

**E5AN/EN/CN/GN
Temperature Controllers
Communications Function**

USER MANUAL

OMRON

Preface

The E5AN/EN/CN/GN supports serial communications specifications, CompoWay/F and Sysway.

This User's Manual describes the communications functions of the E5AN/EN/CN/GN. Before using your E5AN/EN/CN/GN thoroughly read and understand this manual in order to ensure correct use.

Also, store this manual in a safe place so that it can be retrieved whenever necessary.

© OMRON, 1999

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

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

PRECAUTIONS

When the product is used under the circumstances or environments described in this manual always adhere to the limitations of the rating and functions. Also, for safety, take countermeasures such as fitting fail-safe installations.


DO NOT USE:


- In circumstances or environments that have not been described in this manual.
- For control in nuclear power, railway, aircraft, vehicle, incinerator, medical, entertainment, or safety applications
- Where death or serious property damage may occur, or where extensive safety precautions are required.

SAFETY PRECAUTIONS


■ Safety Signal Words

This manual uses the following signal words to mark safety precautions for the E5AN/EN/CN/GN. These precautions provide important information for the safe application of the product. You must be sure to follow the instructions provided in all safety precautions.

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

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

■ Safety Precautions

|  CAUTION |
|---|
| <p>● Electric Shock Warning</p> <p>Do not touch the terminals while the power is ON. Doing so may cause an electric shock.</p> |
| <p>Do not allow metal fragments or lead wire scraps to fall inside this product. These may cause electric shock, fire or malfunction.</p> |
| <p>Never disassemble, repair or modify the product. Doing so may cause electric shock, fire or malfunction.</p> |
| <p>The life expectancy of the output relays varies greatly with the switching capacity and other switching conditions. Always use the output relays within their rated load and electrical life expectancy. If an output relay is used beyond its life expectancy, its contacts may become fused or burned.</p> |
| <p>Do not operate this product in flammable and explosive gas atmospheres.</p> |
| <p>Use this product within the rated load. Not doing so may cause damage or fire.</p> |
| <p>Use this product within the rated supply voltage. Not doing so may cause damage or fire.</p> |
| <p>Tighten the terminal screws properly. Loose screws may cause malfunction. Tighten to a torque of :</p> <p>E5AN : 0.74 to 0.90 N·m E5EN : 0.74 to 0.90 N·m E5CN : 0.74 to 0.90 N·m E5GN : Terminals 1 to 6 : 0.23 to 0.25 N·m Terminals 7 to 9 : 0.12 to 0.14 N·m</p> |
| <p>Set all settings according to the control target of the product. If the settings are not appropriate for the control target, the product may operate in an unexpected manner, resulting in damage to the product or resulting in accidents.</p> |
| <p>To maintain safety in the event of a product malfunction, always take appropriate safety measures, such as installing an alarm on a separate line to prevent excessive temperature rise. If a malfunction prevents proper control, a major accident may result.</p> |

NOTICE

Be sure to observe these precautions to ensure safe use.

- (1) Do not wire unused terminals.
- (2) Be sure to wire properly with correct polarity of terminals.
- (3) To reduce induction noise, separate the high-voltage or large-current power lines from other lines, and avoid parallel or common wiring with the power lines when you are wiring to the terminals. We recommend using separating pipes, ducts, or shielded lines.
- (4) Do not use this product in the following places:
 - Places subject to dust or corrosive gases (in particular, sulfide gas and ammonia gas)
 - Places subject to high humidity, condensation or freezing
 - Places subject to direct sunlight
 - Places subject to vibration and large shocks
 - Places subject to splashing liquid or oily atmosphere
 - Places directly subject to heat radiated from heating equipment
 - Places subject to intense temperature changes
- (5) To allow heat to escape, do not block the area around the product. (Ensure enough space is left for the heat to escape.)
Do not block the ventilation holes on the case.
- (6) When you draw out or draw in the internal mechanism from the housing (E5AN/EN/CN) or draw out the terminals (E5GN), never touch electrical components inside or subject the internal mechanism or terminals to shock.
- (7) Cleaning: Do not use paint thinner or the equivalent. Use standard grade alcohol to clean the product.
- (8) On the E5AN/EN/CN, use specified size (M3.5, width 7.2 mm or less) crimped terminals for wiring. On the E5GN, use AWG24 to AWG14 leads for terminal Nos.1 to 6 (with lead cover peel back allowance of 5 or 6 mm) and AWG28 to AWG22 leads for terminal Nos.7 to 9 (with lead cover peel back allowance of 5 or 6 mm).
- (9) Allow as much space as possible between the E5AN/EN/CN/GN and devices that generate powerful high-frequency noise (e.g. high-frequency welders, high-frequency sewing machines) or surges.
- (10) When executing self-tuning, turn the load (e.g. heater) ON simultaneously with the main unit. If you turn the main unit ON before turning the load ON, correct self-tuning and optimum control can no longer be obtained.
- (11) Use a 100 to 240 VAC (50/60 Hz), 24 VAC (50/60 Hz) or 24 VDC power supply matched to the power specifications of the E5AN/EN/CN/GN. Also, make sure that rated voltage is attained within two seconds of turning the power ON.
- (12) Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular, motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component).
- (13) When mounting a noise filter on the power supply, be sure to first check the filter's voltage and current capacity, and then mount the filter as close as possible to the E5AN/EN/CN/GN.
- (14) Use within the following temperature and humidity ranges:
 - Temperature: -10 to 55°C, Humidity: 25 to 85% (with no icing or condensation)If the E5AN/EN/CN/GN is installed inside a control board, the ambient temperature must be kept to under 55°C, including the temperature around the E5AN/EN/CN/GN.
If the E5AN/EN/CN/GN is subjected to heat radiation, use a fan to cool the surface of the E5AN/EN/CN/GN to under 55°C.
- (15) Store within the following temperature and humidity ranges:
 - Temperature: -25 to 65°C, Humidity: 25 to 85% (with no icing or condensation)
- (16) Never place heavy objects on, or apply pressure to the E5AN/EN/CN/GN as it may cause it to deform and deteriorate during use or storage.
- (17) Avoid using the E5AN/EN/CN/GN in places near a radio, television set, or wireless installation. These devices can cause radio disturbances which adversely affect the performance of the E5AN/EN/CN/GN.

Conventions Used in This Manual

■ How This Manual is Organized

| Purpose | Title | Description |
|------------------------------|---|---|
| ● Introduction | Chapter 1 ABOUT COMMUNICATIONS METHODS | This chapter briefly describes communications methods and wiring. |
| ● CompoWay/F | Chapter 2 CompoWay/F COMMUNICATIONS PROCEDURES | This chapter describes CompoWay/F format communications. |
| ● Communications Data | Chapter 3 COMMUNICATIONS DATA | This chapter lists CompoWay/F and Sysway communications data. |
| ● Sysway | Chapter 4 Sysway COMMUNICATIONS PROCEDURES | This chapter describes Sysway communications. |
| ● Appendix | APPENDIX | |

■ Related Manuals

This User's Manual describes the communications functions of the E5AN/EN/CN/GN. For details on the functions of each of these digital controllers, refer to the respective User's Manuals.

Table of Contents

| | |
|---------------------------------------|-----|
| Preface | I |
| Precautions | II |
| Safety Precautions | III |
| Notice | IV |
| Conventions Used in This Manual | V |

CHAPTER 1 ABOUT COMMUNICATIONS METHODS 1-1

This chapter briefly describes the supported communications methods and how to wire equipment. First-time users should read this chapter without fail to ensure proper installation of the equipment.

| | |
|-------------------------------------|-----|
| 1.1 Outline | 1-2 |
| Introduction | 1-2 |
| Communications specifications | 1-2 |
| Transmission procedure | 1-3 |
| Interface | 1-3 |
| Wiring | 1-3 |
| Communications parameters | 1-5 |

CHAPTER 2 COMPOWAY/F COMMUNICATIONS PROCEDURES 2-1

Read this chapter if you are to communicate using the CompoWay/F format.

| | |
|-------------------------------------|------|
| 2.1 Data Format | 2-2 |
| Command frame | 2-2 |
| BCC calculation example | 2-3 |
| Response frame | 2-3 |
| Communications data | 2-4 |
| Example of end code | 2-4 |
| 2.2 Structure of Command Text | 2-6 |
| PDU structure | 2-6 |
| Area definitions | 2-6 |
| Type code (variable type) | 2-6 |
| Addresses | 2-7 |
| Number of elements | 2-7 |
| List of services | 2-7 |
| 2.3 Details of Services | 2-8 |
| Read from variable area | 2-8 |
| Write to variable area | 2-9 |
| Read controller attributes | 2-11 |
| Read controller status | 2-12 |
| Echoback test | 2-13 |
| Operation instructions | 2-14 |
| 2.4 Response Code List | 2-17 |

CHAPTER 3 COMMUNICATIONS DATA 3-1

This chapter lists the details of each of the communications data in the CompoWay/
F and Sysway communications procedures.

- 3.1 Variable Area (setup range) List 3-2
- 3.2 Status 3-8

**CHAPTER 4 SYSWAY (E5 □J, □X FORMAT)
COMMUNICATIONS PROCEDURES 4-1**

These communications procedures are supported for ensuring compatibility with
existing temperature controller models E5jJ and E5jX.

- 4.1 Data Format 4-2
 - Command frame format 4-2
 - FCS calculation example 4-2
 - Response frame 4-3
 - Communications data 4-3
 - Sysway command lists 4-4
- 4.2 Command Descriptions 4-5
 - Read process value 4-5
 - Write set values 4-6
 - Read set value and MV monitor 4-7
 - Communications writing switching 4-8

APPENDIX A-1

- ASCII List (ANSI X 3.4-1986) A-2

INDEX

CHAPTER 1

ABOUT COMMUNICATIONS METHODS

This chapter briefly describes the supported communications methods and how to wire equipment. First-time users should read this chapter without fail to ensure proper installation of the equipment.

| | | |
|-----|-------------------------------------|-----|
| 1.1 | Outline | 1-2 |
| | Introduction | 1-2 |
| | Communications specifications | 1-2 |
| | Transmission procedure | 1-3 |
| | Interface | 1-3 |
| | Wiring | 1-3 |
| | Communications parameters | 1-5 |

1.1 Outline

■ Introduction

The program for the communications functions are created on the host computer, and the E5AN/EN/CN/GN's parameters are monitored or set from the host computer. Therefore, the description provided here is from the viewpoint of the host computer.

CompoWay/F is OMRON's standard communications format for general serial communications. This format uses a standard frame format as well as the FINS* commands which have proven successful in OMRON's PLCs. Therefore, it can simplify communications between components and the host computer.

* FINS (Factory Interface Network Service)

The FINS protocol provides message communications between controllers in OMRON FA networks.

The E5AN/EN/CN/GN have the following communications functions:

- Reading/writing of parameters
- Operation instructions
- Selection of setup levels

Communications are subject to the following condition:

- Parameters can be written only when the "communications writing" parameter is set to ON (enabled).

■ Communications specifications

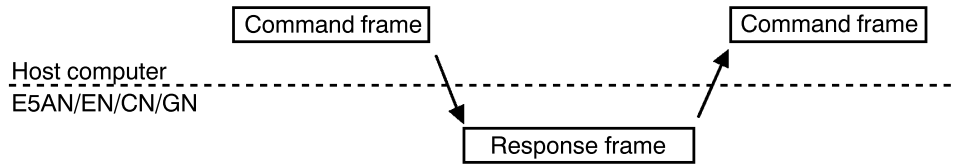
| | |
|------------------------------|--|
| Transmission line connection | RS-485 : Multiple point RS-232C : Point to point |
| Communications method *1 | RS-485 (2-wire, half-duplex) RS-232C |
| Synchronization method | Start-stop synchronization |
| Baud rate | 1200, 2400, 4800, 9600 , 19200 bps |
| Communication code *2 | ASCII |
| Data bits *2 | 7 or 8 bits |
| Stop bits *2 | 1 or 2 bits |
| Error detection | Vertical parity (non, even , or odd) FCS (frame check sequence) during Sysway communications BCC (block check character) during CompoWay/F communications |
| Flow control | None |
| Interface *1 | RS-485/RS-232C |
| Retry function | None |
| Communications buffer | 40 byte |

*1 RS-232C is only available with the E5AN/EN.

*2 Communications speed, data bits, stop bits and vertical parity can each be set independently in the communications setting level. Highlighted characters in the table above indicate defaults.

Transmission procedure

When the host computer transmits a command frame, the E5AN/EN/CN/GN transmits a response frame that corresponds to the command frame. A single response frame is returned for each command frame. The following diagram shows the operation of the command and response frames.



Allow a wait time of at least 2 ms until the next command is sent after the host computer receives a response from the E5AN/EN/CN/GN.

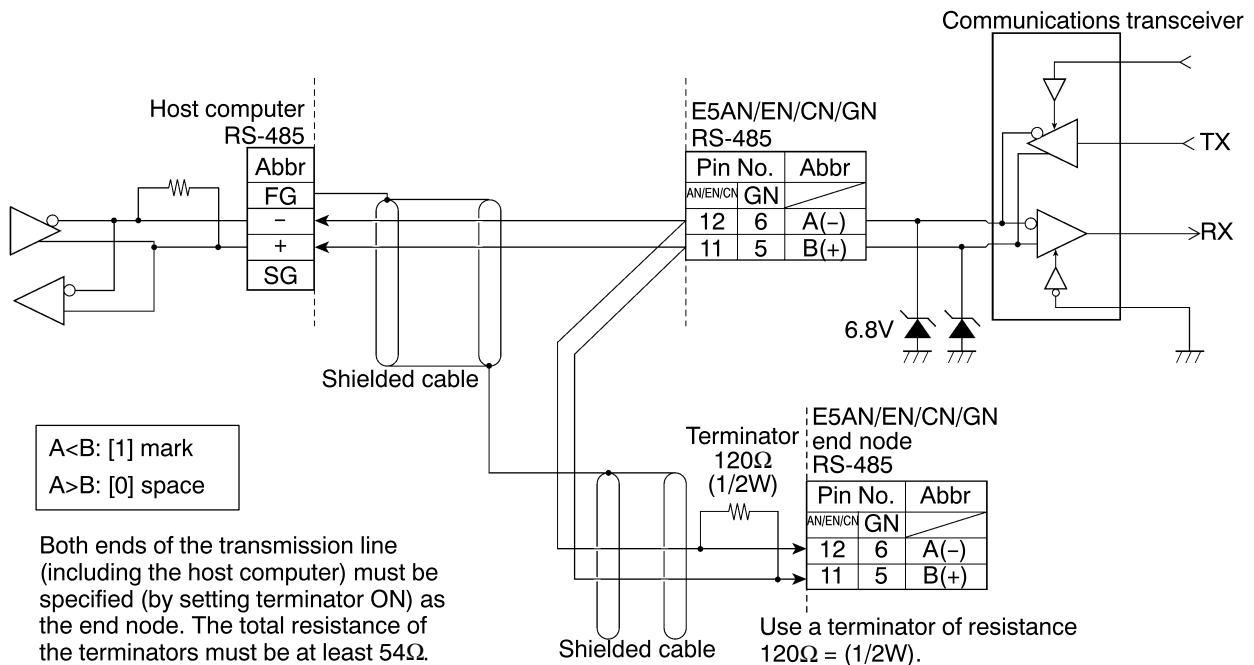
Interface

Communications with the host computer are carried out through a standard RS-485, RS-232C (RS-232C is only available with the E5AN/EN) interface.

Wiring

RS-485

- RS-485 connections can be 1 : 1 or 1 : N. A maximum of 32 Units (including the host computer) can be connected in one-to-N systems.
- The total cable length is 500 m max.
- Use a shielded, twisted-pair cable AWG28 or larger for wiring the E5AN/EN/CN, and AWG24 to AWG14 for wiring the E5GN.

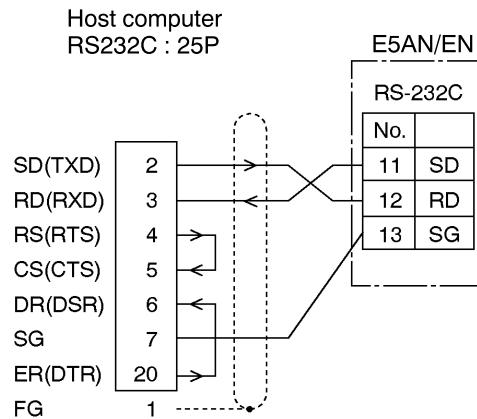


Match the communications specifications of the E5AN/EN/CN/GN and the host computer. If a one-to-N system is being used, be sure that the communications specifications of all devices in the system (except individual unit numbers) are the same.

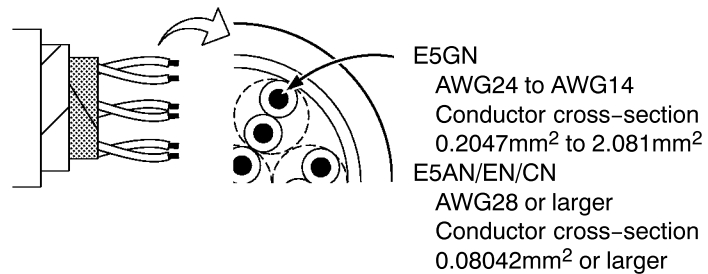
This section explains how to set the E5AN/EN/CN/GN's communications specifications. For details on the host computer, refer to the User's Manual provided with the host computer.

RS-232C (Applies to the E5AN/EN only.)

- RS-232C connections are 1 : 1.
- The total cable length is 15m max.
- Use a shielded, twisted-pair cable AWG28 or larger.



Cable reference diagram



Communications parameters

The E5AN/EN/CN/GN's communications specifications are set in the communications setting level. These parameters are set on the E5AN/EN/CN/GN's front panel.






The following table shows the communications parameters and their setting ranges.

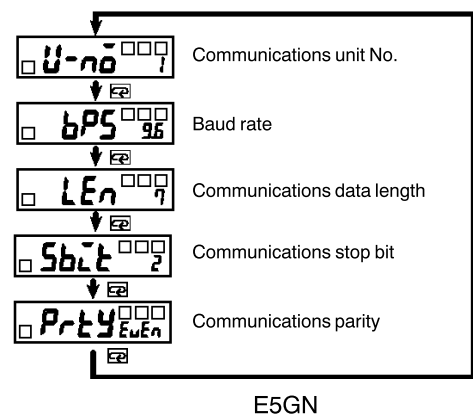
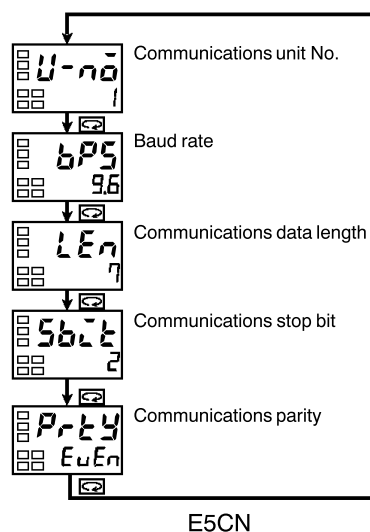
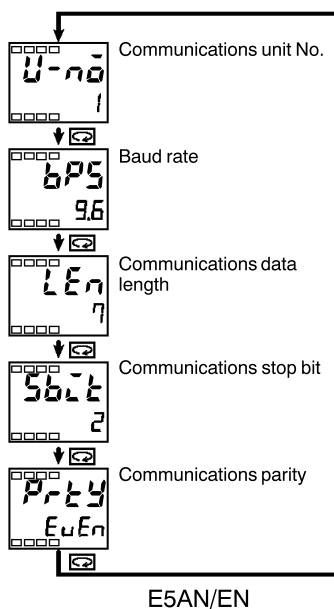
| Parameter | Displayed Characters | Setting Range | Set Value |
|----------------------------|----------------------|-------------------------------------|--|
| Communications unit No. | U-nō | 0 to 99 | 0, 1 to 99 |
| Baud rate | bPS | 1.2 / 2.4 / 4.8 / 9.6 / 19.2 (kbps) | 1.2 / 2.4 / 4.8 / 9.6 / 19.2 (kbps) |
| Communications data length | LEn | 7 / 8 (bit) | 7 / 8 (bit) |
| Communications stop bit | Sbct | 1 / 2 | 1 / 2 |
| Communications parity | Prty | None / even / odd | nōnE / EuEn / odd |

Highlighted characters indicate defaults.

Communications parameter setup

Before you carry out communications with the E5AN/EN/CN/GN, set up communications unit No., baud rate and other parameters by carrying out the following procedure. For details of operations other than communications parameter setup, refer to the E5AN/EN/CN/GN User's Manuals.

- (1) Hold down the  key for at least three seconds to move from the "operation level" to the "initial setting level."
- (2) Press the  key for less than one second to move from the "initial setting level" to the "communications setting level."
- (3) Select the parameters as shown below by pressing the  key.
- (4) Use the  or  keys to change the parameter set values.



● Communications parameter setup

Note that communications parameters are enabled after they have been changed by resetting the controller.

- Communications unit No. (U-ŋā)

This parameter is for setting the unit No. to each of the temperature controllers. This unit No. is set so that the host computer can identify the temperature controller when communications are carried out with the host computer. Set a unit No. within the range 0 to 99 for each temperature controller connected to the host computer on the network. Default is “1”. When two or more temperature controllers are used, do not set the same unit No. Doing so will prevent normal operation.

- Baud rate (bP5)

This parameter is for setting the baud rate when communicating with the host computer. Set one of “1.2 (1200 bps)”, “2.4 (2400 bps)”, “4.8 (4800 bps)”, “9.6 (9600 bps)” and “19.2 (19200 bps)”.

- Communications data length (L Eŋ)

This parameter is for setting the communications data length. Set either of “7 bits” or “8 bits”.

- Communications stop bit (SbĀĀ)

This parameter is for setting the communications stop bit. Set either of “1” or “2”.

- Communications parity (P-ĀY)

This parameter is for setting the communications parity. Set one of “none”, “even” or “odd”.

CHAPTER 2

CompoWay/F COMMUNICATIONS PROCEDURES

Read this chapter if you are to communicate using the CompoWay/F format.

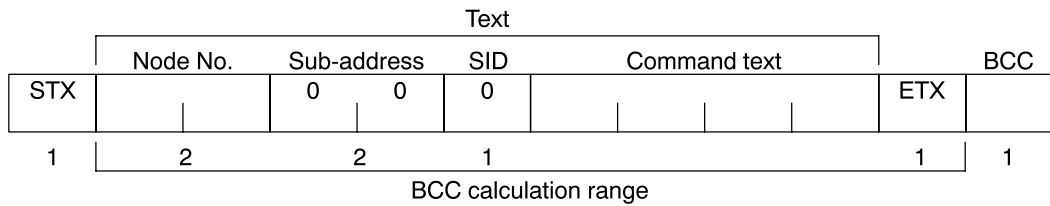
| | | |
|-----|--------------------------------------|------|
| 2.1 | Data Format | 2-2 |
| | Command frame | 2-2 |
| | BCC calculation example | 2-3 |
| | Response frame | 2-3 |
| | Communications data | 2-4 |
| | Example of end code | 2-4 |
| 2.2 | Structure of Command Text | 2-6 |
| | PDU structure | 2-6 |
| | Area definitions | 2-6 |
| | Type code (variable type) | 2-6 |
| | Addresses | 2-7 |
| | Number of elements | 2-7 |
| | List of services | 2-7 |
| 2.3 | Details of Services | 2-8 |
| | Read from variable area | 2-8 |
| | Write to variable area | 2-9 |
| | Read controller attributes | 2-11 |
| | Read controller status | 2-12 |
| | Echoback test | 2-13 |
| | Operation instructions | 2-14 |
| 2.4 | Response Code List | 2-17 |

2.1 Data Format

Unless otherwise indicated, numbers in this manual are expressed in hexadecimal. Values in double quotation marks, such as “00”, are ASCII.

The number underneath each delimiter in a frame indicates the number of bytes.

■ Command frame



| | |
|------------------|---|
| STX | This code (02) indicates the beginning of the communications frame (text). Always set this character in the first byte. When STX is received again during reception, reception is carried out again from the point where STX was received. |
| Node number | <ul style="list-style-type: none"> • This number specifies the transmission's destination. • Specify the E5AN/EN/CN/GN's "Communications unit No." • BCD range "00" to "99" and "XX" can be set. • Specify "XX" for a broadcast transmission. No response will be returned for broadcast transmissions. • No responses will be returned from node Nos. set otherwise from the above. |
| Sub-address | This is not used on the E5AN/EN/CN/GN. Be sure to set the sub-address to "00". |
| SID (service ID) | This is not used on the E5AN/EN/CN/GN. Be sure to set the sub-address to "00". |
| Command text | Command text area. For details, see "2.2 Structure of Command Text." |
| ETX | This code (03) indicates the end of the text. |
| BCC | Block Check Character The BCC result is found by calculating the exclusive OR of the bytes from the node No. up to ETX. |

■ BCC calculation example

The BCC is formed by converting the 8-bit value obtained by converting the exclusive OR of the node No. up to ETX into two ASCII characters, and setting this to the BCC area.

| STX | Node No. | | Sub-address | | SID | Command text | | | | ETX | BCC |
|-----|----------|--------|-------------|--------|--------|--------------|--------|--------|--------|-----|-----|
| 02H | 0(30H) | 0(30H) | 0(30H) | 0(30H) | 0(30H) | 0(30H) | 5(35H) | 0(30H) | 3(33H) | 03H | 35H |

$$\text{BCC} = 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 35\text{H} \oplus 30\text{H} \oplus 33\text{H} \oplus 03\text{H} = 35\text{H}$$

Calculation result 35H is set to the BCC area.

The \oplus symbol indicates exclusive OR operation and the H indicates hexadecimal code.

■ Response frame

| STX | Node No. | Sub-address | End code | Command text | ETX | BCC |
|-----|----------|-------------|----------|--------------|-----|-----|
| 1 | 2 | 2 | 2 | | 1 | 1 |

| End code | Name | Description | Error Detection Priority |
|----------|--------------------|---|--------------------------|
| 00 | Normal completion | The command ended normally without error. | None |
| 0F | FINS command error | The specified FINS command could not be executed. The FINS response code should indicate why the command could not be executed. | 8 |
| 10 | Parity error | The sum total of bits whose received data is "1" does not match the set value of "communications parity." | 2 |
| 11 | Framing error | Stop bit is "0". | 1 |
| 12 | Overrun error | An attempt was made to transfer new data when the reception data was already full. | 3 |
| 13 | BCC error | The calculated BCC value is different from the received BCC value. | 5 |
| 14 | Format error | <ul style="list-style-type: none"> The command text contains characters other than 0 to 9, and A to F. This error is not applicable to the echoback test. (For details, see chapters 2.3 "Echoback test.") No SID and command text. Or, no command text "MRC/SRC" not included in command text | 7 |
| 16 | Sub-address error | <ul style="list-style-type: none"> Illegal (unsupported) sub-address No sub-address, SID and command text Sub-address less than two characters, and no SID and command text | 6 |
| 18 | Frame length error | The received frame exceeds the fixed (supported) number of bytes. | 4 |

- The end code is returned to received command frames addresses to the self node.
- No response will be returned if all the items in the response frame are incomplete up to the ETX and BCC.
- "Error Detection Priority" indicates the priority when two or more errors occur simultaneously.

■ Communications data

| Communications specifications | Set (monitor) Value | Minus Value | Decimal point |
|-------------------------------|---------------------|----------------|---|
| CompoWay/F | 8 digits (Hex) | 2's complement | Decimal point is removed and the result is converted to hexadecimal. Example) 105.0 → 1050 → 000041A |

■ Example of end code

The following examples show an end code when a command did not end normally.

Example 1) Illegal sub-address, and no SID and command text

Command Format

| | Node No. | Sub-address | BCC |
|-----|----------|-------------|-----|
| STX | | 0 A | ETX |

Response Format

| | Node No. | Sub-address | End code | BCC |
|-----|----------|-------------|----------|-----|
| STX | | 0 A | 1 6 | ETX |

End code is "16" (sub-address error).

This is because a sub-address was received and the sub-address error has a higher error detection priority than the format error.

Example 2) No command text

Command Format

| | Node No. | Sub-address | SID | BCC |
|-----|----------|-------------|-----|-----|
| STX | | 0 0 | 0 | ETX |

Response Format

| | Node No. | Sub-address | End code | BCC |
|-----|----------|-------------|----------|-----|
| STX | | 0 0 | 1 4 | ETX |

End code is "14" (format error).

Example 3) All node Nos. not provided

Command Format

| | | BCC |
|-----|--|-----|
| STX | | ETX |

The node No. is lacking one character.

Response Format

No response

Example 4) No sub-address, and illegal BCC

Command Format

| | Node No. | | BCC |
|-----|----------|-----|-----|
| STX | | ETX | Err |

Response Format

| | Node No. | Sub-address | End code | | BCC |
|-----|----------|-------------|----------|-----|-----|
| STX | | 0 0 | 1 3 | ETX | |

Sub-address is "00" and end code is "13" (BCC error).

2.2 Structure of Command Text

■ PDU structure

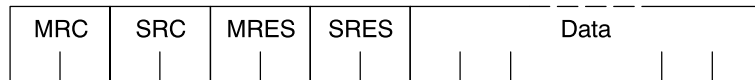
An MRC (Main Request Code) and SRC (Sub-Request Code) followed by the various required data is transferred to the command text.

Service request PDU



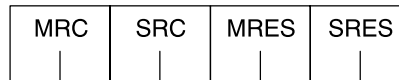
MRES (Main Response Code) and SRES (Sub-Response Code) are transferred following the above MRC/SRC. Data is then transferred following these MRES and SRES.

Service response PDU (during normal operation)



If the specified command text could not be executed, only the MRC/SRC and MRES/SRES become the target response PDUs.

Service response PDU (at non-execution of specified command text)



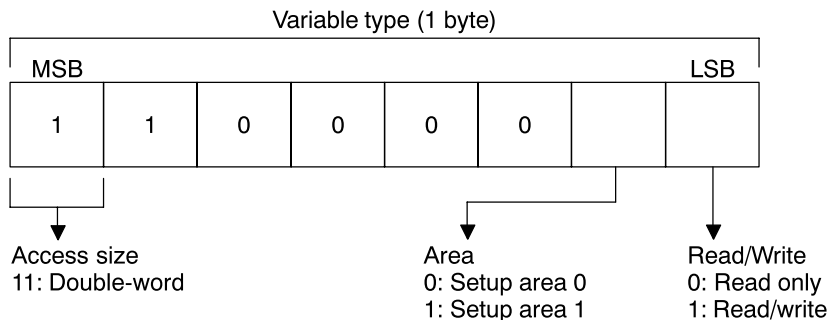
MRES/SRES becomes the response code except when processing ends in “normal completion.”

■ Area definitions

Areas comprise only variable area.

■ Type code (variable type)

The following defines variable area type codes.



The following table summarizes setup areas 0 and 1.

| Area | Description |
|--------------|--|
| Setup area 0 | This area groups together the protect, operation and adjustment levels. |
| Setup area 1 | This area groups together the initial setting, communications setting, advanced function setting and calibration levels. |

The variable type is converted to 2-byte ASCII code and loaded to the frame. The following table shows actually existent variable types.

| Variable type | Description |
|---------------|---|
| C0 | Double-word data. R/O (read only) parameter for setup area 0. |
| C1 | Double-word data. R/W parameter for setup area 0. |
| C3 | Double-word data. R/W parameter for setup area 1. |

* Setup area 1 has no R/O (read only) parameters. Therefore, variable type “C2” does not exist.

■ Addresses

Each of the variable types is appended with an address. Express addresses in 2-byte hexadecimal code, and append with its access size.

■ Number of elements

The number of elements is expressed in 2-byte hexadecimal code. Specify the number of elements within the range “0 to 2”.

For example, when the number of elements is “0002”, this specifies two items of data from the address.

■ List of services

| MRC | SRC | Name of service | Process |
|-----|-----|----------------------------|--|
| 01 | 01 | Read from variable area | This service reads from variable areas. |
| 01 | 02 | Write to variable area | This service writes to variable areas. |
| 05 | 03 | Read controller attributes | This service reads the model No. and communications buffer size. |
| 06 | 01 | Read controller status | This service reads the run status of the controller. |
| 08 | 01 | Echoback test | This service carries out the echoback test. |
| 30 | 05 | Operation instructions | This service carries out run/stop, communications writing, write mode, save RAM data, AT (auto-tuning) execution/cancel, multi-SP, move to protect level, move to setup area 1 and software reset. |

* In a memory error (RAM error) or initial state (until the control starts to look for the process value after the power is turned ON), all commands will not be accepted, and no response will be returned.

2.3 Details of Services

■ Read from variable area

This service reads from variable areas.

Service request PDU

| | | | | | |
|-------|-------|---------------|--------------------|--------------|--------------------|
| MRC | SRC | Variable type | Read start address | Bit position | Number of elements |
| 0 1 | 0 1 | | | 0 0 | |
| 2 | 2 | 2 | 4 | 2 | 4 |

Service response PDU

| | | | |
|-------|-------|---------------|---------------------------------------|
| MRC | SRC | Response code | Read data (for number of elements) |
| 0 1 | 0 1 | | |
| 2 | 2 | 4 | 0 or 8 or 16 |

- (1) Variable type and read start address

For details on variable types and read start addresses, see “Chapter 3 Communications Data.”

- (2) Bit position

Bit accessing is not supported on the E5AN/EN/CN/GN. Fixed to “00”.

- (3) Number of elements

| Number of elements | Process |
|--------------------|--|
| 0000 | Read is not carried out (the service response PDU is not appended with read data), and processing ends in “normal completion.” |
| 0001 to 0002 | Read is carried out, and processing ends in “normal completion.” |

- (4) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

At occurrence of error

| Response code | Error name | Cause |
|---------------|----------------------------------|---|
| 1001 | Command too long | The command is too long. |
| 1002 | Command too short | The command is too short. |
| 1101 | Area type error | The variable type is wrong. |
| 1103 | Start address out-of-range error | The read start address is out of range. |
| 110B | Response too long | The number of elements is larger than “0002”. |
| 1100 | Parameter error | The bit position is other than “00”. |
| 2203 | Operation error | EEPROM error |

(5) Precautions

● Alarm function

Even though alarms are not displayed on the controller's display, they are all functional in communications.

■ Write to variable area

This service writes to variable areas.

Service request PDU

| | | | | | | |
|-------|-------|---------------|---------------------|--------------|--------------------|-------------------------------------|
| MRC | SRC | Variable type | Write start address | Bit position | Number of elements | Write data (for number of elements) |
| 0 1 | 0 2 | | | 0 0 | | |
| 2 | 2 | 2 | 4 | 2 | 4 | 0 or 8 or 16 |

Service response PDU

| | | |
|-------|-------|---------------|
| MRC | SRC | Response code |
| 0 1 | 0 2 | |
| 2 | 2 | 4 |

(1) Variable type and write start address

For details on variable types and write start addresses, see "Chapter 3 Communications Data."

(2) Bit position

Bit accessing is not supported on the EAN/5EN/CN/GN. Fixed to "00".

(3) Number of elements

| Number of elements | Process |
|--------------------|--|
| 0000 | Write is not carried out (the service response PDU is not appended with write data), and processing ends in "normal completion." |
| 0001 to 0002 | Write is carried out, and processing ends in "normal completion." |

(4) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

At occurrence of error

| Response code | Error name | Cause |
|---------------|----------------------------------|---|
| 1002 | Command too short | The command is too short. |
| 1101 | Area type error | Wrong variable type |
| 1103 | Start address out-of-range error | Write start address is out of range. |
| 1104 | End address out-of-range error | The write end address (write start address + number of elements) exceeds the final address of the variable area. |
| 1003 | Number of elements/data mismatch | The number of data does not match the number of elements. |
| 1100 | Parameter error | <ul style="list-style-type: none"> • Bit position is other than "00". • Write data is out of setting range. |
| 3003 | Read-only data | Variable type "C0" was written to. |
| 2203 | Operation error | <ul style="list-style-type: none"> • The "communications writing" parameter is set to "OFF" (disabled). • Writing was carried out on the parameters from setup areas 0 to 1. • Writing was carried out on a protected parameter other than in the protect level. • Writing was carried out during AT execution. • EEPROM error |

* For details on AT (auto-tuning), refer to the separate User's Manuals.

(5) Precautions

● Alarm function

Even though alarms are not displayed on the controller's display, they are all functional in communications.

Read controller attributes

This service reads the model No. and communications buffer size.

Service request PDU

| | |
|-------|-------|
| MRC | SRC |
| 0 5 | 0 3 |
| 2 | 2 |

Service response PDU

| | | | | |
|-------|-------|---------------|-----------|----------------------------|
| MRC | SRC | Response code | Model No. | Communications buffer size |
| 0 5 | 0 3 | | | 0 0 2 8 |
| 2 | 2 | 4 | 10 | 4 |

(1) Model No.

The model No. is expressed in 10-byte ASCII code. Empty bytes are space codes.

Example :

The model No. for a unit equipped with relay output, HBA and communications functions is expressed as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| E | 5 | C | N | - | R | 2 | H | 0 | 3 |
|---|---|---|---|---|---|---|---|---|---|

(2) Communications buffer size

The communications buffer size is expressed in 2-byte hexadecimal code, and read after being converted to 4-byte ASCII code.

Buffer size: 40 bytes (= H'0028)

(3) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

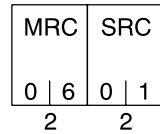
At occurrence of error

| Response code | Name | Description |
|---------------|------------------|--------------------------|
| 1001 | Command too long | The command is too long. |
| 2203 | Operation error | EEPROM error |

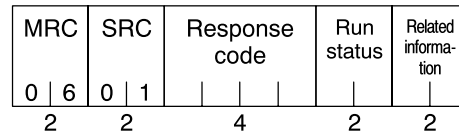
Read controller status

This service reads the run status of the controller.

Service request PDU



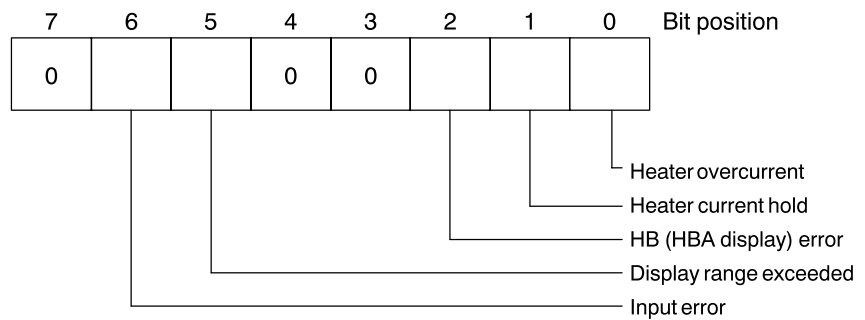
Service response PDU



(1) Run status

| Run status | Description |
|------------|---|
| 00 | Control is being carried out (error has not occurred in setup area 0, and the controller is running). |
| 01 | Control is not being carried out (state other than above). |

(2) Related information



(3) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

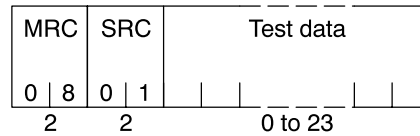
At occurrence of error

| Response code | Name | Description |
|---------------|------------------|--------------------------|
| 1001 | Command too long | The command is too long. |
| 2203 | Operation error | EEPROM error |

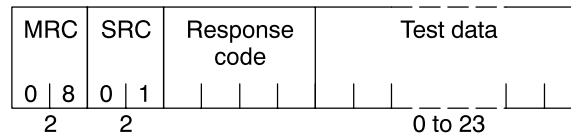
■ Echoback test

This service carries out the echoback test.

Service request PDU



Service response PDU



(1) Test data

Set any test data within the range “0” to “23”.

Set a value for the test data within the ranges shown below according to the communications data length.

| Communications data length | Test data |
|----------------------------|--|
| 8 bits | 20 to 7E, A1 to FE converted to ASCII code |
| 7 bits | 20 to 7E converted to ASCII code |

Do not set “40”. Doing so results in no response.

(2) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

At occurrence of error

| Response code | Name | Description |
|---------------|------------------|--------------------------|
| 1001 | Command too long | The command is too long. |
| 2203 | Operation error | EEPROM error |

■ Operation instructions

This service carries out run/stop, communications writing, write mode, save RAM data, AT (auto-tuning) execution/cancel, multi-SP, move to protect level, move to setup area 1 and software reset.

Service request PDU

| | | | |
|-------|-------|-----------------------|-----------------------------|
| MRC | SRC | Instruc- tion code | Related informa- tion |
| 3 0 | 0 5 | | |
| 2 | 2 | 2 | 2 |

Service response PDU

| | | |
|-------|-------|------------------|
| MRC | SRC | Response code |
| 3 0 | 0 5 | |
| 2 | 2 | 4 |

(1) Instruction code and related information

| Instruction code | Description | Related information |
|------------------|------------------------|--|
| 00 | Communications writing | 00: OFF (disabled) 01: ON (enabled) |
| 01 | Run/Stop | 00: Run 01: Stop |
| 02 | Multi-SP | 00: Set point 0 01: Set point 1 02: Set point 2 03: Set point 3 |
| 03 | AT execute/cancel | 00: Cancel 01: AT execute |
| 04 | Write mode | 00: Backup 01: RAM |
| 05 | Save RAM data | 00 |
| 06 | Software reset * | 00 |
| 07 | Move to setup area 1 | 00 |
| 08 | Move to protect level | 00 |

* No response will be returned when a software reset is carried out.

(2) Response code

At normal completion

| Response code | Name | Description |
|---------------|-------------------|-----------------------|
| 0000 | Normal completion | No errors were found. |

At occurrence of error

| Response code | Error name | Cause |
|---------------|-------------------|--|
| 1001 | Command too long | The command is too long. |
| 1002 | Command too short | The command is too short. |
| 1100 | Parameter error | Instruction code and related information are wrong. |
| 2203 | Operation error | <ul style="list-style-type: none"> • The “communications writing” parameter is set to “OFF” (disabled). However, note that the error is accepted regardless of the “communications writing” parameter setting (ON/OFF). • The command cannot be processed. For details, see “(3) Description of operating instructions and precautions” below. • EEPROM error |

(3) Description of operation instructions and precautions

● Communications writing

Set the “communications writing” parameter to “ON: enabled” or “OFF: disabled” according to related information. This instruction can be accepted at both setup areas 0 and 1.

● Run/Stop

Set control to “run” or “stop” according to related information. This instruction can be accepted at both setup areas 0 and 1.

● AT execute/cancel

Set AT (auto-tuning) to “execute” or “cancel” according to related information. This instruction can be accepted at setup area 0 only. However, note that an “operation error” is generated in the following instances:

- When the “run/stop” parameter is set to “stop”
- When the instruction is issued in “setup area 1”
- When the ON/OFF control

● Write mode

Set either the backup mode or RAM write mode according to related information. This instruction can be accepted at both setup areas 0 and 1.

● Multi-SP

Set four set points beforehand in the adjustment level so that you switch to a desired set point.

| Write mode | Description |
|----------------|--|
| Backup mode | Writing is carried out to EEPROM when the parameters in the operation/adjustment levels (excluding R/O parameters) are written by communications. |
| RAM write mode | Writing is not carried out to EEPROM when the parameters in the operation/adjustment levels (excluding R/O parameters) are written by communications. However, note that parameters can be changed by operating the keys on the front panel of the controller. |

- When the RAM write mode is changed to the backup mode, the parameters in the operation/adjustment levels (excluding R/O parameters) are written to EEPROM.
- The RAM write mode is enabled only when the “communications writing” parameter is set to “ON: enabled”. So, when the “communications writing” parameter setting is changed to “OFF: disabled”, the parameters in the operation/adjustment levels (excluding R/O parameters) are written to EEPROM even if the RAM write mode is set to “disabled.”
- Save RAM data
This instruction writes the parameters in the operation/adjustment levels (excluding R/O parameters). This instruction can be accepted at both setup areas 0 and 1.
- Software reset
This instruction resumes processing after the power is turned OFF. This instruction can be accepted at both setup areas 0 and 1. No response will be returned for this operation instruction.
- Move to setup area 1
This instruction moves to “setup area 1” and can be accepted at both setup areas 0 and 1. However, note that when “initial setup/communications protection” is set to “2”, an “operation error” is generated, and move to setup area 1 is forbidden.
When this move is carried out from setup area 0, the display indicates the “input type” in the “initial setting level.” When this operation instruction is issued in setup area 1, the display will not change.
- Move to protect level
This instruction moves to the “protect level” and can be accepted only in setup area 0. When this instruction command is issued in setup area 1, an “operation error” is generated, and move to setup area 1 is forbidden.

2.4 Response Code List

At normal completion

| Response code | Name | Description | Error detection priority |
|---------------|-------------------|-----------------------|--------------------------|
| 0000 | Normal completion | No errors were found. | None |

At occurrence of error

| Response code | Name | Description | Error detection priority |
|---------------|----------------------------------|---|--------------------------|
| 0401 | Unsupported command | The service function for the relevant command is not supported. | 1 |
| 1001 | Command too long | The command is too long. | 2 |
| 1002 | Command too short | The command is too short. | 3 |
| 1101 | Area type error | The variable type is wrong. | 4 |
| 1103 | Start address out-of-range error | The read/write start address is out of range. | 5 |
| 1104 | End address out-of-range error | The write end address (write start address + number of elements) exceeds the final address of the variable area. | 6 |
| 1003 | Number of elements/data mismatch | The number of data does not match the number of elements. | 7 |
| 110B | Response too long | The response exceeds the communications buffer size (when larger than number of elements 0002). | 8 |
| 1100 | Parameter error | <ul style="list-style-type: none"> • The bit position is other than "00". • The write data is out of the setting range. • The instruction code and related information in the operating instruction is wrong. | 9 |
| 3003 | Read-only error | Variable type "C0" was written to. | 10 |
| 2203 | Operation error | <ul style="list-style-type: none"> • The "communications writing" parameter is set to "OFF" (disabled). • Writing was carried out on the parameters from setup areas 0 to 1. • Writing was carried out on a protected parameter other than in the protect level. • Writing was carried out during AT execution. • Processing is not possible by operating instruction. • EEPROM error | 11 |

CHAPTER 3

COMMUNICATIONS DATA

This chapter lists the details of each of the communications data in the CompoWay/F and Sysway communications procedures.

| | | |
|-----|--|-----|
| 3.1 | Variable Area (setup range) List | 3-2 |
| 3.2 | Status | 3-8 |

3.1 Variable Area (setup range) List

The following table lists the variable areas. Items expressed in hexadecimal in the “Set (monitor) Value” column are the setting range in the CompoWay/F specifications. Values in parentheses “()” are the actual setting range. (Refer to these values for the setting range in the Sysway specifications.)

For details of variable areas that are described not in numerical values but by text, refer to the relevant parameter descriptions.

| Variable type | Address | Item | Set (monitor) Value | Level |
|---------------|---------|------------------------|--|-----------|
| C0 | 0000 | Process value | Temperature: Follow the specified range of the sensor. | Operation |
| | | | Analog: Scaling lower limit -5%FS to scaling upper limit +5%FS | |
| C0 | 0001 | Status * | See “4.2 Status.” | |
| C0 | 0002 | Internal set point * | SP lower limit to SP upper limit | |
| C0 | 0003 | Heater current monitor | 00000000 to 00000226 (0.0 to 55.0) | |
| C0 | 0004 | MV monitor (heat) | Standard : FFFFFFFCE to 0000041A (-5.0 to 105.0) | |
| | | | Heating and cooling: 00000000 to 0000041A (0.0 to 105.0) | |
| C0 | 0005 | MV monitor (cool) | 00000000 to 0000041A (0.0 to 105.0) | |

* Not displayed on the controller display.

| Variable type | Address | Item | Set (monitor) Value | Level |
|---------------|---------|---|--|------------|
| C1 | 0000 | Operation/adjustment protection | 00000000(0): No restrictions in operation and adjustment levels 00000001(1): Move to adjustment level restricted 00000002(2): Display and change of only "PV" and "PV/SP" parameters enabled 00000003(3): Display of only "PV" and "PV/SP" parameters enabled | Protect |
| C1 | 0001 | Initial setting/communications protection | 00000000(0): Move to initial setting/communications setting level enabled (move to advanced function setting level displayed) 00000001(1): Move to initial setting/communications setting level enabled (move to advanced function setting level not displayed) 00000002(2): Move to initial setting/communications setting level restricted | |
| C1 | 0002 | Setup change protection | 00000000(0): OFF (changing of setup on controller display enabled) 00000001(1): ON (changing of setup on controller display disabled) | |
| C1 | 0003 | Set point | SP lower limit to SP upper limit | Operation |
| C1 | 0004 | Alarm value 1 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 0005 | Upper-limit alarm 1 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 0006 | Lower-limit alarm 1 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 0007 | Alarm value 2 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 0008 | Upper-limit alarm 2 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 0008 | Lower-limit alarm 2 | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 000A | Alarm value 3 * | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 000B | Upper-limit alarm 3 * | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 000C | Lower-limit alarm 3 * | FFFFFF831 to 0000270F (-1999 to 9999) | |
| C1 | 000D | Heater burnout detection | 00000000 to 000001F4 (0.0 to 50.0) | Adjustment |
| C1 | 000E | Set point 0 | SP lower limit to SP upper limit | |
| C1 | 000F | Set point 1 | SP lower limit to SP upper limit | |
| C1 | 0010 | Set point 2 | SP lower limit to SP upper limit | |
| C1 | 0011 | Set point 3 | SP lower limit to SP upper limit | |
| C1 | 0012 | Temperature input shift | FFFFFF831 to 0000270F (-199.9 to 999.9) | |
| C1 | 0013 | Upper-limit temperature input shift value | FFFFFF831 to 0000270F (-199.9 to 999.9) | |
| C1 | 0014 | Lower-limit temperature input shift value | FFFFFF831 to 0000270F (-199.9 to 999.9) | |
| C1 | 0015 | Proportional band | 00000001 to 0000270F (0.1 to 999.9) | |
| C1 | 0016 | Integral time | 00000000 to 00000F9F (0 to 3999) | |
| C1 | 0017 | Derivative time | 00000000 to 00000F9F (0 to 3999) | |
| C1 | 0018 | Cooling coefficient | 00000001 to 0000270F (0.01 to 99.99) | |

* Only displayed on the E5EN-□3□□□

The alarm function can be also be utilized on units without alarm output terminals. In this case, confirm alarm occurrences via the status data.

| Variable type | Address | Item | Set (monitor) Value | Level |
|---------------|---------|---------------------|--|-----------------|
| C1 | 0019 | Dead band | FFFFFF831 to 0000270F (-199.9 to 999.9) | Adjustment |
| C1 | 001A | Manual reset value | 00000000 to 000003E8 (0.0 to 100.0) | |
| C1 | 001B | Hysteresis (OUT1) | 00000001 to 0000270F (0.1 to 999.9) | |
| C1 | 001C | Hysteresis (OUT2) | 00000001 to 0000270F (0.1 to 999.9) | |
| C3 | 0000 | Input type * | 00000000(0): Pt (-200 to 850°C/-300 to 1500°F) 00000001(1): Pt (-199.9 to 500.0°C/-199.9 to 900.0°F) 00000002(2): Pt (-0.0 to 100.0°C/-0.0 to 210.0°F) 00000003(3): Jpt (-199.9 to 500.0°C/-199.9 to 900.0°F) 00000004(4): Jpt (-0.0 to 100.0°C/0.0 to 210.0°F) 00000000(0): K (-200 to 1300°C/-300 to 2300°F) 00000001(1): K (-20.0 to 500.0°C/0.0 to 900.0°F) 00000002(2): J (-100 to 850°C/-100 to 1500°F) 00000003(3): J (-20.0 to 400.0°C/0.0 to 750.0°F) 00000004(4): T (-200 to 400°C/-300 to 700°F) 00000005(5): E (0 to 600°C/0 to 1100°F) 00000006(6): L (-100 to 850°C/-100 to 1500°F) 00000007(7): U (-200 to 400°C/-300 to 700°F) 00000008(8): N (-200 to 1300°C/-300 to 2300°F) 00000009(9): R (0 to 1700°C/0 to 3000°F) 0000000A(10): S (0 to 1700°C/0 to 3000°F) 0000000B(11): B (100 to 1800°C/300 to 3200°F) 0000000C(12): Non-contact temperature sensor (K10 to 70°C) 0000000D(13): Non-contact temperature sensor (K60 to 120°C) 0000000E(14): Non-contact temperature sensor (K115 to 165°C) 0000000F(15): Non-contact temperature sensor (K160 to 260°C) 00000010(16): 0 to 50mV | Initial setting |
| C3 | 0001 | Scaling upper limit | Scaling lower limit +1 to 0000270F (scaling lower limit +1 to 9999) | |
| C3 | 0002 | Scaling lower limit | FFFFFF831 to Scaling upper limit -1 (-1999 to scaling upper limit -1) | |
| C3 | 0003 | Decimal point | 00000000 to 00000001 (0 to 1) | |

* The input type can be selected according to the connected sensor. Two input type specifications are supported, “platinum resistance thermometer” and “thermocouple and non-contact temperature sensor.”

| Variable type | Address | Item | Set (monitor) Value | Level |
|--|---------|------------------------------|--|-----------------|
| C3 | 0004 | °C/°F selection | 00000000(0):°C 00000001(1):°F | Initial setting |
| C3 | 0005 | SP upper limit | Temperature: SP lower limit +1 to Input range upper limit | |
| | | | Analog: SP lower limit +1 to scaling upper limit | |
| C3 | 0006 | SP lower limit | Temperature: Input range lower limit to SP upper limit -1 | |
| | | | Analog: Scaling lower limit to SP upper limit -1 | |
| C3 | 0007 | PID/ ON/OFF | 00000000(0): ON/OFF 00000001(1): 2-PID | |
| C3 | 0008 | Standard/Heating and cooling | 00000000(0): Standard 00000001(1): Heating and cooling | |
| C3 | 0009 | ST | 00000000(0): OFF 00000001(1): ON | |
| C3 | 000A | Control period (OUT1) | 00000001 to 00000063 (1 to 99) | |
| C3 | 000B | Control period (OUT2) | 00000001 to 00000063 (1 to 99) | |
| C3 | 000C | Direct/reverse operation | 00000000(0): Reverse operation 00000001(1): Direct operation | |
| C3 | 000D | Alarm 1 type | 00000000(0): Alarm function OFF | |
| | | | 00000001(1): Upper- and lower-limit alarm | |
| | | | 00000002(2): Upper-limit alarm | |
| | | | 00000003(3): Lower-limit alarm | |
| | | | 00000004(4): Upper- and lower-limit range alarm | |
| | | | 00000005(5): Upper- and lower-limit alarm with standby sequence | |
| | | | 00000006(6): Upper-limit alarm with standby sequence | |
| | | | 00000007(7): Lower-limit alarm with standby sequence | |
| | | | 00000008(8): Absolute-value upper-limit alarm | |
| | | | 00000009(9): Absolute-value lower-limit alarm | |
| | | | 0000000A(10): Absolute-value upper-limit alarm with standby sequence | |
| 0000000B(11): Absolute-value lower-limit alarm with standby sequence | | | | |
| C3 | 000E | Alarm 2 type | Same as alarm 1 type | |
| C3 | 000F | Alarm 3 type * | Same as alarm 1 type | |

* The alarm function can be also be utilized on units without alarm output terminals. In this case, confirm alarm occurrences via the status data.

| Variable type | Address | Item | Set (monitor) Value | Level |
|---------------|---------|-------------------------------|---|----------------------------|
| C3 | 0010 | Communications unit No. *1 | 00000000 to 00000063 (0 to 99) | Communica-tions setting |
| C3 | 0011 | Baud rate *1 | 00000000(0): 1.2 00000001(1): 2.4 00000002(2): 4.8 00000003(3): 9.6 00000004(4): 19.2 | |
| C3 | 0012 | Communications data length *1 | 00000007(7): 7 00000008(8): 8 | |
| C3 | 0013 | Communications stop bit *1 | 00000001(1): 1 00000002(2): 2 | |
| C3 | 0014 | Communications parity | 00000000(0): None 00000001(1): Even 00000002(2): Odd | |
| C3 | 001A | Multi-SP | 00000000(0): OFF 00000001(1): ON | Advanced func-tion setting |
| C3 | 001B | Spare | | |
| C3 | 001C | SP ramp set value | 00000000(0): OFF 00000001 to 0000270F (1 to 9999) | |
| C3 | 001D | Standby sequence reset method | 00000000(0): Condition A 00000001(1): Condition B | |
| C3 | 001E | Alarm 1 open in alarm | 00000000(0): Close in alarm 00000001(1): Open in alarm | |
| C3 | 001F | Alarm 1 hysteresis | 00000001 to 0000270F (0.1 to 999.9) | |
| C3 | 0020 | Alarm 2 open in alarm | 00000000(0): Close in alarm 00000001(1): Open in alarm | |
| C3 | 0021 | Alarm 2 hysteresis | 00000001 to 0000270F (0.1 to 999.9) | |
| C3 | 0022 | Alarm 3 open in alarm* | 00000000(0): Close in alarm 00000001(1): Open in alarm | |
| C3 | 0023 | Alarm 3 hysteresis | 00000001 to 0000270F (0.1 to 999.9) | |
| C3 | 0024 | HBA used | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0025 | Heater burnout latch | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0026 | Heater burnout hysteresis | 00000001 to 00001F4 (0.1 to 50.0) | |
| C3 | 0027 | ST stable range | 00000001 to 0000270F (0.1 to 999.9) | |
| C3 | 0028 | α | 00000000 to 00000064 (0.00 to 1.00) | |

*1 Communications parameters are enabled after they have been changed by resetting the controller.

* The alarm function can be also be utilized on units without alarm output terminals. In this case, confirm alarm occurrences via the status data.

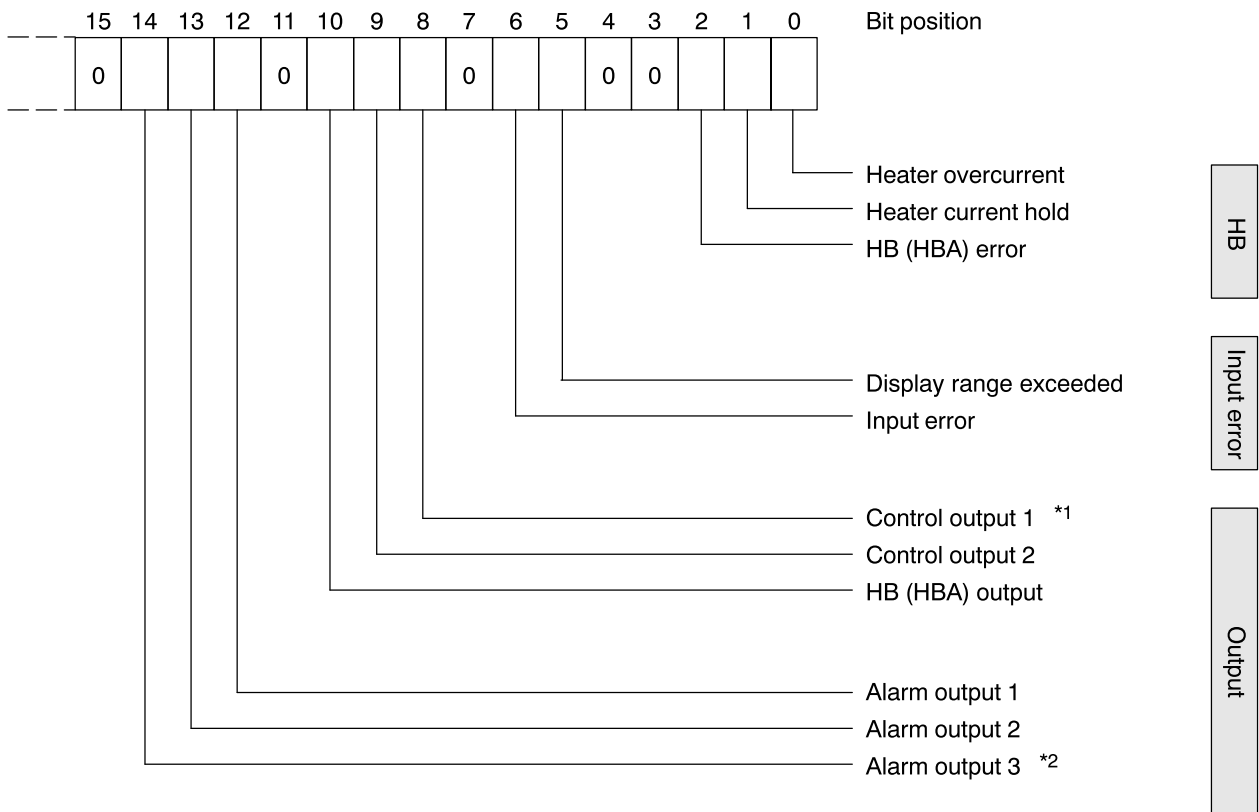
| Variable type | Address | Item | Set (monitor) Value | Level |
|---------------|---------|-----------------------------------|--|---------------------------|
| C3 | 0029 | MV upper limit | Standard: MV lower limit +0.1 to 000041A (MV lower limit +0.1 to 105.0) | Advanced function setting |
| | | | Heating and cooling: 00000000 to 0000041A (0.0 to 105.0) | |
| C3 | 002A | MV lower limit | Standard: FFFFFFFCE to MV upper limit -0.1 (-5.0 to MV upper limit -0.1) | |
| | | | Heating and cooling: FFFFBE6 to 00000000 (-105.0 to 0.0) | |
| C3 | 002B | Input digital filter | 00000000 to 0000270F (0.0 to 999.9) | |
| C3 | 002C | Additional PV display | 00000000(0): OFF 00000001(1): ON | |
| C3 | 002D | Manipulated variable display | 00000000(0): OFF (display of manipulated variable OFF) 00000001(1): ON (display of manipulated variable ON) | |
| C3 | 002E | Automatic return of display mode | 00000000(0): OFF 00000001 to 00000063 (1 to 99) | |
| C3 | 002F | Alarm 1 latch | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0030 | Alarm 2 latch | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0031 | Alarm 3 latch | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0032 | Protect level move time | 00000001 to 0000001E (1 to 30) | |
| C3 | 0033 | Output input error | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0034 | Cold junction compensation method | 00000000(0): OFF 00000001(1): ON | |
| C3 | 0035 | MB command logic switching* | H'00000000(0): OFF H'00000001(1): ON | |

* The logic is switched only in MB command (Sysway).

The logic of CompoWay/F operation instruction code 00 (communications writing) is not influenced.

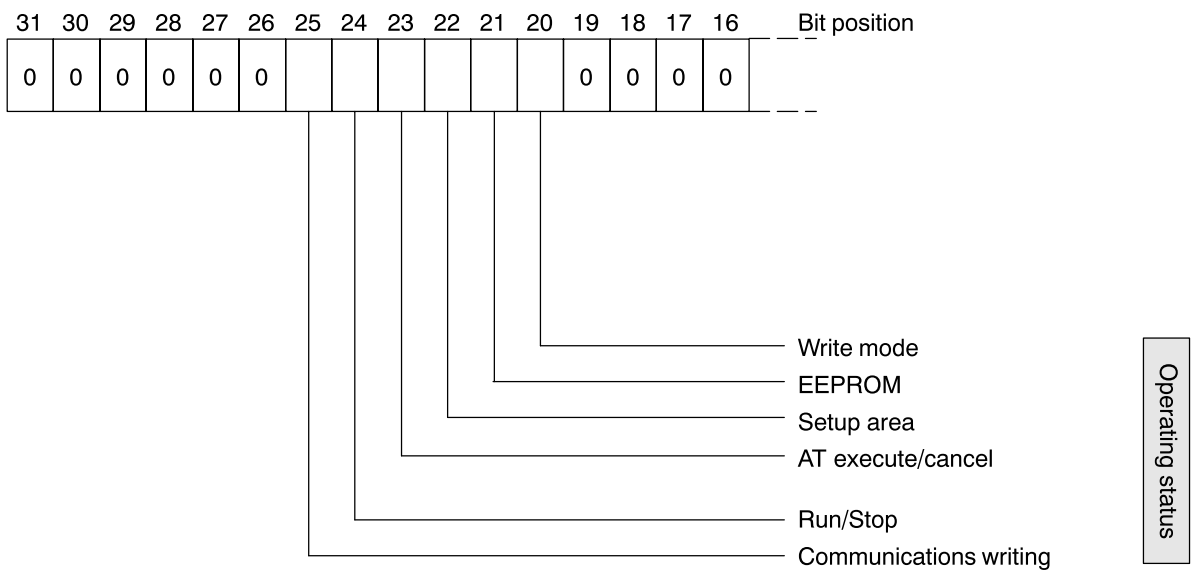
3.2 Status

The figure below shows the structure of the status data:



*1 Whenever the control output is the current output, this data bit is 0.

*2 Applies to the E5EN-□3□□□ only.



Operating status

The following shows the status contents.

| Bit position | Status | Bit Description | |
|--------------|------------------------|-----------------|--------------------------|
| | | 0 | 1 |
| 0 | Heater overcurrent | Not generated | Generated |
| 1 | Heater current hold *1 | Updated | Hold |
| 2 | HB (HBA) error | Not generated | Generated |
| 3 | Spare | | |
| 4 | Spare | | |
| 5 | Display range exceeded | Not generated | Generated |
| 6 | Input error | Not generated | Generated |
| 7 | Spare | | |
| 8 | Control output 1 *2 | OFF | ON |
| 9 | Control output 2 | OFF | ON |
| 10 | HB (HBA) output | OFF | ON |
| 11 | Spare | | |
| 12 | Alarm output 1 | OFF | ON |
| 13 | Alarm output 2 | OFF | ON |
| 14 | Alarm output 3 *3 | OFF | ON |
| 15 | Spare | | |
| 16 | Spare | | |
| 17 | Spare | | |
| 18 | Spare | | |
| 19 | Spare | | |
| 20 | Write mode | Backup mode | RAM write mode |
| 21 | EEPROM | RAM=EEPROM | RAM≠EEPROM |
| 22 | Setup area | Setup area 0 | Setup area 1 |
| 23 | AT execute/cancel | AT canceled | AT execution in progress |
| 24 | Run/Stop | Run | Stop |
| 25 | Communications writing | OFF (disabled) | ON (enabled) |
| 26 | Spare | | |
| 27 | Spare | | |
| 28 | Spare | | |
| 29 | Spare | | |
| 30 | Spare | | |
| 31 | Spare | | |

*1 “1” is set and the heater current is held at the immediately previous current value when the control output ON time is less than 190 ms.

*2 Whenever the control output is the current output, this is OFF.

* “Spare” bits are always OFF.

CHAPTER 4

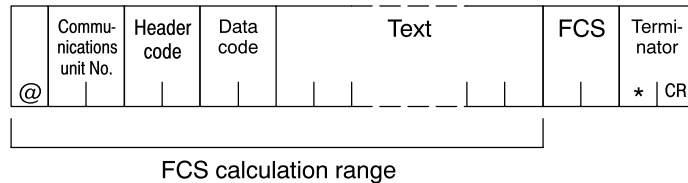
Sysway (E5□J, □X format) **COMMUNICATIONS PROCEDURES**

These communications procedures are supported for ensuring compatibility with existing temperature controller models E5□J and E5□X.

| | | |
|-----|--|-----|
| 4.1 | Data Format | 4-2 |
| | Command frame format | 4-2 |
| | FCS calculation example | 4-2 |
| | Response frame | 4-3 |
| | Communications data | 4-3 |
| | Sysway command lists | 4-4 |
| 4.2 | Command Descriptions | 4-5 |
| | Read process value | 4-5 |
| | Write set value | 4-6 |
| | Read set value and MV monitor | 4-7 |
| | Communications writing switching | 4-8 |

4.1 Data Format

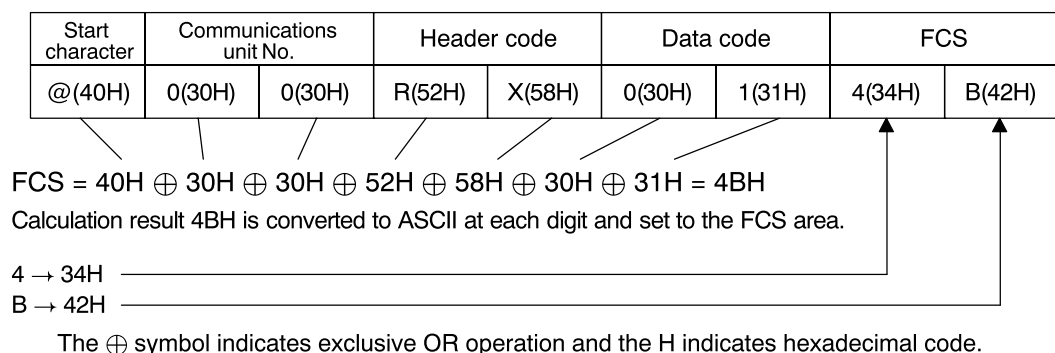
Command frame format



| | |
|-------------------------|---|
| @ | Character (40) that indicates the start of block format |
| Communications unit No. | A number within the range 0 to 99 can be set in BCD. No response will be returned if a number other than this is set. |
| Header code | 2-character alphabet code that indicates the command type |
| Data code | Set "02" only when reading and writing alarm value 2. Otherwise, set "01". |
| Text | This area stores read values, write values and status. The content of this area varies according to the command. |
| FCS | The FCS (Frame Check Sequence) is formed by converting the value obtained by converting the exclusive OR of @ to the last text character into ASCII characters. |
| Terminator | Indicates the end of the block format. Comprises "*" and CR (Character Return 0D) |

FCS calculation example

The FCS is formed by converting the 8-bit value obtained by converting the exclusive OR of start character "@" up to the last text character into two ASCII characters, and setting this to the FCS area.



Response frame

| | | | | | | |
|---|---------------------------------|----------------|-------------|------|-----|-----------------|
| | Communi- cations unit No. | Header code | End code | Text | FCS | Termi- nator |
| @ | | | | | | * CR |

| End code | Name | Description | Priority |
|----------|------------------------|--|----------|
| 10 | Parity error | The sum total of bits whose received data is "1" does not match the set value of "communications parity." | 1 |
| 11 | Framing error | Stop bit is "0". | 2 |
| 12 | Overrun error | An attempt was made to transfer new data when the reception data was already full. | 3 |
| 13 | FCS error | The calculated FCS value is different from the received FCS value. | 4 |
| IC* | Undefined error | The header code of the command cannot be interpreted. | 5 |
| 14 | Format error | <ul style="list-style-type: none"> The command length is incorrect. | 6 |
| 0D | Non-executable command | <ul style="list-style-type: none"> The set value was written when the "communications writing" parameter was set to "OFF" (disabled). The set value was written during AT execution. | 7 |
| 15 | Undefined data value | <ul style="list-style-type: none"> The write data is either outside the setting range or not a numerical value. The data is either outside the setting range or not a numerical value. | 8 |
| 00 | Normal completion | The command ended normally without error. | — |

* The response format for an "undefined error" differs from the regular response format in that an error code not an "end code" is stored to the "header code."

Response format in the case of an undefined error

| | | | | |
|---|---------------------------------|----------------|-----|-----------------|
| | Communi- cations unit No. | Header code | FCS | Termi- nator |
| @ | | I C | | * CR |

Communications data

| Communications specifications | Set (monitor) Value | Minus Value | Decimal Point |
|-------------------------------|-----------------------|---|--|
| Sysway | Four digits (decimal) | If the uppermost digit is "-1", the uppermost digit is set to "A". Example) -1999 → A999 If the uppermost digit is "-", the uppermost digit is set to "F". Example) -10 → F010 | The decimal point is removed. Example) 105.0 → 1050 |

Sysway command lists

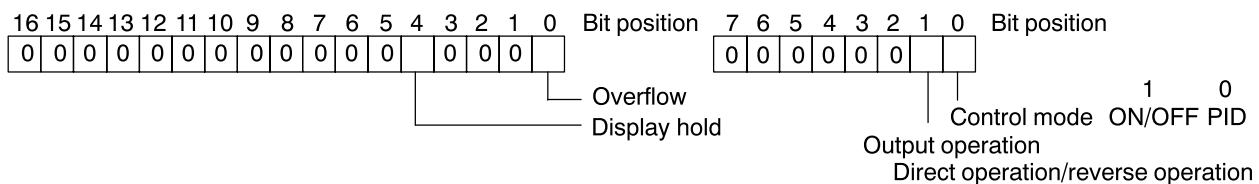
| Category | Header code | Data code | Command | R/W | Data length | Remarks |
|---|-------------|-----------|---|-----|-------------|--|
| Communications writing selection | MB | 01 | Select communications writing | W | 4B | |
| Write mode selection | ME | 01 | Select backup mode | W | None | |
| | MA | 01 | Select RAM write mode | | | |
| Save run/adjustment set value | MW | 01 | Save operation/adjustment set value | | | |
| Write set value | WS | 01 | Write set point | W | 4B | |
| | W% | 01 | Write alarm value 1 | | | |
| | W% | 02 | Write alarm value 2 | | | |
| | WB | 01 | Write proportional band | | | |
| | WN | 01 | Write integral time | | | |
| | WV | 01 | Write derivative time | | | |
| | WI | 01 | Write temperature input shift values | | | |
| Read set value and manipulated variable monitor | RS | 01 | Read set point | R | 4B | |
| | R% | 01 | Read alarm value 1 | | | |
| | R% | 02 | Read alarm value 2 | | | |
| | RB | 01 | Read proportional band | | | |
| | RN | 01 | Read integral time | | | |
| | RV | 01 | Read derivative time | | | |
| | RI | 01 | Read input shift values | | | |
| | RW | 01 | Read temperature heater burnout detection | | | |
| Read SP upper and lower limit values | RL | 01 | Read SP upper and lower limit values | R | 8B | Read both upper/lower limit values at once |
| | | | | | | |
| Read process value | RX | 01 | Read the process value | R | 8B | *1 |
| | RZ | 01 | Read the heater current monitor | | | |
| Read initial status | RU | 01 | Read the initial status | R | 5B | *2 |

* In a memory error (RAM error) or initial state (until the control starts to look for the process value after the power is turned ON), no commands will be accepted, and no response will be returned.

* When writing is carried out when a memory error (RAM error) has occurred, writing to EEPROM is not carried out, and processing ends in “normal completion.” Reading is as normal.

*1 Status

*2 Status



* Overflow: Set 1 when the heater current value is greater than 55.0 A.

* Display hold: Set 1 when the control output ON time is less than 190 ms. The previous heater current value is held.

4.2 Command Descriptions

■ Read process value

This command reads the process value and status.

Command Format

| | Communi- cations unit No. | Header code | Data code | FCS | Termi- nator |
|---|---------------------------------|----------------|--------------|-----|-----------------|
| @ | | R X | 0 1 | | * CR |

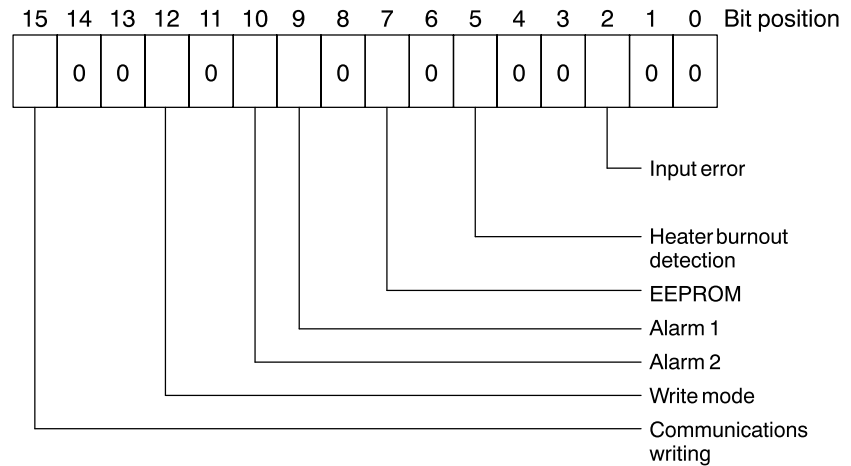
Response Format

| | Communi- cations unit No. | Header code | End code | Process value | Status | FCS | Termi- nator |
|---|---------------------------------|----------------|-------------|------------------|--------|-----|-----------------|
| @ | | R X | | | | | * CR |

(1) Process value

See “Chapter 3 Communications Data.”

(2) Status



| Item | Description | |
|--------------------------|-------------------------------------|----------------|
| | 0 | 1 |
| Input error | Not generated | Generated |
| Heater burnout detection | OFF or does not function | ON |
| EEPROM | RAM=EEPROM | RAM≠EEPROM |
| Alarm 1 | OFF or does not function | ON |
| Alarm 2 | OFF or does not function | ON |
| Write mode | Backup mode | RAM write mode |
| Communications writing | OFF (disabled) or does not function | ON (enabled) |

(3) End code

When the end code is “00”, this indicates normal completion of the command. Otherwise, the command could not be processed. For details on end codes, see “Response frame” on page 4-3.

(4) Precautions

- Even though alarms 1 and 2 are not displayed on the controller’s display, they are all functional in communications.
- When the controller has moved to setting area 1, the previous state is held. “Setting area 1” is where the initial setting, communications setting, advanced function setting and calibration levels are grouped together.

■ Write set values

This command writes the set point, alarm values 1 and 2, proportional band, integral time, derivative time, temperature input shift values and heater burnout detection.

Command Format

| | | | | | | |
|---|---------------------------------|----------------|--------------|-------------|-----|---------------------------|
| @ | Commu- nications unit No. | Header code | Data code | Write value | FCS | Termi- nator * CR |
|---|---------------------------------|----------------|--------------|-------------|-----|---------------------------|

Response Format

| | | | | | |
|---|---------------------------------|----------------|-------------|-----|---------------------------|
| @ | Commu- nications unit No. | Header code | End code | FCS | Termi- nator * CR |
|---|---------------------------------|----------------|-------------|-----|---------------------------|

(1) Header code

| Header Code | Command |
|-------------|--------------------------------------|
| WS | Write set point |
| W% | Write alarm value 1/2 |
| WB | Write proportional band |
| WN | Write integral time |
| WV | Write derivative time |
| WI | Write temperature input shift values |
| WW | Write heater burnout detection |

(2) Data code

Only “write to alarm value 2” is set to “02”. All other settings are “01”.

(3) Write value

For details on the write value (set value) range, see “Chapter 3 Communications Data.”

(4) Precautions

● Alarm values 1 and 2

When “alarm 1 type” is set to one of “upper/lower-limit alarm,” “upper/lower-limit range alarm” or “upper/lower-limit alarm with standby sequence”, “alarm value 1” is disabled as the upper and lower limits of the alarm are set independently. “Upper-limit alarm value 1” and “lower-limit alarm value 1” become the alarm set values.

For this reason, when “upper/lower-limit alarm” is set, write values are written by communications to “upper-limit alarm value 1” and “lower-limit alarm value 1” and not to “alarm value 1.” The same applies to “alarm 2 type.”

- Temperature input shift values

When “input type” is set to “non-contact temperature sensor,” “temperature input shift values” is disabled as temperature input is shifted by 2-point shift. The values set to the “upper-limit temperature input shift value” and “lower-limit temperature input shift value” parameters are the set values used for temperature input shift.

For this reason, when 2-point shift is adopted, write values are written by communications to “upper-limit temperature input shift value” and “lower-limit temperature input shift value” and not to “temperature input shift values.”

- Alarms

Alarms 1 and 2 can be used normally in communications. However, alarm 3 cannot be used.

■ Read set value and MV monitor

This command reads the set point, alarm values 1 and 2, proportional band, integral time, derivative time, temperature input shift values, heater burnout detection and MV monitor.

Command Format

| | | | | | |
|---|---------------------------------|----------------|--------------|-----|-----------------|
| | Commu- nications unit No. | Header code | Data code | FCS | Termi- nator |
| @ | | | | | * CR |

Response Format

| | | | | | | |
|---|---------------------------------|----------------|-------------|-------------|-----|-----------------|
| | Commu- nications unit No. | Header code | End code | Write value | FCS | Termi- nator |
| @ | | | | | | * CR |

(1) Header code

| Header Code | Command |
|-------------|---|
| RS | Read set point |
| R% | Read alarm value 1/2 |
| RB | Read proportional band |
| RN | Read integral time |
| RV | Read derivative time |
| RI | Read input shift values |
| RW | Read temperature heater burnout detection |
| RO | Read MV monitor |

(2) Data code

Only “write to alarm value 2” is set to “02”. All other settings are “01”.

(3) Read value

For details on the read value (set value) range, see “Chapter 3 Communications Data.”

(4) Precautions

● Alarm values 1 and 2

When “alarm 1 type” is set to one of “upper/lower-limit alarm,” “upper/lower-limit range alarm” or “upper/lower-limit alarm with standby sequence”, “alarm value 1” is disabled as the upper and lower limits of the alarm are set independently. “Upper-limit alarm value 1” and “lower-limit alarm value 1” become the alarm set values.

For this reason, when “upper/lower-limit alarm” is set, the value of “upper-limit alarm value 1” and not “alarm value 1” is the value read by communications.

The same applies to “alarm 2 type.”

● Temperature input shift values

When “input type” is set to “non-contact temperature sensor,” “temperature input shift values” is disabled as temperature input is shifted by 2-point shift. The values set to the “upper-limit temperature input shift value” and “lower-limit temperature input shift value” parameters are the set values used for temperature input shift.

For this reason, when 2-point shift is adopted, the value of “upper-limit temperature input shift value” and not “temperature input shift values” is the value read by communications.

● Alarms

Alarms 1 and 2 can be used normally in communications. However, alarm 3 cannot be used.

■ Communications writing switching

The logic of the MB command changes as shown in the table below according to the MB command logic switching setting (advanced function level). The MB command (communications writing switching) is equivalent to the MB command (remote/local switching) on the E5□J.

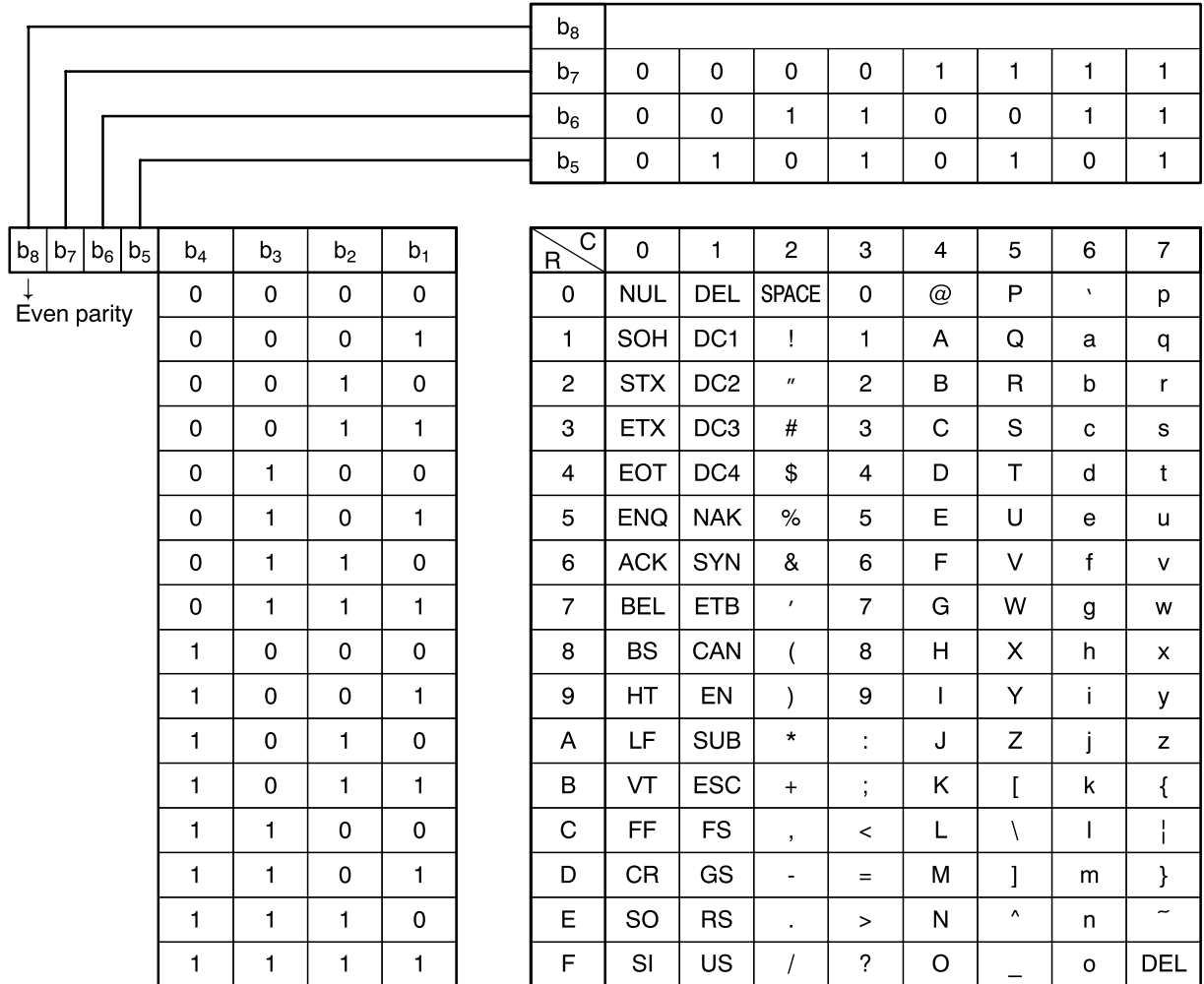
| Text Data of MB Command | MB Command Logic Switching Setting | |
|-------------------------|---|---|
| | OFF | ON |
| 0000 | Communications writing enabled (remote mode selection) | Communications writing disabled (local mode selection) |
| 0001 | Communications writing disabled (local mode selection) | Communications writing enabled (remote mode selection) |

- MB command logic switching default
: OFF (same logic as E5□J)

APPENDIX

| | |
|------------------|-----|
| ASCII List | A-2 |
|------------------|-----|

ASCII LIST (ANSI X 3.4-1986)



- A**
Addresses 2-7
Area definitions 2-6
ASCII list A-2
- B**
BCC 1-2, 2-2, 2-3, 2-5
- C**
Command descriptions 4-5
Command frame 1-3, 2-2
Command frame format 4-2
Command text 2-2, 2-6
Communications data 2-4, 3-1, 4-3
Communications data length ... 1-5, 1-6, 3-6
Communications methods 1-1, 1-2
Communications parameters 1-5
Communications parity 1-5, 1-6, 3-6
Communications specifications 1-2, 1-4
Communications stop bit 1-5, 1-6, 3-6
Communications unit No. 1-5, 1-6, 3-6
Communications writing switching 4-8
CompoWay/F 1-2, 2-1, 3-1, 3-2
- D**
Data format 2-2, 4-2
Details of services 2-8
- E**
Echoback test 2-7, 2-13
End code 2-3, 2-4, 4-6, 4-7
ETX 2-2, 2-3
- F**
FCS 4-2, 4-3
FCS calculation example 4-2
FINS 1-2, 2-3
- I**
Interface 1-2, 1-3
- L**
List of services 2-7
- N**
Number of elements 2-7
- O**
Operation instructions 2-7, 2-15
- P**
PDU 2-6, 2-11
- R**
Read controller attributes 2-7, 2-11
Read controller status 2-7, 2-12
Read from variable area 2-7, 2-8
Read initial status 4-4
Read process value 4-4, 4-5
Read set value and MV monitor 4-7
Read SP upper and lower limit values .. 4-4
Response code list 2-17
Response frame 2-3, 4-3
- S**
SID 2-2, 2-4
Status 3-8
STX 2-2, 2-4
Sysway command lists 4-4
- T**
Transmission procedure 1-3
Type code (variable type) 2-6
- V**
Variable area (setup range) list 3-2
- W**
Wiring 1-3
Write set values 4-6
Write to variable area 2-7, 2-9

Revision History

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

Cat. No. H102-E1-3



Revision code

The following table outlines the change made to the manual during each revision. Page numbers refer to previous version

| Revision code | Data | Revised content |
|---------------|--------------|---|
| 1 | October 1998 | Original production |
| 2 | March 1999 | <p>All pages: Changed "E5CN/GN" to "E5EN/CN/GN".</p> <p>Page III: Modified the torque value.</p> <p>Page IV: Modified "(6)" in "NOTICE".</p> <p>Page 1-2: Modified the table and note in "Communications specifications".</p> <p>Page 1-3: Modified the diagram in "Wiring".</p> <p>Page 1-4: Added "RS-232C" description.</p> <p>Page 1-5: Added the E5EN diagram in "Communications parameter setup".</p> <p>Page 2-11: Modified the example in "(1) Model No.".</p> <p>Page 2-16: Deleted "Note".</p> <p>Page 3-1: Replace "Chapter 3" to "Chapter 4".</p> <p>Page 3-3: Added "Note".</p> <p>Page 3-4: Modified the set value in "Scaling lower limit".</p> <p>Page 3-5: Added "Note".</p> <p>Page 3-7: Added "Note".</p> <p>Page 3-7: Changed "C1" to "C3" in variable type.</p> <p>Page 3-7: Modified the set value in "MV lower limit".</p> <p>Page 3-8: Added "Notes".</p> <p>Page 3-10: Modified the status contents.</p> |
| 3 | April 2000 | <p>All pages: Changed "E5/EN/CN/GN" to "E5AN/EN/CN/GN".</p> <p>Page 1-2: Modified the item of "Transmission line connection" on the table.</p> <p>Page 3-6 to 3-7: Modified "Variable Area (setup range) List".</p> <p>Page 4-8: Added "Communications writing switching".</p> |



OMRON ELECTRONICS LLC

1 Commerce Drive
Schaumburg, IL 60173 USA
800.55.OMRON (66766)

OMRON CANADA, INC.

885 Milner Avenue
Scarborough, Ontario M1B 5V8
416.286.6465

OMRON ON-LINE

Global - <http://www.omron.com>
USA - <http://www.omron.com/oei>
Canada - <http://www.omron.com/oci>

UNITED STATES

To locate a Regional Sales Office, local Distributor or to obtain product information, call:

800.55.OMRON or 847.843.7900

CANADA REGIONAL SALES OFFICES

| | | |
|-------------------------|-----------|--------------|
| Ontario | Toronto | 416.286.6465 |
| | Kitchener | 519.896.1144 |
| | Kingston | 613.376.3968 |
| Quebec | Montreal | 514.636.6676 |
| British Columbia | Vancouver | 604.522.8855 |
| Alberta | Edmonton | 403.440.0818 |
| | Calgary | 403.257.3095 |

BRAZIL SALES OFFICE

Sao Paulo 55.11.5564.6488

ARGENTINA SALES OFFICE

Cono Sur 54.114.787.1129

MEXICO SALES OFFICE - UNITED STATES

Florida 954.227.2121

MEXICO SALES OFFICE - MEXICO

Mexico, D.F. 555.534.1195 **Monterrey, N.L.** 818.377.4281