E5ZE
Multipoint Temperature Controller

Operation Manual

Catalog No. H076-E3-1

Notice:

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

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

$\triangle$ **DANGER**   Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

$\triangle$ **WARNING**   Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

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

OMRON Product References

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

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

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

Visual Aids

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

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

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

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of E5ZE Multipoint Temperature Controllers and includes the sections described below.

Refer to the following manuals according to the model being used before operating the E5ZE.

Refer to the following manual when using the E5ZE Serial Communications Models:

E5ZE Multipoint Temperature Controller Communications Manual (Cat. No. H77)

Refer to the following manual when using the DeviceNet Communications Models:

E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (Cat. No. H104)

DeviceNet Operation Manual (Cat. No. W267)

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate an E5ZE Multipoint Temperature Controller. **Be sure to read the *Precautions* section**.

Precautions provides precautions for installing and using the E5ZE.

Section 1 provides information on the system configuration, component names, and functions.

Section 2 describes the installation and wiring procedures necessary before operating the E5ZE.

Section 3 describes each of the E5ZE functions.

Section 4 describes the troubleshooting procedure for the E5ZE.

The *Appendices* provide information on specifications, ratings, characteristics, the Current Transformer, PID constant manual adjustments, saving data, hardware tests, current outputs, and available models.

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

PRECAUTIONS

This section provides general precautions for using the E5ZE Multipoint Temperature Controller and related devices.

The information contained in this section is important for the safe and reliable application of the E5ZE Multipoint Temperature Controller. You must read this section and understand the information contained before attempting to set up or operate an E5ZE Multipoint Temperature Controller.

1 General Safety Precautions

⚠ **WARNING** Do not attempt to disassemble, apply pressure, distort, subject to temperatures of 100°C or more, or throw the E5ZE into fire. A lithium battery is built into the E5ZE and any attempt to any of the above may result in fire, explosion, or combustion.

⚠ **WARNING** Do not attempt to disassemble, modify, or repair the E5ZE. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠ **Caution** Do not use any terminal that is marked "Don't use."

2 Operating Environment Precautions

⚠ **Caution** Be sure to check polarity when connecting the terminals.

⚠ **Caution** Do not install power lines or high-tension lines alongside lines connected to the E5ZE to prevent the E5ZE from being influenced by inductive noise. Install lines connected to the E5ZE through an independent conduit or use a shielded cable for the lines to protect them from inductive noise.

⚠ **Caution** Separate the E5ZE from devices generating a strong high-frequency, such as high-frequency welding machines, or devices that generate surge.

⚠ **Caution** Do not operate the E5ZE in the following locations:

- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to corrosive or flammable gases.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation.
- Locations subject to shock or vibration.
- Locations subject to severe changes in temperature.
- Locations subject to icing.

⚠ **Caution** Do not install the E5ZE in a location with obstructions preventing radiant heat from escaping.

3 Application Precautions

⚠ **WARNING** Make sure that no metal particles or wire chips are accidentally left in the product. Doing so may result in malfunction, fire, or electric shock.

⚠ **WARNING** Install a separate alarm to prevent the temperature from increasing excessively if the E5ZE malfunctions. Insufficient safety precautions may cause serious accidents if the temperature control malfunctions.

⚠ **Caution** Tighten the screws on the terminal block to the torque specified in the manual. Loose screws may result in burning or malfunction.

⚠ **Caution** Do not connect loads to the E5ZE that exceed the specified ratings. Excessively large loads may result in malfunction or burning.

⚠ **Caution** Always use the power supply voltage specified in the manual. An incorrect voltage may result in malfunction or burning.

⚠ **Caution** Confirm that no adverse effects will occur in the system before attempting to perform a hardware test. Insufficient confirmation may result in unexpected operations.

⚠ **Caution** Make sure that all the E5ZE set values are suitable for the controlled system. Unsuitable set values may result in unexpected operations causing damage to the product or accidents.

SECTION 1
Introduction

This section describes the components, a standard system configuration, and the functions of the E5ZE. Refer to *Section 2 Preparations* and later sections for details on functions and their applications.

1-1 Component Names and Functions

The component names and their functions are provided here.
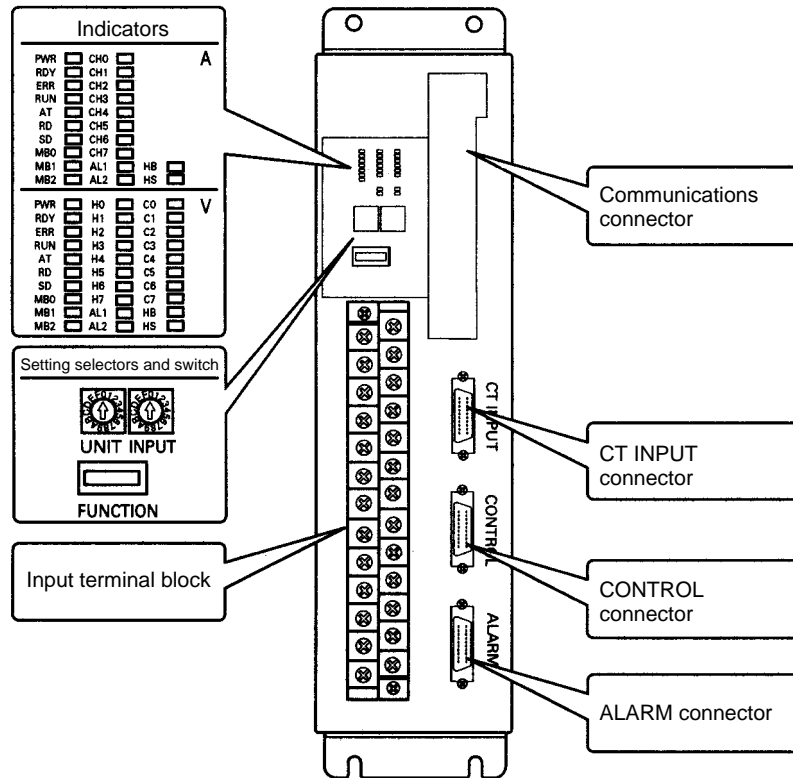
Indicators

A: E5ZE-8A☐☐☐B (Standard Models with casing)

V: E5ZE-8V☐☐☐B (Heating and Cooling Control Models with casing)

Indicators

The indicators show the operating status of the E5ZE, as follows:

PWR: Lit when power is ON.

RDY: Lit when the E5ZE is ready to operate.

ERR: Lit when an error occurs in the E5ZE.

RUN: Lit when the E5ZE is operating.

AT: Lit when auto-tuning is being executed.

RD: Lit when the E5ZE is receiving command data.

SD: Lit when the E5ZE is sending response data.

CH0 to CH7:

Lit for the control points for which the corresponding control outputs are ON. (Not lit for Current Output Models.)

H0 to H7:

Lit for the control points for which the corresponding heating outputs are ON. (Not lit for Current Output Models.)

C0 to C7:

Lit for the control points for which the corresponding cooling outputs are ON.

AL1: Lit when alarm 1 is ON.

AL2: Lit when alarm 2 is ON.

HB: Lit when the HB (heater burnout) alarm is ON.

HS: Lit when the HS alarm (SSR short circuit) is ON.

MB0 to MB2:

Lit when the memory bank designation inputs (bits 2^0 to 2^2) are turned ON with external contacts.

Setting Selectors and Switch

The setting selectors and switch are used to select the temperature sensor type, the unit number, and the functions to be used with the E5ZE. Refer to *2-3 Setting Selectors and Switch* for details on setting methods.

Input Terminal Block

The input terminal block is connected to a DC power supply, temperature sensor, and ground wire. Refer to *2-5 Power Supply and Input Wiring* for details on wiring procedures.

Communications Connector

The communications connector is connected to the communications cable. Refer to the *E5ZE Multipoint Temperature Controller Communications Manual (H77)* or the *E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (H104)* for details on communications functions and their applications.

E5ZE-8□□□D1□B

(for DeviceNet communications)
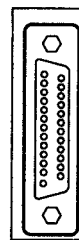
E53-E01

(for RS-232C Communications Unit)

E53-E04

(for RS-422/485 Communications Unit)

CT INPUT Connector

The CT INPUT connector is connected to the Current Transformer (CT) to detect heater burnout or SSR failure. Use E5ZE-CBL□□□ Connecting Cables to connect to the Connector Terminal Conversion Unit (XW2B-20G5 for M3.5 terminal screws or XW2B-20G4 for M2.4 terminal screws). Refer to *2-6 Wiring CT Inputs and Control/Alarm Outputs* for details on wiring procedures.

CONTROL Connector

The CONTROL connector is used to connect the control output and memory bank designation input contacts. Use E5ZE-CBL□□□ Connecting Cables to connect to the Connector Terminal Conversion Unit (XW2B-20G5 for M3.5 terminal screws or XW2B-20G4 for M2.4 terminal screws). Refer to *2-6 Wiring CT Inputs and Control/Alarm Outputs* for details on wiring procedures.

ALARM Connector

The ALARM connector for the E5ZE-8A□□□□□ Standard Models is used for an alarm output and that for the E5ZE-8V□□□□□ Heating and Cooling Control Models is used for cooling control output and alarm output. Use E5ZE-CBL-□□□ Connecting Cables to connect to the following devices.

Device	Model	Specifications and Comments	
Connector Terminal Conversion Units	XW2B-20G4	M2.4 terminal screws	
	XW2B-20G5	M3.5 terminal screws	
I/O Relay Terminal	G7TC-OC08	8 relay outputs (no cooling outputs)	
	G7TC-OC16	16 relay outputs	Cooling outputs terminal is not available on the standard model.
I/O Relay Terminal	G7VC-OC16	16 relay outputs	
	G7VC-OA16	16 SSR AC outputs	
	G7VC-OD16	16 SSR DC outputs	

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1-2   System Configuration

The following diagram shows the system configuration of the E5ZE.
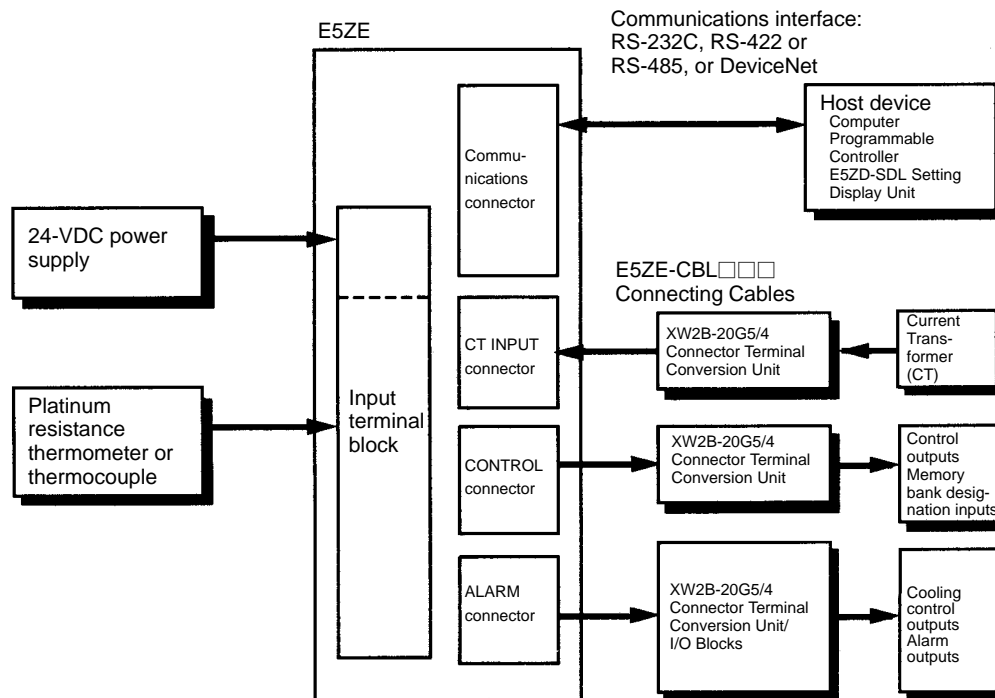
Use the specified cables and wiring devices to prevent malfunctions or accidents caused by incorrect wiring.

• The connection between the communications connector and the host device differs according to the communications interface used. Refer to the *E5ZE Multipoint Temperature Controller Communications Manual (H77)* or the *E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (H104)* for details.

• There are restrictions on the items that can be set or displayed from the E5ZD-SDL Setting Display Unit. Refer to the *E5ZD-SDL Setting Display Unit Datasheet (H61)* for details.

Isolation
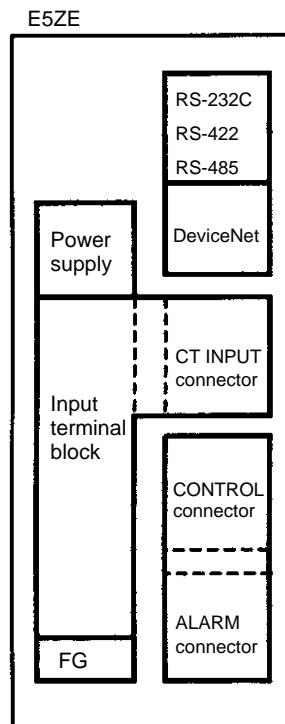
The components of the E5ZE contained within bold lines in the above diagram are electrically isolated.

Note The covers of the CT INPUT, CONTROL, and ALARM connectors are connected to the frame ground (FG).

For the E5ZE-8□□□TC□ (Thermocouple Input Models), the thermocouple inputs of the control points are insolated from each other.

1-3   Main Functions

Input Type
The E5ZE is connected to platinum resistance thermometers or thermocouples, depending on the model used. The type of temperature sensor is specified using the INPUT selector on the front panel of the Unit. The input values can be adjusted using the input adjustment function.

CONTROL Outputs
The control outputs can be either voltage output or current output, depending on the model. The control period and direct/reverse operation can be specified using the set values.

ALARM Outputs
A maximum of 2 alarm outputs are possible. There are 12 alarm modes that can be set for each alarm output according to set values. The outputs are comprehensive output for all control points.

Output Limitations
The output values are limited by the following 2 limiters:
• Output limiter
• Output change rate limiter
If an output value is outside the upper or lower limit for the output, the output will be limited to the preset upper or lower limit. The output change rate limiter limits the rate at which output values change per unit time.

Ramp
The ramp function is used to limit the control temperature (set point) from changing rapidly. If the set point changes quicker than the preset rate, the rate of temperature change will be limited to the preset rate, and the temperature will gradually change until it reaches the new temperature. The ramp can be set by the user.

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Control Adjustment   PID and fuzzy constants can be set by executing auto-tuning (AT). If an offset occurs during P or PD control, manual adjustment is possible using the manual reset function. Temperature turbulence caused by external disturbances can be suppressed and controlled using the fuzzy function.

Heater Burnout and SSR Failure Detection   Output short circuits caused by heater burnout or SSR failure can be detected.

Control Method Selection   Control can be switched between ON/OFF control and the normal 2-PID control (with 2 degrees of freedom). Manual operation is also possible.

Memory Banks   The memory banks store different sets of set values for the control points. There are 8 memory banks for each control point. Memory banks allow the set values for a control point to be changed as a group rather than resetting them individually. Use the external contact inputs or communications to designate the required memory bank.

SECTION 2
Preparations

This section provides details on operations that must be performed before starting the E5ZE, such as installation and wiring.

2-1   List of Models

2-1-1   Serial Communications Models

No. of control points	Casing	Control method	Control output	Heater burnout and SSR failure detection	Commu-nications	Input type	
						Thermocouple	**Platinum resistance thermometer**
8	Yes	Standard	Option	Option	Option	E5ZE-8AAAMTCB-E	E5ZE-8AAAMPB-E
		Heating and cooling	Option	Option	Option	E5ZE-8VAAMTCB-E	E5ZE-8VAAMPB-E

Model Number Legend:

$$\text{E5ZE-8}\square\text{AAM}\square\square\text{-E}$$
$$\quad\quad\ \ 1\quad 2\ \ 3\ 4\ 5\ 6\ 7$$

1. **Control Point**
   8:   8

2. **Control Method**
   A: Standard
   V: Heating and cooling

3. **Control Output**
   A: Option (see note 1)

4. **Heater Burnout and SSR Failure Detection (see note 2)**
   A: Option (see note 3)

5. **Communications**
   M: Option (see note 4)

6. **Input Type**
   TC: Thermocouple
   P: Platinum resistance thermometer

7. **Casing**
   B: Yes

Note: 1. The E53-E8Q Voltage Output Unit or the E53-E8C Current Output Unit can be used with the E5ZE. The E53-E8Q Voltage Output Unit and the E53-E8C Current Output Unit are sold separately.

2. The heater burnout and SSR failure detection function of the E5ZE will be invalid if the heating side control output of the E5ZE is current output.

3. The E54-E8CT CT Input Unit is required for the heater burnout and SSR failure detection. The E54-E8CT CT Input Unit is sold separately.

4. The E53-E01 Communications Unit for RS-232C communication or the E53-E04 Communications Unit for RS-422 and RS-485 communication can be used with the E5ZE. The E53-E01 Communications Unit and the E53-E04 Communications Unit are sold separately.

I/O Units (Order Separately)

Units	Models
RS-232C Communications Unit	**E53-E01**
RS-422/485 Communications Unit	**E53-E04**
CT Input Unit	**E54-E8CT**
Voltage Output Unit	**E53-E8Q**
Current Output Unit	**E53-E8C**

2-1-2 DeviceNet Communications Models

No of control points	Casing	Control method	Control output	HBA and SSR failure detection	Iput type	Name
8	Yes	Standard	Voltage	Yes	Thermocouple	E5ZE-8AQH D1TCB 24VDC
8	Yes	Standard	Voltage	Yes	Platinum resistance thermometer	E5ZE-8AQH D1PB 24VDC
8	Yes	Standard	Current	No	Thermocouple	E5ZE-8ACA D1TCB 24VDC
8	Yes	Standard	Current	No	Platinum resistance thermometer	E5ZE-8ACA D1PB 24VDC
8	Yes	Heating and Cooling	Voltage	Yes	Thermocouple	E5ZE-8VQH D1TCB 24VDC
8	Yes	Heating and Cooling	Voltage	Yes	Platinum resistance thermometer	E5ZE-8VQH D1PB 24VDC
8	Yes	Heating and Cooling	Current	No	Thermocouple	E5ZE-8VCA D1TCB 24VDC
8	Yes	Heating and Cooling	Current	No	Platinum resistance thermometer	E5ZE-8VCA D1PB 24VDC

Model Number Legend:

E5ZE-8□ □ □ □ □ □ □
         1 2 3 4 5 6 7

1. **Control Point**

    8:   8

2. **Control Method**

    A: Standard control

    V: Heating and cooling control

3. **Control Output**

    Q: Voltage output

    C: Current output

4. **Heater Burnout and SSR Failure Detection Function (Not available with Current Output Models.)**

    A: No

    H: Yes

5. **Communications Function**

    D1:   DeviceNet

6. **Input Type**

    TC: Thermocouple

    P: Platinum resistance thermometer

7. **Casing**

    B: Yes

2-2 Mounting the Serial Communications Models

I/O Units

I/O Units are not mounted on the E5ZE.

Mount the appropriate I/O Units according to the specification of the E5ZE.

The diagram below is the view from the back of component side.

Type of I/O Units

Communication Unit

E53-E01 for
RS-232C

or

E53-E04 for
RS-422/RS-485
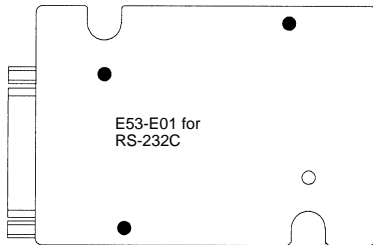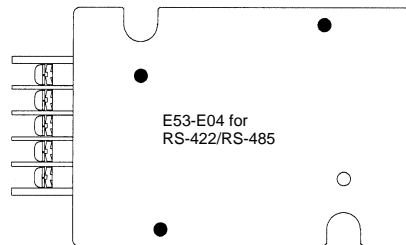
CT Input Unit

CT INPUT

E54-E8CT
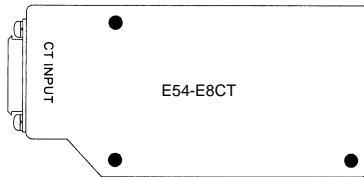
Use this CT input unit in combination
with the E53-E8Q voltage output unit.

Output Unit

CONTROL

ALARM

E53-E8Q for voltage
output

or

CONTROL

ALARM

E53-E8C for current
output
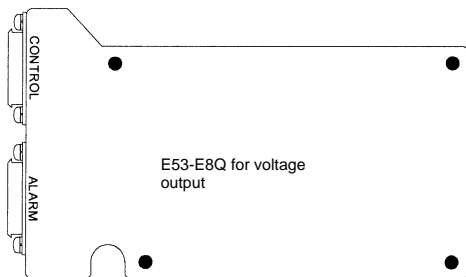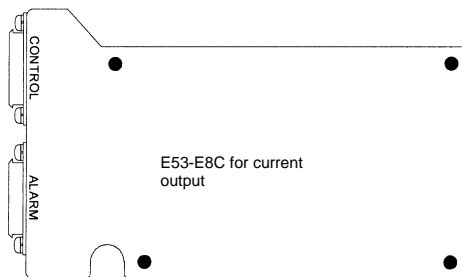
Tighten the screws through the holes marked with a black dot (●) to the fixing
studs of the E5ZE.

Mounting Position of I/O Units

Communication Unit

CT Input Unit

Output Unit

Connector

Communication
Unit

CT Input Unit

Connector

Output Unit

Connector

Remove this screw when the Unit is
mounted on the model with casing.
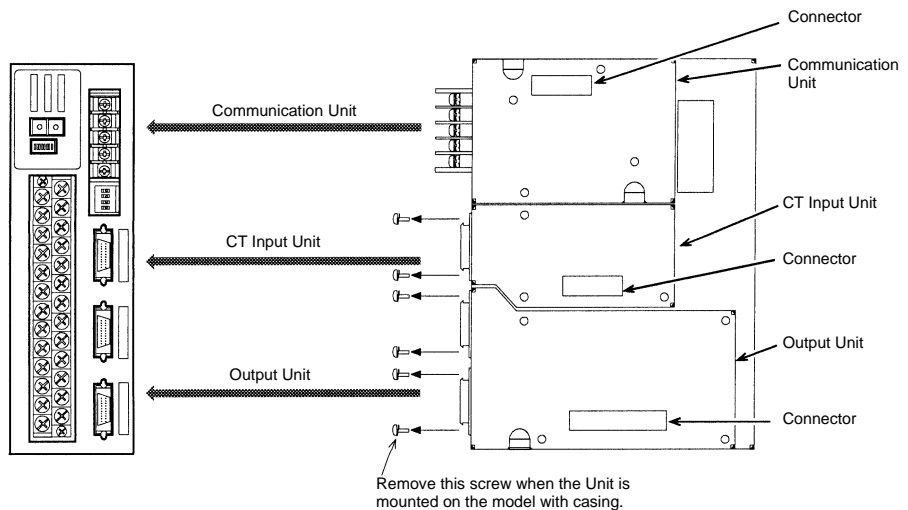
Mounting the Units

Use appropriate Phillips screwdriver for the screws. Use of an inappropriate screwdriver may damage the screws and cause insufficient tightening.

Mount the Units in an environment where anti-static electricity countermeasures have been taken.

Store the removed screws carefully and use them again when required.

Model With Casing

1, 2, 3...
1. Remove the connector fixing screws (2 screws each for a connector) from the Units (except for communication unit).

2. Remove the casing fixing screws (6 screws).

3. Remove the casing.

4. Mount the Units in the same manner as the model without casing.

5. Fix the connector to the case using the connector fixing screws with a torque of 0.34 to 0.39 N•m.

6. Replace the casing in its original position using six casing fixing screws.

Casing securing

Casing

Case

Remove the casing after removing the casing fixing screws(6 pcs.)

Casing securing

Identification label for connector

$$\begin{pmatrix} \text{CT INPUT} \\ \text{CONTROL} \\ \text{ALARM} \end{pmatrix}$$

Communication Unit (sold separately) E53-E01 or E53-E04 (The diagram shows E53-E04)

CT Input Unit (sold separately) E54-E8CT

Output Unit (sold separately) E53-E8Q or E53-E8C

Fixing studs for the Units

Communication Unit : 3 pcs.
CT Input Unit : 3 pcs.
Output Unit : 4 pcs.

The Unit fixing screws are mounted on the fixing studs at the factory.

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2-3   Setting Selectors and Switch

Observe the following precautions when operating the selectors and switch.

- Always make sure the power is OFF before changing the selectors and switch.
- Use a small flat-blade screwdriver to change the selector and switch settings, and be sure that the selectors are correctly positioned.

2-3-1   UNIT Selector
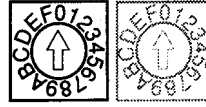
UNIT INPUT

When serial communications are being used, the UNIT selector must be set so that the host device can recognize the E5ZE unit number.

When more than one E5ZE Multipoint Temperature Controller is being used with RS-422 or RS-485 communications, set a different unit number for each E5ZE.

- The selector settings 0 to F correspond to unit numbers 00 to 0F. The factory setting of 0 corresponds to unit number 00.

2-3-2   INPUT Selector
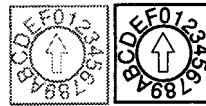
UNIT INPUT

Set the INPUT selector according to the type of temperature sensor connected to the E5ZE. The selector positions and corresponding temperature sensors are as follows:

Selector setting	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Thermocouple	K	J	R	S	T	E	B	N	L	U	W	PLII	Not used.			
Platinum resistance thermometer	Pt	JPt	Not used.													

- The factory setting is 0.
- The platinum resistance thermometer settings "Pt" and "JPt" indicate Pt100 and JPt100 respectively.

2-3-3 FUNCTION Switch

The FUNCTION switch is used to set the parameters of the E5ZE, such as the baud rate and startup operation.

FUNCTION

Operation mode change
Not used. (Always set to OFF.)
Temperature unit (°C or °F)
Startup operation
E5ZD-SDL Setting Display Unit connection
Memory bank designation method
Baud rate (serial communications)
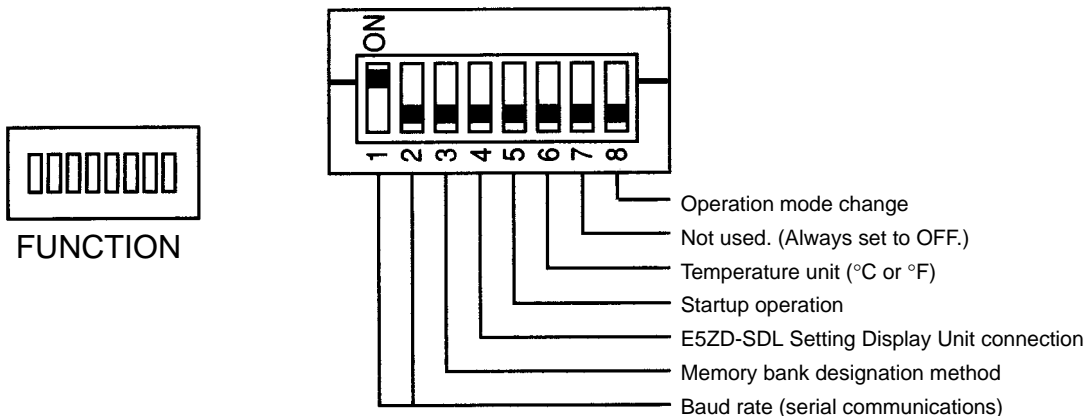
Baud Rate (Serial Communications)

Set the baud rate using pins 1 and 2 to the baud rate of the host device connected to the EZ5E.

Baud rate	19,200 bps	9,600 bps	4,800 bps	2,400 bps
Pin 1 Pin 2	OFF / OFF	ON / OFF	OFF / ON	ON / ON

The factory setting is 9,600 bps (pin 1 ON, pin 2 OFF).

Memory Bank Designation Method

Pin 3 is used to set the memory bank designation method.

Memory bank designation	Communications	Contact inputs
Pin 3	OFF	ON

The factory setting is for communications (pin 3 OFF).

When contact inputs are used to switch memory banks, the specified memory bank will be used for all control points.

E5ZD-SDL Setting Display Unit Connection

Pin 4 is used to specify when an E5ZD-SDL Setting Display Unit is connected.

E5ZD-SDL connection	Not connected	Connected
Pin 4	OFF	ON

The factory setting is for no connection (pin 4 OFF). Set pin 4 to ON when an E5ZD-SDL Setting Display Unit is to be connected to the E5ZE.

Startup Operation   Pin 5 is used to set the startup operation.

Startup operation	Stop operation control	Continue status at power OFF
Pin 5	 5 OFF	 5 ON

The factory setting is for stop operation control (pin 5 OFF).

If the power is turned OFF during manual operation and pin 5 is set to ON (continuous operation), manual operation will automatically begin when the power is turned ON again. The output value will be 0%.

Temperature Unit   Pin 6 is used to set the unit for measuring temperature.

Temperature unit	°C	°F
Pin 6	 6 OFF	 6 ON

The factory setting is for degrees Celsius (pin 6 OFF).

When the temperature unit is changed, the temperature data does not automatically change, so make sure to reset the temperature using the following procedure.

1, 2, 3...   1. Initialize the setting data.

2. Recalculate the data according to the following conversion formula and reset the control data within the setting range.
   (value in °F) = 1.8 x (value in °C) + 32

3. Store the settings in memory.

Operation Mode Change   Pins 3, 4, 5, and 8 are used to change the operation mode.

E5ZE operation mode	Control mode	Hardware test mode
Pins 3, 4, 5, and 8	 3 4 5 8 OFF	 3 4 5 8 ON

The factory setting is for Control Mode (pins 3, 4, 5, and 8 all OFF).

Control Mode: Use for normal temperature control.

Hardware Test Mode: Use for testing Peripheral Devices and wiring.

Refer to *Appendix E* for details on how to use Hardware Test Mode. Outputs can be turned ON and OFF in Hardware Test Mode regardless of the process value.

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2-4 Installation

2-4-1 External and Panel Dimensions

Serial Communications Model   Unit: mm   Mounting Hole Dimensions
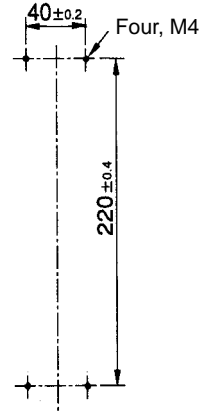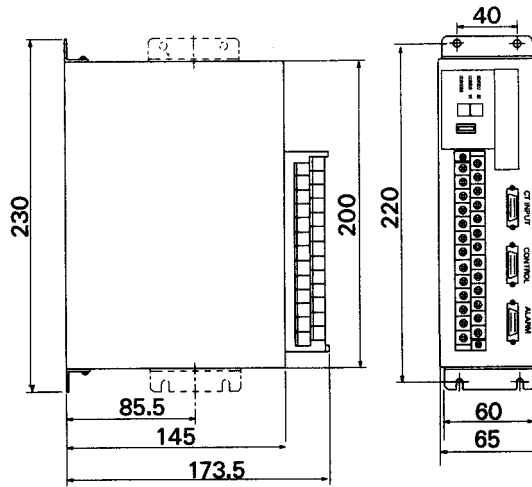
E5ZE-8☐☐☐D1☐B
(DeviceNet Interface)
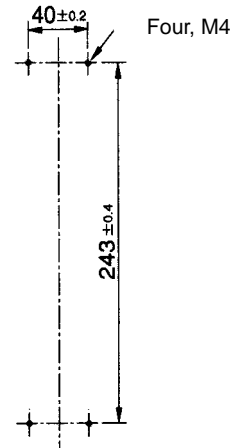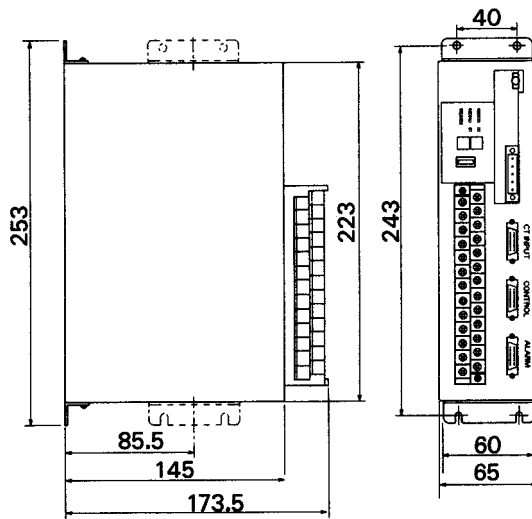
2-4-2 Mounting

Mount the Unit using the methods shown here. The Unit will not operate properly if other methods are used to mount the Unit.

Precautions

- Use the following mounting screws. Make sure the length of the screws is appropriate for the mounting panel used.

    E5ZE-8☐☐☐☐☐B: 4 x M4 screws

- Use spring and flat washers and tighten to a torque of 0.43 to 0.58 N • m {4.4 to 5.9 kgf • cm}.

- Do not mount the terminal block with the connectors facing upwards. Doing so may cause measurement errors.

Mounting Bracket

Secure the mounting bracket using the screws provided according to the appropriate mounting method. Tighten to a torque of 0.43 to 0.58 N • m {4.4 to 5.9 kgf • cm}.

Mounting Models
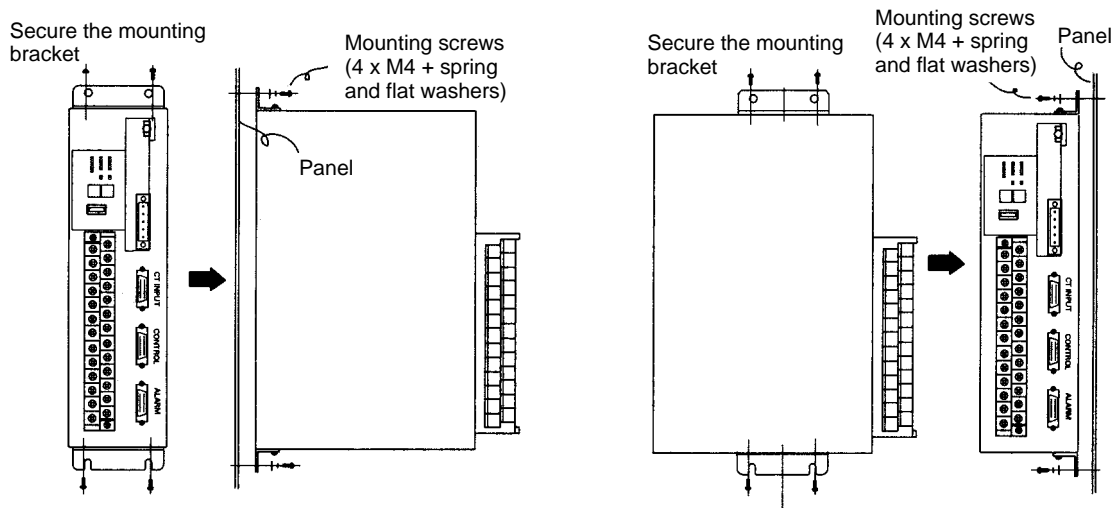
2-5 Power Supply and Input Wiring

2-5-1 Terminal Block

The input terminal block has been designed with a removable terminal-screw panel. When connecting the power supply or temperature sensor, the terminal-screw panel can be conveniently removed before wiring.
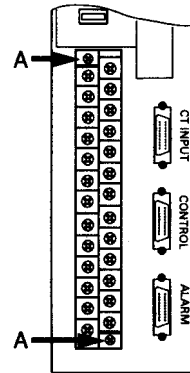
- To remove the terminal-screw panel, loosen the two screws alternately indicated by A in the above diagram.
- To mount the terminal-screw panel, insert it into the terminal block and secure the two screws (A) alternately.
- If the terminal block has been removed from the E5ZE Thermocouple Input Model, when reconnecting make sure that the E5ZE's lot number and serial number are the same as those of the terminal block. Accuracy cannot be guaranteed for a Unit that has been connected to a terminal block with a different lot number and serial number.

2-5-2 Wiring

- Always turn OFF the power supply before performing any wiring.
- Be sure to check polarity when connecting the power supply and temperature sensor.
- Wire the power supply cables separately from the temperature sensor cables to prevent noise interference.
- Use either crimp terminals or solder the wire ends when wiring terminals.
- Tighten the terminal screws.
- Wire the power lines close to the terminal block to prevent external force being exerted on the power lines from torsion or weight.
- Do not use the terminals that are marked "Don't use."
- Do not bend the crimp terminals after they have been connected and the screws have been tightened.

• Use the crimp terminals shown in the following diagram.

Crimp Terminals

7.9 mm max.

7.9 mm max.

Terminal Block Screw Dimensions

9.5 mm

8.1 mm

8 x M3.5 self-rising screws

End Soldering

Length of exposed wire: 6 to 8 mm
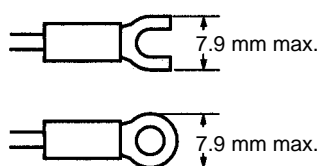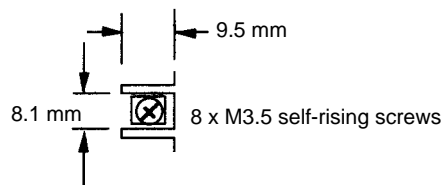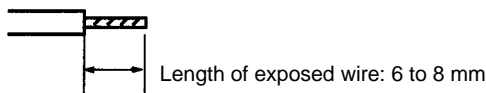
Applicable wire size: AWG 22 to 16

2-5-3 Terminal Arrangement

The following diagram shows the arrangement of terminals on the terminal block.

Thermocouple

24 VDC

Platinum Resistance Thermometer
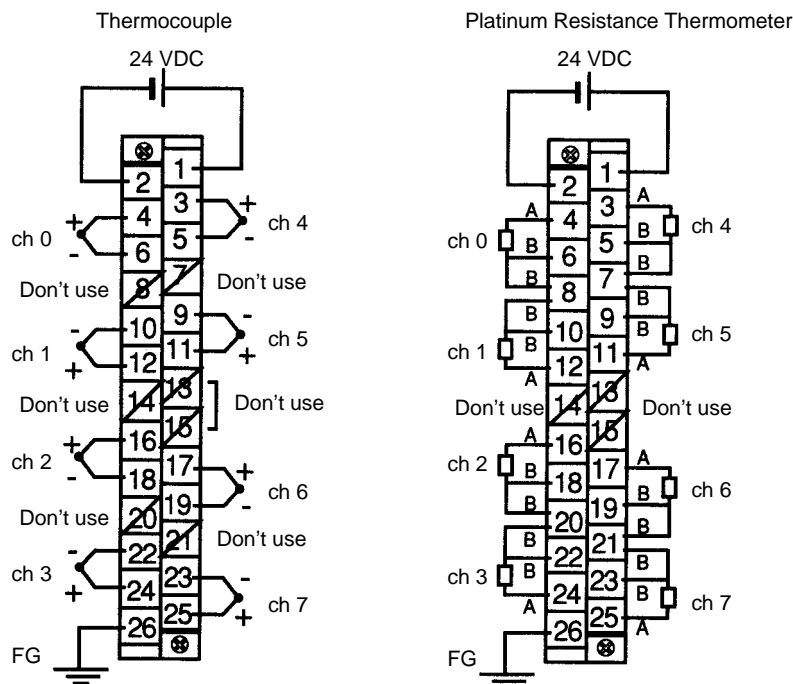
24 VDC

2-5-4 Power Supply

The power supply specifications are as follows:
24 VDC (20.4 to 26.4 VDC) 15 W + 20% max.

Use a power supply with a minimum capacity of 2 A. Be sure to consider the inrush current.

2-5-5 Ground

Connect the ground wire to terminal 26. Ground to 100 Ω max.

2-5-6 Thermocouple Input

- The terminal polarity varies with the control point. Be sure to check polarity when connecting thermocouples to the terminal block.
- When extending the input lead wires, connect compensating conductors that match the thermocouple used. Do not solder the ends of the thermocouple or compensating conductors.
- Never remove the cold junction compensator connected to terminals 13 and 15.
- Do not touch the cold junction compensators.
- Short-circuit the positive and negative terminals of each control point that is not used. The process value for each control point that is not being used will be the ambient temperature of the terminal block.

2-5-7 Platinum Resistance Thermometer Input

- The terminal polarity varies with the control point. Be sure to check polarity when connecting platinum resistance thermometers to the terminal block.
- When extending the input lead wires, make sure that the conductor resistance is the same for the A terminal and two B terminals.
- Connect a 100- to 200-Ω resistor between the A and B terminals of any unused control point, and short-circuit the two B terminals of any unused control point. The process value for each control point that is not being used will correspond to the resistance of the resistor connected to the terminals.

2-6 Wiring CT Inputs and Control/Alarm Outputs

CT inputs and control/alarm outputs are connected using wiring-reduction devices. Always use E5ZE-CBL□□□ Connecting Cables to connect the E5ZE to the wiring-reduction devices. Refer to the wiring-reduction device datasheet for details, including wiring precautions.

Use the identification labels provided for each cable to prevent incorrect wiring of the CONTROL, ALARM, and CT INPUT connectors.

Cable identification label

Hood: Connect to the FG terminal.

FG terminal: Connect to improve noise resistance

E5ZE-CBL□□□ Connecting Cable
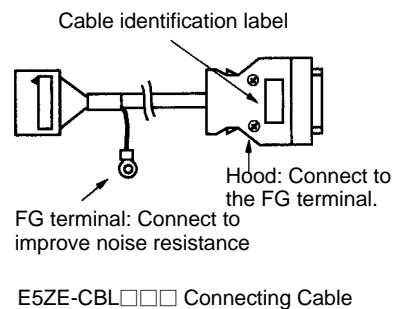
2-6-1 CT Inputs

The CT INPUT connector can be connected to an XW2B-20G5 Connector Terminal Conversion Unit (20-terminal M3.5 terminal block) or an XW2B-20G4 Connector Terminal Conversion Unit (20-terminal M2.4 terminal block).

Cable Connections

E5ZE-CBL□□□ Connecting Cable

XW2B-20G5/4 Connector Terminal Conversion Unit
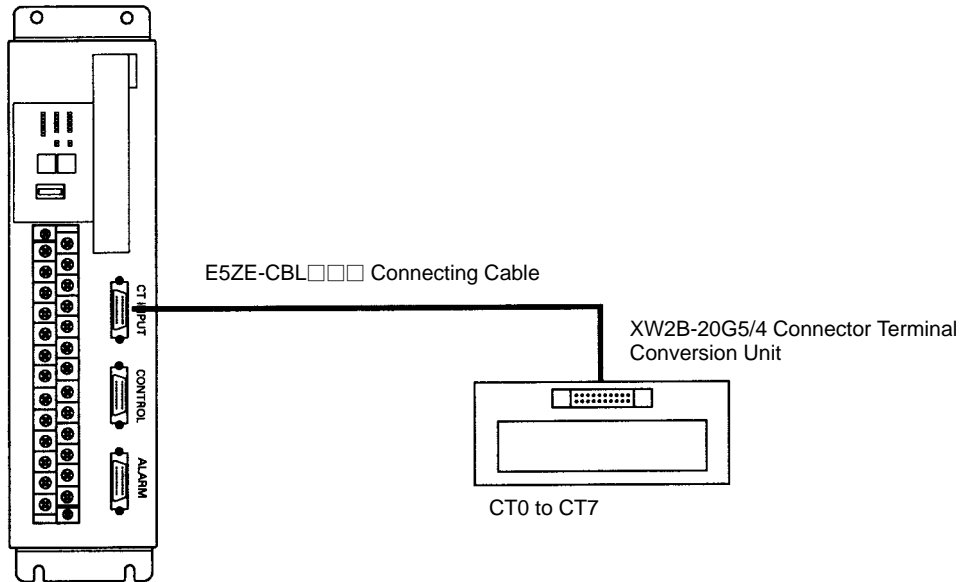
CT0 to CT7

Wiring

The following diagram shows the terminal arrangement for CT inputs when a XW2B-20G5/4 Connector Terminal Conversion Unit is connected. Connect CT0 to CT7 to the CT inputs for control points 0 to 7. For example, CT0 will detect heater burnout or SSR failure for the output of control point 0.
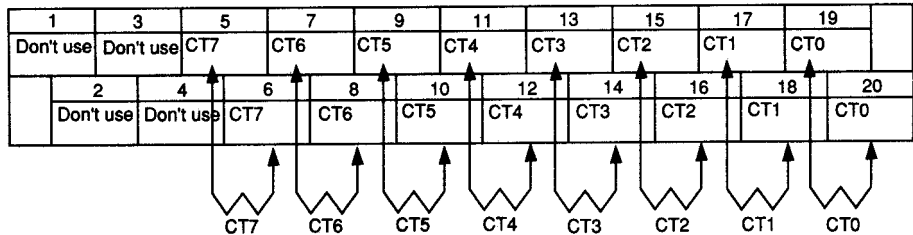
Use the E54-CT1 or E54-CT3 Current Transformer (CT). Refer to *Appendix B* for further details on the CT. Refer to *3-10 Heater Burnout Detection* for details on wiring the CT.

2-6-2 Outputs

Cable Connections

XW2B-20G5/4 Connector Terminal
Conversion Unit

Heating control output, memory bank designation input

XW2B-20G5/4 Connector Terminal
Conversion Unit

G7TC-OC08/16, G7VC-O□16
I/O Blocks

E5ZE-CBL□□□
Connecting Cable

Cooling control output, ALM1 and ALM2, HB alarm,
HS alarm, temperature controller error
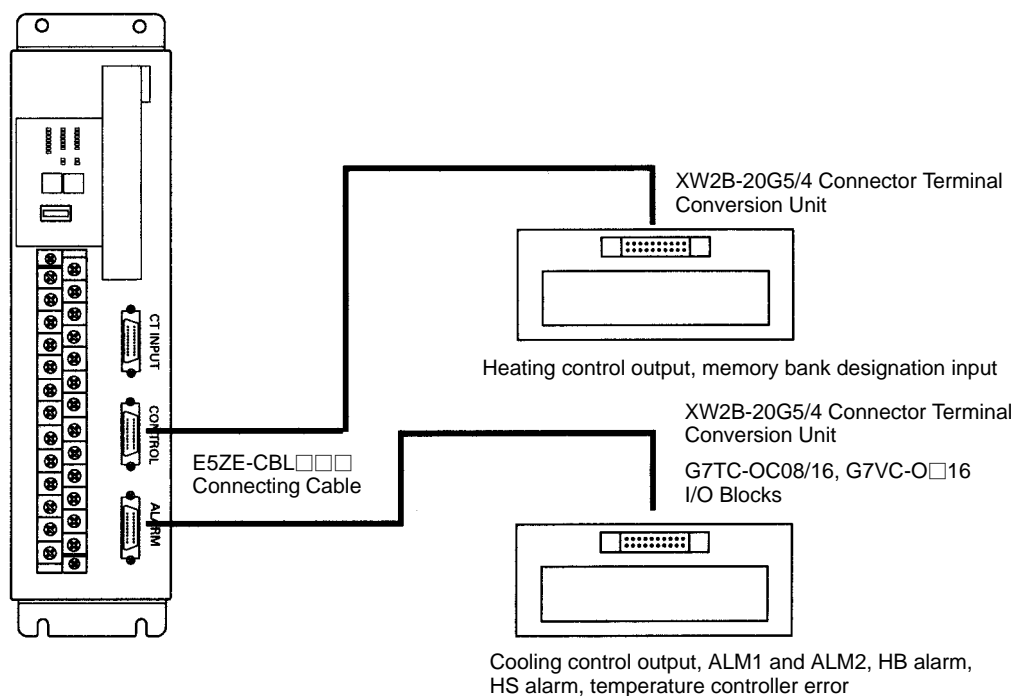
**CONTROL Connector
Wiring**

The CONTROL connector can be connected to an XW2B-20G5 Connector Terminal Conversion Unit (20-terminal M3.5 terminal block) or an XW2B-20G4 Connector Terminal Conversion Unit (20-terminal M2.4 terminal block).

- The terminal arrangement for outputs when an XW2B-20G5/4 Connector Terminal Conversion Unit is connected is shown in the following diagram.

CONTROL Connector Terminal Block
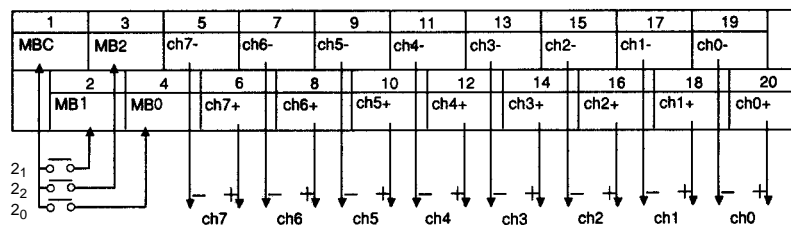
- The output specifications are shown in the following table. Connect a load that is compatible with the output type and output rating.

Output	Specification	
Voltage output	Output voltage:	12 ± 1.2 VDC
	Output current:	30 mA max.
Current output	Output current:	$4^{+0}/_{-0.6}$ to $20^{+2}/_{-0}$ mA DC
	Load resistance:	600 Ω max.

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• When connecting a relay load, insert a diode to prevent surge.

ch n: Control point 0 to 7
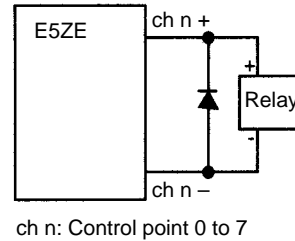
• The following diagram shows the wiring when designating the memory bank using contact inputs.
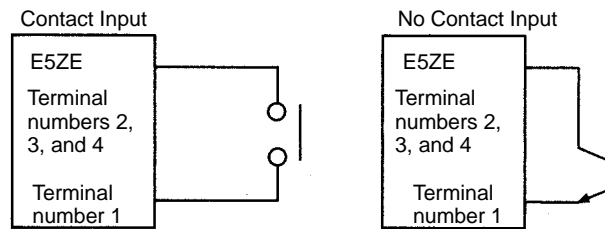
	Contact Input			No Contact Input	
ON:	Short-circuit resistance:	1 kΩ max.	ON:	Residual voltage:	2 VDC max.
	Outflow current:	3 mA DC		Outflow current:	3 mA DC
OFF:	Open resistance:	100 kΩ min.	OFF:	Leakage current:	1 mA max.

ALARM Connector Wiring

The ALARM connector can be used with the following devices.

• XW2B-20G5 or XW2B-20G4 Connector Terminal Conversion Unit

• G7TC-OC16, G7TC-OC08, or G7VC-O☐16 I/O Block

The following diagram shows the terminal arrangement when the ALARM connector is connected to an XW2B-20G5 or XW2B-20G4 Connector Terminal Conversion Unit. In the diagram, RL indicates a relay load.

Cooling control output (Do not use these terminals with E5ZE-8A☐☐☐☐ Standard Models.)
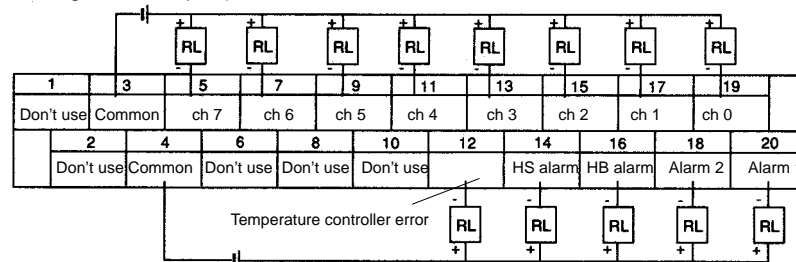
• The following table shows the specifications for alarm output and cooling control output. The E5ZE does not have an overcurrent protection function for alarm output and cooling control output. Connect a load to each alarm output and cooling control output that corresponds to the output ratings.

Output	Specifications
Open collector output	NPN, 30 VDC, 50 mA max.
	Residual voltage when ON: 2 VDC max.
	Leakage current when OFF: 1 mA max.

• Do not use the terminals marked "Don't use."

• When connecting a relay load, insert a diode to prevent surge.
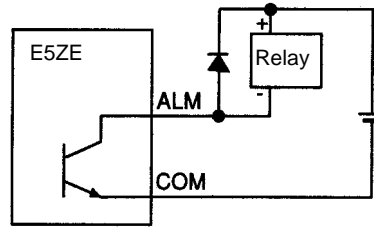
ALM: Temperature Controller error, Alarm 1 and 2, HB, and HS

Connecting G7TC I/O Blocks

The following diagrams shows an ALARM connector connected to a G7TC-OC08 and G7TC-OC16 I/O Block respectively.

G7TC-OC08
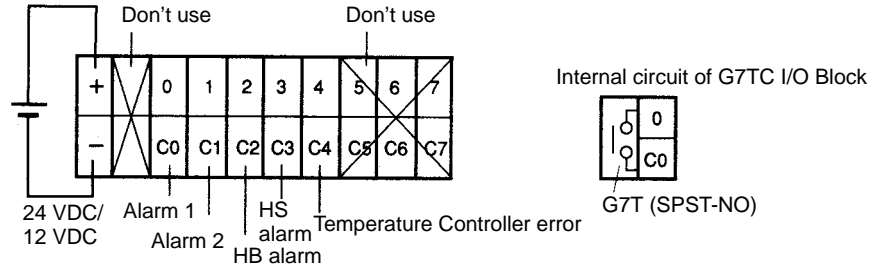
G7TC-OC16
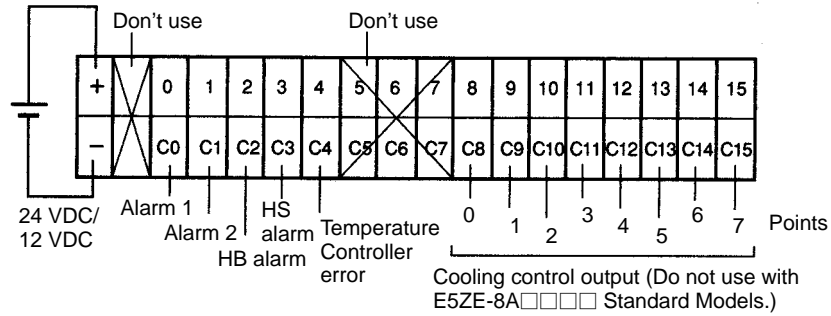
• Do not use terminals marked "Don't use." Doing so may cause the E5ZE or G7TC to malfunction.

• G7TC-OC08 I/O Blocks cannot be used with E5ZE-8V□□□□ Heating and Cooling Control Models.

• Refer to the separate datasheets for details on precautions for the I/O Blocks.

Connecting G7VC I/O Blocks

The following diagram shows an ALARM connector connected to a G7VC-O□16 I/O Block.

G7VC-O□16
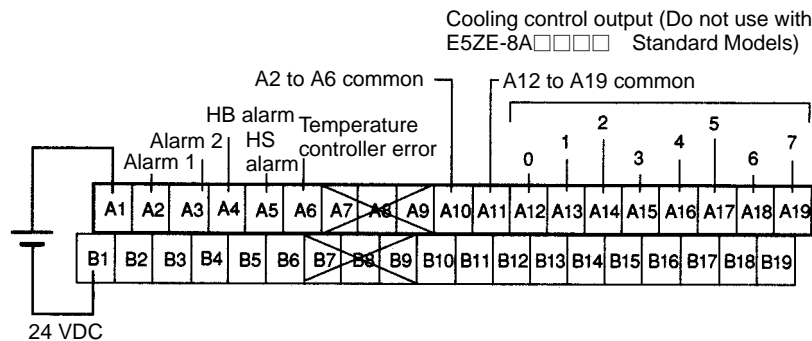
• Do not use terminals marked "Don't use." Doing so may cause the E5ZE or G7VC to malfunction.

- The following G7VC-O□16 I/O Blocks for output are available.

  G7VC-OC16: Relay outputs

  G7VC-OA16: SSR AC outputs

  G7VC-OD16: SSR DC outputs

- Refer to the separate datasheets for details on precautions for the I/O Blocks.

2-7 Connecting Communications

The wiring and connections of the communications interfaces are described here. For further details, refer to the following manuals.

Serial communications: *E5ZE Multipoint Temperature Controller Communications Manual (H77)*

DeviceNet communications: *E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (H104)*

2-7-1 RS-232C

- Mount the RS-232C Communications Unit on the E5ZE Serial Communications Model.
- The E5ZE is connected to the RS-232C interface in the ratio of 1:1.
- Refer to the *E5ZE Multipoint Temperature Controller Communications Manual (H77)* for details on communications.

Cable Connections

- The maximum cable length is15 m. To extend the transmission path, use the OMRON Z3RN RS-232C Optical Interface.
- Use shielded twisted-pair cable with a wire thickness of AWG28 minimum.
- Use the following OMRON 25-pin D-sub Connectors or equivalent.

  Plug: XM2A-2501 Connector

  Hood: XM2S-2511 Hood
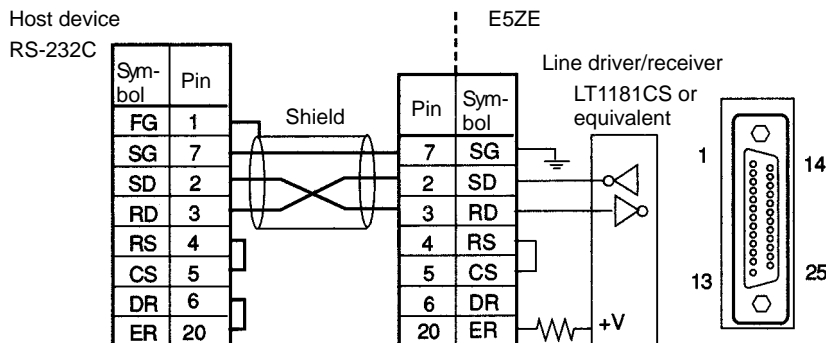
- The E5ZE's RS-232C communications do not support a CD (carrier detect) signal from the host device. If the CD signal is required, provide support at the host device.

When using the RS-232C auxiliary setting jack on the E5ZE-8□□□D1□B (DeviceNet Model with casing), use the following Connecting Cables.

- ES100-CT021-202 (25-pin)

  This Cable is used to connect the E5ZD-SDL1 Setting Display Unit.

- ES100-CT023-202 (9-pin)

The RS-232C auxiliary setting jack is designed to be used only temporarily for initial settings and performing maintenance. Do not use the RS-232C auxiliary setting jack to mount the E5ZE to a device. If the RS-232C auxiliary setting jack is left connected for a long time, the reliability of the connection will deteriorate.

2-7-2 RS-422 and RS-485

- Mount the RS-422/485 Communications Unit on the E5ZE Serial Communications Model.

- The E5ZE can be connected to the communications interface in the ratio of 1:N with a maximum of 16 Units connected.

- The maximum cable length is 500 m.

- Refer to the *E5ZE Multipoint Temperature Controller Communications Manual (H77)* for further details on communications.

Parameter Settings

- Specify the following parameters using the communications DIP switch. Always turn OFF the power before changing the switch.

  - Communications interface
  - Terminating resistance

E5ZE-8□□□04□
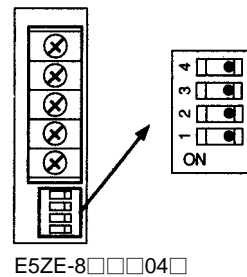
Setting		Pin	RS-422	RS-485
Terminating resistance (pins 3 and 4)	Yes	Pin 4 Pin 3	ON ON	ON
	No	Pin 4 Pin 3		
Interface (pins 1 and 2)		Pin 2 Pin 1	ON	ON ON

- Set the terminating resistance at both ends of the transmission path including the host device. If terminating resistance is to be set at devices other than the E5ZE, make sure that the total terminating resistance value of the transmission paths is at least 100 Ω.

Wiring the Communications Terminal Block

- Always turn OFF the power supply before wiring.

- Wire the power lines and communications cables separately to prevent noise interference.

- Use crimp terminals or solder the wire ends when wiring the terminals.

- Tighten the terminal screws to a torque of 0.59 N • m, or 6 kgf • cm.

- Do not apply a force of more than 100 N or 10.2 kgf to the terminal screws.

- Do not bend any crimp terminals after connecting them to the terminal screws and tightening.

• The following crimp terminals can be used.

Crimp Terminal **Terminal Block Screw Dimensions**

6 mm max.

6.25 mm
6 mm max.

10.4 mm

M3 x 7.2 screws with
square washers

End Soldering

Length of exposed wire: 6 to 7 mm
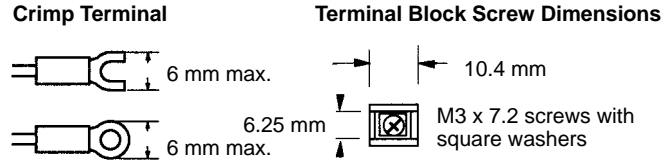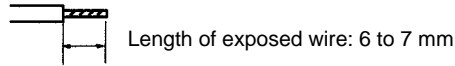
Applicable wire size: AWG14 to 20

Shielded twisted-pair cable

RS-422 Wiring
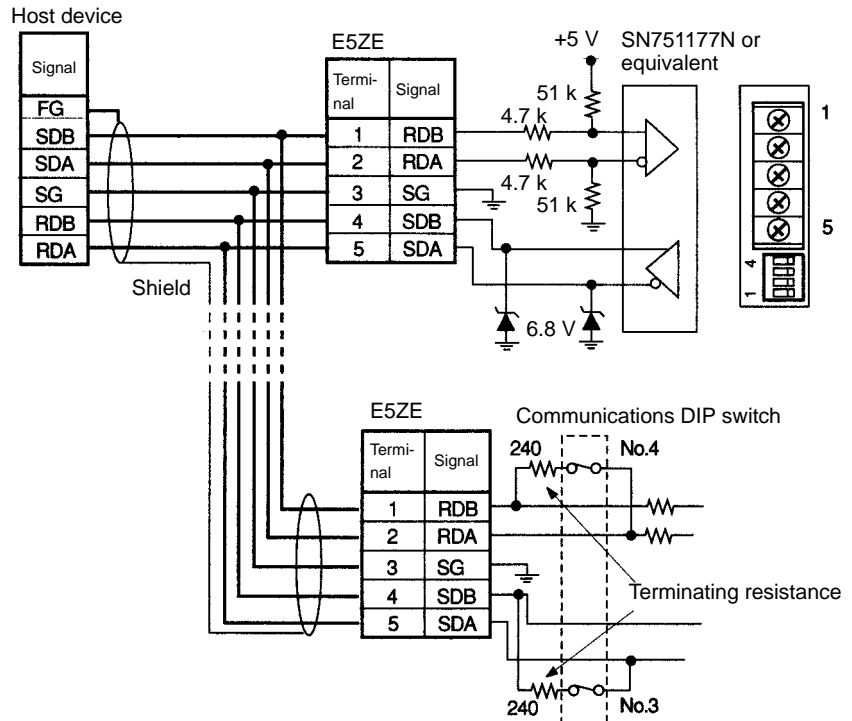
RS-485 Wiring

- Do not use terminals 1 and 2.
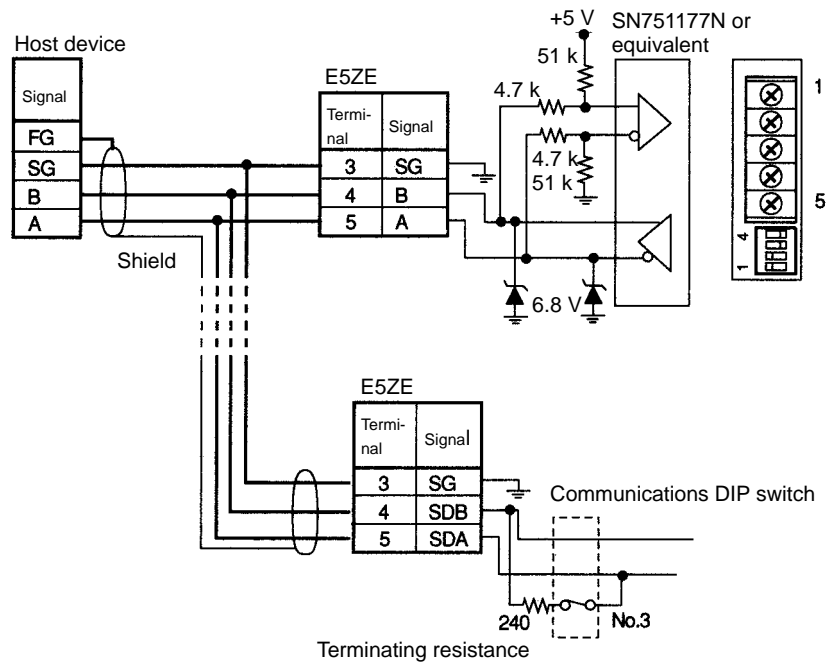
2-7-3 DeviceNet Interface

- Use the E5ZE-8□□□D1□B for DeviceNet communications.

- Refer to the *DeviceNet Operation Manual (W267)* for details on DeviceNet Network configurations and connection methods.

- Refer to the *E5ZE-8 DeviceNet Communications Manual (H104)* for details on DeviceNet communications applications.

Communications Settings Set the following parameters using the DeviceNet DIP switch.

- Node addresses

- Baud rate

- E5ZE operation for DeviceNet communications errors.
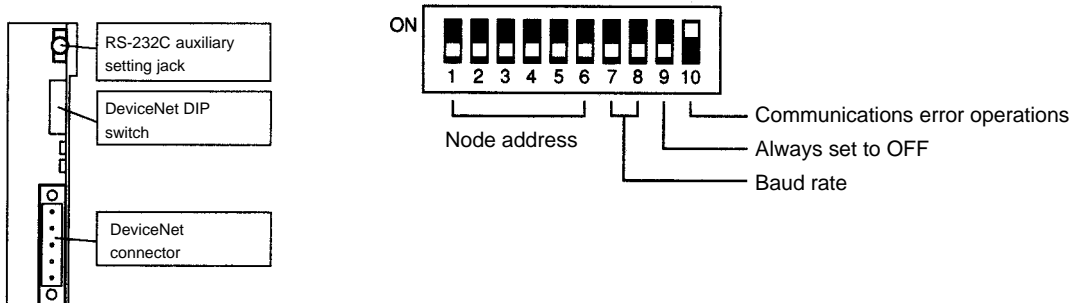
- Pins 1 to 6 are used to set the node address. The factory setting is 00 (pins 1 to 6 all OFF).

Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
2^0	2^1	2^2	2^3	2^4	2^5

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- Pins 7 and 8 are used to set the baud rate. Be sure to set the baud rate to match that of the DeviceNet Master Unit. The factory setting is 125 kbps (pins 7 and 8 OFF).

Baud rate	Pin 7	Pin 8
125 kbps	OFF	OFF
250 kbps	ON	OFF
500 kbps	OFF	ON
Not used	ON	ON

- Pin 10 is used to set the E5ZE operation when a DeviceNet communications error occurs.

  ON: The E5ZE continues to operate according to the data that was transmitted immediately before the error occurred.

  OFF: The E5ZE stops operating.

  The factory setting is ON.

- A DeviceNet transmission error is a connection time-out error or a transmission data error that has occurred during communications between the DeviceNet Master and the E5ZE.

Cable Connections

- The following diagram shows how the DeviceNet connector is wired.

- Multi-drop connections cannot be used.
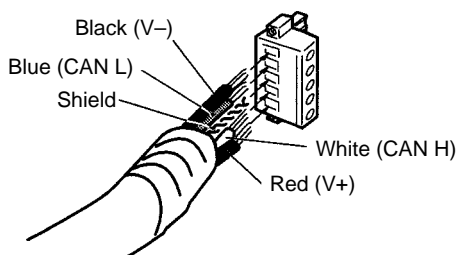
Number of Connectable Units

The number of E5ZE-8□□□D1□B DeviceNet Models with casing that can be connected to one DeviceNet Master Unit depends on the capability of the Master being used. The maximum number of Units that can be connected to one Master is calculated according to the number of words allocated to the E5ZE-8□□□D1□B and the number of words that can be used by the Master.

- The number of words allocated to the E5ZE-8□□□D1□B is as follows:

  Inputs: 14 words

  Outputs: 9 words

  Message communications (FINS messages) are used.

Example: C200HW-DRM21-V1 DeviceNet Master Unit without Configurator

- The number of words used by the Master is 50 input words and 50 output words (current as of July 31, 1998). The E5ZE-8□□□D1□B is allocated 14 words, so the maximum number of Units that can be connected is as follows:

  50 ÷ 14 = 3 Units.

This section provides details on the functions of the E5ZE and their applications. For details on the settings and measurement values for the functions, refer to the *E5ZE Multipoint Temperature Controller Communications Manual (H77)* and the *E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (H104).*

3-1   Data Configuration

Set Values   The following diagram shows how data is structured in the E5ZE.

Common set values:	Output operation (direct/reverse operation)
	Setting unit
	HB alarm, HS alarm valid control points

CH0 (Control Point 0) Set Values	CH1 (Control Point 1) Set Values	CH7 (Control Point 7) Set Values
Memory bank number	Memory bank number	Memory bank number
Alarm mode	Alarm mode	Alarm mode
Manual output value	Manual output value	Manual output value
HB alarm, HS alarm detection current value	HB alarm, HS alarm detection current value	HB alarm, HS alarm detection current value

Memory Bank 7 Set Values

Memory Bank 1 Set Values

Memory Bank 0 Set Values	Memory Bank 0 Set Values	Memory Bank 0 Set Values
Set point	Set point	Set point
Proportional band (P constant)	Proportional band (P constant)	Proportional band (P constant)
Integral time (I constant)	Integral time (I constant)	Integral time (I constant)
Derivative time (D constant)	Derivative time (D constant)	Derivative time (D constant)
Control period	Control period	Control period
Alarm temperature	Alarm temperature	Alarm temperature
Input shift value	Input shift value	Input shift value
Manual reset value	Manual reset value	Manual reset value
Output limit	Output limit	Output limit
Ramp value	Ramp value	Ramp value
Output change rate limit	Output change rate limit	Output change rate limit
Dead band/overlap band (See note.)	Dead band/overlap band (See note.)	Dead band/overlap band (See note.)
Cooling coefficient (See note.)	Cooling coefficient (See note.)	Cooling coefficient (See note.)
Fuzzy strength	Fuzzy strength	Fuzzy strength
Fuzzy scale 1	Fuzzy scale 1	Fuzzy scale 1
Fuzzy scale 2	Fuzzy scale 2	Fuzzy scale 2

Note The cooling coefficient and dead band/overlap band are applicable only to E5ZE-8V□□□□ Heating and Cooling Control Models.

Memory Banks   The E5ZE has 8 memory banks, 0 to 7, for each control point. The memory banks store specific groups of setting data. The E5ZE controls each control point according to the contents of the current memory bank.

- All set values are written (set) or read using communications. The control point number and memory bank number must be specified for each command. For DeviceNet, however, the control point and memory bank numbers do not always need to be specified.

- When DeviceNet (remote I/O) is used, set values will be read and written according to the current memory bank.

Memory Bank Designation   Memory banks are designated using contact inputs or through communications. The method of memory bank designation is set using pin 3 of the FUNCTION switch. Refer to *2-3 Setting Selectors and Switch* for details on setting methods.

- When the E5ZE is turned ON, the memory banks previously selected through communications will be in effect.

- The memory bank numbers for control points that are being auto-tuned cannot be changed.

- The following table shows the designation methods and functions of the memory banks.

Item		Operation	Function
Setting the memory bank number	Through communications	A memory bank number is designated for each control point through communications.	The different memory bank numbers can be designated for each control point.
	Using contact inputs	A memory bank number is designated by setting contacts MB0 to MB2 on the terminal block connected to the CONTROL connector.	All control points will switch to the designated memory bank number.
Confirming the selected memory bank number		A control point can be designated and read through communications to check the memory bank.	---

The following table shows the status of MB0 to MB2 and their relation to the designated memory bank.

Memory Bank	0	1	2	3	4	5	6	7
MB0	---	ON	---	ON	---	ON	---	ON
MB1	---	---	ON	ON	---	---	ON	ON
MB2	---	---	---	---	ON	ON	ON	ON

The dashed line "---" indicates that the input is OFF.

3-2 I/O Settings

3-2-1 Input Type

The E5ZE is available in models that can be used for thermocouple inputs or platinum resistance thermometer inputs.

The input type is set using the INPUT selector on the front panel of the Unit. Refer to *2-3 Setting Selectors and Switch* for details on settings.

3-2-2 Input Shift

Set the input shift parameter in each memory bank.

The input shift function adds the value set for the input shift to the process value and the E5ZE then controls using this temperature as the process value. For example, if the process value is 100°C and the input shift is –12°C, the E5ZE will use 100°C – 12°C = 88°C as the process value for control.

The input shift setting range is –99.9 to 99.9°C or –99.9 to 99.9°F (default: 0.0°C or 0.0°F.)

3-2-3 Control Period

If the Voltage Output Model is being used, set the control period in each memory bank.

Set the length of the control output period. The setting range is between 1 and 99 s (default: 2 s). For direct operation, the default can be used.

3-2-4 Direct/Reverse Operation

The direct/reverse operation parameter is the same for all control points.

Reverse operation is used for heating control and direct operation is used for cooling control.

The default is 0000, i.e., all control points will operate in reverse (heating control).

3-3 Set Point and Process Value

The setting for the set point used to control the temperature and the process value includes a temperature unit and a setting unit.

The temperature unit (°C or °F) is specified using pin 6 of the FUNCTION switch on the front panel of the Unit. Refer to *2-3 Setting Selectors and Switch* for details on settings.

The setting unit is set using the setting unit parameter as either 0 or 0.1 (default). If serial communications are used to read the set point and process value data, 4 digits will be indicated if the setting unit is "0" and 5 digits will be indicated if the setting unit is "0.1."

The same setting unit is used for all control points.

3-3-1 Setting Set Point

Set the set point using the Set Point Write (WS) command in each memory bank of each control point.

If DeviceNet communications are being used, the values in the memory of the host devices will be automatically reflected in the settings.

The default is 0.0°C or 0.0°F.

3-3-2 Reading Process Value

Read the process value using the Process Value Read (RX) command. The process value will be read for each control point.

If DeviceNet is used, the values in the memory of the host device will be automatically read.

Setting Unit

The setting unit is used as the unit for the alarm temperature and current control temperature during ramp control, as well as for the set point and process value.

The settings will not be affected if the setting unit is changed. If the settings are read, however, they will be indicated as follows:

- If the setting unit is set to 0.1, and data is read after changing the setting unit to 0, any value after the decimal point will be rounded off to a whole integer. For example, 1234.5 will be read as 1235.

- If the setting unit is set to 0, and data is read after changing the setting unit to 0.1, a zero will be added after the decimal point. For example, 1234 will be read as 1234.0.

Operation Start and Stop
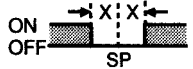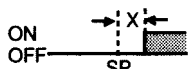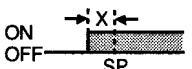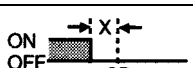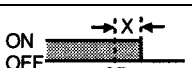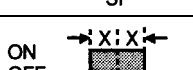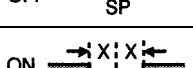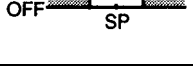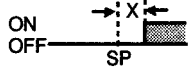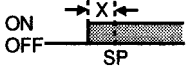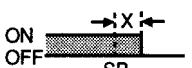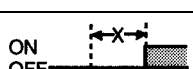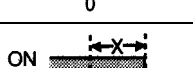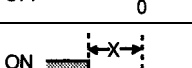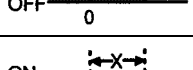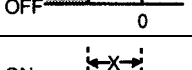
- Execute the Operation Start (OS) command for each control point to start temperature control.

- Execute the Operation Stop (OP) command to stop temperature control or manual operation.

- When DeviceNet communications are used, specific bits are allocated in the memory of the host device for starting and stopping temperature control. Temperature control is started and stopped by turning the corresponding bit ON or OFF.

3-4 Alarm Output Settings

- The alarm outputs can be set for alarms 1 and 2 for each control point. Each alarm output will be output from the alarm 1 and alarm 2 terminals. The alarm 1 and 2 terminals are used for all control points.

- The alarm output conditions are determined by the combination of the alarm mode and alarm temperature settings.

- In addition to normal alarm outputs, alarm outputs for both HB alarms and HS alarms are also possible.

- The alarm outputs do not operate when the E5ZE is stopped.

3-4-1 Alarm Modes

- The following table shows the operations of the alarm modes of the E5ZE.

Code	Alarm mode	Alarm output function	
		Positive alarm temperature (X)	**Negative alarm temperature (X)**
00	No alarms	Always OFF (default setting)	
01	Upper- and Lower-limit Alarm	ON / OFF waveform (X X around SP)	---
02	Upper-limit Alarm	ON / OFF waveform (X at SP)	ON / OFF waveform (X at SP)
03	Lower-limit Alarm	ON / OFF waveform (X at SP)	ON / OFF waveform (X at SP)
04	Upper- and Lower-limit Range Alarm	ON / OFF waveform (X X around SP)	---
05	Upper- and Lower-limit Alarm with Standby Sequence	ON / OFF waveform (X X around SP)	---
06	Upper-limit Alarm with Standby Sequence	ON / OFF waveform (X at SP)	ON / OFF waveform (X at SP)
07	Lower-limit Alarm with Standby Sequence	ON / OFF waveform (X at SP)	ON / OFF waveform (X at SP)
08	Absolute Value Upper-limit Alarm	ON / OFF waveform (X at 0)	ON / OFF waveform (X at 0)
09	Absolute Value Lower-limit Alarm	ON / OFF waveform (X at 0)	ON / OFF waveform (X at 0)
0A	Absolute Value Upper-limit Alarm with Standby Sequence	ON / OFF waveform (X at 0)	ON / OFF waveform (X at 0)
0B	Absolute Value Lower-limit Alarm with Standby Sequence	ON / OFF waveform (X at 0)	ON / OFF waveform (X at 0)
0C	HB and HS Alarm	Turns ON when the HB alarm or HS alarm is output.	

Set the alarm mode for each control point.

3-4-2 Alarm Temperatures

- The alarm temperatures are indicated by X in the above alarm mode table. The operation differs depending on whether the value is positive or negative.

- Set the alarm temperature in each memory bank. The alarm temperature setting is not required, however, if the alarm mode is set to 00 (no alarm function) or 0C (HB and HS alarm).

Standby Sequence

The Standby Sequence enables delaying output of an alarm until the process value enters the alarm range from outside the alarm range.

For example, if the alarm mode is set to Lower-limit Alarm without Standby Sequence, and the ambient temperature is lower than the alarm set value (i.e., within the alarm range), the alarm output will turn ON at startup. If, under the same conditions, the alarm mode is set to Lower-limit Alarm with Standby Sequence, the alarm output will only turn ON when the process value rises once above the alarm set value (i.e., outside the alarm range) and then drops back below it (i.e., within the alarm range).

- When the alarm output turns ON, the standby sequence operation will be ended. The standby sequence will restart again, however, under the following conditions.

  - If temperature control or manual operation is started.
  - If the power is turned ON.
  - If the set point is changed.
  - If the alarm temperature is changed during operation.

Alarm Operation Summary

The following time-chart shows an example of the Lower-limit Alarm with Standby Sequence Mode.

The alarm hysteresis is a fixed value: 1.0°C, 1.0°F
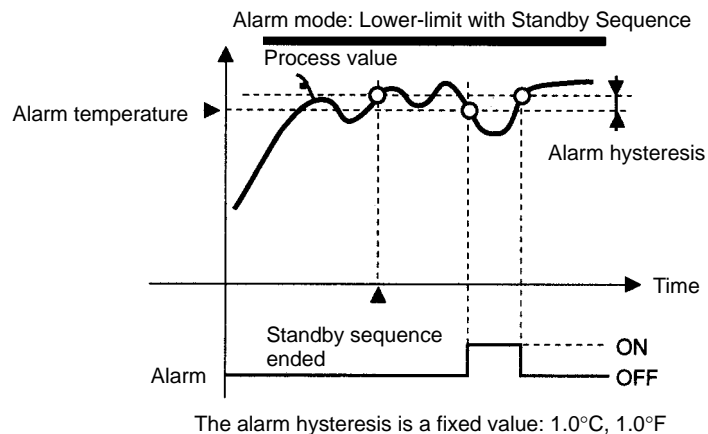
3-5   Output Limitations

The upper and lower limits for the output value are limited by an output limiter and the output change rate is limited by an output change rate limiter.

3-5-1 Output Limiter

If the output value calculated by the E5ZE is outside the range of the output limiter, the actual output will be restricted to the specified upper or lower limit.
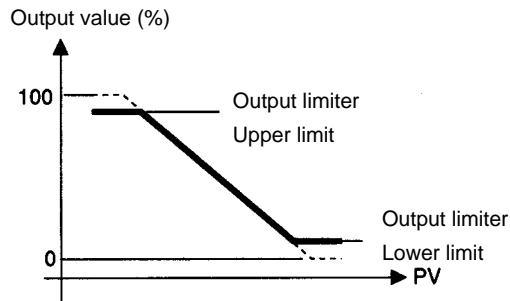
- Set the upper limit and the lower limit within the range of 0.0% to 100.0%.
- The lower limit cannot be set to a value greater than the upper limit.
- If the lower limit is 100.0, the output value will be 100.0%.
- If the upper limit is 0.0, the output value will be 0.0%.
- If the upper limit is equal to the lower limit, the output value will be equal to the output limits.

3-5-2 Output Change Rate Limiter

The change in output value during one sampling period (approx. 200 ms) is limited by the output change rate limiter. If the output value calculated by the E5ZE changes too quickly, the actual output will be that allowed by the setting of the output change rate limiter and will gradually change until it reaches the calculated output value.
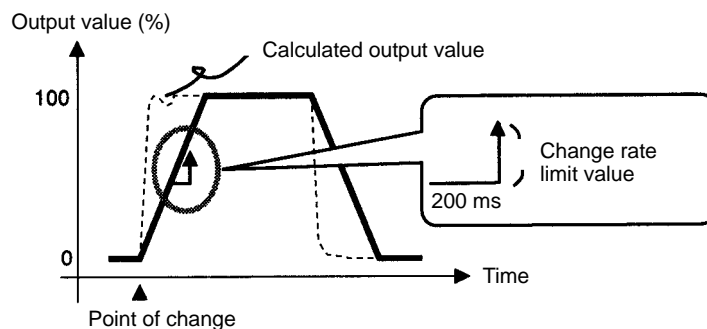
- The change rate limit setting range is between 0.0% and 100.0% per 200 ms. The change rate limiter is disabled if the value is set to 0.0 (default).
- Use the following formula to calculate and set the change rate limit when the change rate is A% for 1 s of output.

    Standard Control Models: A x 0.2

    Heating and Cooling Control Models: A x 0.2 x 0.5

- The output change rate limiter will operate for both heating control and cooling control.

Limiter Operation Conditions

The limiter will be disabled and settings will not be required under the following conditions.

- During manual operation.
- When a temperature sensor input error or temperature controller error occurs.
- When operation is stopped.
- During ON/OFF control.
- During auto-tuning (applies to the output change rate limiter only).

3-6 Ramp

If the ramp function is enabled and the change in the set point exceeds the specified rate of change, the set point will change over an interval, as shown in the following diagram. Temperature will be controlled during the ramp interval according to the value limited by this rate of change (i.e., the current set point), and not by the new set point.
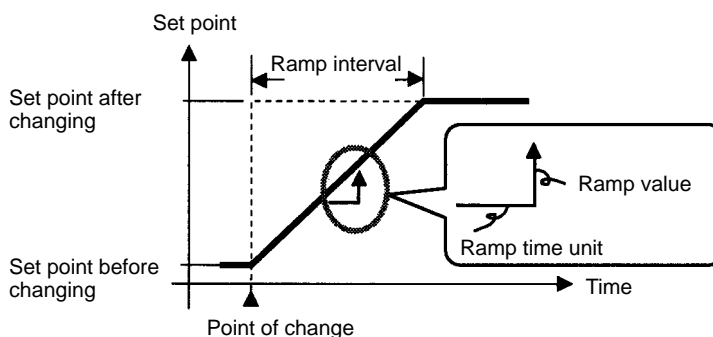
- Set the change rate of the ramp interval in each memory bank. The ramp value and the ramp time unit (hour, minute, or second) must also be set.
- The setting range is 0.1 to 99.9 (°C or °F divided by the ramp time unit).The default is 0.0, i.e., the ramp function is disabled.

Enable Conditions

The ramp function will be used at the following times.

- When temperature control is started.
- When a memory bank number is changed.
- When the set point is changed.

Disable Conditions

The ramp function will be ended at the following times.

- When manual operation is started.
- When auto-tuning is executed.

Application Example

If set points and ramp values are reset in memory banks in advance and the memory bank is switched from the host device over time, the following type of trapezoidal control will be achieved.
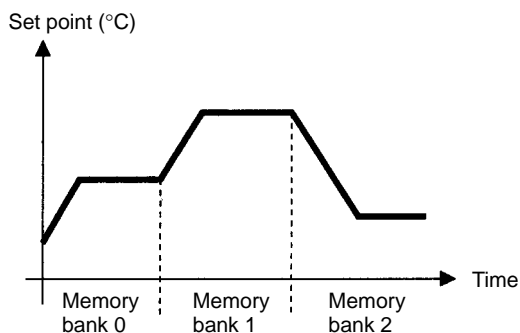
3-7 Control Adjustments

3-7-1 Auto-tuning

Auto-tuning (AT) can be executed independently for any control point, or can be executed for all control points simultaneously or in sequence. (If the DeviceNet is being used, auto-tuning cannot be executed in sequence.)

- If auto-tuning is cancelled, the auto-tuning will stop for all control points at the same time. (If the DeviceNet is being used, auto-tuning can be stopped for each control point separately.)

- When auto-tuning is executed, the optimum PID constants and fuzzy scale for the set point will be automatically set in the current memory bank. The following set values will be changed.

    Proportional band (P constant), integral time (I constant), derivative time (D constant), fuzzy scale 1, fuzzy scale 2

- The AT indicator will be lit while auto-tuning is being executed.

- A method of obtaining the characteristics of the controlled object (the limit cycle method), by causing the output value to fluctuate is used. The application of the method, however, will vary depending on whether the deviation (the difference between the set point value and the process value) is greater or less than 100°C or 180°F when auto-tuning is started.

Deviation 100°C or 180°F   **Deviation < 100°C or 180°F**
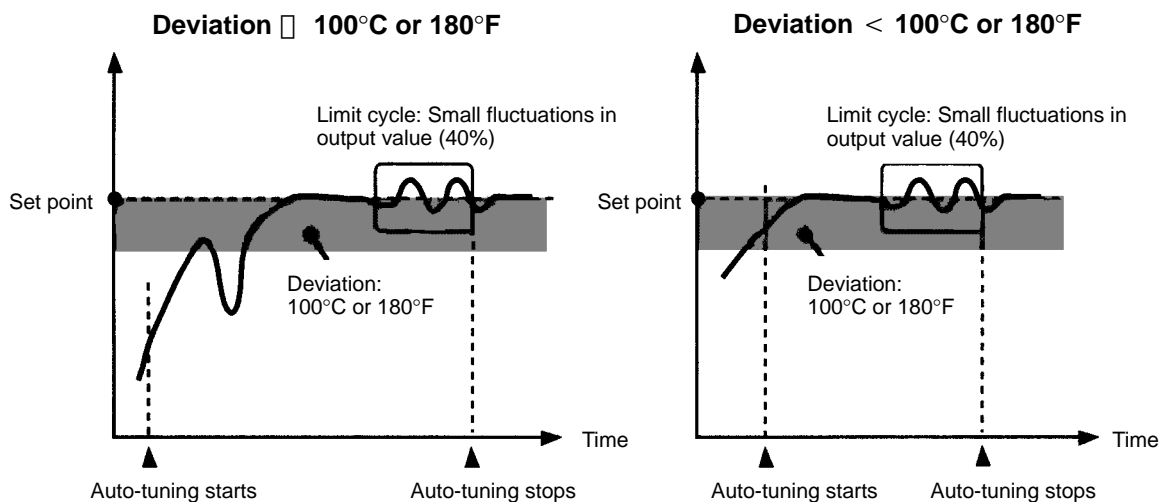
- If auto-tuning is executed for ON/OFF control, auto-tuning will be executed with large fluctuations in the output value. After auto-tuning is completed, 2-PID control will be executed.
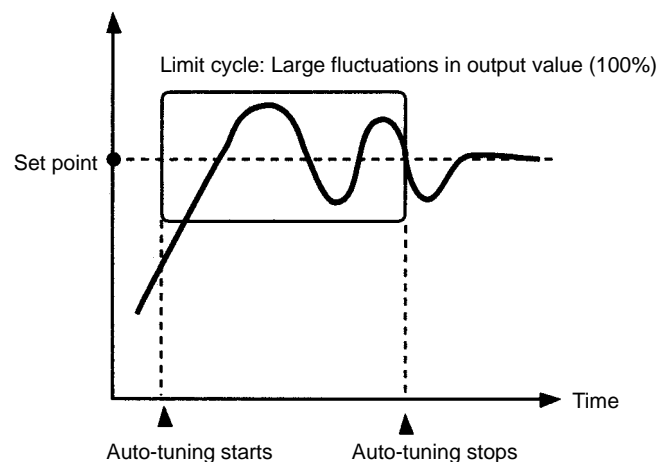
Operation during Auto-tuning

- Auto-tuning cannot be executed when the E5ZE operation is stopped or it is being operated manually.

- The auto-tuning execution time may be extended depending on the controlled object. In such a case, the time required for auto-tuning to be completed may be reduced if the proportional band (P constant) is set to 0.0. The E5ZE goes into ON/OFF operation with oscillations increasing.

- If the optimum PID constants have not been obtained for the controlled object, set them manually.

- Hunting will occur during auto-tuning. If hunting is undesirable, set the PID constants manually.

- The HB and HS alarms will not operate for the control point during auto-tuning.

- If the power is turned OFF during auto-tuning, the E5ZE will stop auto-tuning.

- The auto-tuning function will not operate properly if the controlled object (load) is not connected to the E5ZE.

PID Constants

- The following table shows the relationship between the PID constants and the set point responses for the temperature being controlled. Refer to this table when setting PID constants manually.

PID constant		Set point response		
		Excessive value	**Oscillation**	**Time**
Proportional band	Larger	Decreases	Decreases	Long
	Smaller	Increases	Increases	Short
Integral time	Larger	Decreases	Decreases	Long
	Smaller	Increases	Increases	Short
Derivative time	Larger	Decreases	Increases	Long
	Smaller	Increases	Decreases	Short

Excessive value: Overshooting or undershooting

Oscillation: Hunting

Fuzzy Constants

The fuzzy control function is used when there is external disturbance, to suppress overshooting or undershooting the temperature being controlled by the E5ZE and stabilize the set point within a short period.

- The fuzzy constants are automatically adjusted when the PID constants are changed.

- If automatic adjustment of fuzzy constants is unsatisfactory, adjust them manually referring to the following table.

Fuzzy constant		External disturbance response		
		Excessive value	**Oscillation**	**Time**
Fuzzy strength	Large	Decreases	Increases	---
	Small	Increases	Decreases	
Fuzzy scale 1 and fuzzy scale 2	Large	Increases	Decreases	Long
	Small	Decreases	Increases	Short

3-7-2 Manual Reset

The manual reset function is used to correct a constant offset from the set point after a stable condition is obtained when using P or PD control.

- When an offset occurs, change the manual reset value as shown in the following graph.
- The setting range is between 0.0% and 100.0%. The default is 50%.
- The manual reset value can be set separately in each memory bank.
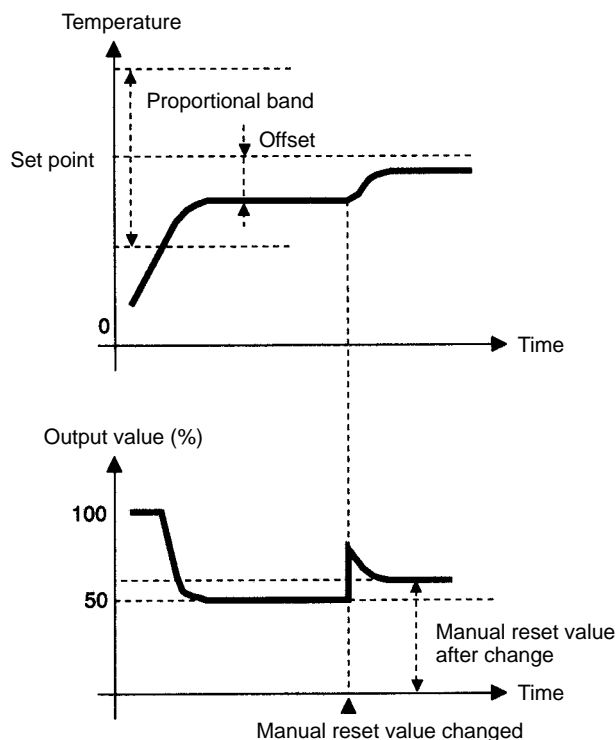
3-8 Control Method Selection

3-8-1 Manual Operation

In manual operation, the control output is operated with manually set output values.

- Each control point can be switched to manual operation independently.
- In manual operation, set the output value through communications.
- If manual operation is continued after the power has been turned OFF or if manual operation is started when the E5ZE has stopped operation, the output value will be 0.0%. In this case, reset the output value.

- When switching between manual operation and 2-PID control, the output value will enter balanceless, bumpless operation.
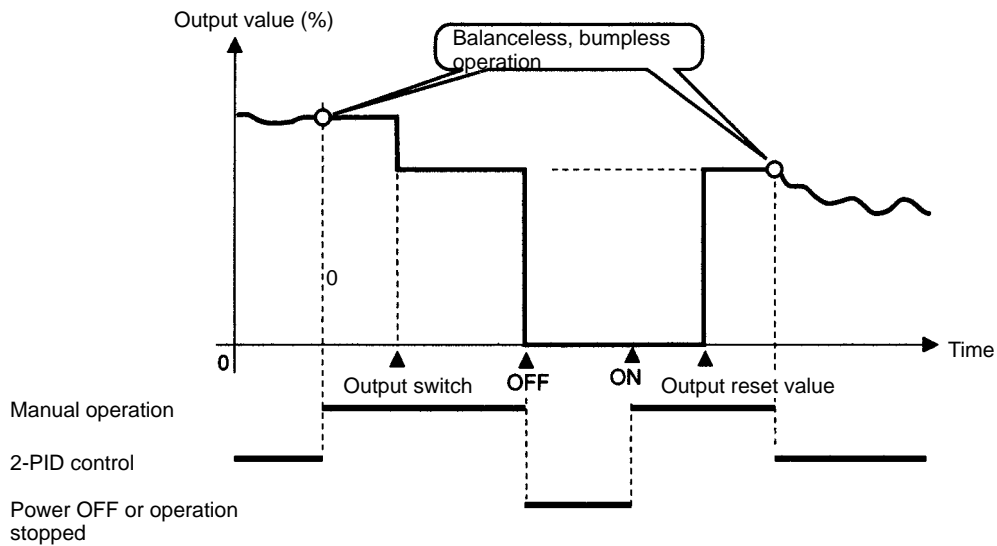
Operating Conditions

- The manual output value can be set only during manual operation. The manual output value cannot be set if there is a temperature sensor input error or a Temperature Controller error.

- Manual operation cannot be started if auto-tuning is being executed or there is a Temperature Controller error.

- The E5ZE-8☐☐☐D1☐B (DeviceNet Model) cannot be operated manually if operation has been stopped. Temperature control must be started with remote I/O before manual operation can be started. For further details, refer to the *E5ZE-8 Multipoint Temperature Controller DeviceNet Communications Manual (H104)*.

3-8-2 ON/OFF Control

2-PID control can be switched to ON/OFF control by setting the proportional band (P constant) to 0.0.

Hysteresis

In ON/OFF control, hysteresis is used to stabilize operation when a change is made to ON/OFF control. The following diagrams show the operation of control output during ON/OFF control.
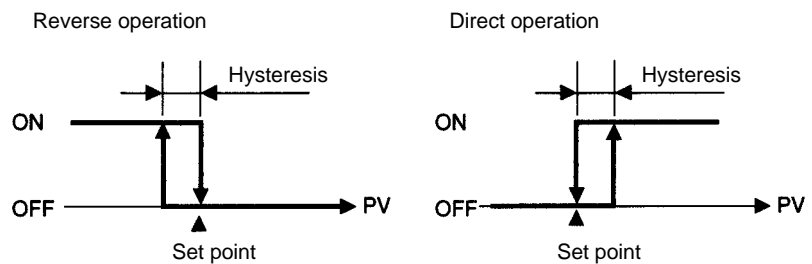
- Set the hysteresis in each memory bank. The settings are only valid when ON/OFF control is being used.

- The setting range is between 0.0 to 99.9 (°C or °F).

- The default value is 0.8°C or 1.5°F.

3-9 Heating and Cooling Control

- The E5ZE-8V☐☐☐ Models are used for heating and cooling control.
- The heating and cooling control function is used for controlling temperatures of objects radiating heat, such as extruding molding machines. The temperature of these objects is controlled using heating control and cooling control outputs.

3-9-1 Dead Band/Overlap Band

The dead band/overlap band function adjusts the output method for the proportional output value close to the set point. The following graphs show the heating and cooling output when using proportional control.

Dead Band Set Value > **0**

Proportional output value (%)
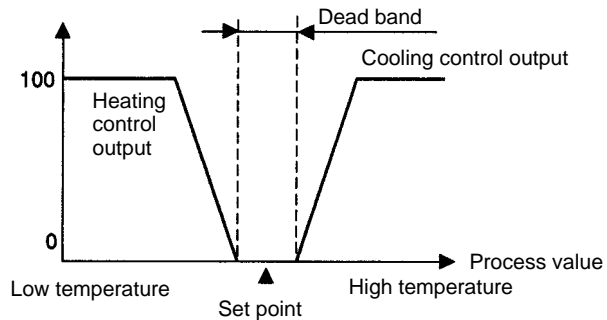
Dead Band Set Value < **0**

Proportional output value (%)
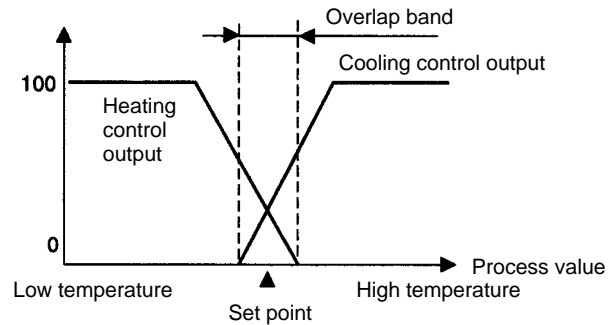
- If the dead band is too wide, hunting may result.
- Control output may occur within the dead band for other types of control apart from proportional control and ON/OFF control.
- Set the dead band in each memory bank.
- The setting range of the dead band is –999 to +999°C (or °F). The default is 0.

• The following graph shows the output when the E5ZE is operating using ON/OFF control.

Dead Band Set Value in ON/OFF Control > 0
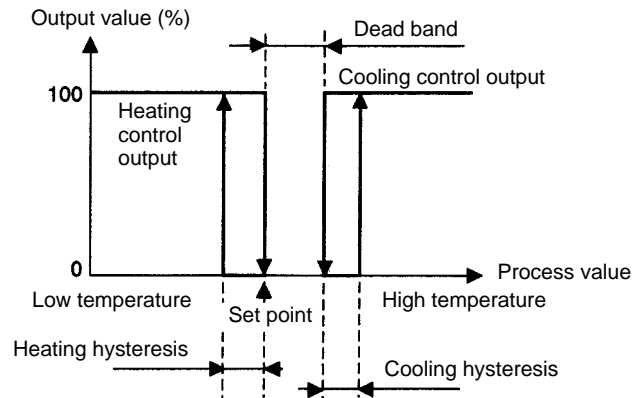
3-9-2 Cooling Coefficient

The difference between the heating characteristics and cooling characteristics of the object being controlled may cause control by PID constants to be unsatisfactory. By changing the cooling coefficient, however, the balance between heating and cooling can be readjusted.

• The cooling coefficient operates according to the following formula.

Cooling P constant = P constant × cooling coefficient

• Set cooling coefficients in each memory bank.

• The cooling coefficient setting range is 0.0 to 10.0. The default is 1.0.

• If the cooling coefficient is set to 0.0, the cooling control output value will be 0%.

3-10 Heater Burnout Detection
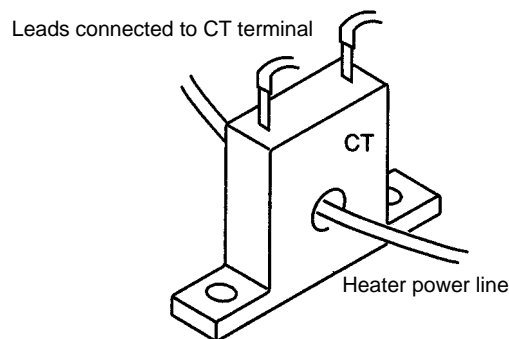
Heater burnout is detected using the following method.

1, 2, 3...   1. Connect the Current Transformer (CT) for the control point to the corresponding terminal on the CT input terminal block, and pass the power cable through the hole in the CT.

2. When current flows through the heater power lines, an AC current corresponding to the amount of current flow is generated in the CT. The heater burnout detection function measures the generated AC current and obtains the amount of current flowing to the heater.

3. When the heater burns out, the current decreases, and after comparing the current with the specified heater burnout detection current value, the HB alarm output will turn ON and the HB indicator will light.

- Set the control points for which HB alarms will be enabled. The factory setting is for the HB alarm to be disabled for all control points. The HB alarm is set by executing the HB Alarm/HS Alarm Effective Control Point Setting (WU) command. If DeviceNet communications are being used, set the HB alarm with FINS messages.

- Set the heater burnout detection current value. The setting range is between 0.0 and 50.0 A.

- If the HB alarm is set to 0.0, it will always be OFF, and if it is set to 50.0, it will always be ON. The default is 0.0 (always OFF).

- To check the CT current, read the values for the heater current and SSR leakage current.

- If the HB alarm is output, it will turn OFF again once the heater current increases to a value greater than or equal to the heater burnout detection current.

- For direct operation, set the heater current to 50 A max. for each control point. If the heater current exceeds 50 A, heater burnout cannot be detected.

- Turn ON the heater power either at the same time as or before turning ON the power to the E5ZE. The HB alarm output will turn ON if the power to the E5ZE is turned ON before turning ON the heater power.

- Temperature control will continue even when the HB alarm turns ON. (The E5ZE will attempt to control the temperature for the heater that has burnt out.)

- The heater burnout detection function operates when the control output is continuously ON for more than 100 ms.

- If the heater's rated current does not match the actual current flowing through the heater, check the actual current being applied by reading the values for the heater current and the SSR leakage current.

- If the difference between normal heater current and heater burnout current is small, the detection function will not operate properly. For reliable detection, use a heater that will give a current difference of at least 1.0 A for heaters that are less than 10.0 A, and at least 2.5 A for heaters that are 10.0 A or more.

- The heater burnout detection function cannot be used when the heater is being controlled by phase control or cycle control, or if a 3-phase heater is being used.

- The heater burnout detection delay is 10 control periods max.

- The HB alarm will not operate for a control point during auto-tuning.

Use the K2CU-F☐☐A-☐GS Heater Burnout Alarm Unit, which has gate input terminals, to detect heater burnout when using 3-phase heaters. (Refer to the relevant datasheets for further details.)

Heater Burnout Detection Current Value Calculation

Calculate the set value for the heater burnout detection current using the following formula.

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

- If more than two heaters are passed through the CT, set the heater burnout detection current to that for the heater with the smaller heater burnout detection current value. (If the heater burnout detection current is the same for all heaters, set the value to the heater burnout detection current for one heater.)

- Heater burnout will be detected under the following conditions.

    If heater current consumption is less than 10.0 A:

        Normal heater current – Heater burnout current ☐ 1 A

        Heater burnout may not be detected if the difference is less than 1 A.

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If heater current consumption is 10.0 A or more:

Normal heater current – Heater burnout current ⎕ 2.5 A

Heater burnout may not be detected if the difference is less than 2.5 A.

Application Examples　　　　**Example 1:**　　**Using One 200-VAC, 1-kW Heater**

Heater　　　Control output

1 kW

200 VAC

CT

E5ZE-12
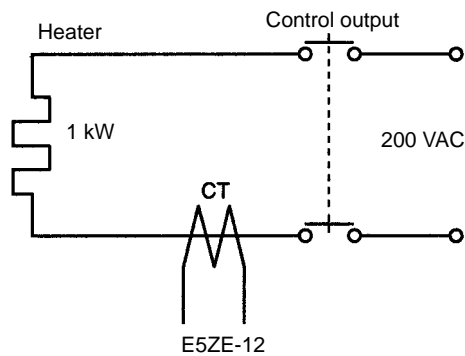
Normal heater current = $\dfrac{1000}{200}$ = 5 A ($<$ 10 A)

Heater burnout current = 0 A

Set value = $\dfrac{5 + 0}{2}$ = 2.5 A

Normal current – burnout current = 5 – 0 = 5 A (⎕ 1 A)

Example 2:　　**Using Three 200-VAC, 1-kW Heaters**

Heater　　　Control output

1 kW x 3

200 VAC

CT

E5ZE-12
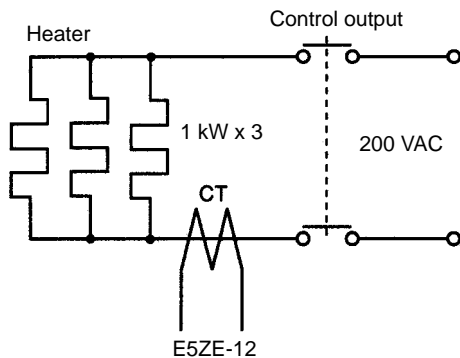
Normal heater current = $\dfrac{1000}{200}$ $\times$ 3 = 15 A (⎕ 10 A)

Heater burnout current for 1 heater = $\dfrac{1000}{200}$ $\times$ 2 = 10 A

Set value = $\dfrac{15 + 10}{2}$ = 12.5 A

Normal current – Burnout current = 15 – 10 = 5 A (⎕ 2.5 A)

3-11　SSR Failure Detection

The Current Transformer (CT) can be used to measure SSR leakage current and detect output short circuits. If an error is detected at any of the control points, the HS alarm output will turn ON and the HS indicator will light. The CT can also detect contact weld in relay.

Operating Conditions

- Set the control point for which the HS alarm is to be used. The factory setting is for the HS alarm to be disabled for all control points. The HS alarm is set by executing the HB Alarm/HS Alarm Effective Control Point Setting (WU) command. If DeviceNet communications are being used, set the HS alarm with FINS messages.
- Set the SSR leakage current value. The setting range is between 0.0 and 50.0 A. The default is 0.5 A.
- To check the CT current value, read the heater current and SSR leakage current.
- The SSR failure detection function operates when the control output is continuously OFF for more than 100 ms.
- The SSR leakage current varies depending on the load voltage. Set the SSR failure detection current according to the heater power voltage that will actually be used.
- Turn ON the heater power either at the same time as or before turning ON the power to the E5ZE. The HS alarm output will turn ON if the power to the E5ZE is turned ON before turning ON the heater power.

- Temperature control will continue even when the HS alarm turns ON.

- The SSR failure detection function cannot be used when the heater is being controlled by phase control or cycle control, or if a 3-phase heater is being used.

- The SSR failure detection delay is 10 control periods max.

- For control points being auto-tuned, the HS alarm will not operate until auto-tuning is completed.

SSR Failure Detection Current Value Calculation

If the default preset SSR failure current value (0.5 A) is used, obtain the SSR failure detection current from the following formula.

SSR failure detection current = Normal SSR leakage current $\times$ 2

- For example, if the normal SSR leakage current value is 1.0 A, the SSR failure detection current is as follows:

SSR failure detection current = 1.0 $\times$ 2 = 2.0 A
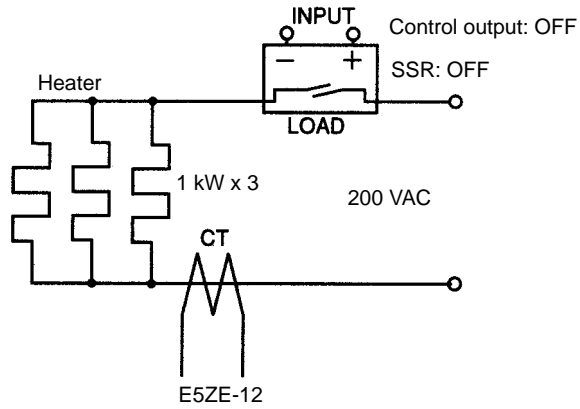
SECTION 4
Troubleshooting

This section describes the troubleshooting procedure and possible errors and remedies when the E5ZE is not operating properly. When performing troubleshooting follow the order in which information is provided in this section.

4-1 Troubleshooting Procedure

If the E5ZE has an error, refer to the following items to find the possible cause of the error and take corrective measures.

1, 2, 3... 1. **Indicators**

Check the operating status of the E5ZE using the indicators.

If the ERR indicator is lit, turn the E5ZE OFF and ON. If the ERR indicator is not lit after the E5ZE is turned ON, it may mean that the E5ZE is being influenced by noise. Find the source of the noise and provide adequate protection against it.

2. **Switch, Selectors, and Wiring**

Check if the switch and selector settings of the E5ZE, the wiring of the E5ZE and devices connected to the E5ZE are correct.

a) Power Supply

- Check that the power supply connected to the E5ZE is turned ON.

- Check whether the supply voltage at the power supply terminals is within the allowable voltage range of the E5ZE.

b) Switch and Selectors

Check that the switch and selectors of the E5ZE are correctly set according to the system.

c) Wiring

- Check that the terminals and connectors are wired together correctly.

- Check that the terminal block wiring is correct.

- Check that the polarity of each wire connected to the E5ZE is correct.

- Check if any wire is disconnected.

- Check if a wire or cable is cut or short-circuited.

- Check that the wiring-reduction devices connected to the E5ZE are the correct designated ones.

d) Communications Conditions

Check that the communications conditions of the E5ZE are compatible with the host device connected to the E5ZE.

Check the above items and remedy any problems listed above. If the error persists after error processing, perform further checks through communications.

3. **Checking through Communications**

- Check the end code and error code with the response returned from the E5ZE.

- Check the status of the E5ZE with the Status Read Command.

- Check if the functions used with the E5ZE have any operating restrictions.

- Check if the set data items of the communication commands used for the E5ZE are correct.

Troubleshoot problems on the basis of the data read with the E5ZE.

4. **Troubleshooting Based on Error Symptoms**

If the cause of the error is still unknown after checking all the previously mentioned items, find the cause by isolating the symptoms of the error while referring to the tables in this section, and remedy accordingly.

4-2 Communications Errors

Communications Not Possible or No Response

	Probable cause	Remedy
Communications conditions	Baud rate of the E5ZE is different from that of the host device.	Set the same rate.
	Communications method of the E5ZE is different from that of the host device.	Set the host device's communications conditions as follows: • Stop bits: 2 • Parity: Even • Bit length: 7 bits
Connections	Excessive number of E5ZE Units are connected in parallel.	Do not connect an excessive number of E5ZE Units. • Do not connect the host device directly to more than one E5ZE through RS-232C communications. • The number of E5ZE Units that can be connected to the host device for RS-422 or RS-485 communications is 16 max.
	Transmission path is too long.	The transmission path must be within the permissible range. • The maximum RS-232C transmission path is 15 m. • The maximum RS-422 or RS-485 transmission path is 500 m in total.
	Same unit number has been assigned more than once on the same transmission path.	Make sure that different numbers are assigned to all the E5ZE Units that communicate with the host device.
	Communications data error due to ambient noise.	• Move the communications cable away from the source of noise. • Use shielded communication cables. • Use an Optical Interface. • Write a program that makes it possible for the host device to detect a response error for any command that the host device transmits and to re-transmit it again.
	Mistake in the use of the Optical Interface and Link Adapter Units.	Refer to the datasheets of the Optical Interface and Link Adapter Units used.

	Probable cause	**Remedy**
Program	System begins communications without any interval after the E5ZE Units are turned ON.	Write a program so that the system starts communications with an interval of 5 s min. after the E5ZE Units are turned ON.
	Unstable signal of the E5ZE, which is generated when the E5ZE is turned ON or OFF, is read as data by the host device.	Initialize the reception buffer of the host device at the following stages. • Before the host device transmits the first command. • After the E5ZE is turned OFF.
	Host device sends commands to the E5ZE before receiving any response from the E5ZE.	Write a program enabling the host device to read the response after the host device sends any command.
	Interval between the time the host device receives a response and sends a command is too short.	The interval between the time the host device receives a response and sends a command must be 20 ms minimum.
	Program of the host device is incorrect.	• Correct the program. • Check the command with the line monitoring function. • Run a sample program with the host device.
Settings	Unit numbers set with the selectors are different from those set using the commands of the host device.	The unit numbers must coincide.
	Pin 8 of the FUNCTION switch on the E5ZE is ON.	Turn OFF pin 8 of the FUNCTION switch on the E5ZE.
	E5ZE is in hardware test mode.	The E5ZE must be in control mode.
	Termination resistance settings for RS-422 or RS-485 communications are incorrect.	The E5ZE or host device located on both ends of the E5ZE system must have termination resistances.
	RS-422 or RS-485 settings are incorrect.	Correct the communications switch settings.

4-3 Temperature Sensing Errors

Temperature Sensing Not Possible or Abnormal

	Probable cause	Remedy
Connections	Polarity or wiring of a temperature sensor is incorrect.	Correct the wiring of the temperature sensor.
	Temperature sensor is not an applicable one.	Replace the temperature sensor with an applicable one.
	Leads of a temperature sensor are disconnected, short-circuited, or deteriorated.	Replace the temperature sensor.
	Temperature sensors are not used.	Use temperature sensors.
	Thermocouple does not use applicable compensating conductors.	• Replace the thermocouple with another thermocouple with long leads. • Connect applicable compensating conductors for the thermocouple.
	Thermocouple is connected to the E5ZE with a device using a metal that is different in type from the metal of the thermocouple or that of the compensating conductors.	Connect a thermocouple-dedicated device between the thermocouple and the E5ZE.
	A screw of the terminal block of the E5ZE is loosened and improper contact is resulting.	Tighten the screw.
	Leads or compensating conductors of a thermocouple are too long and leads or compensating conductors have resistance.	• Use sufficiently thick compensating conductors. • Change the location of the thermocouple so that the length of the leads or compensating conductors can be shortened.
	The resistance of the conductors for the 3 terminals is different from the resistance of the temperature sensor connected to the E5ZE.	Use conductors that are the same in resistance for the two B terminals and the A terminal.
Installation	Noise is affecting the E5ZE.	• Separate the E5ZE from the source of the noise. • Connect a surge absorber or noise filter to the device generating the noise.
	Inductive noise generated from power lines is affecting the leads of a temperature sensor.	• Separate the leads from the power lines. • Wire the leads in a separate conduit or duct. • Do not wire the leads alongside power lines. • Shorten the leads. • Shield the leads.
	Thermal response of a temperature sensor connected to the E5ZE is slow because the temperature sensor is located far from the temperature controlling position of the E5ZE.	Locate the tip of the protective tubing of the temperature sensor at the temperature controlling position.
	Ambient operating temperature of the E5ZE is not within the allowable ambient operating temperature range of the E5ZE.	The ambient operating temperature range of the E5ZE must be between 0°C and 55°C.
	Radio transmitter is being used near the E5ZE.	Shield the E5ZE.
	E5ZE is affected by heat radiation from Peripheral Devices and the temperature of the terminal block of the E5ZE is not even.	Install the E5ZE in a location where it will not be affected by heat radiation.
	Terminal block of the E5ZE is affected by wind.	Protect the terminal block of the E5ZE against wind.

	Probable cause	Remedy
Settings	Selector settings for the input type of temperature sensor are incorrect.	Correct the INPUT selector setting.
	Celsius-Fahrenheit designation of the E5ZE is incorrect.	Correct the FUNCTION switch setting.
	The process value appears to be incorrect due to the input shift setting.	Set the input shift to 0.0.
	E5ZE FUNCTION switch is not set correctly for the E5ZD-SDL Setting Display Unit connected to the E5ZE.	Correct the FUNCTION switch setting.
	Data setting unit is incorrect.	Change the program of the host device.
	Program of the host device is incorrect.	Change the program of the host device.
Operation	Temperature sensor input terminals of the E5ZE thermocouple input model have been short-circuited.	Connect a thermocouple to the temperature sensor input terminals.
	Temperature sensor connected to the E5ZE has been replaced or the switch or selector settings of the E5ZE have been changed while the power is ON.	Turn OFF the power to the E5ZE, and then turn ON again.

Simple Method for Checking Temperature Sensors

Platinum Resistance Thermometer

1, 2, 3...   1. Connect a 100-Ω resistor between the A and B temperature sensor input terminals and short-circuit the B terminals.

2. If the temperature sensed by the E5ZE is 0.0°C or 32.0°F, the E5ZE is operating normally.

Thermocouple

1, 2, 3...   1. Short-circuit the temperature sensor input terminals of the E5ZE.

2. If the E5ZE senses the temperature of the terminal block of the E5ZE, the E5ZE is operating normally.

4-4   Temperature Control Errors

Temperature Does Not Rise

	Probable cause	Remedy
Connections	Process value of the E5ZE is abnormal.	Refer to *4-3 Temperature Sensing Errors* for appropriate troubleshooting.
	Load is not connected to the control output terminal of the E5ZE.	Connect a load.
	Polarity or wiring of a load is incorrect.	Correct the wiring of the load.
	A screw of the terminal block of the E5ZE is loosened and improper contact is resulting.	Tighten the screw.
	Power is not supplied to heaters.	Supply power to the heaters.
	Heaters are burnt out or have deteriorated.	Replace the heaters.
	Heat capacity of the heater is too small.	• Replace the heater with one having a larger heat capacity. • If more than one heater is used and some are burnt out, replace the heaters.
	Overheating prevention device for the E5ZE is operating.	The set value of the overheating prevention device must be larger than the set value of the E5ZE.
Settings	E5ZE is in reverse operation mode, instead of direct operation mode, or vice versa.	Correct the operation mode setting.
	PID constants of the E5ZE are incorrect.	• Execute auto-tuning. • Set the PID constants of the E5ZE to appropriate values.
	E5ZE has not started temperature control.	Start the temperature control.
	Control output value of the E5ZE does not increase because of the restrictions of the set output limit value.	• Set the output limit value of the E5ZE to an appropriate value.
	Control output value of the E5ZE does not increase because of the restrictions of the set output change rate limit.	• Disable the output change rate limit function of the E5ZE by setting to 0000. • Set the output change rate limit of the E5ZE to an appropriate value.
	Cooling fan is operating.	Turn OFF the cooling fan.

Process Value Exceeds Set Point

	Probable cause	Remedy
Connections	Process value of the E5ZE is abnormal.	Refer to *4-3 Temperature Sensing Errors* for appropriate troubleshooting.
	Load is connected to the incorrect control point of the E5ZE and is controlling the heaters with the control output of the incorrect control point.	Correct the wiring of the load.
	Relay driven by control output has contact weld.	Replace the relay.
	SSR is short-circuited.	Replace the SSR.
	SSR leakage current is flowing into the heaters.	Connect a bleeder resistance to the SSR to prevent operation with the SSR leakage current.
Settings	E5ZE is in reverse operation mode, instead of direct operation mode, or vice versa.	Correct the operation mode setting.
	PID constants of the E5ZE are incorrect.	• Execute auto-tuning. • Set the PID constants of the E5ZE to the values suitable to the system.
	Control output value of the E5ZE does not increase because of the restrictions of the set output limit value.	• Set the output limit value of the E5ZE to an appropriate value.
	Control output value of the E5ZE does not increase because of the restrictions of the set output change rate limit value.	• Disable the output change rate limit function of the E5ZE by setting to 0000. • Set the output change rate limit value of the E5ZE to an appropriate value.
	E5ZE is outputting in manual operation.	Interrupt the manual operation of the E5ZE.
Operation	Controlled object is radiating heat.	Execute heating and cooling control.
	Controlled object is influenced by large overshooting.	Refer to the following table regarding overshooting and undershooting for appropriate troubleshooting.

Overshooting or Undershooting

	Probable cause	Remedy
Connections	Process value of the E5ZE is abnormal.	Refer to *4-3 Temperature Sensing Errors* for appropriate troubleshooting.
	General-purpose temperature sensor with slow thermal response characteristics is being used to sense a controlled object with quick thermal response characteristics.	Change to a sheath-type temperature sensor.
Settings	E5ZE has a narrow proportional band and small P constant.	• Increase the P constant keeping within the range where the response delay caused by the P constant can be allowed. • Execute auto-tuning.
	E5ZE has a short integral time or small I constant.	• Increase the I constant keeping within the range where the response delay caused by the I constant can be allowed. • Execute auto-tuning.
	E5ZE has a short derivative time or small D constant.	• Increase the D constant keeping within the range where the D constant will not have an undesirable influence on temperature stability. • Execute auto-tuning.
	E5ZE is executing ON and OFF control with a P constant of 0.	Execute P or PID control.
	Control period is too long when the E5ZE controls the temperature of an object with quick thermal response characteristics.	Shorten the control period.
	Dead band instead of an overlap band is set with the E5ZE in heating and cooling control operation.	Set the overlap band of the E5ZE.

Hunting

For troubleshooting problems with connections and settings, refer to the same probable causes and remedies as provided for overshooting and undershooting.

	Probable cause	Remedy
Operation	Heat capacity of a heater controlling the temperature of an object is too large for the object.	Use a heater with a heat capacity suited to the object.
	Heat capacity of a controlled object changes due to periodical external disturbances.	Take appropriate measures to prevent the periodical external disturbances.
	E5ZE is executing auto-tuning.	Hunting will not occur if auto-tuning is completed.

4-5 Output Errors

Control Output or Alarm Output Does Not Turn ON

	Probable cause	Remedy
Connections	Process value of the E5ZE is abnormal.	Refer to *4-3 Temperature Sensing Errors* for appropriate troubleshooting.
	Polarity of the load or connected terminals are wired incorrectly.	• Correct the wiring.
	Connectors are not connected to the correct terminal blocks.	• Connect the connectors correctly.
	Load exceeding the output ratings of the E5ZE is connected.	• Connect a load that does not exceed the output ratings to the E5ZE. • Request repair of the E5ZE if it is malfunctioning.
	Load power supply is not connected to alarm output or cooling control output.	Provide a power supply satisfying the output ratings of the E5ZE and suitable for the load.
	Polarity of the load power supply for alarm output or cooling control output is incorrect.	Correct the wiring.
	Power is not being supplied to the wiring-reduction device.	Supply power required to satisfy the ratings of the device.
	The wiring-reduction device is not connected to the E5ZE using Connecting Cable.	Use the Connecting Cable specified in *2-6 Wiring CT Inputs and Control/Alarm Outputs*.

	Probable cause	**Remedy**
Settings	Pin 5 of the FUNCTION switch is OFF (control operation OFF).	• Transmit Control Operation Start from the host device after turning the E5ZE ON. • Set pin 5 of the FUNCTION switch to ON (control status continues even after E5ZE is turned OFF).
	E5ZE has not started control operation.	Transmit Control Operation Start from the host device.
	Control point designation is incorrect.	Set the correct control point numbers.
	Set point of the E5ZE is set incorrectly.	Correct the set point settings.
	The parameters for the specified memory bank are not set.	• Set the parameters. • Switch to the correct memory bank.
	Incorrect memory bank of E5ZE is designated.	Set the correct memory bank.
	All the control points of the E5ZE are controlled by a single memory bank because the memory bank was designated with contact input.	Set the FUNCTION switch of the E5ZE to communications so that different memory bank numbers can be designated for each control point.
	When designating a memory bank with contact input, the ON or OFF status of the contact is not kept on hold.	Set the E5ZE so that the ON or OFF status of the contact is kept on hold while designating the memory bank with the contact input.
	E5ZE attempts memory bank designation with communications when memory bank contact input designation is selected.	Correct the memory bank designation method setting.
	Alarm mode of the E5ZE is set to 00 (no alarm function).	Set the correct alarm mode.
	Alarm mode of the E5ZE is set to alarm with standby sequence.	Use alarms without a standby sequence.
	Deviation value and absolute value are incorrect for the alarm mode set.	Set the correct alarm mode.
	DeviceNet communications are being used, but the RUN/STOP Bit is not turned ON at the host device.	Turn ON the RUN/STOP Bit at the host device.
	DeviceNet communications are being used, but the set point is incorrectly set at the host device.	Set the correct set point in the applicable data area at the host device using 16-bit signed binary format.

4-6 HB Alarm and HS Alarm Errors

HB Alarm and HS Alarm Errors: Heater Burnout Detection or SSR Failure Detection Function Not Possible

	Probable cause	Remedy
Connections	Current Transformer is not connected.	Connect a Current Transformer to the E5ZE.
	Current Transformer is wired to an incorrect control point of the E5ZE.	Wire the Current Transformer to the correct control point.
	Heaters are controlled directly with an alarm output.	Change the wiring so that the CT input is connected to the correct control output.
Settings	E5ZE has not started control operation.	Start the control operation.
	Control output of a control point is ON for less than 100 ms.	The HB alarm will operate if the control output of any control point of the E5ZE is turned ON for 100 ms or more.
	Control output of a control point is OFF for less than 100 ms.	The HS alarm will operate if the control output of any control point of the E5ZE is turned OFF for 100 ms or more.
	HB alarm and HS alarm are disabled (set to 0).	Enable the HB alarm and HS alarm by setting to 1.
	HB alarm and HS alarm are enabled before the heaters are turned ON.	Turn ON the heaters before enabling the HB alarm and HS alarm.
	Heaters are turned ON after the E5ZE starts control operation.	Turn ON the heaters before starting the E5ZE control operation.
	Heater burnout detection current value of the E5ZE is set to 0.0 or 50.0 A.	Set the heater burnout detection current value to an appropriate value between 0.1 and 49.9 A.
	Heater burnout detection current value of the E5ZE is set to the rated current.	Determine the heater burnout detection current value from the actual current consumption of the heaters.
	Heater burnout detection current value obtained from the actual current consumption of the heaters is incorrect.	Reset the heater burnout detection current value by considering the voltage range of the power supply for the heaters and any error in measurement of the current.
Operation	Total current consumption of the heaters connected to the E5ZE exceeds 50.0 A.	Set the heater current to 50.0 A maximum.
	Heaters connected are supplied with DC, or the E5ZE is a current output type model.	The HB alarm and HS alarm do not operate under these conditions.
	Pure metal heaters are being used.	Determine the heater burnout detection current value from the actual current consumption of the heaters.

Appendix A
Specifications

E5ZE Ratings

Item		Specification
Power supply voltage		24 VDC
Allowable power supply range		85% to 110% of power voltage
Power consumption		15 W + 20% max. at rated voltage
Sensor inputs		Thermocouple: K, J, R, S, T, E, B, N, L, U, W, PL II
		Platinum resistance thermometer: Pt100, JPt100 (Rated current: 1 mA, 8 points)
CT inputs		E54-CT1 or E54-CT3
	Measurement unit	0.1 A, 8 points
Max. heater current		50 A (single-phase AC)
Control outputs		Voltage output (with short-circuit protecting function) ON: 12 ± 1.2 VDC OFF: 0.5 VDC max. Max. load current: 30 mA DC per point Current output Rated output range: $4^{+0}/_{-0.6}$ to $20^{+2}/_{-0}$ mA Max. load resistance: 600 Ω
Alarm outputs		Cooling control output: 8 points
		Temperature alarm: Two points (one for alarm 1 and one for alarm 2) for total output of each control point
		HB alarm (heater burnout detection): One point for total output of each control point
		HS alarm (SSR failure detection): One point for total output of each control point
		Temperature controller error output (memory, set value, or hardware error): One point
		All of the above are NPN open collector outputs Max. voltage imposition: 30 VDC Max. load current: 50 mA ON residual voltage: 2 VDC max. OFF leakage current: 1 mA max.
Memory bank designation input		No-voltage contact signal input: ON contact resistance: 1 kΩ max. OFF contact resistance: 100 kΩ max. Transistor open collector input: ON residual voltage: 2 VDC max. OFF leakage current: 1 mA max.
No. of input control points		8 inputs and 8 control points, 3 memory bank designation inputs
Setting method		Through communications
Indication method		No indication. Process values are output through communications.
Output operation		Direct and reverse operation
Adjustment mode		ON/OFF control Hybrid of 2-PID control and fuzzy control Manual operation
Auto-tuning		Limit cycle method
Memory bank		No. of banks: 8 for each control point Designation method: Through communications or using contact input

Item	Specification
Ambient operating temperature	−10 to 55 °C (0 to 55 °C for the E5ZE-8□□□D1□B) (with no icing or condensation)
Ambient operating humidity	35% to 85% RH
Storage temperature	−25 to 65 °C (with no icing or condensation)
Storage humidity	35% to 95% (with no condensation)

Communications Ratings

Serial Communications

Communications interface	RS-232C	RS-422	RS-485
Transmission method	Serial communications		
Terminal	Data processing terminal		
Communications method	Half-duplex		
Connecting method	25-pin D-sub connector	5-pole terminal block (with M3 screws)	
Transmission line configuration	3-wire	4-wire	2-wire
Transmission line type	Direct line	Multi-drop line	
Synchronization method	Start-stop synchronization (asynchronous)		
Baud rate	2,400/4,800/9,600/19,200 bps		
Transmission code	ASCII		
No. of stop bits	2		
Parity	Even parity		
Character length	7 bits		
Error detection	Vertical parity and FCS (frame check sequence)		
Communications unit no.	0 to F (hexadecimal)		
Transmission and reception switching time	---	20 ms max.	
Max. cable length	15 m	500 m in total	
No. of controllers connected in parallel	---	16 (excluding host system)	

DeviceNet Communications

Item	Specification
Power supply voltage	24 VDC
Allowable voltage fluctuation range	11 to 25 VDC (supplied through communications connector)
Current consumption	24 VDC at 45 mA max.
No. of Remote I/O words	14 input words, 9 output words
Message communications function	FINS messages

E5ZE Characteristics

Item			Specification			
Measurement range			−20°C (lower limit of the setting range) to 20°C (upper limit of the setting range) −40°F (lower limit of the setting range) to 40°F (upper limit of the setting range)			
Setting range	**Setting unit**		1		0.1	
			Celsius	Fahrenheit	Celsius	Fahrenheit (See note 2.)
	Ther-mocou-ple	K	−200 to 1,300°C	−300 to 2,300°F	−200.0 to 1,300.0°C	−300.0 to 2,300.0°F
		J	−100 to 850°C	−100 to 1,500°F	−100.0 to 850.0°C	−100.0 to 1,500.0°F
		R	0 to 1,700°C	0 to 3,000°F	0.0 to 1,700.0°C	0.0 to 3,000.0°F
		S	0 to 1,700°C	0 to 3,000°F	0.0 to 1,700.0°C	0.0 to 3,000.0°F
		T	−200 to 400°C	−300 to 700°F	−200.0 to 400.0°C	−300.0 to 700.0°F
		E	0 to 600°C	0 to 1,100°F	0.0 to 600.0°C	0.0 to 1,100.0°F
		B	100 to 1,800°C	300 to 3,000°F	100.0 to 1,800.0°C	300.0 to 3,000.0°F
		N	0 to 1,300°C	0 to 2,300°F	0.0 to 1,300.0°C	0.0 to 2,300.0°F
		L	−100 to 850°C	−100 to 1,500°F	−100.0 to 850.0°C	−100.0 to 1,500.0°F
		U	−200 to 400°C	−300 to 700°F	−200.0 to 400.0°C	−300.0 to 700.0°F
		W/Re5-26	0 to 2,300°C	32 to 4,100°F	0.0 to 2,300.0°C	0.0 to 4,100.0°F
		PL-II	0 to 1,300°C	0 to 2,300°F	0.0 to 1,300.0°C	0.0 to 2,300.0°F
	Plati-num resis-tance ther-mome-ter	Pt 100	−100 to 500°C	−100 to 900°F	−100.0 to 500.0°C	−100.0 to 900.0°F
		JPt 100	−100 to 500°C	−100 to 900°F	−100.0 to 500.0°C	−100.0 to 900.0°F
Measurement accuracy			Thermocouple: ±0.3% of the process value or ±2°C, whichever is larger ±1 digit max. ±0.3% of the process value or ±3.6°F, whichever is larger ±1 digit max. Platinum resistance thermometer: ±0.3% of the process value or ±0.8°C, whichever is larger ±1 digit max. ±0.3% of the process value or ±1.5°F, whichever is larger ±1 digit max.			
Setting accuracy			There is no difference between the setting accuracy and measurement accuracy.			
Guaranteed setting accuracy range			Same as the setting range.			
Influence of conductor resistance			Thermocouple: ±0.1°C/Ω or ±0.2°F/Ω max. Platinum resistance thermometer: ±1.0°C/Ω or ±1.8°F/Ω max. per line			
Input shift			−99.9 to 99.9°C/°F (in units of 0.1°C/°F)			
Hysteresis			0.0 to 99.9°C/°F for ON/OFF control only (in units of 0.1°C/°F)			
Cooling coefficient			0.0 to 10.0 (in units of 0.1)			
Proportional band (P constant)			0.0° to 999.9°C/°F (in units of 0.1°C/°F) Cooling proportional band: Proportional band x Cooling factor			
Integral time (I constant)			0 to 3,999 s (in units of 1 s) (cannot be set for heating and cooling independently)			
Derivative time (D constant)			0 to 3,999 s (in units of 1 s) (cannot be set for heating and cooling independently)			
Control period			1 to 99 s (in units of 1 s) Cooling control period: 1 to 99 s (in units of 1 s)			
Sampling period			200 ms for 8 control points			

Item			Specification	
Dead band/overlap band			–999 to 999°C/°F (in units of 1°C/°F)	
Upper-limit output value			ON/OFF pulse type: (Lower-limit output value + 0.1)% to 100.0% (in units of 0.1%) Linear output type: (Lower-limit output value + 0.1)% to 105.0% (in units of 0.1%)	
Lower-limit output value			ON/OFF pulse type: 0.0% to (Upper-limit output value – 0.1)% (in units of 0.1%) Linear output type: –5.0% to (Upper-limit output value – 0.1)% (in units of 0.1%)	
Output value change rate limit			0.0% to 100.0% per sampling period (200 ms approx.) in units of 0.1%	
Alarm output setting range	**Setting unit**		1	0.1 (See note 2)
	Alarm mode	Upper- and lower-limit (See note 1)	0° to 9,999°C/°F	0.0° to 9,999.9°C/°F
		Upper-limit (See note 1)	–999° to 9,999°C/°F	–999.9° to 9,999.9°C/°F
		Lower-limit	–999° to 9,999°C/°F	–999.9° to 9,999.9°C/°F
		Upper- and lower-limit range	0° to 9,999°C/°F	0.0° to 9,999.9°C/°F
		Absolute-value upper-limit (See note 1)	–999° to 9,999°C/°F	–999.9° to 9,999.9°C/°F
		Absolute-value lower-limit (See note 1)	–999° to 9,999°C/°F	–999.9° to 9,999.9°C/°F
		HB and HS alarm	–999° to 9,999°C/°F	–999.9° to 9,999.9°C/°F
CT input measurement range			0.0 to 55.0 A AC(in units of 0.1 A)	
CT input measurement accuracy			±5% FS ± 1 digit max. (between 0.0 to 50.0 A)	
HB and HS alarm setting range			0.0 to 50.0 A (in units of 0.1 A)	
HB and HS alarm setting accuracy			There is no difference between the CT input measurement accuracy and HB and HS alarm setting accuracy.	
HB alarm min. detection ON time			Control output must be continuously ON for 100 ms min.	
HS alarm min. detection OFF time			Control output must be continuously OFF for 100 ms min.	
Fuzzy strength			0% to 99% (in units of 1%)	
Fuzzy scale 1			0.2 to 999.9°C/°F (in units of 0.1°C/°F)	
Fuzzy scale 2			0.02 to 99.99°C/s or °F/s (in units of 0.01°C/s or °F/s)	
Insulation resistance			20 MΩ min. between the FG terminal and all input terminals (at 500 VDC)	
Dielectric strength			500 VAC for 1 minute between the FG terminal and all input terminals	
Vibration resistance			Malfunction: Vibration frequency: 10 to 55 Hz Acceleration: 15 m/s^2 Direction and time: 8 min each in X, Y, and Z directions Destruction: Vibration frequency: 10 to 55 Hz Acceleration: 20 m/s^2 Direction and time: 8 min each in X, Y, and Z directions	

Item	Specification
Shock resistance	Malfunction: Max. acceleration: 150 m/s^2 Direction: 3-axis, 6 directions Times: 18 times in total Destruction: Max. acceleration: 200 m/s^2 Direction: 3-axis, 6 directions Times: 18 times in total
Enclosure rating	IP00
Dimensions	E5ZE-8 □□□□-E (without casing): 169.5 x 192 x 58 mm E5ZE-8 □□□□□B-E (with casing): 173.5 x 230 x 65 mm E5ZE-8 □□□D1□B (DeviceNet): 173.5 x 253 x 65 mm
Set value backup	Lithium battery
Set value backup period	10 years min. provided that the ambient temperature is within the normal room temperature
Weight	Without casing: Approx. 900 g With casing: Approx. 1,700 g (including 2 mounting brackets)

Note 1. These alarm mode settings include the standby sequence.

2. When DeviceNet is used to set the alarm settings, the upper limit is 3,000.0 °C/°F (in units of 0.1)

3. The applicable standards for the temperature sensor input types are as follows:

        K, J, T, E, R, S, B: JIS C1602-1981

        L: Fe-CuNi, DIN 43710-1985

        U: Cu-CuNi, DIN 43710-1985

        N: Nicrosil-NisiL, IEC584-1, 1977; Amendment No. 1, 1989

        W: W5Re/W26Re, ASTM E988-1990

        PL II: According to PLATINEL II Electromotive Force Table by ENGELHARD

        JPt100:   JIS C 1604-1989, JIS C1606-1989

        Pt100:   JIS C 1604-1989, JIS C1606-1989 IEC 751

Appendix B
Current Transformer Specifications

Specifications

Model	E54-CT1	E54-CT3
Max. continuous heater current	50 A	120 A (see note 1)
Dielectric strength	1,000 VAC for 1 minute	1,000 VAC for 1 minute
Vibration resistance	50 Hz, 98 m/s^2 {10 G} max.	50 Hz, 98 m/s^2 {10 G} max.
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	None	Armatures: 2 Plugs: 2

Note The maximum continuous heater current of the E5ZE is 50 A.

Dimensions

E54-CT1
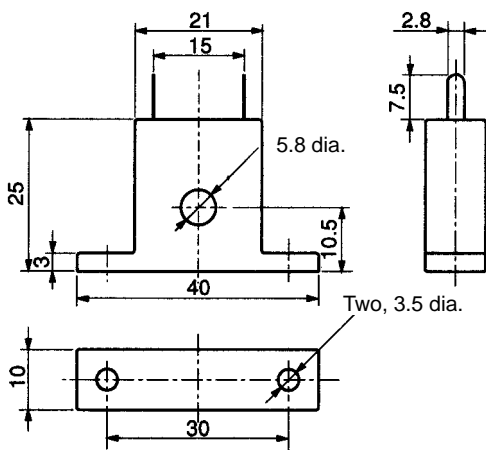
E54-CT3
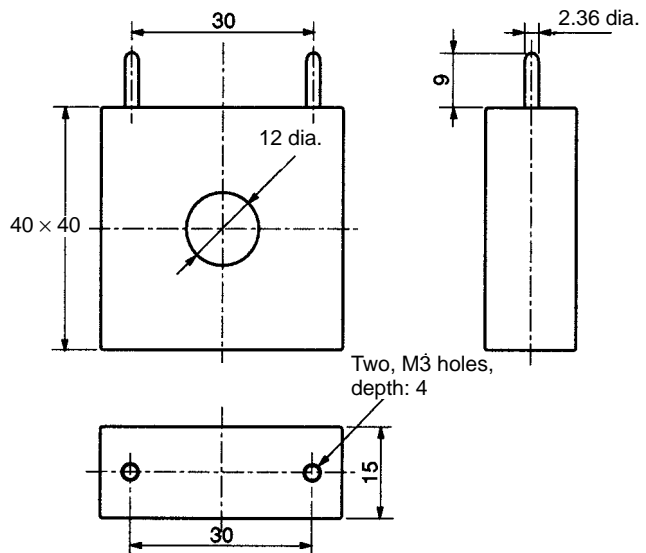
Appendix C
Manually Setting PID Constants

Refer to the information provided here on the operation of the proportional band (P constant), integral time (I constant), and derivative time (D constant) when setting the PID constants manually.

Proportional Band (P Constant)

If the proportional band is too wide, overshooting the set point can be suppressed but the startup time will be slow.

If the proportional band is too narrow, the startup time will be quicker but overshooting and hunting for the set point will result.

An offset from the set point will result in P or PD control operation.

Adjustments

Adjust the width of the proportional band from a large value to a smaller value.

If there is slow temperature hunting, increase the width of the proportional band.
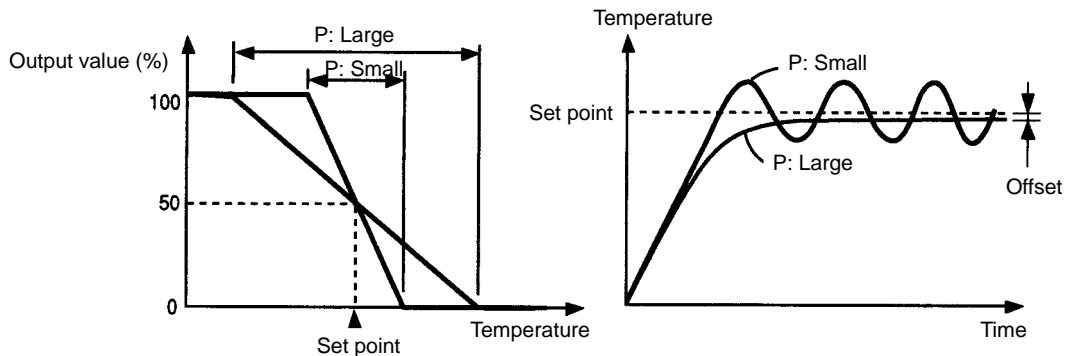
Integral Time (I Constant)

Integral operation is used to gradually eliminate the offset of the temperature that is caused by proportional control.

Do not set the value of the integral time to too small a value in attempt to quickly eliminate the offset of the temperature. Doing so will result in hunting of the temperature.

Adjustments

Adjust the value of the integral time from a larger value (longer time) to a smaller value (shorter time) to find the optimum integral time.

If there is slow temperature hunting or the temperature is stabilized after repeated temperature overshooting, the integral time of the E5ZE is too short.
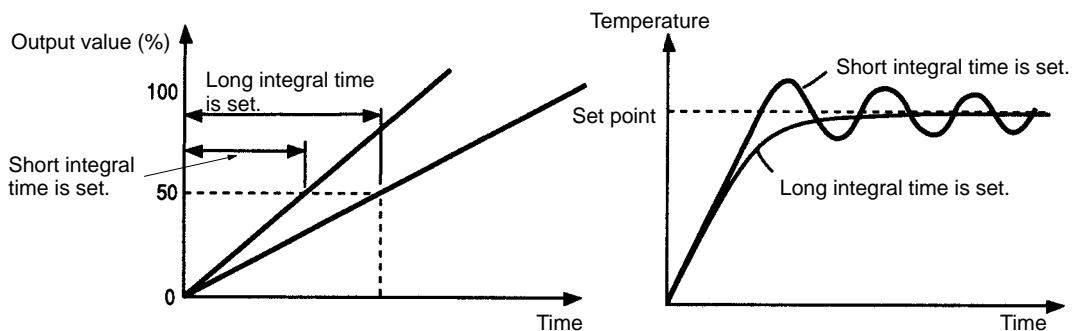
Derivative Time (D Constant)

Derivative operation is used to quickly return the temperature to its original value by providing a large output value even if there is radical external disturbance.

Do not set the derivative time to be too long, otherwise a large temperature output value will continue to be output and the temperature will not be stabilized. At this time, hunting of the temperature, with a cycle shorter than hunting caused by incorrect proportional band or integral time values, will result.

Adjustment

Adjust the value of the derivative time from the larger value (longer time) to a smaller value (shorter time) to find the optimum derivative time.

If there is hunting of the temperature with a short cycle, the derivative time may be set too long and the temperature control response may be too fast.
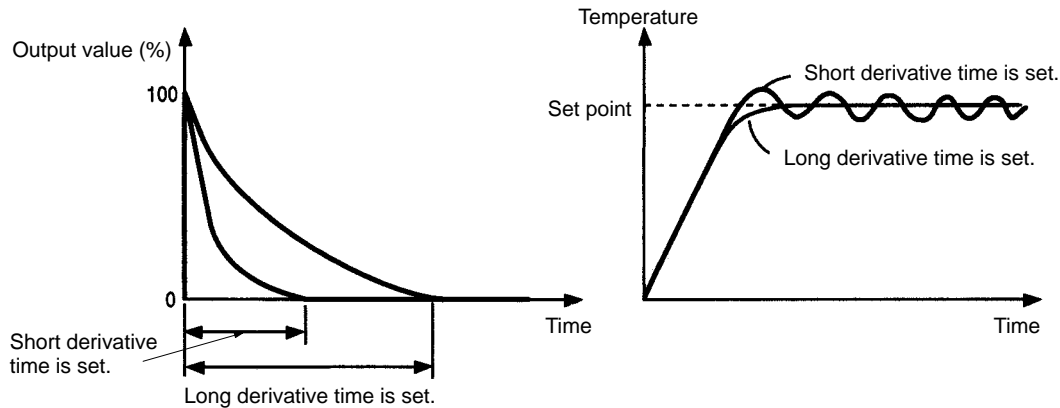
Fuzzy Constants

Fuzzy constants are normally adjusted automatically. If, however, the results of automatic adjustment are not satisfactory, or the response to external disturbance needs further improvement, the fuzzy constants can be manually adjusted. The following flowchart shows how to manually adjust fuzzy constants.
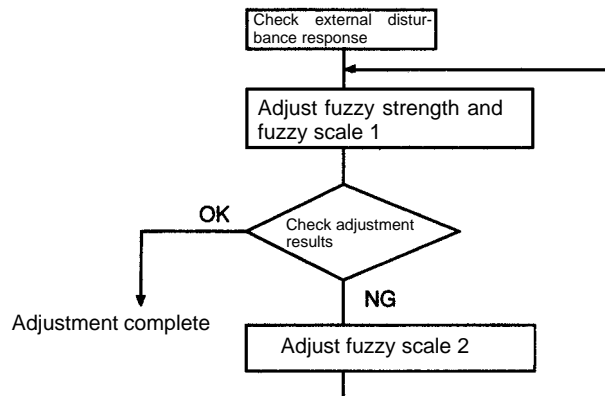
Adjust fuzzy scale 2 only when fuzzy strength and fuzzy scale 1 adjustments are unsatisfactory.

Increasing Fuzzy Strength
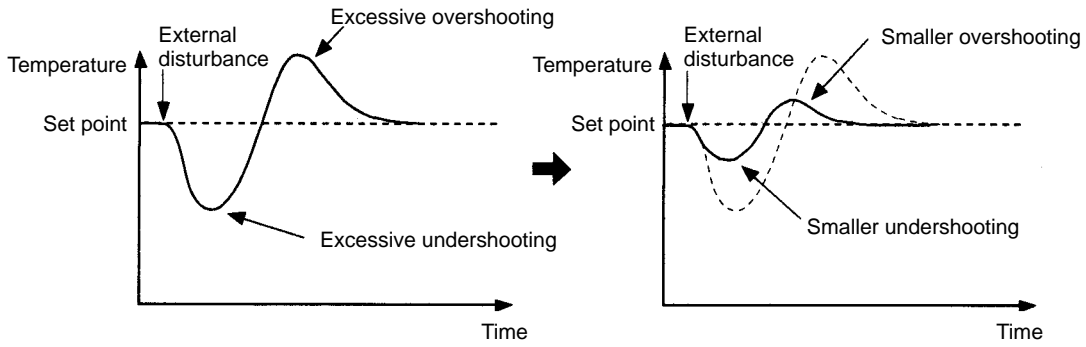
Increasing Fuzzy Scale 1
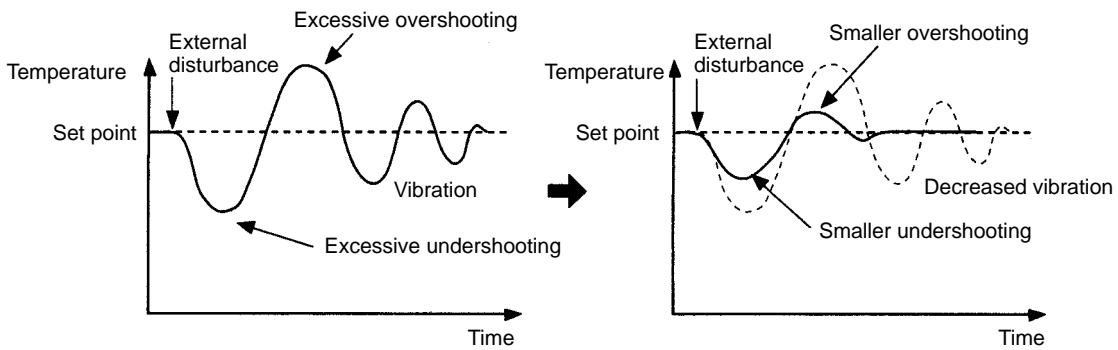
Reducing Fuzzy Scale 1
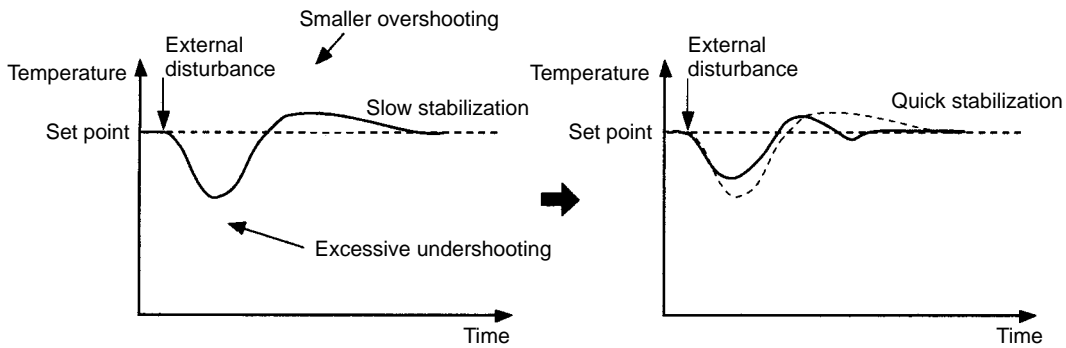
The following table shows the tendency of external disturbance response when fuzzy constants are adjusted.

Fuzzy constants		External disturbance response		
		Excessive value	**Oscillation**	**Stabilization time**
Fuzzy strength	Larger	Decreases	Increases	---
	Smaller	Increases	Decreases	
Fuzzy scale 1 and fuzzy scale 2	Larger	Increases	Decreases	Long
	Smaller	Decreases	Increases	Short

Excessive value: Overshooting or undershooting

Oscillation: Hunting

Appendix D
Saving Data

Function

All temperature control data set with the E5ZE using serial communications will be deleted if the E5ZE is turned OFF without saving the temperature control data.

Execute the Memory Write (WE) command to save temperature control data set with the E5ZE.

Data set using DeviceNet communications will not be deleted even if the power is turned OFF.

Save

Use the following procedure to save the temperature control data set with the E5ZE in the memory.

1, 2, 3...   1. Transmit the WE command to the E5ZE.

2. After transmitting the WE command, confirm that the response transmitted from the E5ZE is normal.

If the E5ZE is turned OFF before the E5ZE completes transmitting the response of the WE command, the temperature control data set with the E5ZE may not be saved and when the power is turned ON again a memory error may occur.

Confirming Saved Data

Transmit the Status Read (RX) command to read the operating status of the E5ZE. Check the status code of the response to confirm whether the data has been saved.

Data Processing

The following shows how the temperature control data set with the E5ZE is processed.
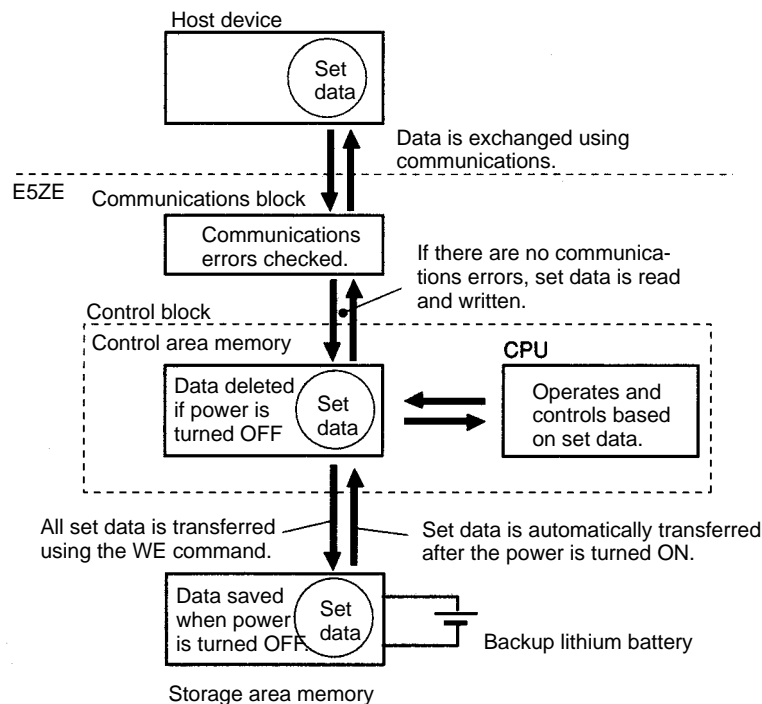
Appendix E
Hardware Test

If Peripheral Devices are connected to an E5ZE in a system without a host device connection, the hardware test function of the E5ZE makes it possible to check whether the Peripheral Devices are connected properly.

The following tests can be performed with the hardware test function.

- E5ZE self-communications test (loop-back test)
- Memory bank designation input (MB0 to MB2) test
- Control output test and alarm output test
- Temperature sensor input test
- Current Transformer (CT) input test

Hardware Test Mode

Set the FUNCTION switch pins according to the following diagram, so that the E5ZE will be in hardware test mode.
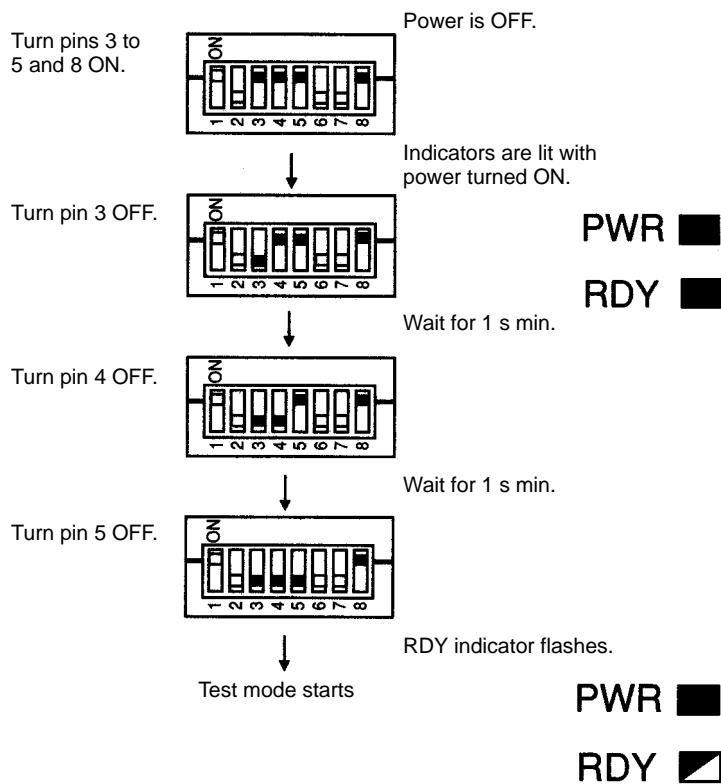
Test Item Selection

After the E5ZE is in hardware test mode, select the tests to be performed using the FUNCTION switch, as shown in the following table.

Test	FUNCTION switch				Test check-ing indica-tor	Commu-nications path
	Pin 3	Pin 4	Pin 5	Pin 8		
Commu-nications test	OFF	OFF	OFF	ON	None	Connected
Memory bank desig-nation input	OFF	OFF	OFF	ON		Not connected
Control out-put and alarm output	ON	OFF	OFF	ON	MB0 lit	
Temperature sensor input	OFF	ON	OFF	ON	MB1 lit	
CT input	OFF	OFF	ON	ON	MB2 lit	

Temperature Sensor Input Test

• In this test, if a temperature sensor is correctly connected to a control point, the control output indicator (CH0 to CH7 or H0 to H7) corresponding to the control point will be lit.

• If the control indicator is not lit, recheck the wiring connecting the E5ZE to the temperature sensor. The cause of the indicator not lighting may be as follows:

Thermocouple:

A lead of the temperature sensor is disconnected or incorrectly wired.

Platinum resistance thermometer:

A lead of the temperature sensor is disconnected or incorrectly wired or the A and B terminals of the temperature sensor are short-circuited.

Procedure

1, 2, 3...   1. While in hardware test mode, set pins 4 and 8 of the FUNCTION switch to OFF.

2. Make sure that the MB0 indicator is lit.

3. Set the INPUT selector according to the temperature sensor connected to the control point.

4. Make sure that the control output indicators corresponding to each of the control points are lit.

Memory Bank Designation Input Test

If a contact connecting a memory bank designation input is ON, the MB designation input indicator (MB0 to MB2) corresponding to the contact will be lit. If the MB designation input indicator is not lit, check that the input is wired correctly.

Procedure

1, 2, 3...   1. While in hardware test mode, set pin 8 of the FUNCTION switch to ON.

2. Turn ON or OFF the contact corresponding to the memory bank designation input.

3. Make sure that the MB designation input indicator corresponding to the con-tact that is ON is lit.

Control Output and Alarm Output Test

In this test, a control output or alarm output is turned ON (100% output) and the indicator for the output will light. Depending on the wiring, an output may be unintentionally produced for the wrong control point. Make sure that any output that is ON will not affect the object being controlled when performing this test.

Procedure

1. While in hardware test mode, set the UNIT or INPUT selector of the E5ZE so that the control output or alarm output will be ON. The relationship between the selectors and the outputs is shown in the following tables.

UNIT Selector

Set value	Output to be turned ON	
0	0	
1	1	
2	2	
3	3	
4	4	Control points
5	5	
6	6	
7	7	
8	Alarm 1	
9	Alarm 2	
A	HB alarm	
B	HS alarm	
C	Temperature controller error	
D	None	
E		
F		

INPUT Selector

Set value	Output to be turned ON	
0	0	
1	1	
2	2	
3	3	Cooling control points (See note.)
4	4	
5	5	
6	6	
7	7	
8	None	
9		
A		
B		
C		
D		
E		
F		

Note Outputs will not turn ON if an E5ZE-8□□□□ Standard Model is being used.

2. Set pins 3 and 8 of the FUNCTION switch to ON.

3. Check if the output is ON, the MB0 indicator is lit, and the indicator corresponding to the output is lit. (The control output indicator is lit even if the E5ZE is a Current Output Model.)

4. To change the output to be turned ON, set with the UNIT or INPUT selector after setting pins 3 and 8 of the FUNCTION switch to OFF.

Current Transformer (CT) Input Test

The CT input test can be performed when a model with heater burnout detection and SSR failure detection is being used.

The carry current and leakage current of a control point that is measured using CT input are displayed as bar graphs by using the E5ZE indicators.

The carry current is the CT input measurement when the control output is turned ON. The leakage current is the CT input measurement when the control output is turned OFF.

If the leakage current bar graph is displayed, and the current bar graph indicates a value very different from the heater's rated value, check the selector, switch settings and the wiring.

Procedure

1, 2, 3... 1. While in hardware test mode, set the control point to be measured and the type of current with the UNIT selector.

UNIT Selector

Set value	Control point to be measured	
0	0	
1	1	
2	2	
3	3	Carry current measurement
4	4	
5	5	
6	6	
7	7	
8	0	
9	1	
A	2	
B	3	Leakage current measurement
C	4	
D	5	
E	6	
F	7	

2. Set pins 5 and 8 of the FUNCTION switch to ON.

3. Check that the MB2 indicator is lit.

The CT input measurement value of the selected control point will be displayed as a bar graph using the indicators, as follows:

```
PWR ■    □ 45 A min.
RDY ◪    □ 40 A min.
         □ 35 A min.    The second row of indicators will
         □ 30 A min.    be lit for the bar graph display.
         □ 25 A min.
         □ 20 A min.
         □ 15 A min.
         □ 10 A min.
         □ 5 A min.   ■ Lit
MB2 ■    □ 1 A min.   ◪ Flashing
```

4. To change the control point to be measured, set pins 5 and 8 of the FUNC-TION switch to OFF and reset the UNIT selector.

Communications Test

The communications test can be performed when an RS-232C Communications Model or RS-422/RS-485 Communications Model is being used.

The E5ZE can transmit and receive data to check its communications circuit by self-diagnosis (loop-back test).

The E5ZE transmits the following character string repeatedly for the communications test. "_" represents a space and "[CR]" represents a carriage return.

```
E5ZE_Copyright_1995_OMRON_Corporation[CR]
```

Procedure

1, 2, 3...   1. While in hardware test mode, set pin 8 of the FUNCTION switch to ON.

2. Short-circuit the send data and receive data at the E5ZE when RS-232C or RS-422 communications are being used, as follows:

Communications interface	RS-232C	RS-422
Short-circuit locations	Communications connector: Pins 2 and 3	Communications terminal block: Terminals 5 and 2 Terminals 1 and 4

3. Make sure that the SD or RD indicator is lit. The following indicate a communications error:

- The SD and RD indicators are not lit.
- The ERR indicator is lit.

If MB0, MB1, or MB2 is lit, this does not indicate an error.

Current Output

The E5ZE Current Output Model can be connected to a Power Controller or a Cycle Control Unit to enable more accurate temperature control.

Phase Control   **Cycle Control**
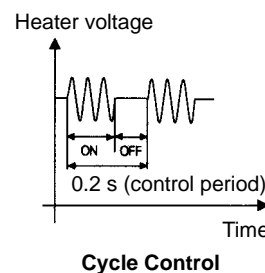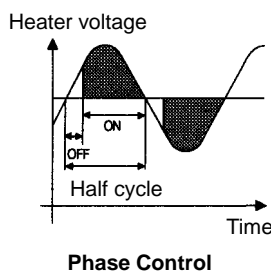
Phase Control

Phase control is possible when a Current Control Model is used in combination with the G3PX Power Controller.

Phase control will enable highly-precise temperature control and prolongs the life of the heaters connected to the E5ZE.

Cycle Control

Cycle control is possible when a Current Control Model is used in combination with the G32A-EA Cycle Control Unit and a G3PA or G3NH SSR.

Cycle control will enable high-speed response with minimal noise generation.

The relationship between the output values and current output values of the Current Output Model are as follows:

Control Output

Output value: 0% to 100%

Current output value: $4^{+0}/_{-0.6}$ to $20^{+2}/_{-0}$ mA

Output with Control Interrupted

Output value: 0%

Current output value: $4^{+0}/_{-0.6}$ mA

Output with Control Interrupted by Error

Output with Temperature Controller error

Output value: −16%

Current output value: 1 ± 0.5 mA

Appendix F
Available Models

E5ZE Models

Serial Communications Models

No. of control points	Casing	Control method	Control output	Heater burnout and SSR failure detection	Commu-nications	Input type	
						Thermocouple	Platinum resistance thermometer
8	Yes	Standard	Option	Option	Option	E5ZE-8AAAMTCB-E	E5ZE-8AAAMPB-E
		Heating and cooling	Option	Option	Option	E5ZE-8VAAMTCB-E	E5ZE-8VAAMPB-E

Model Number Legend:

E5ZE-8□AAM□□-E
_{1 2 3 4 5 6 7}

1. Control Point
   8:   8

2. Control Method
   A: Standard
   V: Heating and cooling

3. Control Output
   A: Option (see note 1)

4. Heater Burnout and SSR Failure Detection (see note 2)
   A: Option (see note 3)

5. Communications
   M: Option (see note 4)

6. Input Type
   TC: Thermocouple
   P: Platinum resistance thermometer

7. Casing
   B: Yes

Note: 1. The E53-E8Q Voltage Output Unit or the E53-E8C Current Output Unit can be used with the E5ZE. The E53-E8Q Voltage Output Unit and the E53-E8C Current Output Unit are sold separately.

2. The heater burnout and SSR failure detection function of the E5ZE will be invalid if the heating side control output of the E5ZE is current output.

3. The E54-E8CT CT Input Unit is required for the heater burnout and SSR failure detection. The E54-E8CT CT Input Unit is sold separately.

4. The E53-E01 Communications Unit for RS-232C communication or the E53-E04 Communications Unit for RS-422 and RS-485 communication can be used with the E5ZE. The E53-E01 Communications Unit and the E53-E04 Communications Unit are sold separately.

I/O Units (Order Separately)

Units	Models
RS-232C Communications Unit	**E53-E01**
RS-422/485 Communications Unit	**E53-E04**
CT Input Unit	**E54-E8CT**
Voltage Output Unit	**E53-E8Q**
Current Output Unit	**E53-E8C**

DeviceNet Communications Models

No of control points	Casing	Control method	Control output	HBA and SSR failure detection	Iput type	Name
8	Yes	Standard	Voltage	No	Thermocouple	E5ZE-8AQA D1TCB 24VDC
8	Yes	Standard	Voltage	No	Platinum resistance thermometer	E5ZE-8AQA D1PB 24VDC
8	Yes	Standard	Voltage	Yes	Thermocouple	E5ZE-8AQH D1TCB 24VDC
8	Yes	Standard	Voltage	Yes	Platinum resistance thermometer	E5ZE-8AQH D1PB 24VDC
8	Yes	Standard	Current	No	Thermocouple	E5ZE-8ACA D1TCB 24VDC
8	Yes	Standard	Current	No	Platinum resistance thermometer	E5ZE-8ACA D1PB 24VDC
8	Yes	Heating and Cooling	Voltage	No	Thermocouple	E5ZE-8VQA D1TCB 24VDC
8	Yes	Heating and Cooling	Voltage	No	Platinum resistance thermometer	E5ZE-8VQA D1PB 24VDC
8	Yes	Heating and Cooling	Voltage	Yes	Thermocouple	E5ZE-8VQH D1TCB 24VDC
8	Yes	Heating and Cooling	Voltage	Yes	Platinum resistance thermometer	E5ZE-8VQH D1PB 24VDC
8	Yes	Heating and Cooling	Current	No	Thermocouple	E5ZE-8VCA D1TCB 24VDC
8	Yes	Heating and Cooling	Current	No	Platinum resistance thermometer	E5ZE-8VCA D1PB 24VDC

Model Number Legend:

E5ZE-8□□□□□□□
      1 2 3 4 5 6 7

1. **Control Point**

   8: 8

2. **Control Method**

   A: Standard control

   V: Heating and cooling control

3. **Control Output**

   Q: Voltage output

   C: Current output

4. **Heater Burnout and SSR Failure Detection Function (Not available with Current Output Models.)**

   A: No

   H: Yes

5. **Communications Function**

   D1: CompoBus/D

6. **Input Type**

   TC: Thermocouple

   P: Platinum resistance thermometer

7. **Casing**

   B: Yes

E5ZE
Multipoint Temperature Controller
Operation Manual

Revision History

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

Cat. No. H076-E3-1

Revision code

The following table outlines the changes made to the manual during each revision.

Revision code	Date	Revised content
H076-E1-1	May 1997	Original production
H076-E1-2	January 1999	Manual completely restructured for clarity and revised to include information on E5ZE Temperature Controllers that support DeviceNet communications. (Note that these page numbers refer to the previous version.)
H076-E3-1	November 2000	Section 1-4 removed; CompoBus/D changed to DeviceNet throughout; general types of updates for these pages: vii, 1, 3, 6, 9, 10, 11, 15, 17, 21, 27, 79.