Back Pressure Type Indicator
[Differential Pressure Type]

LE110

Communication Instruction Manual

RKC® RKC INSTRUMENT INC.

IMR01C06-E3

- Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation in the USA and other countries.
- Company names and product names used in this manual are the trademarks or registered trademarks of the respective companies.

Thank you for purchasing this 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.
- 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.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- 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.

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 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.

CONTENTS

Page

1.OUTLINE 1

2. SPECIFICATIONS 2

3. WIRING 3

4. SETTING 5

4.1 Transfer to Communication Parameter Group 6
4.2 Setting the Communication Parameters 7
4.3 Communication Requirements 11

5. PROTOCOL 13

5.1 Polling 13
5.1.1 Polling procedures 14
5.1.2 Polling procedure example 17
5.2 Selecting 18
5.2.1 Selecting procedures 18
5.2.2 Selecting procedure example 21
5.3 Communication Identifier List 22

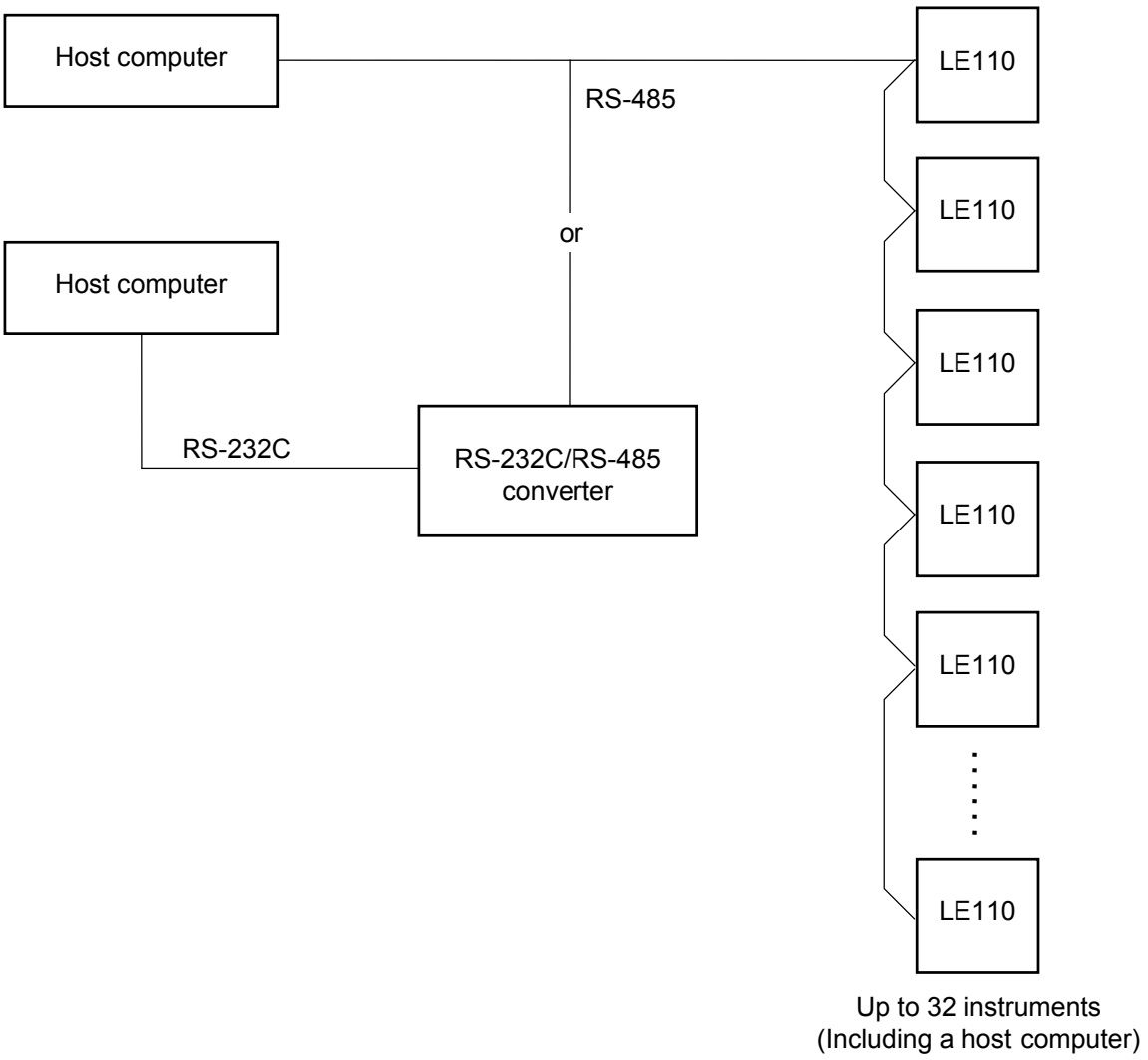
6. TROUBLESHOOTING 36

7. ASCII 7-BIT CODE TABLE 38

MEMO

1. OUTLINE

This manual describes the communication functions between the back pressure type indicator LE110 and the host computer.
The back pressure type indicator LE110 interfaces with the host computer via RKC communication protocol.



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: 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.

3. WIRING

⚠ WARNING

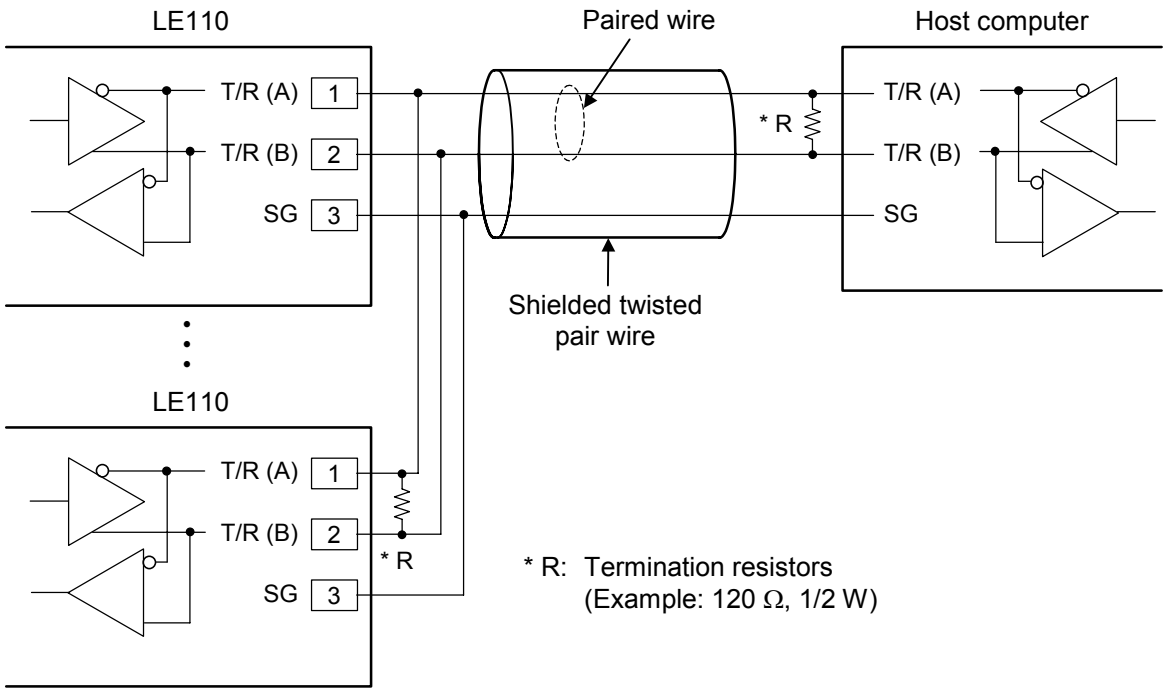
To prevent electric shock or instrument failure, do not turn on the power until all the wiring is completed.

■ 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

■ Wiring method

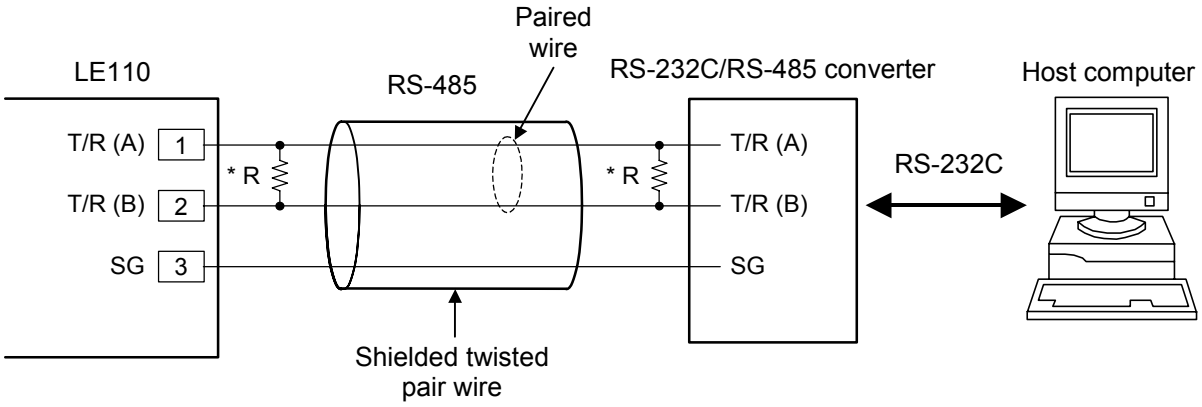
● Connection to the RS-485 port of the host computer



Maxmum connections: 32 instruments (Including a host computer)

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

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



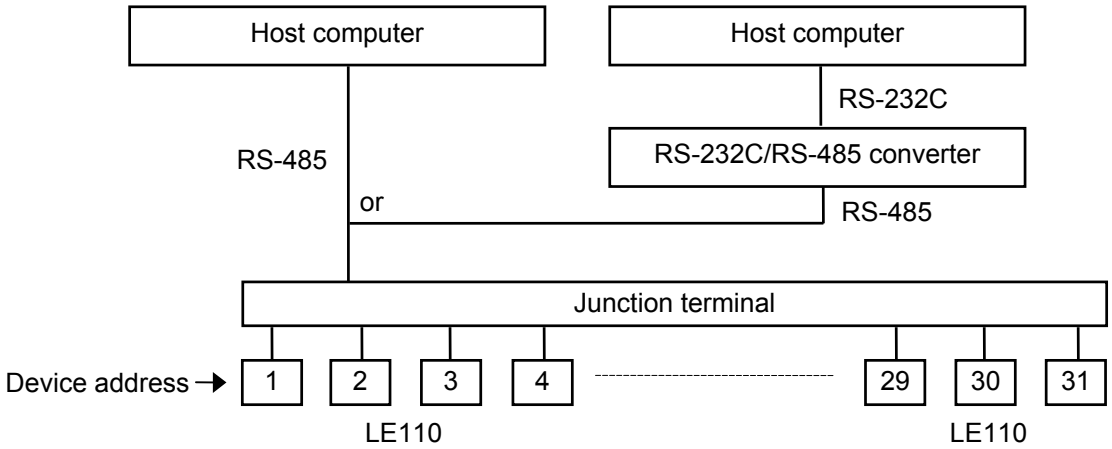
* R: Termination resistors (Example: 120 Ω, 1/2 W)

When the host computer uses Windows 95/98/Me/NT/2000/XP, 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.

When the host computer (OS: Windows 98SE/2000/XP) is corresponding to the USB connector, our communication converter COM-K (sold separately) can be used.

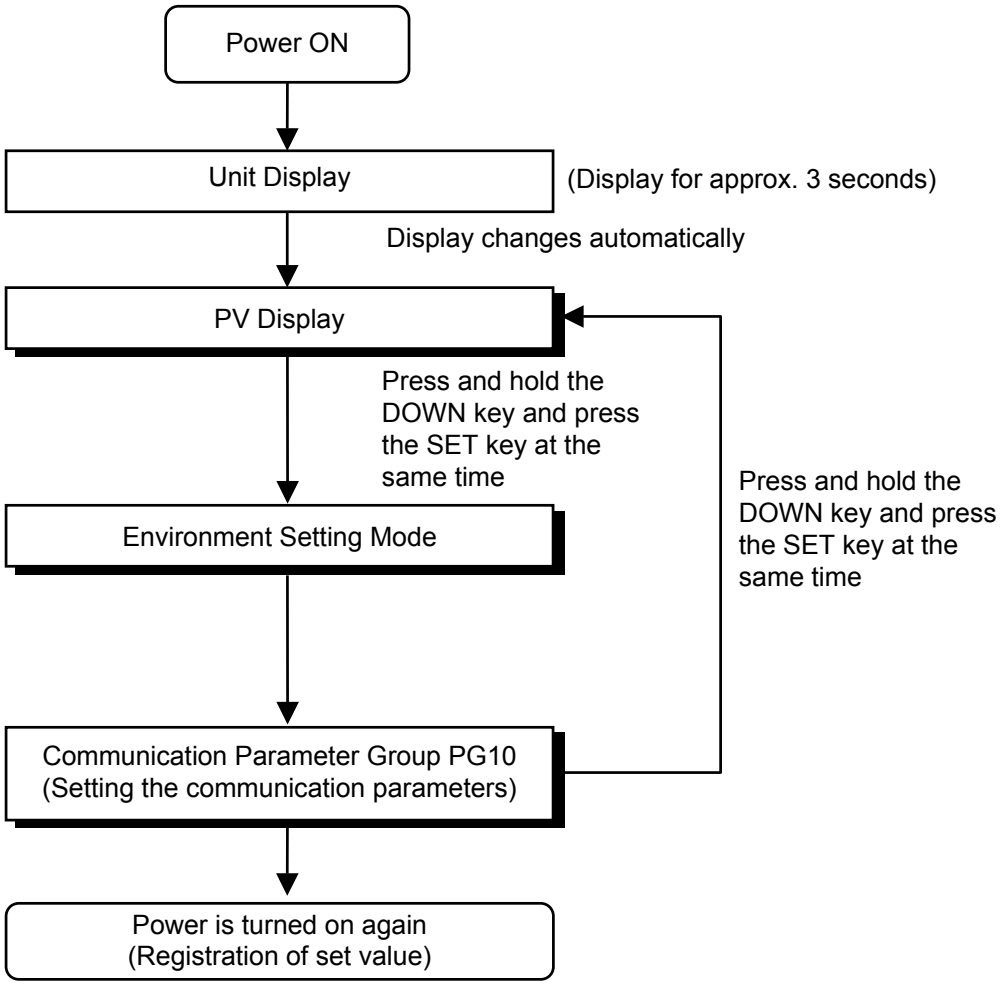
The cable is provided by the customer.

■ Connection with up to 31 LE110 and one host computer



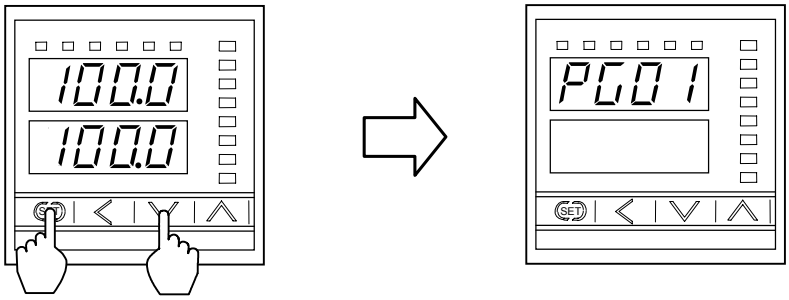
4. SETTING

To establish communication parameters between host computer and LE110, it is necessary to set the device address, communication speed, data bit configuration and interval time on each LE110 in the communication parameter group.

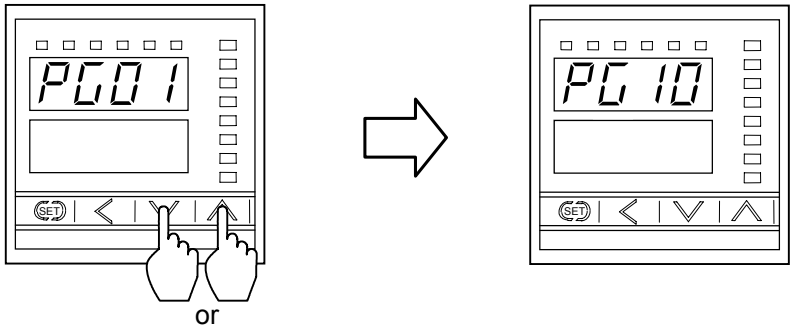


4.1 Transfer to Communication Parameter Group

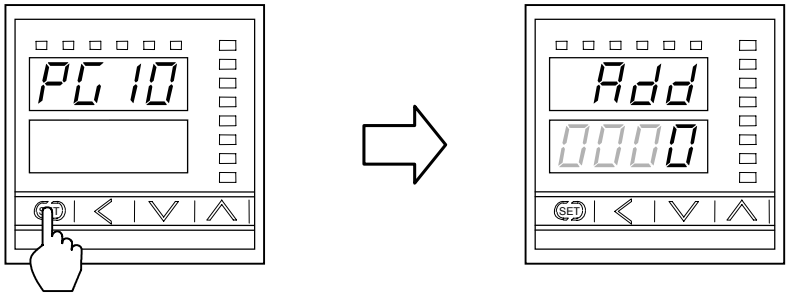
1. To go to the environment setting mode, you must be in PV display. Press and hold the DOWN key and press the SET key at the same time to initiate environment setting mode. The first parameter to be displayed will be the *PG01*.



2. Press the UP key or DOWN key to change the present display to the communication parameter group *PG10*.



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

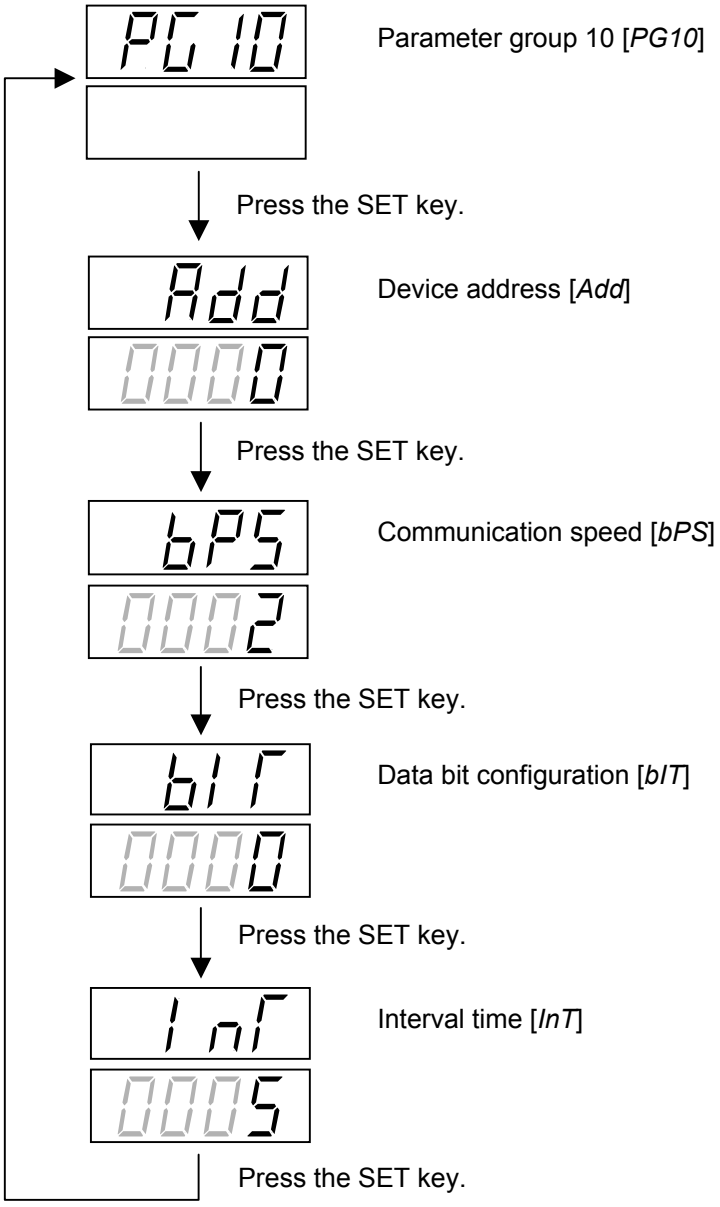


When let communication parameter group finish, press and hold the DOWN key and press the SET key at the same time. The display changes to the PV display.

4.2 Setting the Communication Parameters

To select parameters in communication parameter group, 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
Add (Add)	Device address	0 to 99	Please set it not to duplication in multi-drop connection.	0
bPS (bPS)	Communication speed	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps	Set the same communication speed for both the LE110 and the host computer.	2
bIT (bIT)	Data bit configuration	☞ See **Data bit configuration table**	Set the same data bit configuration for both the LE110 and the host computer.	0
InT (InT)	Interval time *	0 to 250 ms	The LE110's interval time must match the specifications of the host computer.	5

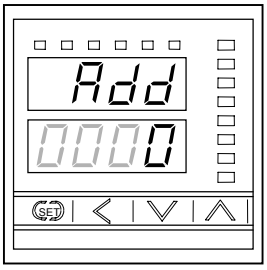
Data bit configuration table

Set value	Data bit	Parity bit	Stop bit
0	8	Without	1
1	8	Without	2
2	7	Even	1
3	7	Even	2
4	7	Odd	1
5	7	Odd	2

* The interval time for the LE110 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 LE110 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 LE110's interval time must match the specifications of the host computer.

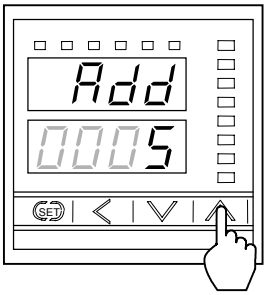
■ Setting procedure example

1. Go to the communication parameter group *PG10* so that device address, *Add*, is displayed. Present set value is displayed, and the least significant digit brightly lit.

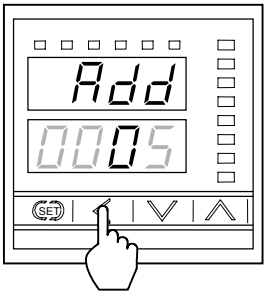


Device address

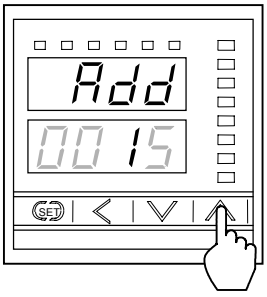
2. Set the device address. Press the UP key to enter *5* at the least significant digit.
Example: Setting the device address to 15.



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

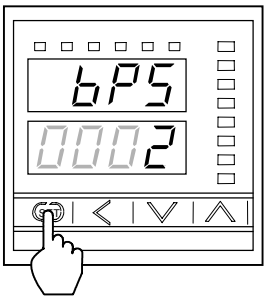


4. Press the UP key to enter *1* at the tens digit.



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 LE110 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 LE110 to send data:

-Response wait time after LE110 sends BCC in polling procedure
-Response wait time after LE110 sends ACK or NAK in selecting procedure

Polling procedure

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after LE110 receives ENQ	1.0	2.0	3.0
Response send time after LE110 receives ACK	1.5	2.5	3.5
Response send time after LE110 receives NAK	1.0	2.0	3.0
Response send time after LE110 sends BCC	–	0.8	1.0

Selecting procedure

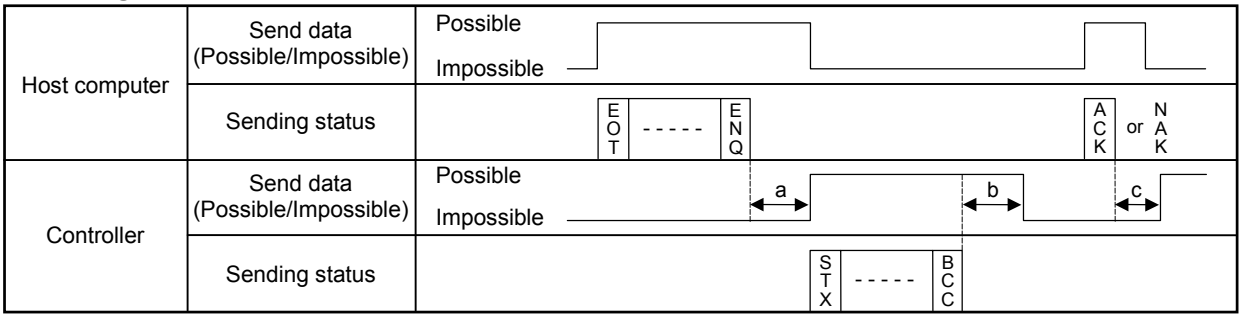
Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after LE110 receives BCC	2.0	3.0	4.0
Response wait time after LE110 sends ACK	–	0.8	1.0
Response wait time after LE110 sends NAK	–	0.8	1.0

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

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

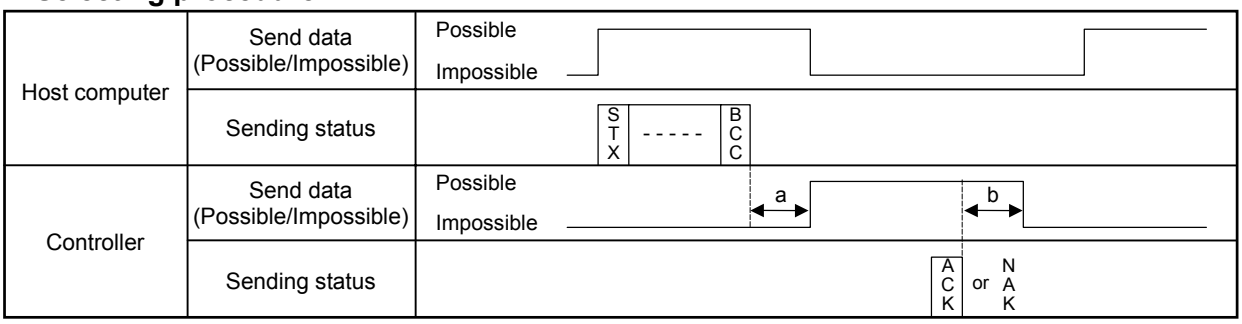
The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Typical polling and selecting procedures between the host computer and LE110 are described below:

● Polling procedure



a: Response send time after LE110 receives [ENQ] + Interval time
b: Response send time after LE110 sends BCC
c: Response send time after LE110 receives [ACK] + Interval time or
Response send time after LE110 receives [NAK] + Interval time

● Selecting procedure



a: Response send time after LE110 receives BCC + Interval time
b: Response wait time after LE110 sends ACK or Response wait time after LE110 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 LE110 to send data:
-Response wait time after LE110 sends BCC in polling procedure
-Response wait time after LE110 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 (EEPROM) 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.

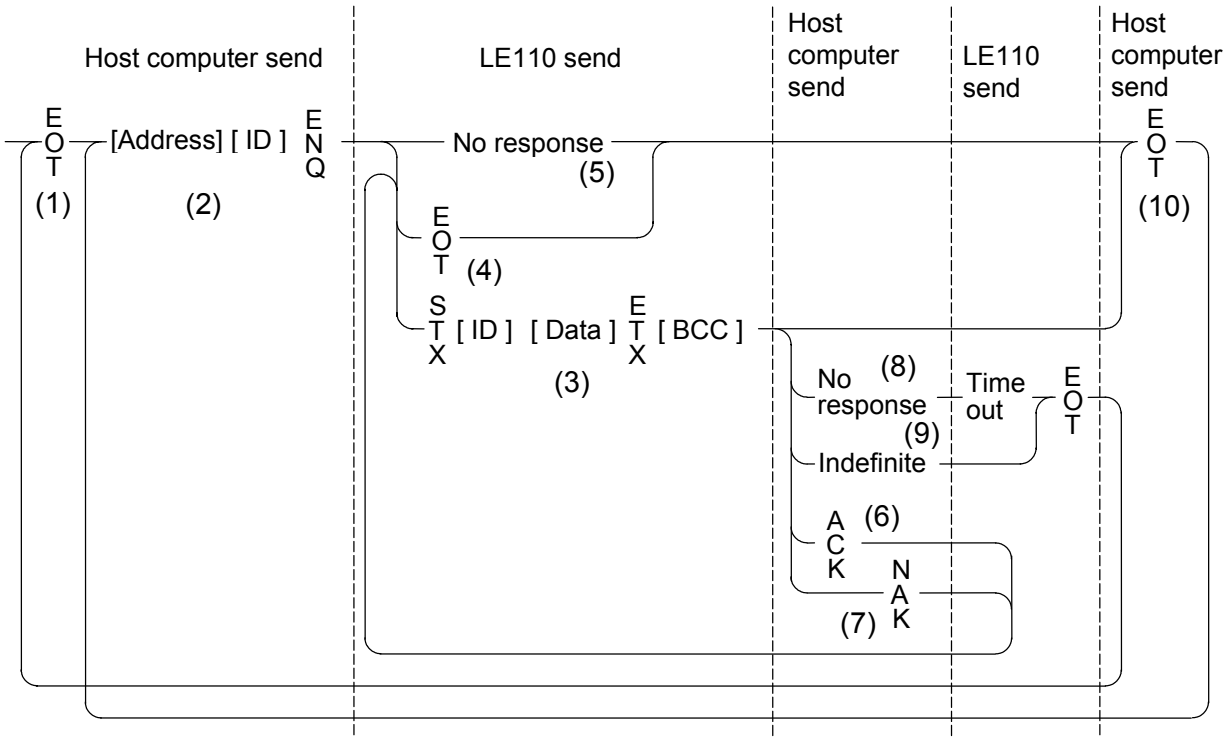
5. PROTOCOL

LE110 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 LE110).

- 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 LE110 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.

5.1 Polling

Polling is the action where the host computer requests one of the connected LE110s to transmit data. An example of the polling procedure is shown below:



ID: Identifier

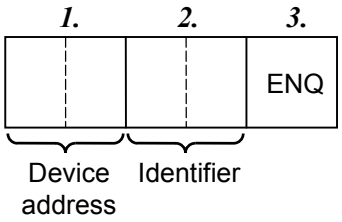
5.1.1 Polling procedures

(1) Data link initialization

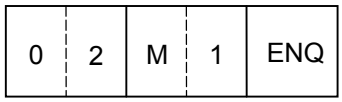
Host computer sends EOT to the LE110s to initiate data link before polling sequence.

(2) Data sent from host computer - Polling sequence

Host computer sends polling sequence with the format shown below:



Example:



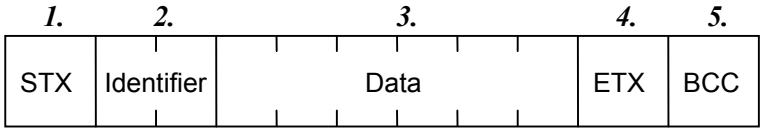
1. Device address (2 digits)
The device address specifies the LE110 to be polled and each LE110 must have its own unique device address.
☞ For details, see **4.2 Setting the Communication Parameters (P. 7)**.

2. Identifier (2 digits)
The identifier specifies the type of data that is requested from the LE110.
☞ For details, see **5.3 Communication Identifier List (P. 22)**.

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 LE110.

(3) Data sent from the LE110

If the polling sequence is received correctly, the LE110 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) ☞ For details, see **5.3 Communication Identifier List (P. 22)**.
The identifier indicates the type of data (measured value, status and set value) sent to the host computer.

3. Data (6 digits)
Data is the information being sent from the LE110. 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 LE110 (Ending data transmission from the LE110)

In the following cases, the LE110 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 LE110

The LE110 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.

(1) ACK Acknowledgment

An acknowledgment ACK is sent by the host computer when data received is correct. When the LE110 receives ACK from the host computer, the LE110 will send any remaining data of the next identifier without additional action from the host computer.

☞ For the identifier, see **5.3 Communication Identifier List (P. 22)**.

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 LE110, it sends a negative acknowledgment NAK to the LE110. The LE110 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 LE110 sends data, the LE110 sends EOT to terminate the data link.

(9) Indefinite response from host computer

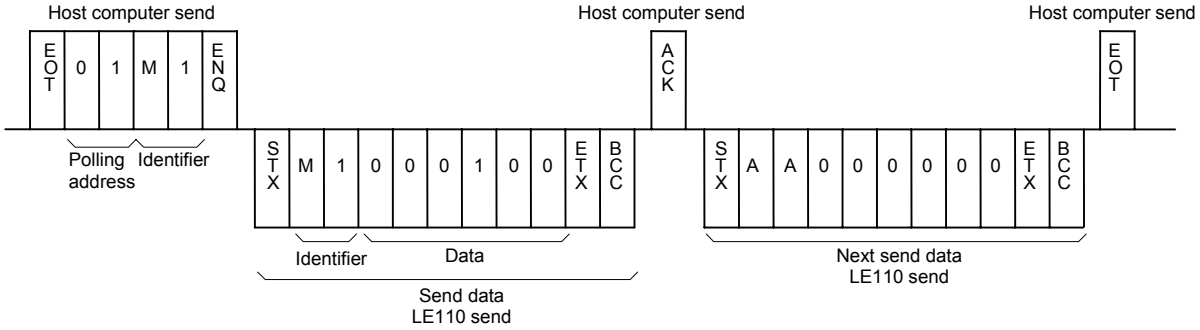
The LE110 sends EOT to terminate the data link when the host computer response is indefinite.

(10) EOT Data link termination

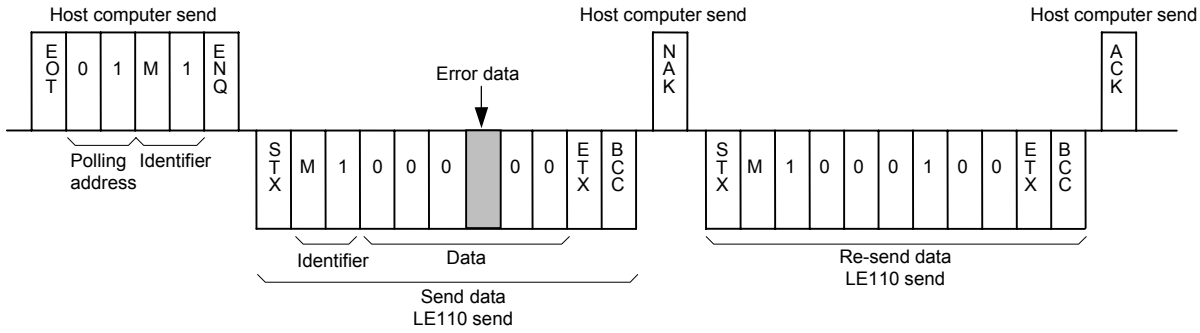
The host computer sends EOT message when it is necessary to suspend communication with the LE110 or to terminate the data link due lack of response from the LE110.

5.1.2 Polling procedure example

■ Normal transmission

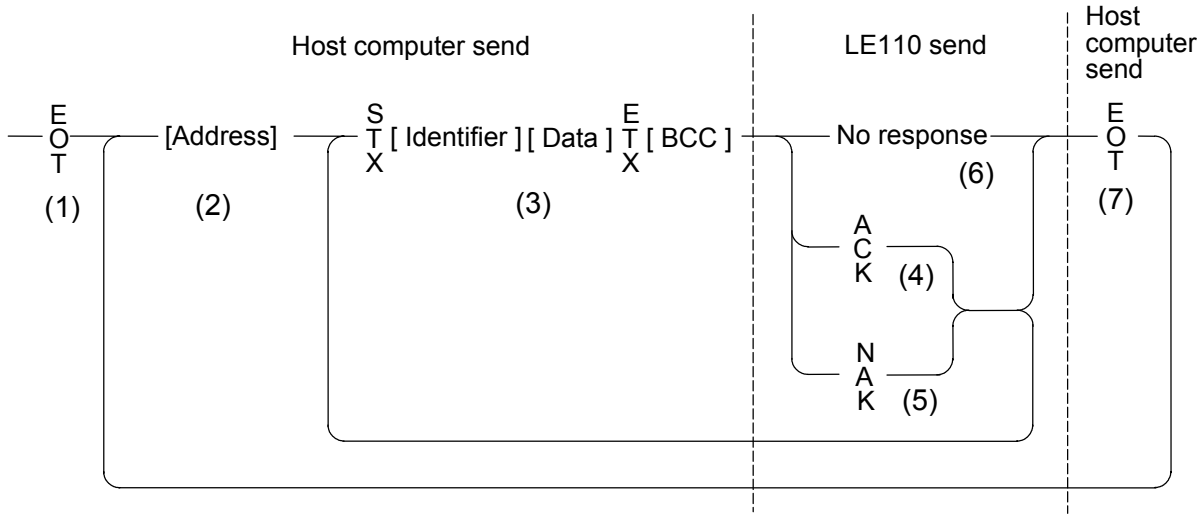


■ Error transmission



5.2 Selecting

Selecting is the action where the host computer requests one of the connected LE110s 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 LE110s to initiate data link before selecting sequence.

(2) Sending selecting address from the host computer

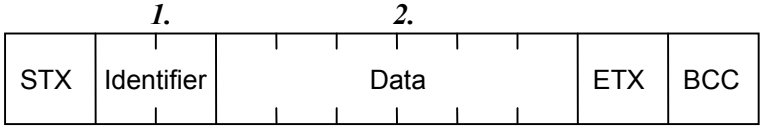
Host computer sends selecting address for the selecting sequence.

Device address (2 digits)
The device address specifies the LE110 to be selected and each LE110 must have its own unique device address.

☞ For details, see **4.2 Setting the Communication Parameters (P. 7)**.

(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. 13)**.

1. Identifier (2 digits)
The identifier specifies the type of data that is requested from the LE110, such as set value.
☞ For details, see **5.3 Communication Identifier List (P. 22)**.

2. Data (Maximum 6 digits)
Data is the information being sent to the LE110. 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, LE110 can receive a data.

- When the host computer send data with decimal point to item of without decimal point, LE110 receives a message with the value which cut off below the decimal point.
  <Example> When setting range is 0 to 200, LE110 receives as a following.

Send data	0.5	100.5
Receive data	0	100

- LE110 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, LE110 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

LE110 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 LE110 when data received is correct. When the host computer receives ACK from the LE110, the host computer will send any remaining data. If there is no more data to be sent to LE110, the host computer sends EOT to terminate the data link.

(5) Negative acknowledge NAK

If the LE110 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 LE110 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 LE110

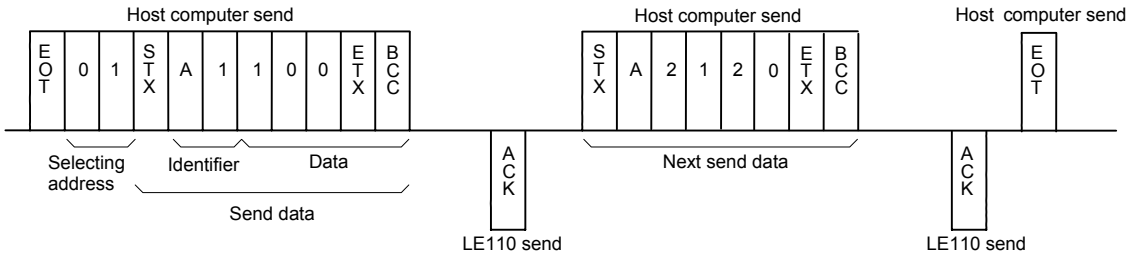
The LE110 does not respond when it can not receive the selecting address, STX, ETX or BCC.

(7) EOT Data link termination

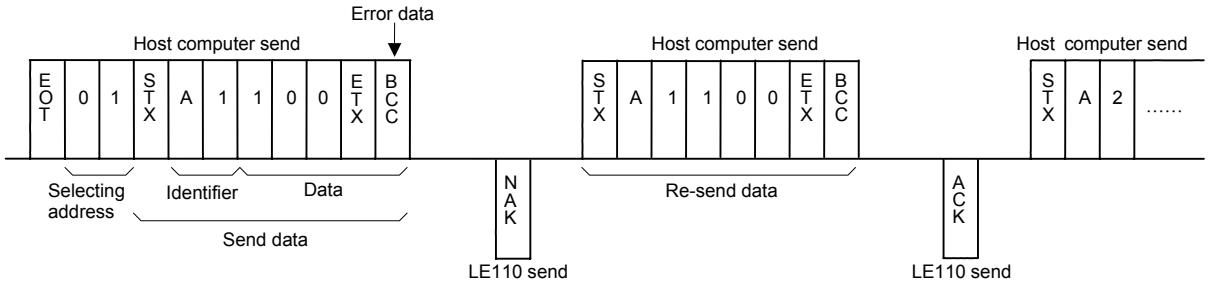
The host computer sends EOT when there is no more data to be sent from the host computer or there is no response from the LE110.

5.2.2 Selecting procedure example

■ Normal transmission



■ Error transmission



5.3 Communication Identifier List

Communication is not possible when an identifier is specified that the LE110 can not recognize.
The number of digits for data is 6.

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

Name	Identifier	Description	Factory set value	Attribute
Measured value (PV)	**M1**	Within input range ☞ See **Input range table (P. 35)**.	—	RO
Output 1 status	**AA**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 2 status	**AB**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 3 status	**AC**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 4 status	**AD**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 5 status	**AE**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 6 status	**AF**	0: OFF 1: ON This is the identifier effective when output type other than OFF are selected.	—	RO
Output 7 status	**AG**	0: OFF 1: ON This is the identifier effective when output 8 points specification and any output type other than OFF are selected.	—	RO

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 8 status	**AH**	0: OFF 1: ON This is the identifier effective when output 8 points specification and any output type other than OFF are selected.	—	RO
Burnout	**B1**	0: OFF 1: ON	—	RO
Error code	**ER**	0: No error 1: Adjusted data destruction error 2: EEPROM write error 4: EEPROM 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 simultaneously, the total summation of these error codes is displayed.	—	RO
ID data	**ID**	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	RO

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Specific gravity monitor	**MS**	0.800 to 2.500	—	RO
Scale low monitor	**ML**	Scale low to Scale high	—	RO
Scale high monitor	**MH**	Scale low to Scale high	—	RO
Peak hold monitor	**HP**	Scale low to Scale high	—	RO
Bottom hold monitor	**HQ**	Scale low to Scale high	—	RO
Number of wafer processing times monitor	**MW**	1 to Number of wafer processing times setting This is the identifier effective when the presence of the specific gravity correction function is selected.	—	RO
Amount of emptiness correction monitor	**MZ**	−5.00 to +5.00 of full span	—	RO
Output 1 set value	**A1**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W
Output 2 set value	**A2**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W
Output 3 set value	**A3**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W
Output 4 set value	**A4**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W
Output 5 set value	**A5**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 6 set value	**A6**	Scale low to Scale high This is the identifier effective when outputs type other than OFF are selected.	Input range high	R/W
Output 7 set value	**A7**	Scale low to Scale high This is the identifier effective when output 8 points specification and any output type other than OFF are selected.	Input range high	R/W
Output 8 set value	**A8**	Scale low to Scale high This is the identifier effective when output 8 points specification and any output type other than OFF are selected.	Input range high	R/W
Actual liquid output setting	**A9**	0: Not executed 1 to 8: Each output is executed	—	WO
Emptiness adjustment	**AZ**	0: Not executed 1: Executed	0	R/W
Number of wafer processing times	**WT**	1: Executed This is the identifier effective when the presence of the specific gravity correction function is selected.	—	WO
Initializing the number of wafer processing times	**CW**	0: Executed This is the identifier effective when the presence of the specific gravity correction function is selected.	—	WO
Hold reset	**HR**	1: Executed	—	WO
Interlock release	**IR**	0: Executed This is the identifier effective when the presence of the output 1 to 8 interlock is selected.	—	WO
Set data lock	**LK**	0: Set data lock not provided. 1: Only output set value can be set. 2: All parameter cannot be set.	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Default setting	**IS**	1: Executed	—	WO
Error release	**EC**	0: Executed	—	WO
Decimal point position selection	**LU**	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places This is the identifier effective when the engineering unit is set to *l* or m*l*.	1	R/W
Number of linearizing table setting	**LT**	2 to 11 This is the identifier effective when the engineering unit is set to *l* or m*l*.	11	R/W
Linearizing table setting 0	**L0**	Scale low to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	0.0	R/W
Linearizing table setting 1	**L1**	Linearizing table setting 0 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	3.6	R/W
Linearizing table setting 2	**L2**	Linearizing table setting 1 to Scale high	7.2	R/W
Linearizing table setting 3	**L3**	Linearizing table setting 2 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	10.8	R/W
Linearizing table setting 4	**L4**	Linearizing table setting 3 to Scale high	14.4	R/W
Linearizing table setting 5	**L5**	Linearizing table setting 4 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	18.0	R/W
Linearizing table setting 6	**L6**	Linearizing table setting 5 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	21.6	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Linearizing table setting 7	**L7**	Linearizing table setting 6 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	25.2	R/W
Linearizing table setting 8	**L8**	Linearizing table setting 7 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	28.8	R/W
Linearizing table setting 9	**L9**	Linearizing table setting 8 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	32.4	R/W
Linearizing table setting 10	**LA**	Linearizing table setting 9 to Scale high This is the identifier effective when the engineering unit is set to *l* or m*l*.	36.0	R/W
Digital filter	**F1**	0 to 100 seconds (0: OFF)	3	R/W
Number of empty adjustment decision times	**AS**	1 to 20 times	10	R/W
Output 1 type selection	**XA**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W
Output 1 deviation value setting	**DA**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 1 interlock function selection	**QA**	0: Without interlock function 1: With interlock function	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 1 action selection	**NA**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 1 differential gap	**HA**	0.0 to 10.0 % of span	0.3	R/W
Output 1 timer setting	**TA**	0 to 600 seconds	0	R/W
Output 2 type selection	**XB**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W
Output 2 deviation value setting	**DB**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 2 interlock function selection	**QB**	0: Without interlock function 1: With interlock function	0	R/W
Output 2 action selection	**NB**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 2 differential gap	**HB**	0.0 to 10.0 % of span	0.3	R/W
Output 2 timer setting	**TB**	0 to 600 seconds	0	R/W
Output 3 type selection	**XC**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 3 deviation value setting	**DC**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 3 interlock function selection	**QC**	0: Without interlock function 1: With interlock function	0	R/W
Output 3 action selection	**NC**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 3 differential gap	**HC**	0.0 to 10.0 % of span	0.3	R/W
Output 3 timer setting	**TC**	0 to 600 seconds	0	R/W
Output 4 type selection	**XD**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W
Output 4 deviation value setting	**DD**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 4 interlock function selection	**QD**	0: Without interlock function 1: With interlock function	0	R/W
Output 4 action selection	**ND**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 4 differential gap	**HD**	0.0 to 10.0 % of span	0.3	R/W
Output 4 timer setting	**TD**	0 to 600 seconds	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 5 type selection	**XE**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W
Output 5 deviation value setting	**DE**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 5 interlock function selection	**QE**	0: Without interlock function 1: With interlock function	0	R/W
Output 5 action selection	**NE**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 5 differential gap	**HE**	0.0 to 10.0 % of span	0.3	R/W
Output 5 timer setting	**TE**	0 to 600 seconds	0	R/W
Output 6 type selection	**XF**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm.	1	R/W
Output 6 deviation value setting	**DF**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected.	0	R/W
Output 6 interlock function selection	**QF**	0: Without interlock function 1: With interlock function	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 6 action selection	**NF**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state	0	R/W
Output 6 differential gap	**HF**	0.0 to 10.0 % of span	0.3	R/W
Output 6 timer setting	**TF**	0 to 600 seconds	0	R/W
Output 7 type selection	**XG**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm. This is the identifier effective when output 8 points specification is selected.	1	R/W
Output 7 deviation value setting	**DG**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected. This is the identifier effective when output 8 points specification is selected.	0	R/W
Output 7 interlock function selection	**QG**	0: Without interlock function 1: With interlock function This is the identifier effective when output 8 points specification is selected.	0	R/W
Output 7 action selection	**NG**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state This is the identifier effective when output 8 points specification is selected.	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 7 differential gap	**HG**	0.0 to 10.0 % of span This is the identifier effective when output 8 points specification is selected.	0.3	R/W
Output 7 timer setting	**TG**	0 to 600 seconds This is the identifier effective when output 8 points specification is selected.	0	R/W
Output 8 type selection	**XH**	0: OFF 1: Process high output 2: Process low output 3: Deviation high output 4: Deviation low output The high limit or low limit deviation output can be set only when the engineering unit is set to mm. This is the identifier effective when output 8 points specification is selected.	1	R/W
Output 8 deviation value setting	**DH**	−50 to +50 mm This is the identifier effective when output type 3 (high limit deviation output) or 4 (low limit deviation output) is selected. This is the identifier effective when output 8 points specification is selected.	0	R/W
Output 8 interlock function selection	**QH**	0: Without interlock function 1: With interlock function This is the identifier effective when output 8 points specification is selected.	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Output 8 action selection	**NH**	0: Transistor turned on in the output activating state 1: Transistor turned off in the output activating state This is the identifier effective when output 8 points specification is selected.	0	R/W
Output 8 differential gap	**HH**	0.0 to 10.0 % of span This is the identifier effective when output 8 points specification is selected.	0.3	R/W
Output 8 timer setting	**TH**	0 to 600 seconds This is the identifier effective when output 8 points specification is selected.	0	R/W
Monitor output high	**HV**	Monitor output low to Scale high This is the identifier effective when the presence of the monitor function is selected.	1000	R/W
Monitor output low	**HW**	Scale low to Monitor output high This is the identifier effective when the presence of the monitor function is selected.	0	R/W
End specific gravity setting	**EG**	0.800 to 2.500 This is the identifier effective when the presence of the specific gravity correction function is selected.	1.000	R/W
Number of wafer processing times setting	**SW**	1 to 20 This is the identifier effective when the presence of the specific gravity correction function is selected.	10	R/W
Scale low	**XX**	0 to 50 mm This is the identifier effective when the specific gravity setting is changed to the manual setting.	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Identifier	Description	Factory set value	Attribute
Specific gravity setting	**SG**	0.800 to 2.500 This is the identifier effective when the specific gravity setting is changed to the manual setting.	1.000	R/W
Scale 1 actual liquid setting	**J1**	0 to 1250 mm This is the identifier effective when the specific gravity setting is changed to the actual liquid setting.	0	R/W
Scale 2 actual liquid setting	**J2**	1 to 1250 mm This is the identifier effective when the specific gravity setting is changed to the actual liquid setting.	1250	R/W
Correction on the low limit side by actual liquid 2	**J3**	1: Executed This is the identifier effective when the engineering unit is set to % (% display of pressure).	—	WO
Correction on the high limit side by actual liquid 2	**J4**	1: Executed This is the identifier effective when the engineering unit is set to % (% display of pressure).	—	WO
Unit setting	**UN**	0: mm 1: % (% display of liquid level) 2: % (% display of pressure) 3: *l* 4: m*l* 5: kPa 6: Pa ☞ See **Input range table (P. 35)**.	0	R/W
Specific gravity setting transfer	**SP**	0: Manual setting 1: Actual liquid setting This is the identifier effective when the engineering unit is set to mm, % (% display of liquid level), *l* or m*l*.	0	R/W

Continued on the next page.

Continued from the previous page.

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

Name	Iden-tifier	Description	Factory set value	Attrib-ute
Specific gravity correction function selection	**SS**	0: Without specific gravity correction function 1: With specific gravity correction function This is the identifier effective when the engineering unit is set to mm and the specific gravity setting is changed to the manual setting.	0	R/W
DI function selection	**DS**	0: For conducting the emptiness adjustment 1: For counting the number of wafer processing times This is the identifier effective when the presence of the contact input and also specific gravity correction function are selected.	0	R/W
Volume/level display selection	**MM**	0: Volume display 1: Level display This is the identifier effective when the engineering unit is set to *l* or m*l*.	0	R/W

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 0.8: 0 to 1250 mm At specific gravity 1: 0 to 1000 mm At specific gravity 2.5: 0 to 400 mm
1	%	0.0 to 100.0	% display of liquid level.
2	%	0.0 to 100.0	% display of pressure.
3	*l*	0 to 360	The decimal point position depends on the decimal point position selection.
4	m*l*	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 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.

■ RKC communication

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	

Continued on the next page.

Continued from the previous page.

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

b5 to b7	b4	b3	b2	b1		0	1	2	3	4	5	6	7
					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
	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: JUN. 2004 [IMQ00]
The third edition: OCT. 2005 [IMQ00]

RKC INSTRUMENT INC.

HEADQUARTERS: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO 146-8515 JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799)
E-mail: info@rkcinst.co.jp
FAX: 03-3751-8585 (+81 3 3751 8585)

IMR01C06-E3 **OCT. 2005**