Digital indicator
with alarm function

AE500

Communication Instruction Manual

RKC® RKC INSTRUMENT INC.

IMAE02-E3

Thank you for purchasing the RKC instrument. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place this manual in a convenient location for easy reference.

SYMBOLS

WARNING : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

CAUTION : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

 : This mark indicates that all precautions should be taken for safe usage.

 : This mark indicates important information on installation, handling and operating procedures.

 : This mark indicates supplemental information on installation, handling and operating procedures.

 : This mark indicates where additional information may be located.

⚠ WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take adequate measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.
  The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage or failure, protect the power line and the input/output lines from high currents with a protection device such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- Do not connect modular connectors to telephone line.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC software is licensed for use with one computer and cannot be modified. This software may not be duplicated except for backup purposes.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
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CONTENTS

MEMO

1. SPECIFICATIONS

Interface: Based on RS-485, EIA standard

Connection method: 2-wire system, half-duplex multi-drop connection

Communication distance: 1 km max.
The maximum communication distance will be affected by the surrounding conditions.

Synchronous method: Start/stop synchronous type

Communication speed: 2400 bps, 4800 bps, 9600 bps, 19200 bps

Data bit configuration:
Start bit: 1
Data bit: 7 or 8
Parity bit: Without, Odd or Even
Stop bit: 1 or 2

Protocol: ANSI X3.28 subcategory 2.5, A4
Polling/selecting type

Error control: Vertical parity (With parity bit selected)
Horizontal parity (BCC check)

Communication code: ASCII 7-bit code

Termination resistor: Externally connected

Xon/Xoff control: None

Maximum connections: 32 instruments maximum including a host computer

Signal logic: RS-485

Signal voltage	Logic
V (A) - V (B) ≥ 2 V	0 (SPACE)
V (A) - V (B) ≤ -2 V	1 (MARK)

Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

2. WIRING

⚠ WARNING

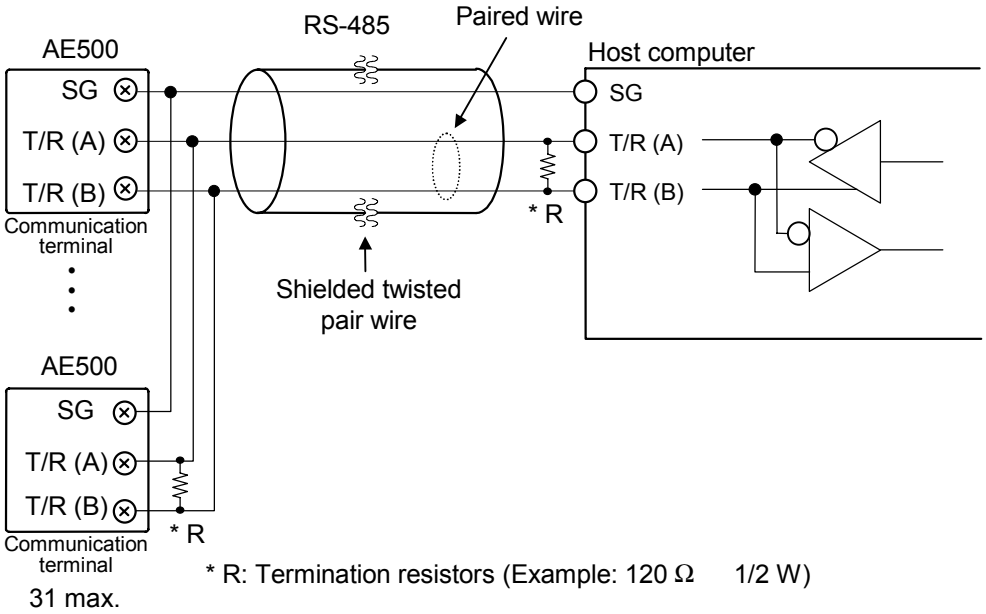
To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

■ Connector pin number and signal details

Pin No.	Symbol name	Symbol
13	Signal ground	SG
14	Send data/Receive data	T/R (A)
15	Send data/Receive data	T/R (B)

■ Wiring method

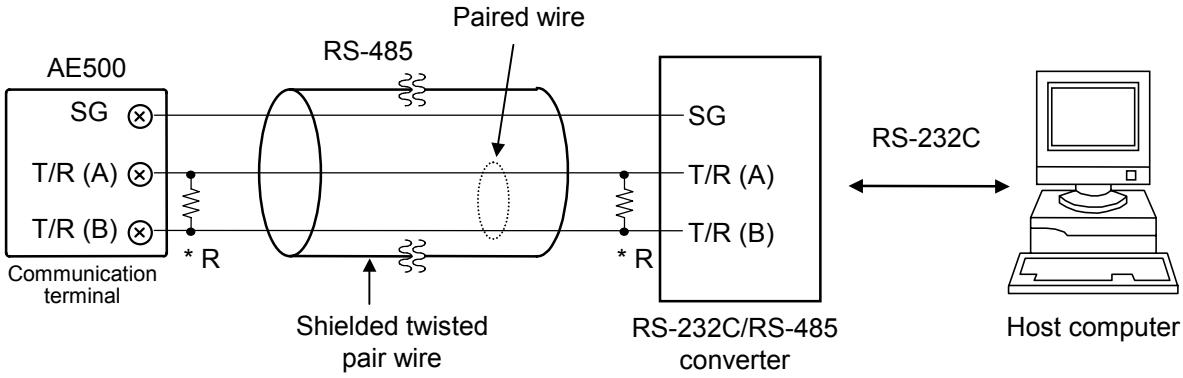
● Connection to the RS-485 port of the host computer



* R: Termination resistors (Example: 120 Ω 1/2 W)

● Connection to the RS-232C port of the host computer

A RS-232C/RS-485 converter is required.

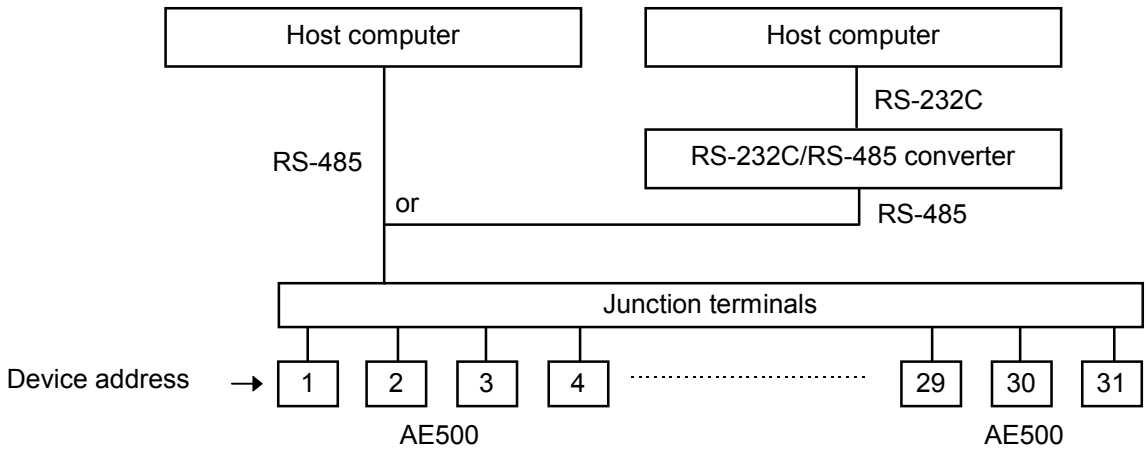


* R: Termination resistors (Example: 120 Ω 1/2 W)

When the host computer uses **Windows 95/98/NT**, use a RS-232C/RS-485 converter with an automatic send/receive transfer function.
Recommended: **CD485**, **CD485/V** manufactured by Data Link, Inc. or equivalent.

The cable is provided by the customer.

■ Connection with up to 31 AE500 and one host computer



3. SETTING FOR COMMUNICATION

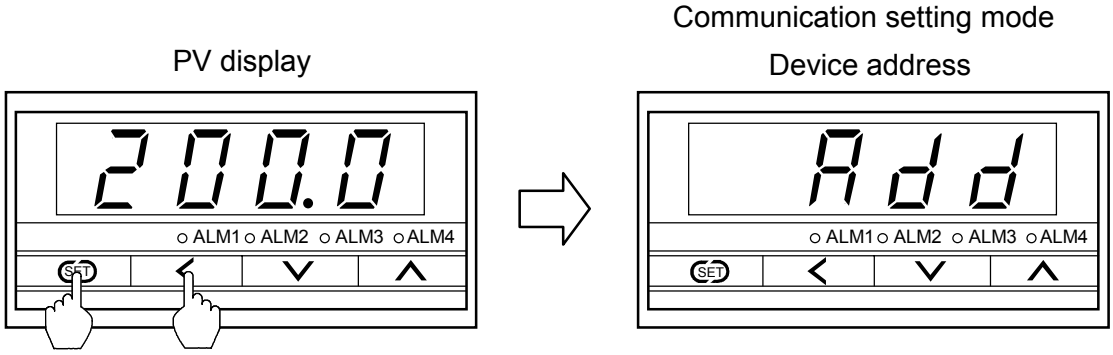
In order to make communication between the digital indicator AE500 and the host computer, it is necessary to set the device address, communication speed, data bit configuration and interval time. Communication settings are made in communication setting mode.

The section in each picture is dimly lit.

3.1 Transfer to Communication Setting Mode

1. Turn on the power to the AE500. Thus, the input type and PV display change in this order.

2. Pressing the SET key while the shift key is being pressed when PV display is being displayed selects communication setting mode. In this mode, device address *Add* are displayed in the first place.

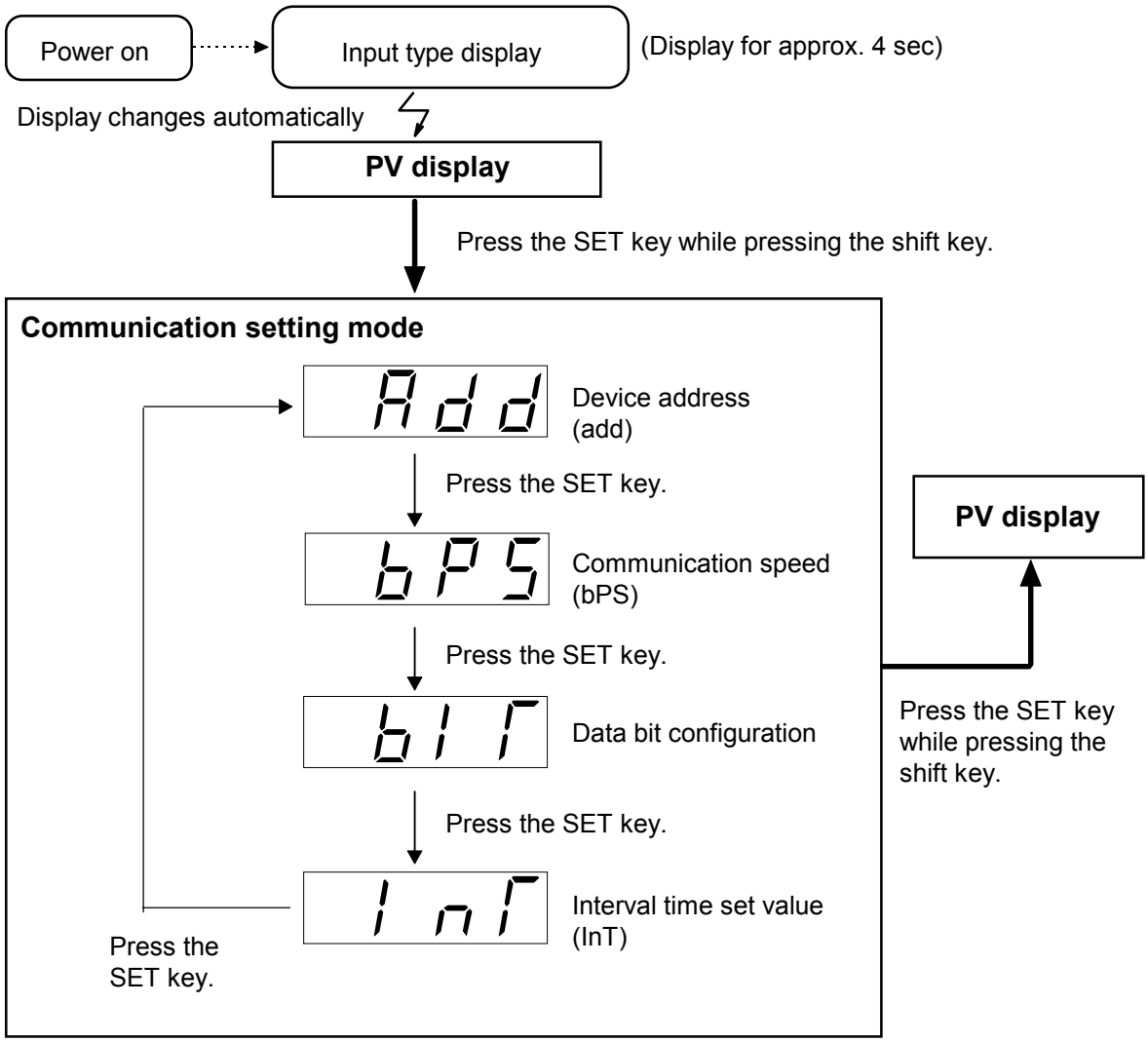


In order to terminate the communication setting mode, press the SET key while pressing the shift key. After the communication setting mode terminates, the display changes to the PV display.

3.2 Communication Parameter Selection

Parameters in communication setting mode are selected in the order of device address *Add*, communication speed *bPS*, data bit configuration *bIT* and interval time set value *InT*. Each parameter is selected by pressing the SET key.

■ Display flowchart



3.3 Device Address Setting

Set the device address by using numerals from 0 to 99. Press the UP or DOWN key to change the numeral, and also press the shift key to shift the digit.

Symbol	Name	Setting range	Description	Factory set value
Add	Device address	0 to 99	Sets the AE500 device address.	0
Add				

When the communication parameter was changed, always turn on the power again. Otherwise, no communication is performed by using the changed value.

If key operation is not performed for more than 1 minute without pressing the SET key after the device address is set, the AE500 is automatically changed to PV display. In this case, the set device address returns to the value before the setting is changed.

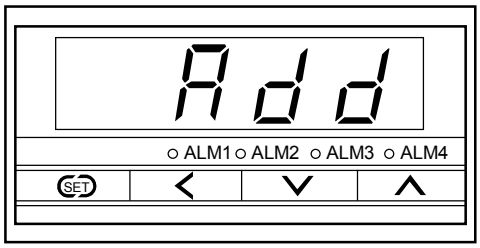
■ Setting procedure

Example: When setting device address to 15.

1. Change the AE500 to communication setting mode, and then display the device address

☞ For details, see the **3.1 Transfer to Communication Setting Mode (P. 4)** and **3.2 Communication Parameter Selection (P. 5).**

Device address



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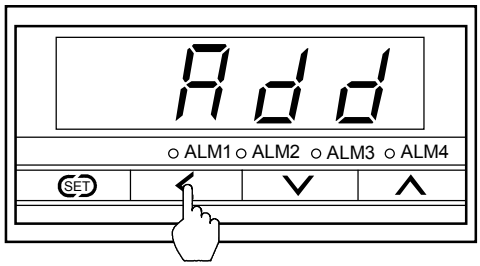
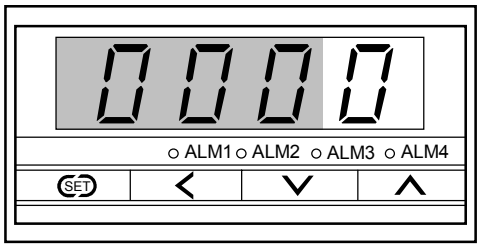
2. Press the shift key to change the display from character to set value.

Character display of device address



Set value display of device address



3. Set the device address. Press the UP key to enter *5* in the lowest digit.

4. Press the shift key to brightly light the tens digit.

Continued on the next page.

5. Press the UP key to enter *1* in the tens digit.

6. Press the SET key to select the next communication parameter “Communication speed (bPS).” As a result, the set device address is registered.

3.4 Communication Speed Setting

Set a communication speed of 2400 bps, 4800 bps, 9600 bps or 19200 bps by using numerals from 0 to 3. Press the UP or DOWN key to change the numeral.

Symbol	Name	Setting range	Description	Factory set value
bPS **bPS**	Communication speed	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps	Selects the communication speed.	2

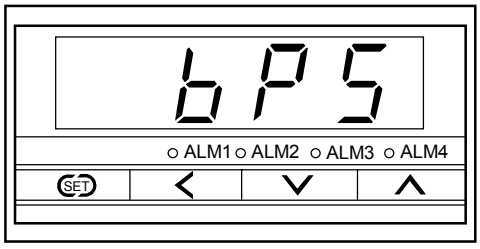
- Set the same communication speed to both the AE500 and connecting host computer.
- When the communication parameter was changed, always turn on the power again. Otherwise, no communication is performed by using the changed value.
- If key operation is not performed for more than 1 minute without pressing the SET key after the device address is set, the AE500 is automatically changed to PV display. In this case, the set communication speed returns to the value before the setting is changed.

■ Setting procedure

Example: When setting communication speed to "1: 4800 bps."

1. Change the AE500 to communication setting mode, and then display the communication speed.
☞ For details, see the **3.1 Transfer to Communication Setting Mode (P. 4)** and **3.2 Communication Parameter Selection (P. 5).**

Communication speed



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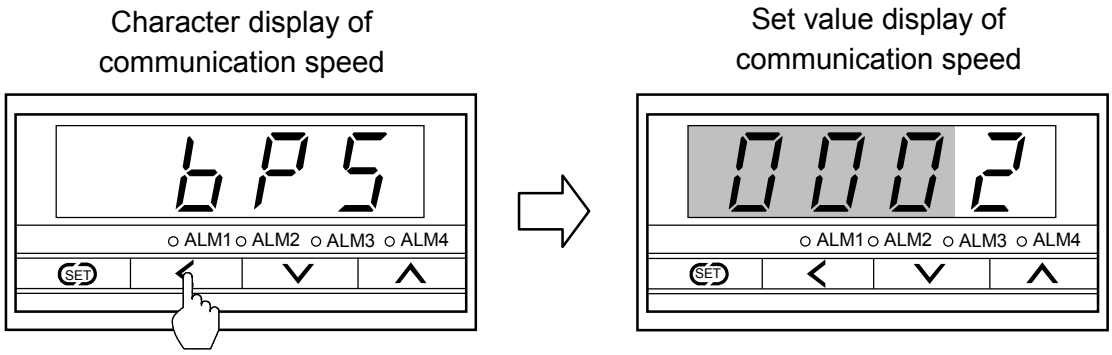
2. Press the shift key to change the display from character to set value.



3. Press the DOWN key to enter *1* in the lowest digit. As a result, a communication speed of 4800 bps is set.

4. Press the SET key to change to the next communication parameter "Data bit configuration (bIT)."As a result, the set communication speed is registered.

3.5 Data bit Configuration Setting

Set the data bit configuration during communication. Press the UP or DOWN key to change the numeral.

Symbol	Name	Setting range	Description	Factory set value
bIT	Data bit configuration	0 to 5 See Data bit configuration table	Selects data bit configuration during communication.	0

Data bit configuration table

Setting	Data bit [bit]	Parity bit	Stop bit [bit]
0	8	None	1
1	8	None	2
2	7	Even	1
3	7	Even	2
4	7	Odd	1
5	7	Odd	2

- Set the same data bit configuration to both the AE500 and connecting host computer.
- When the communication parameter was changed, always turn on the power again. Otherwise, no communication is performed by using the changed value.
- If key operation is not performed for more than 1 minute without pressing the SET key after the device address is set, the AE500 is automatically changed to PV display. In this case, the set data bit construction returns to the value before the setting is changed.

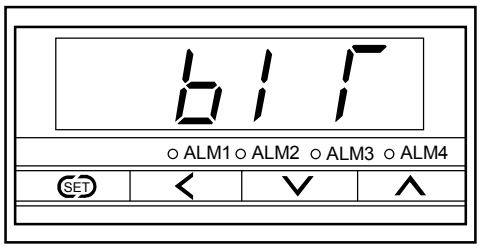
■ Setting procedure

Example: When setting data bit configuration to "1: 8 data bits, no parity bit and 2 stop bits."

1. Change the AE500 to communication setting mode, and then display the data bit configuration.

☞ For details, see the **3.1 Transfer to Communication Setting Mode (P. 4)** and **3.2 Communication Parameter Selection (P. 5).**

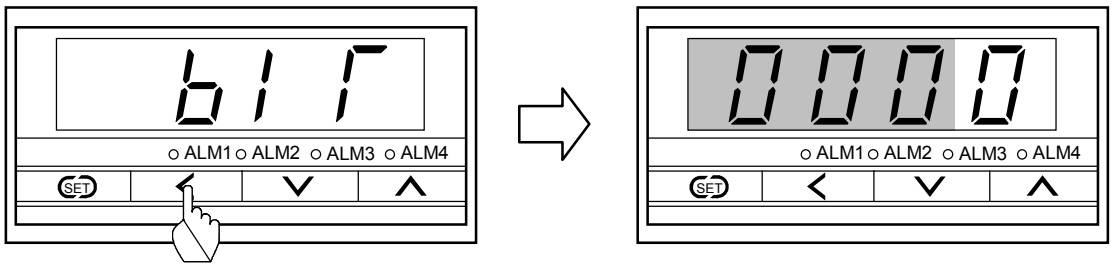
Data bit configuration



2. Press the shift key to change the display from character to set value.

Character display of data bit configuration

Set value display of data bit configuration



3. Press the UP key to enter *1* in the lowest digit. As a result, data bit configuration is set to "8 data bits, no parity bit and 2 stop bits."

4. Press the SET key to change to the next communication parameter "Interval time set value (InT)."

As a result, the set data configuration is registered.

3.6 Interval Time Setting

Set the interval time. Press the UP or DOWN key to change the numeral, and press the shift key to shift the digit.

Symbol	Name	Setting range	Description	Factory set value
InT	Interval time set value	0 to 150 *	Sets the value to set the interval time.	5

* Can be set up to 250 ms if converted to interval time.

Equations for calculating interval time and interval time set value

Equations :

Interval time = Interval time set value × 1.666 ms
Interval time set value = Interval time ÷ 1.666 ms

When the communication parameter was changed, always turn on the power again. Otherwise, no communication is performed by using the changed value.

If key operation is not performed for more than 1 minute without pressing the SET key after the device address is set, the AE500 is automatically changed to PV display. In this case, the set interval time set value returns to the value before the setting is changed.

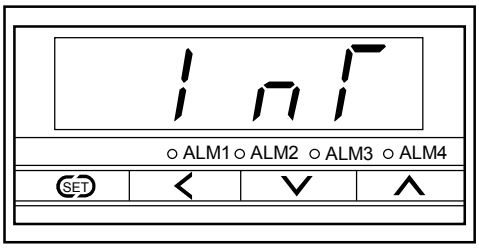
■ Setting procedure

Example: When setting interval time to 250 ms.

1. Change the AE500 to communication setting mode, and then display the interval time set value

☞ For details, see the **3.1 Transfer to Communication Setting Mode (P. 4)** and **3.2 Communication Parameter Selection (P. 5).**

Interval time



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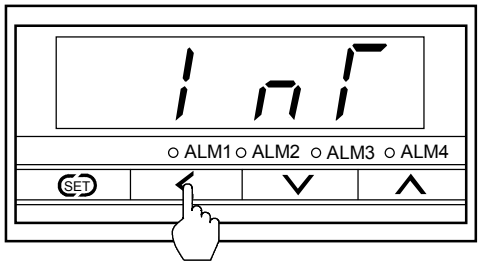
2. Press the shift key to change the display from character to set value.

Character display of interval time



Set value display of interval time

3. Here, as an interval time of 250 ms needs to be set, calculate the interval time set value using the equation.

☞ For the equation, see the **Equations for calculating interval time and interval time set value (P. 13).**

Interval time set value:

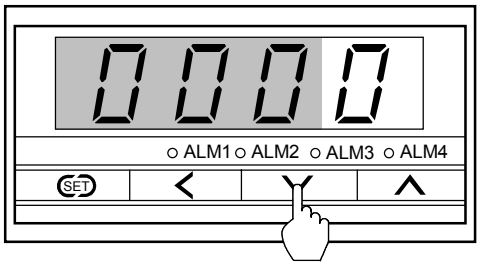
250 ms ÷ 1.666 ms ≒ 150 (Round to the nearest whole number.)

Interval time:

150 × 1.666 ms ≒ 249.9 (Approx. 250 ms)

Thus, enter an interval time set value of 150 calculated from the above by pressing the UP or DOWN key at the front of the AE500.

4. Press the DOWN key to enter *0* in the lowest digit.



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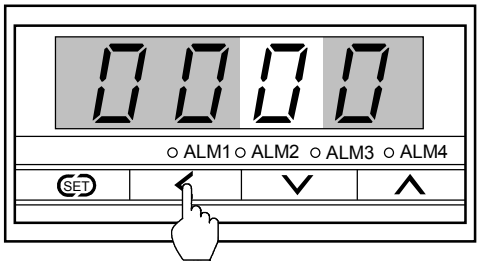
5. Press the shift key to brightly light the tens digit.



6. Press the UP key to enter *5* in the tens digit.

7. Press the shift key to brightly light the hundreds digit.

Continued on the next page.

8. Press the UP key to enter *1* in the hundreds digit.

9. Press the SET key to change to the first communication parameter “Device address (Add).” As a result, the set interval time set value is registered.

3.7 Communication Requirements

■ Processing times during data send/receive

The AE500 requires the following processing times during data send/receive.
Whether the host computer is using either the polling or selecting procedure for communication, the following processing times are required for AE500 to send data:

-Response wait time after AE500 sends BCC in polling procedure
-Response wait time after AE500 sends ACK or NAK in selecting procedure

RKC communication (Polling procedure)

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after AE500 receives ENQ	1.5	2.0	3.0
Response send time after AE500 receives ACK	1.5	2.0	3.5
Response send time after AE500 receives NAK	1.0	1.5	3.0
Response send time after AE500 sends BCC	—	0.7	1.0

RKC communication (Selecting procedure)

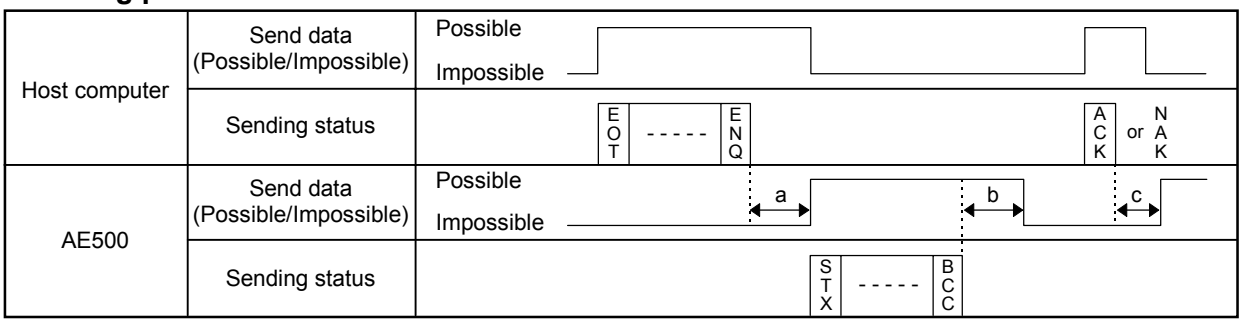
Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after AE500 receives BCC	2.0	3.0	4.0
Response wait time after AE500 sends ACK	—	0.7	1.0
Response wait time after AE500 sends NAK	—	0.7	1.0

Response send time is time at having set interval time in 0 ms.

■ RS-485 (2-wire system) send/receive timing

The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Typical polling and selecting procedures between the host computer and AE500 are described below:

● Polling procedure

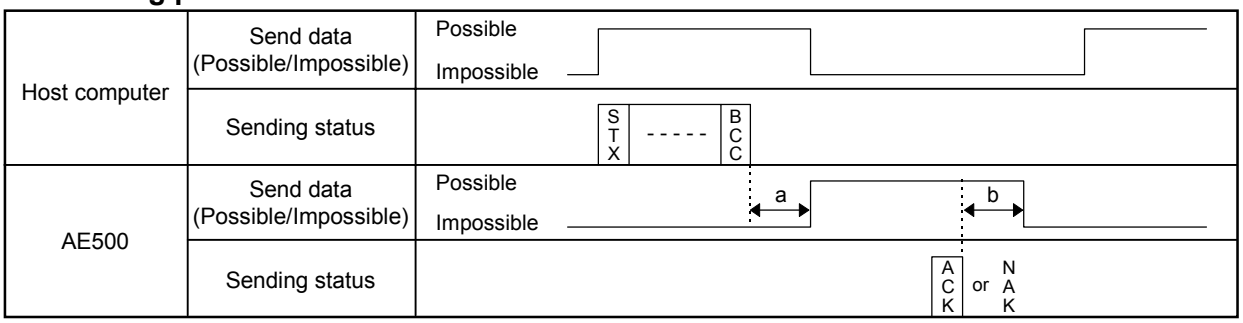


a: Response send time after AE500 receives [ENQ] + Interval time

b: Response send time after AE500 sends BCC

c: Response send time after AE500 receives [ACK] + Interval time or
Response send time after AE500 receives [NAK] + Interval time

● Selecting procedure



a: Response send time after AE500 receives BCC + Interval time

b: Response wait time after AE500 sends ACK or Response wait time after AE500 sends NAK

To switch the host computer from transmission to reception, send data must be on line. To check if data is on line, do not use the host computer's transmission buffer but confirm it by the shift register.

Whether the host computer is using either the polling or selecting procedure for communication, the following processing times are required for AE500 to send data:

-Response wait time after AE500 sends BCC in polling procedure

-Response wait time after AE500 sends ACK or NAK in selecting procedure

■ Fail-safe

A transmission error may occur with the transmission line disconnected, shorted or set to the high-impedance state. In order to prevent the above error, it is recommended that the fail-safe function be provided on the receiver side of the host computer. The fail-safe function can prevent a framing error from its occurrence by making the receiver output stable to the MARK (1) when the transmission line is in the high-impedance state.

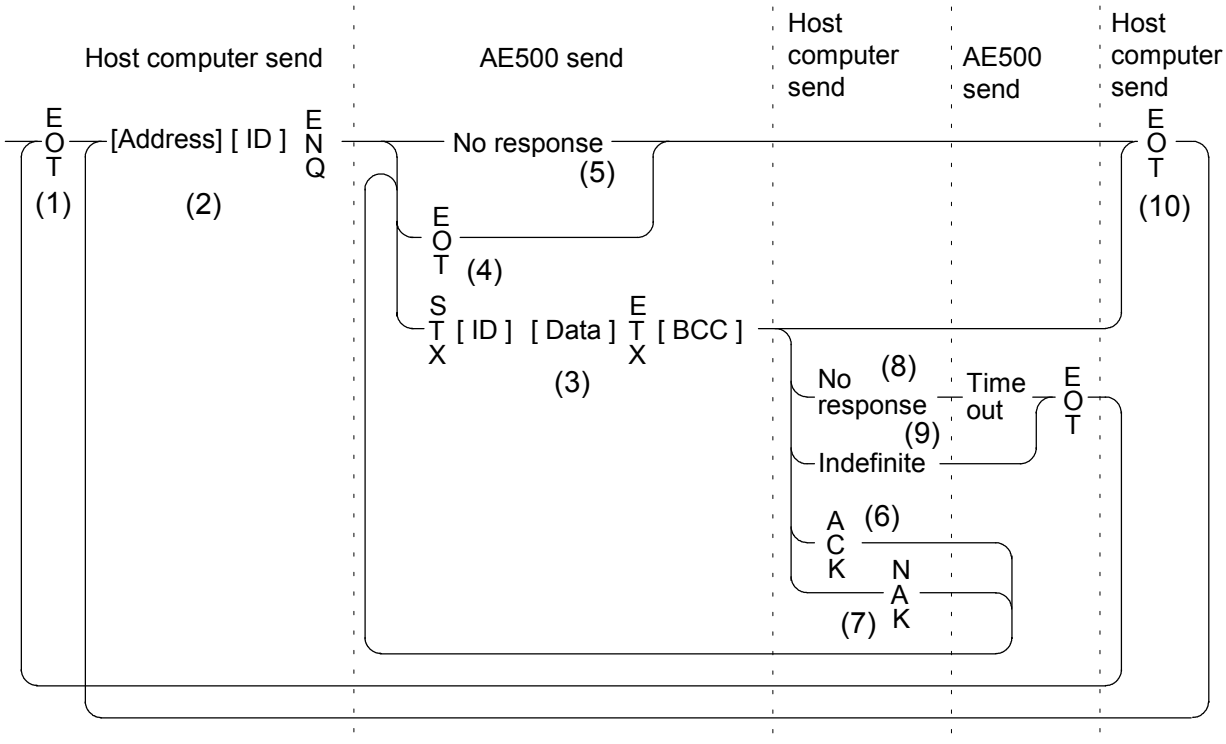
4. PROTOCOL

AE500 uses the polling/selecting method to establish a data link. The basic procedure is followed ANSI X3.28 subcategory 2.5, A4 basic mode data transmission control procedure (Fast selecting is the selecting method used in this AE500).

- The polling/selecting procedures are a centralized control method where the host computer controls the entire process. The host computer initiates all communication so the AE500 responds according to queries and commands from the host.
- The code use in communication is 7-bit ASCII code including transmission control characters. The transmission control characters are EOT (04H), ENQ (05H), ACK (06H), NAK (15H), STX (02H) and ETX (03H). The figures in the parenthesis indicate the corresponding hexadecimal number.

4.1 Polling

Polling is the action where the host computer requests one of the connected AE500s to transmit data. An example of the polling procedure is shown below:



ID: Identifier

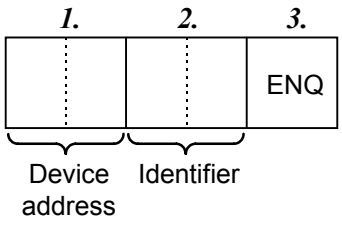
4.1.1 Polling procedures

(1) Data link initialization

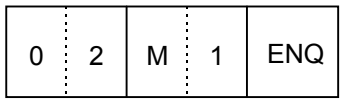
Host computer sends EOT to the AE500s to initiate data link before polling sequence.

(2) Data sent from host computer - Polling sequence

Host computer sends polling sequence with the format shown below:



Example:



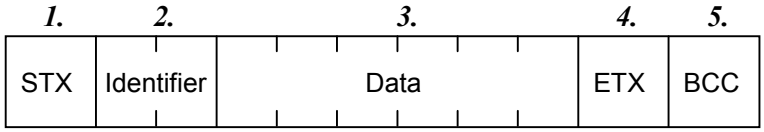
1. Device address (2 digits)
The device address specifies the AE500 to be polled and each AE500 must have its own unique device address.
☞ For details, see **3.3 Device Address Setting (P. 6)**.

2. Identifier (2 digits)
The identifier specifies the type of data that is requested from the AE500.
☞ For details, see **4.3 Communication Identifier List (P. 28)**.

3. ENQ
The ENQ is the transmission control character that indicates the end of the polling sequence. The ENQ must be attached to the end of the identifier. The host computer then must wait for a response from the AE500.

(3) Data sent from the AE500

If the polling sequence is received correctly, the AE500 sends data in the following format:



1. STX
STX is the transmission control character which indicates the start of the text transmission (identifier and data).

2. Identifier (2 digits)
The identifier indicates the type of data (measured value, status and set value) sent to the host computer.
☞ For details, see **4.3 Communication Identifier List (P. 28)**.

3. Data (6 digits [Expect model code.])
Data is the information being sent from the AE500. It is expressed in decimal ASCII code including a minus sign (-) and a decimal point. No zero suppression is made.

4. ETX
ETX is a transmission control character used to indicate the end of text transmission.

5. BCC
BCC (Block Check Character) detects error using horizontal parity and is calculated by horizontal parity (even number).

Calculation method of BCC: *Exclusive OR* all data and characters from STX through ETX, not including STX.

Example:

STX	M	1	0	0	0	5	0	0	ETX	BCC
4DH	31H	30H	30H	30H	35H	30H	30H	03H	←	Hexadecimal numbers

BCC = 4DH ⊕ 31H ⊕ 30H ⊕ 30H ⊕ 30H ⊕ 35H ⊕ 30H ⊕ 30H ⊕ 03H = 7AH
Value of BCC becomes 7AH.

(4) EOT sent from the AE500 (Ending data transmission from the AE500)

In the following cases, the AE500 sends EOT to terminate the data link:

- When the specified identifier is invalid
- When there is an error in the data type
- When all the data has been sent

(5) No response from the AE500

The AE500 will not respond if the polling address is not received correctly. It may be necessary for the host computer to take corrective action such as a time-out.

(6) ACK (Acknowledgment)

An acknowledgment ACK is sent by the host computer when data received is correct. When the AE500 receives ACK from the host computer, the AE500 will send any remaining data of the next identifier without additional action from the host computer.

☞ For the identifier, see **4.3 Communication Identifier List (P. 28)**.When host computer determines to terminate the data link, EOT is sent from the host computer.

(7) NAK (Negative acknowledge)

If the host computer does not receive correct data from the AE500, it sends a negative acknowledgment NAK to the AE500. The AE500 will re-send the same data when NAK is received. This cycle will go on continuously until either recovery is achieved or the data link is corrected at the host computer.

(8) No response from host computer

When the host computer does not respond within approximately three seconds after the AE500 sends data, the AE500 sends EOT to terminate the data link.

(9) Indefinite response from host computer

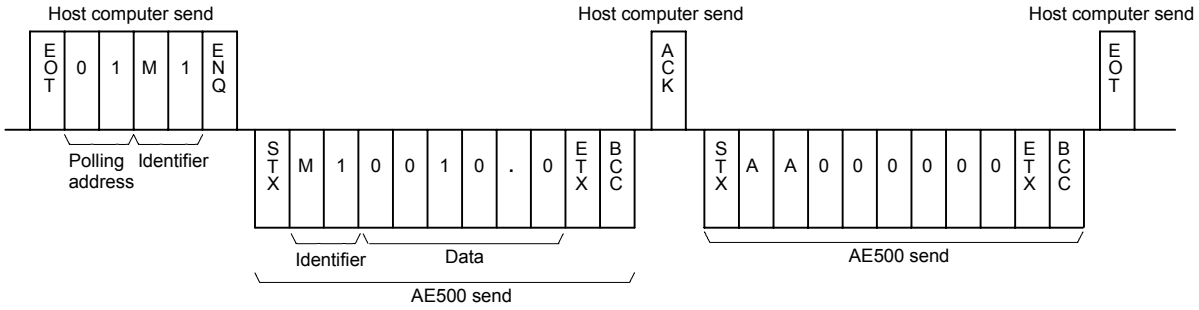
The AE500 sends EOT to terminate the data link when the host computer response is indefinite.

(10) EOT (Data link termination)

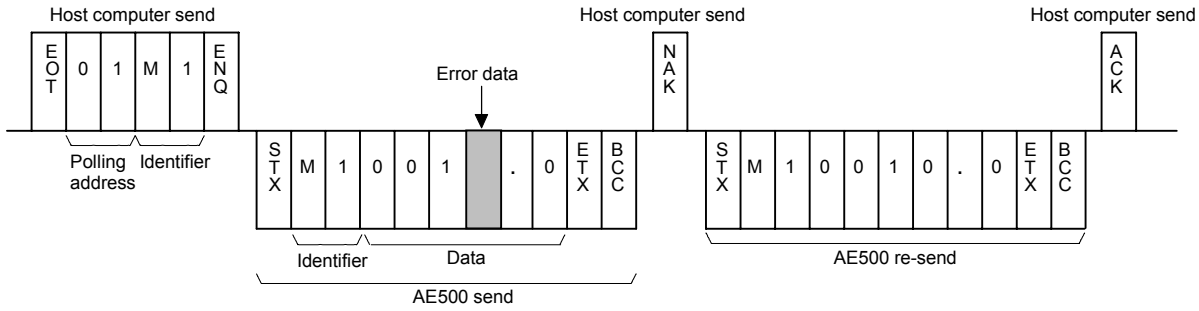
The host computer sends EOT message when it is necessary to suspend communication with the AE500 or to terminate the data link due lack of response from the AE500.

4.1.2 Polling procedure example

■ Normal transmission

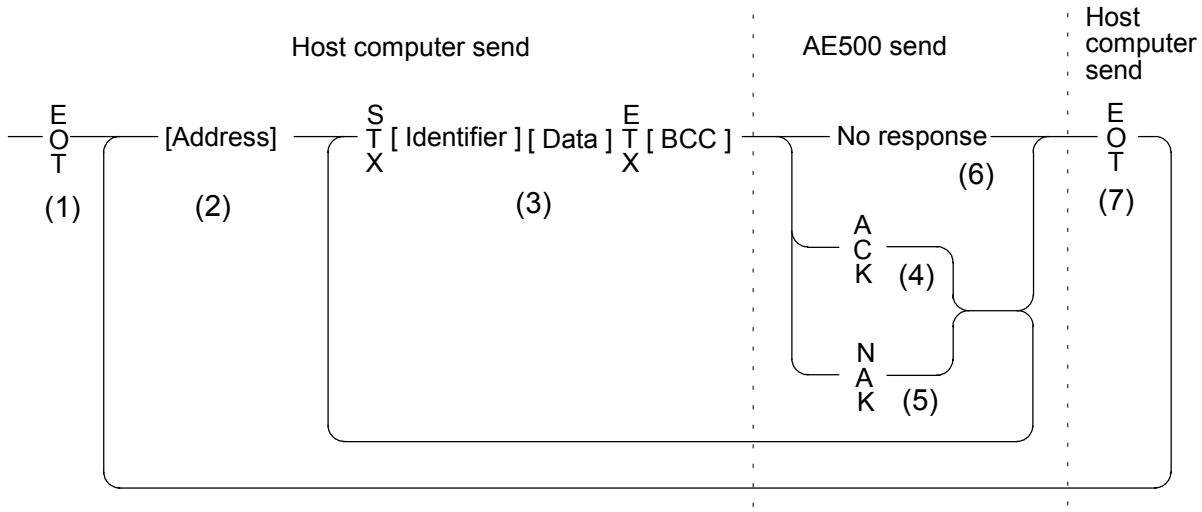


■ Error transmission



4.2 Selecting

Selecting is the action where the host computer requests one of the connected AE500s to receive data. An example of the selecting procedure is shown below:



4.2.1 Selecting procedures

(1) Data link initialization

Host computer sends EOT to the AE500s to initiate data link before selecting sequence.

(2) Sending selecting address from the host computer

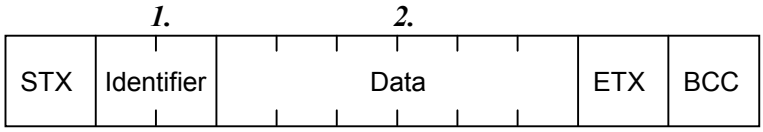
Host computer sends selecting address for the selecting sequence.

Device address (2 digits)
The device address specifies the AE500 to be selected and each AE500 must have its own unique device address.

☞ For details, see **3.3 Device Address Setting (P. 6)**.

(3) Data sent from the host computer

The host computer sends data for the selecting sequence with the following format:



☞ For the STX, ETX and BCC, see **4.1 Polling (P. 19)**.

1. Identifier (2 digits)
The identifier specifies the type of data that is requested from the AE500, such as set value.
☞ For details, see **4.3 Communication Identifier List (P. 28)**.

2. Data (Maximum 6 digits)
Data is the information being sent to the AE500. It is expressed in decimal ASCII code including a minus sign (-) and a decimal point (period).

● **About numerical data**

The data that receipt of letter is possible

- Data with numbers below the decimal point omitted or zero suppressed data can be received.
  <Example> When data send with -001.5, -01.5, -1.5, -1.50, -1.500 at the time of -1.5, AE500 can receive a data.
- When the host computer send data with decimal point to item of without decimal point, AE500 receives a message with the value which cut off below the decimal point.
  <Example> When setting range is 0 to 200, AE500 receives as a following.

Send data	0.5	100.5
Receive data	0	100

- AE500 receives value in accordance with decided place after the decimal point. The value below the decided place after the decimal point is cut off.
  <Example> When setting range is -10.00 to +10.00, AE500 receives as a following.

Send data	-.5	-.058	.05	-0
Receive data	-0.50	-0.05	0.05	0.00

The data that receipt of letter is impossible

AE500 sends NAK when received a following data.

+	Plus sign and the data that gained plus sing
-	Only minus sign (there is no figure)
.	Only decimal point (period)
-.	Only minus sign and decimal point (period)

(4) ACK (Acknowledgment)

An acknowledgment ACK is sent by the AE500 when data received is correct. When the host computer receives ACK from the AE500, the host computer will send any remaining data. If there is no more data to be sent to AE500, the host computer sends EOT to terminate the data link.

(5) NAK (Negative acknowledge)

If the AE500 does not receive correct data from the host computer, it sends a negative acknowledgment NAK to the host computer. Corrections, such as re-send, must be made at the host computer. The AE500 will send NAK in the following cases:

- When an error occurs on communication the line (parity, framing error, etc.)
- When a BCC check error occurs
- When the specified identifier is invalid
- When receive data exceeds the setting range

(6) No response from AE500

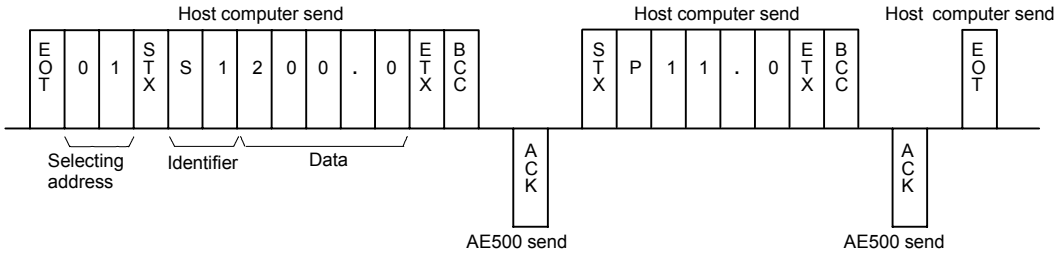
The AE500 does not respond when it can not receive the selecting address, STX, ETX or BCC.

(7) EOT (Data link termination)

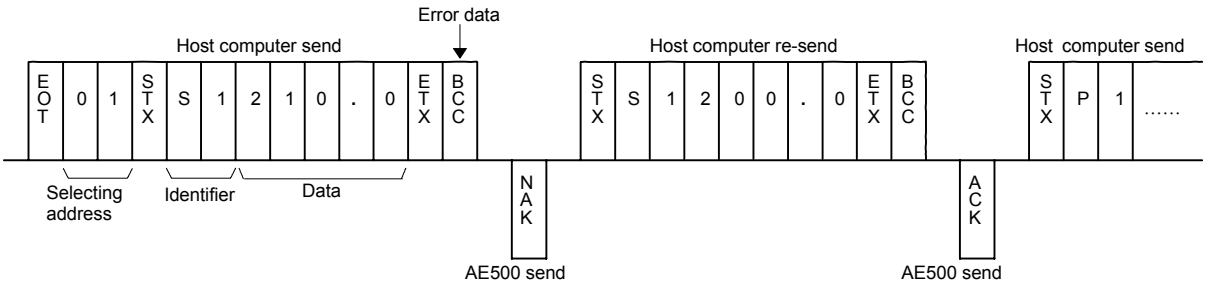
The host computer sends EOT when there is no more data to be sent from the host computer or there is no response from the AE500.

4.2.2 Selecting procedure example

■ Normal transmission



■ Error transmission



4.3 Communication Identifier List

Communication is not possible when an identifier is specified that the AE500 can not recognize.
The number of digits for data is 6.

(Attribute RO: Read only, R/W: Read and Write)

Name	Identifier	Data range	Factory set value	Attribute
Measured value (PV)	M1	Within input range	----	RO
Alarm 1 monitor [1]	AA	0: OFF 1: ON	----	RO
Alarm 2 monitor [2]	AB	0: OFF 1: ON	----	RO
Alarm 3 monitor [3]	AC	0: OFF 1: ON	----	RO
Alarm 4 monitor [4]	AD	0: OFF 1: ON	----	RO
Burnout	B1	0: OFF 1: ON	----	RO
Error code	ER	0 to 255 [a]	----	RO
Alarm 1 setting [1]	A1	Temperature input: -1999 to +9999 °C [°F] or -199.9 to +999.9 °C [°F] Voltage/current inputs: SLL (Setting limiter low limit) to SLH (Setting limiter high limit)	Temperature input: 0 or 0.0 Voltage/current inputs:0.0	R/W
Alarm 2 setting [2]	A2			R/W
Alarm 3 setting [3]	A3			R/W
Alarm 4 setting [4]	A4			R/W
Alarm 1 differential gap setting [1]	HA	Temperature input: 0 to 100 °C [°F] or 0.0 to 100.0 °C [°F] Voltage/current inputs: 0.0 to 10.0 % of span	Temperature input: 2 or 2.0 Voltage/current inputs: 2.0	R/W
Alarm 2 differential gap Setting [2]	HB			R/W

[1] This is an identifier which enables communication at alarm 1 is provided.
[2] This is an identifier which enables communication at alarm 2 is provided.
[3] This is an identifier which enables communication at alarm 3 is provided.
[4] This is an identifier which enables communication at alarm 4 is provided.
[a] Any number other than *0* indicates errors (RAM write error, etc.) detected by the controller self-diagnosis function. Contact your nearest RKC sales office or agent.

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(Attribute RO: Read only, R/W: Read and Write)

Name	Identifier	Data range	Factory set value	Attribute
Alarm 3 differential gap setting [1]	HC	Temperature input: 0 to 100 °C [°F] or 0.0 to 100.0 °C [°F] Voltage/current inputs: 0.0 to 10.0 % of span.	Temperature input: 2 or 2.0 Voltage/ current inputs:	R/W
Alarm 4 differential gap setting [2]	HD			
PV bias	PB	Temperature input: -1999 to +9999 °C [°F] or -199.9 to +999.9 °C [°F] Voltage/current inputs: -span to +span However, within -1999 to +9999	Temperature input: 0 or 0.0 Voltage/ current inputs: 0.0	R/W
Analog output scale high [3]	HV	ALS (Analog output scale low) to SLH (Setting limiter high limit)	SLH	R/W
Analog output scale low [3]	HW	SLL (Setting limiter [low limit) to AHS (Analog output scale high)	SLL	R/W
Set data lock function [4]	LK	0: Can be changed 1: Can not be changed	0	R/W

[1] This is an identifier which enables communication at alarm 3 is provided.

[2] This is an identifier which enables communication at alarm 4 is provided.

[3] This is an identifier which enables communication at analog output is provided.

[4] The set data lock function is effective only for the setting performed by key operation. Setting items in the data lock state cannot be set by key operation, but can a always be selected via communication.

5. INPUT RANGE TABLES

Input Range Table 1

Input type		Input range	Code	
			Input	Range
Thermocouple	K	0 to 200 °C	K	01
		0 to 400 °C	K	02
		0 to 600 °C	K	03
		0 to 800 °C	K	04
		0 to 1000 °C	K	05
		0 to 1200 °C	K	06
		0 to 1372 °C	K	07
		0 to 100 °C	K	13
		0 to 300 °C	K	14
		0 to 450 °C	K	17
		0 to 500 °C	K	20
		0 to 800 °F	K	A1
		0 to 1600 °F	K	A2
		0 to 2502 °F	K	A3
		20 to 70 °F	K	A9
	J	0 to 200 °C	J	01
		0 to 400 °C	J	02
		0 to 600 °C	J	03
		0 to 800 °C	J	04
		0 to 1000 °C	J	05
		0 to 1200 °C	J	06
		0 to 450 °C	J	10
		0 to 800 °F	J	A1
		0 to 1600 °F	J	A2
		0 to 2192 °F	J	A3
		0 to 400 °F	J	A6
		0 to 300 °F	J	A7
	R	0 to 1600 °C *	R	01
		0 to 1769 °C *	R	02
		0 to 1350 °C *	R	04
		0 to 3200 °F *	R	A1
		0 to 3216 °F *	R	A2
	S	0 to 1600 °C *	S	01
		0 to 1769 °C *	S	02
		0 to 3200 °F *	S	A1
		0 to 3216 °F *	S	A2

* Accuracy is not guaranteed between 0 to 399 °C (0 to 799 °F)

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Input type		Input range	Code	
			Input	Range
Thermocouple	B	400 to 1800 °C	B	01
		0 to 1820 °C [1]	B	02
		800 to 3200 °F	B	A1
		0 to 3308 °F [1]	B	A2
	E	0 to 800 °C	E	01
		0 to 1000 °C	E	02
		0 to 1600 °F	E	A1
		0 to 1832 °F	E	A2
	N	0 to 1200 °C	N	01
		0 to 1300 °C	N	02
		0 to 2300 °F	N	A1
		0 to 2372 °F	N	A2
	T	-199.9 to +400.0 °C [2]	T	01
		-199.9 to +100.0 °C [2]	T	02
		-100.0 to +200.0 °C	T	03
		0.0 to 350.0 °C	T	04
		-199.9 to +752.0 °F [2]	T	A1
		-100.0 to +200.0 °F	T	A2
		-100.0 to +400.0 °F	T	A3
		0.0 to 450.0 °F	T	A4
		0.0 to 752.0 °F	T	A5
	W5Re/W26Re	0 to 2000 °C	W	01
		0 to 2320 °C	W	02
		0 to 4000 °F	W	A1
	PL II	0 to 1300 °C	A	01
		0 to 1390 °C	A	02
		0 to 1200 °C	A	03
		0 to 2400 °F	A	A1
		0 to 2534 °F	A	A2
	U	-199.9 to +600.0 °C [2]	U	01
		-199.9 to +100.0 °C [2]	U	02
		0.0 to 400.0 °C	U	03
		-199.9 to +999.9 °F [2]	U	A1
		-100.0 to +200.0 °F	U	A2
		0.0 to 999.9 °F	U	A3

[1] Accuracy is not guaranteed between 0 to 399 °C (0 to 799 °F)
[2] Accuracy is not guaranteed between -199.9 to -100.0 °C (-199.9 to -158.0 °F)

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Input type		Input range	Code	
			Input	Range
Thermocouple	L	0 to 400 °C	L	01
		0 to 800 °C	L	02
		0 to 800 °F	L	A1
		0 to 1600 °F	L	A2
RTD	Pt100	-199.9 to +649.0 °C	D	01
		-199.9 to +200.0 °C	D	02
		-100.0 to +50.0 °C	D	03
		-100.0 to +200.0 °C	D	05
		0.0 to 50.0 °C	D	06
		0.0 to 100.0 °C	D	07
		0.0 to 200.0 °C	D	08
		0.0 to 300.0 °C	D	09
		0.0 to 500.0 °C	D	10
		-199.9 to +999.9 °F	D	A1
		-199.9 to +400.0 °F	D	A2
		-199.9 to +200.0 °F	D	A3
		-100.0 to +300.0 °F	D	A5
		0.0 to 100.0 °F	D	A6
		0.0 to 200.0 °F	D	A7
		0.0 to 400.0 °F	D	A8
		0.0 to 500.0 °F	D	A9
	JPt100	-199.9 to +649.0 °C	P	01
		-199.9 to +200.0 °C	P	02
		-100.0 to +50.0 °C	P	03
		-100.0 to +100.0 °C	P	04
		-100.0 to +200.0 °C	P	05
		0.0 to 50.0 °C	P	06
		0.0 to 100.0 °C	P	07
		0.0 to 200.0 °C	P	08
		0.0 to 300.0 °C	P	09
		0.0 to 500.0 °C	P	10

Input Range Table 2

Input type		Input range	Code	
			Input	Range
Voltage	0 to 5 V DC	0. 0 to 100.0 %	4	01
	0 to 10 V DC *		5	01
	1 to 5 V DC		6	01
Current	0 to 20 mA DC		7	01
	4 to 20 mA DC		8	01

* Z-1010 Specification.

For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

6. TROUBLESHOOTING

⚠ WARNING

- To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.
- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- To prevent electric shock or instrument failure, do not turn on the power until all the wiring is completed.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

CAUTION

All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.
The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.

This section lists some of the main causes and solutions for communication problems.
If you can not solve a problem, please contact RKC sales office or the agent, on confirming the type name and specifications of the product.

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host	Confirm the settings and set them correctly
	Wrong address setting	

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Problem	Probable cause	Solution
No response	Error in the data format	Reexamine the communication program
	Transmission line is not set to the receive state after data send (for RS-485)	
EOT return	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it
	Error in the data format	Reexamine the communication program
NAK return	Error occurs on the line (parity bit error, framing error, etc.	Confirm the cause of error, and solve the problem appropriately. (Confirm the transmitting data, and resend data)
	BCC error	
	The data exceeds the setting range	Confirm the setting range and transmit correct data
	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it

7. ASCII 7-BIT CODE TABLE

					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
					b5	0	1	0	1	0	1	0	1
b5 to b7	b4	b3	b2	b1		0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	P	‘	p
	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC2	”	2	B	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
	0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
	0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
	0	1	1	0	6	ACK	SYM	&	6	F	V	f	v
	0	1	1	1	7	BEL	ETB	’	7	G	W	g	w
	1	0	0	0	8	BS	CAN	(	8	H	X	h	x
	1	0	0	1	9	HT	EM	)	9	I	Y	i	y
	1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
	1	0	1	1	B	VT	ESC	+	;	K	[	k	{
	1	1	0	0	C	FF	FS	,	<	L	¥	l	|
	1	1	0	1	D	CR	GS	-	=	M	]	m	}
	1	1	1	0	E	SO	RS	.	>	N	^	n	~
	1	1	1	1	F	SI	US	/	?	O	_	o	DEL

The first edition: FEB. 1999
The third edition: AUG. 2001

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IMAE02-E3 **AUG.2001**