

## SECTION 2

# Commands and Responses

This section provides a list of commands, end codes, and error codes. Information on writing and reading data sets are also provided.

2-1	Commands .....
2-2	Writing Sets of Data .....
2-3	Reading Sets of Data .....
2-4	End Codes .....
2-5	Error Codes .....

## 2-1 Commands

### Operational Status and Commands

The following provides a list of commands that can be used with the E5ZE.



If the following are designated when sending a command, a set of data can be written or read.

Memory bank no. and control point no.: A

Data code: AA

Refer to 1-2 Writing Data Sets and 1-3 Reading Data Sets for details.

@	Unit	Header code	MB	Control point	Data code			}}				FCS	*	z
								}}						

MB: Memory bank

#### Basic Commands for Temperature Control

OK: Valid

NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Set Point	Write	WS	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RS	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
				A	00			
Process Value	Read	RX	0	0 to 7	00	OK	OK	OK
				A	00			
Output Value	Read	RO	0	0 to 7	00	OK	OK	OK
					01			
					AA (see note)			
				A	00			
					01			
Proportional Band	Write	WB	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RB	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
				A	00			
Integral Time	Write	WN	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RN	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
				A	00			

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Derivative Time	Write	WV	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RV	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
			A	0 to 7	00			
Control Period	Write	WT	0 to 7	0 to 7	00	OK	OK	NO
					01			
					AA			
				A	00			
					01			
					AA			
			A	0 to 7	00			
					01			
					AA			
				A	00			
					01			
					AA			
	Read	RT	0 to 7	0 to 7	00	OK	OK	OK
					01			
					AA			
				A	00			
Output Operation	Write	WU	0	0	00	OK	NO	NO
	Read	RU	0	0	00	OK	OK	OK
Alarm Mode	Write	W#	0	0 to 7	00	OK	NO	NO
					01			
					AA			
				A	00			
					01			
					AA			
	Read	R#	0	0 to 7	00	OK	OK	OK
					01			
					AA			
				A	00			
					01			

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Alarm Temperature	Write	W%	0 to 7		00	OK	OK	OK
					01			
					AA			
				A	00			
					01			
					AA			
			A	0 to 7	00			
					01			
					AA			
				A	00			
					01			
					AA			
	Read	R%	0 to 7		00	OK	OK	OK
					01			
					AA			
			A		00			
					01			
					AA			
Memory Bank Designation	Write	WM	0	0 to 7	00	OK	OK	NO
				A	00			
	Read	RM	0	0 to 7	00	OK	OK	OK
				A	00			
Hysteresis	Write	WH	0 to 7		00	OK	OK	NO
					01			
					AA			
				A	00			
					01			
					AA			
			A	0 to 7	00			
					01			
					AA			
				A	00			
					01			
					AA			
	Read	RH	0 to 7		00	OK	OK	OK
					01			
					AA			
			A		00			
					01			
					AA			
Status	Read	RX	0	0 to 7	02	OK	OK	OK
				A	02			
Error	Read	RU	0	0	03	OK	OK	OK

**Note** The contents of data codes will be read in numerical order if Output Value Read (RO) is used with the data code set to AA. Ignore the contents of data code 02 because the contents of data code 02 are not defined.

**Commands Used  
According to Application**

OK: Valid  
NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status			
						Operation stopped	Operating	Auto-tuning	
Auto-tuning	Start	AS	0	0 to 7	00	NO	OK	NO	
				A	00				
					01				
	Stop	AP	0	0	00	OK	OK	OK	
Setting Unit	Write	Wt	0	0	00	OK	OK	OK	
	Read	Rt	0	0	00	OK	OK	OK	
Input Shift	Write	WI (see note 1)	0 to 7	0 to 7	00	OK	OK	NO	
				A	00				
			A	0 to 7	00				
				A	00				
	Read	RI (see note 1)	0 to 7	0 to 7	00	OK	OK	OK	
				A	00				
			A	0 to 7	00				
	Manual Reset Value	Write	WK	0 to 7	0 to 7	00	OK	OK	NO
A					00				
A				0 to 7	00				
				A	00				
Read		RK	0 to 7	0 to 7	00	OK	OK	OK	
				A	00				
			A	0 to 7	00				
Ramp Value		Write	WR	0 to 7	0 to 7	00	OK	OK	OK
	A				00				
	A			0 to 7	00				
				A	00				
	Read	RR	0 to 7	0 to 7	00	OK	OK	OK	
				A	00				
A			0 to 7	00					
Present Set Point	Read	Rs	0	0 to 7	00	OK	OK	OK	
				A	00				
Manual Output Value	Write	WO	0	0 to 7	00	NO	OK (see note 2)	NO	
									01
				A	00				
									01

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Output Variable Limit Value	Write	WL	0 to 7	0 to 7	00	OK	OK	NO
					01			
				A	00			
					01			
			A	0 to 7	00			
					01			
				A	00			
					01			
	Read	RL	0 to 7	0 to 7	00	OK	OK	OK
					01			
				A	00			
					01			
A			0 to 7	00				
				01				
Output Variable Change Rate Limit Value	Write	WG	0 to 7	0 to 7	00	OK	OK	NO
					A			
			A	0 to 7	00			
					A			
	Read	RG	0 to 7	0 to 7	00	OK	OK	OK
					A			
			A	0 to 7	00			
Memory Write		WE	A	A	00	OK	OK	OK
Initialize Setting Data		MC	---	---	---	OK	NO	NO
Communication Test		TS	---	---	---	OK	OK	OK

- Note**
1. Upper-case I ("ai").
  2. Manual Output (WO) is valid if it is used for the E5ZE in manual operation and invalid if it is used for the E5ZE for 2-PID control.

#### Heater Burnout and SSR Failure Detection

OK: Valid  
NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
HB Alarm and HS Alarm Point	Write	WU	0	0	02	OK	NO	NO
	Read	RU	0	0	02	OK	OK	OK
Heater Burnout and SSR Failure Detection Current Value	Write	WW	0	0 to 7	00	OK	OK	OK
					01			
				A	00			
					01			
	Read	RW	0	0 to 7	00	OK	OK	OK
					01			
				A	00			
					01			
Heater Current Value and SSR Leakage Current Value	Read	RZ	0	0 to 7	00	OK	OK	OK
					01			
				A	00			
					01			

**Heating and Cooling Control**OK: Valid  
NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Dead Band and Overlap Band	Write	WD	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RD	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
Cooling Coefficient	Write	WC	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	RC	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
			A	0 to 7	00			

**Fuzzy Control**OK: Valid  
NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Fuzzy Strength	Write	Wj	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	Rj	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
Fuzzy Scale 1	Write	Wk	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	Rk	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
Fuzzy Scale 2	Write	Wl (see note)	0 to 7	0 to 7	00	OK	OK	NO
				A	00			
			A	0 to 7	00			
				A	00			
	Read	Rl (see note)	0 to 7	0 to 7	00	OK	OK	OK
				A	00			
			A	0 to 7	00			

**Note** Lower-case l ("el").

OK: Valid  
NO: Invalid

Command		Header code	Memory bank	Control point	Data code	Operation status		
						Operation stopped	Operating	Auto-tuning
Operation	Start	OS	0	0 to 7	00	OK	OK	NO
				A	00			
	Stop	OP	0	0 to 7	00	OK	OK	OK
				A	00			
Manual Operation	Start	OM	0	0 to 7	00	OK	OK	NO
				A	00			



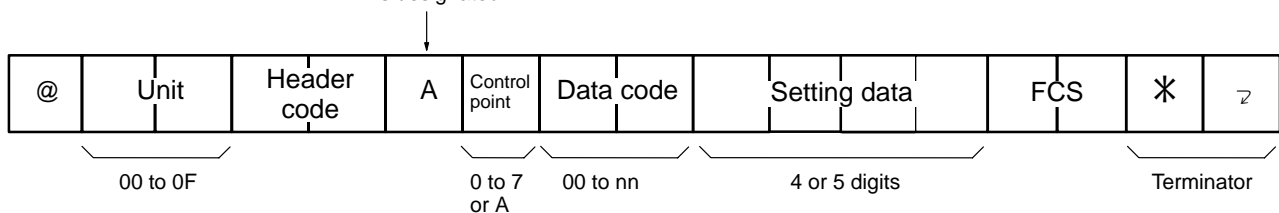
Status Read (RX) can be used with a data code to read a variety of data as shown in the following table.

Header code	Memory bank	Control point	Data code	Data to be read
RX	0	0 to 7 or A	00	Process value
			01	Output value
			02	Status
			03	Heater current value
			04	Present set point
			AA	The contents of data codes 00 to 02 in sequence
			BB	The contents of data codes 00 to 04 in sequence

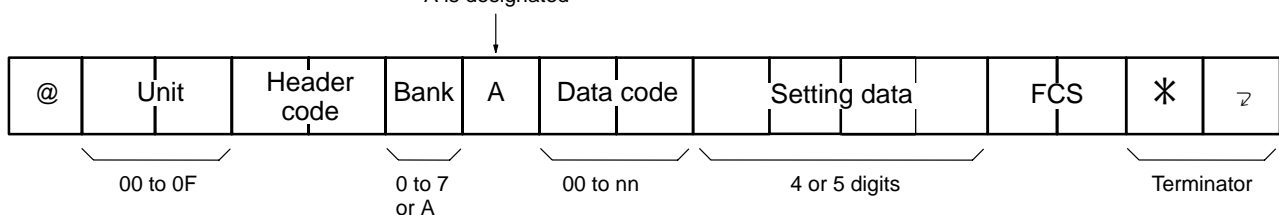
## Function

## Commands

A is designated

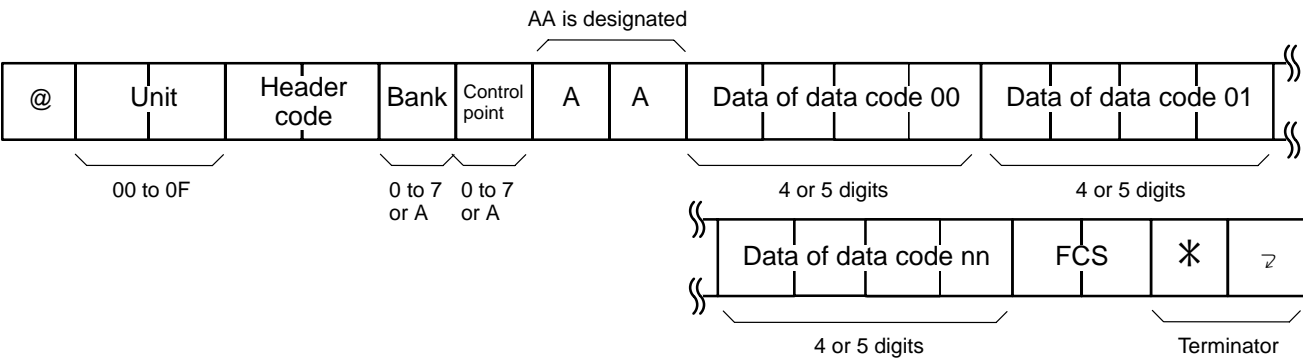


A is designated

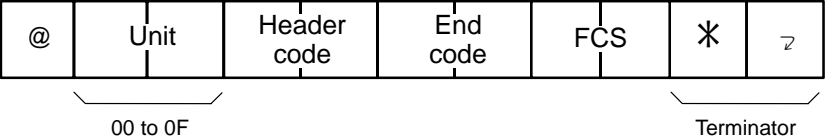




Use the following command format so that the contents of all data codes can be set.



Response

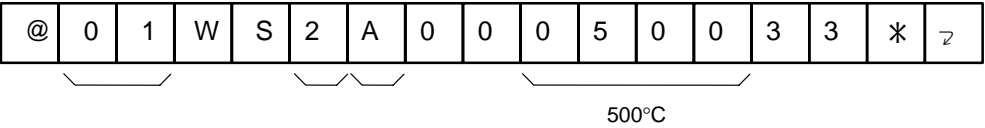


Communications Example

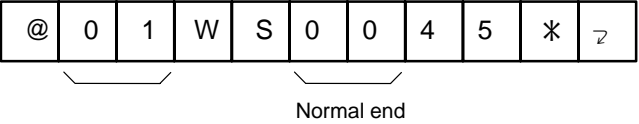
In this example, the following unit number, memory bank number, and set point of all the control points are set.

Unit no.: 1  
Memory bank no: 2  
Set point: 500°C

Command



Response



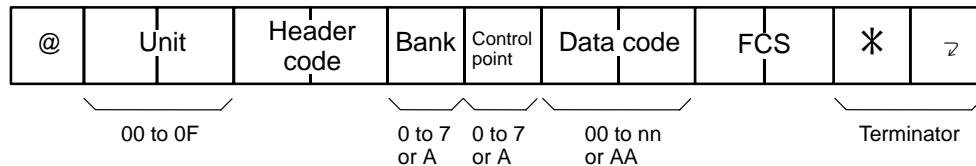
## 2-3 Reading Sets of Data

### Function

A single command block can make it possible to read the contents of all the memory banks or control points, or the contents of all data codes.

### Command

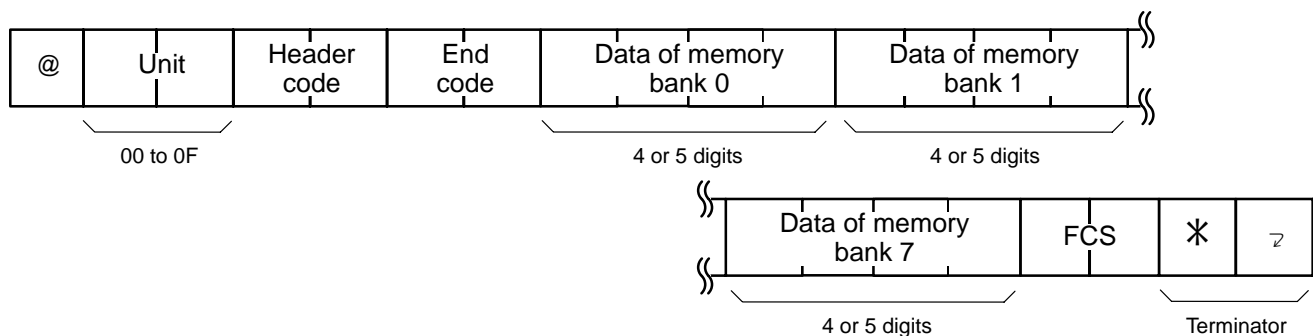
Designate A or AA for the set of memory bank data, control point data, or data code of the command block to read the set of data. A or AA can be used only once in the command block.



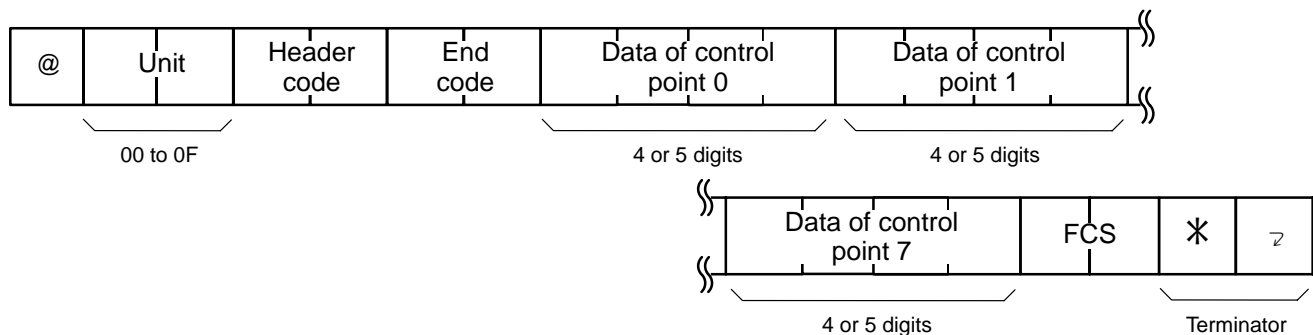
It is not possible to use A or AA only once in a command block (e.g., if A is used for the memory bank data, it cannot be used for the control point data and AA cannot be used for the data code).

### Response

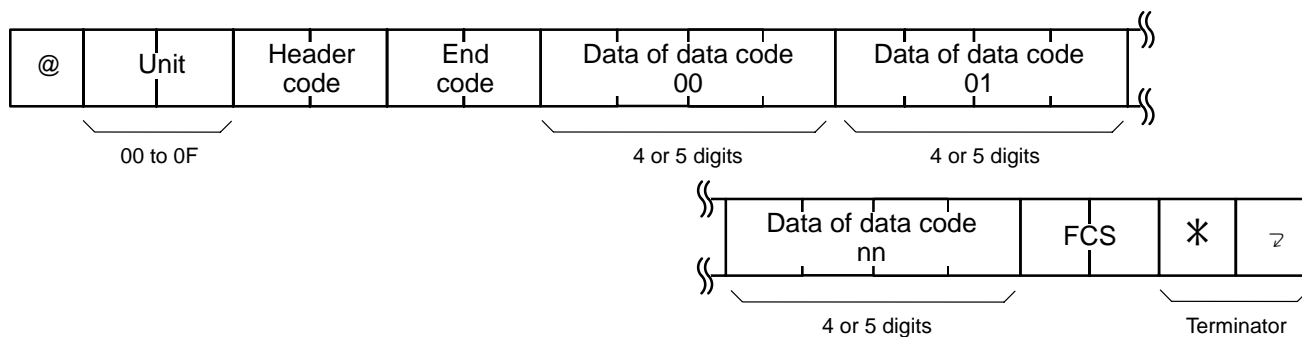
Use the following command format so that the contents of all the memory banks can be read.



Use the following command format so that the contents of all the control points can be read.



Use the following command format so that the contents of all data codes can be read.

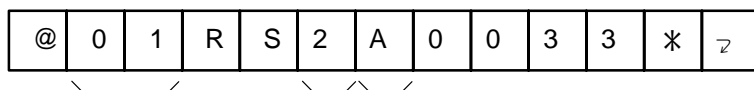


### Communications Example

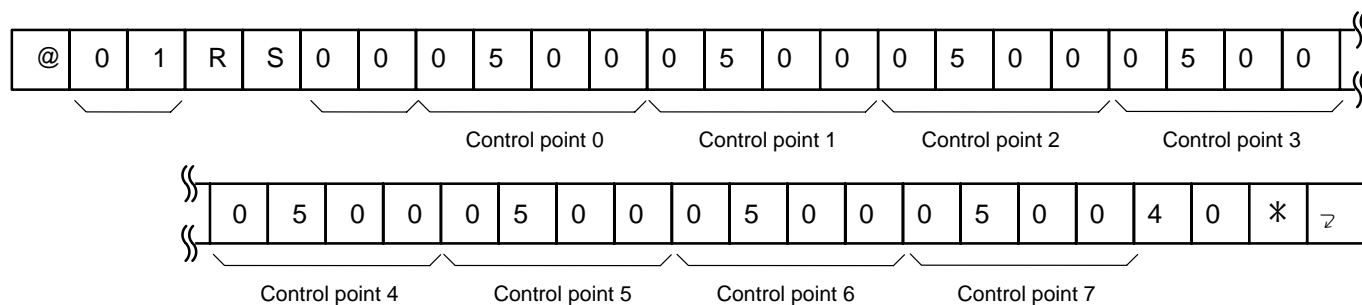
In this example, the following unit number, memory bank number, and set point of all the control points are set.

Unit no.: 1  
 Memory bank no.: 2  
 Set point: 500°C

#### Command



#### Response



## 2-4 End Codes

### List of End Codes

End code	Name	Command	Cause	Remedy
00	Normal End	---	---	---
01	Prohibited Command	WB, WN, WV, WI*, WS, WT, WH, WK, WL, WG, Wj, Wk, WI**, WD, WC, OS, OM	The designated control point is being auto-tuned.	Send the command after interrupting the auto-tuning of the control point.
		W#, MC	The E5ZE is in control operation or manual operation at the designated control point.	Send the command after interrupting the control operation or manual operation at the control point.
		WM	The memory bank designation method has been set to contact input designation.	Set the memory bank designation method to communications designation. Refer to the <i>E5ZE Operation Manual</i> for details.
			The designated control point is being auto-tuned.	Send the command after interrupting the auto-tuning of the control point.
		AS	The control operation at the designated control point is stopped.	Execute the auto-tuning after the E5ZE starts temperature control at the control point.
			The designated control point is already being auto-tuned.	Correct the program because the control point being auto-tuned does not accept Auto-tuning Start (AS).
		WO	The E5ZE was not in manual operation at the designated control point.	Send the command after sending Manual Operation Start (OM) to the E5ZE to start the manual operation.
		WU	The E5ZE is in temperature control operation or manual operation at the designated control point.	Send the command after interrupting the temperature control operation or manual operation at the control point.
			HB Alarm and HS Alarm Point Write (WU) with data code 02 was sent to an E5ZE model without HB or HS alarm function.	This command cannot be sent to any E5ZE model without HB or HS alarm function.
		WW, RW	These commands were sent to an E5ZE model without HB or HS alarm function.	These commands cannot be sent to any E5ZE model without HB or HS alarm function.
			The HB or HS alarm function of the designated control point was not valid.	Before sending these commands, send HB Alarm and HS Alarm Point Write (WU) to the designated control point so that the HB and HS alarms of the designated control point will be valid.
		RZ	The E54-E8CT CT Input Unit is not connected to the E5ZE.	Connect the E54-E8CT CT Input Unit to the E5ZE.
04	Invalid Address	---	A nonexistent control point, memory bank, or data code was designated.	Designate the control point, memory bank, and data code correctly.
			A was designated for the control point and memory bank and AA was designated for the data code simultaneously.	A or AA can be used only once in each command block.

End code	Name	Cause	Remedy
10	Parity Error	The data sent was not even parity.	Set the host system data to even parity.
		The parity was not detected correctly.	It is possible that E5ZE communications suffered noise interference. Separate the communication cable from other wires.
11	Framing Error	The stop bit was not detected.	It is possible that E5ZE communications suffered noise interference. Separate the communication cable from other wires.
12	Overrun Error	The reception buffer overflowed.	It is possible that E5ZE communications suffered noise interference. Separate the communication cable from other wires.
			Reduce the communications speed used for the communications between the E5ZE and host computer because the communications speed is too high for the E5ZE.
13	FCS Error	The FCS was calculated incorrectly.	Refer to 3-3 <i>Communications and Checks</i> and make sure that the calculation of the FCS is correct.
		The FCS was not detected correctly.	It is possible that E5ZE communications suffered noise interference. Separate the communication cable from other wires.
14	Format Error	The format of the command block was incorrect.	Check the format of the command block. Make sure that the format of the command block is correct, especially whether the number of digits of the set temperature is four or five.
15	Numeric Error	The set data for the command was not within the setting range of the command.	Send data within the setting range.
		The negative (–) symbol was not added to the leftmost set value while the set data was a negative value.	Add the negative (–) symbol to the leftmost set data on the left.
18	Frame Length Error	The command block exceeded 510 characters.	Check the contents of the command block.
19	Invalid Command due to Error Status	The present alarm temperature set value is not within the alarm range set with Alarm Mode Write (W#).	Change the alarm temperature set value within the alarm range before setting the alarm mode.

End code	Name	Cause	Remedy
21	Invalid Command Due to Error Status	There is a temperature controller error.	<p>Check the type of temperature controller error with Output Operation Read (RU). Take the following countermeasures according to the kind of temperature controller error.</p> <p><u>Memory Error</u></p> <p>Turn the power OFF and ON. If a memory error occurs again, send Initialize Setting Data (MC) and Memory Write (WE) in this order and turn the power OFF and ON again. If a memory error still occurs, the memory needs repairs.</p> <p><u>Cold Junction Compensation Error</u></p> <p>The ambient operating temperature is <math>-15^{\circ}\text{C}</math> or less, or <math>60^{\circ}\text{C}</math> or more. Use the E5ZE at an ambient operating temperature of <math>-15^{\circ}</math> to <math>60^{\circ}\text{C}</math>.</p> <p><u>Set Data Error</u></p> <p>The set point at some control points or in some memory banks are not within the setting range. Initialize Setting Data (MC) must be sent to initialize all the data items and reset the data items within the setting range.</p> <p><u>Other Errors</u></p> <p>Turn the power OFF and ON. If the same errors occur, the E5ZE needs repairs.</p>

- Note**
1. \*Upper-case I ("ai").
  2. \*\*Lower-case l ("el")

### End Code Priority

If multiple end codes are generated by execution of a single command, only the end code with the highest priority will be returned with the response. End code priority, from highest to lowest, is as follows:

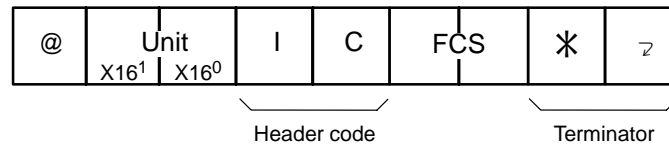
1. Framing errors
2. Parity errors
3. Overrun errors
4. Frame length errors
5. FCS errors
6. Command undefined errors
7. Invalid address
8. Format errors
9. Error status
10. Prohibited command
11. Numeric errors
12. Invalid commands due to error status

## 2-5 Error Codes

### Command Undefined Error

The E5ZE will send back the following response block if the E5ZE cannot recognize the header code. In such cases, check the header code of the command block.

#### Response



### List of Error Codes

Error code	Name	Command	Cause	Remedy
E001	Memory Error	RX	The memory contents were destroyed.	Turn the power OFF and ON. If a memory error occurs again, send Initialize Setting Data (MC) and Memory Write (WE) in this order and turn the power OFF and ON again. If a memory error still occurs, the memory needs repairs.
E002	Sensor Input AD Error	RX	The sensor AD converter circuitry failed.	Turn the power OFF and ON. If a sensor input AD error occurs again, the sensor AD converter circuitry needs repairs.
E003	Cold Junction Compensation Error	RX	The ambient operating temperature is $-15^{\circ}\text{C}$ or less, or $60^{\circ}\text{C}$ or more.	Use the E5ZE at an ambient operating temperature of $-15^{\circ}$ to $60^{\circ}\text{C}$ .
E004	CT Input AD Error	RZ	The CT input AD converter circuitry failed.	Turn the power OFF and ON. If a CT input AD error occurs again, the CT input AD converter circuitry needs repairs.
E011	Sensor Error	RX	The wires of a temperature sensor connected to the E5ZE are burnout, shorted, or incorrectly wired.	Make sure that the wires of the temperature sensor are not burnout, shorted, or incorrectly wired.
E012	Upper Limit Error	RX	The process value at the designated control point was $20^{\circ}\text{C}/40^{\circ}\text{F}$ or more than the set point upper limit value.	Use the E5ZE so that the process value will not exceed the upper limit.
E013	Lower Limit Error	RX	The process value at the designated control point was $20^{\circ}\text{C}/40^{\circ}\text{F}$ or less than the set point lower limit value.	Use the E5ZE so that the process value will not be less than the lower limit.
E022	Heater Current Upper Limit Error	RZ	The process heater current value at the designated control point was 55.0 A or more.	The E5ZE cannot measure a heater current value of 55.0 A or more.
M001	Temperature Control Interrupted	Rs	The temperature control operation of the designated control point is stopped.	The ramp function does not operate and reading is not possible while operational control is stopped.