5 A

The current when each phase is normal is 5.8 A (\approx 10 A \times (1 / $\sqrt{3}$)).



The heater burnout detection current for this connecting line is 5.4 A = (5.8 + 5) / 2.

10 A × (1/ $\sqrt{3}$) × ($\sqrt{3}/2$) = 5 A

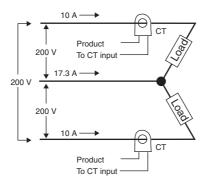
Burnout

СТ

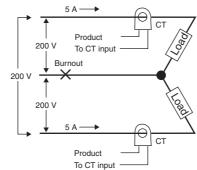
(c) V Connecting Lines

Example: Using Two 200-VAC, 2-kW Heaters

Normal



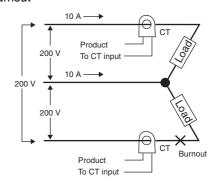
Normal



Current when there is a burnout =

 $10 \text{ A} \times (1/2) = 5 \text{ A}$

Burnout



Current when there is a burnout = 0 A

The heater burnout current when there is a burnout at the common is as follows: Heater burnout detection current = (10 + 5) / 2 = 7.5 [A]

The heater burnout current when there is a burnout at the load is as follows: Heater burnout detection current = (10 + 0) / 2 = 5 [A]

To enable detection in either case, use 7.5 A as the heater burnout detection current.

4-13 Customizing the PV/SP Display

The following table shows the contents of the No. 1, 2, and 3 displays, according to the setting of the PV/SP Display Screen Selection parameter.

PV/SP Display Selections

The following table shows the contents of the No. 1, 2, and 3 displays, according to the setting of the PV/SP Display Screen Selection parameter in the Advanced Function Setting Level.

Set value	No. 1 display	No. 2 display	No. 3 display (E5EC, E5EC-B, and E5AC Only)
0	Nothing is displayed.	Nothing is displayed.	Nothing is displayed.
1	PV	SP	Nothing is displayed.
2	PV	Nothing is displayed.	Nothing is displayed.
3	SP	SP (character display)	Nothing is displayed.
4	PV	SP	MV (Valve opening for Position-proportional Models)
5	PV	SP	Multi-SP No.
6	PV	SP	Soak Time Remain 000
7	PV	SP	Internal Set Point (ramp SP)
8	PV	SP	Alarm Value 1*

The set value of the Alarm Value 1 parameter is displayed even if it is not valid due to the setting of the Alarm 1 Type parameter.

	Monitoring range	Unit	
PV	Temperature input: The specified range for the specified sensor.	EU	
	Analog input: Scaling lower limit –5%FS to Scaling upper limit +5%FS		

	Setting (monitoring) range	Unit
SP	SP lower limit to SP upper limit	EU

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

PV/SP Display Selections

Code	Parameter	Default	Level
SPd I	PV/SP No. 1 Display Selection	4*	Advanced Function Setting
SP42	PV/SP No. 2 Display Selection	0	Level

The default is 1 for models other than the E5 \square C- \square -0 \square .

MV Displays for Heating and Cooling Control (Not Supported for Position-proportional Models.)

Select either the manipulated variable for heating or the manipulated variable for cooling as the MV to be displayed for PV/SP/MV during heating and cooling control. The MV Display Selection parameter is displayed only when heating/cooling control is being performed and PV/SP/MV is selected in the PV/SP Display Screen parameter or a Monitor/Setting Item Display parameter.

Code	Parameter	Set value	Displayed value	Level
ōdSL	MV Display Selection	ō	MV (heating)	Advanced Function
		[-ō	MV (cooling)	Setting Level

Advanced Operations

5-1	Shifting Input Values 5-3				
5-2	Setting	g Scaling Upper and Lower Limits for Analog Inputs	5-5		
5-3		ting Heating/Cooling Control upported for Position-proportional Models.)			
5-4	Using 5-4-1 5-4-2 5-4-3	Event Inputs Event Input Settings How to Use the Multi-SP Function Operation Commands Other than Multi-SP	5-11 5-11		
5-5	Setting 5-5-1 5-5-2	Set Point Limiter	5-15		
5-6	Using 5-6-1	the SP Ramp Function to Limit the SP Change Rate			
5-7	Using 5-7-1 5-7-2	the Key Protect Level	5-19		
5-8	Displa 5-8-1	ying Only Parameters That Have Been Changed			
5-9	OR O u 5-9-1	Itput of Alarms			
5-10		Delays Alarm Delays			
5-11	(Not S	Burnout Alarm upported for Position-proportional Models.)			
5-12		ming Manual Control			
5-13	or othe 5-13-1	the Transfer Output for the Process Value, Set Point, er Data Transfer Output Function Simple Transfer Output Function	5-36		

	5-14-1 5-14-2	the Simple Program Function	5-42 5-45
5-15	Output 5-15-1 5-15-2	t Adjustment Functions	5-48 5-48 5-48
		the Extraction of Square Root Parameter5 Extraction of Square Roots	
		g the Width of MV Variation	
		p the PF Key	
		ying PV/SV Status5 PV and SV Status Display Functions	
5-20	Using a	a Remote SP	5-60
5-21	Contro	olling Valves (Can Be Used with a Position-proportional Model) 5	5-62
	5-22-1 5-22-2	Operations 5 The Logic Operation Function (CX-Thermo) 5 Using Logic Operations 5 Using Status Display Messages 6	5-65 5-65
5-23	Initializ	zing Settings	5-75

Shifting Input Values

Shifting Inputs

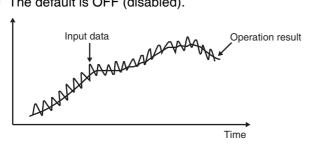
You can set the Process Value Slope Coefficient and Process Value Input Shift parameters to compensate the PV.

Parameter	Setting range	Unit	Default
Process Value Input Shift	Temperature input: -199.9 to 999.9	°C or °F	0.0
Frocess value input Shift	Analog input: -1,999 to 9,999	EU	0
Process Value Slope Coefficient 000	0.001 to 9.999	None	1.000

 Calculating the Process Value Slope Coefficient and Process Value Input Shift In the following equation, PVi is the input to the calculation, PVo is the result, INRT is the process value slope coefficient, and INS is the process value input shift: PVo = (PVi × INRT) + INS

Moving Average

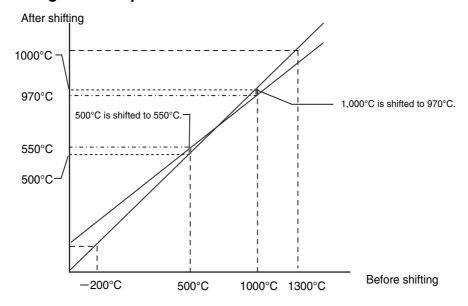
- The moving average operation reduces sudden changes in the input due to noise and other factors, and can be enabled separately for each input.
- The Moving Average Count parameter is used for the moving average. It can be set to OFF, 2, 4, 8, 16, or 32.
- The default is OFF (disabled).



Parameter	Setting range	Unit	Default
Moving Average Count	OFF, 2, 4, 8, 16, or 32	Times	OFF*

The default is 8 for models other than the E5\(\times C-\C\)-0\(\times \).

Using the PV Input Shift



(1) Find the two points to shift and determine the PVs after the shifts are applied.

Example: Shift 500°C (temperature before shifting) to 550°C (temperature after shifting). Example: Shift 1,000°C (temperature before shifting) to 970°C (temperature after shifting).

(2) Find the process value slope coefficient from the above results.

$$(970 - 550) / (1,000 - 500) = 0.840$$

* Do not yet set the Process Value Slope Coefficient parameter in the Digital Controller.

(3) Adjust the PV display on the Digital Controller to the point to be shifted.

Example: Adjust the PV to 500°C.

(4) Set the Process Value Slope Coefficient parameter to the value that you found in step

Example: Set the Process Value Slope Coefficient parameter to 0.840.

(5) Read off the PV after the setting is changed.

Example: The PV will be displayed as 420°C.

(6) Find the difference between the anticipated PV (i.e., the PV after shifting) and the PV that you read off in step 5.

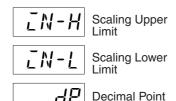
Example: $550^{\circ}C - 420^{\circ}C = 130^{\circ}C$

(7) Set the Process Value Input Shift parameter to the value that you found in step 6.

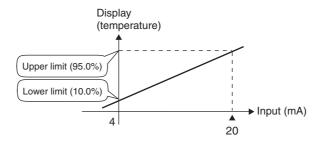
Example: Set the Process Value Input Shift parameter to 130°C.

5-2 Setting Scaling Upper and Lower Limits for Analog Inputs

Analog Input



- When an analog input is selected, scaling can be performed as needed by the control application.
- Scaling is set in the Scaling Upper Limit, Scaling Lower Limit, and Decimal Point parameters (Initial Setting Level). These parameters cannot be used when a temperature input is selected.
- The Scaling Upper Limit parameter sets the physical quantity to be expressed
 by the upper limit value of input, and the Scaling Lower Limit parameter sets
 the physical quantity to be expressed by the lower-limit value of input. The
 Decimal Point parameter specifies the number of digits below the decimal
 point.
- The following figure shows a scaling example for a 4 to 20 mA input.
 After scaling, the temperature can be directly read. Here, one place below the decimal point is set.



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

Operating Procedure

· Setting the Input Type

	<u> </u>			
1	Move to the Initial Setting Level. IN-L (Input Type) will be dis-	Initial Setting Level		
	played.	Input Type		
		5		
2	Press the ♠ or ❤ Key to set the value to 25.	<u>- , , , , , , , , , , , , , , , , , , ,</u>		
	The default is 5.	LN-E		
		25		
• Se	etting the Scaling Upper Limit			
1	Press the Key several times in the Initial Setting Level to	Initial Setting Level		
	display ∠N-H (Scaling Upper Limit).	Scaling Upper		
2	Press the ♠ or ❤ Key to set the value to 950. The default is 100.	ĨN-H 950		

• Setting the Scaling Lower Limit

1	Press the Key several times in the Initial Setting Level to display N-L (Scaling Lower Limit).	Initial Setting Level
	uisplay EN E (Scaling Lower Limit).	L N - L Scaling Lower Limit
2	Press the ♠ or ❤ Key to set the value to 100.	— h
	The default is 0.	<u> N-L</u>
		100
• Se	etting the Decimal Point	
1	Press the Key several times in the Initial Setting Level to	Initial Setting Level
	display dP (Decimal Point).	Decimal Point
2	Press the ♠ or ❤ Key to set the value to 1.	15
	The default is 0.	dř

5-3 Executing Heating/Cooling Control (Not Supported for Position-proportional Models.)

5-3-1 Heating/Cooling Control

Heating/cooling control can be used with control output 2 and auxiliary outputs 1 to 4. Heating/cooling control operates when H- Γ (heating/cooling) is selected for the Standard or Heating/Cooling parameter. The following functions are assigned to outputs in the default status.

Parameter name	Display	Initial status
Control Output 1 Assignment	ōUŁ I	Control output for heating
Control Output 2 Assignment (E5CC, E5EC, and E5AC only)	ōUE2	Not assigned.
Auxiliary Output 1 Assignment	5Ub 1	Alarm 1*1
Auxiliary Output 2 Assignment	5062	Alarm 2
Auxiliary Output 3 Assignment (E5CC, E5EC, E5EC-B, and E5AC Only)	5063	Alarm 3
Auxiliary Output 4 Assignment (E5EC, E5EC-B, and E5AC Only)	5064	Alarm 4

Each output assignment is automatically initialized as shown below when changing between standard and heating/cooling control.

Assigned Output Functions

Digital Controllers with Three or Fewer Auxiliary Outputs

Parameter name	Display	Without control output 2		With control output 2	
rarameter name Display		Standard	Heating/cooling	Standard	Heating/cooling
Control Output 1 Assignment	āUE I	Control output (heating)	Control output (heating)	Control output (heating)	Control output (heating)
Control Output 2 Assignment	āUE2			Not assigned.	Control output (cooing)
Auxiliary Output 1 Assignment	SU6 1	Alarm 1 ^{*1}	Alarm 1 ^{*1}	Alarm 1 ^{*1}	Alarm 1*1
Auxiliary Output 2 Assignment	SU62	Alarm 2	Control output (cooing)*2	Alarm 2	Alarm 2
Auxiliary Output 3 Assignment	5063	Alarm 3	Alarm 3	Alarm 3	Alarm 3

Digital Controllers with Four Auxiliary Outputs

Parameter name	Display	Without control output 2		With control output 2	
Parameter mame		Standard	Heating/cooling	Standard	Heating/cooling
Control Output 1 Assignment	āUE I	Control output (heating)	Control output (heating)	Control output (heating)	Control output (heating)
Control Output 2 Assignment	āUE2			Not assigned.	Control output (cooing)

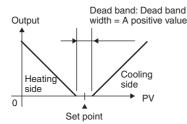
Parameter name	Display	Without control output 2		With control output 2	
rarameter name	Display	Standard	Heating/cooling	Standard	Heating/cooling
Auxiliary Output 1 Assignment	SUb I	Alarm 1 ^{*1}	Alarm 1 ^{*1}	Alarm 1 ^{*1}	Alarm 1 ^{*1}
Auxiliary Output 2 Assignment	SU62	Alarm 2	Alarm 2	Alarm 2	Alarm 2
Auxiliary Output 3 Assignment	SU63	Alarm 3	Alarm 3	Alarm 3	Alarm 3
Auxiliary Output 4 Assignment	SUBY	Alarm 4	Control output (cooing)	Alarm 4	Alarm 4

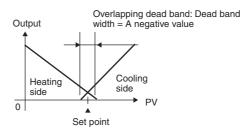
^{*1} If the Digital Controller is equipped with HB/HS alarm detection, it is set by default to HB (Heater Alarm). If the Program Pattern parameter is changed to a setting other than OFF, the Auxiliary Output 1 Assignment parameter is set as the program end output.

- *2 When heating/cooling control is used on the E5GC, auxiliary output 1 is the control output for cooling.
- The heating/cooling operation of the control outputs will switch when the Direct/Reverse Operation parameter is set to direct operation.
- When DRS (Invert Direct/Reverse Operation) is set for an Event Input Assignment 1 to 6 parameter, control will start with the opposite of the setting of the Direct/Reverse Operation parameter when the event input turns ON. When the event input turns OFF, control will return to operation according to the setting of the Direct/Reverse Operation parameter. For details on event inputs and control combined with the Direct/Reverse Operation parameter, refer to Control by Inverting Direct/Reverse Operation on page 5-13.
- If heating/cooling control is selected, also set the Dead Band, Proportional Band (Cooling), Integral Time (Cooling), Derivative Time (Cooling), and Heating/Cooling Tuning Method parameters.

Dead Band

- For heating/cooling control, the dead band is set with the set point as its center. The dead band width is the set value of the Dead Band parameter (Adjustment Level). Setting a negative value produces an overlapping band.
- If an overlapping band is set, the bumpless function may not operate when switching between manual operation and automatic operation.
- The default is 0.0 EU for Digital Controllers with Temperature Inputs and 0.00% FS for Digital Controllers with Analog Inputs.





Heating/Cooling PID Control

If heating/cooling PID control is used, you can set PID control separately for heating and cooling. The PID constants for both heating and cooling can be automatically set according to the cooling control characteristics by setting the Heating/Cooling Tuning Method parameter and then performing autotuning (AT).

Parameter	Setting range	Default	Level	
Heating/Cooling Tuning Method	0: Same as heating control			
	1: Linear	0	Advanced Function	
	2: Air cooling		Setting Level	
	3: Water cooling			

Parameter	Setting r	Setting range		Default	Level
Proportional Band	Temperature input	0.1 to 999.9	°C or °F	8.0	
(Cooling)	Analog input	0.1 10 999.9	%FS	10.0	
Integral Time (Cooling)*	Integral/Derivative Time Unit of 1 s	0 to 9999	Seconds	233	
	Integral/Derivative Time Unit of 0.1 s	0.0 to 999.9	Seconds	233.0	Adjustment Level
Derivative Time	Integral/Derivative Time Unit of 1 s	0 to 9999	Seconds	40	
(Cooling)*	Integral/Derivative Time Unit of 0.1 s	0.0 to 999.9	Seconds	40.0	

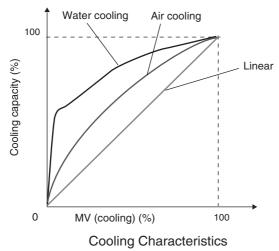
The unit is determined by the setting of the Integral/Derivative Time Unit parameter. The Proportional Band (Cooling), Integral Time (Cooling), and Derivative Time (Cooling) parameters are initialized if the Integral/Derivative Time Unit parameter is changed.

Air Cooling/Water Cooling Tuning

Control that is suitable for an application that does not have linear cooling characteristics (such as plastic molding machines) is performed. The response is fast and the response characteristics are stable.

Linear Tuning

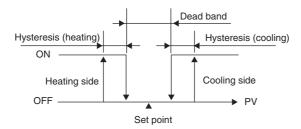
Control that is suitable for an application that has linear cooling characteristics is performed.



• Three-position Control

- Set the PID ON/OFF parameter to $\bar{a}N\bar{a}F$ and set the Standard or Heating/Cooling Parameter to H- Γ to perform three-position control.
- A dead band (an area where the MV is 0) can be set for either heating or cooling control.

Reverse operation



5-4 Using Event Inputs

5-4-1 Event Input Settings

Events can be used on models that have event inputs.

The number of event inputs that is supported depends on the model of the Digital Controller.

E5EC/E5EC-B/E5AC: Up to 6 event inputs

E5CC: Up to 4 event inputs

E5GC/E5CC-B: Up to 2 event inputs

E5DC: Up to 1 event input

- * The E5DC-B does not have models with event inputs.
- Event inputs can be used for switching between RUN and STOP, switching between automatic and manual operation, starting/resetting the program, inverting direct/reverse operation, switching the SP mode, executing/canceling 100% AT, executing/canceling 40% AT, enabling/disabling setting changes, enabling/disabling communications write, canceling the alarm latch, and switching the multi-SP number.

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

The multi-SP function allows you to set up to eight set points (SP 0 to 7) in the Adjustment Level. The set point can be switched by operating the keys on the front panel or by using external input signals (event inputs).

Using Event Inputs

The following table shows the relationships between the ON/OFF status of multi-SP number switching bits 0 to 2 and the set point.

Selected set point	Multi-SP No. switching bits			
Selected Set point	Bit 0	Bit 1	Bit 2	
SP 0	OFF	OFF	OFF	
SP 1	ON	OFF	OFF	
SP 2	OFF	ON	OFF	
SP 3	ON	ON	OFF	
SP 4	OFF	OFF	ON	
SP 5	ON	OFF	ON	
SP 6	OFF	ON	ON	
SP 7	ON	ON	ON	

Note: Any bits that are not assigned to event inputs are treated as being OFF.

Using Key Operations

You can select any of the set points 0 to 7 by changing the set value of the Multi-SP Uses parameter. The Multi-SP Uses parameter display conditions are as follows:

- Digital Controllers without event inputs for which the Number of Multi-SP Points parameter is not set to OFF
- Digital Controllers with event inputs for which the Number of Multi-SP Points parameter is not set to OFF and the Event Input Assignment 1 to 6 parameters are not set to Multi-SP switching bits 0 to 2

The following table shows the relationship between the Multi-SP Uses parameter set value and the selected set point

Multi-SP	Selected set point
0	SP 0
1	SP 1
2	SP 2
3	SP 3
4	SP 4
5	SP 5
6	SP 6
7	SP 7

Note: The set point can also be switched using communications.

5-4-3 **Operation Commands Other than Multi-SP**

The following table shows the functions that can be assigned when an Event Input Assignment 1 or 6 parameter is displayed.

Setting	Function
NāNE	None
SEäP	RUN/STOP ^{*5}
MANU	Auto/Manual ^{*5}
PRSE	Program Start*1
dR5	Invert Direct/Reverse Operation
PSP	SP mode switch ^{*2}
AF-5	100% AT Execute/Cancel*5
AF-1	40% AT Execute/Cancel*3*5
WEPE	Setting Change Enable/Disable
ЕМИЕ	Communications Write Enable/Disable*4
LAE	Alarm Latch Cancel ^{*5}
MSPO	Multi-SP No. switching bit 0
MSP I	Multi-SP No. switching bit 1
MSP2	Multi-SP No. switching bit 2

PRST (Program Start) can be set even when the Program Pattern parameter is set to OFF, but the function will be disabled.

Turn event inputs ON and OFF while the power is being supplied. Event input ON/OFF changes are detected for inputs of 50 ms or longer.

The functions are described in detail below.

Executing Run/Stop Control

When the Event Input Assignment parameter is set to STOP (RUN/STOP), control is started when event input turns OFF. Control is stopped when the input turns ON. Alarm outputs, however, will be according to the process value.

The STOP indicator will light while control is stopped.

^{*2} This function can be set only for a Digital Controller that supports a remote SP input.

^{*3} This function can be set for heating/cooling control or for floating control for Position-proportional Models, but the setting will be disabled.

This function can be set only for a Digital Controller that supports communications. Also, when a work bit is selected as the event input data, Communications Write Enable/Disable cannot be assigned.

^{*5} If the same function is assigned to PF Key, it will be disabled for the PF Key and only the event input can be used to execute the function.

Setting	Input contact	Status
Event input	ON	STOP
Event input	OFF	RUN

Switching between Auto and Manual Control

When the Event Input Assignment parameter is set to MANU (auto/manual), manual control will start when event input turns ON. Auto control will start when the input turns OFF.

The MANU indicator will light during manual control.

Setting	Input contact	Status
Event input	OFF	Automatic
Event input	ON	Manual

Controlling the Start of the Simple Program Function 000

When the Event Input Assignment parameter is set to PRST (program start), the program will start when the event input turns ON. The program will be reset when the input turns OFF and the RUN/STOP status will automatically switch to STOP mode. If the program END output is ON, the program END output will turn OFF.

Setting	Input contact	Status
Event input	OFF	Reset
Event input	ON	Start

Control by Inverting Direct/Reverse Operation

When the Event Input Assignment parameter is set to DRS (Invert Direct/Reverse Operation) and the Direct/Reverse Operation parameter is set for reverse operation, control starts with direct operation (cooling control) when the event input turns ON and control starts with reverse operation (heating control) when the event input turns OFF.

Setting	Input contact	Direct/Reverse Operation parameter	Status
Event input	OFF	Direct operation (cooling)	Direct operation (cooling)
		Reverse operation	Reverse operation
		(heating)	(heating)
Event input	ON	Direct eneration (scaling)	Reverse operation
		Direct operation (cooling)	(heating)
		Reverse operation (heating)	Direct operation (cooling)

Switching the SP Mode

When the Event Input Assignment parameter is set to RSP (SP mode switch), operation with a remote SP will start when the event input turns ON. Operation with a local SP will start when the event input turns OFF. The RSP operation indicator will light during Remote SP Mode.

Setting	Input contact	Status
Event input	OFF	Local SP
Event input	ON	Remote SP

Switching 100% AT Execute/Cancel

When the Event Input Assignment parameter is set to AT-2 (100% AT Execute/Cancel), 100% AT will be executed when the event input turns ON and will be cancelled when the input turns OFF.

Setting	Input contact	Status
Event input	OFF	100% AT cancelled

Setting	Input contact	Status
Event input	ON	100% AT executed

Switching 40% AT Execute/Cancel

When the Event Input Assignment parameter is set to AT-1 (40% AT Execute/Cancel), 40% AT will be executed when the event input turns ON and will be cancelled when the input turns OFF.

Setting	Input contact	Status
Event input	OFF	40% AT cancelled
Event input	ON	40% AT executed

Switching Setting Change Enable/Disable

When the Event Input Assignment parameter is set to WTPT (Setting Change Enable/Disable), the setting change will be disabled when the event input turns ON and will be enabled when the input turns OFF.

Setting	Input contact	Status
Event input	OFF	Enabled
Event input	ON	Disabled

Switching Communications Write Enable/Disable

When the Event Input Assignment parameter is set to CMWT (Setting Change Enable/Disable), writing with communications will be enabled when the event input turns ON and writing with communications will be disabled when the event input turns OFF.

Setting	Input contact	Status
Event input	OFF	Disabled
Event input	ON	Enabled

Switching Alarm Latch Cancel

When the Event Input Assignment parameter is set to LAT (Alarm Latch Cancel), all alarm latches (alarms 1 to 4, heater burnout, HS alarm, latch) will be cancelled when event input turns ON.

Setting	Input contact	Status
Event input	OFF	
Event input	ON	Cancelled

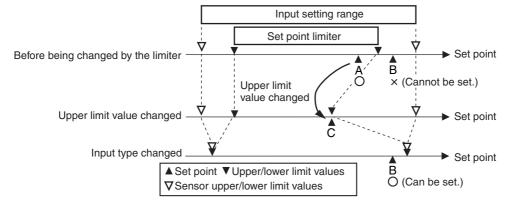
Parameters

Display	Parameter	Description	Level
EV - 1	Event Input Assignment 1		Initial Setting Level
EV - 2	Event Input Assignment 2	Event Input Assignment 2	
EV - 3	Event Input Assignment 3		Initial Setting Level
El - 4	Event Input Assignment 4	Function of event input	Initial Setting Level
EV-5	Event Input Assignment 5	T unotion of event input	Initial Setting Level
EV - 5	Event Input Assignment 6		Initial Setting Level
M5PU	Number of Multi-SP Points		Advanced Function Setting Level

5-5 Setting the SP Upper and Lower Limit Values

5-5-1 Set Point Limiter

The setting range of the set point is limited by the set point limiter. This function can be used to prevent setting incorrect set points. The upper- and lower-limit values of the set point limiter are set using the Set Point Upper Limit and Set Point Lower Limit parameters in the Initial Setting Level. If the set point is not within the range set for the set point limiter as the result of changes to the Set Point Upper Limit or Set Point Lower Limit parameter, the set point will automatically be changed to a value within the set range. When the set point limiter is reset, the set point is forcibly changed to the upper- or lower-limit value of the set point limiter if the set point is out of the limiter range. Also, when the input type and the temperature unit, scaling upper-limit value, or lower-limit value are changed, the set point limiter is forcibly reset to the input setting range or the scaling upper- or lower-limit value.

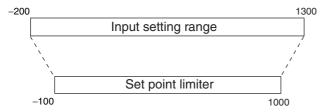


Parameters

Parameters	Parameter	Description	Level
SL-H	Set Point Upper Limit	To limit the SP setting	Initial Setting Level
5L -L	Set Point Lower Limit	To limit the SP setting	Initial Setting Level

5-5-2 **Setting**

Set the set point upper and lower limits in the Set Point Upper Limit and Set Point Lower Limit parameters in the Initial Setting Level. In this example, it is assumed that the input type is set to a K thermocouple with a temperature range of -200 to 1300°C.



Set the upper and lower limits for the set point.

Set Point Upper Limit = 1000

Set Point Lower Limit = -100

Operating Procedure

Setting the Set Point Upper Limit

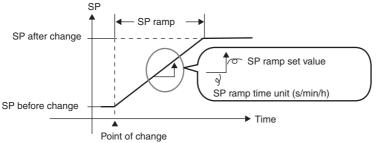
• 56	etting the Set Point Upper Limit	
1	Press the	Initial Setting Level Set Point Upper-limit
2	Press the ♠ or ❤ Key to set the value to 1000. The default is 1300.	5L - H
• Se	etting the Set Point Lower Limit	
1	Press the Key several times in the Initial Setting Level to display 5L -L (Set Point Lower Limit).	Initial Setting Level 51 - 1 Set Point Lower Limit
2	Press the ♠ or ❤ Key to set the value to -100. The default is -200.	5L - L - 100

5-6 Using the SP Ramp Function to Limit the SP Change Rate

5-6-1 SP Ramp

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

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



The rate of change during an SP ramp is specified using the SP Ramp Set Value, SP Ramp Fall Value, and SP Ramp Time Unit parameters. The SP Ramp Set Value parameter is set to OFF by default and the SP Ramp Fall Value parameter is set to SAME by default, i.e., the SP ramp function is disabled. Changes in the ramp set point can be monitored in the Set Point During SP Ramp parameter (Operation Level). Use this parameter when monitoring SP ramp operation.

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

Parameters

Display	Parameter	Description	Level
SPRE	SP Ramp Set Value	To limit the SP rate of change	Adjustment Level
5 <i>PRL</i> 000	SP Ramp Fall Value	To limit the SP rate of change	Adjustment Level
SPRU	SP Ramp Time Unit	Unit for setting the SP	Advanced Function Setting Level
RLSP 000	Alarm SP Selection	Alarm SP selection	Advanced Function Setting Level

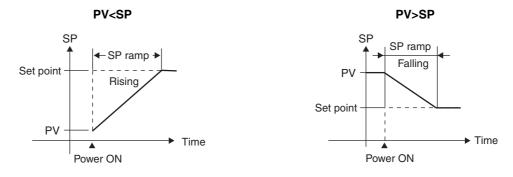


Precautions for Correct Use

To use the SP ramp function, the ST (self-tuning) parameter must be set to OFF (default: ON). If the ST parameter is set to ON, the settings for the SP ramp function will not be displayed.

Operation at Startup

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

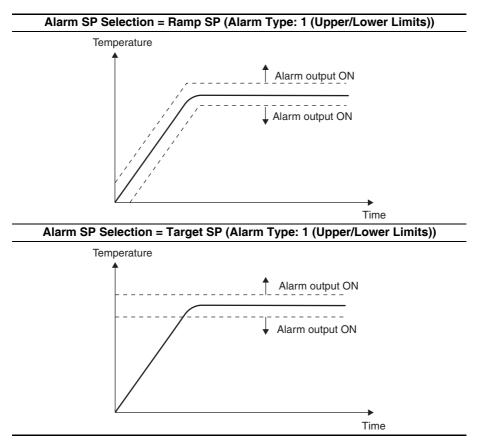


Restrictions during SP Ramp Operation

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

Alarms during SP Ramp Operation 000

The operation of alarms during SP ramp operation depends on whether alarms are set to be based on the ramp set point or the target set point (refer to the following diagrams). The set point to be used is set in the Alarm SP Selection parameter.



5-7 Using the Key Protect Level

5-7-1 Protection

- To move to the Protect Level, press the and Keys simultaneously for at least three seconds in Operation Level or Adjustment Level.*
 - * The key pressing time can be changed in the Move to Protect Level Time parameter (Advanced Function Setting Level).
- The Protect Level protects parameters that are not changed during Digital Controller operation until operation is started to prevent them from being modified unintentionally.
 - There are four types of protection: operation/adjustment protect, initial setting/communications protect, setting change protect, and PF Key protect.
- The protect level settings restrict the range of parameters that can be used.

Operation/Adjustment Protect

Displaying and changing settings in Operation Level and moving to Adjustment Level are restricted. The following table shows the relationship between set values and the range of protection.



Lev	rol .	Set value			
Lev	CI	0	1	2	3
	PV	Can be dis- played	Can be dis- played	Can be dis- played	Can be dis- played
Operation	PV/SP	Can be dis- played and changed	Can be dis- played and changed	Can be dis- played and changed	Can be dis- played
Level	Others	Can be dis- played and changed	Can be dis- played and changed	Cannot be dis- played and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible
Adjustmen	t Level	Can be dis- played and changed	Cannot be displayed and moving to other levels is not possible	Cannot be dis- played and moving to other levels is not possible	Cannot be displayed and moving to other levels is not possible

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

Initial Setting/Communications Protect

This protect level restricts movement to the Initial Setting Level, Communications Setting Level, and Advanced Function Setting Level.

L	P	Ŀ
		1

Set value	Initial Setting Level	Communications Setting Level	Advanced Function Setting Level
0	Possible to reach	Possible to reach	Possible to reach
1	Possible to reach	Possible to reach	Not possible to reach
2	Not possible to reach	Not possible to reach	Not possible to reach

[•] The default is 1.

Application Example: To enable setting only the SP, set both the Operation/Adjustment Protect parameter and the Initial Setting/Communications Protect parameter to 2.

Setting Change Protect

This protect level restricts key operations



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

- · The default is OFF.
- The setting change protection indicator (O_{TT}) will light when the Setting Change Protect parameter is set to ON.

PF Key Protect

This protect level enables or disables PF Key operations.



Set value	Description
OFF	PF Key enabled.
ON	PF Key disabled (Operation as function key prohibited).

· The default is OFF.

Entering the Password to Move to the Protect Level 000 5-7-2

 The Protect Level can be moved to only by displaying the password display and entering the correct password. (The user can set any password in the Password to Move to Protect Level parameter.) If no password is set (i.e., if the password is set to 0 in the Password to Move to Protect Level parameter), the password input display to move to the Protect Level will not be displayed and the Protect Level can be moved to directly.

Move to the Protect Level and set the password.

Example password: 1234

Operating Procedure

Password Not Yet Set

1	Press the and Keys simultaneously for at least 3 seconds (default) in the Operation Level.*1 If a password is not set, the Protect Level will be entered and ARPL (Operation/Adjustment Protect) will be displayed.	Protect Level Operation/ Adjustment Protect
2	Press the Key several times in the Protect Level to display PRLP (Password to Move to Protect Level).	Password to Move to Protect Level
3	Press the and Keys simultaneously and set the value to 1234. (This enters the password.) To prevent setting the password incorrectly, the and Keys or and Keys must be pressed simultaneously to set the password.	PRL P 1234

The key pressing time can be changed in PRLE (Move to Protect Level Time) in the Advanced Function Setting Level. (Setting range: 1 to 30 seconds, Default: 3 seconds)

Protect Lovel

Password Already Set

• Deleting the Password (Password Deletion Example: 5678)

7	Press the and Keys simultaneously for at least 3 seconds (default) in the Operation Level.*1 PMak (Move to Protect Level) will be displayed.	Move to Protect Level
2	Press the ♠ or ❤ Key to set the password to 5678. (This enters the password.)	PMal/ 5678
3	Move to the Operation/Adjustment Protect parameter in the Protect Level by pressing the or Key or leaving the setting for at least two seconds. (This deletes the password.)	Operation/Adjustment Protect
• S	etting the Password Again (Password Example: 1234)	
1	Set the password to 1234 again. Press the Key several times in the Protect Level to display PRLP (Password to Move to Protect Level).	PRLP Password to Move to Protect Level
2	Press the and Keys simultaneously and set the value to 1234. (This enters the password.) To prevent setting the password incorrectly, the and Keys or	<i>PRLP</i> 1234

The key pressing time can be changed in PRLE (Move to Protect Level Time) in the Advanced Function Setting Level. (Setting range: 1 to 30 seconds, Default: 3 seconds)



Precautions for Correct Use

Protection cannot be cleared or changed without the password. Be careful not to forget it. If you forget the password, contact your OMRON sales representative.

Communications Operation Command to Move to the Protect Level

The Write Variable operation command can be used via communications to write the password to
the Move to Protect Level parameter. When the correct password is written, the display will
change to the Operation/Adjustment Protect parameter and writing the parameters in the Protect
Level will be enabled.

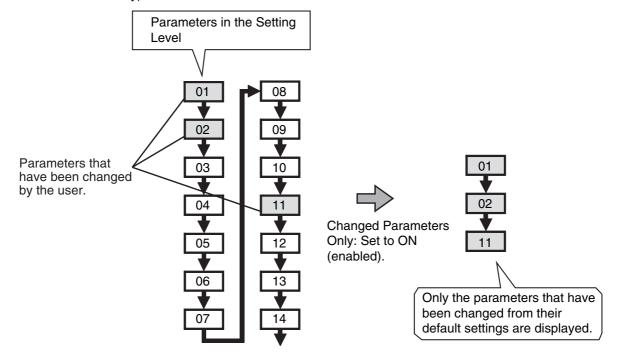
Note 1: If the Write Variable operation command is used to write the wrong password to the Move to Protect Level parameter after the correct parameter has been written, the Move to Protect Level parameter will be displayed and any Write Variable operation commands to write parameters in the Protect Level will result in operation errors.

2: If a password is not set or if it is set to 0, the display will change to the Operation/Adjustment Protect parameter and writing the parameters in the Protect Level will be enabled immediately.

Displaying Only Parameters That 5-8 Have Been Changed

5-8-1 **Displaying Changed Parameters**

You can display only the parameters that have been changed from their default settings. Parameters that have not been changed will not be displayed. This allows you to easily see which parameters have been changed so that you can check for parameters that still need to be changed or for errors in the settings. This is particularly effective in the Initial Setting Level and Advanced Function Setting Level, where there are many parameters. This can also be used to protect the settings by not displaying unnecessary parameters after the required parameters have been changed. Change [HIP] (Changed Parameters Only) in the Protect Level to ON.



Display	Parameter	Value	Level
СНБР		OFF (disabled) or ON (enabled) (default: OFF)	Protect Level



Precautions for Correct Use

- Set this parameter to ON only after making the required settings.
- The following parameters are displayed regardless of the setting of the Changed Parameters Only parameter.
 - Monitor parameters (including the PV, parameters with "monitor" in the parameter name and the Set Point During SP Ramp parameter)
 - Parameters that switch operation (RUN/STOP, Auto/Manual Switch, Multi-SP, Program Start, AT Execute/Cancel, Communications Writing, SP Mode, Parameter Initialization, Copy, and Motor Calibration).
 - Level displays and parameters to move to other levels (such as Adjustment Level Display, Move to Advanced Function Setting Level, and Move to Calibration Level)
 - Manual M\/
- Any parameters that are automatically initialized when another parameter is changed are considered to be at their default settings.

Example: If the Input Type parameter is changed to 7, 850 is considered to be the default setting of the Set Point Upper Limit parameter. Refer to *A-6-9 Initialization According to Parameter Changes* for the parameters that are automatically initialized.

- If the setting of a parameter is changed back to its default setting, it will no longer be displayed. To display it again, set the Changed Parameters Only parameter to OFF.
- If a parameter is not displayed even when the Changed Parameters Only parameter is set to OFF, check the conditions for the parameter.
- Use parameter masks to select the parameters to display without considering whether they are set to their default settings. The CX-Thermo is required to set parameter masks.

Operating Procedure

1	Press the Key several times in the Protect Level to display EHLP (Changed Parameters Only).	Protect Level Changed Parameters Only
2	Press the or Vec Key to set the value to N. Press the + Pec Keys for at least 1 s to return to the Operation Level. Only the parameters that have been changed from their default settings will be displayed.	EHGP āN

OR Output of Alarms 5-9

Integrated Alarm 5-9-1

You can use an integrated alarm to output an OR of alarms 1 to 4, the HB alarm, the HS alarm, the input error, and the RSP input error. Set the Integrated Alarm Assignment parameter (RLMR) and then assign the integrated alarm ($\mathcal{H}LM$) to an auxiliary output or a control output.

Parameters

Parameter	No. 1 display	Value	No. 2 display	Level
Assignment Auxiliary Output 1 to 4 Alarm Assignment Sub 1 to Alarm Assignment ALM: Integration Alarm Assignment		ALM: Integrated alarm (The Integrated Alarm Assignment parameter must be set separately.)	ALM	Advanced Function Setting Level
		ALM: Integrated alarm (The Integrated Alarm Assignment parameter must be set separately.)	ALM	Advanced Function Setting Level
Set the sum of the follon the alarms and errors to OR output. 0 to 255 Alarm 1: +1 Alarm 2: +2 Alarm 3: +4 Alarm 4: +8 Assignment Alarm 4: +8 HB alarm: +16 HS alarm: +32 Input error: +64 RSP input error: +128 (Default: 49 (i.e., an OF		Alarm 1: +1 Alarm 2: +2 Alarm 3: +4 Alarm 4: +8 HB alarm: +16 HS alarm: +32 Input error: +64	0 to 255	Advanced Function Setting Level

Operating Procedure

The following procedure outputs an OR of the following alarms on auxiliary output 2.

- Alarm 1
- HB alarm (Hb)

The settings are made in the Advanced Function Setting Level.

Operating Procedure

• Assigning the Integrated Alarm to an Auxiliary Output

1	Press the [⊕] Key several times in the Advanced Function Setting Level to display 5Ub2 (Auxiliary Output 2 Assignment).	Advanced Function Setting Level Auxiliary Output 2 Assignment
2	Press the ♠ or ❤ Key to select RLM (Integrated Alarm). The default is RLM2 (Alarm 2).	5U62 ALM
• Se	etting the Integrated Alarm Assignment Parameter	
1	Press the ⁽²⁾ Key several times in the Advanced Function Setting Level to display <i>RLMR</i> (Integrated Alarm Assignment).	Advanced Function Setting Level Integrated Alarm Assignment
2	Press the ♠ or ❤ Key to set the set value to 17 (i.e., the sum of 1 for alarm 1 and 16 for the HB alarm). The default is 49. (Alarm 1 (1) + HB alarm (16) + HS Alarm (32)= 49)	ALMA 17



Additional Information

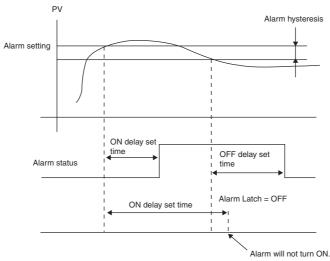
For details on the integrated alarm, refer to Section 6 Parameters.

5-10 Alarm Delays

5-10-1 Alarm Delays

 Delays can be set for the alarm outputs. ON and OFF delays can be set separately for alarms 1, 2, 3, and 4. The ON and OFF delays for alarms 1, 2, 3, and 4 also apply to the individual SUB1, SUB2, SUB3, and SUB4 indicators and to communications status. The alarm ON delays will also function when power is turned ON or when moving from the Initial Setting Level to Operation Level (e.g., to software resets). All outputs will turn OFF and the OFF delays will not function when moving to the Initial Setting Level or when an alarm is output for an A/D converter error.

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



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

Parameters Related to Alarm Delays

Parameter name	Display	Set (monitor) values	Level
Alarm 1 ON Delay	A ION	0 to 999 (s)	
Alarm 2 ON Delay	AS9N	0 to 999 (s)	
Alarm 3 ON Delay	R3āN	0 to 999 (s)	
Alarm 4 ON Delay	RYāN	0 to 999 (s)	Advanced Function
Alarm 1 OFF Delay	R IGF	0 to 999 (s)	Setting Level
Alarm 2 OFF Delay	R25F	0 to 999 (s)	
Alarm 3 OFF Delay	R36F	0 to 999 (s)	
Alarm 4 OFF Delay	RYSF	0 to 999 (s)	

Note 1: The defaults are 0, i.e., the ON and OFF delays are disabled.

2: The parameters are displayed when alarm functions are assigned and when the alarm type is set to any type but 0 (none), 12: LBA, or 13: PV change rate alarm.

Use the following procedure to set ON and OFF delays for the alarm 1. An ON delay of 5 seconds and an OFF delay of 10 s will be set.

Operating Procedure

- Setting the Alarm 1 ON Delay
- 1 Press the

 Key several times in the Advanced Function Setting Level to display

 Advanced Function Setting Level

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 | Press the Sor | Advanced Function Setting Level Function Setting Leve
 - Setting the Alarm 1 OFF Delay
 - Press the
 Key several times in the Advanced Function Setting Level to display
 Advanced Function Setting Level

 Advanced Function Setting Level

 Alarm 1 OFF

 Delay

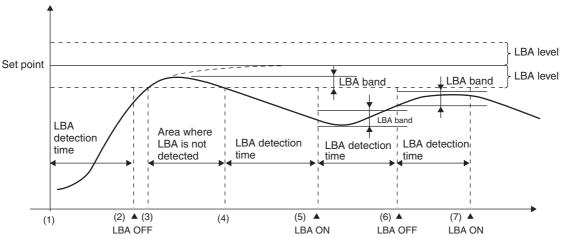
 Press the
 or
 Key to set the value to 10.

 The default is 0.

Loop Burnout Alarm (Not Supported for Position-proportional Models.)

Loop Burnout Alarm (LBA)

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



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

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

If the process value is outside the LBA level between 4 and 5 and the control deviation is not reduced by at least the LBA band within the LBA detection time, the loop burnout alarm will turn ON. If the control deviation is reduced in the area between 5 and 6 (i.e., the set point is approached) and the amount the control deviation is reduced is at least equal to the LBA band, the loop burnout alarm will turn OFF.

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

- If the LBA detection time, LBA level, LBA detection band, and PID settings are not appropriate, alarms may be detected inappropriately or alarms may not be output when necessary.
- Loop burnout alarms may be detected if unexpectedly large disturbances occur continuously and a large deviation does not decrease.
- If a loop burnout occurs when the set point is near the ambient temperature, the temperature deviation in a steady state may be less than the LBA level, preventing detection of the loop
- If the set point is so high or low that it cannot be reached even with a saturated manipulated variable, a temperature deviation may remain even in a steady state and a loop burnout may be detected.
- Detection is not possible if a fault occurs that causes an increase in temperature while control is being applied to increase the temperature (e.g., an SSR short-circuit fault).

• Detection is not possible if a fault occurs that causes a decrease in temperature while control is being applied to decrease the temperature (e.g., a heater burnout fault).

Parameters Related to Loop Burnout Alarms

Parameter name	Display	Setting	g range	Remarks	Level
LBA Detection Time	LbR 0 to 9999 (s)		Setting 0 disables the LBA function.		
LBA Level	L 6AL	Temperature input	0.1 to 999.9 (°C/°F)	Default: 8.0 (°C/°F)	Advanced
LDA Level		Analog input	0.01 to 99.99 (%FS)	Default: 10.00% FS	Function Setting Level
LBA Band		Temperature input	0.0 to 999.9 (°C/°F)	Default: 3.0 (°C/°F)	
LDA Dalla		Analog input	0.00 to 99.99 (%FS)	Default: 0.20% FS	

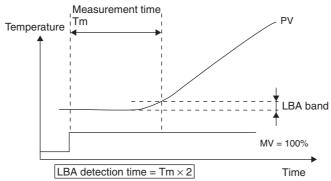
- A loop burnout alarm can be output by setting the alarm 1 type to 12 (LBA).
- A setting of 12 (LBA) can be set for alarms 2 to 4, but the setting will be disabled.
- Loop burnouts are not detected during SP ramp operation.
- Loop burnouts are not detected during auto-tuning, manual operation, or while stopped.
- If the alarm 1 latch is set to ON, the latch will be effective for the loop burnout alarm.
- Loop burnouts are not detected during remote SP operation.

Automatically Setting the LBA Detection Time

- The LBA detection time is automatically set by auto-tuning.
 (It is not set automatically, however, for heating/cooling control.)
- If the optimum LBA detection time is not obtained by auto-tuning, set the LBA Detection Time parameter (Advanced Function Setting Level).

Determining the LBA Detection Time

- To manually set the LBA detection time, set the LBA Detection Time parameter to twice the LBA reference time given below.
 - (1) Set the output to the maximum value.
 - (2) Measure the time required for the width of change in the input to reach the LBA band.



(3) Set the LBA Detection Time parameter to two times the measured time.

LBA Level

· Set the control deviation when the control loop is working properly.

• The default is 8.0 (°C/°F) for Digital Controllers with Temperature Inputs and 10.00% FS for Digital Controllers with Analog Inputs.

LBA Band

- There is assumed to be an error in the control loop and the alarm output turns ON if the control deviation is greater than the threshold set in the LBA Level parameter and if the control deviation does not change by at least the value set in the LBA Band parameter.
- The default is 3.0 (°C/°F) for Digital Controllers with Temperature Inputs and 0.20% FS for Digital Controllers with Analog Inputs.

The LBA is used.

The related parameters are as follows:

LBA Detection Time: 10

LBA Level: 8.0 LBA Band: 3.0

Operating Procedure

Setting the LBA

٠ ٥	etting the LBA	
1	Press the	Initial Setting Level Alarm 1 Type
2	Press the ♠ or ❤ Key to select 12 (LBA). The default is 2 (upper limit).	ALE I
• S	etting the LBA Detection Time	
1	Press the [©] Key several times in the Advanced Function Setting Level to display <i>LbR</i> (LBA Detection Time).	Advanced Function Setting Level LBA Detection Time
2	Press the ♠ or ❤ Key to set the value to 10. The default is 0 (s).	L b R
• S	etting the LBA Level	
1	Press the	Advanced Function Setting Level LBA Level
2	Press the ♠ or ❤ Key to set the value to 8.0. The default is 8.0 (°C/°F).	L bAL 8.0
• S	etting the LBA Band	1
1	Press the ⁽¹⁾ Key several times in the Advanced Function Setting Level to display <i>LbRb</i> (LBA Band).	Advanced Function Setting Level LBA Band 3.0

Press the ♠ or ♥ Key to set the value to 3.0.

The default is 3.0 (°C/°F).

5-12 Performing Manual Control

You can perform manual operation with PID control or with a Position-proportional Model.

5-12-1 Manual MV

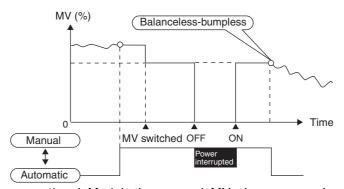
 Standard Models and Position-proportional Models (Close Control with Direct **Setting of Position Proportional MV Parameter Set to ON)**

If you change to Manual Mode, the Manual MV parameter will be displayed and the displayed value will be output as the MV. If you change the setting of the Manual MV parameter, you can set any required MV. (The new value will be applied immediately.) The default setting of the Manual MV parameter is determined by the setting of the Manual Output Method parameter as shown below.

HOLD: The MV from immediately before moving to Manual Mode INIT: The set value of the Manual MV Initial Value parameter

If the power supply is cycled during manual operation, operation will be restarted with the manual MV that was in effect before the power supply was interrupted. When the Manual MV Limit Enable parameter is set to ON (enable), the setting range will be from the MV lower limit to the MV upper limit. When operation is changed back to Automatic Mode, the MV from immediately before the change is inherited and then gradually changes to the value for Automatic Mode to prevent the MV from changing rapidly. (This is called balanceless-bumpless operation.)

The manual operation is illustrated in the following figure when the Manual Output Method parameter is set to HOLD.



For a Position-proportional Model, the manual MV changes as shown below when there is a potentiometer input error.

Manual MV Limit Enable Parameter Set to OFF

Manual MV \geq 100: Open output turns ON.

Manual MV \leq 0: Close output turns ON.

For any other manual MV, both the open output and close output will turn OFF.

Manual MV Limit Enable Parameter Set to ON

Manual MV = MV upper limit: Open output turns ON.

Manual MV = MV lower limit: Close output turns ON.

For any other manual MV, both the open output and close output will turn OFF.

 Position-proportional Models (Floating Control or Direct Setting of Position) **Proportional MV Parameter Set to OFF)**

If you move to Manual Mode, the Valve Opening Monitor parameter will be displayed. Press the Up Key to turn ON the open output. Press the Down Key to turn ON the close output.



Precautions for Correct Use

- The automatic display return function will not operate in Manual Mode.
- Switching between automatic and manual operation is possible for a maximum of one million times.

Related Displays and Parameters

Parameter name	Display	Setting range	Default	Level
Auto/Manual Switch	Я-М	Switching between Automatic Mode and Manual Mode		Operation Level
PV/MV (Manual MV)		Standard control or position-proportional control: -5.0 to 105.0 Heating/cooling control: -105.0 to 105.0 *1		Manual Control Level
Auto/Manual Select Addition	AMAd	OFF: Not displayed. ON: Displayed.	OFF *2	
Manual Output Method	MANE	HOLD INIT	HOLD	
Manual MV Initial Value	MANE	Standard control or position-proportional control: -5.0 to 105.0 Heating/cooling control: -105.0 to 105.0 *1	0.0	Advanced Function Setting
Manual MV Limit Enable 000	MANL	OFF: Disabled. ON: Enabled.	OFF	Level
Direct Setting of Position-proportional MV	PMVd	OFF: Disabled. ON: Enabled.	OFF	

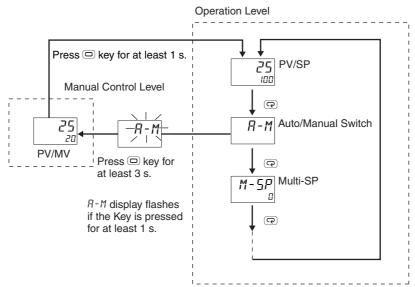
^{*1} If the Manual MV Limit Enable parameter is set to ON, this value will be between the MV upper limit and the MV lower limit.

Note: Refer to 5-15 Output Adjustment Functions for information on the order of priority for the MV.

Moving to the Manual Control Level

- · Moving with a Key Operation
 - When the Key is pressed for at least 3 seconds in the Operation Level's auto/manual switching display, the Manual Mode will be entered and the Manual Control Level will be displayed. It is not possible to move to any displays except for the PV/MV parameter during manual operation. Press the Key for at least one second from the PV/MV parameter display in Manual Control Level to return to Automatic Mode and display the top parameter in the Operation Level.
 - To enable using the Auto/Manual Switch parameter (Operation Level), you must set the Auto/Manual Select Addition parameter (Advanced Function Setting Level) to ON.

^{*2} The default setting is ON for a Position-proportional Model.



- · Using the PF Key to Move to the Manual Control Level
 - When the PF Setting parameter is set to A-M (Auto/Manual), pressing the PF Key for at least one second while in the Adjustment or Operation Level will change the mode to Manual Mode and move to the Manual Control Level. During manual operation it is not possible to move to any displays other than PV/MV (Manual MV). Press the (F) or (C) Key for at least one second from the PV/MV display in the Manual Control Level to change the mode to Automatic Mode, move to the Operation Level, and display the top parameter in the Operation Level.
 - Note 1: Priority of Manual MV and Other Functions Even when operation is stopped, the manual MV is given priority. Auto-tuning and self-tuning will stop when Manual Mode is entered.
 - 2: Manual MV and SP Ramp If operating, the SP ramp function will continue even when Manual Mode is entered.
- Moving to the Manual Control Level with an Event Input
 - If an event input is set to MANU (auto/manual), you can use the event input to switch between Automatic Mode and Manual Mode.

We will set the PF Setting parameter to A-M (auto/manual).

Operating Procedure

• Setting PID Control

1	Press the	Initial Setting Level [NL] PID ON/OFF aNaF
2	Press the ♠ or ❤ Key to set PID.	ENEL
• Se	etting Auto/Manual Selection	
1	Press the	Advanced Function Setting Level PF Setting R-M
2	Press the ♠ or ❤ Key to select R-M (auto/manual).	PF R-M

• Setting the Manual MV with the (FF) Key

1	Press the (F) Key in the Operation Level to enter the Manual	Operation Level	
	Control Level.	25 PV/MV	
2	Press the or Key to set the manual MV. (In this example, the MV is set to 50%.)*1	25 50.0	

^{*1} The manual MV setting must be saved (see page *Applying Changes to Numeric Values* on page 3-9), but values changed with key operations are reflected in the control output immediately.

5-13 Using the Transfer Output for the **Process Value, Set Point, or other Data**

5-13-1 **Transfer Output Function**

A transfer output can be used on models that have a transfer output. With the E5CC-U,* E5DC,* E5DC-B, or E5GC, if the control output is a linear current output, the control output can be used as a simple transfer output. For details on a simple transfer output, refer to 5-13-2 Simple Transfer Output Function.

The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).

Precision and User Calibration

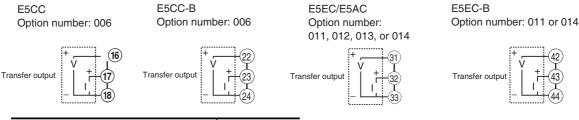
Precision	User calibration
±0.3% FS	Supported.*

For details on calibration, refer to Section 6 Parameters.

Transfer Output Signal (Initial Setting Level)

You can use the Transfer Output Signal parameter to specify whether to output a current or voltage from the transfer output.

Terminal Arrangement



Setting range	Default	
५-२०: 4 to 20mA	4-20	
I-5V: 1-5 V	1 60	

Transfer Output Type (Initial Setting Level)

You can use the Transfer Output Type parameter to specify any of six types of data to output.

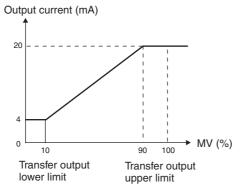
Transfer output type	Display	Setting range
OFF (default)	ōFF	
Set point *1	5P	SP lower limit to SP upper limit
Set point during SP ramp	5P-M	SP lower limit to SP upper limit
PV	PV	Input setting range lower limit to input setting range upper limit or Scaling lower limit to scaling upper limit
MV monitor (heating) *2	Mľ	-5.0 to 105.0 (heating/cooling control: 0.0 to 105.0)
MV monitor (cooling) *3	[-MV	0.0 to 105.0
Valve opening *4	l' - M	-10.0 to 110.0

When the SP is selected, the remote SP will be output while the SP Mode parameter is set to the Remote SP Mode.

- *2 This function can be set for a Position-proportional Model, but the setting will be disabled.
- *3 This function can be set for standard control or for a Position-proportional Model, but the setting will be disabled
- *4 This parameter is displayed only for a Position-proportional Model.

Transfer Scaling

- Reverse scaling is possible by setting the Transfer Output Lower Limit parameter larger than the
 Transfer Output Upper Limit parameter. If the Transfer Output Lower Limit and Transfer Output
 Upper Limit parameters are set to the same value, the transfer output will be output continuously
 at 0%.
- If the SP, SP during SP ramp, or PV is selected, the Transfer Output Upper Limit and Transfer Output Lower Limit parameters will be forcibly initialized to the respective upper and lower setting limits if any of the following parameters is changed: Input Type, Scaling Upper Limit, Scaling Lower Limit, Set Point Upper Limit, Set Point Lower Limit, or Temperature Unit.
 If the MV for heating or MV for cooling is selected, the Transfer Output Lower Limit and Transfer Output Upper Limit parameters will be initialized to 100.0 and 0.0, respectively, when a switch is made between standard control and heating/cooling control using the Standard or Heating/Cooling parameter.
- The output current when transfer output signal is set to 4 to 20 mA, the transfer output upper limit is set to 90.0, and the transfer output lower limit is set to 10.0 is shown in the following graph.
- For scaling from 0.0% to 100.0%, the output for –5.0 to 0.0 will be the same value as for 0.0%, and the output for 100.0 to 105.0 will be the same value as for 100.0%



(The above graph is for when transfer output signal is set to 4 to 20 mA.)

Setting Example to Output 1 to 5 V for the Process Value (–50 to 200 $^{\circ}$ C, Input Type 5)

Operating Procedure

Ope	rating Procedure	
• Se	tting the Transfer Output Signal Type	
1	Press the	Initial Setting Level
	display ERSE (Transfer Output Signal Type).	Transfer Output Signal Type
2	Press the \bigcirc or \bigcirc to select $l-5l'$ (1 to 5 V). The default is $4-2ll$.	ERSE 1-51
• Se	tting the Transfer Output Type	
1	Press the $oldsymbol{\textcircled{P}}$ Key several times in the Initial Setting Level to display $ER-E$ (Transfer Output Type).	Initial Setting Level Transfer Output Type
2	Press the \bigcirc or \bigcirc Key to select PV (Process Value). The default is $\bigcirc FF$.	LR-L PV
• Se	tting the Transfer Output Upper Limit	
1	Press the	Initial Setting Level Transfer Output Upper Limit
2	Press the ♠ or ❤ Key to set the value to 200. The default is 1300.	<i>₽₽-</i> Н 200
• Se	tting the Transfer Output Lower Limit	
1	Press the	Initial Setting Level Transfer Output Lower Limit
2	Press the ♠ or ❤ Key to set the value to –50. The default is –200.	<i>LR-L</i> -50

5-13-2 Simple Transfer Output Function

With the E5CC-U,* E5DC,* E5DC-B, or E5GC, if the control output is a linear current output, the control output can be used as a simple transfer output.

The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).

Precision and User Calibration

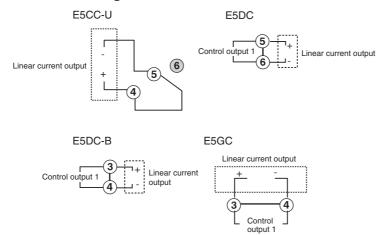
Precision	User calibration
±0.3% FS*	None

* However, the precision between 0 and 4 mA for a 0 to 20-mA output is $\pm 1\%$ FS.

Control Output 1 Signal (Initial Setting Level)

You can use the Control Output 1 Signal parameter to specify whether to output 4 to 20 mA or 0 to 20 mA from the simple transfer output.

Terminal Arrangement



Setting range	Default
Ч-2⊞: 4 to 20 mA	4-20
Ū-2Ū: 0 to 20 mA	1 20

Control Output 1 Assignment (Advanced Function Setting Level)

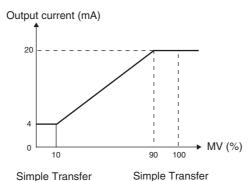
To use the simple transfer output, specify any of the following five types of data to output with the Control Output 1 Assignment parameter.

Simple transfer output type (Control Output 1 Assignment)	Display	Setting range
Simple transfer SP	Ł-5P	SP lower limit to SP upper limit
Simple transfer ramp SP	ŁSPM	SP lower limit to SP upper limit
Simple transfer PV	E-PV	Input setting range lower limit to input setting range upper limit, or Scaling lower limit to scaling upper limit
Simple transfer MV (heating)	E-MV	-5.0 to 105.0 (heating/cooling control: 0.0 to 105.0)
Simple transfer MV (cooling)*	EEM1	0.0 to 105.0

^{*} This function can be set for standard control, but the setting will be disabled.

Simple Transfer Scaling

- Reverse scaling is possible by setting the Simple Transfer Output 1 Lower Limit parameter larger than the Simple Transfer Output 1 Upper Limit parameter. If the Simple Transfer Output 1 Lower Limit and Simple Transfer Output 1 Upper Limit parameters are set to the same value, the simple transfer output will be output continuously at 0%.
- If the Simple Transfer SP, Simple Transfer SP during SP Ramp, or Simple Transfer PV is selected, the Simple Transfer Output 1 Upper Limit and Simple Transfer Output 1 Lower Limit parameters will be forcibly initialized to the respective upper and lower setting limits if any of the following parameters is changed: Input Type, Scaling Upper Limit, Scaling Lower Limit, Set Point Upper Limit, Set Point Lower Limit, or Temperature Unit. If the Simple Transfer MV (Heating) or Simple Transfer MV (Cooling) is selected, the Simple Transfer Output 1 Lower Limit and Simple Transfer Output 1 Upper Limit parameters will be initialized to 100.0 and 0.0, respectively, when a switch is made between standard control and heating/cooling control using the Standard or Heating/Cooling parameter.
- The output current when the Simple Transfer Output 1 Signal parameter is set to 4 to 20 mA, the Simple Transfer Output 1 Upper Limit parameter is set to 90.0, and the Simple Transfer Output 1 Lower Limit parameter is set to 10.0 is shown in the following graph.
- For scaling from 0.0% to 100.0%, the output for -5.0 to 0.0 will be the same value as for 0.0%, and the output for 100.0 to 105.0 will be the same value as for 100.0%



Output 1 Lower Limit Output 1 Upper Limit (The above graph is for when the simple transfer output 1 signal is set to 4 to 20 mA.)

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

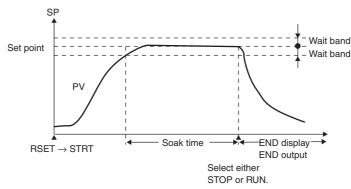
Operating Procedure

- · Setting the Transfer Output Type
- Advanced Function Setting Level ting Level to display all (Control Output 1 Assignment). olit Control Output 1 Assignment Press the \bigcirc or \bigcirc Key to select \angle -5P (simple transfer SP). The default is \bar{a} . • Setting the Simple Transfer Output 1 Upper Limit Initial Setting Level Simple Transfer ā IEK display ā IEH (Simple Transfer Output 1 Upper Limit). Output 1 Upper 1300 Limit **2** Press the ♠ or ❤ Key to set 200. ā IEK The default is 1300. 200 • Setting the Simple Transfer Output 1 Lower Limit Initial Setting Level Press the Key several times in the Initial Setting Level to Simple Transfer display ā IŁL (Simple Transfer Output 1 Lower Limit). ā IEL Output 1 Lower -200 Limit **2** Press the **⑤** or **ⓒ** Key to set –50. ālbl The default is -200. -50

Using the Simple Program Function 000 5-14

5-14-1 **Simple Program Function**

• The simple program function can be used for the following type of control.



• The program will start when the Program Start parameter is changed from RSET to STRT. END will be displayed on the No. 2 display and the output assigned as the program end output will turn ON after the time set in the Soak Time parameter has expired in the wait band. The Program Pattern parameter can be used to select moving to STOP mode or continuing operation in RUN mode after the program ends.

Parameters Related to the Simple Program Function

Parameter name	Display	Set (monitor) values	Unit	Display level
Program Pattern	PERN	OFF, STOP, CONT		Initial Setting Level
Program Start	PRSE	RSET, STRT		Operation Level
Soak Time	55AK	1 to 9999	min, h, or s*1	Adjustment Level
Soak Time Unit	E-U	s (seconds)*1/m (min- utes)/h (hours)		Advanced Function Setting Level
Wait Band	WE-P	OFF or 0.1 to 999.9*	°C or °F*	Adjustment Level
Soak Time Remain Monitor	SKER	0 to 9999	min, h, or s ^{*1}	Operation Level

^{*1} Seconds is supported only by the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)

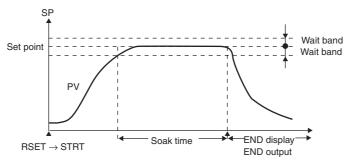
^{*2} The setting unit of the Wait Band parameter is %FS for Digital Controllers with Analog Inputs and the setting range is OFF or 0.01 to 99.99.

Program Pattern

Either of two program patterns can be selected. The simple program operation will not be performed if the Program Pattern parameter is set to OFF.

(1) Pattern 1 (STOP)

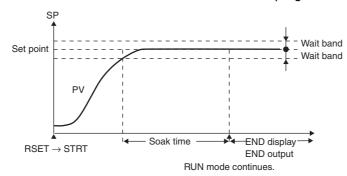
Control will stop and the STOP mode will be entered when the program has ended.



Automatically switches from RUN to STOP mode.

(2) Pattern 2 (CONT)

Control will continue in RUN mode when the program has ended.

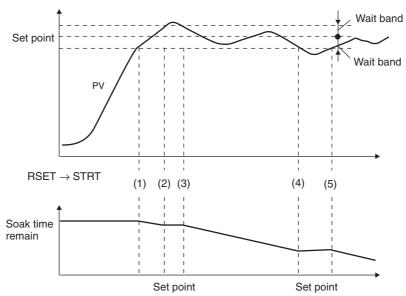


Starting Method

Any of the following three methods can be used to start the simple program.

- Setting the Program Start parameter to STRT.
- Turning ON an event input. (The program start must be assigned to an event input.*)
- Starting with an Operation Command using communications. (When the program start is not assigned to an event input.)
- * When the simple program is started and reset, writing is performed to non-volatile memory. Be sure to consider the write life (1 million writes) of the non-volatile memory in the system design. When the program start is assigned to an event input, the Program Start parameter will function as a monitor display, and the RSET/STRT displays can be used to check when the event input has started or reset the simple program. When this is done, the Program Start parameter functions as a monitor display only and cannot be changed using key operations. If the Program Pattern parameter is set to OFF, the event input assignment setting will be initialized to "None."

Soak Time and Wait Band



The wait band is the band within which the process value is stable in respect to the set point. The soak time is measured within the wait band. The timer that measures the soak time operates only when the process value is within the wait band around the set point (i.e., SP \pm wait band). In the above diagram, the timer will be stopped between the start and (1), (2) and (3), and (4) and (5) and will measure the time only between (1) and (2), (3) and (4), and (5) and the end.

^{*} If the wait band is set to OFF, the wait band will be treated as infinity and the timer will measure time continuously after changing from RSET to STRT.

5-14-2 Operation at the Program End

• Display at the Program End
When the program ends, the process value will be displayed on the No. 1 display* and the set point

and *ENd* will be alternately displayed on the No. 2 display at 0.5 s intervals. * One of the following displays: PV/SP, PV only, or PV/MV.



Program End Output

The output assignment parameters can be used to assign the program END output to any output. The program END output can also be used in communications status.

When the Program Pattern parameter is changed from OFF to STOP or CONT, the Auxiliary Output 1 Assignment parameter will automatically be set to the END output. (However, if heating/cooling control is used for the E5GC, the assignment of the control output for cooling will take priority.) When the Program Pattern parameter is changed from STOP or CONT to OFF, the Alarm 1 Output Assignment parameter will automatically be initialized to ALM1 (or to HA for Digital Controllers that have HB or HS alarms).

• Clearing the Program End Status

The program END output and display will be cleared when the Program Start parameter is changed from STRT to RSET. The setting is changed from STRT to RSET while the Program Start parameter is displayed.

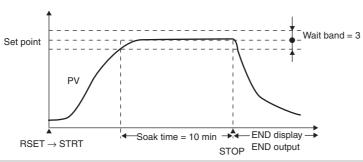
The program END status can also be cleared using an event. If the program start function is assigned to an event, however, the program end status cannot be cleared from the Program Start parameter display, which will function only as a monitor display.

Simple programming is used.

The related parameters are as follows:

Program pattern: STOP Soak time = 10 min

Wait band: 3



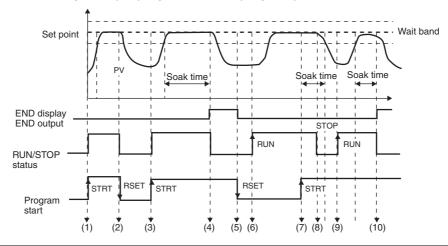
Operating Procedure

• Setting the Program Pattern

1	Press the Key several times in the Initial Setting Level to display <i>PLRM</i> (Program Pattern).	Initial Setting Level Program Pattern GFF
2	Press the ♠ or ❤ Key to select 5₺ oP (STOP). The default is oFF.	PERN SEAP
• Se	etting the Soak Time	
1	Press the @ Key several times in the Adjustment Level to display 5급위서 (Soak Time).	Adjustment Level Soak Time
2	Press the or Key to set the value to 10. The default is 1 (min or h).	SōAK 10
• Se	etting the Wait Band	
1	Press the Key several times in the Adjustment Level to display WŁ - b (Wait Band).	Adjustment Level Wait Band FF
2	Press the \bigcirc or \bigcirc Key to set the value to 3.0. The default is $\overline{a}FF$.	WE - b 3.0

5-14-3 Application Example Using a Simple Program

The program will be started by changing the setting of the Program Start parameter. The following example shows using a simple program with the program pattern set to STOP.



Timing	Description
(1)	The Program Start parameter was changed from RSET to STRT using either an event or key operations.
	• The RUN/STOP status automatically changes to RUN mode when the above operation is performed.
(2)	• The Program Start parameter was changed from STRT to RSET using either an event or key operations before the soak time expired.
	• The RUN/STOP status automatically changes to STOP mode when the above operation is performed.
(3)	The Program Start parameter is again changed from RSET to STRT using either an event or key operations.
	• The RUN/STOP status will automatically change to RUN mode when the above operation is performed.
(4)	• The RUN/STOP status automatically changes to STOP mode when soak time expires.
	• END flashes on the No. 2 display and the program END output turns ON.
(5)	• The Program Start parameter is changed from STRT to RSET using either an event or key operations.
	The END display is cleared and the program END output turns OFF.
(6)	• Key operations are used to switch the RUN/STOP status to RUN with the Program Start parameter set to RSET (stopped).
	Normal control operation is started.
(7)	• The Program Start parameter is changed from RSET to STRT using either an event or key operations after the process value stabilizes.
	• The RUN/STOP status remains as RUN.
(8)	• Key operations are used to change the RUN/STOP status to STOP (during program operation).
	Measuring the soak time is continued within the wait band. (Measuring the soak time stops when the process value leaves the wait band.)
(9)	Key operations are used to change the RUN/STOP status to RUN.
	• Measuring the soak time is continued within the wait band (continuing from the time between (7) and (9)).
(10)	• The RUN/STOP status automatically changes to STOP mode when the measured time reaches the soak time.
	• END flashes on the No. 2 display and the program END output turns ON.

Output Adjustment Functions

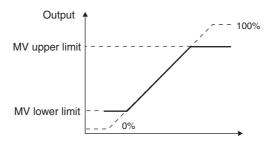
5-15-1 Output Limits

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

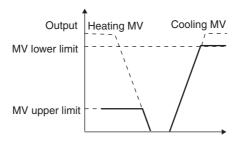
Manual MV*

MV at stop

MV at PV error



- When the manual MV limit is enabled, the manual MV will be restricted by the MV limit.
 - For heating/cooling control, upper and lower limits are set for overall heating/cooling control. (They cannot be set separately for heating/cooling.)



5-15-2 MV at Stop 000

The MV when control is stopped can be set.

To set the MV when control is stopped, set the MV at Stop and Error Addition parameter (Advanced Function Setting Level) to ON.

Standard Models

For heating/cooling control, the MV at stop will apply to the cooling side if the MV is negative and to the heating side if the MV is positive. The default is 0.0, so an MV will not be output for either standard or heating/cooling control.

Position-proportional Models

You can select between open, close, and hold for floating control or when the Direct Setting of Position Proportional MV parameter is set to OFF. For open, only the open output turns ON. For close, only the close output turns ON. For hold, both the open output and close output turn OFF. The default setting is hold, so both outputs are turned OFF. If you set the Direct Setting of Position Proportional MV parameter to ON for close control, you can specify the valve opening. The default setting is 0.0, which means that the open output and close output will be adjusted so that the valve opening will go to 0.

Parameter	Setting range	Unit	Default
MV at Stop	Standard control: -5.0 to 105.0		
	Heating/cooling control: -105.0 to 105.0		
	Position-proportional Control		
	Direct Setting of Position Proportional MV parameter set to ON for close control: –5.0 to 105.0	% or	0.0 or
	Floating control or Direct Setting of Position Proportional MV parameter set to OFF:	none	HOLD
	CLOS (Control output 2 turns ON.)		
	HOLD (Control outputs 1 and 2 turn OFF.)		
	OPEN (Control output 1 turns ON.)		

Note: The order of priority in respect to the manual MV and the MV at PV error is as follows: Manual MV > MV at stop > MV at PV error.

• If the Direct Setting of Position Proportional MV parameter is set to ON, the operation is as shown below when there is a potentiometer input error.

MV at stop \geq 100: Open output turns ON. MV at stop \leq 0: Close output turns ON.

For any other MV at stop, both the open output and close output will turn OFF.

5-15-3 MV at PV Error 000

A fixed MV is output when there is an input error, an RSP input error, or a potentiometer input error (close control only). To set the MV at PV error, set the MV at Stop and Error Addition parameter (Advanced Function Setting Level) to ON. The MV at stop takes priority when control is stopped and the manual MV takes priority in Manual Mode.

Standard Models

For heating/cooling control, the MV at PV Error will apply to the cooling side if the MV is negative and to the heating side if the MV is positive. The default is 0.0, so an MV will not be output for either standard or heating/cooling control.

· Position-proportional Models

You can select between open, close, and hold for floating control or when the Direct Setting of Position Proportional MV parameter is set to OFF. For open, only the open output turns ON. For close, only the close output turns ON. For hold, both the open output and close output turn OFF. The default setting is to hold, so both outputs are turned OFF. If you set the Direct Setting of Position Proportional MV parameter to OFF for close control, you can specify the valve opening. The default setting is 0.0, which means that the open output and close output will be adjusted so that the valve opening will go to 0.

Parameter	Setting range	Unit	Default
MV at PV Error	Standard control: -5.0 to 105.0		
	Heating/cooling control: -105.0 to 105.0		
	Position-proportional Control		
	Direct Setting of Position Proportional MV parameter set to ON for close control: -5.0 to 105.0	% or	0.0 or
	Floating control or Direct Setting of Position Proportional MV parameter set to OFF:	none	HOLD
	CLOS (Control output 2 turns ON.)		
	HOLD (Control outputs 1 and 2 turn OFF.)		
	OPEN (Control output 1 turns ON.)		

Note: The order of priority with respect to the manual MV and the MV at Stop is as follows: Manual MV > MV at stop > MV at PV error.

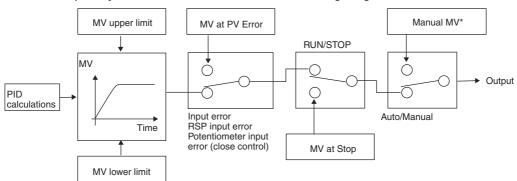
• If the Direct Setting of Position Proportional MV parameter is set to ON, the operation is as shown below when there is a potentiometer input error.

MV at PV error ≥ 100: Open output turns ON.

MV at PV error \leq 0: Close output turns ON.

For any other MV at PV error, both the open output and close output will turn OFF.

• The order of priority of the MV is illustrated in the following diagram.



* When the Manual MV Limit Enable parameter is set to ON, the setting range will be the MV lower limit to the MV upper limit.

5-16 Using the Extraction of Square Root Parameter 000

5-16-1 Extraction of Square Roots

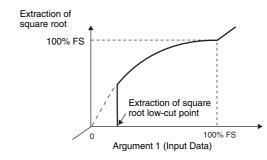
Extraction of Square Root Enable



Extraction of Square Root Low-cut Point



- For analog inputs, the Extraction of Square Root parameter is provided for inputs so that differential pressure-type flow meter signals can be directly input.
- The default setting for the Extraction of Square Root parameter is OFF. The
 Extraction of Square Root Enable parameter must be set to ON in order to use
 this function.
- If the PV input (i.e., the input before extracting the square root) is higher than 0.0% and lower than the low cut point set in the Extraction of Square Root Low-Cut Point parameter, the results of extracting the square root will be 0.0%. If the PV input is lower than 0.0% or higher than 100.0%, extraction of the square root will not be executed, so the result will be equal to the PV input. The low-cut point is set as normalized data for each input, with 0.0 as the lower limit and 100.0 as the upper limit for the input setting range.



Parameter name	Setting range	Unit	Default	Level
Extraction of Square Root Enable	OFF: Disabled, ON: Enabled		OFF	Initial Setting Level
Extraction of Square Root Low-cut Point	0.0 to 100.0	%	0.0	Adjustment Level

This procedure sets the Extraction of Square Root Low-cut Point parameter to 10.0%.

The input type must be set for an analog input.

Operating Procedure

• Enabling Extraction of Square Roots

1	Press the Key several times in the Initial Setting Level to display 5 R (Extraction of Square Root Enable).	Initial Setting Level Straction of Square Root Enable
2	Press the or Key to select (Enabled). The default is FF (disabled).	SOR an

• Setting the Extraction of Square Root Low-cut Point

1	Press the	Adjustment Level Extraction of Square Root Low-cut Point
2	Press the or Key to set the value to 10.0. The default is 0.0 (%).	50RP 10.0

5-17 Setting the Width of MV Variation 000

5-17-1 MV Change Rate Limit

MV Change Rate Limit



- The MV change rate limit sets the maximum allowable width of change per second in the MV (or the change per second in the valve opening for a Position-proportional Model). If the change in the MV exceeds this setting, the MV will be changed by the MV change rate limit until the calculated value is reached. This function is disabled when the setting is 0.0.
- The MV change rate limit does not function in the following situations:
 - In Manual Mode
 - During ST execution (Cannot be set when ST is ON.)
 - During AT execution
 - During ON/OFF control
 - While stopped (during MV at Stop output)
 - During MV at PV Error output

Parameter name	Setting range	Unit	Default	Level
MV Change Rate Limit	0.0 to 100.0	%/s	0.0	Adjustment Level

This procedure sets the MV change rate limit to 5.0%/s. The related parameters are as follows:

PID ON/OFF = PID

ST = OFF

Operating Procedure

• Setting 2-PID Control

1		Initial Setting Level			
•	Press the Key several times in the Initial Setting Level to display [NLL (PID ON/OFF).	FINEL PID ON/OFF			
2	Press the or Key to select Pid (PID). The default is (ON/OFF control).	ENEL Pid			
Turning OFF Self-tuning					
1	Press the $\ \ $ Key several times in the Initial Setting Level to display $5 \mathcal E$ (ST: self-tuning).	Initial Setting Level 5 L an			
2	Press the ♠ or ❤ Key to set the value to ōFF. The default is ōN.	5L GFF			
• Se	Setting the MV Change Rate Limit				
1	Press the $\ \ \ \ $ Key several times in the Adjustment Level to display $\ \ \ \ $ (MV Change Rate Limit).	Adjustment Level MV Change Rate Limit			
2	Press the or Key to set the value to 5.0. The default is 0.0 (%/s).	5.0			

5-18 Setting the PF Key

5-18-1 PF Setting (Function Key)

PF Setting (Advanced Function Setting Level)

• Pressing the PF Key for at least one second executes the operation set in the PF Setting parameter. The default is 5HFL (digit shift).



Set value	Display	Setting	Function	
OFF aFF Disabled		Disabled	Does not operate as a function key.	
RUN	RUN	RUN Specifies RUN status.*5		
STOP	SEGP	STOP Specifies STOP status.*5		
R-S	R-5	RUN/STOP reverse operation Specifies reversing the RUN/STOP operation status. *5		
AT-2	RE-2	100% AT Execute/Cancel	Specifies reversing the 100% AT Execute/Cancel status.*1 *5	
AT-1	AE-1	40% AT Execute/Cancel	Specifies reversing the 40% AT Execute/Cancel status.*1 *4 *5	
LAT	LRE	Alarm Latch Cancel Specifies canceling all alarm latches.*2 *5		
A-M	A-M	Auto/Manual	Specifies reversing the Auto/Manual status.*3 *5	
PFDP	PFdP	Monitor/Setting Item	Specifies the monitor/setting item display. Select the monitor setting item according to the Monitor/Setting Item 1 to 5 parameters (Advanced Function Setting Level).	
SHFT	SHFE	Digit Shift	Operates as a Digit Shift Key when settings are being changed.	

^{*1} When AT cancel is specified, it means that AT is cancelled regardless of whether the AT currently being executed is 100% AT or 40% AT.

Note1: Pressing the PF Key for at least one second executes operation according to the set value. (However, if Digit Shift is set, operation will be in less than one second.) When the Monitor/Setting Item parameter is selected, however, the display is changed in order from Monitor/Setting Item 1 to 5 each time the key is pressed.

2: This function is enabled when PF Key Protect is OFF.

^{*2} Alarms 1 to 4, the HB alarm, and the HS alarm are cancelled.

^{*3} For details on auto/manual operations using the PF Key, refer to 5-12 Performing Manual Control.

^{*4} AT-1 can be set for heating/cooling control or for floating position-proportional control, but the setting will be disabled.

^{*5} The function that is set for the PF Key is disabled if the same function is assigned to an event input. For the default event input assignments, refer to *Event Input Assignment 1* to *Event Input Assignment 6* on page 6-57.

Monitor/Setting Item 000

Monitor/Setting Item 1 (Advanced Function Setting Level)



Setting the PF Setting parameter to the Monitor/Setting Item makes it possible to display monitor/setting items using the F Key. The following table shows the details of the settings. For setting (monitor) ranges, refer to the applicable parameter.

0-4	O. Milinari	Remarks		
Set value	Setting	Monitor/Setting	Display	
0	Disabled			
1	PV/SP/Multi-SP	Can be set. (SP)*1		
2	PV/SP/MV (valve opening for Position-proportional Model)	Can be set. (SP) ^{*1}		
3	PV/SP /Soak time remain	Can be set. (SP)*1		
4	Proportional band (P)	Can be set.	P	
5	Integral time (I)	Can be set.	Ĺ	
6	Derivative time (D)	Can be set.	d	
7	Alarm value 1	Can be set.	AL - I	
8	Alarm value upper limit 1	Can be set.	AL IH	
9	Alarm value lower limit 1	Can be set.	AL IL	
10	Alarm value 2	Can be set.	RL - 2	
11	Alarm value upper limit 2	Can be set.	RL2H	
12	Alarm value lower limit 2	Can be set.	AL 2L	
13	Alarm value 3	Can be set.	AL - 3	
14	Alarm value upper limit 3	Can be set.	RL 3H	
15	Alarm value lower limit 3	Can be set.	AL 3L	
16	Alarm value 4	Can be set.	AL-4	
17	Alarm value upper limit 4	Can be set.	RL YH	
18	Alarm value lower limit 4	Can be set.	RL YL	
19	PV/SP/Internal SP	Can be set. (SP)*1		
20	PV/SP/Alarm Value 1*2	Can be set. (SP)*1		
21	Proportional Band (Cooling)	Can be set.	[-P	
22	Integral Time (Cooling)	Can be set.	[-[
23	Derivative Time (Cooling)	Can be set.	[-d	

^{*1} With the E5CC, E5CC-U, E5CC-B, E5DC, E5DC-B, or E5GC, only the PV and SP can be displayed.

^{*2} The Alarm Value 1 parameter is displayed even if the Alarm 1 Type parameter is set for no alarm. However, any value that is set is not valid.

Setting Monitor/Setting Items

Pressing the Fe Key in either the Operation or Adjustment Level displays the applicable monitor/setting items. Press the Fe Key to display in order Monitor/Setting Items 1 to 5. After Monitor/Setting Item 5 has been displayed, the display will switch to the top parameter in the Operation Level.

- Note 1: Items set as disabled in the Monitor/Setting Items 1 to 5 parameters will not be displayed, and the display will skip to the next enabled setting.
 - 2: While a monitor/setting item is being displayed, the display will be switched to the top parameter in the Operation Level if the

 Key or the

 Key is pressed.

This procedure sets the PF Setting parameter to PFDP, and the Monitor/Setting Item 1 parameter to 7 (Alarm Value 1).

•	erating Procedure etting the PF Key	
1	Press the [®] Key several times in the Advanced Function Setting Level to display <i>PF</i> (PF Setting).	Advanced Function Setting Level PF Setting 5HFE
2	Press the ♠ or ❤ Key to select PFdP (Monitor/Setting Item). The default is 5HFŁ (digit shift).	PF PFdP
• Se	etting the Monitor/Setting Items	
1	Press the	Advanced Function Setting Level Monitor/Setting Item 1
2	Press the ♠ or ❤ Key to select 7 (Alarm Value 1). The default is 1 (PV/SP/Multi-SP No.).	PFd!
3	Return to the Operation Level and press the (FF) Key to display RL - I (Alarm Value 1).	Monitor/Setting Item Level Graph Monitor/Setting Item Display 1

5-19 Displaying PV/SV Status

5-19-1 PV and SV Status Display Functions

PV Status Display Function (Advanced Function Setting Level)

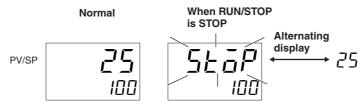
The PV on the No. 1 display in the PV, PV/SP, PV/Manual MV, or PV/SP Manual MV Display and the control or alarm status specified for the PV status display function are alternately displayed in 0.5-s cycles.*1

- PV
- PV/SP*2
- PV/Manual MV (Valve Opening)
- PV/SP/Manual MV (Valve Opening)
- *1 This includes the displays specified with the PV/SP No. 1 and PV/SP No. 2 Display Selection parameters.
- *2 This includes when the PV/SP is selected for the Monitor/Setting Item parameter.

Set value	Display	Function		
OFF	ōFF	No PV status display		
Manual	MANU	MANU is alternately displayed during manual control.		
Stop	SEGP	STOP is alternately displayed while operation is stopped.		
Alarm 1	ALM I	ALM1 is alternately displayed during Alarm 1 status.		
Alarm 2	RLM2	ALM2 is alternately displayed during Alarm 2 status.		
Alarm 3	ALM3	ALM3 is alternately displayed during Alarm 3 status.		
Alarm 4	ALM4 is alternately displayed during Alarm 4 status.			
Alarm 1 to 4 OR status RLM		ALM is alternately displayed when Alarm 1, 2, 3, or 4 is set to ON.		
Heater Alarm HR		HA is alternately displayed when an HB alarm or HS alarm is ON.		
Status display mes- sage*		While one or more of the work bits (WR1 to WR8) is ON, the message for the highest bit number that is ON is alternately displayed with the corresponding bit number.		

Note: The default is OFF.

Example: When STOP Is Selected for the PV Status Display Function



SV Status Display Function (Advanced Function Setting Level)

The SP, Manual MV, or blank on the No. 2 display in the PV/SP, PV, or PV/Manual MV Display and the control or alarm status specified for the SV status display function are alternately displayed in 0.5-s cycles.*1

- PV
- PV/SP*2
- PV/Manual MV (Valve Opening)
- PV/SP/Manual MV (Valve Opening)
- *1 This includes the displays specified with the PV/SP No. 1 and PV/SP No. 2 Display Selection parameters.
- *2 This includes when the PV/SP is selected for the Monitor/Setting Item parameter.

Selection is possible only with the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)

Set value	Display	Function	
OFF	ōFF	No SV status display	
Manual	MANU	MANU is alternately displayed during manual control.	
Stop	SEGP	STOP is alternately displayed while operation is stopped.	
Alarm 1	ALM I	ALM1 is alternately displayed during Alarm 1 status.	
Alarm 2	ALM2	ALM2 is alternately displayed during Alarm 2 status.	
Alarm 3	ALM3	ALM3 is alternately displayed during Alarm 3 status.	
Alarm 4	ALMY	ALM4 is alternately displayed during Alarm 4 status.	
Alarm 1 to 4 OR status RLM		ALM is alternately displayed when Alarm 1, 2, 3, or 4 is set to ON.	
Heater Alarm	HA	HA is alternately displayed when an HB alarm or HS alarm is ON.	
Status display mes- sage*	WR	While one or more of the work bits (WR1 to WR8) is ON, the message for the highest bit number that is ON is alternately displayed with the corresponding bit number.	

Note: The default is OFF.

Example: When ALM1 Is Selected for the SV Status Display Function





Additional Information

Priority of Flashing and Alternating Displays on No. 2 Display

The priority for flashing and alternating displays is as follows:

- (1) Alternating display with SV status display
- (2) Alternating display during program end output

The following procedure sets the PV Status Display Function parameter to ALM1.

Operating Procedure

1	Press the \textcircled{P} Key several times in the Advanced Function Setting Level to display $PV SE$ (PV Status Display Function).	Advanced Function Setting Level	
	ang Level to display 17 32 (1 v oldies Bioplay 1 disclosi).	PV Status Display Function	
2	Press the \bigcirc or \bigcirc Key to select RLM I (alarm 1). The default is $\overline{a}FF$.	PVSE ALM I	
3	If the Alarm 1 status is ON in Operation Level, the PV and RLM (Alarm 1) will be alternately displayed.	Operation Level 25 100 100	

^{*} Selection is possible only with the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)

5-20 Using a Remote SP

A remote SP can be used on models that have a remote SP input. A remote SP uses a remote SP input that is scaled between the remote SP upper and lower limits as the SP. (The remote SP can be 4 to 20 mA DC, 0 to 20 mA DC, 1 to 5 VDC, 0 to 5 VDC, or 0 to 10 VDC.) Set the Remote SP Enable parameter (Advanced Function Setting Level) to ON and select a remote SP in the SP Mode parameter (Adjustment Level) to enable using a remote SP. You can also use an event input to switch to SP Mode.

Parameter	Setting range	Unit	Default	Level
Remote SP Enable (P5PU)	OFF: Disable, ON: Enable	None	OFF	Advanced Function
nemote of Enable (" '" ")	OFF. Disable, ON. Ellable			Setting Level
Remote SP Input (P5-E)	4 to 20 mA DC, 0 to 20 mA DC, 1 to 5		4 to 20 mA	Advanced Function
Hemote St. Input (#2 E)	VDC, 0 to 5 VDC, or 0 to 10 VDC		DC	Setting Level
Remote SP Upper Limit (P5PH)	Temperature input: Input setting	EU	1300	Advanced Function
Hemote SF Opper Limit (1/3/11)	range lower limit to Input setting			Setting Level
	range upper limit	EU	-200	Advanced Function
Remote SP Lower Limit (P5PL)	Analog input: Scaling lower limit to			Setting Level
	Scaling upper limit			
SP Tracking (5PER)	OFF: Disable, ON: Enable	None	OFF	Advanced Function
- Hacking (Jr EN)	OTT. Disable, OTV. Effable			Setting Level
SP Mode (5PMd)	LSP: Local SP, RSP: Remote SP	None	LSP	Adjustment Level
Remote SP Monitor (PSP)	Remote SP lower limit –10% to	EU		Operation Level
Hemote SF Monitor (12)	Remote SP upper limit +10%			
Remote SP Input Shift (P55)	Temperature input: -199.9 to 999.9	°C or °F	0.0	Adjustment Level
nemote or input office (LEC //)	Analog input: -1,999 to 9,999	EU	0	
Remote SP Input Slope Coefficient (P5Pt)	0.001 to 9.999	EU	1.000	Adjustment Level



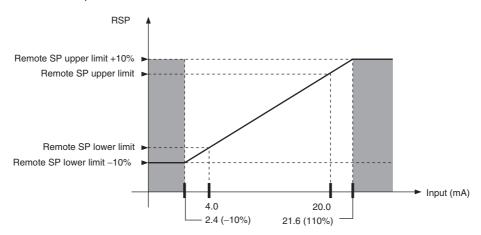
Precautions for Correct Use

- To use the remote SP function, the ST (self-tuning) parameter must be set to OFF (default:
 - If the ST parameter is set to ON, the settings for the remote SP function will not be displayed. When the ST (self-tuning) parameter is turned ON, the SP Mode parameter is forcibly set to LSP.
- The remote SP input is not accepted during autotuning. Autotuning is executed for the remote SP at the beginning of autotuning.
- Changes in the remote SP value are not used as conditions for resetting the standby sequence.

Remote SP Scaling

- You can scale the remote SP input for the PV input range with the remote SP upper and lower limits.
- The remote SP input can be from the remote SP lower limit –10% to the remote SP upper limit +10%. Input values outside of this range are treated as out-of-range input values (RSP input errors) and clamped to the upper or lower limit. The RSP indicator will flash in Remote SP Mode. Also, the Remote SP Monitor will flash on the No. 2 display in any SP Mode.
- When you use the remote SP input value as the control SP, it is restricted by the set point upper limit and the set point lower limit.

Remote SP Input of 4 to 20 mA



SP Mode

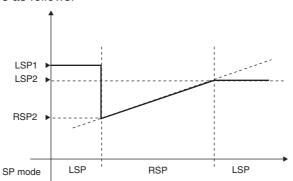
The SP mode is used to switch between local SP and remote SP. When a remote SP is selected in SP mode, the RSP single indicator will light.

Remote SP Monitor

- You can check the remote SP input value in the Remote SP Monitor parameter (Operation Level).
- If a remote SP is selected for the SP Mode parameter, the remote SP input value will be displayed
 as the SP in PV/SP displays. This remote SP input value will be restricted as the control SP by the
 set point upper limit and the set point lower limit.

SP Tracking

- If the SP tracking function is enabled, the local SP inherits the remote SP value after switching from remote SP to local SP. To enable the SP tracking function, set the SP Tracking parameter to ON.
- · SP tracking operates as follows:



- (1) Switching to remote SP when the SP is LSP1 will result in switching to RSP2.
- (2) The operation will proceed according to remote SP inputs.
- (3) If the SP tracking function is enabled, the SP will become LSP2 after switching to local SP. If the SP tracking function is disabled, the SP will remain as LSP1.
- If the SP ramp function is enabled when switching from local SP to remote SP, SP tracking will operate.

• Remote SP Input Compensation

You can set a remote SP input shift and an SP input slope compensation coefficient to compensate the remote SP input.

5-21 Controlling Valves (Can Be Used with a Position-proportional Model)

You can use position-proportional control to control a value with a control motor. With position-proportional control, you can use either close control or floating control.



Precautions for Correct Use

The following functions cannot be used with position-proportional control.

- ON/OFF control
- P and PD control during floating control
- 40% AT during floating control
- ST
- LBA
- HB and HS alarms

Control Method

Close control	A potentiometer is connected and the valve opening and travel time are used to control valve operation. Always perform motor calibration before actual operation.
Floating control	Valve operation is controlled without a potentiometer by estimating the valve opening from the travel time. Always set the travel time before actual operation.

Motor Calibration

The valve position is calibrated and the travel time from completely open to completely closed is set automatically. You can then check the valve opening with the Valve Opening Monitor parameter. If you set the Motor Calibration parameter to ON, the valve will open completely and close completely, and then the setting of the parameter will change to OFF when the measurement has been completed. "ERR" will be displayed if any of the following errors occurs during execution. If an error occurs, check the wiring and other factors and execute motor calibration again.

- · The potentiometer input value does not change or changes backward between completely open and completely closed because the wiring is wrong.
- The value of the potentiometer input is incorrect because of a broken wire, noise, or other factor

Note: Do not change to any other parameter during calibration.

Valve Opening Monitor

You can monitor the valve opening.

You can select either the measured opening or the estimated opening only with the E5EC-PR or E5AC-PR (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)

Measured opening	The valve opening that was measured with a potentiometer is displayed. To monitor the measured opening of the valve, select the measured opening for the Valve Opening Monitor Selection parameter, connect a potentiometer, and then perform motor calibration. Application: Use this setting when you want to display the actual opening.
------------------	--

The valve opening estimated by the Digital Controller is displayed. To monitor the estimated opening of the valve, select the estimated opening for the Valve Opening Monitor Selection parameter and set the travel time.

Application: Use this setting when a potentiometer is not connected and you want to display an approximate opening.

Estimated opening

- After the power supply is turned ON, the Valve Opening Monitor will start at 0%.
- *2 The estimated valve opening will not agree with the actual valve opening. If you want to temporarily align the estimated opening with the actual opening, used the following operation.
 - In Manual Mode, turn ON the close output by pressing the DOWN Key for at least the time set for the travel time. (Refer to *5-12 Performing Manual Control* for the method to change to the Manual Control Level.)
- *1 For close control, you can select only the measured opening. For floating control, you can select either the measured opening or the estimated opening.
- *2 The estimated valve opening will be different from the actual opening. Use the measured opening to check the actual valve opening.

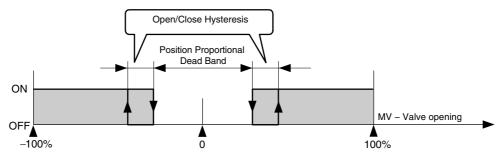
Travel Time

The Travel Time parameter is set to the time from when the valve is completely open until it is completely closed. The Travel Time parameter is set automatically when motor calibration is performed.

Note: With the E5EC/E5AC-PR -0 -0, you cannot monitor the valve opening simply by setting the Travel Time parameter. To monitor the valve opening, always perform motor calibration.

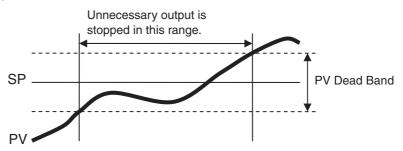
Position Proportional Dead Band and Open/Close Hysteresis

When the difference between the MV and the valve opening is within the value that is set for the Position Proportional Dead Band, opening or closing the valve will be stopped to prevent the valve from deteriorating. The Open/Close Hysteresis parameter is used to offset the ON and OFF points when opening and closing the valve. Refer to the following figure for details.



PV Dead Band

When the PV enters the PV dead band, any unnecessary output is stopped to prevent the valve from deteriorating.



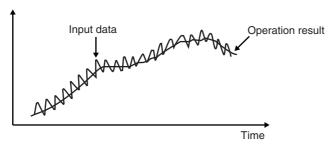
Manual MV, MV at Stop, and MV at PV Error

Refer to the following sections. Manual PV: 5-12-1 Manual MV

MV at Stop and MV at PV Error: 5-15 Output Adjustment Functions

FB Moving Average Count

You can set the moving average count for the FB input. The data after moving average processing is illustrated in the following figure.



Use a moving average to suppress rapid changes in the FB input.

You can use this parameter only with E5EC/E5AC-PR□-8□□ version 2.2 (factory shipments in August 2014 or later).

Related Displays and Parameters

Parameter name	Display	Set (moni	itor) values	Default	Level	
Close/Floating	ELFL	FLOT: Floating control CLOS: Close control		FLOT		
Valve Opening Monitor	VM5L	MEAS: Measu	ired opening	MEAS		
Selection*1*2		ESTM: Estima	ited opening		Initial Setting	
Motor Calibration	CALL	OFF ON ERR (Error occurred.)		OFF	Level	
Travel Time	MāŁ	0 to 999 (s)		30		
Valve Opening Monitor	V - M	Measured opening	Normal operation: -10.0% to 110.0% Error:*3		Operation Level	
		Estimated opening*1	0.0% to 100.0%			
Position Proportional Dead	dЬ	Close control:	0.1% to 10.0%	4.0		
Band		Floating control: 0.1% to 10.0%		2.0	Adjustment Level	
Open/Close Hysteresis	ōE −H	0.1 to 20.0		0.8		
FB Moving Average Count	PMRI/	OFF, 2, 4, 8, 16, or 32		16	Advanced	
PV Dead Band	P-db	0 to 9999		0.0	Function Setting Level	

^{*1} You can use this selection only with the E5EC-PR -8 or E5AC-PR -8 . (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)

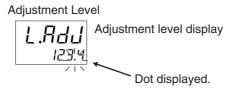
^{*2} You can use this setting only for floating control.

^{*3} Motor calibration not performed, potentiometer not connected, or potentiometer input error.

5-22 Logic Operations 000

5-22-1 The Logic Operation Function (CX-Thermo)

- The logic operation function logically calculates as 1 or 0 the Digital Controller status (alarms, SP ramp, RUN/STOP, auto/manual, etc.) and the external event input status, and outputs the results to work bits. The work bit status can be output to auxiliary or control outputs, and operating status can be switched according to the work bit status.
- Work bit logic operation can be set from 1 to 8. Set them to *No operation (Always OFF)* (the default) when the work bits are not to be used.
- When logic operations are being used, a dot will be displayed between the first two digits on the No. 2 display of the Adjustment Level display



Note: The four numeric digits to identify the product code are displayed in the No. 2 display.

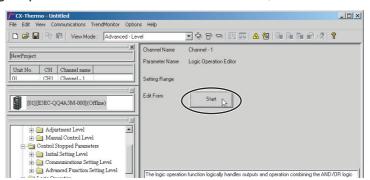
5-22-2 Using Logic Operations

Logic operations are set using the CX-Thermo.

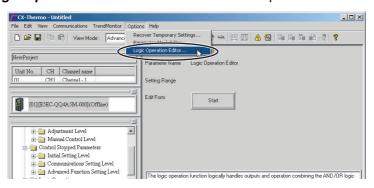
Starting Logic Operations

There are two ways to start logic operations.

• Select Logic Operation Editor from the CX-Thermo tree, and click the Start Button.

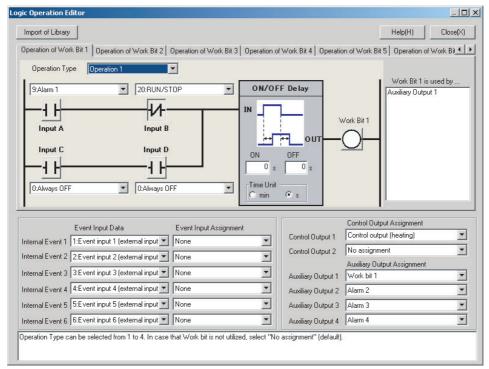


• Select Logic Operation Editor from the CX-Thermo Options Menu.



Making the Settings

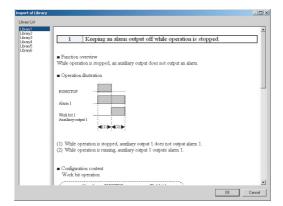
The following display will appear on the Logic Operation Editor Setting Window. Set each of the parameters.



(1) Displaying the Library Import Dialog Box

Logic operation samples for specific cases are set in the library in advance. Examples of settings for specific cases are loaded by selecting them from the library list and clicking the OK Button.

Example: Selecting Library 1



(2) Switching Work Bit Operations

Select the work bit logic operations from the Operation of Work Bit 1 to Operation of Work Bit 8 Tab Pages.

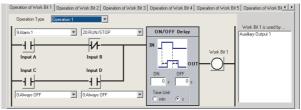
(3) Selecting the Operation Type

From one to four operations are supported. If work bits are not to be used, set them to *No operation (Always OFF)* (the default).

 No operation (AlwaysOFF)

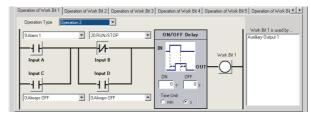


• Operation 1



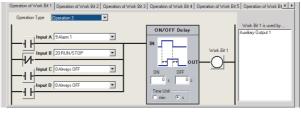
(A and B) or (C and D) When conditions A and B or conditions C and D are satisfied

• Operation 2



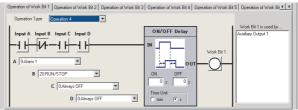
(A or C) and (B or D) When condition A or C and condition B or D are satisfied

• Operation 3



A or B or C or D When condition A, B, C or D is satisfied

Operation 4



A and B and C and D When conditions A, B, C and D are all satisfied

(4) Selecting Input Assignments

Select the input assignment for the work bit logic operation from the following settings.

Parameter name	Setting range
	0. Always OFF
	1. Always ON
	2. ON for one cycle when power is turned
	ON
	3. Event input 1 (external input)*
	4. Event input 2 (external input)*
	5. Event input 3 (external input)*
	6. Event input 4 (external input)*
	7. Event input 5 (external input)*
	8. Event input 6 (external input)*
	9. Alarm 1
	10. Alarm 2
	11. Alarm 3
	12. Alarm 4
	13. Control output (heating)
	14. Control output (cooling)
	15. Input error
	16. RSP input error
Work Bit 1 Input Assignment A	17. HB (heater burnout) alarm
Work Die 1 inpartiongriment /	18. HS alarm
	19. Auto/Manual
	20. RUN/STOP
	21. RSP/LSP
	22. Program start
	23. AT Execute/Cancel
	24. SP ramp operating
	25. Multi-SP No. switching bit 0
	26. Multi-SP No. switching bit 1
	27. Multi-SP No. switching bit 2
	28. Program end output
	29. Work bit 1
	30. Work bit 2
	31. Work bit 3
	32. Work bit 4
	33. Work bit 5
	34. Work bit 6
	35. Work bit 7
	36. Work bit 8
Work Bit 1 Input Assignment B	Same as for work bit 1 input assignment A
Work Bit 1 Input Assignment C	Same as for work bit 1 input assignment A
Work Bit 1 Input Assignment D	Same as for work bit 1 input assignment A
to	to
Work Bit 8 Input Assignment D	Same as for work bit 1 input assignment A

The event inputs that can be used depend on the Digital Controller model.

(5) Switching between Normally Open and Normally Closed for Inputs A to D

Click the condition to switch between normally open and normally closed inputs A to D.

Normally	Normally
open	closed
4 -	+

(6) Switching between Normally Open and Normally Closed for Work Bits

Click the condition to switch between normally open and normally closed work bits.

Normally open	Normally closed	
-	- ∅-	

(7) Setting ON Delay Times

When an input with ON delay turns ON, the output will turn ON after the set delay time has elapsed. The setting range is 0 to 9,999. The default is 0 (disabled).

(8) Setting OFF Delay Times

When an input with OFF delay turns OFF, the output will turn OFF after the set delay time has elapsed. The setting range is 0 to 9,999. The default is 0 (disabled).

(9) Switching ON/OFF Delay Time Unit

Select either seconds or minutes for the ON/OFF delay time unit. The default is seconds. If the Work Bit * Operation Type is set to anything but OFF, the Work Bit * ON Delay and Work Bit * OFF Delay will be displayed in the Adjustment Level and the settings can be changed with key operations.

(10) Changing Event Input Data

Select the event input conditions from the following setting ranges.

Parameter name	Setting range
	Not assigned.
	Event input 1 (external input)
	2. Event input 2 (external input)
	3. Event input 3 (external input)
	4. Event input 4 (external input)
	5. Event input 5 (external input)
	6. Event input 6 (external input)
Internal event 1	7. Work bit 1
	8. Work bit 2
	9. Work bit 3
	10. Work bit 4
	11. Work bit 5
	12. Work bit 6
	13. Work bit 7
	14. Work bit 8
Internal event 2	Same as for Event Input Data 1.
Internal event 3	Same as for Event Input Data 1.
Internal event 4	Same as for Event Input Data 1.
Internal event 5	Same as for Event Input Data 1.
Internal event 6	Same as for Event Input Data 1.

Note: The internal event data can be changed from the default setting even if there is no event input terminal (external input). By changing the default setting, the event input assignment parameters will be displayed at the Digital Controller display and can be set from the Digital Controller.

(11) Changing the Event Input Assignment Function

Select the setting for the internal event assignment.

When a work bit is selected as event input data, Communications Write Enable/Disable cannot be assigned to an event input.

(12) Changing Control Output and Auxiliary Output Settings

Control output and auxiliary output assignments can be changed. The items that can be changed depend on the Digital Controller model. For details, refer to 4-6 Setting Output Specifications.

Assigning a work bit to either a control output or to an auxiliary output is also considered to be the same as assigning an alarm. For example, if work bit 1 is set for the Auxiliary Output 1 Assignment parameter, then alarms 1 to 4 have been assigned.

(13) Displaying Parameter Guides

A description of the parameters can be displayed.

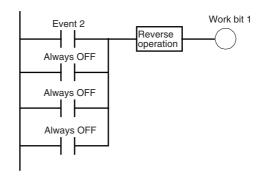
(14) Displaying the Work Bit Use Destinations

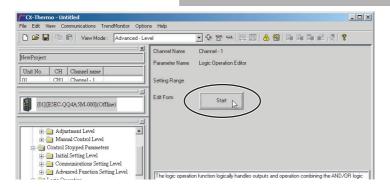
Display a list of destinations where the work bits are used.

Operating Procedure

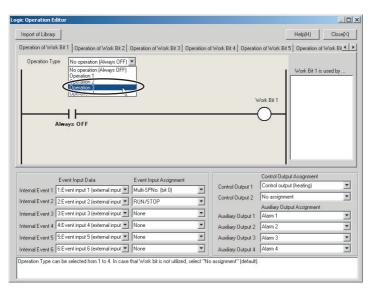
This procedure uses event input 2 to change to RUN or STOP.

Event input 2 ON: RUN Event input 2 OFF: STOP

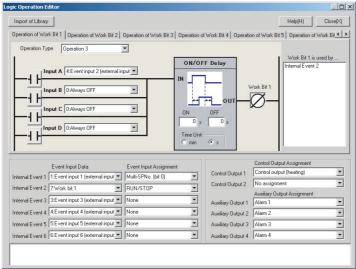




1. Select Logic Operation Editor from the CX-Thermo tree, and click the Start Button.



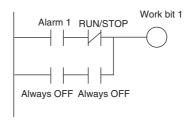
 The Logic Operation Editor will be displayed. Confirm that the screen for work bit 1 is displayed, and select Operation 3 from the Operation Type Field.

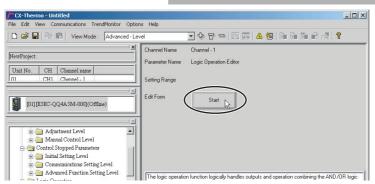


- 3. Set the operation by selecting one of the following:
 Work bit 1 input assignment A = 4: Event input 2
 (external input)
 Work bit 1 input assignment B = 0: Always OFF
 Work bit 1 input assignment C = 0: Always OFF
 Work bit 1 input assignment D = 0: Always OFF
- Invert work bit 1. Click (Normally open) to change it to (Normally closed).
- Assign RUN/STOP to event input 2. Set "5: Work bit 1" for the event input data for event input 2, and set "RUN/STOP" for the assignment function.
- Closing the Logic Operation
 Editor Dialog Box
 Click the Close Button.
 This completes the
 procedure for setting
 parameters using the
 CX-Thermo. Transfer the
 settings to the Digital
 Controller to set the Digital
 Controller. Refer to
 CX-Thermo help for the
 procedure to transfer the
 settings.

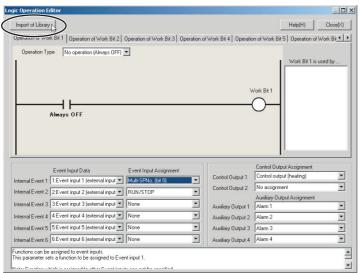
Operating Procedure

This procedure outputs alarm 1 status to auxiliary output 1 during operation (RUN). A library object is used to make the setting.

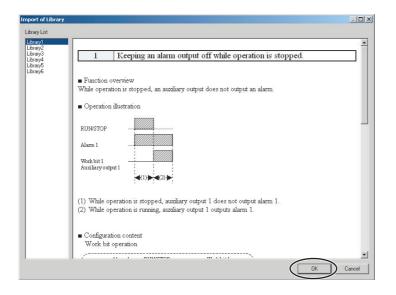


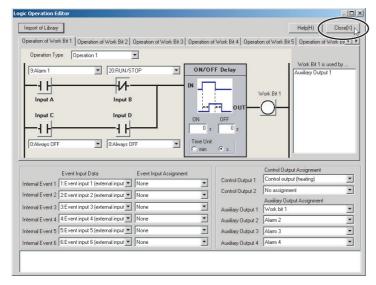


1. Select Logic Operation Editor from the CX-Thermo tree, and click the Start Button.



2. Click the Import of Library Button.





- 3. Select Library 1 from the library list, and then click the OK Button. Confirm the following settings, and then click the OK Button. Work bit 1 operation type: Operation 1 Work bit 1 input assignment A = 7: Alarm 1 Work bit 1 input assignment B = 19: Invert for RUN/STOP Work bit 1 input assignment C = 0: Always OFF Work bit 1 input assignment D = 0: Always OFF
- Closing the Logic Operation Editor Dialog Box Click the Close Button.

Auxiliary output 1 = Work bit

This completes the procedure for setting parameters using the CX-Thermo. Transfer the settings to the Digital Controller to set the Digital Controller. Refer to CX-Thermo help for the procedure to transfer the settings.

5-22-3 Using Status Display Messages

You can use a status display message only with the E5DC, E5DC-B* or E5GC.

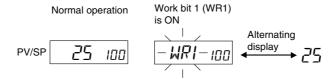
* The E5DC must be manufactured in July 2014 or later (version 2.2).

You can display status display messages using the work bits. While one or more of the work bits (WR1 to WR8) is ON, the message for the highest bit number that is ON is alternately displayed with the corresponding bit number.

Status display messages are displayed when WR (status display message) is selected for the PV status display or SV status display function (Advanced Function Setting Level).

You can set status display messages with CX-Thermo version 4.62 or higher.

Example: When Work Bit 1 (WR1) Is ON for the PV Status Display Function (Registered Message: WR1)

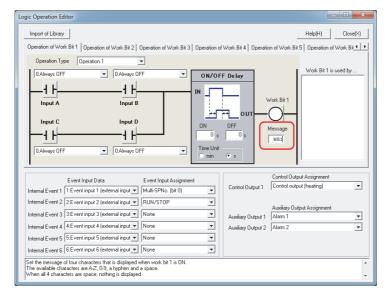


Status Display Message Specifications

- You can use up to four of the following characters: A to Z, 0 to 9, spaces, and hyphens.
- · If nothing is entered in the message field or if all spaces are set, the message is disabled and nothing is displayed.

Operating Procedure

On the Logic Operator Editor, enter the message in the input field for the work bit as shown in the following figure.



The default message settings for the work bits are given in the following table.

Name	Default*
Work Bit 1 Status Display Message	_WR1
Work Bit 2 Status Display Message	_WR2
Work Bit 3 Status Display Message	_WR3
Work Bit 4 Status Display Message	_WR4
Work Bit 5 Status Display Message	_WR5
Work Bit 6 Status Display Message	_WR6
Work Bit 7 Status Display Message	_WR7
Work Bit 8 Status Display Message	_WR8

Underbars in the default messages indicate spaces.



Additional Information

Status Display Message Priority

The status display message for the highest bit number that is ON is given priority.

5-23 Initializing Settings

You can set the Parameter Initialization parameter (Advanced Function Setting Level) to FREL (initialize parameters to defaults given in the manual) to return all of the parameter settings to the factory defaults.

The default is OFF.

Operating Procedure

Moving to the Advanced Function Setting Level

- * Refer to 4-1-4 Moving to the Advanced Function Setting Level for the procedure to enter the Advanced Function Setting Level if you have not done so before.
- Press the Key for at least 3 seconds in the Operation Level. Operation Level The No. 1 display will flash when the key is pressed for 1 s or The display will change from the Operation Level to the Initial Setting Level. Initial Setting Level display the Move to Advanced Function Setting Level parame-Input Type ter. RMal (Move to Advanced Function Setting Level) will be displayed. Initial Setting Level **3** Press the ♠ and ♥ Keys at the Move to Advanced Function Move to Setting Level parameter and then enter - 169. AM5/ Advanced You can hold the ♠ or ❤ Key to increment or decrement the set value Function quickly. Setting Level Move to Advanced Press Key once or wait for 2 seconds or longer without AMal/ **Function Setting** doing anything. You will move to the Advanced Function Set-Level - 169 -169: Password ting Level and init (Parameter Initialization) will be displayed. to move to Advanced **Function Setting** Level Parameter Initialization Display the first parameter, <code>INLE</code> (Parameter Initialization) in Advanced Function Setting the Advanced Function Setting Level. Level ᆫNᆫᆫ Parameter Initialization ōFF. Press the ♠ or ❤ Key to select FALL (initialize to the factory settings described in the manual). The parameter settings will FREE be initialized.
- * The parameter mask settings are not initialized when other settings are initialized. Refer to *Parameter Mask Enable* on page 6-6.

The default is off.

Parameters

6-1	Conventions Used in this Section	6-2
6-2	Protect Level	6-3
6-3	Operation Level	6-7
6-4	Adjustment Level 6	-18
6-5	Monitor/Setting Item Level 6	-38
6-6	Manual Control Level	-39
6-7	Initial Setting Level 6	-41
6-8	Advanced Function Setting Level 6	-61
6-9	Communications Setting Level	-96

Conventions Used in this Section 6-1

Meanings of Icons Used in this Section



Describes the functions of the parameter.



Describes the setting range and default of the parameter.



Used to indicate parameters used only for monitoring.



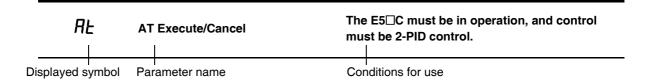
Describes the parameter settings, such as those for Operation Commands, and procedures.



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

About Related Parameter Displays

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



The Order of Parameters in This Section

Parameters are described level by level.

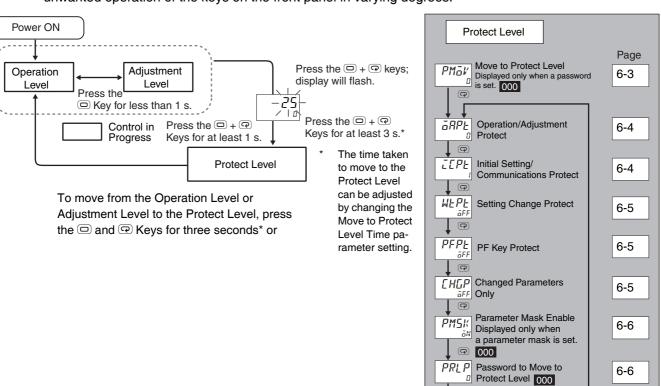
The first page of each level describes the parameters in the level and the procedure to switch between parameters.

Alarms

It will be specified in this section when alarms are set for the Control Output 1 or 2 Assignment parameters, or for the Auxiliary Output 1 to 4 Assignment parameters. For example, when alarm 1 is set for the Control Output 1 Assignment parameter, it will be specified that alarm 1 is assigned. Assigning a work bit to either control output 1 or 2 or to auxiliary output 1 to 4 is also considered to be the same as assigning an alarm. For example, if work bit 1 is set for the Auxiliary Output 1 Assignment parameter, then alarms 1 to 4 have been assigned.

6-2 Protect Level

Four levels of protection are provided on the E5 \square C, operation/adjustment protect, initial setting/communications protect, setting change protect, and PF key protect. These protect levels prevent unwanted operation of the keys on the front panel in varying degrees.



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

PMaV

Move to Protect Level 000

The Password to Move to Protect Level password must not be set to 0.

The password to move to the Protect Level is entered for this parameter.



 If the correct password is entered, the Operation/Adjustment Protect parameter is displayed.



Related Parameters

Password to Move to Protect Level (Protect Level): page 6-6

5RPL **Operation/Adjustment Protect**

Initial Setting/Communications I[PŁ **Protect**

These parameters specify the range of parameters to be protected.



Operation/Adjustment Protect



Level		Set value			
	Levei	0 (default)	1	2	3
	PV	Can be dis- played	Can be dis- played	Can be dis- played	Can be dis- played
Operation	PV/SP	Can be dis- played and changed	Can be dis- played and changed	Can be dis- played and changed	Can be dis- played
Level	Others	Can be dis- played and changed	Can be dis- played and changed	Cannot be displayed and moving to other lev- els is not possible	Cannot be displayed and moving to other lev- els is not possible
Adjustment Level		Can be dis- played and changed	Cannot be displayed and moving to other lev- els is not possible	Cannot be displayed and moving to other lev- els is not possible	Cannot be displayed and moving to other lev- els is not possible

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

Initial Setting/Communications Protect

This protect level restricts movement to the Initial Setting Level, Communications Setting Level, and Advanced Function Setting Level.

Set value	Initial setting level	Communications setting level	Advanced function setting level	
0	Possible to reach	Possible to reach	Possible to reach	
1 (default)	Possible to reach	Possible to reach	Not possible to reach	
2	Not possible to reach	Not possible to reach	Not possible to reach	

WEPE Setting Change Protect

The Event Input Assignment 1 to Event Input Assignment 6 parameters must not be set to enable/disable setting changes.

Changes to settings using key operations are restricted.



Change Setting Protect

This parameter is not displayed if the Event Input Assignment 1 to Event Input Assignment 6 parameters are set to enable/disable setting changes.



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

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

PFPL PF Key Protect



PF Key Protect

This parameter enables and disables PF Key operation.



Set value	Description	
OFF (default)	PF Key enabled	
ON	PF Key disabled (Operation as a function key is prohibited.)	

[HIP Changed Parameters Only



This parameter allows you to display only the parameters that have been changed from their default settings.



Setting range	Default
āN: Enabled, āFF: Disabled	ōFF

* If the setting of a parameter is changed back to its default setting, it will no longer be displayed. To display it again, set the Changed Parameters Only parameter to OFF.

PM5K

Parameter Mask Enable 000

This parameter is displayed only when a parameter mask has been set from the Setup Tool.



- This parameter turns the parameter mask function ON and OFF.
- The parameter mask settings are not initialized when other settings are initialized. Use the Setup Tool to initialize the parameter mask settings.



Setting range	Default
ōN: Enabled, ōFF: Disabled	ōΝ

A parameter mask can be used to hide the displays of parameters that are not needed. The parameter mask function is provided by the Setup Tool. Setup Tool: CX-Thermo (EST2-2C-MV4)

PRLP

Password to Move to Protect Level 000

This parameter is used to set the password to move to the Protect Level.



 To prevent setting the password incorrectly, the

 and □ Keys or ♥ and □ Keys must be pressed simultaneously to set the password.



Setting range	Default
-1999 to 9999	0

Set this parameter to 0 when no password is to be set.



Related Parameters

Move to Protect Level (Protect Level): Page 6-3

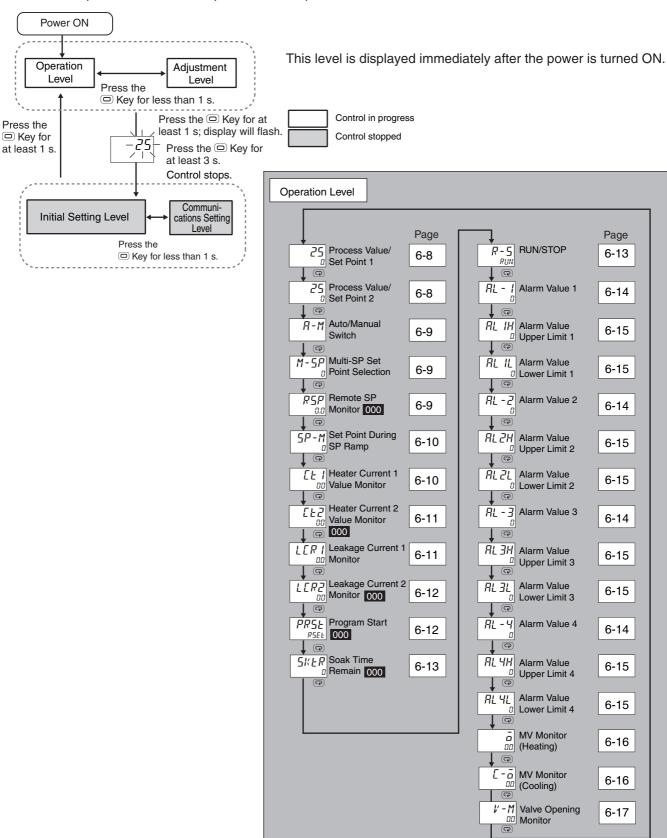


Precautions for Correct Use

Protection cannot be cleared or changed without the password. Be careful not to forget it. If you forget the password, contact your OMRON sales representative.

6-3 Operation Level

Display this level to perform control operations on the E5 \square C. You can set alarm values, monitor the manipulated variable, and perform other operations in this level.



Process Value/Set Point 1 PV/SP No. 1 Display Selection must not be set to 0.

Process Value/Set Point 2 PV/SP No. 2 Display Selection must not be set to 0.



The following table shows the contents of the No. 1, 2, and 3 displays, according to the setting of the PV/SP Display Screen Selection parameter.



Set value	No. 1 display	No. 2 display	No. 3 display (E5EC, E5EC-B, and E5AC only)
0	Nothing is displayed.	Nothing is displayed.	Nothing is displayed.
1	Process value	Set point	Nothing is displayed.
2	Process value	Nothing is displayed.	Nothing is displayed.
3	Set point	SP (character display)	Nothing is displayed.
4	Process value	Set point	MV (valve opening for Position-proportional Models)
5	Process value	Set point	Multi-SP No.
6	Process value	Set point	Soak time remain 000
7	Process value	Set point	Internal set point (ramp SP)
8	Process value	Set point	Alarm value 1 ^{*1}

The set value of the Alarm Value 1 parameter is displayed even if it is not valid due to the setting of the Alarm 1 Type parameter.

	Monitor range	Unit
Process value	Temperature input: The specified range for the specified sensor. Analog input: Scaling lower limit –5% FS to Scaling upper limit +5% FS	EU

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

For a temperature input, the decimal point position depends on the currently selected sensor, and for an analog input it depends on the Decimal Point parameter setting.

PV/SP Display Selections

Parameter	Default
PV/SP No. 1 Display Selection	4*
PV/SP No. 2 Display Selection	0

The default is 1 for models other than the E5\(\times C-\(\tilde{\to}\)-0\(\tilde{\to}\).



Related Parameters

PV/SP Display Selection (Advanced Function Setting Level): Page 6-92

Auto/Manual Switch

The Event Input Assignment 1 to Event Input Assignment 6 parameters must not be set to Auto/Manual and the Auto/Manual Select Addition parameter must be set to ON. The control must be set to 2-PID control.



- This parameter switches the Digital Controller between Automatic and Manual Modes.
- If the Key is pressed for at least 3 seconds when the Auto/Manual Switch parameter is displayed, the Manual Mode will be entered and the manual control level will be displayed.
- This parameter will not be displayed if an event input is set to "MANU" (auto/manual).



Related Parameters

PID ON/OFF (Initial Setting Level): Page 6-45
Auto/Manual Select Addition (Advanced Function Setting Level): Page 6-75

M-5P Multi-SP Set Point Selection (Set Points 0 to 7)

The Number of Multi-SP Points parameter must not be set to OFF and the Event Input Assignment 1 to Event Input Assignment 6 parameters must not be set to "Multi-SP No. switching bit 0" to "Multi-SP No. switching bit 2."



To use the multi-SP function, preset the eight set points (SP 0 to 7) in the Adjustment Level, and then switch the set point either by operating the keys or by using external input signals (event inputs).

This parameter is used to select set points 0 to 7.

RSP Remote SP Monitor 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF

(default: ON).

The Remote SP Enable parameter must be set to ON (default: OFF).



This parameter is used to monitor the remote SP.



Monitor range	Unit
Remote SP lower limit –10% to Remote SP upper limit +10%	EU



Related Parameters

SP Mode (Adjustment Level): Page 6-21

ST (self-tuning) (Initial Setting Level): Page 6-46

Remote SP Enable (Advanced Function Setting Level): Page 6-85 Remote SP Upper Limit (Advanced Function Setting Level): Page 6-86 Remote SP Lower Limit (Advanced Function Setting Level): Page 6-86

5P-M **Set Point During SP Ramp**

The SP Ramp Set Value parameter must not be set to OFF and the SP Ramp Fall Value parameter must not be set to SAME or OFF. The ST parameter must be set to OFF.

This parameter monitors the set point during SP ramp operation.



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

This parameter is displayed when a set value is input for the SP Ramp Set Value parameter (Adjustment Level).

When not in ramp operation, the set point will be the same as the one displayed for the Process Value/Set Point parameter.



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



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 SP Ramp Set Value (Adjustment Level): Page 6-33 SP Ramp Fall Value (Adjustment Level): Page 6-33 Set Point Upper Limit (Initial Setting Level): Page 6-45 Set Point Lower Limit (Initial Setting Level): Page 6-45

$E \vdash I$ **Heater Current 1 Value Monitor**

HB and HS alarms must be supported. The HB ON/OFF parameter must be set to ON.

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



This parameter measures and displays the heater current value.

· Heater burnout is not detected 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the Heater Burnout Detection 1 parameter, the No. 1 display will flash the Heater Current 1 Value Monitor parameter.



Related Parameters

Heater Burnout Detection 1 (Adjustment Level): Page 6-22 Heater Burnout Detection 2 (Adjustment Level): Page 6-23 HB ON/OFF (Advanced Function Setting Level): Page 6-65

Error Display [!: Page A-17

[F2

Heater Current 2 Value Monitor 000

HB and HS alarms must be supported (two CTs). The HB ON/OFF parameter must be set to ON.

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



This parameter measures and displays the heater current value.

 Heater burnout is not detected 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the Heater Burnout Detection 2 parameter, the No. 1 display will flash the Heater Current 2 Value Monitor parameter.



Related Parameters

Heater Burnout Detection 1 (Adjustment Level): Page 6-22 Heater Burnout Detection 2 (Adjustment Level): Page 6-23 HB ON/OFF (Advanced Function Setting Level): Page 6-65 Error Display [\(\frac{1}{2} \)]: Page A-17

LER | Leakage Current 1 Monitor

HB and HS alarms must be supported.

The HS Alarm Use parameter must be set to ON.

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



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

• The HS alarm is not detected if the OFF 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the HS Alarm 1 parameter, the No. 1 display will flash the Leakage Current 1 Monitor parameter.



Related Parameters

HS Alarm 1 (Adjustment Level): Page 6-24 HS Alarm 2 (Adjustment Level): Page 6-25

HS Alarm Use (Advanced Function Setting Level): Page 6-77

Error Display LER I: Page A-17

L C R Z

Leakage Current 2 Monitor 000

HB and HS alarms must be supported (two CTs). The HS Alarm Use parameter must be set to ON.

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



This parameter measures and displays the heater current value.

• The HS alarm is not detected if the OFF 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the HS Alarm 2 parameter, the No. 1 display will flash the Leakage Current 2 Monitor parameter.



Related Parameters

HS Alarm 1 (Adjustment Level): Page 6-24 HS Alarm 2 (Adjustment Level): Page 6-25

HS Alarm Use (Advanced Function Setting Level): Page 6-77

Error Display L [R2: Page A-17

PR5_E Program Start 000 The Program Pattern parameter must not be set to OFF.

This parameter starts and stops the simple program function.



- The RUN/STOP status will automatically switch to RUN when this parameter is set to STRT.
- The simple program will stop when this parameter is set to RSET.
- This parameter will function as a monitor display for the start/stop status of the simple program if an event input is selected to start the simple program.



Setting range		Default
RSET	Stops the simpler program.	RSEŁ
STRT	Starts the simpler program.	



Related Parameters

Soak Time Remain (Operation Level): Page 6-13

RUN/STOP (Operation Level): Page 6-13 Soak Time (Adjustment Level): Page 6-31 Wait Band (Adjustment Level): Page 6-32

Program Pattern (Initial Setting Level): Page 6-47

Soak Time Unit (Advanced Function Setting Level): Page 6-84

5KER Soak Time Remain 000

The Program Pattern parameter must not be set to OFF.



• This parameter measures and displays the remaining time of the soak time for the simple program function.



Monitor range	Unit	
0 to 9999	min, h, or s*	

^{*} Seconds is supported only by the E5DC, E5DC-B, and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)



Related Parameters

Program Start (Operation Level): Page 6-12 Soak Time (Adjustment Level): Page 6-31 Wait Band (Adjustment Level): Page 6-32

Program Pattern (Initial Setting Level): Page 6-47

Soak Time Unit (Advanced Function Setting Level): Page 6-84

R-5 RUN/STOP

The Event Input Assignment 1 to 6 parameters must not be set to RUN/STOP.

This parameter starts and stops the control operation.



When PUN (RUN) is selected, control is started. When $5 \pm \bar{a}P$ (STOP) is selected, control is stopped. The STOP indicator will light when control is stopped.

The default is RUN.



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

AL - I **Alarm Value 1**

RL -2 Alarm Value 2

RL - 3 **Alarm Value 3**

RL - 4 **Alarm Value 4**

Alarm 1 to alarm 4 must be assigned. The Alarm 1 to 4 Type parameters must not be set to 0, 1, 4, 5, or 12.

This parameter is set to one of the input values "X" in 4-10-1 Alarm Types.



- These parameters set the alarm values for alarms 1 to 4.
- During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the Decimal Point parameter setting.

Alarms Other Than an MV Alarm

Setting range	Unit	Default
-1999 to 9999	EU	0

MV Alarms

Setting range	Unit	Default
-199.9 to 999.9	%	0.0



Related Parameters

Input Type (Initial Setting Level): Page 6-43

Scaling Upper Limit, Scaling Lower Limit (Initial Setting Level), and Decimal Point (Initial

Setting Level): Page 6-44

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

Alarm 1 to 4 Hysteresis (Initial Setting Level): Page 6-52

Standby Sequence Reset (Advanced Function Setting Level): Page 6-64

Auxiliary Output 1 to 4 Open in Alarm (Advanced Function Setting Level): Page 6-65

Alarm 1 to 4 Latch (Advanced Function Setting Level): Page 6-71

AL IH	Alarm Value Upper Limit 1	
AL 2H	Alarm Value Upper Limit 2	
AL 3H	Alarm Value Upper Limit 3	
RL 4H	Alarm Value Upper Limit 4	Alarm 1 to alarm 4 must be assigned.
AL IL	Alarm Value Lower Limit 1	The Alarm 1 to 4 Type parameter must be set to 1, 4, or 5.
AL 2L	Alarm Value Lower Limit 2	
AL 3L	Alarm Value Lower Limit 3	

These parameters individually set the alarm value upper and lower limits when a mode for setting the upper and lower limits is selected for the Alarm 1 to 4 Type parameter (Initial Setting Level).



RL YL

- These parameters set the upper and lower limits for alarms 1 to 4.
- · During temperature input, the decimal point position depends on the currently selected sensor, and during analog input it depends on the Decimal Point parameter setting.



Unit	Default
EU	0
	Unit EU



Related Parameters

Alarm Value Lower Limit 4

Input Type (Initial Setting Level): Page 6-43

Scaling Upper Limit, Scaling Lower Limit, and Decimal Point (Initial Setting Level): Page 6-44

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

Alarm 1 to 4 Hysteresis (Initial Setting Level): Page 6-52

Standby Sequence Reset (Advanced Function Setting Level): Page 6-64

Auxiliary Output 1 to 4 Open in Alarm (Advanced Function Setting Level): Page 6-65

Alarm 1 to 4 Latch (Advanced Function Setting Level): Page 6-71

ō **MV Monitor (Heating)**

The MV Display parameter must be set to ON.

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



- During standard control, the manipulated variable is monitored. During heating/cooling control, the manipulated variables on the control output (heating) is monitored.
- The default is OFF and the manipulated variable is not displayed.

\Box
Monitor

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



Related Parameters

MV Display (Advanced Function Setting Level): Page 6-70

[-5 **MV Monitor (Cooling)**

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

The MV Display parameter must be set to ON.

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



- · During heating/cooling control, the manipulated variable on the control output (cooling) is monitored.
- The default is OFF and the manipulated variable is not displayed.



Control	Monitor range	Unit
Heating/cooling	0.0 to 105.0	%



Related Parameters

Standard or Heating/Cooling (Initial Setting Level): Page 6-46 MV Display (Advanced Function Setting Level): Page 6-70

1' - M

Valve Opening Monitor

A Position-proportional Model must be used. The PV/SP Display Selection parameter must not be set to 4.



- This parameter is used to monitor the valve opening for position-proportional control.
- The valve opening can be monitored if a potentiometer is connected and motor calibration is executed.



Control	Monitor range	Unit
Position-proportional control	Measured opening: -10.0 to 110.0	%
	Estimated opening*: 0.0 to 100.0	%

You can use this selection only with the E5EC-PR or E5AC-PR -8 . (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)

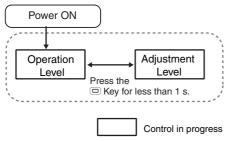


Related Parameters

Motor Calibration (Initial Setting Level): Page 6-59
PV/SP Display Selection (Advanced Function Setting Level): Page 6-92

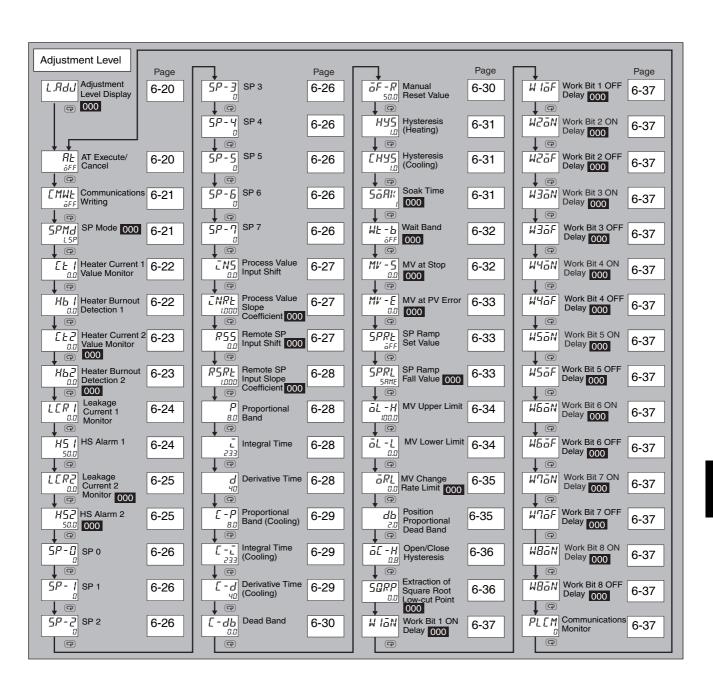
Adjustment Level 6-4

This level is for executing AT (auto-tuning) and other operations, and for set control parameters. This level provides the basic Digital Controller parameters for PID control (proportional band, integral time, derivative time) and heating/cooling control.



To move to the Adjustment Level from the Operation Level, press the Key once.

- The set points 0 to 7 in the Adjustment Level are the set values for switching the set point during multi-SP input.
- The following items are displayed for Digital Controllers with CT Inputs: Heater current monitors, Leakage current monitors, HB alarm detection, and HS alarm detection.
- Adjustment level parameters can be changed after setting the Operation/Adjustment Protect parameter to 0. Displays changing levels are not possible Operation/Adjustment Protect parameter is set to 1 to 3. Protection is set in the Protect Level.



L.RdJ Adjustment Level Display 000

This parameter is displayed after moving to the Adjustment Level. The four numeric digits to identify the product code are displayed in the No. 2 display.

When a logic operation is set, a period "." will be displayed on the No. 2. display.



 This parameter indicates that the Adjustment Level has been entered. (The Adjustment Level parameter will not be displayed again even if the

Rey is pressed in the Adjustment Level to scroll through the parameters.)

RŁ AT Execute/Cancel

The RUN/STOP parameter must be set to RUN (default: RUN), control must be 2-PID control (default: ON/OFF), and the Event Input Assignment parameters must not be set to AT Execute/Cancel.

This parameter executes auto-tuning (AT).



- The MV is forcibly increased and decreased around the set point to find the characteristics of the control object. From the results, the PID constants are automatically set in the Proportional Band (P), Integral Time (I), and Derivative Time (D) parameters.
- Both 100% AT and 40% AT are supported for AT. Only 100% autotuning is supported for heating and cooling control or for floating position-proportional control.
- For heating/cooling control, select the tuning methods that is suitable for the cooling control characteristics in the Heating/Cooling Tuning Method parameter.
- If autotuning is performed with the default settings, the cooling PID constants (i.e., Proportional Band (Cooling), Integral Time (Cooling), and Derivative Time (Cooling) parameters) have the same values as the heating PID constants.
- This parameter will not be displayed when either 100% or 40% AT execute/cancel is set to be executed using an event input.



Setting range		Default
OFF:	AT Cancel	
AT-2:	100%AT Execute	OFF
AT-1:	40%AT Execute	

- This parameter is normally $\bar{a}FF$. Press the A Key and select $RE \bar{c}$ or RE I to execute AT. AT cannot be executed when control is stopped or during ON/OFF control.
- The TUNE indicator will light during autotuning.
- When AT execution ends, the parameter setting automatically returns to αFF.



Related Parameters

RUN/STOP (Operation Level): Page 6-13

Proportional Band, Integral Time, and Derivative Time (Adjustment Level): Page 6-28 Proportional Band (Cooling), Integral Time (Cooling), and Derivative Time (Cooling) (Adjustment Level): Page 6-29

PID ON/OFF (Initial Setting Level): Page 6-45

Heating/Cooling Tuning Method (Advanced Function Setting Level): Page 6-89

Close/Floating (Initial Setting Level): Page 6-59

EMWH Communications Writing

Communications must be supported. The Event Input Assignment 1 to Event Input Assignment 6 parameters must not be set to enable/disable communications writing.



- This parameter enables/disables writing of parameters to the E5□C from the host (personal computer) using communications.
- This parameter is not displayed if the Event Input Assignment 1 to Event Input Assignment 6 parameters are set to enable/disable communications writing.



Setting range		Default
ON:	Writing enabled	OFF
OFF:	Writing disabled	OFF

 The Communications Writing parameter will be automatically turned ON if the Protocol Setting parameter is set to component communications, Host Link (FINS) communications, or the MC Protocol (format 4).



Related Parameters

Communications Setting Level: Page 6-96 Protocol Setting, Communications Unit No., Communications Baud Rate, Communications Data Length, Communications Parity, and Communications Stop Bits

5PMd SP Mode 000 There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF (default: ON).

The Remote SP Enable parameter must be set to ON (default: OFF).

The Event Input Assignment parameters must not be set to SP Mode Switch.



This parameter sets the SP mode. In Local SP Mode, the local SP that is set inside the Digital Controller is used as the SP. In Remote SP Mode, the remote SP that is specified with an external signal (e.g., 4 to 20 mA) is used as the SP.

Setting range	Default
LSP: Local SP and RSP: Remote SP	LSP



Related Parameters

ST (self-tuning) (Initial Setting Level): Page 6-46 Remote SP Enable (Advanced Function Setting Level): Page 6-85

$\Gamma \vdash I$ **Heater Current 1 Value Monitor**

HB and HS alarms must be supported. The HB ON/OFF parameter must be set to ON.

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



This parameter measures and displays the heater current value.

 Heater burnout is not detected 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- . If an alarm is output for the Heater Burnout Detection 1 parameter, the No. 1 display will flash the Heater Current 1 Value Monitor parameter.



Related Parameters

Heater Burnout Detection 1 (Adjustment Level): Page 6-22 Heater Burnout Detection 2 (Adjustment Level): Page 6-23 HB ON/OFF (Advanced Function Setting Level): Page 6-65 Error Displays [L 1: Page A-17

Hb 1 **Heater Burnout Detection 1**

HB and HS alarms must be supported. The HB ON/OFF parameter must be set to ON.

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



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



Setting range	Unit	Default
0.0 to 50.0	Α	0.0



Related Parameters

Heater Current 1 Value Monitor (Adjustment Level): Page 6-22 Heater Burnout Detection (Advanced Function Setting Level): Page 6-65 Heater Burnout Latch (Advanced Function Setting Level): Page 6-66 Heater Burnout Hysteresis (Advanced Function Setting Level): Page 6-66

[F2

Heater Current 2 Value Monitor 000

HB and HS alarms must be supported (two CTs). The HB ON/OFF parameter must be set to ON.

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



This parameter measures and displays the heater current value.

 Heater burnout is not detected 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the Heater Burnout Detection 2 parameter, the No. 1 display will flash the Heater Current 2 Value Monitor parameter.



Related Parameters

Heater Burnout Detection 1 (Adjustment Level): Page 6-22 Heater Burnout Detection 2 (Adjustment Level): Page 6-23 Error Displays [12]: Page A-17

HhP

Heater Burnout Detection 2 000

HB and HS alarms must be supported (two CTs). The HB ON/OFF parameter must be set to ON.

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



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



Setting range	Unit	Default
0.0 to 50.0	Α	0.0



Related Parameters

Heater Current 2 Value Monitor (Adjustment Level): Page 6-23 HB ON/OFF (Advanced Function Setting Level): Page 6-65

Heater Burnout Latch (Advanced Function Setting Level): Page 6-66 Heater Burnout Hysteresis (Advanced Function Setting Level): Page 6-66

LERI **Leakage Current 1 Monitor**

HB and HS alarms must be supported. The HS Alarm Use parameter must be set to ON.

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



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

 The HS alarm is not detected if the OFF 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the HS Alarm 1 parameter, the No. 1 display will flash the Leakage Current 1 Monitor parameter.



Related Parameters

HS Alarm 1 (Adjustment Level): Page 6-24 HS Alarm 2 (Adjustment Level): Page 6-25

HS Alarm Use (Advanced Function Setting Level): Page 6-77

Error Displays LER I: Page A-17

H5 1 HS Alarm 1

HB and HS alarms must be supported. The HS Alarm Use parameter must be set to ON.

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



- · An HS alarm is output when the leakage current value exceeds the setting of this parameter.
- When the set value is 50.0, the HS alarm output is turned OFF. When the set value is 0.0, the HS alarm output is turned ON.



Setting range	Unit	Default
0.0 to 50.0	Α	50.0



Related Parameters

Leakage Current 1 Monitor (Adjustment Level): Page 6-24 HS Alarm (Advanced Function Setting Level): Page 6-77 HS Alarm Latch (Advanced Function Setting Level): Page 6-78 HS Alarm Hysteresis (Advanced Function Setting Level): Page 6-78 LCR2

Leakage Current 2 Monitor 000

HB and HS alarms must be supported (two CTs). The HS Alarm Use parameter must be set to ON.

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



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

• The HS alarm is not detected if the OFF 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).



Monitor range	Unit
0.0 to 55.0	Α

- FFFF is displayed when 55.0 A is exceeded.
- If an alarm is output for the HS Alarm 2 parameter, the No. 1 display will flash the Leakage Current 2 Monitor parameter.



Related Parameters

HS Alarm 1 (Adjustment Level): Page 6-24 HS Alarm 2 (Adjustment Level): Page 6-25

HS Alarm Use (Advanced Function Setting Level): Page 6-77

Error Displays *L ER2*: Page A-17

HS Alarm 2 000

HB and HS alarms must be supported (two CTs). The HS Alarm Use parameter must be set to ON.

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



- An HS alarm is output when the leakage current value exceeds the setting of this parameter.
- When the set value is 50.0, the HS alarm output is turned OFF. When the set value is 0.0, the HS alarm output is turned ON.



Setting range	Unit	Default
0.0 to 50.0	Α	50.0



Related Parameters

Leakage Current 2 Monitor (Adjustment Level): Page 6-25

HS Alarm Use (Advanced Function Setting Level): Page 6-77 HS Alarm Latch (Advanced Function Setting Level): Page 6-78

HS Alarm Hysteresis (Advanced Function Setting Level): Page 6-78

5P-0	SP 0	
5P- I	SP 1	
5P-2	SP 2	
5P-3	SP 3	The Number of Multi-SP Points parameter must be set to 2 to 8 and the Event Input 1 Assignment to
5P-4	SP 4	Event Input 6 Assignment parameters must not be set to "Multi-SP No. switching bit 0" to "Multi-SP No. switching bit 2."
5P-5	SP 5	
5P-6	SP 6	
5P-7	SP 7	

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



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

- When the set point has been changed, the set value of the set point (0 to 7) selected by the multi-SP inputs is also changed to the same value.
- The decimal point position depends on the selected sensor. During analog input, it depends on the Decimal Point parameter setting.



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



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8

Input Type (Initial Setting Level): Page 6-43

Event Input Assignment (Initial Setting Level): Page 6-57

Number of Multi-SP Points (Advanced Function Setting Level): Page 6-63

Process Value Input Shift



Sometimes an error occurs between the process value and the actual temperature. To off-set this, a compensated value can be obtained by adding an input shift value to the input. The compensated value is displayed as the process value and used for control. The entire input range is shifted by a fixed rate. If the input shift value is set to -1° C, control will be performed for a value 1° C lower than the measured temperature.



Setting range	Unit	Default
Temperature input: -199.9 to 999.9	°C or °F	0.0
Analog input: -1,999 to 9,999*	EU	0

^{*} The decimal point position depends on the Decimal Point parameter setting.



Related Parameters

Input Type (Initial Setting Level): Page 6-43

Process Value Slope Coefficient 000



This parameter sets a factor to apply to the input to compensate the process value. The resulting value is displayed as the process value and used in control.



Setting range	Default
0.001 to 9.999	1.000

Remote SP Input Shift 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF

(default: ON).

The Remote SP Enable parameter must be set to

ON (default: OFF).



This parameter sets a compensation value to add to the remote SP input to compensate it. The compensated value is displayed as the process value and used in control.



Setting range	Unit	Default
Temperature input: -199.9 to 999.9	°C or °F	0.0
Analog input: -1,999 to 9,999	EU	0

^{*} The decimal point position depends on the Decimal Point parameter setting.



Related Parameters

Input Type (Initial Setting Level): Page 6-43 ST (self-tuning) (Initial Setting Level): Page 6-46

Remote SP Enable (Advanced Function Setting Level): Page 6-85

RSRL

Remote SP Input Slope Coefficient 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF

(default: ON).

The Remote SP Enable parameter must be set to

ON (default: OFF).



This parameter sets a factor to apply to the remote SP input to compensate it. The resulting value is displayed as the remote SP input value and used in control.



Setting range	Default
0.001 to 9.999	1.000



Related Parameters

ST (self-tuning) (Initial Setting Level): Page 6-46

Remote SP Enable (Advanced Function Setting Level): Page 6-85

Р **Proportional Band**

Integral Time

The control must be set to 2-PID control.

Ы **Derivative Time**

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



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

action:

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

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



Parameter	Setting range			Unit	Default
Proportional	Temperature input		0.1 to 999.9	°C or °F	8.0
Band	Analog input			%FS	10.0
Integral Time *	Integral/ Derivative Time Unit of	Standard, heating/cooling, or close position-proportional control	0 to 9999	Seconds	233
	1 s	Floating position-proportional control	1 to 9999		
	Integral/ Derivative Time Unit of	Standard, heating/cooling, or close position-proportional control	0.0 to 999.9	Seconds	233.0
	0.1 s	Floating position-proportional control	0.1 to 999.9		
Derivative	Integral/Deriv	vative Time Unit of 1 s	0 to 9999	Seconds	40
Time *	Integral/Deriv	ative Time Unit of 0.1 s	0.0 to 999.9	Seconds	40.0

^{*} The unit is determined by the setting of the Integral/Derivative Time Unit parameter. The Proportional Band, Integral Time, and Derivative Time parameters are initialized if the Integral/Derivative Time Unit parameter is changed.



Related Parameters

AT Execute/Cancel (Adjustment Level): Page 6-20 Integral/Derivative Time Unit (Advanced Function Setting Level): Page 6-67

- [-P Proportional Band (Cooling)
- [L Integral Time (Cooling)

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



These parameters set the PID constants for cooling control. These parameters are automatically set according to the Heating/Cooling Tuning Method parameter when AT or ST is executed.



Parameter	Setting range		Unit	Default
Proportional Band	Temperature input	0.1 to 999.9	°C or °F	8.0
(Cooling)	Analog input		%FS	10.0
Integral Time (Cooling) *	Integral/Derivative Time Unit of 1 s	0 to 9999	Seconds	233
	Integral/Derivative Time Unit of 0.1 s	0.0 to 999.9	Seconds	233.0
Derivative Time (Cooling)*	Integral/Derivative Time Unit of 1 s	0 to 9999	Seconds	40
	Integral/Derivative Time Unit of 0.1 s	0.0 to 999.9	Seconds	40.0

^{*} The unit is determined by the setting of the Integral/Derivative Time Unit parameter. The Proportional Band (Cooling), Integral Time (Cooling), and Derivative Time (Cooling) parameters are initialized if the Integral/Derivative Time Unit parameter is changed.



Related Parameters

AT Execute/Cancel (Adjustment Level): Page 6-20 Integral/Derivative Time Unit (Advanced Function Setting Level): Page 6-67

[-дь **Dead Band**

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

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



• This parameter sets an area in which the control output is 0 centering around the set point for a heating/cooling control.



Setting range		Unit	Default
Temperature input	-199.9 to 999.9	°C or °F	0.0
Analog input	-19.99 to 99.99	%FS	0.00

5F-R **Manual Reset Value**

The control must be standard control or 2-PID control and the Integral Time parameter must be set to 0. The Integral Time parameter must also be set to 0 for a Position-proportional Model.



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



Setting range	Unit	Default
0.0 to 100.0	%	50.0



Related Parameters

Integral Time (Adjustment Level): Page 6-28 PID ON/OFF (Initial Setting Level): Page 6-45 HY5 CHY5

Hysteresis (Heating) Hysteresis (Cooling) The control must be ON/OFF control.

For the Hysteresis (Cooling) parameter, the control must be heating/cooling control.

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



- For standard control, use the Hysteresis (Heating) parameter. The Hysteresis (Cooling) parameter cannot be used.
- For heating/cooling control, the hysteresis can be set independently for heating/cooling. The Hysteresis (Heating) parameter is used for the heating side, and the Hysteresis (Cooling) parameter is used for the cooling side.



Parameter name	Setting range		Unit	Default
Hysteresis	Temperature input	0.1 to 999.9	°C or °F	1.0
(Heating)	Analog input	0.01 to 99.99	%FS	0.10
Hysteresis	Temperature input	0.1 to 999.9	°C or °F	1.0
(Cooling)	Analog input	0.01 to 99.99	%FS	0.10



Related Parameters

PID ON/OFF (Initial Setting Level): Page 6-45

Standard or Heating/Cooling (Initial Setting Level): Page 6-46

55RK Soak Time 000

The Program Pattern parameter must not be set to OFF.



• This parameter sets the time for the control operation when using the simple program function.



Setting range	Unit	Unit
1 to 9999	s,* min, or h	1

^{*} Seconds is supported only by the E5DC, E5DC-B, and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)



Related Parameters

Program Start (Operation Level): Page 6-12 Soak Time Remain (Operation Level): Page 6-13

Wait Band (Adjustment Level): Page 6-32

Program Pattern (Initial Setting Level): Page 6-47

Soak Time Unit (Advanced Function Setting Level): Page 6-84

WE-B

Wait Band 000

The Program Pattern parameter must not be set to



· This parameter sets the stable band within which the soak time is measured for the simple program function.



Setti	ng range	Unit	Unit
Temperature input	OFF or 0.1 to 999.9	°C or °F	off
Analog input	OFF or 0.01 to 99.99	%FS	



Related Parameters

Program Start (Operation Level): Page 6-12

Soak Time Remain (Operation Level): Page 6-13

Soak Time (Adjustment Level): Page 6-31

Program Pattern (Initial Setting Level): Page 6-47

Soak Time Unit (Advanced Function Setting Level): Page 6-84

MV-5 MV at Stop 000

The control must be set to 2-PID control or a Position-proportional Model must be used. The MV at Stop and Error Addition parameter must be ON.



• This parameter sets the MV to use when the RUN/STOP status changes from RUN to STOP.



Control method	Setting range	Unit	Default
Standard control	-5.0 to 105.0	%	0.0
Close position-proportional control with the Direct Setting			
of Position-proportional MV parameter set to ON			
Heating/cooling control	-105.0 to 105.0		
Floating position-proportional control or the Direct Setting	CLOS, HOLD, or	None	HOLD
of Position-proportional MV parameter set to OFF	OPEN		



Related Parameters

RUN/STOP (Operation Level): Page 6-13

MV at Stop and Error Addition (Advanced Function Setting Level): Page 6-74

Close/Floating (Initial Setting Level): Page 6-59

Direct Setting of Position Proportional MV (Advanced Function Setting Level): Page 6-88

MV - E MV at PV Error 000

The control must be set to 2-PID control or a Position-proportional Model must be used. The MV at Stop and Error Addition parameter must be ON.



This parameter sets the MV to use when an input error occurs.



Control method	Setting range	Unit	Default
Standard control	-5.0 to 105.0	%	0.0
Close position-proportional control with the Direct Setting			
of Position-proportional MV parameter set to ON			
Heating/cooling control	-105.0 to 105.0		
Floating position-proportional control or the Direct Setting	CLOS, HOLD, or	None	HOLD
of Position-proportional MV parameter set to OFF	OPEN		



Related Parameters

MV at Stop and Error Addition (Advanced Function Setting Level): Page 6-74 Close/Floating (Initial Setting Level): Page 6-59

Direct Setting of Position Proportional MV (Advanced Function Setting Level): Page 6-88

5PRE SP Ramp Set Value

The ST (self-tuning) parameter must be set to OFF (default: ON).

5PRL SP Ramp Fall Value 000



- These parameters set the rate of change during SP ramp operation. They set the maximum permissible change width per unit of time as the SP ramp set value and the SP ramp fall value. The SP ramp function is disabled if this parameter is set to OFF.
- For a temperature input, the decimal point positions of the SP ramp set value and SP ramp fall value depend on the currently selected sensor, and for an analog input they depend on the Decimal Point parameter.



Parameter	Setting range	Unit	Default
SP Ramp Set Value	OFF or 1 to 9,999	EU/s, EU/ min, EU/h	OFF
SP Ramp Fall Value	SAME (Same as SP ramp set value), OFF or 1 to 9,999	EU/s, EU/ min, EU/h	SAME



Related Parameters

ST (self-tuning) (Initial Setting Level): Page 6-46

āL -H	MV Upper Limit	The control must be set to 2-PID control.
		The ST parameter must be set to OFF.
		A Position-proportional Model must be set to close
ōL-L	MV Lower Limit	control.



• The MV Upper Limit and MV Lower Limit parameters set the upper and lower limits of the manipulated variable. When the calculated manipulated variable exceeds the upper or lower limit value, the upper or lower limit value will be the output level.



• MV Upper Limit

Control method	Setting range	Unit	Default
Standard control	MV lower limit + 0.1 to 105.0	%	100.0
Close position-proportional control			
Heating/cooling control	0.0 to 105.0		

• MV Lower Limit

The MV for the cooling control output during heating/cooling control is expressed as a negative value.

Control method	Setting range	Unit	Default
Standard control	-5.0 to MV upper limit - 0.1	%	0.0
Close position-proportional control			
Heating/cooling control	-105.0 to 0.0		-100.0



Related Parameters

PID ON/OFF (Initial Setting Level): Page 6-45

ST (Initial Setting Level): Page 6-46

Close/Floating (Initial Setting Level): Page 6-59

ōRL MV Change Rate Limit 000

2-PID control must be used.

The ST parameter must be set to OFF.



- The MV Change Rate Limit parameter sets the maximum allowable variation in the MV per second. If the change in the MV exceeds this setting, the MV will be changed by the MV change rate limit until the calculated value is reached. If the limit is set to 0.0, this function will be disabled.
- The MV Change Rate Limit parameter will not operate in the following situations.
 - In Manual Mode
 - During ST execution (Cannot be set when ST is ON.)
 - During AT execution
 - During ON/OFF control
 - While stopped (MV output during STOP)
 - During MV output when error occurs



Setting range	Unit	Default
0.0 to 100.0	%/s	0.0



Related Parameters

Proportional Band (Adjustment Level): Page 6-28

Position Proportional Dead Band A Position-proportional Model must be used.



 When the difference between the MV and the valve opening is within the value that is set for the Position Proportional Dead Band, opening or closing the valve will be stopped to prevent the valve from deteriorating.



Setting range	Unit	Default
Close control: 0.1 to 10.0	%	4.0
Floating control: 0.1 to 10.0	%	2.0



Related Parameters

Open/Close Hysteresis (Adjustment Level): Page 6-36

ā[-Н **Open/Close Hysteresis**

A Position-proportional Model must be used.



• The Open/Close Hysteresis parameter is used to shift the ON and OFF points for the open output and close output to prevent output chattering.



Setting range	Unit	Default
0.1 to 20.0	%	0.8



Related Parameters

Position Proportional Dead Band (Adjustment Level): Page 6-35

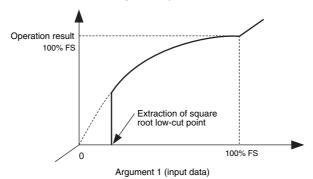
50RP

Extraction of Square Root Low-cut Point 000

The input type must be an analog input, and the **Extraction of Square Root Enable parameter must** be set to ON.



- This parameter sets the extraction of square root low-cut point used for the inputs. The data after extracting the square root is shown below.
- The low-cut point is used for extracting the square root for flowrate sensors.





Setting range	Unit	Default
0.0 to 100.0	%	0.0



Related Parameters

Extraction of Square Root Enable (Initial Setting Level): Page 6-60

W I to BoN Work Bit 1 to 8 ON Delay 000
W I to BoF Work Bit 1 to 8 OFF Delay 000

The work bit operation type must not be set to OFF.



ON Delay

When the results of a work bit logic operation is ON, the work bit is turned ON after the time specified in the parameter elapses.

• OFF Delay

When the results of a work bit logic operation is OFF, the work bit is turned OFF after the time specified in the parameter elapses.



Setting range	Unit	Default
0 to 999	Seconds	0



Related Parameters

Auxiliary Output 1 to 4 Assignment (Advanced Function Setting Level): Page 6-82

PL[M Communications Monitor

Communications must be supported.

The Protocol Setting parameter must be set to Host Link (FINS) or the MC Protocol.



- The Communications Monitor parameter displays the communications cycle time of the E5□C.
- If communications are not possible with the PLC, *E.ERR* is displayed. When communications are restored, the cycle time is displayed again.

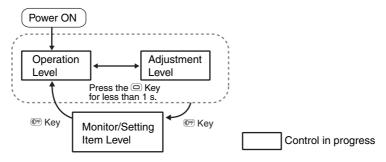


Monitoring range	Default
Normal: 0 to 9999 ms, If 9999 ms is exceeded: בבבב	
Error: E.ERR	

Also refer to the *E5*_*C Digital Controllers Communications Manual* (Cat. No. H175) for information on communications.

Monitor/Setting Item Level 000 6-5

Monitor/setting items can be displayed by means of the function key when the PF Setting parameter (Advanced Function Setting Level) is set to PFDP: Monitor/Setting Item.



PFd / to 5 Monitor/Setting Item Display 1 to 5

The PF Setting parameter must be set to PFDP, and the Monitor/Setting Item 1 to 5 parameters must not be set to OFF.

 When the PF Key is set to display monitor/setting items, pressing the PF Key will display in order the contents of the Monitor/Setting Item 1 to 5 parameters. The contents of these parameters are shown in the following table. For the setting (monitor) ranges, refer to the applicable parameters.

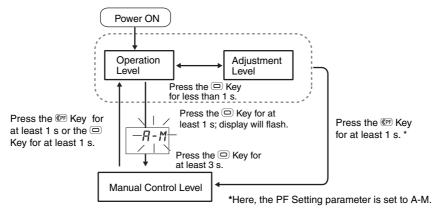
Set value	Satting	Rem	Remarks	
Set value	Setting	Monitor/Setting	Display	
0	Disabled			
1	PV/SP/Multi-SP	Can be set. (SP)*1		
2	PV/SP/MV (valve opening for Position-proportional Models)	Can be set. (SP)*1		
3	PV/SP /Soak time remain	Can be set. (SP)*1		
4	Proportional band (P)	Can be set.	Р	
5	Integral time (I)	Can be set.	L	
6	Derivative time (D)	Can be set.	d	
7	Alarm value 1	Can be set.	AL - I	
8	Alarm value upper limit 1	Can be set.	RL IH	
9	Alarm value lower limit 1	Can be set.	AL IL	
10	Alarm value 2	Can be set.	RL - 2	
11	Alarm value upper limit 2	Can be set.	RL 2H	
12	Alarm value lower limit 2	Can be set.	RL2L	
13	Alarm value 3	Can be set.	RL - 3	
14	Alarm value upper limit 3	Can be set.	RL 3H	
15	Alarm value lower limit 3	Can be set.	RL 3L	
16	Alarm value 4	Can be set.	AL-4	
17	Alarm value upper limit 4	Can be set.	RL 4H	
18	Alarm value lower limit 4	Can be set.	AL YL	
19	PV/SP/Internal SP	Can be set. (SP)*1		
20	PV/SP/Alarm Value 1*2	Can be set. (SP)*1		
21	Proportional Band (Cooling)	Can be set.	[-P	
22	Integral Time (Cooling)	Can be set.	[-[
23	Derivative Time (Cooling)	Can be set.	[-d	

With the E5CC, E5CC-U, E5CC-B, E5DC, E5DC-B, or E5GC, only the PV and SP can be displayed.

^{*2} The Alarm Value 1 parameter is displayed even if the Alarm 1 Type parameter is set for no alarm. However, any value that is set is not valid.

6-6 Manual Control Level

If you change to Manual Mode, the Manual MV parameter will be displayed and the displayed value will be output as the MV.



For details on the setting method, refer to 5-12 Performing Manual Control.

- The MANU indicator will light during manual control.
- It is not possible to move to any parameters except for the PV/MV parameter during manual operation.

PV/MV (Manual MV)

PV/SP/Manual MV



• The manual control level display appears as shown below.

E5EC, E5EC-B, or E5AC E5GC E5DC-B, or E5DC 25 100 <u>25</u>50.0 50.0 50.0

E5CC, E5CC-U, E5CC-B,

PV/Manual MV

PV/Manual MV

	Monitor range	Unit
Process value	Temperature: According to indication range for each sensor.	EU
	Analog: Scaling lower limit –5% FS to Scaling upper limit +5% FS (Refer to <i>A-7 Sensor Input Setting Range, Indication Range, Control Range.</i>)	
Set point	SP lower limit to SP upper limit	EU

	Setting rar	nge	Unit
MV (Manual MV)	Standard control	-5.0 to 105.0 ^{*1}	%
	Heating/cooling control	-105.0 to 105.0*1	
	Close position-proportional control with the Direct Setting of Position-proportional MV parameter set to ON	-105.0 to 105.0 ^{*1}	
	Position-proportional control (floating position-proportional control or the Direct Setting of Position-proportional MV param- eter set to OFF)	*2	

When the Manual MV Limit Enable parameter is set to ON, the setting range will be the MV lower limit to the MV upper limit.

If you display the Valve Opening Monitor parameter, the open output is turned ON if you press the Up Key and the close output is turned ON if you press the Down Key.



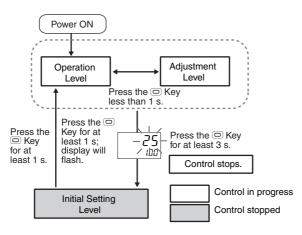
Related Parameters

5-12 Performing Manual Control: Page 5-32

Standard or Heating/Cooling (Initial Setting Level): Page 6-46

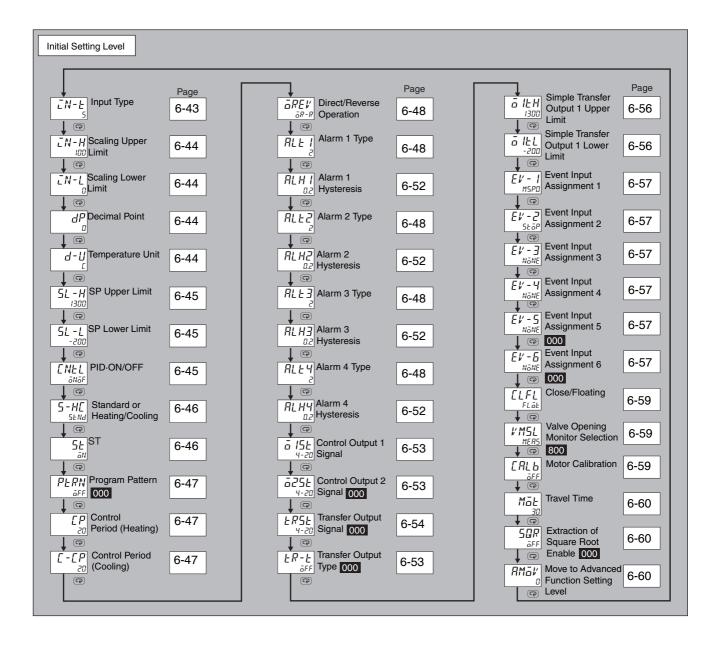
6-7 Initial Setting Level

This level is used to set up the basic Digital Controller specifications. In this level, you can set the Input Type parameter to set the sensor input to be connected, limit the setting range of set points, set the alarm modes, and perform other operations.



To move from the Operation Level or Adjustment Level to the Initial Setting Level, press the Key for at least three seconds with any parameter displayed except for the Auto/Manual Switch parameter

- The Initial Setting Level is not displayed when the Initial Setting/Communications Protect parameter is set to 2. It can be used when the Initial Setting/Communications Protect parameter is set to 0 or 1.
- If the Input Type parameter is set for an analog input, the following parameters will be set: Scaling upper limit, Scaling lower limit, and Decimal point.



Input Type Input Type



- The Input Type parameter is used to set the input type.
- When this parameter is changed, the set point limiter is changed to the defaults. If the limiter must be specified, set the SP Upper Limit and SP Lower Limit parameters (Initial Setting Level) again.
- If a resistance thermometer is mistakenly connected while a setting for other than a resistance thermometer is in effect, 5.ERR will be displayed. To clear the 5.ERR display, check the wiring and then cycle the power.



Input type	Sensor specification	Set value	Temperature range in °C	Temperature range in °F
		0	-200 to 850	-300 to 1500
Docietanos	Pt100	1	-199.9 to 500.0	-199.9 to 900.0
Resistance thermometer		2	0.0 to 100.0	0.0 to 210.0
memometer	JPt100	3	-199.9 to 500.0	-199.9 to 900.0
	JF1100	4	0.0 to 100.0	0.0 to 210.0
	К	5 (default)	-200 to 1300	-300 to 2300
	K	6	-20.0 to 500.0	0.0 to 900.0
	J	7	-100 to 850	-100 to 1500
	J	8	-20.0 to 400.0	0.0 to 750.0
	Т	9	-200 to 400	-300 to 700
	1	10	-199.9 to 400.0	-199.9 to 700.0
	E	11	-200 to 600	-300 to 1100
Thermocouple	L	12	-100 to 850	-100 to 1500
memocoupie	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
	В	18	100 to 1800	300 to 3200
	C/W	19	0 to 2300	0 to 3200
	PLII	20	0 to 1300	0 to 2300
Infrared	10 to 70°C	21	0 to 90	0 to 190
Temperature Sensor	60 to 120°C	22	0 to 120	0 to 240
ES1B	115 to 165°C	23	0 to 165	0 to 320
LOID	140 to 260°C	24	0 to 260	0 to 500
Current input	4 to 20 mA	25	One of the following ranges according	
	0 to 20 mA	26	the scaling:	
	1 to 5 V	27	-1999 to 9999	
Voltage input	0 to 5 V	28	-199.9 to 999.9	
voltage iliput	0 to 10V	29	-19.99 to 99.99	
	0 to 50 mV*	30	-1.999 to 9.999	

^{*} This range can be used only for E5CC-U Digital Controllers and only if they are manufactured i May 2014 or later (version 2.2 or higher).



Related Parameters

Temperature Unit (Initial Setting Level): Page 6-44 Set Point Upper Limit and Set Point Lower Limit (initial Setting Level): Page 6-45 IN-H **Scaling Upper Limit**

IN-L **Scaling Lower limit**

The input type must be set for an analog input.

dР **Decimal Point**



• The Decimal Point parameter specifies the decimal point position of parameters (set point, etc.) whose unit is EU.



• Scaling Upper Limit, Scaling Lower Limit

Parameter name	Setting range	Default
Scaling Upper Limit	Scaling lower limit + 1 to 9999	100
Scaling Lower Limit	-1999 to scaling upper limit - 1	0

Decimal Point

Parameter name	Setting range	Default
Decimal Point	0 to 3	0

Set value	Settings	Example
0	0 digits past decimal point	1234
1	1 digits past decimal point	123.4
2	2 digits past decimal point	12.34
3	3 digits past decimal point	1.234



Related Parameters

Input Type (Initial Setting Level): Page 6-43

d-U **Temperature Unit**

The input type must be set for a temperature input.



• Set the temperature input unit to either °C or °F.



Setting range	Default
[: °C, F: °F	Ε

 $^{^{\}star}$ The temperature unit is not displayed by the E5DC and E5DC-B.



Related Parameters

Input Type (Initial Setting Level): Page 6-43

5L - H SP Upper Limit

5L -L SP Lower Limit



- These parameters set the upper and lower limits of the set points. A set point can be set
 within the range defined by the upper and lower limit set values in the SP Upper Limit and
 SP Lower Limit parameters. If these parameters are reset, any set point that is outside of
 the new range will be forcibly changed to either the upper limit or the lower limit.
- When the temperature input type and temperature unit have been changed, the set point upper limit and set point lower limit are forcibly changed to the upper and lower limits of the sensor.
- For a temperature input, the decimal point position depends on the currently selected sensor, and for an analog input it depends on the Decimal Point parameter setting.



Parameter	name	Setting range	Unit	Default
Set Point Upper Limit	Temperature input	SP lower limit + 1 to Input setting range upper limit	EU	1300
	Analog input	SP lower limit + 1 to scaling upper limit	EU	100
Set Point Lower Limit	Temperature input	Input setting range lower limit to SP upper limit - 1	EU	-200
	Analog input	Scaling lower limit to SP upper limit - 1	EU	0



Related Parameters

Input Type (Initial Setting Level): Page 6-43
Temperature Unit (Initial Setting Level): Page 6-44

ENEL PID ON/OFF

A Standard Model must be used.



- This parameter selects 2-PID control or ON/OFF control.
- The auto-tuning and self-tuning functions can be used in 2-PID control.



Setting range	Default
Pīd: 2-PID, āNāF: ON/OFF	ōNōF



Related Parameters

AT Execute/Cancel (Adjustment Level): Page 6-20 Manual Reset Value (Adjustment Level): Page 6-30

Hysteresis (Heating) and Hysteresis (Cooling) (Adjustment Level): Page 6-31

ST Stable Range (Advanced Function Setting Level): Page 6-67

5-HC Standard or Heating/Cooling

A Standard Model must be used.



- This parameter selects standard control or heating/cooling control.
- If heating/cooling control is selected for the E5CC, E5CC-B, E5CC-U, E5DC, or E5DC-B when there is only one control output, the auxiliary output 2 terminal is assigned as the control output for cooling. (If the Digital Controller has only one auxiliary output, an output is not automatically allocated for the control output for cooling.)
- If heating/cooling control is selected for the E5EC, E5EC-B, or E5AC when there is only
 one control output, the auxiliary output 4 terminal is assigned as the control output for
 cooling. (If the Digital Controller has only two auxiliary outputs, auxiliary output 2 is
 allocated as the control output for cooling.)
- When heating/cooling control is selected for the E5GC, auxiliary output 1 is assigned as the control output for cooling.

Note: If standard control is selected, set the Control Output 1 Assignment to \bar{a} (control output (heating)) for either direct (cooling) or reverse (heating) operation.



Setting range	Default
5ŁNd: Standard, H-E: Heating/cooling	5ENd



Related Parameters

MV Monitor (Heating) (Operation Level): Page 6-16 MV Monitor (Cooling) (Operation Level): Page 6-16

Dead Band (Adjustment Level): Page 6-30

Hysteresis (Heating) and Hysteresis (Cooling) (Adjustment Level): Page 6-31 Control Period (Heating) and Control Period (Cooling) (Initial Setting Level): Page 6-47 Control Output 1 and 2 Assignment (Advanced Function Setting Level): Page 6-81 Auxiliary Output 1 to 4 Assignment (Advanced Function Setting Level): Page 6-82

5L ST (self-tuning)

The control must be set to a temperature input, standard control, and 2-PID control.



- The ST (self-tuning) function executes tuning from the start of program execution to calculate PID constants matched to the control target. When the ST function is in operation, be sure to turn ON the power supply of the load connected to the control output simultaneously with or before starting E5□C operation.
- Auto-tuning can be started during self-tuning.



Setting range	Default
āFF: ST function OFF, āN: ST function ON	ōΝ



Related Parameters

Input Type (Initial Setting Level): Page 6-43 PID ON/OFF (Initial Setting Level): Page 6-45

ST Stable Range (Advanced Function Setting Level): Page 6-67

PERN Program Pattern 000

This parameter sets the type of control when using the simple program function.



- If the program pattern is set to $\bar{a}FF$, the simple program will not operate.
- If the program pattern is set to 5½āP, the RUN/STOP status will change to STOP after the soak time has expired. If the program pattern is set to £āNŁ, control will continue in RUN status after the soak time has expired.



	Setting range	Default
ōFF	Simple program function turned OFF	ōFF
SEAP	Go to STOP mode at end of program.	
EāNE	Continue in RUN mode at end of program.	



Related Parameters

Program Start (Operation Level): Page 6-12

Soak Time Remain (Operation Level): Page 6-13

RUN/STOP (Operation Level): Page 6-13 Soak Time (Adjustment Level): Page 6-31 Wait Band (Adjustment Level): Page 6-32

Soak Time Unit (Advanced Function Setting Level): Page 6-84

[P [-[P

Control Period (Heating)
Control Period (Cooling)

The cooling control output and heating control output must be assigned to relay or voltage outputs (for driving SSR).

The control must be set to 2-PID control.

For the Control Period (Cooling) parameter, the control must be set to heating/cooling control.



- These parameters set the output periods. Set the control periods taking the control characteristics and the electrical life of the relay into consideration.
- For standard control, use the Control Period (Heating) parameter. The Control Period (Cooling) parameter cannot be used.
- When the heating control output is a current output, the Control Period (Heating) parameter cannot be used.
- For heating/cooling control, the control period can be set independently for heating and cooling. The Control Period (Heating) parameter is used for the heating control output, and the Control Period (Cooling) parameter is used for the cooling control output.



Parameter name	Setting range	Unit	Default
Control Period	0.1, 0.2, 0.5, 1 to 99	Seconds	20 for relay output
(Heating)			2 for voltage output (for driving SSR)
Control Period	0.1, 0.2, 0.5, 1 to 99	Seconds	20 for relay output
(Cooling)			2 for voltage output (for driving SSR)



Related Parameters

PID ON/OFF (Initial Setting Level): Page 6-45

GREV Direct/Reverse Operation



"Direct operation" refers to control where the manipulated variable is increased when the process value increases. Alternatively, "reverse operation" refers to control where the manipulated variable is increased when the process value decreases.



Setting range	Default
$\bar{a}R - \bar{R}$: Reverse operation, $\bar{a}R - d$: Direct operation	-RB

ALE I	Alarm 1 Type	Alarm 1 must be assigned.
ALF5	Alarm 2 Type	Alarm 2 must be assigned.
ALF3	Alarm 3 Type	Alarm 3 must be assigned.
ALEY	Alarm 4 Type	Alarm 4 must be assigned.



- Set the alarm type independently for each alarm in the Alarm 1 to 4 Type parameters in the Initial Setting Level.
- The alarms that can be set are listed in the following table.
- You can use an LBA (12) only for alarm 1. You cannot use an LBA on a Position-proportional Model.
- If the Controller is equipped with HB/HS alarm detection, the Alarm Type 1 is not displayed for the default settings. To use alarm 1, set an output assignment to alarm 1. (Refer to 4-6-3 Assigned Output Functions (Assigning Control Outputs Is Not Supported for Position-proportional Models.).)

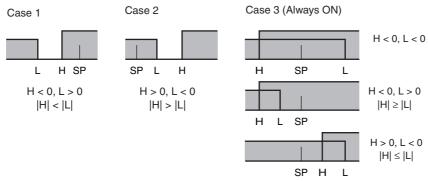
Set		Alarm output operation		
value	Alarm type	When alarm value	When alarm value	Description of function
		X is positive	X is negative	
0	Alarm function OFF	Outpu	it OFF	No alarm
1	Upper- and	on → L H ←	*2	Set the upward deviation in
	lower-limit*1	ON OFF PV		the set point for the alarm
		35		upper limit (H) and the
				lower deviation in the set
				point for the alarm lower
				limit (L). The alarm is ON
				when the PV is outside this
				deviation range.
2	Upper-limit	ON → X ←	ON → X ←	Set the upward deviation in
(default)		OFF SP PV	OFF SP PV	the set point by setting the
		-		alarm value (X). The alarm
				is ON when the PV is higher
				than the SP by the
				deviation or more.

	Alarm output operation			
Set	Alarm type	When alarm value When alarm value		Description of function
value	71	X is positive	X is negative	
3	Lower-limit	-	ON X PV	Set the downward deviation in the set point by setting the alarm value (X). The alarm is ON when the PV is lower than the SP by the deviation or more.
4	Upper- and lower-limit range*1	ON OFF SP PV	*3	Set the upward deviation in the set point for the alarm upper limit (H) and the lower deviation in the set point for the alarm lower limit (L). The alarm is ON when the PV is inside this deviation range.
5	Upper- and lower-limit with standby sequence *1	ON OFF SP PV	*4	A standby sequence is added to the upper- and lower-limit alarm (1). *6
6	Upper-limit with standby sequence	ON X PV	ON OFF SP PV	A standby sequence is added to the upper-limit alarm (2). *6
7	Lower-limit with standby sequence	ON X PV	ON X PV	A standby sequence is added to the lower-limit alarm (3). *6
8	Absolute-value upper-limit	ON	ON OFF 0 PV	The alarm will turn ON if the process value is larger than the alarm value (X) regardless of the set point.
9	Absolute-value lower-limit	ON ⊢X → OFF O PV	ON OFF OPV	The alarm will turn ON if the process value is smaller than the alarm value (X) regardless of the set point.
10	Absolute-value upper-limit with standby sequence	ON	ON	A standby sequence is added to the absolute-value upper-limit alarm (8). *6
11	Absolute-value lower-limit with standby sequence	ON ⊢ X → OFF 0 PV	ON OFF O PV	A standby sequence is added to the absolute-value lower-limit alarm (9). *6
12	LBA (alarm 1 type only)			*7
13	PV change rate alarm			*8
14	SP absolute-value upper-limit alarm	ON	ON → X → SP	This alarm type turns ON the alarm when the set point (SP) is higher than the alarm value (X).
15	SP absolute-value lower-limit alarm	ON	ON → X → O PV	This alarm type turns ON the alarm when the set point (SP) is smaller than the alarm value (X).

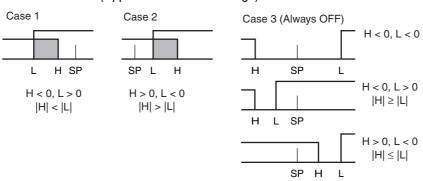
Set		Alarm outpo	ut operation	
value	Alarm type	When alarm value	When alarm value	Description of function
Value		X is positive	X is negative	
16	MV absolute-value	Standard Control	Standard Control	This alarm type turns ON
	upper-limit alarm*9	$\begin{array}{c c} \text{ON} & & \leftarrow X \rightarrow \\ \text{OFF} & & 0 \end{array}$	ON ← X → MV	the alarm when the manipulated variable (MV) is higher than the alarm
		Heating/Cooling	Heating/Cooling	value (X).
		Control (Heating	Control (Heating	,
		MV)	MV)	
		$ \begin{array}{c c} ON & \longrightarrow & \longrightarrow \\ OFF & 0 & MV \end{array} $	Always ON	
17	MV absolute-value	Standard Control	Standard Control	This alarm type turns ON
	lower-limit alarm*9	ON → X → MV	ON X → MV	the alarm when the manipulated variable (MV) is lower than the alarm
		Heating/Cooling	Heating/Cooling	value (X).
		Control (Cooling	Control (Cooling	,
		MV)	MV)	
		$ \begin{array}{c c} ON & \longrightarrow & \longrightarrow \\ OFF & 0 & MV \end{array} $	Always ON	
18	RSP absolute-value upper-limit alarm*10	ON X → RSP	ON PSP	This alarm type turns ON the alarm when the remote SP (RSP) is higher than the
	000			alarm value (X).
19	RSP absolute-value lower-limit alarm*10	ON OFF 0 RSP	ON → X → O RSP	This alarm type turns ON the alarm when the remote SP (RSP) is lower than the alarm value (X).

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

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



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



^{*4} Set value: 5 (Upper- and lower-limit alarm with standby sequence)

- For the upper- and lower-limit alarms in cases 1 and 2 above, the alarm is always OFF if upper- and lower-limit hysteresis overlaps.
- In case 3, the alarm is always OFF.
- *5 Set value: 5 (Upper- and lower-limit alarm with standby sequence)
 - The alarm is always OFF if upper- and lower-limit hysteresis overlaps.
- *6 Refer to Standby Sequence Reset on page 6-64 for information on the operation of the standby sequence.
- *7 Refer to 5-11-1 Loop Burnout Alarm (LBA).
- *8 Refer to PV Change Rate Alarm on page 4-36.
- *9 When heating/cooling control is performed, the MV absolute-value upper-limit alarm functions only for the heating operation and the MV absolute-value lower-limit alarm functions only for the cooling operation.
- *10 This value is displayed only when a remote SP input is used. It functions in both Local SP Mode and Remote SP Mode.



Related Parameters

Alarm Value 1 to 4 (Operation Level): Page 6-14

Alarm Value Upper Limit 1 to 4 and Alarm Value Lower Limit 1 to 4 (Operation Level): Page 6-15

Alarm 1 to 4 Hysteresis (Initial Setting Level): Page 6-52

Standby Sequence Reset (Advanced Function Setting Level): Page 6-64

Auxiliary Output 1 to 4 Open in Alarm (Advanced Function Setting Level): Page 6-65

Alarm 1 to 4 Latch (Advanced Function Setting Level): Page 6-71

ALH I	Alarm 1 Hysteresis	Alarm 1 must be assigned. The alarm 1 type must not be 0, 12, or 13.
ALH2	Alarm 2 Hysteresis	Alarm 2 must be assigned. The alarm 2 type must not be 0, 12, or 13.
ALH3	Alarm 3 Hysteresis	Alarm 3 must be assigned. The alarm 3 type must not be 0, 12, or 13.
ALHY	Alarm 4 Hysteresis	Alarm 4 must be assigned. The alarm 4 type must not be 0, 12, or 13.



• These parameters set the hysteresis for alarms 1, 2, 3, and 4.



Alarms Other Than an MV Alarm

Setting	ı range	Unit	Default
Temperature input	0.1 to 999.9	°C or °F	0.2
Analog input	0.01 to 99.99	%FS	0.02

MV Alarms

Setting range	Unit	Unit
0.01 to 99.99	%	0.50



Related Parameters

Alarm Value 1 to 4 (Operation Level): Page 6-14

Alarm Value Upper Limit 1 to 4 and Alarm Value Lower Limit 1 to 4 (Operation Level): Page 6-15

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

Standby Sequence Reset (Advanced Function Setting Level): Page 6-64

Auxiliary Output 1 to 4 Open in Alarm (Advanced Function Setting Level): Page 6-65

Alarm 1 to 4 Latch (Advanced Function Setting Level): Page 6-71

ā 15Ł	Control Output 1 Signal	Control output 1 must be a linear current output.
ā25£	Control Output 2 Signal 000	Control output 2 must be a linear current output.



These parameters set the output signal for linear current outputs.

• Select 4 to 20 mA or 0 to 20 mA for the signal.



Setting range	Default
Ч-2⊞: 4 to 20mA	4-2N
Д-2Д: 0 to 20mA	7-60

Transfer Output Signal 000 There must be a transfer output.



This parameter sets the output signal for the transfer output.

• Select 4 to 20 mA or 1 to 5 V.



Setting range	Default	
੫-2∄: 4 to 20mA	4-20	
/-5⊮: 1 to 5 V	7-60	

LR-L

Transfer Output Type 000

There must be a transfer output.



• This parameter sets the transfer output type.



Transfer output type		Default
OFF	ōFF	ōFF
Set point *1	5P	
Set point during SP ramp	SP-M	
PV	Pl'	
MV (heating) *2	MV	
MV (cooling) *3	E-MV	
Valve opening *4	l' - M	

- *1 The remote SP will be output while the SP Mode parameter is set to the Remote SP Mode.
- *2 This function can be set for a Position-proportional Model, but the setting will be disabled.
- *3 This function can be set for standard control or for a Position-proportional Model, but the setting will be disabled.
- This setting is displayed only for a Position-proportional Model.



Related Parameter

Transfer Output Upper Limit and Transfer Output Lower Limit (Initial Setting Level): Page 6-55

ER-H

Transfer Output Upper Limit 000

There must be a transfer output. The transfer output type must not be set to OFF.

LR-L

Transfer Output Lower Limit 000



• This parameter sets the upper and lower limit values of transfer outputs.



	Setting range		Default		
Transfer output type			Transfer output lower limit	Transfer output upper limit	Unit
Set point*1	SP lower limit to SP upper limit		SP lower limit	SP upper limit	EU
Set point during SP ramp	SP lower limit	to SP upper limit			
PV	Temperature	Input setting range	Input setting	Input setting	
	input	lower limit to input	range lower limit	range upper	
		setting range upper limit		limit	
	Analog input	Analog scaling	Scaling lower	Scaling upper	
		lower limit to analog scaling upper limit	limit	limit	
MV	Standard	-5.0 to 105.0	0.0	100.0	%
(heating) ^{*2}	Heating/	0.0 to 105.0			
MV	cooling				
(cooling)*3					
Valve	Position-	-10.0 to 110.0]		
opening*4	proportional				

- The remote SP will be output while the SP Mode parameter is set to the Remote SP Mode.
- This function can be set for a Position-proportional Model, but the setting will be disabled.
- This function can be set for standard control or for a Position-proportional Model, but the setting will be disabled.
- This setting is displayed only for a Position-proportional Model.



Related Parameter

Transfer Output Type (Initial Setting Level): Page 6-54

ā IEH	Simple Transfer Output 1 Upper Limit	E5CC-U, E5DC, E5DC-B, or E5GC only. There must be a linear current output.
ā IEL	Simple Transfer Output 1 Lower Limit	The Control Output 1 Assignment parameter must specify the simple transfer SP, simple transfer ramp SP, simple transfer PV, simple transfer MV (heating), or simple transfer MV (cooling).



- This parameter sets the upper and lower limit values for simple transfer output 1.
- You can use this parameter only for the E5CC-U, E5DC, E5DC-B, or E5GC. The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).



			Default		
Transfer output type	Set	ting range	Transfer output lower limit	Transfer output upper limit	Unit
Simple transfer SP	SP lower limit	to SP upper limit	SP lower limit	SP upper limit	EU
Simple transfer ramp SP	SP lower limit	to SP upper limit			
Simple transfer PV	Temperature input	Input setting range lower limit to input setting range upper limit	Input setting range lower limit	Input setting range upper limit	
	Analog input	Analog scaling lower limit to analog scaling upper limit	Scaling lower limit	Scaling upper limit	
Simple	Standard	-5.0 to 105.0	0.0	100.0	%
transfer MV	Heating/	0.0 to 105.0			
(heating)	cooling				
Simple					
transfer MV					

This function can be set for standard control, but the setting will be disabled.



Related Parameter

Control Output 1 Assignment (Advanced Function Setting Level): Page 6-81

```
EV-1 Event Input Assignment 1

EV-2 Event Input Assignment 2

EV-3 Event Input Assignment 3 There must be event inputs.

EV-4 Event Input Assignment 4

EV-5 Event Input Assignment 5 000
```



EV-5

• The following functions can be assigned to event inputs 1 to 6.

RUN/STOP

Auto/Manual Switch

Event Input Assignment 6 000

Program Start

Invert Direct/Reverse Operation

SP Mode Switch

100% AT Execute/Cancel

40% AT Execute/Cancel

Setting Change Enable/Disable

Communications Writing Enable/Disable

Alarm Latch Cancel

Multi-SP No. Switching Bit 0

Multi-SP No. Switching Bit 1

Multi-SP No. Switching Bit 2

• Default: Event Input Assignment 1: M5₽@

Event Input Assignment 2: 5ŁāP
Event Input Assignment 3: NāNE
Event Input Assignment 4: NāNE
Event Input Assignment 5: NāNE
Event Input Assignment 6: NāNE

• Do not assign the same function to more than one event input.



Setting	Function
NāNE	None
SŁāP	RUN/STOP
MRNU	Auto/Manual
PRSE	Program Start*1
dR5	Invert Direct/Reverse Operation
PSP	SP Mode Switch ^{*2}
AF - 5	100% AT Execute/Cancel
AE-1	40% AT Execute/Cancel*3
WEPE	Setting Change Enable/Disable
ЕМИЕ	Communications Writing Enable/Disable ^{*4}
LAF	Alarm Latch Cancel
MSPO	Multi-SP No. Switching Bit 0*5
MSP I	Multi-SP No. Switching Bit 1*5
M5P2	Multi-SP No. Switching Bit 2*5

- PRST (Program Start) can be set even when the Program Pattern parameter is set to OFF, but the function will be disabled.
- *2 This function can be set only for a Digital Controller that supports a remote SP.
- *3 This function can be set for heating/cooling control or for floating control for Position-proportional Models, but the setting will be disabled.
- This function can be set only for a Digital Controller that supports communications. Also, if a work bit is selected as the event input data, you cannot select communications writing enable/disable.
- The following table shows the relationships between the ON/OFF status of multi-SP number switching bits 0 to 2 and the set point.

Selected set point	Multi-SP No. switching bits			
Selected Set politi	Bit 0	Bit 1	Bit 2	
SP 0	OFF	OFF	OFF	
SP 1	ON	OFF	OFF	
SP 2	OFF	ON	OFF	
SP 3	ON	ON	OFF	
SP 4	OFF	OFF	ON	
SP 5	ON	OFF	ON	
SP 6	OFF	ON	ON	
SP 7	ON	ON	ON	

Note: Any bits that are not assigned to event inputs are treated as being OFF.



Related Parameter

SP 0 to 7 (Adjustment Level): Page 6-26

[LFL Close/Floating

A Position-proportional Model must be used.



 The Close/Floating parameter is used to set the control method for a Position-proportional Model.



Setting range	Default
FLat: Floating control	FLāt
ELā5: Close control	

VM5L

Valve Opening Monitor
Selection 800

Floating control must be used (Position-proportional Model).



- Select the value to monitor for the valve opening.
- If you select the measured opening, the valve opening that was measured with a
 potentiometer is displayed.
- If you select the estimated opening, the valve opening estimated by the Digital Controller is displayed.
- You can use this parameter only with the E5EC-PR□-8□□ or E5AC-PR□-8□□. (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)



Setting range	Default
MEAS: Measured opening	MEAS
ESTM: Estimated opening	

[RLЬ

Motor Calibration

A Position-proportional Model must be used.



The Motor Calibration parameter is used to calibrate the valve position and automatically set the travel time from completely open to completely closed. You can then check the valve opening with the Valve Opening Monitor parameter.



If you set the Motor Calibration parameter to ON, the valve will open completely and close completely, and then the setting of the parameter will change to OFF when the measurement has been completed. "ERR" will be displayed if any of the following errors occurs during execution. If an error occurs, check the wiring and other factors and execute motor calibration again.

- The potentiometer input value does not change or changes backward between completely open and completely closed because the wiring is wrong.
- The value of the potentiometer input is incorrect because of a broken wire, noise, or other factor.
 - * Do not change to any other parameter during calibration.



Related Parameters

Travel Time (Initial Setting Level): Page 6-60

MāŁ

Travel Time

A Position-proportional Model must be used.



The Travel Time parameter is set to the time from when the valve is completely open until it is completely closed. The Travel Time parameter is set automatically when motor calibration is performed.



Setting range	Unit	Default
1 to 999	Seconds	30



Related Parameters

Motor Calibration (Initial Setting Level): Page 6-59

SOR

Extraction of Square Root Enable

An analog input must be supported.



This parameter enables and disables square root extraction.



Setting range	Default
āN: Enabled, āFF: Disabled	OFF



Related Parameter

Extraction of Square Root Low-cut Point (Adjustment Level): Page 6-36

RMar

Move to Advanced Function Setting Level

The Initial Setting/Communications Protect parameter must be set to 0.



- Set the Move to Advanced Function Setting Level parameter set value to "-169."
- Move to the advanced function setting level either by pressing

 Key or

 Key or

 Key or by waiting or two seconds to elapse.



Related Parameter

Initial Setting/Communication Protect (Protect Level): Page 6-4

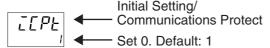
6-8 Advanced Function Setting Level

The Advanced Function Setting Level is used for optimizing Digital Controller performance. To move to this level, input the password ("-169") from the Initial Setting Level.

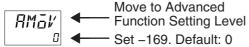
To be able to enter the password, the Initial Setting/Communications Protect parameter in the Protect Level must be set to 0.

Moving to Advanced Function Setting Level

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



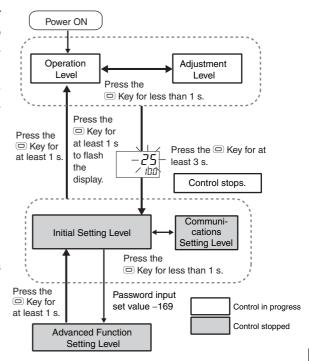
- $oldsymbol{3}$ Change the set value to 0.
- 4 Move from the Protect Level to the Operation Level to the Initial Setting Level.
- **5** Display the Move to Advanced Function Setting Level parameter.

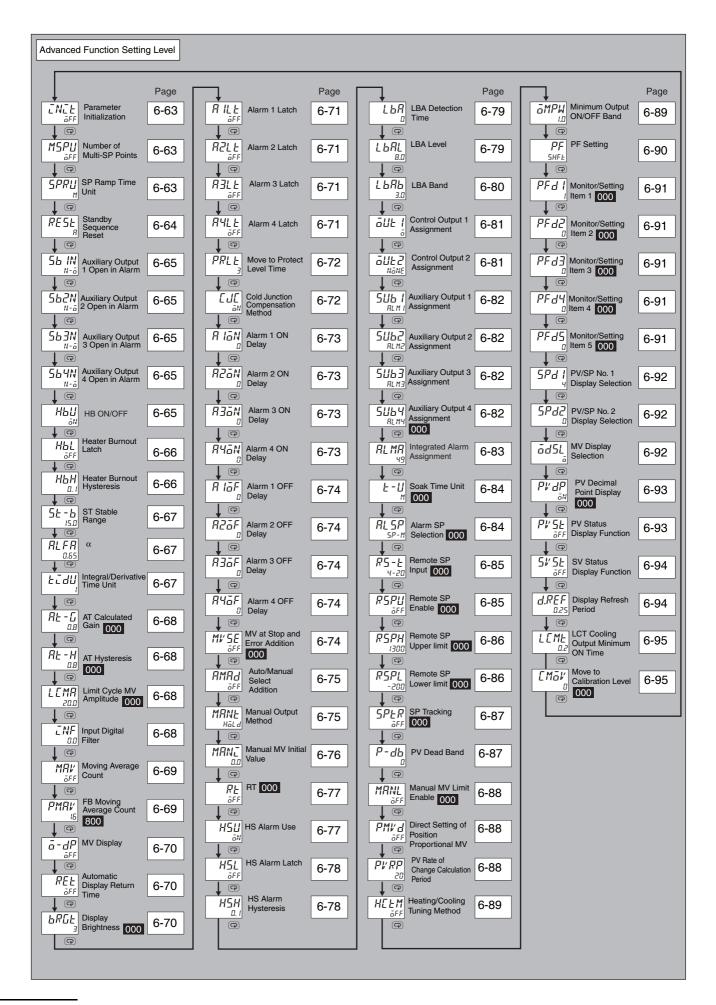


- $m{6}$ Change the set value to –169.
- 7 The Advanced Function Setting Level is displayed.

INIT) will be displayed.

- The parameters in this level can be used when the Initial Setting/Communications Protect parameter is set to 0.
- To switch between setting levels, press the
 Key.





Parameter Initialization



- This parameter returns all parameter settings to their defaults.
- After the initialization, the set value automatically turns OFF.



Setting range		Default
ōFF:	Initialization is not executed.	ōFF
FREE:	Initializes to the factory settings described in the manual.	

M5PU Number of Multi-SP Points

The Digital Controller must not have event inputs or the Event Input Assignment 1 to Event Input Assignment 6 parameters must not be set to "Multi-SP No. switching bit 0" to "Multi-SP No. switching bit 2."



This parameter sets the number of Multi-SP points that will be used with key operations (none or 2 to 8).



Setting range	Default
OFF, 2 to 8	OFF

5PRU SP Ramp Time Unit

The ST parameter must be set to OFF.



• This parameter sets the time unit for the rate of change during SP ramp operation.



Setting range	Default
5: EU/s, ∦: EU/min, ∦: EU/h	М



Related Parameters

Ramp SP Monitor (Operation Level): 6-10 SP Ramp Set Value and SP Ramp Fall Value (Adjustment Level): Page 6-33

RESE **Standby Sequence Reset**

Alarm 1 to 4 type must be 5, 6, 7, 10, or 11.

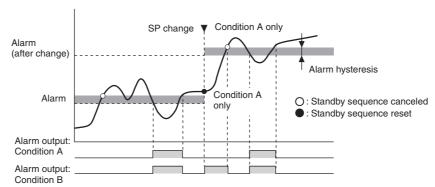


- · This parameter selects the conditions for enabling reset after the standby sequence of the alarm has been canceled.
- Output is turned OFF when switching to the Initial Setting Level, Communications Setting Level, Advanced Function Setting Level, or Calibration Level.
- Condition A

Control started (including when the power supply is turned ON), and an alarm value (alarm value upper/lower limit), the process value input shift, the process value slope coefficient, or the SP changed. However, the standby sequence will not be restarted if the SP is changed with a remote SP.

• Condition B Power ON

• The following example shows the reset action when the alarm type is lower-limit alarm with standby sequence.





Setting range	Default
ቭ: Condition A, b: Condition B	Я



Related Parameters

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48 Alarm 1 to 4 Latch (Advanced Function Setting Level): Page 6-71

56 IN	Auxiliary Output 1 Open in Alarm	Auxiliary output 1 must be assigned.
562N	Auxiliary Output 2 Open in Alarm	Auxiliary output 2 must be assigned.
563N	Auxiliary Output 3 Open in Alarm	Auxiliary output 3 must be assigned.
564N	Auxiliary Output 4 Open in Alarm	Auxiliary output 4 must be assigned.



- This parameter sets the output status of auxiliary outputs 1 to 4.
- When Close in Alarm is set, the status of the auxiliary output function is output unchanged. When Open in Alarm is set, the status of the auxiliary output function is reversed before being output. The following table shows the relationship between the auxiliary output function, auxiliary output, and operation displays (SUB1 to SUB4).



	Auxiliary output function	Auxiliary output	Operation display (SUB1 to SUB4)
Close in	ON	ON	Lit
Alarm	OFF	OFF	Not lit
Open in	ON	OFF	Lit
Alarm	OFF	ON	Not lit

Setting range	Default
N-a: Close in alarm, N-E: Open in alarm	N-ā



Related Parameters

Auxiliary Output 1 to 4 Assignment (Advanced Function Setting Level): Page 6-82

HЫU HB ON/OFF

HB and HS alarms must be supported.

A Control Output Assignment or Auxiliary Output
Assignment must be set to a heater alarm or heater
burnout alarm.



Set to use the heater burnout alarm.



Setting range	Default
āN: Enabled, āFF: Disabled	āΝ

HbL **Heater Burnout Latch**

HB and HS alarms must be supported. The HB ON/OFF parameter must be set to ON.



- · When this parameter is set to ON, the heater burnout alarm is held until either of the following conditions is satisfied.
 - a Heater burnout detection is set to 0.0 A.
 - b The power is cycled.
 - c The latch is cancelled by the PF Key. (PF Setting = LAT: Alarm Latch Cancel)
 - d The latch is cancelled by an event input. (Event Input Assignment 1 to Event Input Assignment 6 = LAT: Alarm Latch
- Output is turned OFF when switching to the Initial Setting Level.



Setting range	Default
$\bar{a}N$: Enabled, $\bar{a}FF$: Disabled	ōFF



Related Parameters

Heater Burnout Detection 1 (Adjustment Level): Page 6-22 Heater Burnout Detection 2 (Adjustment Level): Page 6-23 Event Input Assignment 1 to 6 (Initial Setting Level): Page 6-57 HB ON/OFF (Advanced Function Setting Level): Page 6-65 PF Setting (Advanced Function Setting Level): Page 6-90

НЬН **Heater Burnout Hysteresis**

The HB ON/OFF parameter must be set to ON. The Heater Burnout Latch parameter must be set to OFF.

HB and HS alarms must be supported.



• This parameter sets hysteresis for heater burnout detection.



Setting range	Unit	Default
0.1 to 50.0	Α	0.1



Related Parameters

HB ON/OFF (Advanced Function Setting Level): Page 6-65

5L-6 ST Stable Range

Temperature input, standard control, 2-PID control must be set.

The ST parameter must be set to ON.



• The setting of this parameter determines when ST operates. This parameter cannot be used when ST is set to OFF.



Setting range	Unit	Default
0.1 to 999.9	°C or °F	15.0



Related Parameters

Input Type (Initial Setting Level): Page 6-43 PID ON/OFF (Initial Setting Level): Page 6-45

ST (Initial Setting Level): Page 6-46

ALFA α

2-PID control must be set.

The ST parameter must be set to OFF.



- Normally, use the default for this parameter.
- This parameter sets the 2-PID control a constant.



Setting range	Default
0.00 to 1.00	0.65



Related Parameters

PID ON/OFF (Initial Setting Level): Page 6-45 ST (Initial Setting Level): Page 6-46

FIGU

Integral/Derivative Time Unit

Control must be set to 2-PID control.



This parameter sets the time unit for the Integral Time, Integral Time (Cooling), Derivative Time, and Derivative Time (Cooling) parameters.



Setting range	Unit	Default
1 to 0.1	Seconds	1

Note: The Integral/Derivative Time Unit parameter changes to 0.1 when the RT (robust tuning) parameter is changed from OFF to ON.



Related Parameters

Integral Time and Derivative Time (Adjustment Level): Page 6-28

Derivative Time (Cooling) and Integral Time (Cooling) (Adjustment Level): Page 6-29

RE-G AT Calculated Gain 000

Control must be set to 2-PID control.

RE-H AT Hysteresis 000

LEMR Limit Cycle MV Amplitude 000 Control must be set to 2-PID control or close position-proportional control.



- Normally use the default values for these parameters.
- The AT Calculated Gain parameter sets the gain for when PID values are calculated using AT. When emphasizing response, decrease the set value. When emphasizing stability, increase the set value.
- The AT Hysteresis parameter sets the hysteresis for limit cycle operation during autotuning when switching ON and OFF.
- The Limit Cycle MV Amplitude parameter sets the MV amplitude for limit cycle operation during autotuning.



Parameter name	Setting range	Unit	Default
AT Calculated Gain	0.1 to 10.0		Standard Model: 0.8 Position-proportional Model: 1.0
AT Hysteresis	Temperature	°C	0.8
	input: 0.1 to 999.9	°F	1.4
	Analog input: 0.01 to 9.99	%FS	0.20
Limit Cycle MV Amplitude	5.0 to 50.0	%	20.0



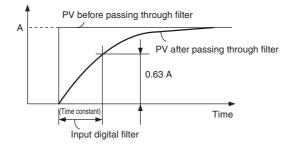
Related Parameters

AT Execute/Cancel (Adjustment Level): Page 6-20

INF **Input Digital Filter**



· This parameter sets the time constant for the input digital filter. The following diagram shows the effect on data after passing through the digital filter:



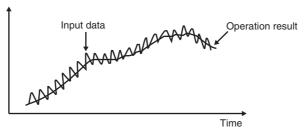


Setting range	Unit	Default
0.0 to 999.9	Seconds	0.0

MRV **Moving Average Count**



 This parameter sets the number of inputs to include in the moving average. The data after moving average processing is illustrated in the following figure.



· Use a moving average to suppress rapid changes in the input.



Setting range	Unit	Default
OFF, 2, 4, 8, 16, or 32	Times	OFF*

^{*}The default is 8 for models other than the E5 C- -0.

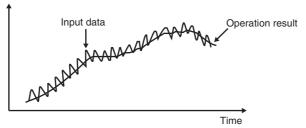
PMRV

FB Moving Average Count 800

Position-proportional Models



· You can set the moving average count for the FB input. The data after moving average processing is illustrated in the following figure.



- Use a moving average to suppress rapid changes in the FB input.
- You can use this parameter only with the E5EC-PR□-8□□ or E5AC-PR□-8□□. (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)



Setting range	Unit	Default
OFF, 2, 4, 8, 16, or 32	Times	16

ā-dP

MV Display

A Standard Model must be used.



This parameter is used to display the manipulated variable (MV).

The manipulated variable is displayed when the MV Monitor (Heating) and MV Monitor (Cooling) parameters are set to ON, and not displayed when these parameters are set to OFF.



Setting range	Default
$\bar{a}N$: Displayed, $\bar{a}FF$: Not displayed	ōFF



Related Parameters

MV Monitor (Heating) (Operation Level): Page 6-16 MV Monitor (Cooling) (Operation Level): Page 6-16

REL **Automatic Display Return Time**



- In the Operation Level, Adjustment Level, or Monitor/Setting Item Level, the display automatically returns to the PV/SP if there are no key operations for the time set for this parameter.
- The automatic display return time is disabled when the parameter is set to OFF. (In that case, the display will not be automatically switched.)



Setting range	Unit	Default
OFF, 1 to 99	Seconds	āFF

BRGE Display Brightness 000



This parameter sets the display brightness to one of three levels. Adjust the level if the display is too bright.



Setting range	Default
1 (dark) to 3 (bright)	3

A ILL	Alarm 1 Latch	Alarm 1 must be assigned, and the alarm 1 type must not be 0.
ASLF	Alarm 2 Latch	Alarm 2 must be assigned, and the alarm 2 type must not be 0 or 12.
A3LF	Alarm 3 Latch	Alarm 3 must be assigned, and the alarm 3 type must not be 0 or 12.
AYLE	Alarm 4 Latch	Alarm 4 must be assigned, and the alarm 4 type must not be 0 or 12.



- When this parameter is set to ON, the alarm function is held until one of the following conditions is satisfied.
 - a The power is cycled.
 - b The latch is cancelled by the PF Key. (PF Setting = LAT: Alarm Latch Cancel)
 - The latch is cancelled by an event input.
 (Event Input Assignment 1 to Event Input Assignment 6 = LAT: Alarm Latch Cancel)
- The output is turned OFF when switching to the Initial Setting Level, Communications Setting Level, Advanced Function Setting Level, or Calibration Level.
- If an auxiliary output is set to close in alarm, the output is kept closed. If it is set to open in alarm, it is kept open.
- If an alarm OFF delay is set, the alarm latch will not be canceled immediately even if condition b or c is met. It will be canceled after the time set for the OFF delay has expired.



Setting range	Default
$\bar{a}N$: Enabled, $\bar{a}FF$: Disabled	ōFF



Related Parameters

Alarm Value 1 to 4 (Operation Level): Page 6-14

Alarm Value Upper Limit 1 to 4 and Alarm Value Lower Limit 1 to 4 (Operation Level): Page 6-15

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

Standby Sequence Reset (Advanced Function Setting Level): Page 6-64

Event Input Assignment 1 to 6 (Initial Setting Level): Page 6-57

Auxiliary Output 1 to 4 Open in Alarm (Initial Setting Level): Page 6-65

Alarm 1 to 4 Hysteresis (Initial Setting Level): Page 6-52 HB ON/OFF (Advanced Function Setting Level): Page 6-65 PF Setting (Advanced Function Setting Level): Page 6-90

PRLE **Move to Protect Level Time**



• This parameter sets the key pressing time required to move to the Protect Level from the Operation Level, the Adjustment Level, or Monitor/Setting Item Level.



Setting range	Unit	Default
1 to 30	Seconds	3

ЕЛЕ

Cold Junction Compensation Method

Input type must be thermocouple or infrared temperature sensor



- This parameter specifies whether cold junction compensation is to be performed internally by the Digital Controller or to be performed externally when the input type setting is 5 to 24.
- The cold junction compensation external setting is enabled when the temperature difference is measured using two thermocouples or two ES1B Sensors.



Setting range	Default
$\bar{a}N$: Internally, $\bar{a}FF$: Externally	ōΝ



Related Parameters

Input Type (Initial Setting Level): Page 6-43

A IāN	Alarm 1 ON Delay	Alarm 1 must be assigned, and the alarm 1 type must not be 0, 12, or 13.
AS SN	Alarm 2 ON Delay	Alarm 2 must be assigned, and the alarm 2 type must not be 0, 12, or 13.
Rāēr	Alarm 3 ON Delay	Alarm 3 must be assigned, and the alarm 3 type must not be 0, 12, or 13.
AYāN	Alarm 4 ON Delay	Alarm 4 must be assigned, and the alarm 4 type must not be 0, 12, or 13.

The alarm 1, 2, 3, or 4 output is prevented from turning ON until after the delay times set in these parameters have elapsed.



- Set the time for which the ON delay is to be enabled.
- To disable the ON delay, set 0.



Setting range	Unit	Default
0 to 999	Seconds	0



Related Parameters

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

A IōF	Alarm 1 OFF Delay	Alarm 1 must be assigned, and the alarm 1 type must not be 0, 12, or 13.
A26F	Alarm 2 OFF Delay	Alarm 2 must be assigned, and the alarm 2 type must not be 0, 12, or 13.
R3ŏF	Alarm 3 OFF Delay	Alarm 3 must be assigned, and the alarm 3 type must not be 0, 12, or 13.
ЯЧБЕ	Alarm 4 OFF Delay	Alarm 4 must be assigned, and the alarm 4 type must not be 0, 12, or 13.

The alarm 1, 2, 3, or 4 output is prevented from turning OFF until after the delay times set in these parameters have elapsed.



- Set the time for which the OFF delay is to be enabled.
- To disable the OFF delay, set 0.



Setting range	Unit	Default
0 to 999	Seconds	0



Related Parameters

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

MV5E

MV at Stop and Error Addition

000

Control must be set to 2-PID control.



• This parameter sets whether or not the MV at Stop and MV at PV Error parameters are to be displayed.



Setting range	Default
āN: Displayed, āFF: Not displayed	ōFF



Related Parameters

MV at Stop (Adjustment Level): Page 6-32 MV at PV Error (Adjustment Level): Page 6-33

Auto/Manual Select Addition Control must be set to 2-PID control.



• This parameter sets whether the Auto/Manual Select Addition parameter is to be displayed.



Setting range	Default
āN: Displayed, āFF: Not displayed	Standard Model: aFF
	Position-proportional Model: all



Related Parameters

Auto/Manual Switch (Operation Level): Page 6-9

MRNE Manual Output Method

Control must be set to 2-PID control.

A Position-proportional Model set to Close Control with the Direct Setting of Position-proportional MV parameter set to ON must be used.



If this parameter is set to HOLD when control moves from Automatic Mode to Manual Mode, the final MV from Automatic Mode will be used as the initial manual MV. If this parameter is set to INT, the setting of the Manual MV Initial Value parameter will be used as the initial manual MV.



Setting range	Default
HāLd: HOLD, ĒNĒE: INIT	HōLd



Related Parameters

Manual MV Initial Value (Advanced Function Setting Level): 6-76

MRNE

Manual MV Initial Value

Control must be set to 2-PID control. A Position-proportional Model set to Close Control with the Direct Setting of Position-proportional MV parameter set to ON must be used.



This parameter sets the initial value of the manual MV to use after control moves from Automatic Mode to Manual Mode.



Setting range	Unit	Default
Standard control: -5.0 to 105.0	%	0.0
Heating/cooling control: -105.0 to 105.0	1	

If the Manual MV Limit Enable parameter is set to ON, the setting range will be the MV lower limit to the MV upper limit.



Related Parameters

Manual Output Method (Advanced Function Setting Level): Page 6-75 Manual MV Limit Enable (Advanced Function Setting Level): Page 6-88 RE RT 000

Control must be set to 2-PID control. If the input type is set for a temperature input, either the Standard or Heating/Cooling parameter must be set to standard control or, if the Standard or Heating/Cooling parameter is set to heating/cooling control, the Heating/Cooling Tuning Method parameter must not be set to air or water cooling.

Or, a Position-proportional Model must be used.

This parameter executes robust tuning (RT).



- When AT or ST is executed with RT selected, PID constants are automatically set which
 make it hard for control performance to degenerate even when control object
 characteristics are changed.
- Even when hunting occurs for PID constants when AT or ST is executed in normal mode, it is less likely to occur when AT or ST is executed in RT mode.



Setting range	Default
āN: RT function ON, āFF: RT function OFF	ōFF

Note: The Integral/Derivative Time Unit parameter changes to 0.1 when the RT (Robust Tuning) parameter is changed from OFF to ON.



Related Parameters

AT Execute/Cancel (Adjustment Level): Page 6-20

Proportional Band, Integral Time, and Derivative Time (Adjustment Level): Page 6-28 Proportional Band (Cooling), Derivative Time (Cooling), and Integral Time (Cooling) (Adjustment Level): Page 6-29

PID ON/OFF (Initial Setting Level): Page 6-45

ST (Initial Setting Level): Page 6-46

Integral/Derivative Time Unit (Advanced Function Setting Level): Page 6-67

HS Alarm Use

HB and HS alarms must be supported.

A Control Output Assignment or Auxiliary Output Assignment must be set to a heater alarm or HS alarm



• Set this parameter to use HS alarms.



Setting range	Default
$\bar{a}N$: Enabled, $\bar{a}FF$: Disabled	āΝ

H5L **HS Alarm Latch**

HB and HS alarms must be supported. The HS Alarm Use parameter must be set to ON.



- · When this parameter is set to ON, the HS alarm is held until any of the following conditions is satisfied.
 - a The HS alarm current is set to 50.0 A.
 - b The power is cycled.
 - c The latch is cancelled by the PF Key. (PF Setting = LAT: Alarm Latch Cancel)
 - d The latch is cancelled by an event input. (Event Input Assignment 1 to Event Input Assignment 6 = LAT: Alarm Latch Cancel)
- · Output is turned OFF when switching to the Initial Setting Level, Communications Setting Level, Advanced Function Setting Level, or Calibration Level.



Setting range	Default
ōN: Enabled, ōFF: Disabled	ōFF



Related Parameters

HS Alarm Use (Advanced Function Setting Level): Page 6-77 Event Input Assignment 1 to 6 (Initial Setting Level): Page 6-57 HB ON/OFF (Advanced Function Setting Level): Page 6-65 PF Setting (Advanced Function Setting Level): Page 6-90

HSH

HS Alarm Hysteresis

HB and HS alarms must be supported. The HS Alarm Use parameter must be set to ON. The HS Alarm Latch parameter must be set to OFF.



This parameter sets the hysteresis for HS alarms.



Setting range	Unit	Default
0.1 to 50.0	Α	0.1



Related Parameters

HS Alarm Use (Advanced Function Setting Level): Page 6-77

LbR

LBA Detection Time

A Standard Model must be used. Alarm 1 must be assigned. The alarm type must be set to 12 (LBA).

This parameter enables or disables the LBA function and sets the detection time interval.



• To disable the LBA function, set 0.



Setting range	Unit	Default
0 to 9999	Seconds	0



Related Parameters

Alarm 1 to 4 Type (Initial Setting Level): Page 6-48 LBA Level (Advanced Function Setting Level): Page 6-79 LBA Band (Advanced Function Setting Level): Page 6-80

LBA Level

A Standard Model must be used.

Alarm 1 must be assigned.

The alarm type must be set to 12 (LBA).

The LBA detection time must not be 0.



- This parameter sets the LBA level.
- If the deviation between the SP and PV exceeds the LBA level, a loop burnout is detected.



Setting range		Unit	Default
Temperature input	0.1 to 999.9	°C or °F	8.0
Analog input	0.01 to 99.99	%FS	10.00



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

LBA Detection Time (Advanced Function Setting Level): Page 6-79

LBA Band (Advanced Function Setting Level): Page 6-80

LЬЯЬ **LBA Band**

A Standard Model must be used. Alarm 1 must be assigned. The alarm type must be set to 12 (LBA). The LBA detection time must not be 0.



- This parameter sets the LBA band.
- If a control deviation greater than the LBA band is not reduced when the LBA level is exceeded, an loop burnout is detected.



Setting range		Unit	Default
Temperature input	0.0 to 999.9	°C or °F	3.0
Analog input	0.00 to 99.99	%FS	0.20



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

LBA Detection Time (Advanced Function Setting Level): Page 6-79

LBA Level (Advanced Function Setting Level): Page 6-79

Control Output 1 Assignment

A Standard Model must be used.

Control Output 2 Assignment

A Standard Model with two control outputs must be used.



• These parameters set the function to assign to control outputs 1 and 2.



	Setting range	Default
EEMV	Simple transfer MV (cooling)*1	Control Output 1 Assignment: a
E-MV	Simple transfer MV (heating) ^{*1}	Control Output 2 Assignment: NaNE*6
E-P1/	Simple transfer PV ^{*1}	
E SPM	Simple transfer ramp SP*1	
E-5P	Simple transfer SP*1	
Nane:	Disabled	
ō:	Control output (heating)	
[-ō:	Control output (cooling)*2	
ALM I:	Alarm 1 ^{*3}	
ALM2:	Alarm 2 ^{*3}	
RLM3:	Alarm 3 ^{*3}	
ALMY:	Alarm 4 ^{*3}	
HR:	Heater alarm ^{*3}	
НЬ:	HB alarm ^{*3}	
H5:	HS alarm ^{*3}	
S.ERR:	Input error ^{*3}	
RS.ER:	RSP input error ^{*3}	
P.ENd:	Program end output ^{*3*4}	
RUN:	RUN output ^{*3}	
ALM:	Integrated Alarm*3	
WR I:	Work bit 1*3*5	
WRZ:	Work bit 2*3*5	
W₽∃:	Work bit 3*3*5	
WRY:	Work bit 4*3*5	
WR5:	Work bit 5*3*5	
WR5:	Work bit 6 ^{*3*5}	
WR7:	Work bit 7*3*5	
WRB:	Work bit 8 ^{*3*5}	

- *1 For the E5CC-U, E5DC, E5DC-B, or E5GC with a linear current output, you can select these settings only for the Control Output 1 Assignment parameter. (The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)
- *2 If $\mathcal{L} = \bar{a}$ is assigned for standard control, a value equivalent to 0% is output.
- *3 Can be selected for relay and voltage outputs (for driving SSR) only.
- *4 Can be selected when the Program Pattern parameter is set to OFF, but the function will be disabled.
- *5 WR1 to WR8 are not displayed when the logic operation function is not used.
- *6 If the Standard or Heating/Cooling parameter is set to heating/cooling control, control automatically switches to $\mathcal{L}^{-}\bar{a}$.

5Ub 1	Auxiliary Output 1 Assignment	There must be an auxiliary output 1.
5Ub2	Auxiliary Output 2 Assignment	There must be an auxiliary output 2.
5Ub3	Auxiliary Output 3 Assignment	There must be an auxiliary output 3.
5ИЬЧ	Auxiliary Output 4 Assignment	There must be an auxiliary output 4. 000

• These parameters set the function to assign to auxiliary outputs 1 to 4.

	Setting range	Default
NāNE:	Disabled	Auxiliary Output 1 Assignment: #LM 1*5
<u>ā:</u>	Control output (heating)	Auxiliary Output 2 Assignment: 무너제근*2
[-ā:	Control output (cooling)*1	Auxiliary Output 3 Assignment: #LM3*2
ALM I:	Alarm 1	Auxiliary Output 4 Assignment: 위L MY*2
ALM2:	Alarm 2	
ALM3:	Alarm 3	
ALMY:	Alarm 4	
HA:	Heater alarm	
НЬ:	HB alarm	
H5:	HS alarm	
S.ERR:	Input error	
RS.ER:	RSP input error	
P.ENd:	Program end output ^{*3}	
RUN:	RUN output	
ALM:	Integrated Alarm	
WR 1:	Work bit 1 ^{*4}	
WR2:	Work bit 2 ^{*4}	
WR∃:	Work bit 3 ^{*4}	
WRY:	Work bit 4 ^{*4}	
WRS:	Work bit 5 ^{*4}	
WR6:	Work bit 6 ^{*4}	
WR7:	Work bit 7 ^{*4}	
WRB:	Work bit 8 ^{*4}	

^{*1} If \mathcal{L} - \bar{a} is assigned for standard control, a value equivalent to 0% will be output.

- If heating/cooling control is selected for the E5EC, E5EC-B, or E5AC when there is only one control output, the auxiliary output 4 terminal is assigned as the control output for cooling. (If the Digital Controller has only two auxiliary outputs, auxiliary output 2 is allocated as the control output for cooling.)
- When heating/cooling control is selected for the E5GC, auxiliary output 1 is assigned as the control output for cooling.

If heating/cooling control is selected for the E5CC, E5CC-B, E5CC-U, E5DC, or E5DC-B when there is only one control output, the auxiliary output 2 terminal is assigned as the control output for cooling. (If the Digital Controller has only one auxiliary output, an output is not automatically allocated for the control output for cooling.)

- *3 Can be selected when the Program Pattern parameter is set to OFF, but the function will be disabled.
- *4 WR1 to WR8 are not displayed when the logic operation function is not used.
- *5 If the Digital Controller is equipped with HB/HS alarm detection, it is set by default to HR (Heater Alarm).

RLMR

Integrated Alarm Assignment

The integrated alarm must be assigned.



You can use the integrated alarm to output an OR of alarm 1, alarm 2, alarm 3, alarm 4, the HB alarm, the HS alarm, the input alarm, and the RSP input alarm. Set this parameter to the sum of the codes of the status for which to output an OR.

The default is 49 (i.e., an OR of alarm 1, the HB alarm, and the HS alarm is output). The alarm 1 code is 1, the HB alarm code is 16, and the HS alarm code is 32: 1 + 16 + 32 = 49.



Code	Status
+1	Alarm 1
+2	Alarm 2
+4	Alarm 3
+8	Alarm 4
+16	HB alarm
+32	HS alarm
+64	Input error
+128	RSP input error

Setting range	Default
0 to 255	49



Related Parameters

Alarm Value 1 to 4 (Operation Level): Page 6-14

MV at Error (Adjustment Level): Page 6-33

HB ON/OFF (Advanced Function Setting Level): Page 6-65 HS Alarm Use (Advanced Function Setting Level): Page 6-77

Remote SP Enable (Advanced Function Setting Level): Page 6-85

E-11 Soak Time Unit 000 The Program Pattern parameter must not be set to OFF.



• Set the soak time unit for the simple program function.



Setting range	Default
s: Seconds,* m: Minutes, h: Hours	М

You can select seconds only for the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)



Related Parameters

Program Start (Operation Level): Page 6-12

Soak Time Remain (Operation Level): Page 6-13

Soak Time (Adjustment Level): Page 6-31 Wait Band (Adjustment Level): Page 6-32

Program Pattern (Initial Setting Level): Page 6-47

RL SP Alarm SP Selection 000 Alarm 1 to alarm 4 must be assigned.

The SP Ramp Set Value parameter must not be set to OFF and the SP Ramp Fall Value parameter must not be set to SAME or OFF. The ST parameter must be set to OFF.

The alarm type must be set to 1, 2, 3, 4, 5, 6, 7, 14, 15, 18, or 19.

This parameter sets whether the set point that triggers the alarm is the ramp SP or target SP.



Setting range	Default
5 <i>P</i> - M: Ramp SP, 5 <i>P</i> : SP	5P-M



Related Parameters

SP Ramp Set Value and SP Ramp Fall Value (Adjustment Level): Page 6-33 ST (Self-tuning) (Initial Setting Level): Page 6-46

R5-E Remote SP Input 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF (default: ON).



This parameter sets the input type for the remote SP.



Setting range	Default
୳-ଅପ: 4 to 20mA	
Ū-2Ū: 0 to 20mA	
<i>l-5l</i> ′: 1 to 5V	4-20
Ū-51⁄: 0 to 5V	
Ū- IŪ: 0 to 10V	



Related Parameters

ST (self-tuning) (Initial Setting Level): Page 6-46

RSPU Remote SP Enable 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF (default: ON).



This parameter is set to ON to enable setting SP Mode. You can set the SP Mode parameter to LSP to select a local SP or to RSP to select a remote SP. If this parameter is set to OFF, only a local SP can be used.



Setting range	Default
$\bar{a}N$: Enabled or $\bar{a}FF$: Disabled	ōFF



Related Parameters

SP Mode (Adjustment Level): Page 6-21

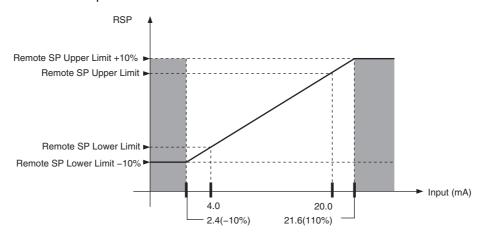
ST (self-tuning) (Initial Setting Level): Page 6-46

R5PH	Remote SP Upper Limit 000	There must be a remote SP input. The ST (self-tuning) parameter must be set to OFF (default: ON).
R5PL	Remote SP Lower Limit 000	The Remote SP Enable parameter must be set to ON (default: OFF).



You can scale the remote SP input for the PV input range with the values that are set for the Remote SP Upper and Lower Limit parameters.

Remote SP Input of 4 to 20 mA



- The remote SP input can be from the remote SP lower limit –10% to the remote SP upper limit +10%. Input values outside of this range are treated as out-of-range input values (RSP input errors) and clamped to the upper or lower limit. The RSP indicator will flash in Remote SP Mode. Also, the Remote SP Monitor will flash on the No. 2 display in any SP
- When you use the remote SP input value as the control SP, it is restricted by the set point upper limit and the set point lower limit.



Parameter	Setting range	Unit	Default
Remote SP Upper Limit	Temperature input: Input setting range lower limit to Input setting range upper limit	EU	1300
Remote SP Lower Limit	Analog input: Scaling lower limit to Scaling upper limit	D	-200



Related Parameters

ST (self-tuning) (Initial Setting Level): Page 6-46 Remote SP Input (Advanced Function Setting Level): Page 6-85 Remote SP Enable (Advanced Function Setting Level): Page 6-85

6 - 86

5PER SP Tracking 000

There must be a remote SP input.

The ST (self-tuning) parameter must be set to OFF

(default: ON).

The Remote SP Enable parameter must be set to

ON (default: OFF).



- This parameter sets the operation to perform when moving from Remote SP Mode to Local SP Mode.
- When this parameter is set to ON, operation continues using the remote SP as the local SP
- When this parameter is set to OFF, the remote SP does not affect the local SP.



Setting range	Default
$\bar{a}N$: Enabled or $\bar{a}FF$: Disabled	ōFF



Related Parameters

Set Point During SP Ramp (Operation Level): Page 6-10

SP Mode (Adjustment Level): Page 6-21

ST (self-tuning) (Initial Setting Level): Page 6-46

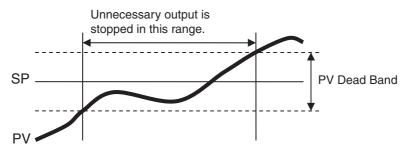
Remote SP Enable (Advanced Function Setting Level): Page 6-85

P-db PV Dead Band

A Position-proportional Model must be used.



When the PV enters the PV dead band, any unnecessary output is stopped to prevent the valve from deteriorating.





Setting range	Unit	Default
0 to 9999	EU	0



Related Parameters

Close/Floating, Motor Calibration, and Travel Time (Initial Setting Level): Page 6-59 Position Proportional Dead Band (Adjustment Level): Page 6-35, Open/Close Hysteresis (Adjustment Level): Page 6-36

MRNL

Manual MV Limit Enable 000

Control must be set to 2-PID control. Close control must be used (Position-proportional Model).



 This parameter sets whether the MV Upper Limit and MV Lower Limit parameters are to be enabled for manual MV in Manual Mode.



Setting range	Default
āN: Enabled, āFF: Disabled	ōFF



Related Parameters

MV Upper Limit (Adjustment Level): Page 6-34 MV Lower Limit (Adjustment Level): Page 6-34

PMV d

Direct Setting of Position Proportional MV

Close control must be used (Position-proportional Model).



• The Direct Setting of Position Proportional MV parameter can be set to ON to enable specifying the valve open with the MV at Stop, MV at PV Error, and Manual MV parameters.



Setting range	Default
āN: Enabled, āFF: Disabled	ōFF



Related Parameters

MV at Stop and MV at PV Error (Adjustment Level): Page 6-32 and Page 6-33 PV/MV (Manual MV): Page 6-40

Pl'RP

PV Rate of Change Calculation Period

Alarms 1, 2, 3, and 4 must be assigned. The alarm type must be set to 13.



- The change width can be found for PV input values in any set period. Differences with previous values in each set period are calculated, and an alarm is output if the results exceed the alarm value.
- The PV rate of change calculation period can be set in units of 50 ms (sampling period).



Setting range	Unit	Default
1 to 999	Sampling cycle	20 (1 s)



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 Alarm 1 to 4 Type (Initial Setting Level): Page 6-48

HEFW

Heating/Cooling Tuning Method

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



This parameter sets the tuning method that is suitable for the cooling control characteristics.



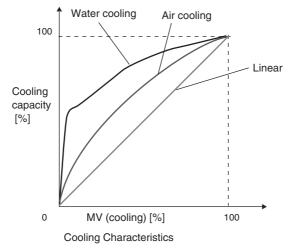
Setting range	Default	
0: Same as heating control		
1: Linear	0	
2: Air cooling	U	
3: Water cooling		

• Air Cooling/Water Cooling

Control that is suitable for an application that does not have linear cooling characteristics (such as plastic molding machines) is performed. The response is fast and the response characteristics are stable.

Linear

Control that is suitable for an application that has linear cooling characteristics is performed.



āMPW

Minimum Output ON/OFF Band

A Standard Model must be used.
The control must be set to 2-PID control.



This parameter sets the minimum ON/OFF width of the outputs that are assigned for the heating and cooling control outputs. You can set this parameter to prevent deterioration of a relay output.



Setting range	Unit	Default
0.0 to 50.0	%	1.0

PF **PF Setting**



This parameter sets the function of the PF Key.



• The default is SHFT (Digit Shift).

Set value	Setting	Function
OFF: aFF	Disabled	Does not operate as a function key.
RUN: FUN	RUN	Specifies RUN status.*5
STOP: 5 <i>L</i> 6 <i>P</i>	STOP	Specifies STOP status.*5
R-S: <i>R-5</i>	Reversing RUN/STOP opera- tion	Specifies reversing RUN/STOP operation status. *5
AT-2: ∄Ŀ - ∂	100%AT Execute/Cancel	Specifies reversing 100% AT Execute/Cancel status. *1 *5
AT-1: #£ - 1	40%AT Execute/Cancel	Specifies reversing 40% AT Execute/Cancel status. *1 *4 *5
LAT: LAL	Alarm Latch Cancel	Specifies canceling alarm latches. *2 *5
A-M: Я-М	Auto/Manual	Specifies reversing Auto/Manual status. *3 *5
PFDP: <i>PFdP</i> 000	Monitor/Setting Item	Specifies the monitor/setting item display. Select the monitor/setting item using the Monitor/Setting Item 1 to 5 parameters (Advanced Function Setting Level).
SHFT: 5HFŁ	Digit Shift	Operates as a Digit Shift Key when settings are being changed.

- When AT cancel is specified, it means that AT is cancelled regardless of whether the AT currently being executed is 100% AT or 40% AT.
- *2 Alarms 1 to 4, the HB alarm, and the HS alarm are cancelled.
- *3 For details on auto/manual operations using the PF Key, refer to 5-12 Performing Manual Control.
- *4 This function will be disabled if it is selected for heating and cooling control or for floating control with a Position-proportional Model.
- The function that is set for the PF Key is disabled if the same function is assigned to an event input.



Related Parameters

Monitor/Setting Item 1 to 5 (Advanced Function Setting Level): Page 6-91

PFd1 Monitor/Setting Item 1 000

PFd2 Monitor/Setting Item 2 000

PFd3 Monitor/Setting Item 3 000 The PF Setting parameter must be set to PFDP.

PFd4 Monitor/Setting Item 4 000

PFd5 Monitor/Setting Item 5 000



When the PF Key is set to display monitor/setting items, pressing the PF Key will display
in order the contents of the Monitor/Setting Item 1 to 5 parameters. The contents of these
parameters are shown in the following table. Refer to the relevant parameters for the
setting/monitor ranges.

Set	Set	Remarks	
value	Setting	Monitor/Setting	Display
0	Disabled		
1	PV/SP/Multi-SP	Can be set. (SP)*1	
2	PV/SP/MV (valve opening for Position-proportional Models)	Can be set. (SP)*1	
3	PV/SP/Soak time remain	Can be set. (SP)*1	
4	Proportional band	Can be set.	Р
5	Integral time	Can be set.	ī.
6	Derivative time	Can be set.	d
7	Alarm value 1	Can be set.	AL - I
8	Alarm value upper limit 1	Can be set.	AL IH
9	Alarm value lower limit 1	Can be set.	AL IL
10	Alarm value 2	Can be set.	RL - 2
11	Alarm value upper limit 2	Can be set.	RL2H
12	Alarm value lower limit 2	Can be set.	AL 2L
13	Alarm value 3	Can be set.	AL - 3
14	Alarm value upper limit 3	Can be set.	RL 3H
15	Alarm value lower limit 3	Can be set.	AL 3L
16	Alarm value 4	Can be set.	AL-4
17	Alarm value upper limit 4	Can be set.	RL YH
18	Alarm value lower limit 4	Can be set.	AL YL
19	PV/SP/Internal SP	Can be set. (SP)*1	
20	PV/SP/Alarm Value 1*2	Can be set. (SP)*1	
21	Proportional Band (Cooling)	Can be set.	[-P
22	Integral Time (Cooling)	Can be set.	[-[
23	Derivative Time (Cooling)	Can be set.	[-d

^{*1} With the E5CC, E5CC-B, E5CC-U, E5DC, E5DC-B, or E5GC only the PV and SP can be displayed.

^{*2} The Alarm Value 1 parameter is displayed even if the Alarm 1 Type parameter is set for no alarm. However, any value that is set is not valid.

SPd I PV/SP No. 1 Display Selection

5Pd2 PV/SP No. 2 Display Selection



These parameters set the items to display on the No. 1 display, No. 2 display, and No. 3 dis-



Set value	No. 1 display	No. 2 display	No. 3 display (E5EC, E5EC-B, and E5AC only)
0	Nothing is displayed.	Nothing is displayed.	Nothing is displayed.
1	Process value	Set point	Nothing is displayed.
2	Process value	Nothing is displayed.	Nothing is displayed.
3	Set point	SP (character display)	Nothing is displayed.
4	Process value	Set point	MV (valve opening for
			Position-proportional Models)
5	Process value	Set point	Multi-SP No.
6	Process value	Set point	Soak time remain 000
7	Process value	Set point	Internal set point (ramp SP)
8	Process value	Set point	Alarm value 1*

The Alarm Value 1 parameter is displayed even if the Alarm 1 Type parameter is set for no alarm. However, any value that is set is not valid.

Parameter	Setting range	Default
PV/SP No. 1 Display Selection	0 to 8	4*
PV/SP No. 2 Display Selection	0 10 6	0

The default is 1 for models other than the E5 \square C- \square -0 \square .

ōd5L **MV Display Selection** A Standard Model with a No. 3 display (E5EC, E5EC-B, or E5AC) must be used and heating and cooling control must be used. The PV/SP No. 1 Display Selection or PV/SP No. 2 Display Selection parameter must be set to 4, or the PF Setting parameter must be set to PFDP and one of the monitor/setting items 1 to 5 must be set to 2.



• This parameter selects the MV display for PV/SP/MV during heating and cooling control. Either heating MV or cooling MV can be selected.



Setting range	Default	
ā: MV (heating)	<u> </u>	
[-a: MV (cooling)	0	

Pl' dP

PV Decimal Point Display 000

The input type must be set for a temperature input.

The display below the decimal point in the PV can be hidden for temperature inputs.



The PV decimals below the decimal point can be hidden by setting the PV Decimal Point
Display parameter to OFF. When this parameter is set to ON, the display below the
decimal point will appear according to the input type setting.



Setting range	Default
āN: ON, āFF: OFF	ON



Related Parameters

Input Type (Initial Setting Level): Page 6-43

PV 5L PV Status Display Function



- This parameter sets a control or alarm status that is displayed alternately in 0.5-s cycles on the No. 1 display when the PV is set to be displayed in the No. 1 display.*1
- PV
- PV/SP*2
- PV/Manual MV (Valve Opening)
- PV/SP/Manual MV (Valve Opening)
- *1 This includes the displays specified with the PV/SP No. 1 and PV/SP No. 2 Display Selection parameters.
- *2 This includes when the PV/SP is selected for the Monitor/Setting Item parameter.



	Setting range	Default
ōFF:	No PV status display	ōFF
MANU:	MANU is alternately displayed during manual control.	
SŁōP:	STOP is alternately displayed while operation is stopped.	
ALM I:	ALM1 is alternately displayed during Alarm 1 status.	
RLM2:	ALM2 is alternately displayed during Alarm 2 status.	
RLM3:	ALM3 is alternately displayed during Alarm 3 status.	
ALMY:	ALM4 is alternately displayed during Alarm 4 status.	
ALM:	ALM is alternately displayed when Alarm 1, 2, 3, or 4 is set to ON.	
HR:	HA is alternately displayed when an HB alarm or HS alarm is ON.	
₩₽*:	While one or more of the work bits (WR1 to WR8) is ON, the message	
	for the highest bit number that is ON is alternately displayed with the	
	corresponding bit number.	

^{*} Selection is possible only with the E5DC, E5DC-B, and E5GC. (The D5DC must be manufactured in July 2014 or later (version 2.2 or higher).)



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 PV/MV (Manual MV) (Manual Control Level): Page 6-40

51/5E **SV Status Display Function**



- This parameter sets a control or alarm status that is displayed alternately in 0.5-s cycles on the No. 2 display when the PV is set to be displayed in the No. 1 display.*1
- PV
- PV/SP*2
- PV/Manual MV (Valve Opening)
- PV/SP/Manual MV (Valve Opening)
- This includes the displays specified with the PV/SP No. 1 and PV/SP No. 2 Display Selection parameters.
- *2 This includes when the PV/SP is selected for the Monitor/Setting Item parameter.



	Setting range	Default
ōFF:	No SV status display	ōFF
MANU:	MANU is alternately displayed during manual control.	
SE OP:	STOP is alternately displayed while operation is stopped.	
ALM I:	ALM1 is alternately displayed during Alarm 1 status.	
ALM2:	ALM2 is alternately displayed during Alarm 2 status.	
ALM3:	ALM3 is alternately displayed during Alarm 3 status.	
ALMY:	ALM4 is alternately displayed during Alarm 4 status.	
ALM:	ALM is alternately displayed when Alarm 1, 2, 3, or 4 is set to ON.	
HR:	HA is alternately displayed when an HB alarm or HS alarm is ON.	
W₽*:	While one or more of the work bits (WR1 to WR8) is ON, the message	
	for the highest bit number that is ON is alternately displayed with the	
	corresponding bit number.	

Selection is possible only with the E5DC, E5DC-B, and E5GC. (The D5DC must be manufactured in July 2014 or later (version 2.2 or higher).)



Related Parameters

Process Value/Set Point (Operation Level): Page 6-8 PV/MV (Manual MV) (Manual Control Level): Page 6-40

d.REF **Display Refresh Period**



- · This parameter delays the display refresh period for monitor values. Only display refreshing is delayed, and the refresh period for process values used in control is not changed.
- This function is disabled by setting the parameter to OFF. If this function is disabled, the display refresh period will be the same as the sampling period, 50 ms.



Setting range	Unit	Default
OFF, 0.25, 0.5, 1.0	Seconds	0.25

LEME

LCT Cooling Output Minimum ON Time

The control output on the cooling side must be a relay or voltage output.

Heating/cooling control must be used, 2-PID control must be used, and the Heating/Cooling Tuning Method parameter must be set to air or water cooling.



- · This parameters sets the minimum output ON time for the cooling-side control output during autotuning.
- Set the time in seconds that is required for the operation of the actuator that is connected to the cooling-side control.

Note: This parameter is not supported for E5CC, E5EC, and E5AC version 2.0 or lower.

Example: The following calculation is used when the configuration consists of the E5□C (with a relay output), a relay, and a solenoid valve.

 $(0.02 \text{ s (fixed)} + 0.02 \text{ s} + 0.06 \text{ s}) \times 2 \text{ (safety factor)} = 0.2 \text{ s}$

The default setting of this parameter is based on the operating time of an actuator on a standard extruder.



Setting range	Unit	Default
0.1 to 1.0	Seconds	0.2

EMAV

Move to Calibration Level 000

Initial setting/communications protect must be 0.

This parameter sets the password to move to the Calibration Level.



- Set the password to move to the Calibration Level. The password is 1201.
- Move to the Calibration Level either by pressing the

 Key or

 Key or

 Key or by waiting for two seconds to elapse.



Related Parameter

Initial Setting/Communications Protect (Protect Level): Page 6-4

Communications Setting Level

PSEL	Protocol Setting	Communications must be supported.
U-Nō	Communications Unit No.	
ЬP5	Communications Baud Rate	
LEN	Communications Data Length	CompoWay/F must be selected as the protocol.
56 <u>2</u> E	Communications Stop Bits	CompoWay/F must be selected as the protocol.
PRLY	Communications Parity	CompoWay/F or Modbus must be selected as the protocol.
5dWE	Send Data Wait Time	



- Each parameter is enabled when the power is reset.
- Match the communications specifications of the E5 C and the host computer. If multiple devices are connected, ensure that the communications specifications for all devices in the system (except the Communications unit number) are the same.



Item	Display	Set values	Settings	Default
Protocol setting	PSEL	EWF	CompoWay/F	EMF
		Mād	Modbus	
		EMP	Component communications	
		FINS	Host Link (FINS)	
		MEP4	MC Protocol (format 4)	
		FXPY	Dedicated protocol (format 4)	
Communications	U-Nā	0 to 99	0 to 99	1
Unit No.				
Communications	6PS	9.6/19.2/38.4/57.6	9.6/19.2/38. 4/57.6 (kbps)	9.6
baud rate		(Kbps)		
Communications	LEN	7 or 8 bits	7 or 8 bits	7
data length				
Stop bits	Sbīt	1 or 2 bits	1 or 2 bits	2
Communications	PRFA	NONE EVEN Odd	None, Even, Odd	EVEN
parity				
Send data wait	SdWE	0 to 99	0 to 99 (ms)	20
time				

Writing with communications is enabled if you set the Protocol Setting parameter to component communications, Host Link (FINS), MC protocol (format 4), or dedicated protocol (format 4).



Related Parameter

Communications Writing (Adjustment Level): Page 6-21

Programless communications and component communications can be used with version 1.1 or higher of the E5CC/EC/AC, version 1.0 or higher of the E5DC, and version 2.2 or higher of the E5GC. Refer to the *E5*_C Digital Controllers Communications Manual (Cat. No. H175) for details.

Protocol Setting = Host Link (FINS), MC Protocol (Format 4), or Dedicated Protocol (Format 4))

Parameter	Parameter display	Display	Settings	Default
Highest Communications	MRXU	🛭 to 99	0 to 99	0
Unit No.				
Area	RRER	0 to 25	0 to 25	0
First Address Upper Word	RARH	🛭 to 99	0 to 99	0
First Address Lower Word	RdRL	🛭 to 9999	0 to 9999	0
Receive Data Wait Time	RWRE	100 to 9999	100 to 9999 ms	1000
Communications Node	UNIE	0 to 99	0 to 99	0
Number				
Upload Settings 1 to 13*	<i>∐P I</i> to <i>1</i> 3	0 to 98	0 to 98	
Download Settings 1 to 13	dN to ∃	<i>30</i> to <i>98</i>	30 to 98	
Сору	EGPY	āFF, ALL, 1 to 15		OFF

^{*} You cannot use Upload Setting 13 parameter if you set the dedicated protocol (format 4).

Protocol Setting Parameter = Component Communications

Parameter	Parameter display	Display	Settings	Default
Highest Communications Unit No.	MAXU	0 to 99	0 to 99	0
Receive Data Wait Time	RWRL	100 to 9999	100 to 9999 ms	1000
Сору	CaPy	āFF, ALL, 1 to 15		OFF
SP Slope	SPS	0.00 I to 9.999	Same as at the left.	1.000
SP Offset	SP65	Temperature input: - 199.9 to 999.9 Analog input: - 1999 to 9999	Same as at the left.	0.0



User Calibration 000

7-1	User Calibration	7-2
7-2	Parameter Structure	7-3
7-3	Thermocouple Calibration	7-4
7-4	Resistance Thermometer Calibration	7-7
7-5	Calibrating Analog Input	7-9
7-6	Calibrating the Transfer Output	7-13
7-7	Checking Indication Accuracy	7-15

User Calibration 7-1

The E5 C is correctly calibrated before it is shipped from the factory. Normally it does not need to be calibrated by the user.

If, however, it must be calibrated by the user, use the parameters for calibrating temperature input and analog input. OMRON, however, cannot ensure the results of calibration by the user. Also, calibration data is overwritten with the latest calibration results. The default calibration settings cannot be restored after user calibration. Perform user calibration with care.

Calibrating Inputs

The input type selected in the parameter is used for calibration. The input types are as follows:

16 types • Thermocouple: • Infrared temperature sensor: 4 types · Resistance thermometer: 5 types · Current input: 2 types · Voltage input: 3 types*

Registering Calibration Data

The new calibration data for each item is temporarily registered. It can be officially registered as calibration data only when all items have been calibrated to new values. Therefore, be sure to temporarily register all items when you perform the calibration. When the data is registered, it is also recorded that user calibration has been performed.

Prepare separate measuring devices and equipment for calibration. For details on how to handle measuring devices and equipment, refer to the respective instruction manuals.

Wiring the E5□C-B (Models with Push-In Plus Terminal Blocks)

When connecting two wires to one terminal to calibrate the E5□C-B, do so as given below.

· Using Stranded Wire

Use AWG24 to AWG20 (0.25 to 0.5 mm²) stranded wires and connect two wires to the terminal.

Using Twin Ferrules

Use AWG22 to AWG18 (0.5 to 0.75 mm²) wires.

Attach the two wires to the twin ferrule first, and then connect the ferrule to the terminal.

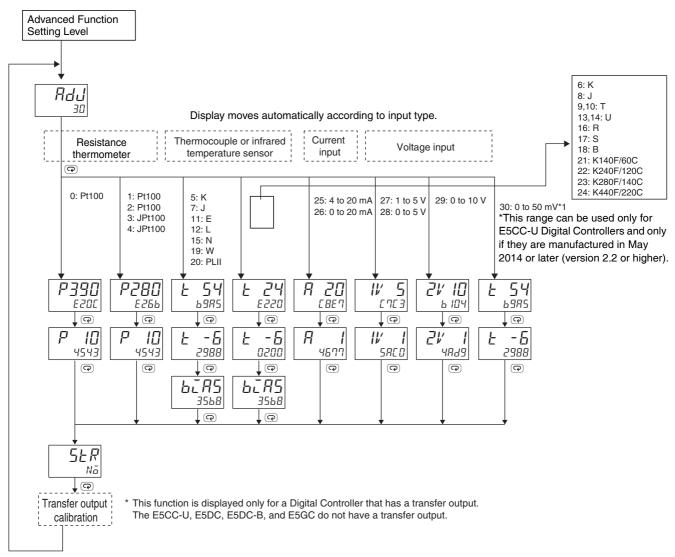
Recommended Twin Ferrules

Manufacturer	Model number
Phoenix Contact	AL-TWIN2 × 0,5-8WH
	AL-TWIN2 × 0,75-8GY
Weidmuller	H0.5/14
	H0.75/14
Wago	FE-0.5-8W-WH
	FE-0.75-8W-GY

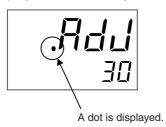
^{*1} There are four types of voltage inputs for E5CC-U Digital Controllers manufactured in May 2014 or later (version 2.2 or higher).

7-2 Parameter Structure

- To execute user calibration, enter the password "1201" at the Move to Calibration Level parameter in the Advanced Function Setting Level. The mode will be changed to the calibration mode, and Rdd will be displayed.
- The Move to Calibration Level parameter may not be displayed when the user is doing the calibration for the first time. If this happens, set the Initial Setting/Communications Protect parameter in the Protect Level to 0 before moving to the Advanced Function Setting Level.
- The calibration mode is ended by turning the power OFF.
- The parameter calibrations in the calibration mode are structured as shown below.



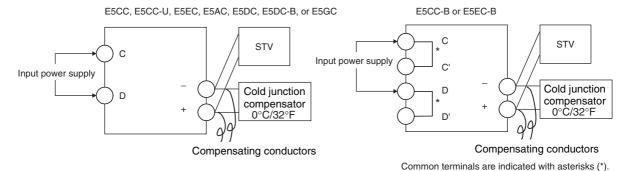
When calibration has been performed after purchase, the user calibration information shown in the following illustration will be displayed when moving to the Calibration Level.



Thermocouple Calibration

- Calibrate according to the type of thermocouple: thermocouple group 1 (input types 5, 7, 11, 12, 15, 19, and 20) and thermocouple group 2 (input types 6, 8, 9, 10, 13, 14, 16, 17, 18, 21, 22, 23, and 24).
- When calibrating, do not cover the bottom of the Digital Controller.

Preparations



The terminal numbers are as follows:

• Input Terminals (Negative and Positive)

E5CC: 5 and 6 E5CC-U: 2 and 1 E5EC/E5AC: 23 and 24 E5DC: 13 and 14 E5DC-B: 15 and 16 E5GC: 11 and 12

• Input Power Supply (C and D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2 E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2

The terminal numbers are as follows:

Input Terminals (Negative and Positive)

E5CC-B: 7 and 8 E5EC-B: 31 and 32

• Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

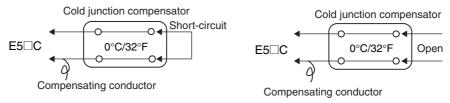
- Set the cold junction compensator designed for compensation of internal thermocouples to 0°C. Make sure that internal thermocouples are disabled (i.e., that tips are open).
- In the above figure, STV indicates a standard DC current/voltage source.
- Use the compensating conductor designed for the selected thermocouple. When thermocouples R, S, E, B, W, or PLII or an infrared temperature sensor is used, the cold junction compensator and the compensating conductor can be substituted with the cold junction compensator and the compensating conductor for thermocouple K.



Additional Information

Connecting the Cold Junction Compensator

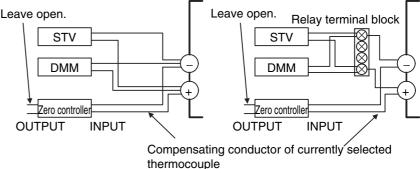
Correct process values cannot be obtained if you touch the contact ends of the compensating conductor during calibration of a thermocouple. Accordingly, short-circuit (enable) or open (disable) the tip of the thermocouple inside the cold junction compensator as shown in the figure below to create a contact or non-contact state for the cold junction compensator.



In this example, calibration is shown for a Digital Controller with thermocouple/infrared temperature sensor set as the input type.

- 1. Connect the power supply.
- 2. Connect a standard DC current/voltage source (STV), precision digital multimeter (DMM), and contact junction compensator (e.g., a zero controller as in the figure) to the thermocouple input terminals, as shown in the figure below. When you calibrate the E5□C-B or E5GC, connect STV and DMM through the terminal block.

E5CC, E5CC-U, E5EC, E5AC, or E5DC E5□C-B or E5GC



Use K thermocouple compensating conductor for E, R, S, B, W, and PLII thermocouples and for an infrared temperature sensor.

- 3. Turn the power ON.
- 4. Move to the Calibration Level. This starts the 30-minute aging timer. This timer provides an approximate timer for aging. After 30 minutes have elapsed, the No. 2 display changes to 0. You can advance to the next step in this procedure even if 0 is not displayed.
- Input types 5, 7, 11, 12,
 When the Key is pressed, the status changes as shown to the left. The No. 2 display at this time shows the currently entered count value in hexadecimal. Set the STV as follows:
 - Input types 5, 7, 11, 12, 15, 19, 20: Set to 54 mV.
 - Input types 6, 8, 9, 10, 13, 14, 16, 17, 18, 21, 22, 23, 24: Set to 24 mV. Allow the count value on the No. 2 display to fully stabilize, then press the ♥ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.



15, 19, 20:



• Input types 6, 8, 9, 10, 13, 14, 16, 17, 18, 21, 22, 23, 24:





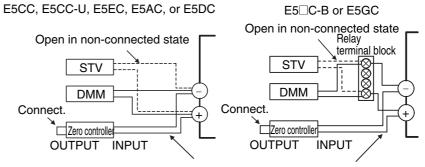


6. When the Key is pressed, the status changes as shown to the left. Set the STV to -6 mV.

Allow the count value on the No. 2 display to fully stabilize, then press the W Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.

- 7. When the Key is pressed, the status changes as shown to the left.
- 8. Change the wiring as follows:



Compensating conductor of currently selected thermocouple

Use K thermocouple compensating conductor for E, R, S, B, W, and PLII thermocouples and for an infrared temperature sensor.

Disconnect the STV to enable the thermocouple of the cold junction compensator. When doing this, be sure to disconnect the wiring on the STV side.

- Allow the count value on the No. 2 display to fully stabilize, then press the

 ✓ Key to temporarily register the calibration settings.
- 10. When the Key is pressed, the status changes as shown to the left. The data to be temporarily registered is not displayed if it is not complete. Press the Key. The No. 2 display changes to 4E5. Release the key and wait two seconds or press the <a> Key. This stores the temporarily registered calibration data to non-volatile memory. To cancel the saving of temporarily registered calibration data to non-volatile memory, press the @ Key (while No is displayed in the No. 2 display) without pressing the A Key.
- 11. The calibration mode is ended by turning the power OFF. For Digital Controllers that have a transfer output, you can continue by calibrating the transfer output. For detailed setting methods, refer to 7-6 Calibrating the Transfer Output.

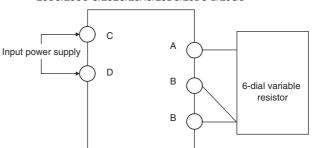


7-4 Resistance Thermometer Calibration

In this example, calibration is shown for Digital Controller with a resistance thermometer set as the input type. Use connecting wires of the same thickness

- 1. Connect the power supply.
- 2. Connect a precision resistance box (called a "6-dial variable resistor" in this manual) to the resistance thermometer input terminals, as shown in the following diagram.

E5CC/E5CC-U/E5EC/E5AC/E5DC/E5DC-B/E5GC



The terminal numbers are as follows:

• Input Terminals (A/B/B)

E5CC: 4, 5, and 6 E5CC-U: 3, 2, and 1

E5EC/E5AC: 22, 23, and 24

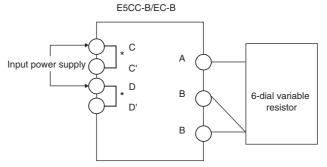
E5DC: 12, 13, and 14 E5DC-B: 11, 15, and 16

E5GC: 10, 11, and 12

• Input Power Supply (C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2

E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2



* Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

- Input Terminals (A/B/B) E5CC-B: 6, 7, and 8 E5EC-B: 30, 31, and 32
- Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4



• Input type 0:



• Input types 1, 2, 3, 4:







- 3. Turn the power ON.
- 4. Move to the Calibration Level.

This starts the 30-minute aging timer. This timer provides an approximate timer for aging. After 30 minutes have elapsed, the No. 2 display changes to 0. You can advance to the next step in this procedure even if 0 is not displayed.

5. Execute calibration for the main input.

Press the Key to display the count value for each input type.

The No. 2 display at this time shows the currently entered count value in hexadecimal. Set the 6-dial as follows:

• Input type 0: 390Ω

• Input type 1, 2, 3 or 4: 280Ω

Allow the count value on the No. 2 display to fully stabilize, then press the ⊌ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.

6. When the Key is pressed, the status changes as shown to the left. Set the 6-dial to 10 Ω .

Allow the count value on the No. 2 display to fully stabilize, then press the ♥ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.

7. When the Key is pressed, the status changes as shown to the left. The data to be temporarily registered is not displayed if it is not complete. Press the Key. The No. 2 display changes to 4£5. Release the key and wait two seconds or press the @ Key. This stores the temporarily registered calibration data to non-volatile memory.

To cancel the saving of temporarily registered calibration data to non-volatile memory, press the \bigcirc Key (while $\mathbb{N}_{\overline{a}}$ is displayed in the No. 2 display) without pressing the Key.

8. The calibration mode is guit by turning the power OFF.

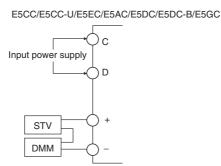
For Digital Controllers that have a transfer output, you can continue by calibrating the transfer output. For detailed setting methods, refer to 7-6 Calibrating the Transfer Output.

7-5 Calibrating Analog Input

Calibrating a Current Input

In this example, calibration is shown for a Digital Controller with an analog input, with a current input set as the input type.

- 1. Connect the power supply.
- 2. Connect an STV and DMM to the current input terminals, as shown in the following diagram.



E5CC-B/E5EC-B

The terminal numbers are as follows:

• Input Terminals (Negative and Positive)

E5CC: 5 and 4 E5CC-U: 2 and 3 E5EC/E5AC: 23 and 22 E5DC: 13 and 12 E5DC-B: 11 and 15 E5GC: 11 and 10

• Input Power Supply (C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2 E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2 * Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

Input Terminals (Negative and Positive)

E5CC-B: 7 and 6 E5EC-B: 31 and 30

• Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

3. Turn the power ON.



4. Move to the Calibration Level.

This starts the 30-minute aging timer. This timer provides an approximate timer for aging. After 30 minutes have elapsed, the No. 2 display changes to 0. You can advance to the next step in this procedure even if 0 is not displayed.



5. When the Key is pressed, the status changes as shown to the left.

The No. 2 display at this time shows the currently entered count value in hexadecimal. Set the STV to 20 mA.

Allow the count value on the No. 2 display to fully stabilize, then press the ♥ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.



6. When the Key is pressed, the status changes as shown to the left. Set the STV to 1 mA.

Allow the count value on the No. 2 display to fully stabilize, then press the ♥ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.



7. When the Key is pressed, the status changes as shown to the left. The data to be temporarily registered is not displayed if it is not complete. Press the $ext{ } ext{ } ext{ } ext{Key.}$ The No. 2 display changes to $ext{ } ext{ }$ or press the $\ \ \ \ \$ Key. This stores the temporarily registered calibration data to non-volatile

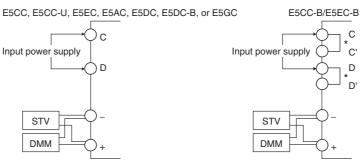
To cancel the saving of temporarily registered calibration data to non-volatile memory, press the $\ \ \,$ Key (while $\ \ \,$ is displayed in the No. 2 display) without pressing the $\ \ \,$ Key.

8. The calibration mode is ended by turning the power OFF. For Digital Controllers that have a transfer output, you can continue by calibrating the transfer output. For detailed setting methods, refer to 7-6 Calibrating the Transfer Output.

Calibrating a Voltage Input

In this example, calibration is shown for a Digital Controller with an analog input, with a voltage input set as the input type.

- 1. Connect the power supply.
- 2. Connect an STV and DMM to the voltage input terminals, as shown in the following diagram.



* Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

Input Terminals (Negative and Positive)

E5CC: 5 and 6 E5CC-U: 2 and 1 E5EC/E5AC: 23 and 24 E5DC: 13 and 14 E5DC-B: 15 and 16 E5GC: 11 and 12

Input Power Supply (C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2 E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2 The terminal numbers are as follows:

• Input Terminals (Negative and Positive)

E5CC-B: 7 and 8 E5EC-B: 31 and 32

• Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

3. Turn the power ON.

88 80 30

4. Move to the Calibration Level.

This starts the 30-minute aging timer. This timer provides an approximate timer for aging. After 30 minutes have elapsed, the No. 2 display changes to 0. You can advance to the next step in this procedure even if 0 is not displayed.

• Input type 27 or 5. When the Key is pressed, the status changes as shown to the left. 28: The No. 2 display at this time shows the currently entered count value

The No. 2 display at this time shows the currently entered count value in hexadecimal. Set the STV as follows:

Input type 27 or 28: 5 V
 Input type 29: 10 V
 Input type 30: 54 mV

Input type 29:



Allow the count value on the No. 2 display to fully stabilize, then press the $\ensuremath{\,\boxtimes\,}$ Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.

• Input type 30:



• Input type 27 or 6. When the Rey is pressed, the status changes as shown to the left. 28: Set the STV as follows:



- Input type 27, 28, or 29: 1 V
- Input type 30: -6 mV





Allow the count value on the No. 2 display to fully stabilize, then press the W Key to temporarily register the calibration settings.

If this count value is outside of the specified range, the No. 2 display will flash and the count value will not be temporarily registered.

• Input type 30:





7. When the Key is pressed, the status changes as shown to the left.

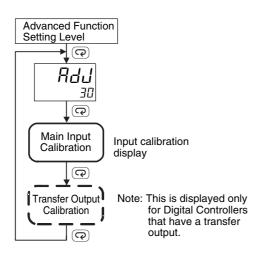
The data to be temporarily registered is not displayed if it is not complete.

Press the Key. The No. 2 display changes to 4£5. Release the key and wait two seconds or press the Rey. This stores the temporarily registered calibration data to non-volatile memory.

To cancel the saving of temporarily registered calibration data to non-volatile memory, press the $\ \ \,$ Key (while $\ \ \,$ is displayed in the No. 2 display) without pressing the $\ \ \,$ Key.

8. The calibration mode is ended by turning the power OFF. For Digital Controllers that have a transfer output, you can continue by calibrating the transfer output. For detailed setting methods, refer to 7-6 Calibrating the Transfer Output.

Calibrating the Transfer Output

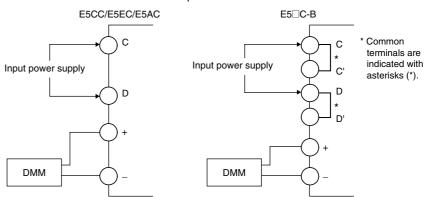


For Digital Controllers that have a transfer output, the transfer output calibration display will be displayed after input calibration has been completed.

The E5CC-U, E5DC, E5DC-B, and E5GC do not have a transfer output.

Use the following procedure to calibrate the transfer output for 4 to 20 mA.

1. Connect a DMM to the transfer output terminals.



The terminal numbers are as follows:

• Transfer Output Terminals (Positive • Transfer Output Terminals (Positive and Negative)

E5CC: 17 and 18 E5EC/E5AC: 32 and 33 Input Power Supply (C/D)

E5CC: 11 and 12 E5EC/E5AC: 1 and 2 The terminal numbers are as follows:

and Negative)

E5CC-B: 23 and 24 E5EC-B: 43 and 44

• Input Power Supply (C or C', and D

or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

2. Press the Key to display the parameter for the transfer output.

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- 3. The calibration display for 20 mA will be displayed. Press the ♠ or ❤ Key until the DMM monitor value changes to 20 mA.
 - Press the Key. The calibration settings will be temporarily registered.
- 4. The calibration display for 4 mA will be displayed. Press the ♠ or ❤ Key until the DMM monitor value changes to 4 mA.
 - Press the [®] Key. The calibration settings will be temporarily registered.



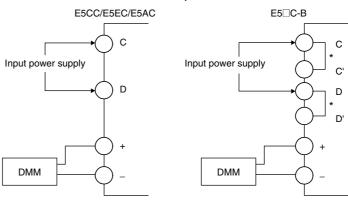
5. To cancel saving the temporarily registered calibration data to non-volatile memory, press the \bigcirc Key without pressing the \bigcirc Key, i.e., while $N_{\bar{a}}$ is displayed in the No. 2 display.

Press the ♠ Key. The No. 2 display changes to ₹5. Release the key and wait 2 seconds or press the
Key. This saves the temporarily registered calibration data in non-volatile memory.

6. The Calibration Mode is ended by turning OFF the power supply.

Use the following procedure to calibrate the transfer output for 1 to 5 V.

1. Connect a DMM to the transfer output terminals.



* Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

• Transfer Output Terminals (Positive and Negative)

E5CC: 16 and 18 E5EC/E5AC: 31 and 33 • Input Power Supply (C/D)

E5CC: 11 and 12 E5EC/E5AC: 1 and 2 The terminal numbers are as follows:

• Transfer Output Terminals (Positive and Negative)

E5CC-B: 22 and 24 E5EC-B: 42 and 44

• Input Power Supply (C or C', and D

or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

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- 2. Press the Key to display the parameter for the transfer output.
- 3. The calibration display for 5 V will be displayed. Press the ♠ or ❤ Key until the DMM monitor value changes to 5 V.

Press the Key. The calibration settings will be temporarily registered.

4. The calibration display for 1 V will be displayed. Press the ♠ or ❤ Key until the DMM monitor value changes to 1 V.

Press the Key. The calibration settings will be temporarily registered.

5. To cancel saving the temporarily registered calibration data to non-volatile memory, press the Rey without pressing the Key, i.e., while $N_{\bar{a}}$ is displayed in the No. 2 display.

Press the ♠ Key. The No. 2 display changes to ₹5. Release the key and wait 2 seconds or press the Tkey. This saves the temporarily registered calibration data in non-volatile memory.

6. The Calibration Mode is ended by turning OFF the power supply.

7-7 Checking Indication Accuracy

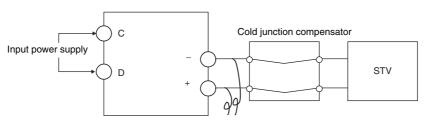
- After calibrating the input, be sure to check the indication accuracy to make sure that the calibration has been executed correctly.
- Operate the E5□C in the process value/set point monitor mode.
- Check the indication accuracy at the following three values: upper limit, lower limit, and mid-point.
- To check the range of an infrared sensor, set the input type parameter to 6 (i.e., a K thermocouple) and input a voltage that is equivalent to the starting power of a K thermocouple.

Thermocouple or Infrared Temperature Sensor

Preparations

The diagram below shows the required device connections. Make sure that the E5\(\text{C}\) and cold junction compensator are connected by a compensating conductor for the thermocouple that is to be used during actual operation.

E5CC, E5CC-U, E5EC, E5AC, E5DC, E5DC-B, or E5GC



Compensating conductor

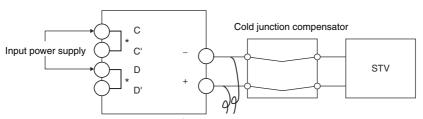
The terminal numbers are as follows:

• Input Terminals (Negative and Positive)

E5CC: 5 and 6 E5CC-U: 2 and 1 E5EC/E5AC: 23 and 24 E5DC: 13 and 14 E5DC-B: 15 and 16 E5GC: 11 and 12 Input Power Supply (C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2 E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2





Compensating conductor

* Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

Input Terminals (Negative and Positive)
 E5CC-B: 7 and 8

E5EC-B: 31 and 32

 Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

Operation

Make sure that the cold junction compensator is at 0°C, and set the STV output to the voltage equivalent of the starting power of the check value.

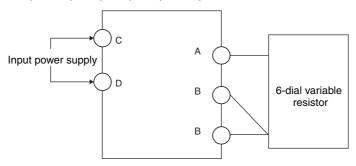
The cold junction compensator and compensation conductor are not required when an external cold junction compensation method is used.

Resistance Thermometer

Preparations

The diagram below shows the required device connections.

E5CC, E5CC-U, E5EC, E5AC, E5DC, E5DC-B, or E5GC



The terminal numbers are as follows:

• Input Terminals (A/B/B)

E5CC: 4, 5, and 6 E5CC-U: 3, 2, and 1

E5EC/E5AC: 22, 23, and 24

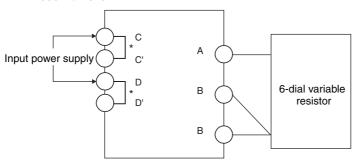
E5DC: 12, 13, and 14 E5DC-B: 11, 15, and 16 E5GC: 10, 11, and 12

• Input Power Supply (C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2

E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2

E5CC-B or E5EC-B



* Common terminals are indicated with asterisks (*).

The terminal numbers are as follows:

• Input Terminals (A/B/B) E5CC-B: 6, 7, and 8

E5EC-B: 30, 31, and 32

• Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 E5EC-B: 1 or 2, and 3 or 4

Operation

Set the 6-dial variable resistor to the resistance that is equivalent to the test value.

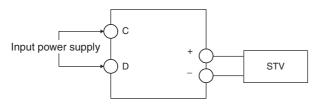
Analog Input

Preparations

The diagram below shows the required device connections. (The connection terminals depend on the model and input type.)

Current Input

E5CC, E5CC-U, E5EC, E5AC, E5DC, E5DC-B, or E5GC



The terminal numbers are as follows:

 Input Terminals (Positive and Negative)

E5CC: 4 and 5 E5CC-U: 3 and 2 E5EC/E5AC: 22 and 23 E5DC: 12 and 13

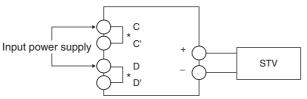
E5DC-B: 11 and 15 E5GC: 10 and 11

Input Power Supply

(C/D)

E5CC: 11 and 12 E5CC-U: 10 and 11 E5EC/E5AC: 1 and 2 E5DC: 1 and 2 E5DC-B: 1 and 2 E5GC: 1 and 2

E5CC-B or E5EC-B



• Input Terminals (Positive and Negative) E5CC-B: 6 and 7

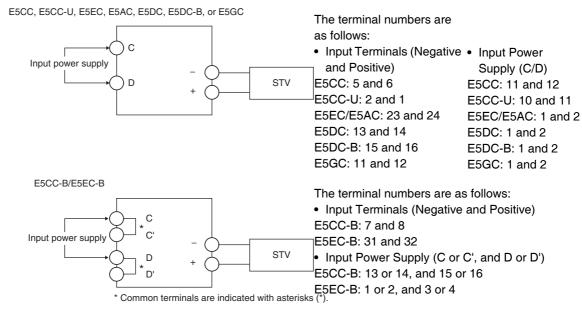
The terminal numbers are as follows:

E5EC-B: 30 and 31

• Input Power Supply (C or C', and D or D')

E5CC-B: 13 or 14, and 15 or 16 * Common terminals are indicated with asterisks (*). E5EC-B: 1 or 2, and 3 or 4

Voltage Input



Operation

Set the STV output to the voltage or current test value.



Appendices

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Specifications A-1

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		
	E5CC/E5CC-U/E5CC-B		Option number 000: 5.2 VA max. Other option numbers: 6.5 VA max.	Option number 000: 3.1 VA max./1.6 W max. Other option numbers: 4.1 VA max./2.3 W max.	
Power	E5EC/E5EC-B		Option number 000: 6.6 VA max. Other option numbers: 8.3 VA max.	Option number 000: 4.1 VA max./2.3 W max. Other option numbers: 5.5 VA max./3.2 W max.	
consumption	E5AC		Option number 000: 7.0 VA max. Other option numbers: 9.0 VA max.	Option number 000: 4.2 VA max./2.4 W max. Other option numbers: 5.6 VA max./3.4 W max.	
	E5DC/E5	DC-B	4.9 VA max.	2.8 VA max./1.5 W max.	
	E5GC		5.9 VA max.	3.2 VA max./1.8 W max.	
Sensor input *1			Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII Platinum resistance thermometer: Pt100, JPt100 Infrared temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C Current input *2: 4 to 20 mA, 0 to 20 mA (Input impedance: 150 Ω max.) Voltage input *2: 1 to 5 V, 0 to 5 V, 0 to 10 V, 0 to 50 mV*5 (Input impedance: 1 M Ω min.)		
		E5CC/E5CC-B/	SPST-NO, 250 VAC, 3 A (resistive load),	electrical life: 100,000 operations	
		E5DC/E5DC-B	Min. applicable load: 5 V, 10 mA*3 (referer	nce values)	
	Relay	E5CC-U	SPDT, 250 VAC, 3 A (resistive load), electrical life: 100,000 operations Min. applicable load: 5 V, 10 mA (reference values)		
	output	E5EC/E5EC-B/ E5AC	SPST-NO, 250 VAC, 5 A (resistive load), of Min. applicable load: 5 V, 10 mA (reference	•	
		E5GC	SPST-NO, 250 VAC, 2 A (resistive load), Min. applicable load: 5 V, 10 mA (reference		
Control	Voltage	E5CC/E5CC-U/ E5CC-B/E5DC/ E5DC-B/E5GC	Output voltage 12 VDC \pm 20% (PNP), max. load current 21 mA, with short-circuit protection circuit		
output 1/2 ^{*4}	output (for driving SSR)	E5EC/E5EC-B/ E5AC	Control Output 1 Output voltage 12 VDC ±20% (PNP), max. load current 40 mA, with short-circuit protection circuit (21 mA if there are two control outputs) Control Output 2 12 VDC ±20% (PNP), max. load current 21 mA, with short-circuit protection circuit		
	E5CC/E5CC-U/		4 to 20 mA DC, 0 to 20 mA DC, Load: 500	Ω max.	
	Linear current output	E5CC-B/E5EC/ E5EC-B/E5AC/ E5AC-B/E5DC/ E5DC-B/E5GC *3	Resolution: Approx. 10,000		
		E5CC	auxiliary outputs: 2 A (resistive load),	el), ry outputs: 3 A (resistive load), model with 3 m applicable load: 10 mA at 5 V (reference values)	
		E5CC-U	1 or 2 auxiliary outputs (depends on mode SPST-NO, 250 VAC, 3 A (resistive load), Electrical life: 100,000 operations, Minimu	el), m applicable load: 10 mA at 5 V (reference values)	
Auxiliary	Relay	E5CC-B	2 auxiliary outputs SPST-NO, 250 VAC, 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference valu		
output	outputs	E5EC/E5EC-B/	2 or 4 auxiliary outputs (depends on model), SPST-NO, 250 VAC, model with 2 auxiliary outputs: 3 A (resistive load), model with 4		
		E5AC	auxiliary outputs: 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference values)		
		E5DC/E5DC-B	2 (depends on model) SPST-NO, 250 VAC, 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference val		
		E5GC	1 or 2 auxiliary outputs (depends on model), SPST-NO, 250 VAC, 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference values)		

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC		
Control method	ON/OFF or 2-PID control (with autot	ON/OFF or 2-PID control (with autotuning)		
Setting method	Digital setting using front panel keys	3		
Indication method	11-segment digital displays and indi	11-segment digital displays and individual indicators		
Other functions Depend on the model				
Ambient temperature	· ·	-10 to 55°C (with no condensation or icing), For 3-year warranty: Mounted individually at -10 to 50°C (with no condensation or icing)		
Ambient humidity	25% to 85%	25% to 85%		
Storage temperature	-25 to 65°C (with no condensation of	-25 to 65°C (with no condensation or icing)		
Altitude 2,000 m max.				
Recommended fuse	T2A, 250 VAC, time lag, low shut-of	T2A, 250 VAC, time lag, low shut-off capacity		
Installation environment	Overvoltage Category II, Pollution C	Overvoltage Category II, Pollution Class 2 (EN/IEC/UL 61010-1)		

- *1 For input setting ranges, refer to A-7 Sensor Input Setting Range, Indication Range, Control Range.
- *2 When connecting the ES2-HB/THB, connect it 1:1.
- *3 With the E5CC, you cannot select a relay output or linear current output for control output 2.
- *4 The E5CC-U, E5CC-B, E5EC-B, E5DC, E5DC-B, and E5GC do not have control output 2.
- *5 The 0 to 50 mV range can be used only for E5CC-U Digital Controllers and only if they are manufactured in May 2014 or later (version 2.2 or higher).

HB and HS Alarms

(E5□C Models with HB and HS Alarms)

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

		E5CC, E5CC-B, E5EC, E5EC-B, E5AC, E5DC, E5DC-B, and E5GC:		
Indication Thermocouple *1		$(\pm 0.3\% \text{ of indication value or } \pm 1^{\circ}\text{C}, \text{ whichever is greater}) \pm 1 \text{ digit max}.$		
		E5CC-U:		
accuracy		$(\pm 1\% \text{ of PV or } \pm 2^{\circ}\text{C}, \text{ whichever is greater}) \pm 1 \text{ digit max.}$		
(when mounted individually, Resistance thermometer		$(\pm 0.2\% \text{ of indication value or } \pm 0.8^{\circ}\text{C}$, whichever is greater) ± 1 digit max.		
ambient	Analog input	±0.2% FS ±1 digit max.		
temperature of 23°C)	CT input	±5% FS ±1 digit max.		
20 0)	Potentiometer	±5% FS ±1 digit max.		
	input			
Temperature		Thermocouple (R, S, B, W, PLII)		
variation influence		($\pm 1\%$ of indication value or $\pm 10^{\circ}$ C, whichever is greater) ± 1 digit max.		
*2	Thermocouple	Other thermocouples:		
Voltage variation		($\pm 1\%$ of indication value or $\pm 4^{\circ}$ C, whichever is greater) ± 1 digit max.		
influence *2	Resistance	*K thermocouple at -100°C max: ±10°C max.		
Electromagnetic	thermometer	($\pm 1\%$ of indication value or $\pm 2^{\circ}$ C, whichever is greater) ± 1 digit max.		
interference influence	Analog input	±1% FS ±1 digit max.		
(according to EN	CT input	±5% FS ±1 digit max.		
61326-1)	Remote SP input	±1% FS ±1 digit max.		
	Tromoto or impair	R, S, B, W, or PLII thermocouple: (±1% of indication value or ±10°C, whichever		
Installation		is greater) ±1 digit max.		
influence	Thermocouple	Other thermocouple: $(\pm 1\%$ of indication value or $\pm 4^{\circ}$ C, whichever is greater) ± 1		
(E5DC/E5DC-B		digit max.		
only)		* K thermocouple at -100°C max: ±10°C 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	Temperature input	0.1 to 999.9°C or °F (in units of 0.1°C or °F)		
band (P)	Analog input	0.1% to 999.9% FS (in units of 0.1% FS)		
		Standard, heating/cooling, or close position-proportional control: 0 to 9,999 s		
Integral time (I) *3		(in 1-s increments) or 0.0 to 999.9 s (in 0.1-s increments)		
• ()		Floating position-proportional control: 1 to 9,999 s (in 1-s increments) or 0.1 to 999.9 s (in 0.1-s increments)		
		0 to 9,999 s (in units of 1 s)		
Derivative time (D)	*3	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%)		
		-1,999 to 9,999 (except for MV alarm)		
		Temperature input: The decimal point is automatically set when the sensor		
Alarm setting rang	A	is selected.		
Alarm Setting rang		Analog input: The decimal point depends on the Decimal Point parameter		
		setting.		
0		-199.9 to 999.9 (MV alarm)		
Sampling cycle Insulation resistan	00	50 ms		
insulation resistan	Ce Comment	20 M Ω min. (at 500 VDC) 100 to 240 VAC: 3,000 VAC, 50/60 Hz for 1 min between terminals of different		
Dielectric strength		charge		
		24 VAC/DC: 3,000 VAC,* 50/60 Hz for 1 min between terminals of different		
		charge		
		*E5GC only: 2,300 VAC		
Malfunction vibrati	on	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		
	E5CC	Approx. 120 g	Adapter: Approx. 10 g	Terminal cover: Approx. 0.5 g each
	E5CC-B	Approx. 120 g	Adapter: Approx. 10 g	
	E5CC-U	Approx. 100 g	Adapter: Approx. 10 g	
Wainbt	E5EC	Approx. 210 g	Adapter: Approx. 4 g × 2	Terminal Cover: Approx. 1 g each
Weight	E5EC-B	Approx. 210 g	Adapter: Approx. 4 g × 2	
	E5AC	Approx. 250 g	Adapter: Approx. 4 g \times 2	Terminal Cover: Approx. 1 g each
	E5DC	Main Unit: Approx. 80 g, Terminal Unit: Approx. 40 g		
	E5DC-B	Main Unit: Approx. 80 g, Terminal Unit: Approx. 40 g		
	E5GC	Approx. 80 g	Adapters: Approx. 4 g × 2	
	E5CC/E5CC-B/	Front panel: IP66	6, rear case: IP20, terminals	s: IP00
Degree of	E5EC/E5EC-B/			
•	E5AC/E5GC			
protection	E5CC-U	Front panel: IP50, rear case: IP20, terminals: IP00		
	E5DC/E5DC-B	Main Unit: IP20, Terminal Unit: 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 $\pm 2^{\circ}$ C ± 1 digit maximum.

The indication accuracy of U and L thermocouples is $\pm 2^{\circ}C \pm 1$ 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 $(\pm 0.3\%$ of PV or $\pm 3^{\circ}$ 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

	Contact Input		
	ON: 1 k Ω max., OFF: 100 k Ω min.		
Event inputs	Non-contact Input		
	ON: Residual voltage 1.5 V max.; OFF: Leakage current 0.1 mA max.		
	Current flow: Approx. 7 mA per contact.		
	Transmission path: RS-485: Multidrop		
	Communications method: RS-485 (2-wire, half duplex)		
Communications	Synchronization: Start-stop		
	Protocol: CompoWay/F or Modbus		
	Baud rate: 9.6, 19.2, 38.4, or 57.6 kbps		
Transfer sutnut	Current output: 4 to 20 mA DC, Load: 500 Ω max., Resolution: 10,000, Accuracy: ±0.3% FS		
Transfer output	Linear voltage output: 1 to 5 VDC, Load: 1 kΩ min., Resolution: 10,000, Accuracy: ±0.3% FS		
Pomoto SD input	Current input: 4 to 20 or 0 to 20 mA DC with input impedance of 150 Ω max.		
Remote SP input	Voltage input: 1 to 5, 0 to 5, or 0 to 10 VDC with input impedance of 1 M Ω min.		

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

Y92S-P12 (for DIN 48 × 24)	Y92S-P8 (for DIN 48 × 48)
Y92S-P9 (for DIN 48 × 96)	Y92S-P10 (for DIN 96 × 96)

A-1-5 Unit Labels

Order the Unit Labels separately to use them with the E5DC or E5DC-B.

Y92S-L2



A-1-6 Setup Tool Port Cover for Front Panel

A Y92F-P7 Setup Tool Port Cover for the front panel is included with the E5EC, E5EC-B, or E5AC. Order this Port Cover separately if the Port Cover on the front-panel Setup Tool port is lost or damaged. The Waterproof Packing must be periodically replaced because it may deteriorate, shrink, or harden depending on the operating environment.



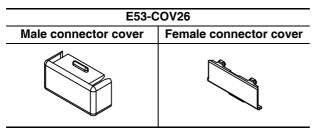
Use the following procedure to replace the Setup Tool Port Cover for the front panel.

Replacement Procedure

1	Open the Setup Tool Port Cover on the front panel.	
2	Pull gently on the Setup Tool Port Cover to remove it from the Digital Controller.	
3	Insert the stopper on the Setup Tool Port Cover into the hole at the bottom of the port.	Insertion hole
4	Make sure that the Setup Tool Port Cover is closed.	

Connector Cover of the Terminal Unit (models with Push-in Plus A-1-7 **Terminal Blocks)**

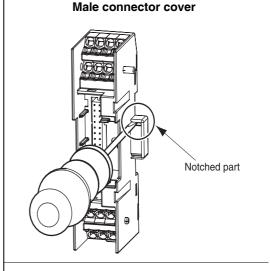
The Terminal Units of the E5DC-B have male and female connector covers (E53-COV26), respectively. Order the connector covers separately, if lost or damaged.



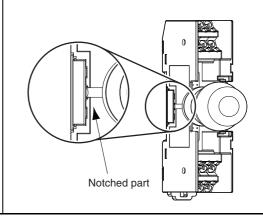
The attachment and removal procedure of the connector covers is described below.

Removing the Connector Covers

Insert a flat-blade screwdriver in the notched part of both the male and female connector covers, and remove the connector covers.



Female connector cover





Precautions for Correct Use

The product may get damaged.

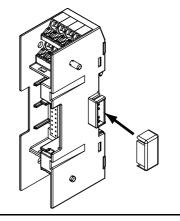
Take care not to insert the flat-blade screwdriver too much inside the notched part of the female connector cover.

Attaching the Connector Covers

For a male connector cover

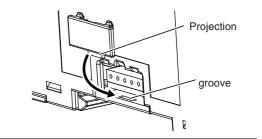
Attach the connector cover until the claws on the connector cover fit into the connector with a click sound.

A male connector does not have an up/down direction.

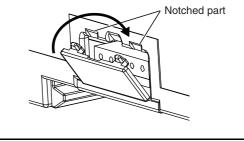


• For a female connector cover

1 Insert the projection on the female connector cover into the groove on the Terminal Unit.



Attach the female connector cover until the claws on the connector cover fit into the notched part of the Terminal Unit with a click sound.



A-2 Current Transformer (CT)

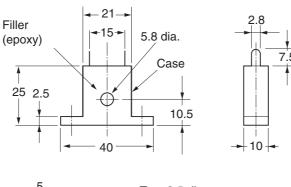
A-2-1 Specifications

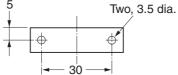
Item	Specifications				
Model number	E54-CT1	E54-CT3	E54-CT1L	E54-CT3L	
Max. continuous current	50 A AC 120 A AC *1		50 A AC	120 A AC*1	
Dielectric strength	1,000 VAC (for 1 mir	٦)	1,500 VAC (1 min)		
Vibration resistance	50 Hz, 98 m/s ²				
Weight	Approx. 11.5 g Approx. 50 g		Approx. 14 g	Approx. 57 g	
Accessories	None Armature (2), Plug (2)		None	None	

^{*1} The maximum continuous current of the E5□C is 50 A.

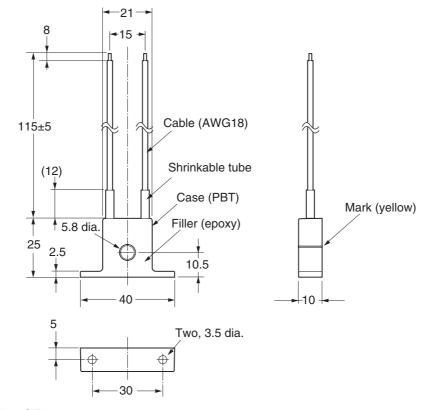
A-2-2 Dimensions (Unit: mm)

• E54-CT1

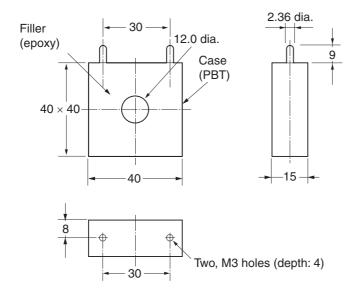




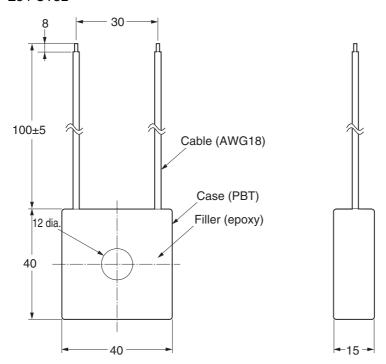
• E54-CT1L

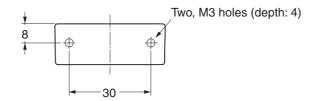


• E54-CT3



• E54-CT3L





A-3 USB-Serial Conversion Cable and Conversion Cable

A Conversion Cable is also required to connect to the Setup Tool port on the front panel of the E5EC, E5EC-B, E5AC, E5DC, or E5DC-B or to the Setup Tool port on the bottom panel of the E5GC. The following table lists the cables and ports that are used.

Connection port Cable	
Setup Tool port (card edge type)	E58-CIFQ2 USB-Serial Conversion Cable
Setup Tool port (pin jack)	E58-CIFQ2 USB-Serial Conversion Cable and E58-CIFQ2-E Conversion
	Cable

Refer to 2-4 Using the Setup Tool Port for the connection procedure.

A-3-1 E58-CIFQ2 USB-Serial Conversion Cable

Specifications

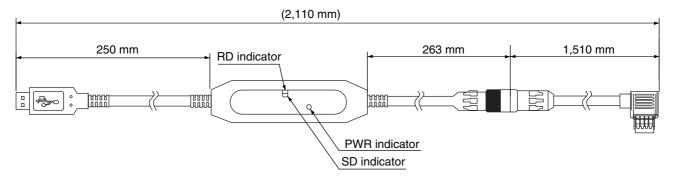
Item	Specifications
Applicable OS	Windows XP, Vista, 7, 8, or 10 ^{*2}
Applicable software	CX-Thermo
Applicable models	E5CC, E5EC, or E5AC: CX-Thermo version 4.5 or higher
	E5DC: CX-Thermo version 4.6 or higher
	E5CC-U or E5□C-T: CX-Thermo version 4.61 or higher
	E5GC: CX-Thermo version 4.62 or higher
	E5CC-B, or E5EC-B: CX-Thermo version 4.65 or higher
	E5DC-B: CX-Thermo version 4.69 or higher
USB interface rating	Conforms to USB Specification 2.0
DTE speed	38,400 bps
Connector	Computer end: USB (type A plug)
specifications	Digital Controller: Special serial connector
Power supply	Bus power (Supplied from USB host controller)*1
Power supply voltage	5 VDC
Current consumption	450 mA max.
Output voltage	4.7±0.2 VDC (Supplied through USB-Serial Conversion Cable to the Digital
	Controller.)
Output current	250 mA max. (Supplied through USB-Serial Conversion Cable to the Digital
	Controller.)
Ambient temperature	0 to 55°C (with no condensation or icing)
Ambient humidity	10% to 80%
Storage temperature	−20 to 60°C (with no condensation or icing)
Storage humidity	10% to 80%
Altitude	2,000 m max.
Weight	Approx. 120 g

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

^{*1} Use a high-power port for the USB port.

^{*2} CX-Thermo version 4.65 or higher runs on Windows 10.

Dimensions



LED Indicator Display

Indicator	Color	Status	Meaning	
PWR	Green	Lit.	USB bus power is being supplied.	
		Not lit.	USB bus power is not being supplied.	
SD	Yellow	Lit	Sending data from USB-Serial Conversion Cable	
		Not lit	Not sending data from USB-Serial Conversion Cable	
RD	Yellow	Lit	Receiving data from the USB-Serial Conversion Cable	
		Not lit	Not receiving data from the USB-Serial Conversion Cable	

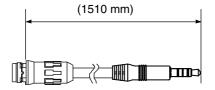
E58-CIFQ2-E Conversion Cable A-3-2

Specifications

Item	Specification
Applicable models	E5EC/E5EC-B/E5AC/E5DC/E5DC-B/E5GC Series and E5EC-T/E5AC-T Series
Connector	Digital Controller: 4-pin plug
specifications	E58-CIFQ2: Small special connector
Ambient temperature	0 to 55°C (with no condensation or icing)
Ambient humidity	10% to 80%
Storage temperature	−20 to 60°C (with no condensation or icing)
Storage humidity	10% to 80%
Altitude	2,000 m max.
Weight	Approx. 60 g

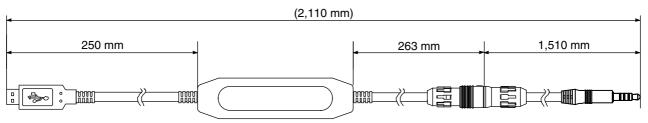
Dimensions

E58-CIFQ2-E Conversion Cable



Note: Always use the E58-CIFQ2-E together with the E58-CIFQ2.

Connected to the E58-CIFQ2 USB-Serial Conversion Cable



A-4 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.

S.F.R.R

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 $+20^{\circ}$ C (Temperature setting lower limit -40° F to temperature setting upper limit $+40^{\circ}$ 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 Digital 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

E5□C Digital Temperature Controllers User's Manual (H174)

After an error occurs, the error is displayed and the alarm outputs function as if the upper limit has been exceeded.

It will also operate as if transfer output exceeded the upper limit. 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, MV at stop, or MV at error is set, the control output is determined by the set value.

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: ccc
- When more than 9,999: בבבב

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

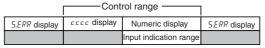
Control range

5.ERR display

Numeric display

5.ERR display

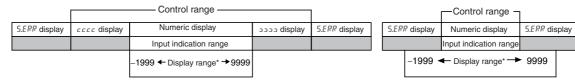
Resistance thermometer input (Except for models with a setting range of –1999. to 500.0°C)
Thermocouple input (Except for models with a setting range of –199.9 to 400.0°C)



Analog Input
• When display range < control range

Input indication rang

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 Digital 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, auxiliary, and transfer outputs turn OFF. (A linear current output will be approx. 0 mA. A linear voltage output will be approx. 0 V.)

E ! ! ! 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 Digital 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, auxiliary, and transfer outputs turn OFF. (A linear current output will be approx. 0 mA. A linear voltage output will be approx. 0 V.)

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

Heater current 2 value monitor

Leakage current 1 monitor

Leakage current 2 monitor

[E | HB Alarm [[R | HS Alarm [[R]

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, Heater Current 2 Value Monitor, Leakage Current 1 Monitor, or Leakage Current 2 Monitor parameters in the Operation or Adjustment Level will flash on the No. 1 display. However, control continues and operation is normal.

- - - - Potentiometer Input Error (Position-proportional Models Only)

Meaning

"---" will be displayed for the Valve Opening Monitor parameter if any of the following error occurs.

- Motor calibration has not been performed.
- The wiring of the potentiometer is incorrect or broken.
- The potentiometer input value is incorrect (e.g., the input is out of range or the potentiometer has failed).

Action

Check for the above errors.

Operation

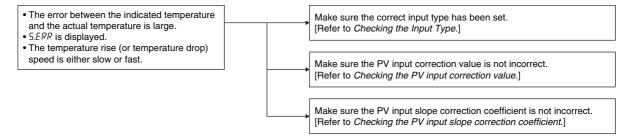
Close control: The control output is OFF or the value that is set for the MV at PV Error parameter is output.

Floating control: Operation will be normal.

A-5 Troubleshooting

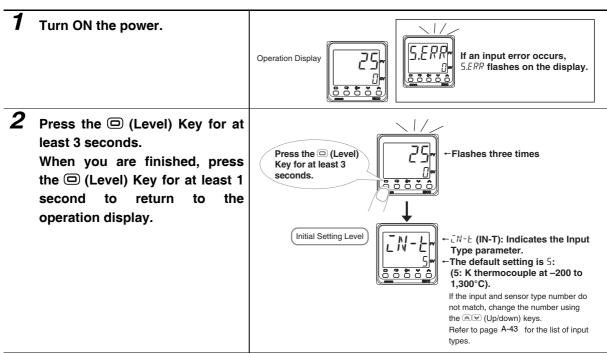
A-5-1 Frequently Asked Questions

Under Troubleshooting, the method of checking for problems that are frequently encountered by the customers has been described below. If a similar event occurs, please check the contents below. For events to which this section may not be applicable, refer to the list *A-5-2 Checking Problems* on page A-22.



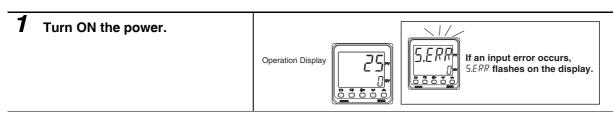
Checking the Input Type

* If the setting value is to be changed for the purpose of checking, OMRON recommends that you make a note of the setting value before change.



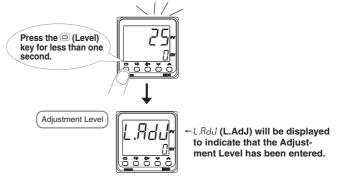
Checking the PV Input Shift Value

If the setting value is to be changed for the purpose of checking, OMRON recommends that you make a note of the setting value before change.



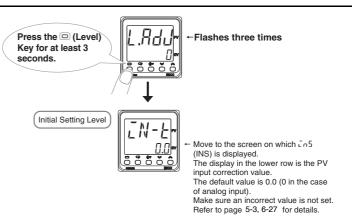
2 Press the (Level) key for less than one second.

Move to the adjustment level.



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

After completion, press the (Level) key for less than one second to return to the Operation screen.





Additional Information

Meaning of the PV input correction value *INS* (INS):

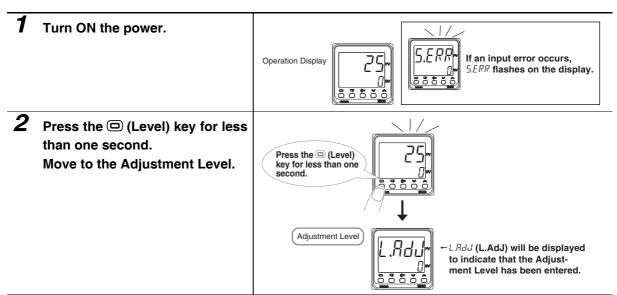
The ins amount is added to the input value from the sensor.

Example) $\bar{L}N5 = 30.0$; When the input value is 100.0° C, the indicated temperature will be 130.0° C.

 $\bar{L}N5$ = -20.0; When the input value is 100.0°C, the indicated temperature will be 80.0°C.

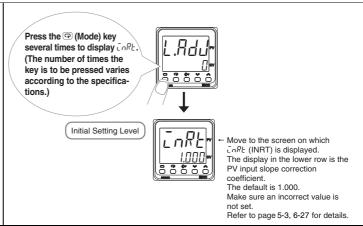
Checking the PV Input Slope Correction Coefficient

* If the setting value is to be changed for the purpose of checking, OMRON recommends that you make a note of the setting value before change.



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

After completion, press the (Level) key for less than one second to return to the Operation screen.





Additional Information

Meaning of the PV input shift value LNRL (INRT):

Specifies the amount of change in the indicated value with respect to the increase/decrease in the sensor input value.

ENRE is calculated as Amount of change in indicated value / Amount of change in input value, and its default value is 1.000.

Example) $\overline{LNRL} = 2.000$; When the amount of change in the input value is +100°C, the amount of change in the indicated value will be +200°C.

 $\bar{L}NRL = 0.200$; When the amount of change in the input value is $+100^{\circ}$ C, the amount of change in the indicated value will be $+20^{\circ}$ C.

A-5-2 **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	Page
Turning	The TUNE indicator will	ST (self-tuning) is in	This is not a product fault.	4-27
ON the power for	flash.	progress (default setting: ON).	The TUNE indicator flashes during self-tuning.	
the first	Temperature error is	Input type mismatch	Check the sensor type and reset the input type correctly.	4-12
time	large. Input error (S.Err display)	Thermometer is not installed properly.	Check the thermometer installation location and polarity and install correctly.	2-25, 2-41
	Communications are not possible.	Non-recommended adapter is being used.	Make sure that the connected device is not faulty.	*1
During operation	Overshooting Undershooting Hunting	ON/OFF control is enabled (default: ON/OFF control selected).	Select PID control and execute either ST (self-tuning) or AT (auto-tuning). When using self-tuning, turn ON the power supply to the 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.	4-24
		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.	4-15
		Unsuitable PID constant	Set appropriate PID constants using either of the following methods. • Execute AT (autotuning). • Set PID constants individually using manual settings.	4-24
		HS alarm operation fault	Use breeder resistance if the problem is due to leakage current. Also investigate the errors detected by the HS alarm function.	4-42
	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.	4-15
		Heater is burnt out or deteriorated.	Check whether heater burnout or deterioration have occurred. Also investigate the errors detected by the heater burnout alarm.	4-40
		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.	
	The AT Execute/Cancel parameter (#£) is not	ON/OFF control is enabled.	Set the PID ON/OFF parameter to PID.	6-45
	displayed.	The Controller is stopped.	Set the RUN/STOP parameter to RUN.	6-13
	The SP Ramp Set Value parameter (5PRE) is not displayed.	ST is enabled	Set the ST parameter to OFF.	6-33
	The Remote SP Enable parameter (P5PU) is not displayed.	ST is enabled	Set the ST parameter to OFF.	6-85
	The Alarm 1 Type parameter (RLE I) is not displayed.	The Auxiliary Output 1 Assignment parameter is set to a heater alarm for a Controller with heater burnout detection.	Set the Auxiliary Output 1 Assignment parameter to Alarm 1. The default setting is for a heater alarm (HA).	6-83

Also refer to the *E5*_C Digital Controllers Communications Manual (Cat. No. H175) for details.

Timing	Status	Meaning	Countermeasures	Page
During operation	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.	5-12
(continued)		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.	4-15
		A high hysteresis is set for ON/OFF operation (default: 1.0°C)	Set a suitable value for the hysteresis.	4-21
		The specified power is not being supplied from the terminals.	The output will not turn ON while the Digital Controller is being operated with power supplied through the USB-Serial Conversion Cable. Supply the specified power from the terminals.	
	Digital 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.	5-12
	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 compensating conductors that are 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.	5-3
	Keys will not operate	Setting change protect is ON.	Turn OFF setting change protect.	5-19
	Cannot shift levels	Operations limited due to protection.	Set the operation/adjustment protect, initial setting/communications protect, and setting change protect values as required.	5-19
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.*2	2-55
*2 The sr	pecified torque is 0.5 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 shielded twisted-pair cable for the communications cable. For detailed wire specifications, refer to 2-2-9 Precautions when Wiring.
More than the specified number of	When 1:N communications are used, a maximum of 32 nodes may be
communications devices are connected to the same communications path.	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 E5 \Box C 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 Digital 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 Digital 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 Digital Controller.	Use the same unit number.
The same unit number as the Digital 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 Digital Controller.	Shorten the send data wait time in the Digital 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 Digital Controller does not return responses for broadcast commands.
The host device sent another command before receiving a response from the Digital 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 Digital Controller.	After receiving a response, wait at least 2 ms before sending the next command.
The communications line became unstable when Digital 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 Digital Controller.
The communications data was corrupted from noise from the environment.	Try using a slower baud rate. Separate the communications cable from the source of noise. Use a shielded, twisted-pair cable for the communications cable. Use as short a communications cable as possible, and do not lay or loop extra cable. To prevent inductive noise, do not run the communications cable parallel to a power line. If noise countermeasures are difficult to implement, use an Optical Interface.

Also refer to the E5 C Digital Controllers Communications Manual (Cat. No. H175) for details on errors.

A-6 Parameter Operation Lists

A-6-1 Operation Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Process Value		Temperature: According to indication range for each sensor. Analog: Scaling lower limit			EU
		-5% FS to Scaling upper limit +5% FS			
Set Point		SP lower limit to SP upper limit		0	EU
Multi-SP Set Point Selection	M-5P	0 to 7		0	None
Remote SP Monitor 000	RSP	Remote SP lower limit –10%FS to remote SP upper limit + 10%FS			EU
Set Point During SP Ramp	5P-M	SP lower limit to SP upper limit			EU
Heater Current 1 Value Monitor	[E I	0.0 to 55.0			Α
Heater Current 2 Value	[F5	0.0 to 55.0			Α
Monitor 000					
Leakage Current 1 Monitor	LERI	0.0 to 55.0			Α
Leakage Current 2	LCR2	0.0 to 55.0			Α
Monitor 000					
Program Start 000	PRSE	RSET, STRT	RSEE, SERE	RSET	None
Soak Time Remain 000	SKER	0 to 9999			s, ^{*1} min, or h
RUN/STOP	R-5	RUN/STOP	RUN, SE BP	Run	None
Alarm Value 1	AL - I	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	AL IH	-1,999 to 9,999		0	EU
Alarm Value Lower Limit 1	AL IL	-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	RL2H	-1,999 to 9,999		0	EU
Alarm Value Lower Limit 2	AL 2L	-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	RL 3H	-1,999 to 9,999		0	EU
Alarm Value Lower Limit 3	RL 3L	-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	RL YH	-1,999 to 9,999		0	EU
Alarm Value Lower Limit 4	ALYL	-1,999 to 9,999		0	EU
MV Monitor (Heating)	ō	-5.0 to 105.5 (standard) 0.0 to 105.0 (heating/cooling)			%
MV Monitor (Cooling)	[-ō	0.0 to 105.0		1	%
Valve Opening Monitor	V - M	Measured opening: -10.0 to 110.0			%
		Estimated opening*2: 0.0 to 100.0			

^{*1} Seconds is supported only by the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)

^{*2} You can use this parameter only with the E5EC-PR or E5AC-PR or E5AC-PR or E5AC-PR or Later (version 2.2 or higher).)

A-6-2 Adjustment Level

Parameters Characters		Setting (monitor) value	Display	Default	Unit
Adjustment Level	L.AdJ				
Display 000					
AT Execute/Cancel	ЯĿ	OFF, AT Cancel	ōFF, AĿ-2,	OFF	None
		AT-2: 100%AT Execute	AF - 1		
		AT-1: 40%AT Execute*1			
Communications Writing	EMWE	OFF, ON	āFF,āN	OFF	None
SP Mode 000	SPMd	LSP, RSP	LSP, RSP	LSP	None
Heater Current 1 Value Monitor	EE I	0.0 to 55.0			Α
Heater Burnout Detection 1	НЬ І	0.0 to 50.0		0.0	А
Heater Current 2 Value	[7]	0.0 to 55.0			Α
Monitor 000					
Heater Burnout	HP5	0.0 to 50.0		0.0	Α
Detection 2 000					
Leakage Current 1	LERI	0.0 to 55.0			Α
Monitor		3.0.0			'`
HS Alarm 1	H5 I	0.0 to 50.0		50.0	Α
Leakage Current 2	LER2	0.0 to 55.0			Α
Monitor 000					
HS Alarm 2 000	H52	0.0 to 50.0		50.0	Α
SP 0	5P-0	SP lower limit to SP upper limit		0	EU
SP 1	5P-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	5P-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	5P-5	SP lower limit to SP upper limit		0	EU
SP 6	5P-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	INS	Temperature input: -199.9 to 999.9		0.0	°C or °F
Shift		Analog input: -1,999 to 9,999		0	EU
Process Value Slope	INRE	0.001 to 9.999		1.000	None
Coefficient 000					
Remote SP Input Shift	RSS	Temperature input: -199.9 to 999.9		0.0	°C or °F
000		Analog input: -1,999 to 9,999		0	EU
Remote SP Input Slope Coefficient 000	RSRE	0.001 to 9.999		1.000	None
Proportional Band	Р	Temperature input: 0.1 to 999.9		8.0	°C or °F
•		Analog input: 0.1 to 999.9		10.0	%FS
Integral Time	Ĺ	Standard, heating/cooling, or close position-proportional control: Integral/Derivative Time Unit of 1 s: 0 to 9,999 Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9 Floating position-proportional control: Integral/Derivative Time Unit of 1 s: 1 to 9999 Integral/Derivative Time Unit of 0.1 s: 0.1 to 999.9		233 233.0	Seconds
Derivative Time	d	Integral/Derivative Time Unit of 1 s: 0 to 9,999 Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9		40 40.0	Seconds
Proportional Band	[-P	Temperature input: 0.1 to 999.9		8.0	°C or °F
(Cooling)		Analog input: 0.1 to 999.9		10.0	%FS

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Integral Time (Cooling)	[-[Integral/Derivative Time Unit of 1 s: 0 to 9,999		233	Seconds
		Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9		233.0	
Derivative Time (Cooling)	[-d	Integral/Derivative Time Unit of 1 s: 0 to 9,999 Integral/Derivative Time Unit of 0.1 s: 0.0 to 999.9		40 40.0	Seconds
Dead Band [-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	ōF-R	0.0 to 100.0		50.0	%
Hysteresis (Heating)	H45	Temperature input: 0.1 to 999.9		1.0	°C or °F
		Analog input: 0.01 to 99.99		0.10	%FS
Hysteresis (Cooling)	CH95	Temperature input: 0.1 to 999.9		1.0	°C or °F
		Analog input: 0.01 to 99.99		0.10	%FS
Soak Time 000	SäRK	1 to 9999		1	min, h, or s*2
Wait Band 000	WE-B	Temperature input: OFF or 0.1 to 999.9	āFF, 0. I to 999.9	OFF	°C or °F
		Analog input: OFF, 0.01 to 99.99	āFF, 0.0 I to 99.99	OFF	%FS
MV at Stop 000	MV -5	Standard: -5.0 to 105.0 Heating/cooling: -105.0 to 105.0		0.0	%
		Floating position-proportional control or the Direct Setting of Position-proportional MV parameter set to OFF: CLOS, HOLD, or OPEN	ELāS,HāLd, āPEN	HOLD	None
		Close position-proportional control with the Direct Setting of Position-proportional MV parameter set to ON: –5.0 to 105.0		0.0	%
MV at PV Error 000	MV -E	Same as the MV at Stop parameter.		0.0	%
SP Ramp Set Value	SPRE	OFF, 1 to 9,999		OFF	EU/s, EU/min, EU/h
SP Ramp Fall Value	SPRL	SAME, OFF, or 1 to 9,999 5RME, aFF, 1 to 9999		SAME	EU/s, EU/min, EU/h
MV Upper Limit	āL-H	Standard control: MV lower limit + 0.1 to 105.0 Heating/cooling control: 0.0 to 105.0		100.0	%
		Close position-proportional control: MV lower limit + 0.1 to 105.0		-	
MV Lower Limit	ōL-L	Standard control: -5.0 to MV upper limit - 0.1		0.0	%
		Heating/cooling control: -105.0 to 0.0		-100.0	
		Close position-proportional control: –5.0 to MV upper limit –0.1		0.0	
MV Change Rate Limit	āRL	0.0 to 100.0 (0.0: MV Change Rate Limit Disabled)		0.0	%/s
Position Proportional	db	Close position-proportional control: 0.1 to 10.0		4.0	%
Dead Band		Floating position-proportional control: 0.1 to 10.0		2.0	
Open/Close Hysteresis	ōC-H	0.1 to 20.0		0.8	%
Extraction of Square Root Low-cut Point	SORP	0.0 to 100.0		0.0	%
000 Work Bit * ON Delay	W I to BāN	0 to 999		0	Seconds
000	A 1 10 UUN				Occorius
Work Bit * OFF Delay	₩ I to BāF	0 to 999		0	Seconds
Communications Monitor	PLEM	0 to 9999			ms

^{*1} This setting is not displayed for heating and cooling control or for floating position-proportional control.

^{*2} Seconds is supported only by the E5DC, E5DC-B, and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)

A-6-3 Initial Setting Level

Parameters	Characters		Setting (monitor) value	Display	Default	Unit
Input Type	ĪN-E	Temperature input	0: Pt100 1: Pt100 2: Pt100 3: JPt100 4: JPt100 5: K 6: K 7: J 8: J 9: T 10: T 11: E 12: L 13: U 14: U 15: N 16: R 17: S 18: B 19: W 20: PLII 21: 10 to 70°C 22: 60 to 120°C 23: 115 to 165°C		5	None
		Analog input	24: 140 to 260°C 25: 4 to 20 mA 26: 0 to 20 mA 27: 1 to 5 V 28: 0 to 5 V 29: 0 to 10 V 30: 0 to 50 mV*1		5	None
Scaling Upper Limit	ĪN-H	Scaling lower I	imit + 1 to 9,999		100	None
Scaling Lower Limit	īN-L	_	ng upper limit –1		0	None
Decimal Point	dР	0 to 3			0	None
Temperature Unit	d-U	°C, °F		E, F	°C	None
SP Upper Limit	SL-H	range upper lir	nput: SP lower limit + 1 to Input setting mit SP lower limit + 1 to scaling upper limit		1300	EU
SP Lower Limit	5L -L	Temperature in SP upper limit	nput: Input setting range lower limit to		-200 0	EU
PID ON/OFF	ENEL	ON/OFF 2-PID		ōNōF, Pīd	ON/OFF	None
Standard or Heating/Cooling	5-HC	Standard or he		5ENd, H-E	Standard	None
ST	5Ł	OFF, ON		āFF,āN	ON	None
Program Pattern 000	PERN	OFF, STOP, C	ONT	āFF, SEāP, CāNE	OFF	None
Control Period (Heating)	ЕР	0.1, 0.2, 0.5, or 1 to 99		0.1,0.2,0.5, 1 to 99	Relay output: 20 Voltage output (for driving SSR): 2	Seconds
Control Period (Cooling)	Е-ЕР			0.1,0.2,0.5, 1 to 99	Relay output: 20 Voltage output (for driving SSR): 2	Seconds
Direct/Reverse Operation	āREV	Reverse opera	tion, direct operation	ōR-R, ōR-d	Reverse operation	None

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Alarm 1Type	RLE I	O: Alarm function OFF 1: Upper and lower-limit alarm 2: Upper-limit alarm 3: Lower-limit alarm 4: Upper and lower-limit range alarm 5: Upper- and lower-limit alarm with standby sequence 6: Upper-limit alarm with standby sequence 7: Lower-limit alarm with standby sequence 8: Absolute-value upper-limit alarm 9: Absolute-value lower-limit alarm 10: Absolute-value upper-limit alarm with standby	Display	2	None None
		sequence 11: Absolute-value lower-limit alarm with standby sequence 12: LBA (Loop Burnout Alarm) (A Standard Model must be used.) 13: PV change rate alarm 14: SP absolute-value upper-limit alarm 15: SP absolute-value lower-limit alarm 16: MV absolute-value upper-limit alarm 17: MV absolute-value upper-limit alarm 18: RSP absolute-value upper-limit alarm 18: RSP absolute-value lower-limit alarm (There must be a remote SP input.) 19: RSP absolute-value lower-limit alarm (There must be a remote SP input.)			
Alarm 1 Hysteresis	ALH I	Temperature input: 0.1 to 999.9 for all alarms except for MV absolute-value upper-limit or MV lower-limit alarms Analog input: 0.01 to 99.99 for all alarms except for MV absolute-value upper-limit or MV lower-limit		0.2	°C or °F
		alarms 0.01 to 99.99 for MV absolute-value upper-limit or MV lower-limit alarms		0.50	%
Alarm 2 Type	ALF5	Same as Alarm 1 Type except that 12 (LBA) cannot be set.		2	None
Alarm 2 Hysteresis	RLH2	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 0.01 to 99.99 for MV absolute-value upper-limit or		0.02	%FS
Alarm 3 Type	RLE3	MV lower-limit alarms Same as Alarm 1 Type except that 12 (LBA) cannot		2	None
Alarm 3 Hysteresis	ALH3	be set. Temperature input: 0.1 to 999.9 for all alarms except		0.2	°C or °F
, 0 11y3101G313		for MV absolute-value upper-limit or MV lower-limit alarms		V.E	
		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	ALEY	Same as Alarm 1 Type except that 12 (LBA) cannot be set.		2	None
Alarm 4 Hysteresis	RLHY	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	ā 15£	4-20: 4-20 mA 0-20: 0-20 mA	4-20, 0-20	4-20	None

Parameters Characte		Setting (monitor) value	Display	Default	Unit	
Control Output 2 Signal	ō25Ł	4-20: 4-20 mA 0-20: 0-20 mA	4-20, 0-20	4-20	None	
Transfer Output Signal	ERSE	4-20: 4-20 mA 1-5V: 1-5 V	4-20, I-5V	4-20	None	
Transfer Output Type 000	ER-E	OFF: OFF SP: Set point*2 SP-M: Ramp set point PV: Process value MV: MV (heating) (Not supported for Position-proportional Models.) CMV: MV (cooling) (Supported only for heating/cooling control.) V-M: Valve opening (Supported only for Position-proportional Models.)	ōFF SP SP-M PV MV E-MV	OFF	None	
Transfer Output Upper Limit 000	ŁR-H	*3		*3	*3	
Transfer Output Lower Limit 000	ER-L	*3		*3	*3	
Simple Transfer Output 1 Upper Limit	ā IEH	*4		*4	*4	
Simple Transfer Output 1 Lower Limit	ō IŁL	*4		*4	*4	
Event Input Assignment 1	Ev - 1	NONE: None STOP: RUN/STOP MANU: Auto/Manual Switch PRST: Program Start *5 DRS: Invert Direct/Reverse Operation RSP: SP Mode Switch (There must be a remote SP input.) AT-2: 100% AT Execute/Cancel AT-1: 40% AT Execute/Cancel *6 WTPT: Setting Change Enable/Disable Communications Writing Enable/Disable (Communications must be supported.) LAT: Alarm Latch Cancel MSP0: Multi-SP No. switching bit 0 MSP1: Multi-SP No. switching bit 1 MSP2: Multi-SP No. switching bit 2 Same as Event Input Assignment 1.	NōNE SEĞP MANU PRSE dRS RSP AE-2 AE-1 WEPE CMWE LAE MSP0 MSP1 MSP2 Same as	MSP0 STOP	None	
Assignment 2	EV - 3	Company Superham to Assistance 4.4	Event Input Assignment 1.	NONE	Nana	
Event Input Assignment 3	LV - 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	
Event Input Assignment 5 000	EV-5	Same as Event Input Assignment 1.	Same as Event Input	NONE	None	
Event Input Assignment 6 000	EV - 6	Same as Event Input Assignment 1. Same as Event Input Assignment 1.		NONE	None	
Close/Floating	ELFL	FLOT: Floating control CLOS: Close control	Assignment 1.	FLOT	None	
Valve Opening Monitor	VM5L	MEAS: Measured opening	MEAS ESTM	MEAS	None	
Selection*7 800						
Selection*7 800 Motor Calibration	CAL b	ESTM: Estimated opening OFF or ON	ōFF, ōN	OFF	None	

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Extraction of Square	SOR	OFF: ON	āFF, āN	OFF(0)	None
Root Enable 000					
Move to Advanced function Setting Level	AMāV	-1,999 to 9,999		0	None

- *1 This range can be used only for E5CC-U Digital Controllers and only if they are manufactured in May 2014 or later (version 2.2 or higher).
- *2 The remote SP will be output while the SP Mode parameter is set to the Remote SP Mode.

*3

Transfer output type	Setting (monitor) range	Default* ^{3.1} (transfer output upper/lower limits)	Unit
Set Point	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
Set Point During SP Ramp	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
PV	Temperature input: Input setting range lower limit to Input setting range upper limit	Input setting range upper/lower limit	EU
	Analog input: Scaling lower limit to Scaling upper limit	Scaling upper/lower limit	
MV (Heating)	Standard: -5.0 to 105.0 Heating/cooling: 0.0 to 105.0	100.0/0.0	%
MV (Cooling)	0.0 to 105.0	100.0/0.0	%
Valve opening	-10.0 to 110.0	100.0/0.0	%

^{*3.1} Initialized when the transfer output type is changed.

Initialized if the input type, temperature unit, scaling upper/lower limit, or SP upper/lower limit is changed when the transfer output type is SP, ramp SP, or PV.

(When initialized by the initializing settings, it is initialized to 100.0/0.0.)

*4

Setting of the simple transfer output type	Setting (monitor) range	Default ^{*4.1} (simple transfer output upper/lower limits)	Unit
Simple transfer SP	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
Simple transfer ramp SP	SP lower limit to SP upper limit	SP upper limit/lower limit	EU
Simple transfer PV	Temperature input: Input setting range lower limit to Input setting range upper limit	Input setting range upper/lower limit	EU
	Analog input: Scaling lower limit to Scaling upper limit	Scaling upper/lower limit	
Simple transfer MV (heating)	Standard: -5.0 to 105.0 Heating/cooling: 0.0 to 105.0	100.0/0.0	%
Simple transfer MV (cooling)	0.0 to 105.0	100.0/0.0	%

^{*4.1} Initialized if the control output 1 type is changed.

Initialized if the input type, temperature unit, scaling upper/lower limit, or SP upper/ lower limit is changed when the control output 1 type is set to the simple transfer SP, simple transfer ramp SP, or simple transfer PV

- *5 PRST (Program Start) can be set even when the Program Pattern parameter is set to OFF, but the function will be disabled.
- *6 This function can be set for heating/cooling control or for floating control for Position-proportional Models, but the setting will be disabled.
- *7 You can use this parameter only with the E5EC-PR□-8□□ or E5AC-PR□-8□□. (The Digital Controller must be manufactured in August 2014 or later (version 2.2 or higher).)

Manual Control Level A-6-4

Parameters	Setting (monitor) value	Default	Unit
Manual MV	-5.0 to 105.0 (standard)*1	0.0	%
	-105.0 to 105.0 (heating/cooling)*2		
	-5.0 to 105.0 (position-proportional)*1*2		

When the Manual MV Limit Enable parameter is set to ON, the setting range will be the MV lower limit to the MV upper

Monitor/Setting Item Level A-6-5

The contents displayed vary depending on the Monitor/Setting 1 to 5 (advanced function setting level) setting.

Advanced Function Setting Level A-6-6

Parameters	Characters	Setting (monitor) value	Display	Default	Unit	
Parameter Initialization	INIE	OFF, FACT	äFF, FREE	OFF	None	
Number of Multi-SP Points	MSPU	OFF(1), 2 to 8		OFF	None	
SP Ramp Time Unit	SPRU	S: EU/second M: EU/minute H: EU/hour	5, M, H	М	None	
Standby Sequence Reset	RESE	Condition A, condition B	Я, Ь	Condition A	None	
Auxiliary Output 1 Open in Alarm	56 IN	N-O: Close in alarm N-C: Open in alarm	N-ō, N-E	N-O	None	
Auxiliary Output 2 Open in Alarm	562N	N-O: Close in alarm N-C: Open in alarm	N-ō, N-E	N-O	None	
Auxiliary Output 3 Open in Alarm	563N	N-O: Close in alarm N-C: Open in alarm	N-ō, N-E	N-O	None	
Auxiliary Output 4 Open in Alarm	SBYN	N-O: Close in alarm N-C: Open in alarm	N-ā, N-E	N-O	None	
HB ON/OFF	НЬИ	OFF, ON	ōFF, ōN	ON	None	
Heater Burnout Latch	НЬL	OFF, ON	āFF, āN	OFF	None	
Heater Burnout Hysteresis	НЬН	0.1 to 50.0		0.1	А	
ST Stable Range	5E-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	FīdU	1, 0.1	1, 0. 1	1	Second	
AT Calculated Gain	RE-G	0.1to 10.0		Standard Model: 0.8 Position-pro portional Model: 1.0	None	
AT Hysteresis 000	AF-H	Temperature input: 0.1 to 999.9		0.8	°C or °F	
7 ti Tiyoto. Gold Gold		Analog input: 0.01 to 9.99		0.20	%FS	
Limit Cycle MV	LEMR	5.0 to 50.0		20.0	%	
Amplitude 000						
Input Digital Filter	INF	0.0 to 999.9		0.0	Second	
Moving Average Count	MRI/	OFF, 2, 4, 8, 16, or 32		OFF*5	Times	
FB Moving Average	PMRV	OFF, 2, 4, 8, 16, or 32	1	16	Times	
Count ^{*9} 800						
MV Display	ō-dP	OFF, ON	āFF, āN	OFF	None	
Automatic Display Return Time	REŁ	OFF, 1 to 99	ōFF, 1 to 99	OFF	Second	

^{*2} The valve opening is monitored for floating control or for close control with the Direct Setting of Position-proportional MV parameter set to OFF.

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Display Brightness	P&@F	1 to 3		3	None
000					
Alarm 1 Latch	A ILE	OFF, ON	ōFF, ōN	OFF	None
Alarm 2 Latch	R2LE	OFF, ON	ōFF, ōN	OFF	None
Alarm 3 Latch	R3LE	OFF, ON	ōFF, ōN	OFF	None
Alarm 4 Latch	RYLE	OFF, ON	ōFF, ōN	OFF	None
Move to Protect Level Time	PRLE	1 to 30		3	Second
Cold Junction Compensation Method	ЕЛЕ	OFF, ON	ōFF, ōN	ON	None
Alarm 1 ON Delay	A ION	0 to 999 (0: ON delay disabled)		0	Second
Alarm 2 ON Delay	ASEN	0 to 999 (0: ON delay disabled)		0	Second
Alarm 3 ON Delay	A39N	0 to 999 (0: ON delay disabled)		0	Second
Alarm 4 ON Delay	AHāN	0 to 999 (0: ON delay disabled)		0	Second
Alarm 1 OFF Delay	A löf	0 to 999 (0: OFF delay disabled)		0	Second
Alarm 2 OFF Delay	A26F	0 to 999 (0: OFF delay disabled)		0	Second
Alarm 3 OFF Delay	A36F	0 to 999 (0: OFF delay disabled)		0	Second
Alarm 4 OFF Delay	RYGF	0 to 999 (0: OFF delay disabled)		0	Second
MV at Stop and Error	MV SE	OFF, ON	āFF, āN	OFF	None
Addition 000					
Auto/Manual Select Addition	ЯМЯН	OFF, ON		Standard Model:OFF Position-pro portional Model: ON	None
Manual Output Method	MANE	HOLD or INIT	HōLd, īNīŁ	HOLD	None
Manual MV Initial Value	MANE	-5.0 to 105.0 for standard control *1		0.0	%
		-105.0 to 105.0 for heating/cooling control *1			
RT 000	RE	OFF, ON	āFF, āN	OFF	None
HS Alarm Use	HSU	OFF, ON	āFF, āN	ON	None
HS Alarm Latch	HSL	OFF, ON	ōFF, ōN	OFF	None
HS Alarm Hysteresis	Н5Н	0.1 to 50.0		0.1	Α
LBA Detection Time	LЬЯ	0 to 9999 (0: LBA function disabled)		0	Second
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	L b A b	Temperature input: 0.0 to 999.9		3.0	°C or °F
		Analog input: 0.00 to 99.99		0.20	%FS

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Control Output 1	āUE I	Relay Output or Voltage Output (for Driving SSR) *2		0	None
Assignment		NONE: No assignment	NāNE		
		O: Control output (heating)	ō		
		C-O: Control output (cooling)	[-ā		
		ALM1: Alarm 1	ALM I		
		ALM2: Alarm 2	ALM2		
		ALM3: Alarm 3	ALM3		
		ALM4: Alarm 4	ALMY		
		HA: Heater alarm (HB + HS)	HR		
		HB: Heater burnout alarm (HB)	Hb Hc		
		HS: Heater short alarm (HS)	HS S.ERR		
		S.ERR: Input error RS.ER: Remote SP input error	2.ER RS.ER		
		1	P.ENd		
		P.END: Program End output *3			
		RUN: RUN output	RUN		
		ALM: Integrated alarm	ALM WR I		
		WR1: Work bit 1 *4			
		WR2: Work bit 2 *4	MR2		
		WR3: Work bit 3 *4	WR3		
		WR4: Work bit 4 *4	WRY		
		WR5: Work bit 5 *4	WR5		
		WR6: Work bit 6 *4	WR5		
		WR7: Work bit 7 *4	₩R7		
		WR8: Work bit 8 *4	WR8		
		For Linear Current Output *2			
		TCMV: Simple transfer MV (cooling) ^{*5}	EEMV		
		T-MV: Simple transfer MV (heating)*5	E-MV		
		T-PV: Simple transfer PV*5	E-PV		
		TSPM: Simple transfer ramp SP*5	Ł SPM		
		T-SP: Simple transfer SP*5	E-5P		
		NONE: Not assigned.	NāNE		
		O: Control output (heating)	ō		
		C-O: Control output (cooling)	[-ā		
Control Output 2	ōUE2	Same as for the Control Output 1 Assignment	Same as for	NONE	None
Assignment		parameter except for the setting (monitor) value	the Control Output 1		
		marked with *5.	Assignment		
			parameter		
			except for the		
			setting		
			(monitor) value marked		
			with *5.		
	l		1	l	L

Parameters Characters		Setting (monitor) value	Display	Default	Unit
Auxiliary Output 1 5Ub I		NONE: No assignment	NōNE	ALM1	None
ssignment		O: Control output (heating)	ō	*Digital	
		C-O: Control output (cooling)	E-ā	Controllers without HB	
		ALM1: Alarm 1	ALM I	and HS	
		ALM2: Alarm 2	ALM2	alarm	
		ALM3: Alarm 3	ALM3	detection:	
		ALM4: Alarm 4	ALMY	HA	
		HA: Heater alarm (HB + HS)	HR		
		HB: Heater burnout alarm (HB)	НЬ		
		HS: Heater short alarm (HS)	H5		
		S.ERR: Input error	S.ERR		
		RS.ER: RSP input error	RS.ER		
		P.END: Program end output *3	P.E.N.d		
			RUN		
		RUN: RUN output	ALM		
		ALM: Integrated alarm			
		WR1: Work bit 1 *4	WR I		
		WR2: Work bit 2 *4	WR2		
		WR3: Work bit 3 *4	WR3		
		WR4: Work bit 4 *4	WRЧ		
			urs		
		WR5: Work bit 5 *4			
		WR6: Work bit 6 *4	WR5		
		WR7: Work bit 7 *4	WR7		
		WR8: Work bit 8 *4	WB8		
Auxiliary Output 2	5062	Same as the Auxiliary Output 1 Assignment	Same as the	ALM2	None
Assignment		parameter.	Auxiliary		
			Output 1		
			Assignment		
			parameter.		
Auxiliary Output 3	5063	Same as the Auxiliary Output 1 Assignment	Same as the	ALM3	None
Assignment		parameter.	Auxiliary Output 1		
			Assignment		
			parameter.		
uxiliary Output 4	SUBY	Same as the Auxiliary Output 1 Assignment	Same as the	ALM4	None
Assignment 000		parameter.	Auxiliary		
000			Output 1		
			Assignment		
	OL MO	0.1.055	parameter.	40	N.
ntegrated Alarm Assignment	RLMR	0 to 255 Alarm 1: +1		49	None
assignini c ni		Alarm 2: +2			
		Alarm 3: +4			
		Alarm 4: +8			
		HB alarm: +16			
		HS alarm: +32			
		Input error: +64			
	- L_II	RSP input error: +128	MII	NA.	Now-
Soak Time Unit 000	E-U	M: Minutes H: Hours	М, Н	М	None
		S: Seconds ^{*6}			
Marm SP Selection	RLSP		5P-M, 5P	SP-M	None
	חרפר	SP-M: Ramp set point SP: Set point	יין, אר	OF-IVI	None
000		·			
Remote SP Input	R5-E	4-20: 4-20 mA	4-20, 0-20,	4-20	None
000		0-20: 0-20 mA	1-51, 0-51,		
		1-5V: 1-5 V	0-10		
		0-5V: 0-5 V 0-10: 0-10 V			
Remote SP Enable	RSPU	OFF, ON	āFF, āN	OFF	None
	ח וב יו	OII, OIN	יים, יים		INOTIE
000	1				1

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Remote SP Upper limit	RSPH	Temperature input: Input setting range lower limit to Input setting range upper limit		1300	EU
000		Analog input: Scaling lower limit to Scaling upper limit		100	
Remote SP lower limit	RSPL	Temperature input: Input setting range lower limit to Input setting range upper limit		-200	EU
000		Analog input: Scaling lower limit to Scaling upper limit		0	
SP Tracking 000	SPER	OFF, ON	āFF, āN	OFF	None
PV Dead Band	P-db	0 to 9999		0	EU
Manual MV Limit Enable 000	MANL	OFF, ON	ōFF, ōN	OFF	None
Direct Setting of Position Proportional MV	PMV d	OFF, ON	ōFF, ōN	OFF	None
PV Rate of Change Calculation Period	PI; RP	1 to 999		20	Sampling period
Heating/CoolingTuning Method	HEFW	0: Same as heating control 1: Linear 2: Air cooling 3: Water cooling		0	None
Minimum Output ON/OFF Band	ōMPW	0.0 to 50.0		1.0	%
PF Setting	PF	OFF: OFF RUN: RUN STOP: STOP R-S: RUN/STOP AT-2: 100% AT execute/cancel AT-1: 40% AT execute/cancel LAT: Alarm Latch Cancel A-M: Auto/manual PFDP: Monitor/setting item SHFT: Digit Shift Key	GFF RUN SEGP R-S RE-2 RE-1 LAE R-M PFDP SHFE	SHFT	None
Monitor/Setting Item 1 000	PFd I	0: Disabled 1: PV/SP/Multi-SP 2: PV/SP/MV (valve opening for Position-proportional Models) 3: PV/SP/Soak time remain 4: Proportional band (P) 5: Integral time (I) 6: Derivative time (D) 7: Alarm value 1 8: Alarm value upper limit 1 9: Alarm value lower limit 1 10: Alarm value lower limit 2 11: Alarm value upper limit 2 12: Alarm value lower limit 2 13: Alarm value upper limit 3 14: Alarm value upper limit 3 15: Alarm value lower limit 3 16: Alarm value lower limit 4 18: Alarm value upper limit 4 18: Alarm value upper limit 4 19: PV/SP/Internal SP 20: PV/SP/Alarm value 1 21: Proportional Band (Cooling) (C-P) 22: Integral Time (Cooling) (C-D)		1	None
Monitor/Setting Item 2	PFd2	Same as Monitor/Setting Item 1.		0	None
Monitor/Setting Item 3	PF d 3	Same as Monitor/Setting Item 1.		0	None
Monitor/Setting Item 4	PF d4	Same as Monitor/Setting Item 1.		0	None

Characters	Setting (monitor) value	Display	Default	Unit	
PFdS	Same as Monitor/Setting Item 1.		0	None	
SPd I	0: Nothing is displayed.		⊿ *6	None	
	1: PV/SP/Nothing displayed		7		
	2: PV/Nothing displayed/Nothing displayed				
	3: SP/SP (character display)/Nothing displayed				
	Position-proportional Models)				
	5: PV/SP/Multi-SP No.				
	6: PV/SP/Soak time remain				
	7: PV/SP/Internal SP (ramp SP)				
	8: PV/SP/Alarm value 1				
SP42	Same as PV/SP No. 1 Display Selection.		0	None	
ōd5L	O: MV (Heating)	ā, E -ā	0	None	
	C-O: MV (Cooling)				
PV dP	OFF, ON	āFF,āN	ON	None	
PV 5E	OFF: OFF	ōFF	OFF	None	
	MANU: Manual	MANU			
	STOP: Stop				
	ALM1: Alarm 1	ALM I			
51/5E			OFF	None	
	· ·				
		ИR			
AREE			0.25	Second	
0.7.27	011, 0.23, 0.3, 1.0		0.23	Occoria	
LEME	0.1 to 1.0		0.2	Second	
[MāV	-1999 to 9999		0	None	
	SPd I SPd I SPd I AdSt PV dP PV SE SV SE	PFd5 Same as Monitor/Setting Item 1. 5Pd I 0: Nothing is displayed. 1: PV/SP/Nothing displayed 2: PV/Nothing displayed/Nothing displayed 3: SP/SP (character display)/Nothing displayed 4: PV/SP/MV (valve opening for Position-proportional Models) 5: PV/SP/Multi-SP No. 6: PV/SP/Soak time remain 7: PV/SP/Internal SP (ramp SP) 8: PV/SP/Alarm value 1 5Pd2 Same as PV/SP No. 1 Display Selection. 5Pd2 OFF: OFF MANU: Manual STOP: Stop ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3 ALM4: Alarm 4 ALM: OR of alarms 1 to 4 HA: Heater alarm WR: Status display message 17 5V 5L OFF: OFF MANU: Manual STOP: Stop ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3 ALM4: Alarm 1 ALM2: Alarm 1 ALM3: Alarm 3 ALM4: Alarm 4 ALM: OR of alarms 1 to 4 HA: Heater alarm WR: Status display message 17 d.REF OFF, 0.25, 0.5, 1.0	PFd5 Same as Monitor/Setting Item 1. 5Pd I 0: Nothing is displayed. 1: PV/SP/Nothing displayed 2: PV/Nothing displayed/Nothing displayed 3: SP/SP (character display)/Nothing displayed 4: PV/SP/MV (valve opening for Position-proportional Models) 5: PV/SP/Multi-SP No. 6: PV/SP/Soak time remain 7: PV/SP/Internal SP (ramp SP) 8: PV/SP/Alarm value 1 5Pd2 Same as PV/SP No. 1 Display Selection. ād5L O: MV (Heating) C-O: MV (Cooling) ā, £-ā PV dP OFF, ON āFF MANU: Manual STOP: Stop ALM1: Alarm 1 ALM2: Alarm 2 RL M2 ALM3: Alarm 3 RL M3 ALM4: Alarm 4 RL M1 ALM4: Alarm 4 RL M1 HR WR: Status display message 7 SV SE OFF: OFF MANU: Manual MRRHU STOP: Stop ALM2: Alarm 1 ALM1: Alarm 1 RL M1 ALM2: Alarm 2 RL M2 ALM3: Alarm 3 RL M3 ALM4: Alarm 4 RL M4 ALM4:	PFdS Same as Monitor/Setting Item 1. 0 5Pd I 0: Nothing is displayed. 1: PV/SP/Nothing displayed 2: PV/Nothing displayed/Nothing displayed 3: SP/SP (character display)/Nothing displayed 4: PV/SP/MV (valve opening for Position-proportional Models) 5: PV/SP/Multi-SP No. 6: PV/SP/Soak time remain 7: PV/SP/Internal SP (ramp SP) 8: PV/SP/Alarm value 1 0 5Pd2 Same as PV/SP No. 1 Display Selection. 0 ād5L O: MV (Heating) C-O: MV (Cooling) ō, E - ō 0 PV dP OFF, ON ōFF, ōN ON PV 5L OFF: OFF MANU: Manual STOP: Stop ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3 ALM4: Alarm 4 ALM: OR of alarms 1 to 4 HA: Heater alarm WR: Status display message '7 OFF SV 5L OFF: OFF MANU: Manual STOP: Stop ALM1: Alarm 1 ALM2: Alarm 2 ALM3: Alarm 3 ALM4: Alarm 1 ALM2: Alarm 1 ALM3: Alarm 3 ALM4: Alarm 4 ALM: OR of alarms 1 to 4 HA: Heater alarm WR: Status display message '7 OFF d/REF OFF, 0.25, 0.5, 1.0 ōFF, 0.25, 0.25 d/REF OFF, 0.25, 0.5, 1.0 ōFF, 0.25, 0.25	

- *1 If the Manual MV Limit Enable parameter is set to ON, the setting range will be the MV lower limit to the MV upper limit.
- *2 The setting ranges are different for relay and voltage outputs (for driving SSR) and for linear current outputs.
- *3 This parameter can be set when the Program Pattern parameter is set to OFF, but the function will be disabled.
- *4 WR1 to WR8 are not displayed when the logic operation function is not used.
- *5 With the E5CC-U, E5DC, E5DC-B or E5GC, if the control output is a linear current output, the control output can be used as a simple transfer output. (The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)
- You can select seconds (S) only for the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)
- *7 You can select the status display message (WR) only for the E5DC, E5DC-B and E5GC. (The E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)
- *8 This parameter is not supported for E5CC, E5EC, and E5AC version 2.0 or lower.
- *9 You can use this parameter only with the E5EC-PR or E5AC-PR or E5AC-PR or Light Controller must be manufactured in August 2014 or later (version 2.2 or higher).)

Protect Level A-6-7

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Move to Protect level 000	PMōV	-1999 to 9999		0	None
Operation/Adjustment Protect	5RPL	0 to 3		0	None
Initial Setting/Communications Protect	I E P E	0 to 2		1	None
Setting Change Protect	WEPE	OFF, ON	āFF, āN	OFF	None
PF Key Protect	PFPL	OFF, ON	āFF, āN	OFF	None
Changed Parameters Only	ЕНБР	OFF, ON	āFF, āN	OFF	None
Parameter Mask Enable 000	PM5K	OFF, ON	āFF, āN	ON	None
Password to Move to Protect Level 000	PRLP	-1,999 to 9,999		0	None

A-6-8 Communications Setting Level

Parameters	Characters	Setting (monitor) value	Display	Default	Unit
Protocol Setting	PSEL	CWF: CompoWay/F	EWF	CompoWay/	None
		MOD: Modbus	Mōd	F	
		CMP: Component communications	EMP		
		FINS: Host Link (FINS)	FINS		
		MCP4: MC Protocol (format 4)	MEPY		
		FXP4: Dedicated protocol (format 4)	FXPY		
Communications Unit No.	U-Nā	0 to 99		1	None
Communications Baud Rate	<i>6P</i> 5	9.6, 19.2, 38.4, or 57.6	9.5, 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	PRES	NONE: None EVEN: Even ODD: Odd	NāNE, EVEN, ādd	Even	None
Send Data Wait Time	SdWE	0 to 99		20	ms
Highest Communications Unit No.	MRXU	0 to 99		0	None
Area	AREA	0 to 25		0	None
First Address Upper Word	AARH	0 to 99		0	None
First Address Lower Word	AdRL	0 to 9999		0	None
Receive Data Wait Time	RWAF	100 to 9999		1000	ms
Communications Node Number	UNEE	0 to 99		0	None
Upload Settings 1 to 13	UP / to /3	0 to 98			None
Download Settings 1 to 13	dN to 3	30 to 98			None
Сору	СБРУ	OFF, ALL, or 1 to 15		OFF	None
SP Slope	SPS SPS	0.001 to 9.999		1.000	None
SP Offset	SPäS	Temperature input: -199.9 to 999.9 Analog input: -1999 to 9999		0.0	EU

A-6-9 Initialization According to Parameter Changes

The parameters that are initialized when parameters are changed are shown under Related initialized parameters.

Related initialized parameters Related parameter	Input Type	Temperature Unit	Scaling Lower Limit Scaling Upper Limit Analog	SP Lower Limit SP Upper Limit	PID ON/OFF	Standard or Heating/Cooling	Program Pattern	ST	Remote SP Enable	Transfer Output Type	Control Output 1 Assignment	RT	Integral/Derivative Time Unit	Alarm 1 to 4 Type	SP 0 to 7 Set Point	Password to Move to Protect Level	Close/Floating	Direct Setting of Position Proportional MV Position
initialization execution condition		input	input														-proport ional Model with FB input	-proport ional Model with FB input, close control
SP Upper Limit SP Lower Limit	●*1	*1 *23	●*1															
Set Point	●*2	*2 *23	●*2	●*2											●*16			
SP0 to SP7	●*2	*2 *23	●*2	●*2						-			-		●*16	-		
PV Input Shift		● *23																
RT	●*3																	
Proportional Band	●*13	● *23										●*9	●*19					
Integral Time	●*13											●*9	●*19				●*21	
Derivative Time	●*13						-				-	●*9	●*19	-				
Proportional Band (Cooling)	●*13	*23					1				-	●*9	●*19	-				
Integral Time (Cooling)	●*13											●*9	●*19					
Derivative Time (Cooling)	●*13											●*9	●*19					
Integral/Derivative Time Unit							-			1	1	●*9		1		1		
MV Upper Limit, MV Lower Limit						●*5				-	-		-	-		1		
MV at Stop						•											•	•
MV at PV Error Manual MV						•											•	•
Transfer Output Upper Limit, Transfer Output Lower Limit *4	•*4.1	●*4.1	●*4.1	•*4.1		•*4.2				•*4.3								
SP Mode	●*17				●*17	●*17	-	●*11	●*12									
Remote SP Enable	●*17				●*17	●*17		●*11										
Remote SP Upper Limit Remote SP Lower Limit	●*1	●*1	●*1															
Control Output 1 Assignment						•	•			-			-					
Control Output 2 Assignment						●*6	● *6			1	-		1					
Auxiliary Output 1 Assignment						●*7	●*7											
Auxiliary Output 2 Assignment						●*6	●*6											

Changed parameter Related initialized parameters	Input Type	Temperature Unit	Scaling Lower Limit Scaling Upper Limit	SP Lower Limit SP Upper Limit	PID ON/OFF	Standard or Heating/Cooling	Program Pattern	ST	Remote SP Enable	Transfer Output Type	Control Output 1 Assignment	RT	Integral/Derivative Time Unit	Alarm 1 to 4 Type	SP 0 to 7 Set Point	Password to Move to Protect Level	Close/Floating	Direct Setting of Position Proportional MV
Auxiliary Output 3 Assignment						•	•											
Auxiliary Output 4 Assignment						●*6	●*6											
Event Input Assignment 1 to 6							●*8											
Move to Protect Level																●*10		
MV Display Selection						•												
Position Proportional Dead Band																	●*20	
Dead Band	●*13	● *23			-												-	
Hysteresis (Heating)	●*13	*23			-													
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LBA Level	●*13	● *23			-		-											
LBA Band	●*13	*23			-		-											
SP Ramp Set Value		*23																
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SP Offset		*23																
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^{*1} Initialized to input setting range upper and lower limits, or scaling upper and lower limits.

- SP: SP upper and lower limits
- Ramp SP: SP upper and lower limits
- PV: Input setting range upper and lower limits or scaling upper and lower limits
- MV (Heating): 100.0/0.0 • MV (Cooling): 100.0/0.0 • Valve opening: 100.0/0.0
 - *4.1 Initialized only when the transfer output type is set to SP, Ramp SP, or PV.
 - *4.2 Initialized only when the transfer output type is set to MV (Heating) or MV (Cooling).

^{*2} Clamped by SP upper and lower limits.

^{*3} This parameter is initialized only when the input type is changed to analog input when the RT parameter is ON. The RT parameter turns OFF.

Initialization is performed as shown below according to the transfer output type setting. The initialization differs depending on the changed parameter and the output type setting.

- *4.3 Initialized to the above default values regardless of the settings for changing the transfer output type.
- *5 Initialized as follows according to the Standard or Heating/Cooling parameter setting.
 - MV Upper Limit: 100.0
 - MV Lower Limit: Standard 0.0, heating/cooling –100.0
- *6 Initialized to control output (cooling) for heating and cooling control, according to the following.

(The defaults for standard control are the defaults in the parameter list.)

E5CC, E5CC-U, E5CC-B, E5EC, E5EC-B, E5AC, E5DC, or E5DC-B

- With control output 2: The Control Output 2 Assignment parameter is initialized to control output (cooling).
- If the Digital Controller does not have control output 2 but has four auxiliary outputs, the Auxiliary Output 4 Assignment parameter is initialized to Control Output (Cooling).
- If the Digital Controller does not have control output 2 but has two auxiliary outputs, the Auxiliary Output 2 Assignment parameter is initialized to Control Output (Cooling).
- Otherwise, the Auxiliary Output 2 Assignment parameter is initialized to Control Output (Cooling).

F5GC

- The Auxiliary Output 1 Assignment parameter is initialized to control output (cooling).
- *7 If the Program Pattern parameter is set to OFF, the Auxiliary Output 1 Assignment parameter is initialized as follows:
 - Digital Controllers with HB and HS alarms: Heater alarm
 - Digital Controllers without HB and HS alarms: Alarm 1

If the Program Pattern parameter is not set to OFF, the Auxiliary Output 1 Assignment parameter is initialized to the program end output. If the E5GC is used for heating/cooling control, the parameter is initialized to Control Output (Cooling).

- *8 If the Program Start parameter is assigned when the program pattern is changed to OFF, the Program Start parameter will be initialized to "not assigned."
- *9 For a temperature input, the Integral/Derivative Time Unit parameter is initialized only when the RT parameter is turned ON. The default is as follows:
 - Integral/Derivative Time Unit: 0.1 s (The PID parameters are also initialized when the Integral/Derivative Time Unit parameter is initialized.) *19
- *10 This parameter is initialized to the new Password to Move to Protect Level password.
- *11 When the ST parameter is turned ON, the SP Mode parameter is initialized to LSP and the Remote SP Enable parameter is initialized to OFF.
- *12 When the Remote SP Enable parameter is turned OFF, the SP Mode parameter is initialized to LSP.
- *13 These parameters are initialized when the Input Type parameter is changed from a temperature input to an analog input or from an analog input to a temperature input.
- *14 This parameter is initialized when the Input Type parameter is changed from a temperature input to an analog input or from an analog input to a temperature input. However, it is not initialized if the applicable alarm is an MV absolute-value upper-limit alarm or an MV absolute-value lower-limit alarm.
- *15 This parameter is initialized to 50 (0.50%) if a non-MV alarm is changed to an MV alarm. This parameter is initialized to 2 (0.2°C or 0.02%FS) if an MV alarm is changed to a non-MV alarm.
- *16 Write to both so that the SP and the currently selected Multi-SP SP0 to SP7 match.
- *17 When the ST condition is met, the SP Mode parameter is initialized to LSP and the Remote SP Enable parameter is initialized to OFF.
- *18 Initialized to 0.8 when the temperature unit is $^{\circ}$ C, and to 1.4 when the temperature unit is $^{\circ}$ F.
- *19 These parameters are initialized as follows:
 - Integral/Derivative Time Unit of 1 s: Proportional band to 8, integral time to 233, and derivative time to 40. (This applies to both the heating and cooling constants.)
 - Integral/Derivative Time Unit of 0.1 s: Proportional band to 8.0, integral time to 233.0, and derivative time to 40.0. (This applies to both the heating and cooling constants.)
- *20 This parameter is initialized to 4.0 for closed control and 2.0 for floating control.
- *21 If the Close/Floating parameter is set to floating and the integral time is 0, the parameter is initialized to 233. If the integral time is 0.0, it is initialized to 233.0.
- *22 Initialization is performed as shown below if the Control Output 1 Assignment parameter is set to a simple transfer output. The initialization differs depending on the changed parameter and the simple transfer output setting. You can use the simple transfer output only for the E5CC-U, E5DC, E5DC-B, and E5GC. (The E5CC-U must be manufactured in May 2014 or later (version 2.2 or higher) and the E5DC must be manufactured in July 2014 or later (version 2.2 or higher).)
 - Simple Transfer SP: SP upper and lower limits
 - Simple Transfer Ramp SP: SP upper and lower limits
 - Simple Transfer PV: Input setting range upper and lower limits or scaling upper and lower limits
 - Simple Transfer MV (Heating): 100.0/0.0
 - Simple Transfer MV (Cooling): 100.0/0.0

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- *22.1 Initialized only when the simple transfer output is set to Simple Transfer SP, Simple Transfer Ramp SP, or Simple Transfer PV.
- *22.2 Initialized only when the simple transfer output is set to Simple Transfer MV (Heating) or Simple Transfer MV (Cooling).
- *22.3 Initialized to the above default values regardless of the settings for changing the simple transfer output.
- *23 If you change the temperature unit for the E5DC or E5DC-B, these values will be converted to the new temperature unit. (The E5DC must be manufactured in July 2014 or later (version 2.2).)

A-7 Sensor Input Setting Range, Indication Range, Control Range

	Specificati ons	Set value	Input setting range	Input indication range
Resistance	Pt100	0	−200 to 850 (°C)/−300 to 1500 (°F)	-220 to 870 (°C)/-340 to 1540 (°F)
thermometer		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)
	Т	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)
	В	18	100 to 1800 (°C)/300 to 3200 (°F)	0 to 1820 (°C)/0 to 3240 (°F)
	C/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	10 to 70°C	21	0 to 90 (°C)/0 to 190 (°F)	−20 to 130 (°C)/−40 to 270 (°F)
Temperature Sensor	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:	-5% to 105% of setting range. The display shows
	0 to 20 mA	26	-1999 to 9999	-1999 to 9999 (numeric range with decimal point
Voltage input	1 to 5 V	27	-199.9 to 999.9	omitted).
	0 to 5 V	28	-19.99 to 99.99 -1.999 to 9.999	
	0 to 10 V	29	1.000 to 0.000	
	0 to 50 mV	30*		

- 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 C1602-2015, IEC60584-1

L: Fe-CuNi, DIN 43710-1985

U: Cu-CuNi, DIN 43710-1985

C/W: W5Re/W26Re, JIS C 1602-2015, ASTM E988-1990

JPt100: JIS C 1604-1989, JIS C 1606-1989

Pt100: JIS C 1604-1997, IEC 60751

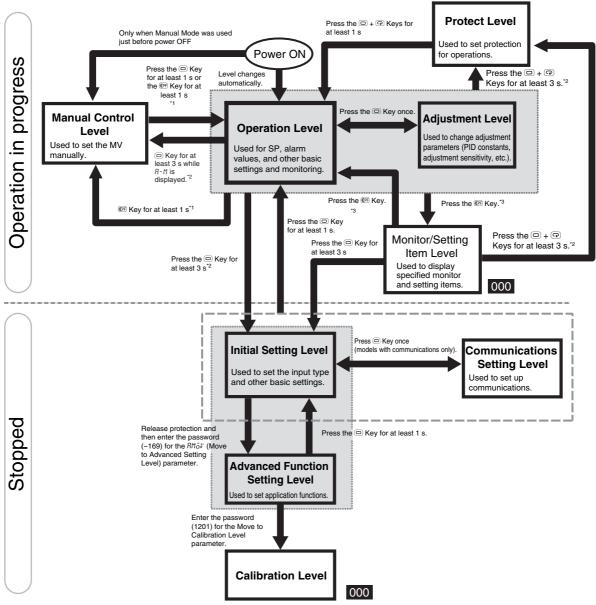
PLII: According to Platinel II Electromotive Force Table by Engelhard Corp.

* The 0 to 50 mV range can be used only for E5CC-U Digital Controllers and only if they are manufactured in May 2014 or later (version 2.2 or higher).

A-8 Setting Levels Diagram

This diagram shows all of the setting levels. To move to the Advanced Function Setting Level and Calibration Level, you must enter passwords. Some parameters are not displayed depending on the protect level setting and the conditions of use.

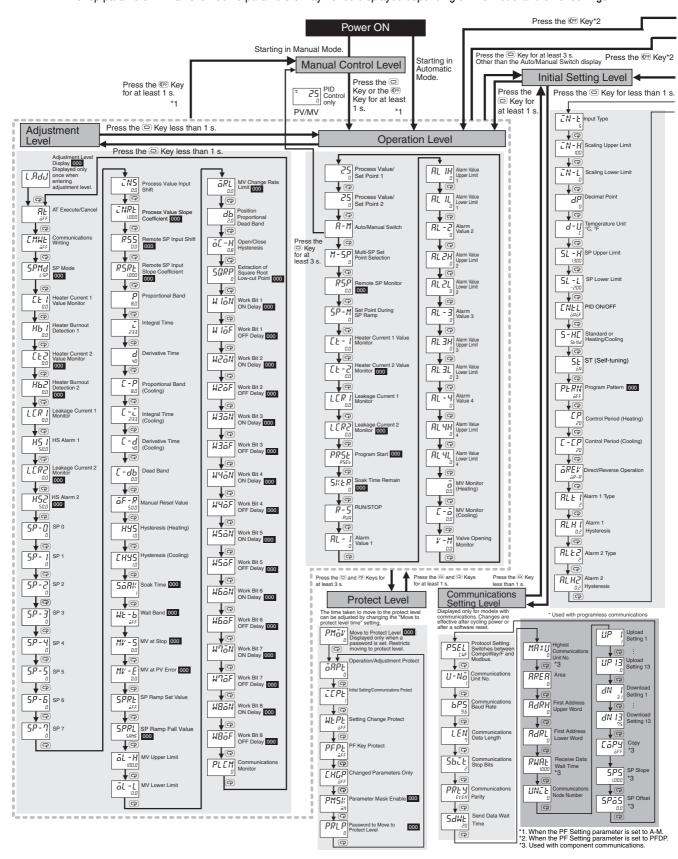
Control stops when you move from the Operation Level to the Initial Setting Level.



- *1 Set the PF Setting parameter to #-M (Auto/Manual).
- *2 The No. 1 display will flash when the keys are pressed for 1 s or longer.
- *3 Set the PF Setting parameter to PF dP (monitor/setting items).

A-9 Parameter Flow

This section describes the parameters set in each level. Pressing the (Mode) Key at the last parameter in each level returns to the top parameter in that level. Some parameters may not be displayed depending on the model and other settings.





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Note: Specifications are subject to change.