Back Pressure Type Indicator

LE100A/LE110A

Communication Instruction Manual

RKC INSTRUMENT INC.

IMR01C22-E1

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 explanation purpose.
- 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 is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- 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.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

Safety Precautions

■ Pictorial Symbols (safety symbols)

Various pictorial symbols are used in this manual to ensure safe use of the product, to protect you and other people from harm, and to prevent damage to property. The symbols are described below.
Be sure you thoroughly understand the meaning of the symbols before reading this manual.

⚠ 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.

⚠ WARNING

- To prevent injury to persons, damage to the instrument and the equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to the instrument and the equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the 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 may occur and warranty is void under these conditions.

⚠ CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy plant.)
- 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 additional measures.
- 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 to operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- 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 dissipation.
- 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 may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to the instrument display, do not rub with an abrasive material or push the front panel with a hard object.

For Proper Disposal

When disposing of each part used for this instrument, always follows the procedure for disposing of industrial wastes stipulated by the respective local community.

Symbols

■ Pictorial Symbols (safety symbols)

NOTE : 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.

■ Character Symbols

7-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
											

A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
											

L	M	N (n)	O (o)	P	Q	R	S	T	t	U	u
											

V	W	X	Y	Z	Degree	／	Prime	✱ (Asterisk)
								

About This Manual

There are five manuals pertaining to this product. Please be sure to read all manuals specific to your application requirements.

The following manuals can be downloaded from the official RKC website:
https://www.rkcinst.co.jp/english/download-center/

Manual	Manual Number	Remarks
LE100A-D Installation Manual	IMR01C20-X☐	This manual is enclosed with instrument. This manual explains the mounting and wiring.
LE110A-D Installation Manual	IMR01C23-X☐	
LE100A-D Instruction Manual	IMR01C21-E☐	This manual describes installation, wiring, troubleshooting, and product specification.
LE110A-D Instruction Manual	IMR01C24-E☐	
LE100A/ LE110A Communication Instruction Manual	**IMR01C22-E1**	This manual you are reading now. This manual explain communication protocol (ANSI X3.28-1976) relating to communication parameters setting.

Read this manual carefully before operating the instrument. Please place the manual in a convenient location for easy reference.

Document Configuration

This manual consists of 6 chapters and an appendix. If you are looking for topics concerning the host communication, you may be able to find one in the following table.

	What do you want to do?	See the following section for more details
☐	I want to know the features of the host communication	1. OUTLINE
☐	I want to know the specification of the host communication	2. SPECIFICATIONS
☐	I want to know how to connect to the host computer	3. WIRING
☐	I want to know how to set up the communication parameters	4. PARAMETER SETTING
☐	I want to know the content of communication protocol	5. COMMUNICATION PROTOCOL
☐	I want to check communication [identifier, data attribute, data range, and factory set values]	5.3. Communication Data List
☐	I want to know how to cope with errors	6. TROUBLESHOOTING
☐	I want to see the table of ASCII/JIS 7-bit code	A. APPENDIX

Contents

MEMO

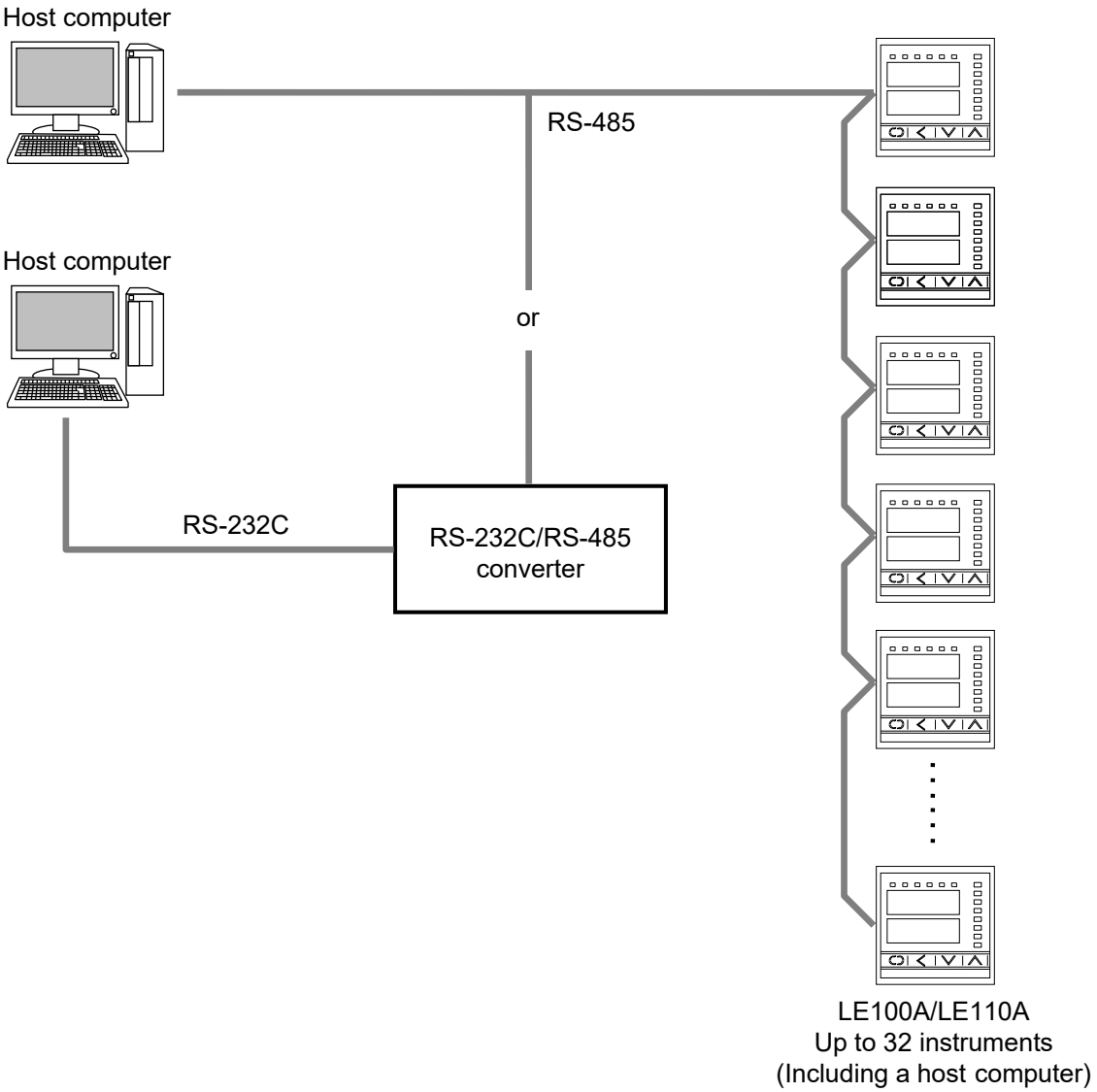
1. OUTLINE

The communication function makes it possible to monitor and set the data of the Back Pressure Type Indicator LE100A/LE110A from a host computer.
The LE100A/LE110A interfaces with the host computer via RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4) protocol.

■ Host communication (RKC communication)

Communication interface: RS-485

● Multi-drop connection



2. 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: None, Odd or Even
Stop bit: 1 or 2

Protocol: ANSI X3.28-1976 subcategories 2.5 and 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.

3. WIRING

⚠ WARNING

- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

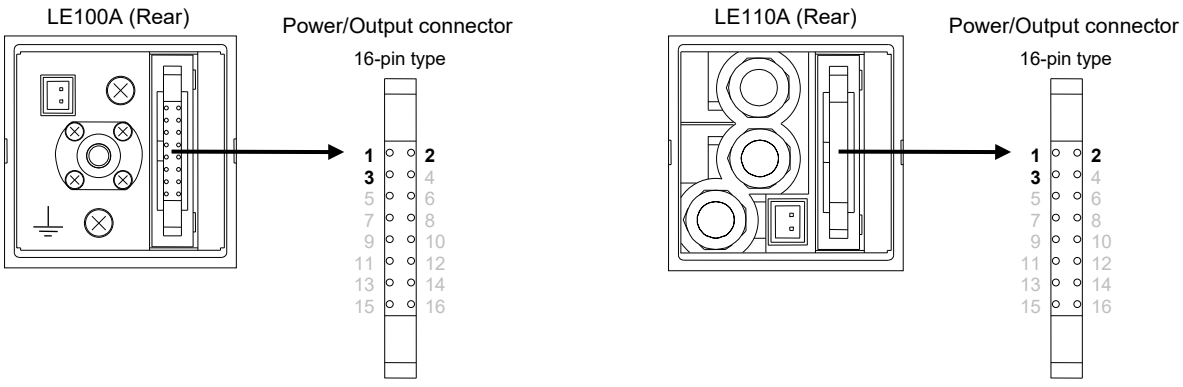
3.1 Wiring Cautions

- To avoid noise induction, keep communication wire away from instrument power line, load lines and power lines of other electric equipment.
- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- In order to prevent the instrument from malfunctioning, firmly connect the connector. Check that the Power/Output connector is locked with the lock lever.

3.2 Wiring for Host Communication

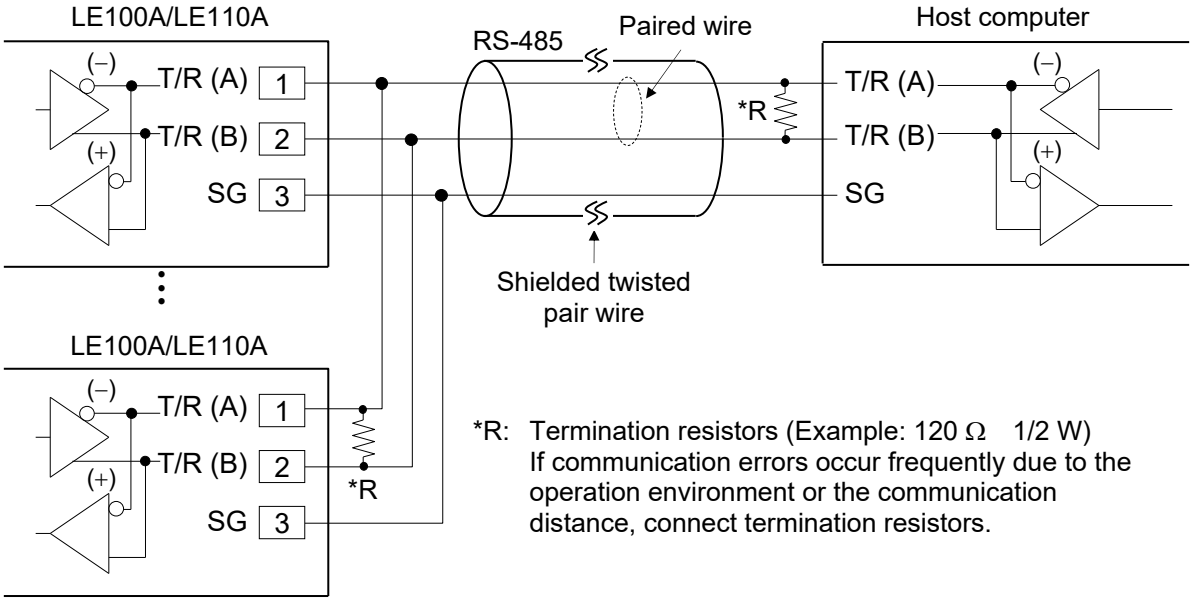
■ Connector pin number and signal details

Pin No.	Signal name	Symbol
1	Send data/Receive data	T/R (A)
2	Send data/Receive data	T/R (B)
3	Signal ground	SG



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

● Connection example



*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.

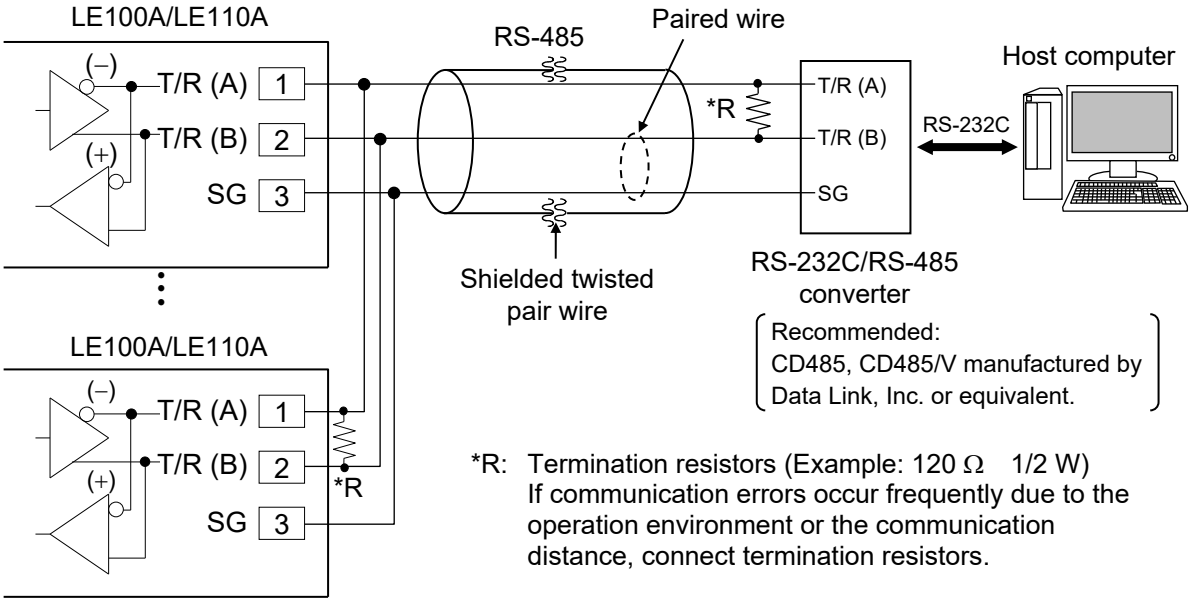
Maximum connections:
32 instruments (including a host computer)

📖 The communication cable and termination resistor(s) must be provided by the customer.

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

Use a RS-232C/RS-485 converter with an automatic send/receive transfer function.

● Connection example



*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.

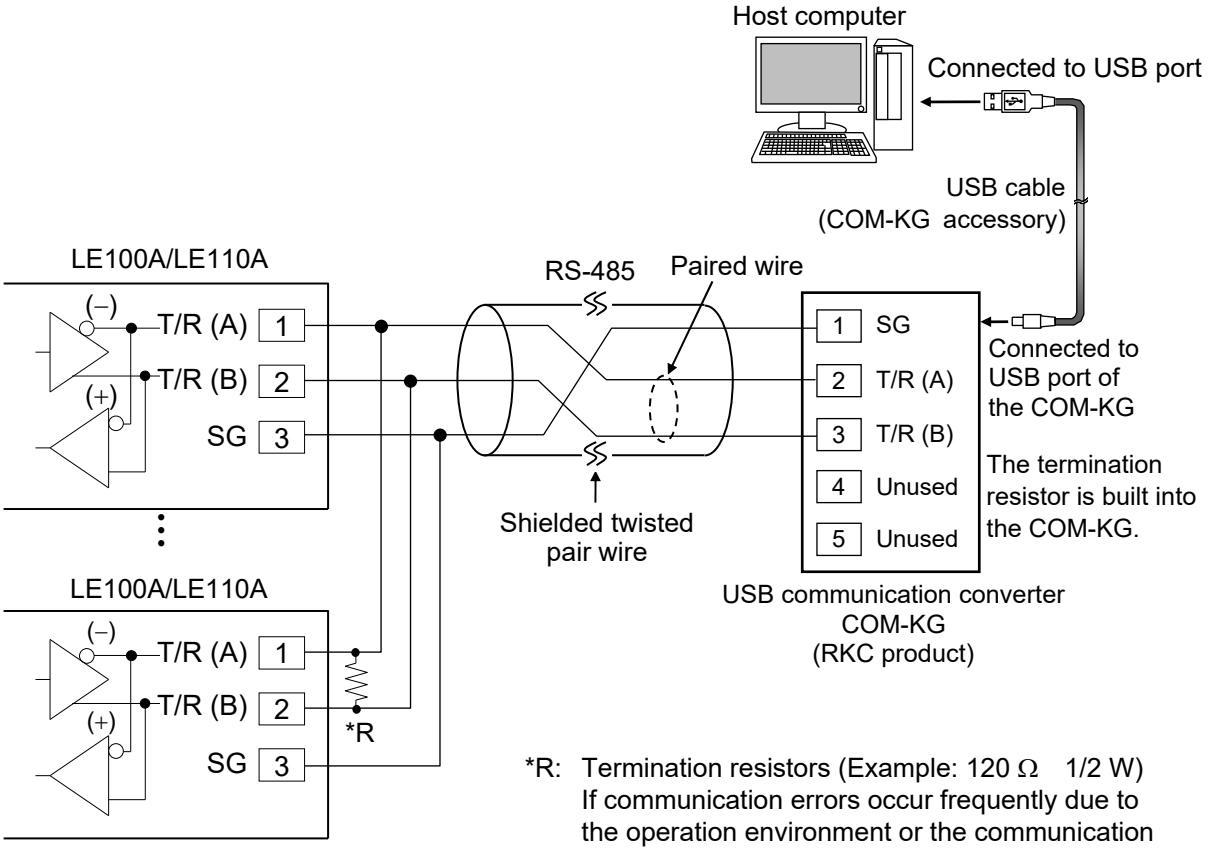
Maximum connections:
32 instruments (including a host computer)

The communication cable and termination resistor(s) must be provided by the customer.

■ Connection to the USB of the host computer

Connect the USB communication converter between the host computer and the LE100A/LE110A.

● Connection example



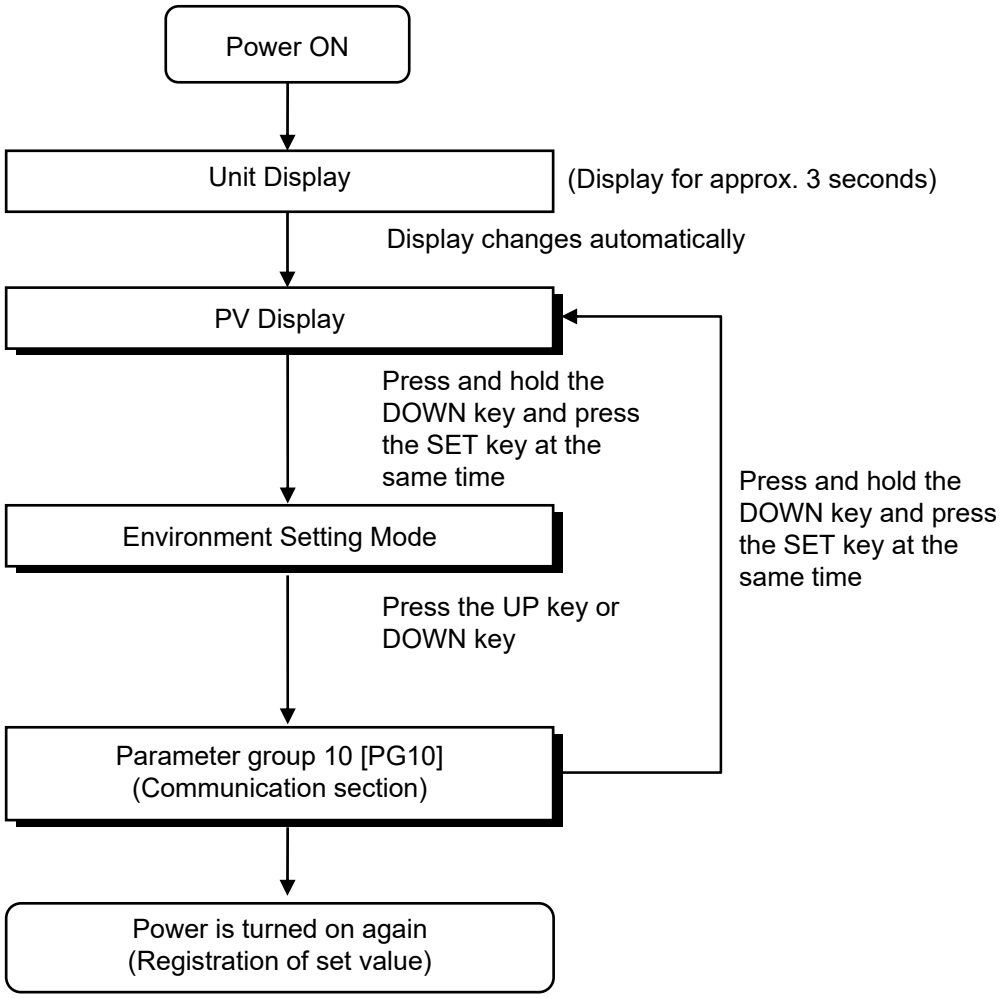
*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.

The communication cable and termination resistor(s) must be provided by the customer.

For the COM-KG, refer to the **COM-KG Instruction Manual**.
You can also use our USB communication converter COM-K2.

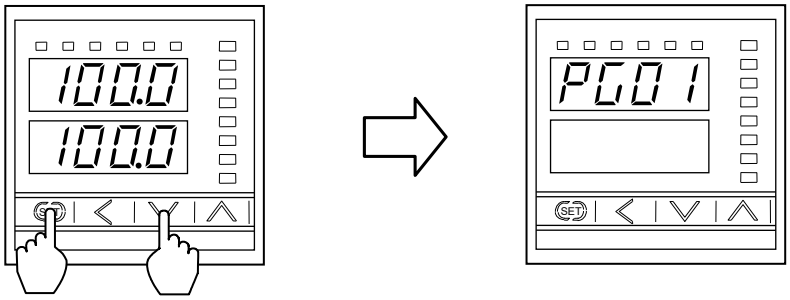
4. PARAMETER SETTING

To establish communication parameters between host computer and LE100A/LE110A, it is necessary to set the device address, communication speed, data bit configuration and interval time on each LE100A/LE110A in the Parameter group 10 (Communication section).

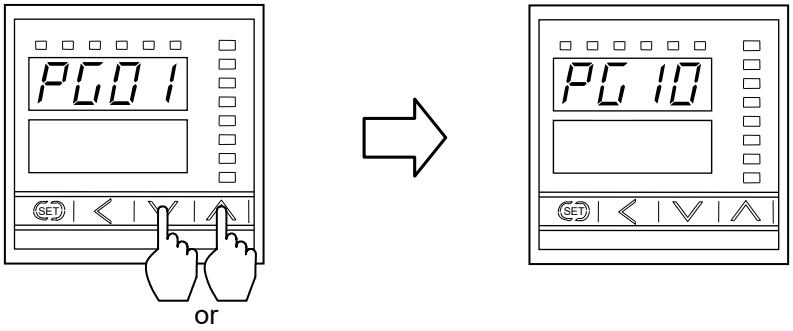


4.1 Transfer to Parameter Group 10 (PG10)

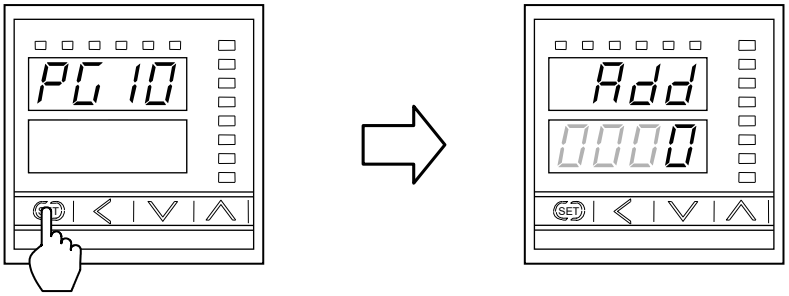
1. To go to the environment setting mode, you must be in PV display. Press and hold the DOWN key and press the SET key at the same time to initiate environment setting mode. The first parameter to be displayed will be the Parameter Group 1 [PG01].



2. Press the UP key or DOWN key to change the present display to the Parameter Group 10 [PG10] (Communication section).



3. Press the SET key. The first parameter to be displayed will be the device address [Add].

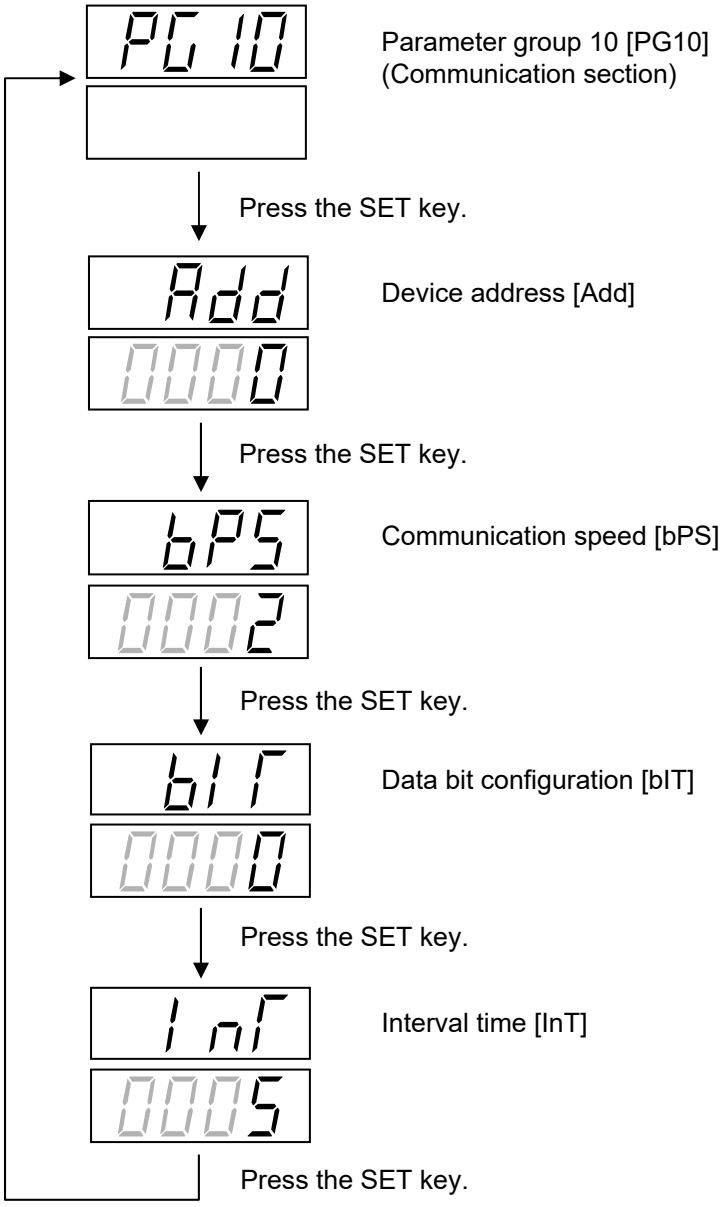


When let Parameter Group 10 [PG10] (Communication section) finish, press and hold the DOWN key and press the SET key at the same time. The display changes to the PV display.

4.2 Setting the Communication Parameters

To select parameters in Parameter Group 10 [PG10] (Communication section), press the SET key. The parameters are displayed and sequenced in the order of device address [Add], communication speed [bPS], data bit configuration [bIT] and interval time set value [InT].

■ Setting procedure



■ Registration of set value

After completing all communication parameter settings, turn on the power again, and register the set value which changed.

■ Description of each parameters

Symbol	Name	Setting range	Description	Factory set value
PG 10 (PG10)	Parameter Group 10	—	This is the first parameter symbol of parameter group 10.	—
Add (Add)	Device address	0 to 99	Use to set device address of this instrument.	0
bPS (bPS)	Communication speed	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps	Use to select the communication speeds.	2
bIT (bIT)	Data bit configuration	☞ See **Data bit configuration table**	Use to select the data bit configuration during communication.	0
InT (InT)	Interval time *	0 to 250 ms	Use to set the interval time to match timing during data send and receive.	5

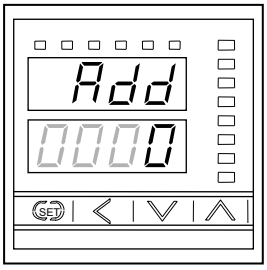
Data bit configuration table

Set value	Data bit	Parity bit	Stop 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

* The interval time for the LE100A/LE110A should be set to provide a time for host computer to finish sending all data including stop bit and to switch the line to receive data. If the interval time between the two is too short, the LE100A/LE110A may send data before the host computer is ready to receive it. In this case, communication transmission can not be conducted correctly. For a successful communication sequence to occur, the LE100A/LE110A's interval time must match the specifications of the host computer.

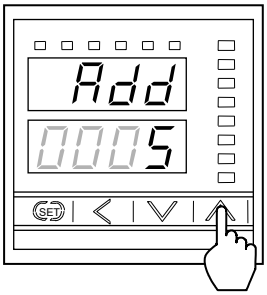
■ Setting procedure example

1. Go to the Parameter Group 10 [PG10] (Communication section) so that device address [Add], is displayed.
Present set value is displayed, and the least significant digit brightly lit.

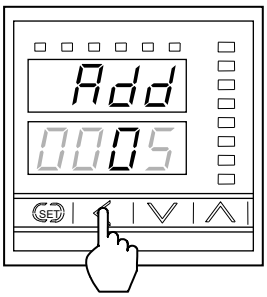


Device address

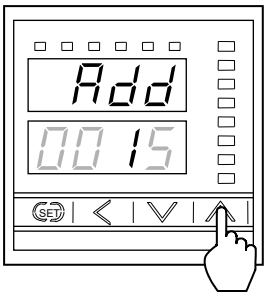
2. Set the device address. Press the UP key to enter “5” at the least significant digit.
Example: Setting the device address to “15”.



3. Press the <R/S key to brightly lit the tens digit.

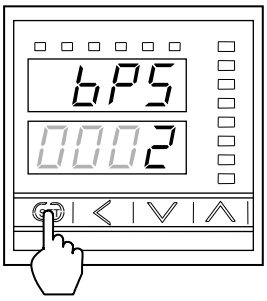


4. Press the UP key to enter “1” at the tens digit.



Continued on the next page.

5. Press the SET key to set the value thus set. The display changes to the next communication parameter. It the SET key is not pressed within 1 minute, the present display returns to the PV display and the value set here returns to that before the setting is changed.



Communication speed

6. After completing all communication parameter settings, turn on the power again, and register the set value which changed.

4.3 Communication Requirements

■ Processing times during data send/receive

The LE100A/LE110A 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 LE100A/LE110A to send data:

-Response wait time after LE100A/LE110A sends BCC in polling procedure
-Response wait time after LE100A/LE110A sends ACK or NAK in selecting procedure

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

Polling procedure

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after LE100A/LE110A receives ENQ	1.0	2.0	3.0
Response send time after LE100A/LE110A receives ACK	1.5	2.5	3.5
Response send time after LE100A/LE110A receives NAK	1.0	2.0	3.0
Response send time after LE100A/LE110A sends BCC	–	0.8	1.0

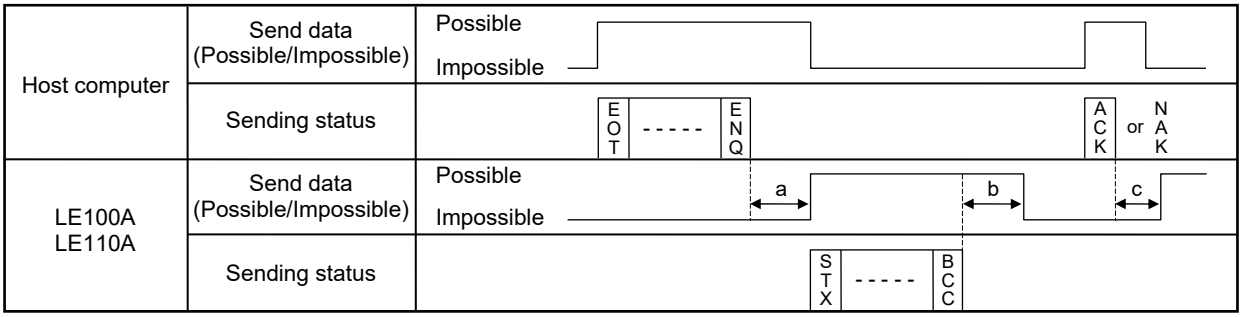
Selecting procedure

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after LE100A/LE110A receives BCC	2.0	3.0	4.0
Response wait time after LE100A/LE110A sends ACK	–	0.8	1.0
Response wait time after LE100A/LE110A sends NAK	–	0.8	1.0

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

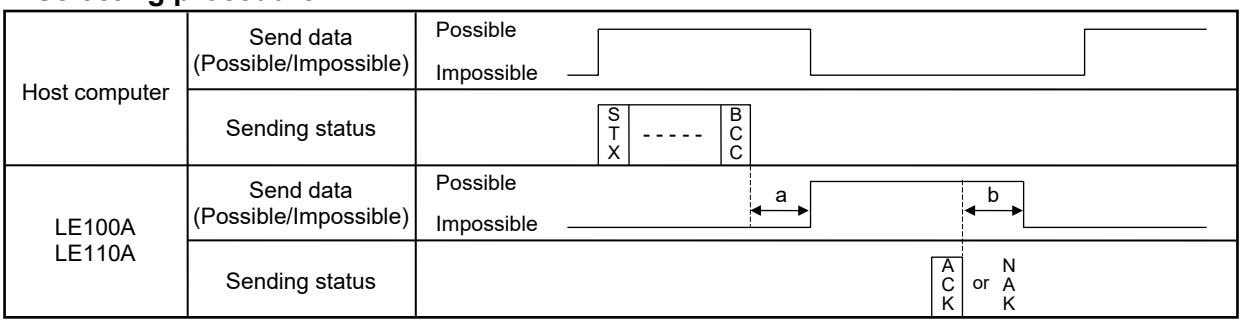
The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Typical polling and selecting procedures between the host computer and LE100A/LE110A are described below:

● Polling procedure



a: Response send time after LE100A/LE110A receives [ENQ] + Interval time
b: Response send time after LE100A/LE110A sends BCC
c: Response send time after LE100A/LE110A receives [ACK] + Interval time or
Response send time after LE100A/LE110A receives [NAK] + Interval time

● Selecting procedure



a: Response send time after LE100A/LE110A receives BCC + Interval time
b: Response wait time after LE100A/LE110A sends ACK or
Response wait time after LE100A/LE110A 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 LE100A/LE110A to send data:

-Response wait time after LE100A/LE110A sends BCC in polling procedure
-Response wait time after LE100A/LE110A 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.

■ Data backup

The nonvolatile memory (EEP-ROM) for data backup has limitations on the number of memory rewrite times (approx. 100,000 times). Avoid using the memory to frequently change the set value via communication.

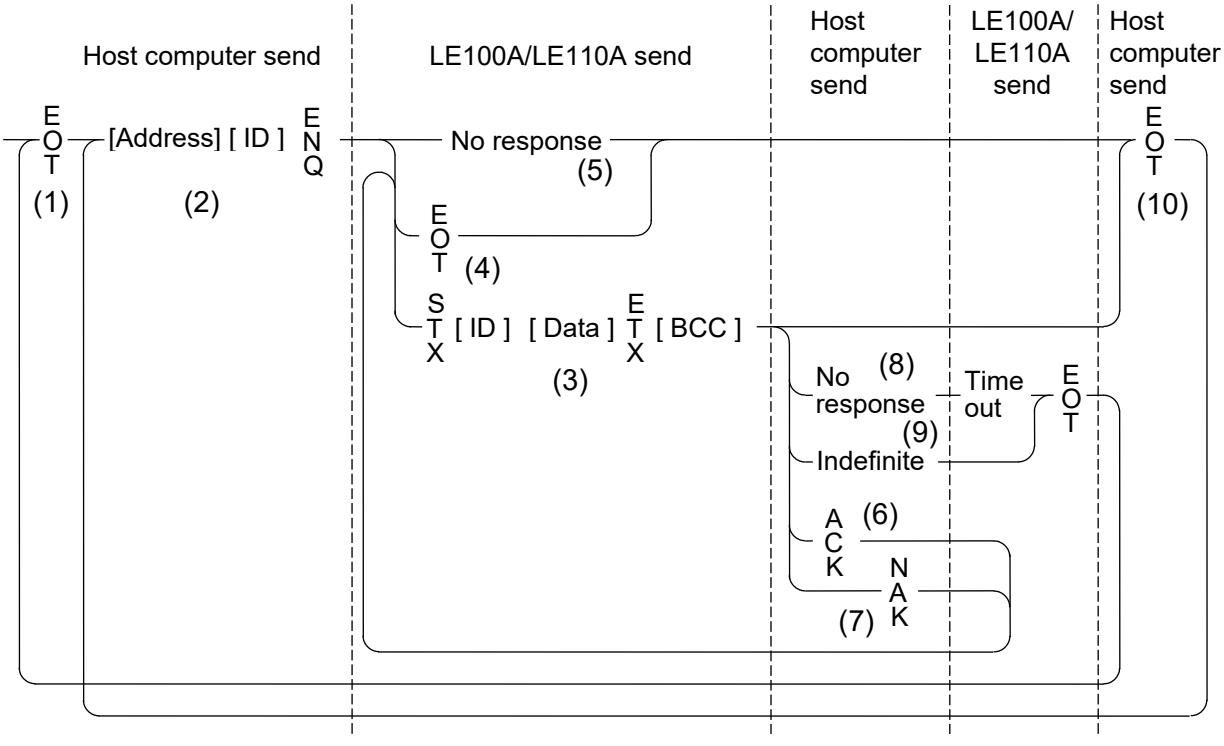
5. COMMUNICATION PROTOCOL

LE100A/LE110A uses the Polling/Selecting method to establish a data link. The basic procedure is followed ANSI X3.28 subcategories 2.5 and A4 basic mode data transmission control procedure (Fast selecting is the selecting method used in LE100A/LE110A).

- 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 LE100A/LE110A responds according to queries and commands from the host.
- The code used 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.

5.1 Polling

Polling is the action where the host computer requests one of the connected LE100A/LE110As to transmit data. An example of the polling procedure is shown below:



ID: Identifier

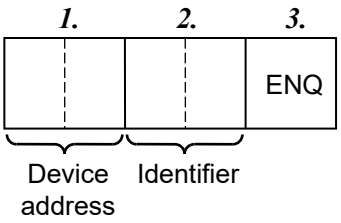
5.1.1 Polling procedures

(1) Data link initialization

Host computer sends EOT to the LE100A/LE110As 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:

0	2	M	1	ENQ

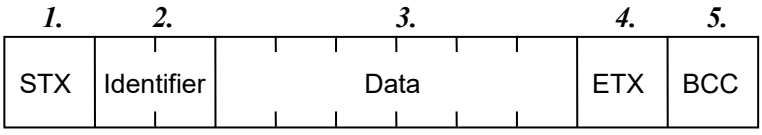
1. Device address (2 digits)
The device address specifies the LE100A/LE110A to be polled and each LE100A/LE110A must have its own unique device address.
☞ For details, see **4.2 Setting the Communication Parameters (P. 9)**.

2. Identifier (2 digits)
The identifier specifies the type of data that is requested from the LE100A/LE110A.
☞ For details, see **5.3 Communication Data List (P. 24)**.

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 LE100A/LE110A.

(3) Data sent from the LE100A/LE110A

If the polling sequence is received correctly, the LE100A/LE110A 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 **5.3 Communication Data List (P. 24)**.

3. Data (6 digits)
Data is the information being sent from the LE100A/LE110A. It is expressed in decimal ASCII code including a minus sign (−) and a decimal point. Data is not zero-suppressed.

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
(⊕: *Exclusive OR*)
Value of BCC becomes 7AH.

(4) EOT sent from the LE100A/LE110A (Ending data transmission from the LE100A/LE110A)

In the following cases, the LE100A/LE110A 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 LE100A/LE110A

The LE100A/LE110A 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 LE100A/LE110A receives ACK from the host computer, the LE100A/LE110A will send any remaining data of the next identifier without additional action from the host computer.

☞ For details, see **5.3 Communication Data List (P. 24)**.

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 LE100A/LE110A, it sends a negative acknowledgment NAK to the LE100A/LE110A. The LE100A/LE110A 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 LE100A/LE110A sends data, the LE100A/LE110A sends EOT to terminate the data link.
(Time out: 3 seconds)

(9) Indefinite response from host computer

The LE100A/LE110A sends EOT to terminate the data link when the host computer response is indefinite.

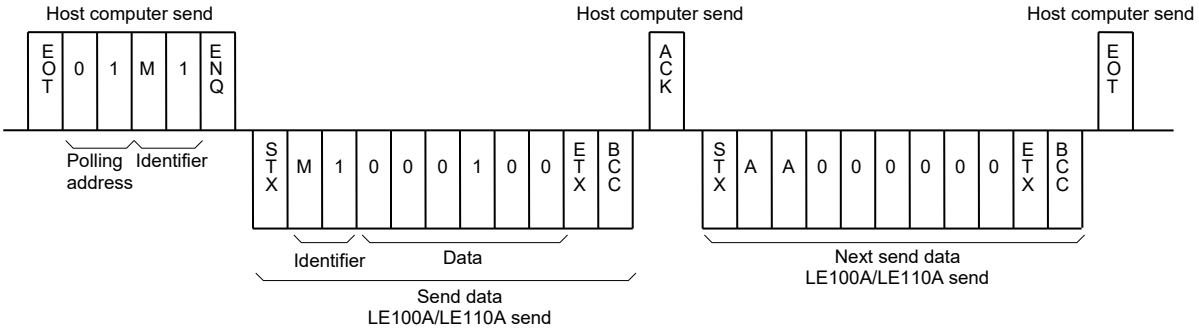
(10) EOT (Data link termination)

The host computer sends EOT message when it is necessary to suspend communication with the LE100A/LE110A or to terminate the data link due lack of response from the LE100A/LE110A.

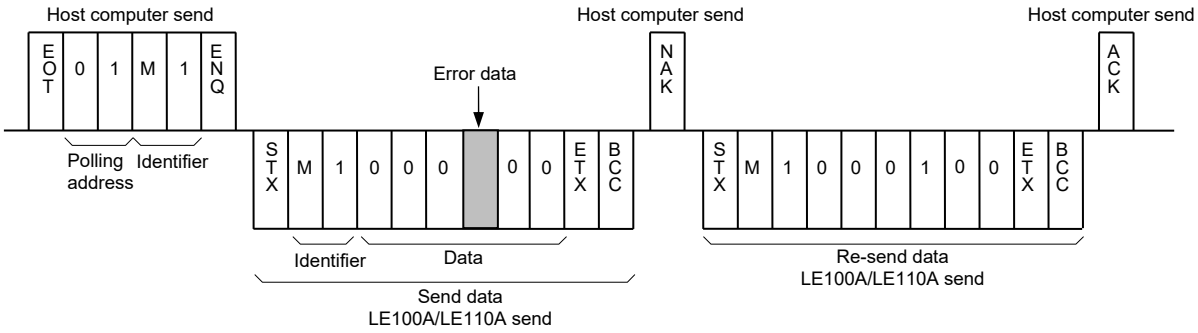
5.1.2 Polling procedure example

Example: When the Measured value (identifier: M1) is polled

■ Normal transmission

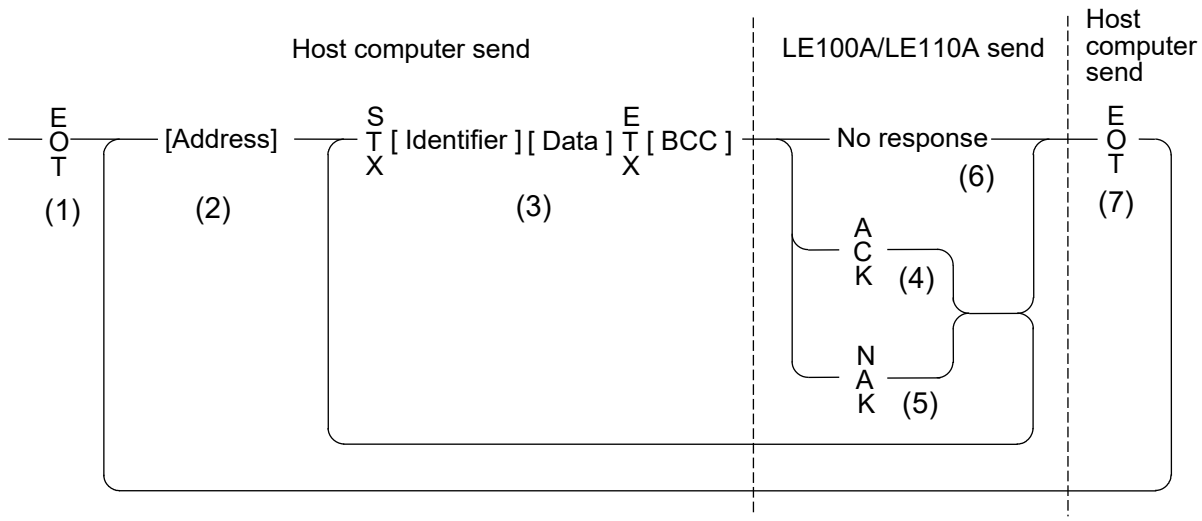


■ Error transmission



5.2 Selecting

Selecting is the action where the host computer requests one of the connected LE100A/LE110As to receive data. An example of the selecting procedure is shown below:



5.2.1 Selecting procedures

(1) Data link initialization

Host computer sends EOT to the LE100A/LE110As to initiate data link before selecting sequence.

(2) Sending selecting address from the host computer

Host computer sends selecting address for the selecting sequence.

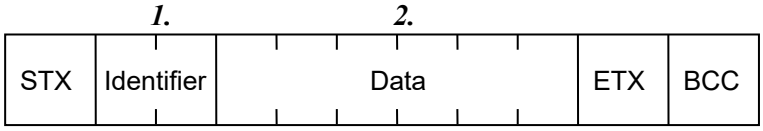
• Device address (2 digits)

The device address specifies the LE100A/LE110A to be selected and each LE100A/LE110A must have its own unique device address.

☞ For details, see **4.2 Setting the Communication Parameters (P. 9)**.

(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 **5.1 Polling (P. 15)**.

1. Identifier (2 digits)
The identifier specifies the type of data that is requested from the LE100A/LE110A, such as set value.

☞ For details, see **5.3 Communication Data List (P. 24)**.

2. Data (6 digits)
Data is the information being sent to the LE100A/LE110A. 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. (Number of digits: Within 6 digits)
  Example: When data send with –001.5, –01.5, –1.5, –1.50, –1.500 at the time of –1.5, LE100A/LE110A can receive a data.

- When the host computer send data with decimal point to item of without decimal point, LE100A/LE110A receives a message with the value which cut off below the decimal point.
  Example: When setting range is 0 to 200, LE100A/LE110A receives as a following.

Send data	0.5	100.5
Receive data	0	100

- LE100A/LE110A 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, LE100A/LE110A 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

LE100A/LE110A 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 LE100A/LE110A when data received is correct. When the host computer receives ACK from the LE100A/LE110A, the host computer will send any remaining data. If there is no more data to be sent to LE100A/LE110A, the host computer sends EOT to terminate the data link.

(5) NAK (Negative acknowledge)

If the LE100A/LE110A 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 LE100A/LE110A will send NAK in the following cases:

- When an error occurs on communication the line (parity error, 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 LE100A/LE110A

The LE100A/LE110A does not respond when it can not receive the selecting address, STX, ETX or BCC.

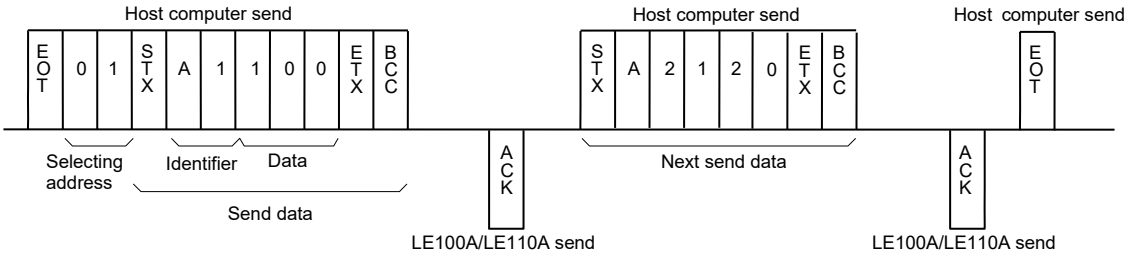
(7) EOT (Data link termination)

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 LE100A/LE110A.

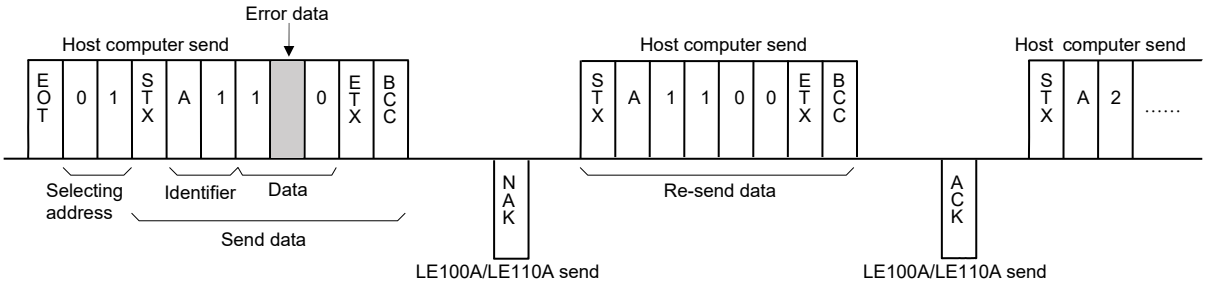
5.2.2 Selecting procedure example

Example: When the Output 1 set value (identifier: A1) is selected

■ Normal transmission



■ Error transmission



5.3 Communication Data List

Communication is not possible when an identifier is specified that the LE100A/LE110A can not recognize.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
1	Measured value (PV)	**M1**	6	RO	Within input range ☞ See **Input range table (P. 30)**.	—
2	Output 1 status [1]	**AA**	6	RO	0: OFF 1: ON	—
3	Output 2 status [1]	**AB**	6	RO	0: OFF 1: ON	—
4	Output 3 status [1]	**AC**	6	RO	0: OFF 1: ON	—
5	Output 4 status [1]	**AD**	6	RO	0: OFF 1: ON	—
6	Output 5 status [1]	**AE**	6	RO	0: OFF 1: ON	—
7	Output 6 status [1]	**AF**	6	RO	0: OFF 1: ON	—
8	Output 7 status [2]	**AG**	6	RO	0: OFF 1: ON	—
9	Output 8 status [2]	**AH**	6	RO	0: OFF 1: ON	—
10	Burnout	**B1**	6	RO	0: OFF 1: ON	—
11	Error code	**ER**	6	RO	0: No error 1: Adjusted data destruction error 2: EEP-ROM write error 4: EEP-ROM time out error 8: Input capture hardware error 16: Emptiness adjustment execution error 32: Span setting by actual liquid error 64: Span adjustment execution error 128: Number of wafer processing times error 256: Output setting by actual liquid error 512: Linearizing table creation error If two or more errors occur, the error values are summed up.	—
12	ID data	**ID**	6	RO	Model code □6∗□□□ N: No monitor output 1: Monitor output N: No communication 5: RS-485 N: No contact input 1: Contact input 6: Power supply voltage (24 V DC) 6: Output 6 points 8: Output 8 points	To vary depending on the specification

[1] This is the identifier enabled when Output type selection other than OFF is selected.
[2] This is the identifier enabled when Output type selection is set to other than OFF on the 8-output type.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
13	Specific gravity monitor	**MS**	6	RO	0.800 to 2.500	—
14	Scale low monitor	**ML**	6	RO	Scale low to Scale high	—
15	Scale high monitor	**MH**	6	RO	Scale low to Scale high	—
16	Peak hold monitor	**HP**	6	RO	Scale low to Scale high	—
17	Bottom hold monitor	**HQ**	6	RO	Scale low to Scale high	—
18	Number of wafer processing times monitor [1]	**MW**	6	RO	1 to Number of wafer processing times setting	—
19	Amount of emptiness correction monitor	**MZ**	6	RO	−5.00 to +5.00 of span	—
20	Output 1 set value [2]	**A1**	6	R/W	Scale low to Scale high	Input range high
21	Output 2 set value [2]	**A2**	6	R/W	Scale low to Scale high	Input range high
22	Output 3 set value [2]	**A3**	6	R/W	Scale low to Scale high	Input range high
23	Output 4 set value [2]	**A4**	6	R/W	Scale low to Scale high	Input range high
24	Output 5 set value [2]	**A5**	6	R/W	Scale low to Scale high	Input range high
25	Output 6 set value [2]	**A6**	6	R/W	Scale low to Scale high	Input range high
26	Output 7 set value [3]	**A7**	6	R/W	Scale low to Scale high	Input range high
27	Output 8 set value [3]	**A8**	6	R/W	Scale low to Scale high	Input range high
28	Actual liquid output setting	**A9**	6	WO	0: Not executed 1 to 8: Each output is executed	—
29	Emptiness adjustment	**AZ**	6	R/W	0: Not executed 1: Executed	0
30	Number of wafer processing times [1]	**WT**	6	WO	1: Executed	—
31	Initializing the number of wafer processing times [1]	**CW**	6	WO	0: Executed	—
32	Hold reset	**HR**	6	WO	1: Executed	—
33	Interlock release [4]	**IR**	6	WO	0: Executed	—
34	Set data lock	**LK**	6	R/W	0: Set data lock not provided. 1: Only output set value can be set. 2: All parameter cannot be set.	0
35	Default setting	**IS**	6	WO	1: Executed	—
36	Error release	**EC**	6	WO	0: Executed	—

[1] This is the identifier enabled when the presence of the specific gravity correction function is selected.
[2] This is the identifier enabled when Output type selection other than OFF is selected.
[3] This is the identifier enabled when Output type selection is set to other than OFF on the 8-output type.
[4] This is the identifier enabled when Interlock is set for any of Outputs 1 to 8.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
37	Decimal point position selection [1]	**LU**	6	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places	1
38	Number of linearizing table setting [1]	**LT**	6	R/W	2 to 11	11
39	Linearizing table setting 0 [1]	**L0**	6	R/W	Scale low to Scale high	0.0
40	Linearizing table setting 1 [1]	**L1**	6	R/W	Linearizing table setting 0 to Scale high	3.6
41	Linearizing table setting 2 [1]	**L2**	6	R/W	Linearizing table setting 1 to Scale high	7.2
42	Linearizing table setting 3 [1]	**L3**	6	R/W	Linearizing table setting 2 to Scale high	10.8
43	Linearizing table setting 4 [1]	**L4**	6	R/W	Linearizing table setting 3 to Scale high	14.4
44	Linearizing table setting 5 [1]	**L5**	6	R/W	Linearizing table setting 4 to Scale high	18.0
45	Linearizing table setting 6 [1]	**L6**	6	R/W	Linearizing table setting 5 to Scale high	21.6
46	Linearizing table setting 7 [1]	**L7**	6	R/W	Linearizing table setting 6 to Scale high	25.2
47	Linearizing table setting 8 [1]	**L8**	6	R/W	Linearizing table setting 7 to Scale high	28.8
48	Linearizing table setting 9 [1]	**L9**	6	R/W	Linearizing table setting 8 to Scale high	32.4
49	Linearizing table setting 10 [1]	**LA**	6	R/W	Linearizing table setting 9 to Scale high	36.0
50	Digital filter	**F1**	6	R/W	0 to 100 seconds (0: Filter OFF)	3
51	Number of empty adjustment decision times	**AS**	6	R/W	1 to 20 times	10
52	Output 1 type selection [2]	**XA**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
53	Output 1 deviation value setting [3]	**DA**	6	R/W	–50 to +50 mm	0
54	Output 1 interlock function selection	**QA**	6	R/W	0: Without interlock function 1: With interlock function	0
55	Output 1 action selection	**NA**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
56	Output 1 differential gap	**HA**	6	R/W	0.0 to 10.0 % of span	0.3

[1] This is the identifier enabled when the engineering unit is set to L(liter) or mL.
[2] The high limit or low limit deviation output can be set only when the engineering unit is set to mm.
[3] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 1 type selection.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
57	Output 1 timer setting	**TA**	6	R/W	0 to 600 seconds	0
58	Output 2 type selection [1]	**XB**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
59	Output 2 deviation value setting [2]	**DB**	6	R/W	–50 to +50 mm	0
60	Output 2 interlock function selection	**QB**	6	R/W	0: Without interlock function 1: With interlock function	0
61	Output 2 action selection	**NB**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
62	Output 2 differential gap	**HB**	6	R/W	0.0 to 10.0 % of span	0.3
63	Output 2 timer setting	**TB**	6	R/W	0 to 600 seconds	0
64	Output 3 type selection [1]	**XC**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
65	Output 3 deviation value setting [3]	**DC**	6	R/W	–50 to +50 mm	0
66	Output 3 interlock function selection	**QC**	6	R/W	0: Without interlock function 1: With interlock function	0
67	Output 3 action selection	**NC**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
68	Output 3 differential gap	**HC**	6	R/W	0.0 to 10.0 % of span	0.3
69	Output 3 timer setting	**TC**	6	R/W	0 to 600 seconds	0
70	Output 4 type selection [1]	**XD**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
71	Output 4 deviation value setting [4]	**DD**	6	R/W	–50 to +50 mm	0
72	Output 4 interlock function selection	**QD**	6	R/W	0: Without interlock function 1: With interlock function	0
73	Output 4 action selection	**ND**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0

[1] The high limit or low limit deviation output can be set only when the engineering unit is set to mm.
[2] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 2 type selection.
[3] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 3 type selection.
[4] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 4 type selection.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
74	Output 4 differential gap	**HD**	6	R/W	0.0 to 10.0 % of span	0.3
75	Output 4 timer setting	**TD**	6	R/W	0 to 600 seconds	0
76	Output 5 type selection [1]	**XE**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
77	Output 5 deviation value setting [2]	**DE**	6	R/W	−50 to +50 mm	0
78	Output 5 interlock function selection	**QE**	6	R/W	0: Without interlock function 1: With interlock function	0
79	Output 5 action selection	**NE**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
80	Output 5 differential gap	**HE**	6	R/W	0.0 to 10.0 % of span	0.3
81	Output 5 timer setting	**TE**	6	R/W	0 to 600 seconds	0
82	Output 6 type selection [1]	**XF**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
83	Output 6 deviation value setting [3]	**DF**	6	R/W	−50 to +50 mm	0
84	Output 6 interlock function selection	**QF**	6	R/W	0: Without interlock function 1: With interlock function	0
85	Output 6 action selection	**NF**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
86	Output 6 differential gap	**HF**	6	R/W	0.0 to 10.0 % of span	0.3
87	Output 6 timer setting	**TF**	6	R/W	0 to 600 seconds	0
88	Output 7 type selection [1, 5]	**XG**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
89	Output 7 deviation value setting [4, 5]	**DG**	6	R/W	−50 to +50 mm	0
90	Output 7 interlock function selection [5]	**QG**	6	R/W	0: Without interlock function 1: With interlock function	0

[1] The high limit or low limit deviation output can be set only when the engineering unit is set to mm.
[2] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 5 type selection.
[3] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 6 type selection.
[4] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 7 type selection.
[5] This is the identifier enabled when the 8-output specification is selected.

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
91	Output 7 action selection [1]	**NG**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
92	Output 7 differential gap [1]	**HG**	6	R/W	0.0 to 10.0 % of span	0.3
93	Output 7 timer setting [1]	**TG**	6	R/W	0 to 600 seconds	0
94	Output 8 type selection [1, 2]	**XH**	6	R/W	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output	1
95	Output 8 deviation value setting [1, 3]	**DH**	6	R/W	−50 to +50 mm	0
96	Output 8 interlock function selection [1]	**QH**	6	R/W	0: Without interlock function 1: With interlock function	0
97	Output 8 action selection [1]	**NH**	6	R/W	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0
98	Output 8 differential gap [1]	**HH**	6	R/W	0.0 to 10.0 % of span	0.3
99	Output 8 timer setting [1]	**TH**	6	R/W	0 to 600 seconds	0
100	Monitor output high [4]	**HV**	6	R/W	Monitor output low to Scale high	1000
101	Monitor output low [4]	**HW**	6	R/W	Scale low to Monitor output high	0
102	End specific gravity setting [5]	**EG**	6	R/W	0.800 to 2.500	1.000
103	Number of wafer processing times setting [5]	**SW**	6	R/W	1 to 20	10
104	Scale low [6]	**XX**	6	R/W	0 to 50 mm	0
105	Specific gravity setting [7]	**SG**	6	R/W	0.800 to 2.500	1.000
106	Scale 1 actual liquid setting [8]	**J1**	6	R/W	0 to 1250 mm	0
107	Scale 2 actual liquid setting [8]	**J2**	6	R/W	1 to 1250 mm	1250
108	Correction on the low limit side by actual liquid 2 [9]	**J3**	6	WO	1: Executed	—
109	Correction on the high limit side by actual liquid 2 [9]	**J4**	6	WO	1: Executed	—

[1] This is the identifier enabled when the 8-output specification is selected.
[2] The high limit or low limit deviation output can be set only when the engineering unit is set to mm.
[3] This is the identifier enabled when 3 (deviation high output) or 4 (deviation low output) is selected in the Output 8 type selection.
[4] This is the identifier enabled when the monitor output is selected.
[5] This is the identifier enabled when the specific gravity correction function is selected.
[6] This is the identifier enabled when the engineering unit is set to mm, L (liter) or mL.
[7] This is the identifier enabled when the engineering unit is set to mm, % (liquid level displayed in %), L (liter) or mL and the specific gravity setting transfer is set to the manual setting.
[8] This is the identifier enabled when the specific gravity setting transfer is set to the actual liquid setting.
[9] This is the identifier enabled when the engineering unit is set to % (pressure displayed in %)

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

No.	Name	Iden-tifier	Digits	Attri-bute	Data range	Factory set value
110	Unit setting	**UN**	6	R/W	0: mm 1: % (% display of liquid level) 2: % (% display of pressure) 3: L (liter) 4: mL 5: kPa 6: Pa ☞ See **Input range table** below	0
111	Specific gravity setting transfer [1]	**SP**	6	R/W	0: Manual setting 1: Actual liquid setting	0
112	Specific gravity correction function selection [2]	**SS**	6	R/W	0: Without specific gravity correction function 1: With specific gravity correction function	0
113	DI function selection [3]	**DS**	6	R/W	0: For conducting the emptiness adjustment 1: For counting the number of wafer processing times	0
114	Volume/Level display selection [4]	**MM**	6	R/W	0: Volume display 1: Level display	0

[1] This is the identifier enabled when the engineering unit is set to mm, % (liquid level displayed in %), L (liter) or mL.
[2] This is the identifier enabled when the engineering unit is set to mm and the specific gravity setting transfer is set to the manual setting.
[3] This is the identifier enabled when the contact input and the specific gravity correction function are selected.
[4] This is the identifier enabled when the engineering unit is set to L(liter) or mL.

Input range table

Unit setting	Unit	Range	Notes
0	mm	0 to 1250	The high limit is determined by the specific gravity setting. At specific gravity 2.5: 0 to 400 mm At specific gravity 1: 0 to 1000 mm At specific gravity 0.8: 0 to 1250 mm
1	%	0.0 to 100.0	Liquid level displayed in %
2	%	0.0 to 100.0	Pressure displayed in %
3	L (liter)	0 to 360	The decimal point position depends on the decimal point position selection.
4	mL	0 to 360	The decimal point position depends on the decimal point position selection.
5	kPa	0 to 9.807	—
6	Pa	0 to 9807	—

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 wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- 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 cannot 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 computer	Confirm the settings and set them correctly
	Wrong address setting	
	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 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

A. APPENDIX

A.1 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

MEMO

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