High Resolution
Temperature Controller

REX-F9000

Communication
Instruction Manual

- MELSEC : MITSUBISHI product
- C200HS: OMRON product
- 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 product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the 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**

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

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. SPECIFICATION

Interface: Based on EIA standard RS-485

Connection method: 2-wire system, half-duplex multidrop connection

Communication distance: 1 km (max.)
(However, the maximum communication distance varies slightly with the surroundings such as cables etc.)

Synchronous method: Start/stop synchronous type

Communication speed: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps

Data type: RKC standard communication:
  Start bit: 1
  Data bit: 7 or 8
  Parity bit: Unused or Used (Odd number or even number)
  Stop bit: 1 or 2
Ladder communication:
  Start bit: 1
  Data bit: 8 (Fixed)
  Parity bit: None
  Stop bit: 1

Protocol: RKC standard communication:
  ANSI X3.28-1976 subcategories 2.5 and A4
  Polling/selecting type
Ladder communication:
  Non-protocol type

Error control (Only RKC standard communication):
Vertical parity (With parity bit selected)
Horizontal parity (BCC check)

Maximum connection: RKC standard communication:
  32 sets including a host computer
Ladder communication:
  32 sets including a programmable controller

Communication code: RKC standard communication:
      ASCII 7-bit code
      Ladder communication:
        Text: BCD code
        Control code: STX (02H) *, CR (0DH) *, LF (0AH) *
        * Code in brackets ( ) are in hexadecimal.

Terminal resister: 100 Ω or more (Externally connected)

Xon/Xoff control: None

Signal logic:

Signal voltage	Logic
V (A) > V (B)	0 (Space status)
V (A) < V (B)	1 (Mark status)

2. CONNECTION

Up to 32 REX-F9000 including the host computer (or programmable controller [hereinafter, the "PLC"]) can be connected if multidrop connected by RS-485.

(1) Terminal No. and signal details

Terminal No.	Signal name	Name	Signal direction REX-F9000 Host computer or PLC
7	SG	Signal ground	————————
8	T/R(A)	Send data/Receive data	⟵—————⟶
9	T/R(B)	Send data/Receive data	⟵—————⟶

📖 Use the solderless terminal appropriate to the screw size.
- Screw size: M3 × 8
- Recommended tightening torque: 0.4 N·m [4 kgf·cm]
- Maximum allowance tighten torque: 1.0 N·m [10 kgf·cm]
- Specified solderless terminals: With isolation
- Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm^2

(2) Connecting method

■ When RS-485 is used as a host computer or PLC interface

It is necessary that a circuit to transfer send and receive be built-in the host computer (or PLC).

*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.
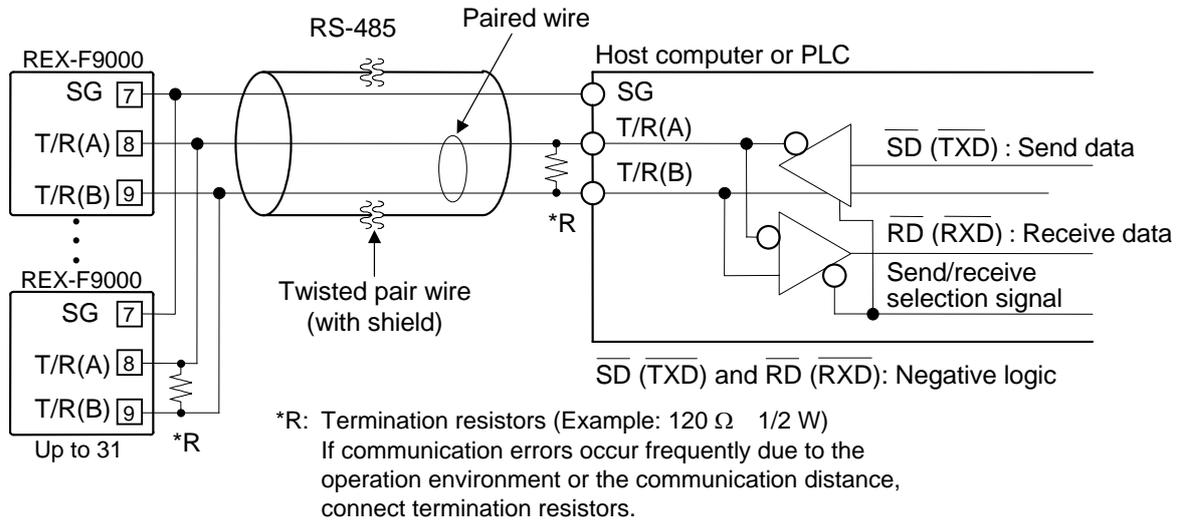
■ When RS-232C is used as a host computer or PLC interface

Communication level converter (RS-232C/RS-485) is used.

*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.
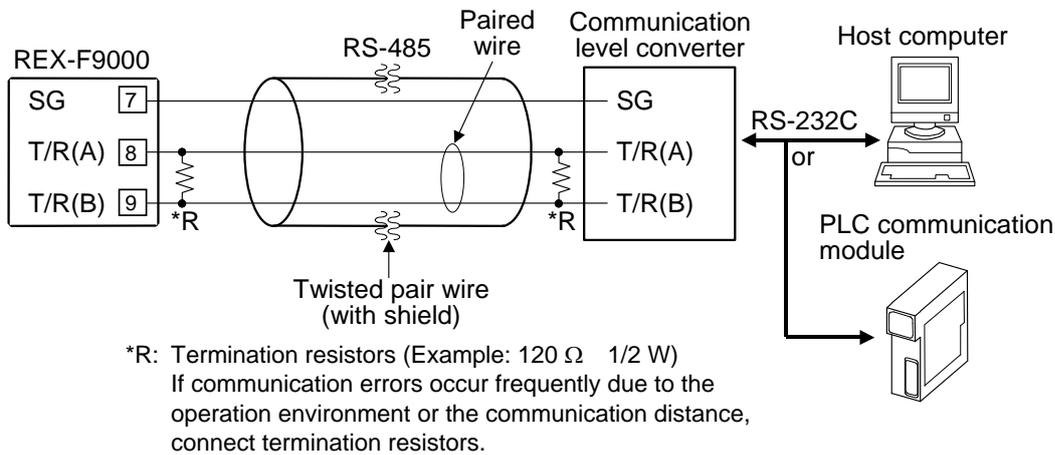
Use a communication level converter of the automatic send/receive select type.
Recommended: CD485, CD485/V manufactured by Data Link, Inc. or equivalent.

IM9000F02-E4

(3) Connection example

■ 1-channel type

When up to 32 REX-F9000 controllers including host computer (or PLC) are connected.
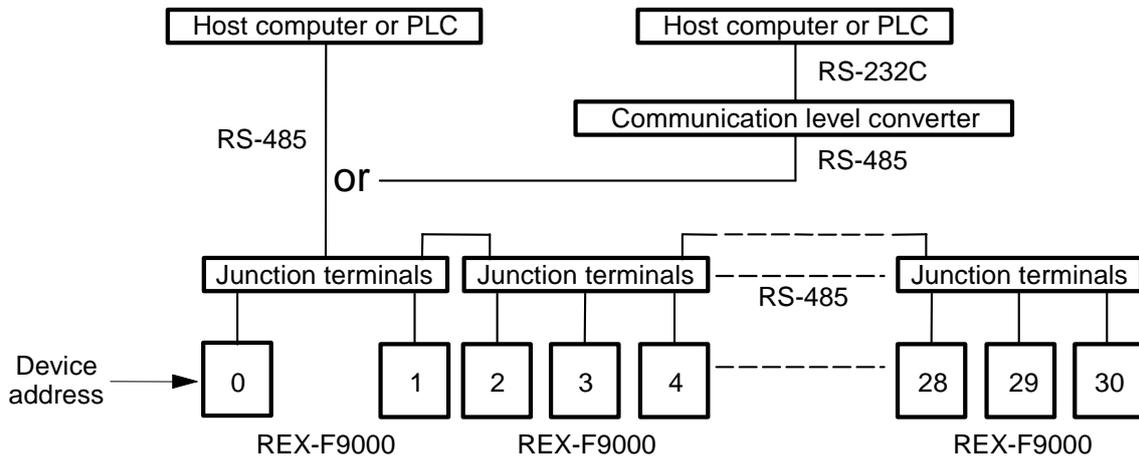
■ 2-channel type

For the 2-channel type REX-F9000 controller, set independent device addresses to CH1 and CH2.
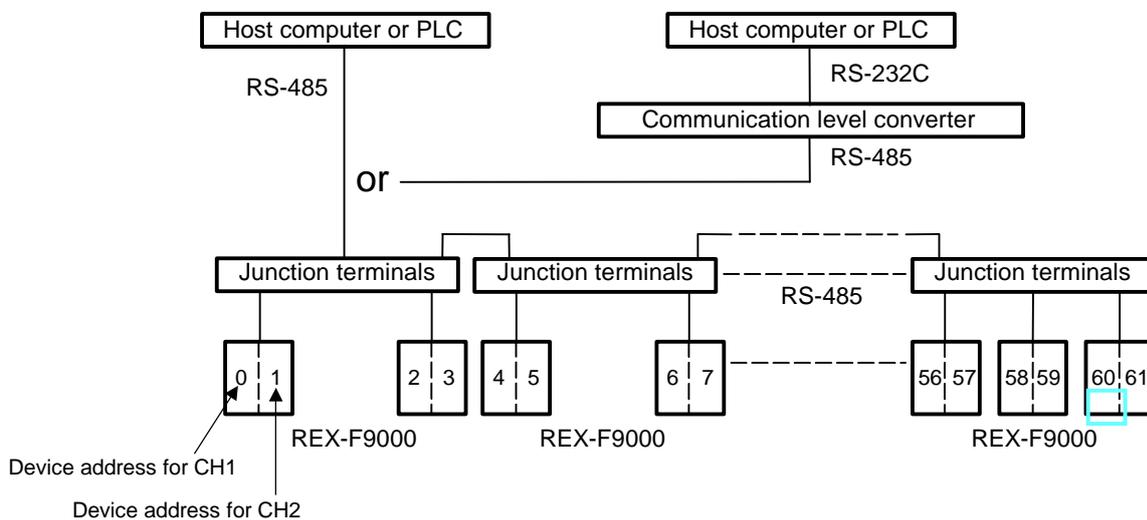
3. SETTING FOR COMMUNICATION

In order to make communication between the REX-F9000 and the host computer (or PLC), it is necessary to set the device address, communication speed, communication data configuration, interval time and protocol. Communication settings are made in parameter group 24 (PG24).

3.1 Preparation for Setting Communication Parameters

The setting of parameter group 24 (PG24) can be changed only in control stop mode. Before the SETUP mode is selected, it is necessary to set the mode selection of "Control RUN/STOP" to "STOP."
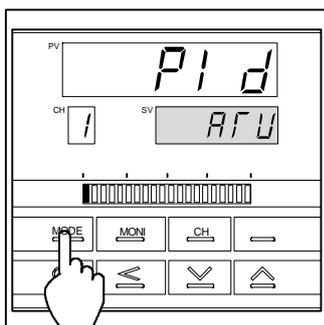
1. Press the MODE key to set the instrument to the mode transfer.
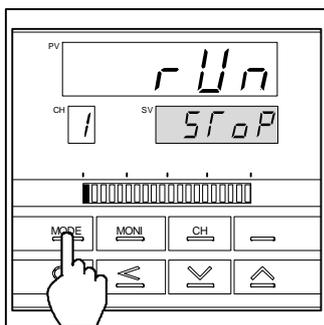
2. Press the MODE key to display "Control RUN/STOP."
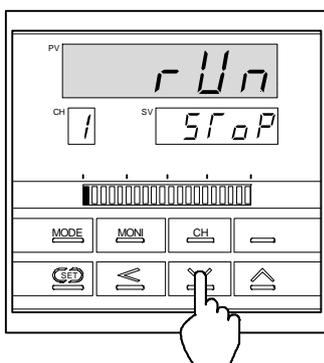
3. Press the DOWN key to control is changed from execution (RUN) to STOP.

☐ : Bright lighting

▨ : Dim lighting

3.2 Transfer to Parameter Group 24 (PG24)
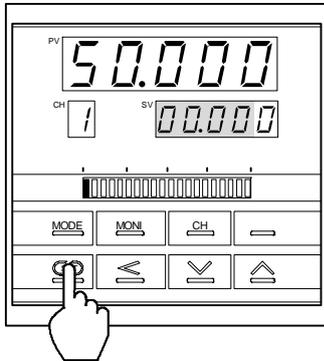
1. Press the SET key to set the instrument to the SV setting mode.
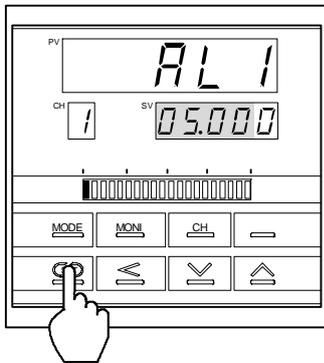
2. Press the SET key for more than 5 seconds in SV setting mode to set the instrument to operator set mode.
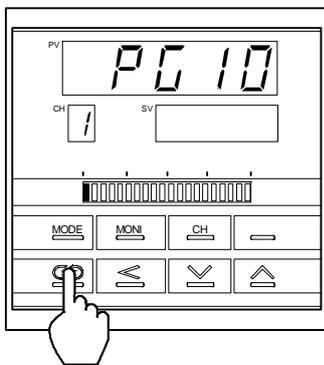
3. Press the SET key for more than 5 seconds in operator set mode to set the instrument to setup mode.
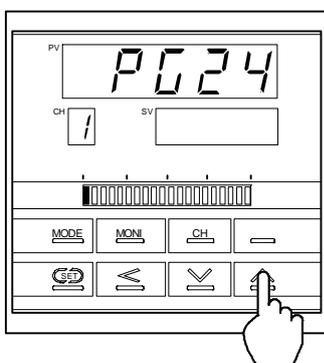
4. Press the UP key a few times to display "PG24."

☐ : Bright lighting

▩ : Dim lighting

3.3 Communication Parameter Selection

Communication parameter in parameter group 24 (PG24) are selected in the order of device address (Add), communication speed (bPS), communication data configuration (bIT), interval time (InT) and protocol selection (CMPS). Each communication parameter is selected by pressing the SET key.

■ Display sequence

PV: *PG24* CH: *1* SV: — Parameter group 24 (PG24)

Press the SET key.

PV: *Add* CH: *1* SV: *0* — Device address (Add)

Press the SET key.

PV: *bPS* CH: *1* SV: *3* — Communication speed (bPS)

Press the SET key.

PV: *bIT* CH: *1* SV: *0* — Data configuration (bIT)

Press the SET key.

PV: *InT* CH: *1* SV: *250* — Interval time (InT)

Press the SET key.

PV: *CMPS* CH: *1* SV: *0* — Protocol selection (CMPS)
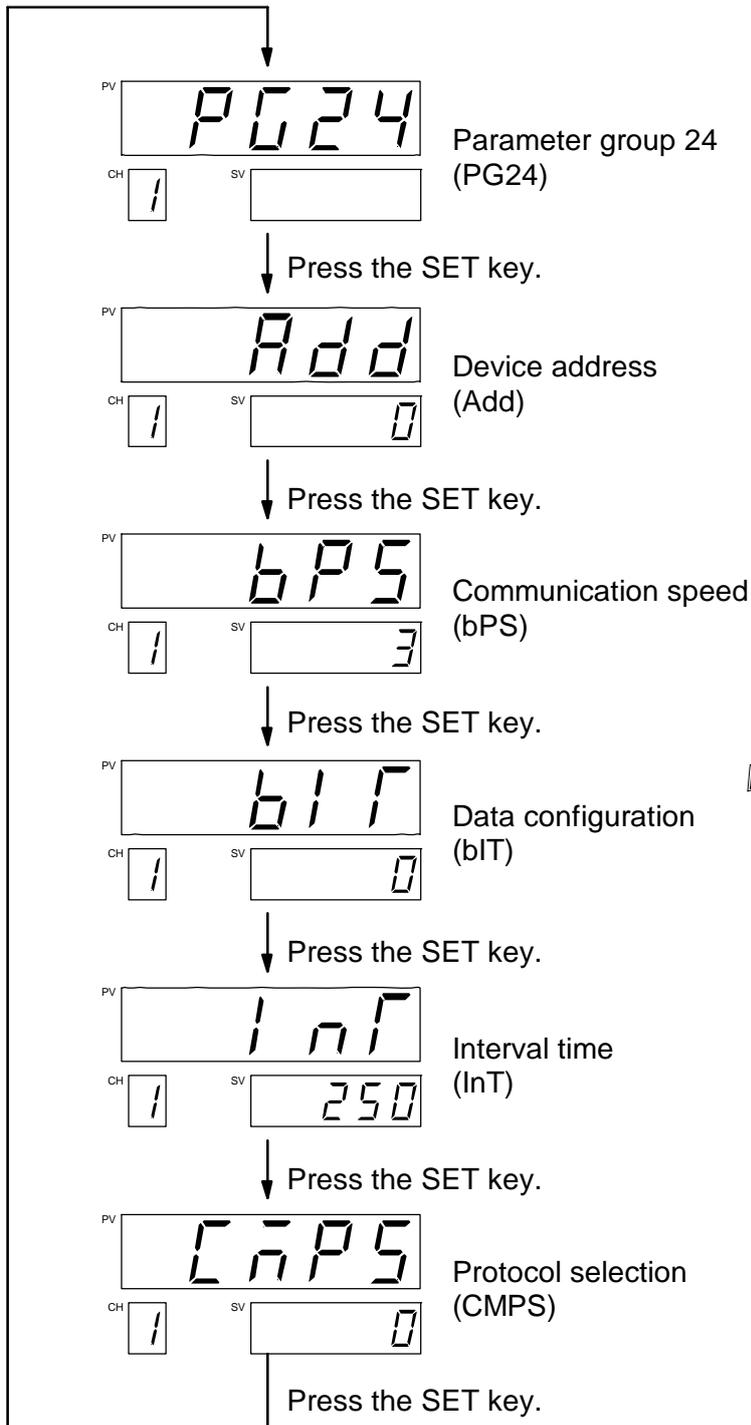
Press the SET key.

📖 In order to set the CH2 monitor, communication parameter, press the CH key to change CH1 to CH2. The setting procedure is the same as the CH1 setting.

IM9000F02-E4

3.4 Device Address Setting

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

■ Symbol and symbol name

Add (Add) : Device address

■ Setting range

Range: 0 to 99   Factory set value: 0

■ Setting procedure

📖   **For the 2-channel type REX-F9000, set independent device addresses to CH1 and CH2.**

Example: When setting device address to 15.
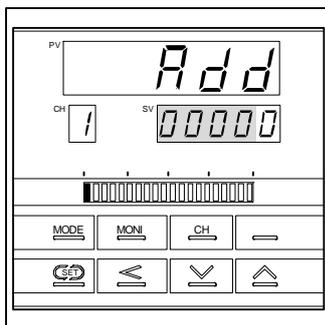
1. Change the controller to parameter group 24 (PG24), and then display the device address (See P. 8).
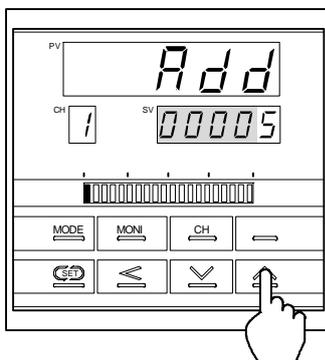
2. Set the devise address. Press the UP key to enter "5" in the lowest
digit.

☐ : Bright lighting
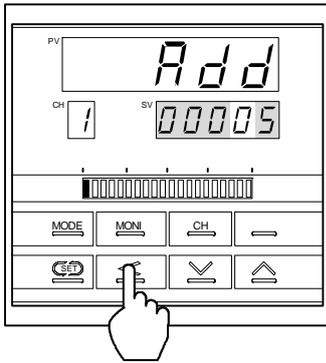
▨ : Dim lighting

3. Press the SHIFT key to brightly light the tens digit.
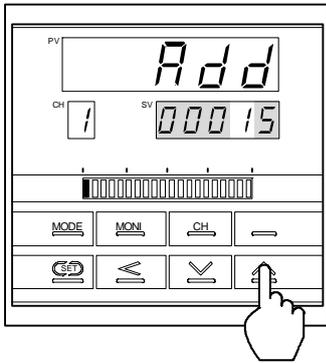
4. Press the UP key to enter "1" in the tens digit.
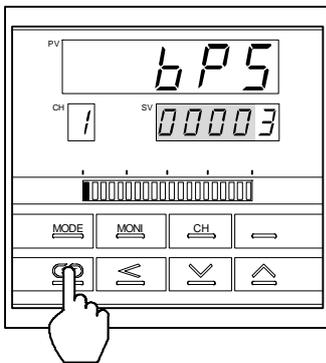
5. Press the SET key to select the next communication parameter.
As a result, the set device address is registered.

⬜ : Bright lighting

⬛ : Dim lighting

📖　For the 1-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the PV/SV display.

📖　For the 2-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the CH1PV/CH2PV display.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　IM9000F02-E4

3.5 Communication Speed Setting

Set a communication speed of 1200 bps, 2400 bps, 4800 bps, 9600 bps or 19200 bps by using numerals from 0 to 4. Press the UP or DOWN key to change the numeral.

■ Symbol and symbol name

bPS

(bPS) : Communication speed

■ Setting items

Set value	Communication speed	Factory set value
0	1200 bps	
1	2400 bps	
2	4800 bps	3
3	9600 bps	
4	19200 bps	

■ Setting procedure

📖 **Set the same communication speed to both the REX-F9000 and connecting host computer (or PLC).**

📖 **For the 2-channel type REX-F9000, set the same communication speed to CH1 and CH2.**

Example: When setting communication speed to "2: 4800 bps."
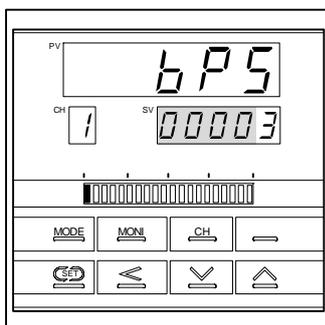
1. Select the communication speed display. (See P. 8.)

☐ : Bright lighting
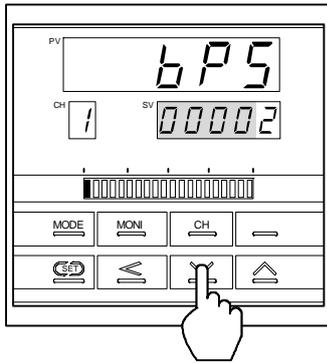
▨ : Dim lighting

2. Press the DOWN key to enter "2" in the lowest digit. As a result, a communication speed of 4800 bps is set.
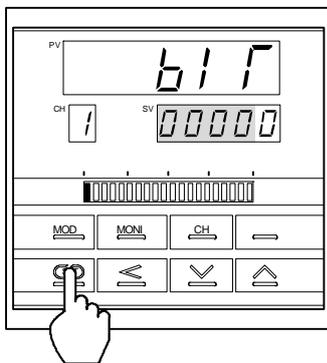
3. Press the SET key to change to the next communication parameter. As a result, the set communication speed is registered.

☐ : Bright lighting

▨ : Dim lighting

📖 For the 1-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the PV/SV display.

📖 For the 2-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the CH1PV/CH2PV display.

3.6 Communication Data Configuration Setting

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

■ Symbol and symbol name

bI T (bIT) : Communication data configuration

■ Setting items

(1) RKC standard communication: Set the desired numeric value from 0 to 11.

Set value	Parity bit	Data bit	Stop bit	Factory set value
0	None	8	1	
1	None	8	2	
2	Even	8	1	
3	Even	8	2	
4	Odd	8	1	
5	Odd	8	2	0
6	None	7	1	
7	None	7	2	
8	Even	7	1	
9	Even	7	2	
10	Odd	7	1	
11	Odd	7	2	

(2) Ladder communication: The following numeric value is fixed.

Parity bit:	None
Data bit:	8
Stop bit:	1

📖   If the protocol is for ladder communication, it becomes invalid even when the communication data bit configuration is selected.

■ Setting procedure

📖 **For the 2-channel type REX-F9000, set the same communication data configuration to CH1 and CH2.**

Example: When setting communication data configuration to "1: 8 data bits, no parity bit and 2 stop bits."
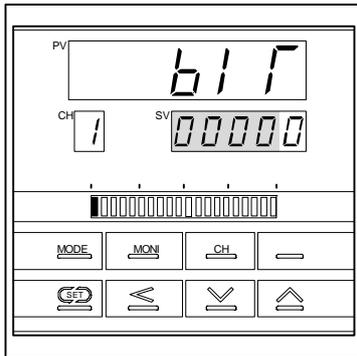
1. Select the data configuration during communication. (See P. 8.)
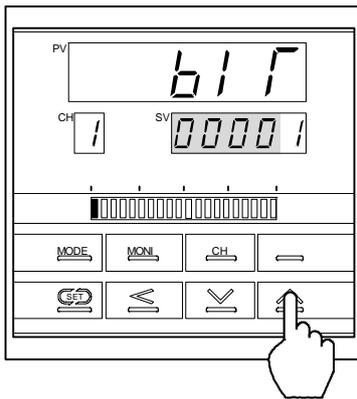
2. Press the UP key to enter "1" in the lowest digit. As a result, communication data configuration is set to "8 data bits, no parity bit and 2 stop bits."
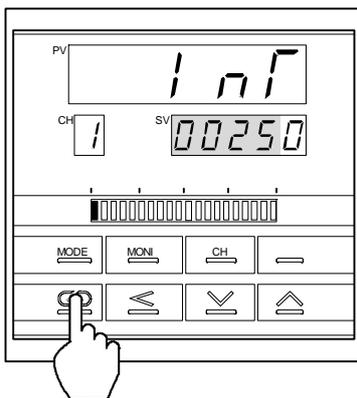
3. Press the SET key to change to the next communication parameter. As a result, the set communication data configuration is registered.

⬜ : Bright lighting

▨ : Dim lighting

📖 For the 1-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the PV/SV display.

📖 For the 2-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the CH1PV/CH2PV display.

IM9000F02-E4

3.7 Interval Time Setting

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

■ Symbol and symbol name

$I \sqcap \Gamma$ (InT) : Interval time

■ Setting range

Range: 0 to 250 ms	Factory set value: 250

■ Setting procedure

📖   **For the 2-channel type REX-F9000, set the same interval time to CH1 and CH2.**

Example: When setting interval time to 200 ms.
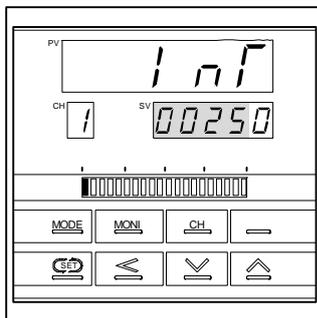
1. Select the interval time display. (See P. 8.)
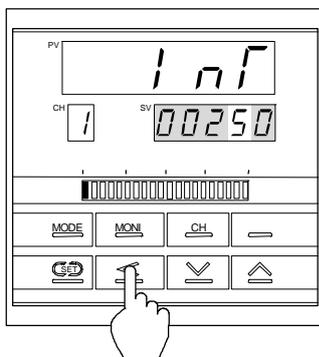
2. Press the SHIFT key to brightly light the tens digit.

☐ : Bright lighting
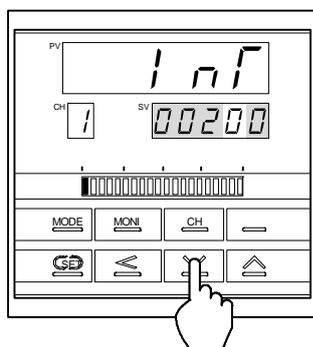
▨ : Dim lighting

3. Press the DOWN key to enter "0" in the tens digit.
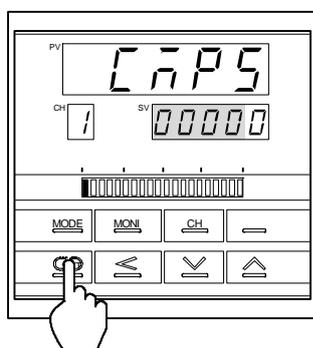
4. Press the SET key to change to the next communication parameter. As a result, the set interval time is registered.

☐ : Bright lighting

▨ : Dim lighting

📖   For the 1-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the PV/SV display.

📖   For the 2-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the CH1PV/CH2PV display.

IM9000F02-E4

3.8 Protocol Setting

The protocol is selected. Either RKC standard communication or ladder communication is selected. Press the UP or DOWN key to change the numeral.

■ Symbol and symbol name

CmPS (CMPS) : Protocol selection

■ Setting items

Set value	Protocol type	Factory set value
0	RKC standard communication	0
1	Ladder communication	

■ Setting procedure

📖 **For the 2-channel type REX-F9000, set the same protocol selection to CH1 and CH2.**

Example: When setting protocol to "1: Ladder communication."
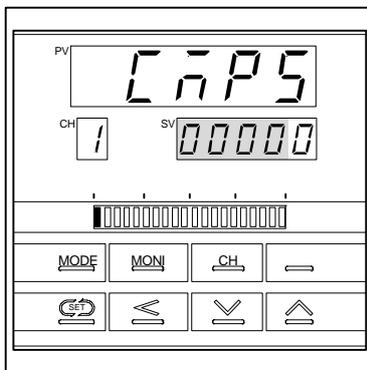
1. Select the protocol selection display. (See P. 8.)

☐ : Bright lighting
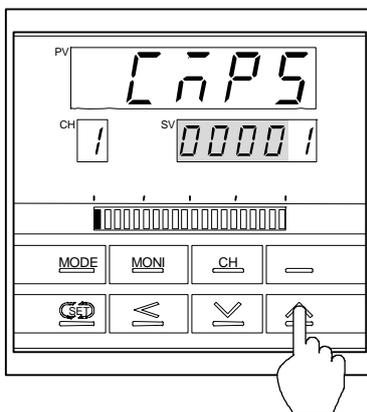
▨ : Dim lighting

2. Setting a numeric value of "1" by pressing the UP key changes the protocol to ladder communication.
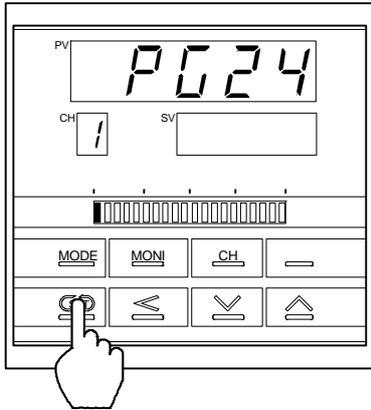
3. Press the SET key to change to the next communication parameter. As a result, the set data construction is registered.

☐ : Bright lighting

▨ : Dim lighting

📖 For the 1-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the PV/SV display.

📖 For the 2-channel type, if the key is not operated for more than 1 minute, the present display automatically returns to the CH1PV/CH2PV display.

3.9 Cautions for Communication

(1) Send/receive selection

■ When host computer is selected from data sending to data receiving

When switching the host computer into reception from transmission, it must be confirmed that the data was surely put on line. This is not observe the transmission buffer of host computer itself, but confirming with shift register.

Next, the REX-F9000 side secures the maximum time until the transmission line changes to the data receiving side (until the REX-F9000 is ready to send data) after the host computer has received the stop bit corresponding to the final character. This maximum time corresponds to interval time. If no interval time is set, the REX-F9000 side may be set to the send state even when the host computer side is not set to the receive state. As a result, no communication is conducted correctly. In addition, set the interval time so as to match the host computer.

■ When host computer is selected from data receiving to data sending

Polling procedure "Response wait time after BCC send" or selecting procedure "Response wait time after [ACK] or [NAK] send" is processing time required during REX-F9000 data sending. Therefore, select the host computer from receiving to sending after the lapse of the above time. As for the necessary processing time, refer to the table of page 21.

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

The transmission and reception of RS-485 communication are operated by a transmitting wire.

Therefore, the timing of switching should be acted correctly. Send/receive example in the host computer and REX-F9000 is show in the following.

■ Polling procedure

Host computer	Send data (Possible/Impossible)	Possible / Impossible	
	Sending status		E O T - - - - - E N Q ... A C K or N A K
REX-F9000	Send data (Possible/Impossible)	Possible / Impossible	a. ... b. ... c.
	Sending status		S T X - - - - - B C C
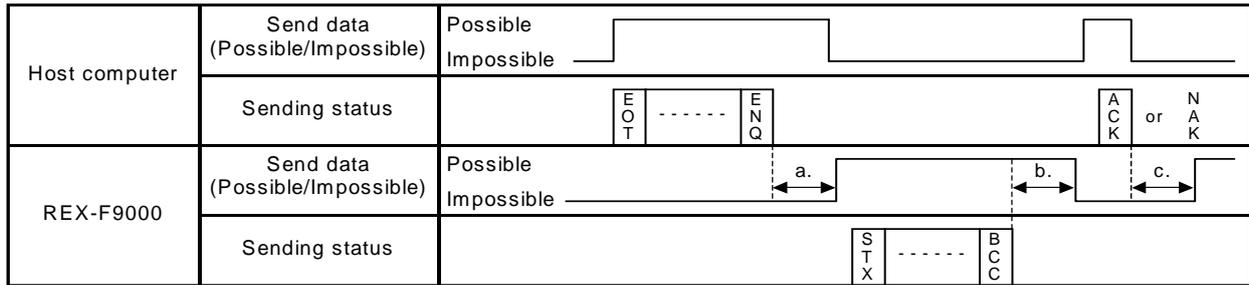
a. (Response send time after calling [ENQ] receive) + (Interval time)

b. Response send time after BCC send

c. (Response send time after acknowledgment [ACK] receive) + (Interval time) or
   (Response send time after negative acknowledge [NAK] receive) + (Interval time)

■ Selecting procedure

Host computer	Send data (Possible/Impossible)	Possible / Impossible	
	Sending status		S T X - - - - - B C C
REX-F9000	Send data (Possible/Impossible)	Possible / Impossible	a. ... b.
	Sending status		A C K or N A K
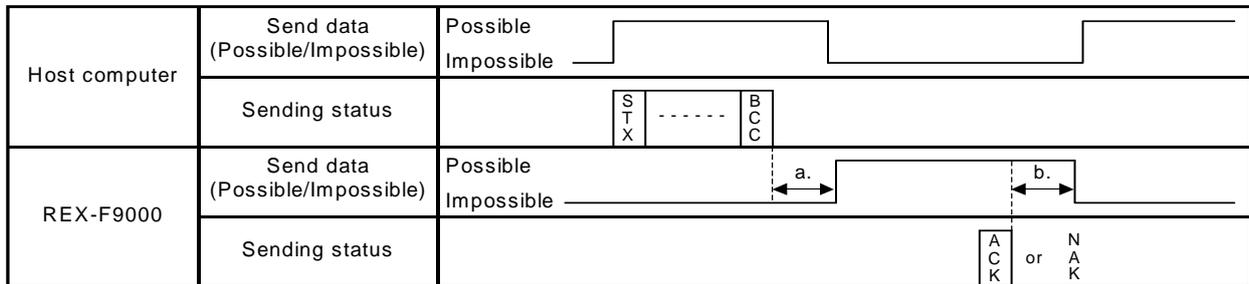
a. (Response send time after BCC receive) + (Interval time)

b. Response wait time after acknowledgment [ACK] send or
   Response wait time after negative acknowledge [NAK] send

📖 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.

📖 Polling procedure "Response wait time after BCC send" or selecting procedure "Response wait time after [ACK] or [NAK] send" is processing time required during REX-F9000 data sending. Therefore, select the host computer from receiving to sending after the lapse of the above time.

(3) RS-422A/RS-485 Fail-safe

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

(4) Send/receive processing times

The processing time shown in the following is required for the REX-F9000 during data sending and receiving.

■ Polling procedure

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after calling [ENQ] receive	—	—	7.0
Response send time after acknowledgment [ACK] receive	—	—	7.0
Response send time after negative acknowledge [NAK] receive	—	—	7.0
Response send time after BCC send	—	—	1.0

📖 Data link is terminated sending [EOT], if no response within about 3 seconds after BCC send. Response wait time is the time when the interval time is set to 0 ms.

■ Selecting procedure

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after BCC receive	2.0	3.0	7.0
Response wait time after acknowledgment [ACK] send	—	—	1.0
Response wait time after negative acknowledge [NAK] send	—	—	1.0

📖 Response wait time is the time when the interval time is set to 0 ms.

4. RKC STANDARD COMMUNICATION

4.1 Communication Protocol

The REX-F9000 uses the polling/selecting method to establish a data link. The basic procedure is followed ANSI X3.28-1976 subcategories 2.5 and A4 basic mode data transmission control procedure (Fast selecting is established for selecting).

- In the polling/selecting method, the REX-F9000 is controlled completely by the host computer is permitted. Since the host computer invites information message sending from and receiving to the REX-F9000, send the data in accordance with the polling or selecting procedure. (Centralized control method)

- The code use in communication is 7-bit ASCII code including transmission control character. The transmission control characters are [EOT] (04H), [ENQ] (05H), [ACK] (06H), [NAK] (15H), [STX] (02H) and [ETX] (03H). The figure in the parenthesis is indicating hexadecimal number.

4.1.1 Polling

Polling is an action that host computer requesting one of the REX-F9000 which selected among multidrop connected, to transmit the data. The procedure is as the following.

ID: Identifier

■ **Polling procedure**

(1) **Initialize of data link**

Host computer sends [EOT] for initializing of data link before polling sequence.

(2) **Polling sequence send**

Host computer sends polling sequence with a format shown below.

1.	*2.*	*3.*
		ENQ

Device address | Identifier

Example:

0	2	M	1	ENQ
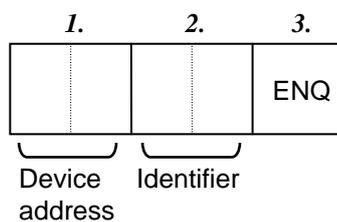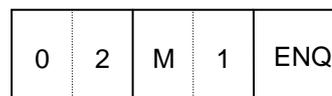
1. **Device address [Number of digits: 2]**

This data is a device address of the REX-F9000 for polled and must be the same as the device address set value in item "**3.4 Device address setting**" (P. 9).

2. **Identifier [Number of digits: 2]** (See P. 31)

This is for identifying data requested for the REX-F9000.
Always attach the [ENQ] code to the end of the identifier.

3. **[ENQ]**

This is the transmission control character which indicates the end of the polling sequence. Then, the host computer waits for response from the REX-F9000.

(3) **REX-F9000 data send**

If the polling sequence is received correctly, the REX-F9000 sends data in the following format.

1.	*2.*	*3.*	*4.*	*5.*
STX	Identifier	Data	ETX	BCC

1. **[STX]**

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

2. **Identifier [Number of digits: 2]** (See P. 31)

This is for identifying data (measured value, status and set value) sent to the host computer.

3. **Data [Number of digits: 7]**

Data indicated by the identifier belonging to the REX-F9000. It is expressed in decimal ASCII code including a minus sing (−) and a decimal point. No zero suppression is made.

4. **[ETX]**

A transmission control character used to indicate text end.

5. **[BCC]**

BCC (Block Check Character) for error detection using horizontal parity. BCC is calculated by horizontal parity (even number).

<Algorithm>

Take off exclusive "OR" of all character from next [STX] through [ETX].
Not including [STX].

Example:

In the case of the data are:

S T X	M	1	0	2	3	.	0	0	0	E T X	BCC
4DH	31H	30H	32H	33H	2EH	30H	30H	30H	03H		50H

In the parenthesis are indicated with hexadecimal number.

BCC = 4DH $\oplus$ 31H $\oplus$ 30H $\oplus$ 32H $\oplus$ 33H $\oplus$ 2EH $\oplus$ 30H $\oplus$ 30H $\oplus$ 30H $\oplus$ 03H = 50H
Value of BCC becomes 50H

(4) REX-F9000 data send end (EOT send)

If the following cases, the REX-F9000 sends [EOT] to terminate the data link.

- When there is no specified identifier.
- When there is an error in the data type.
- After all the data has been sent.

(5) REX-F9000 no response

The REX-F9000 is set to no response when the polling sequence is not received correctly. If necessary, take time out recovery etc. for the host computer.

(6) Acknowledgment [ACK]

Send [ACK] when the host computer could receive data items correctly.
Next, the REX-F9000 sends the identifier data following the identifier just sent in succession shown in "■ **Communication identifier list**" (P. 31).
If data send from the REX-F9000 is suspend, send [EOT] to terminate the data link.

(7) Negative acknowledge [NAK]

If the host computer cannot receive send data correctly from the REX-F9000, it sends [NAK] to the controller. Then, the REX-F9000 re-sends the same data to the host computer.
As the number of re-send times is not specified, take the necessary measures on the host computer side if no recovery is made.

(8) No response from host computer

When the host computer is set to no response after the REX-F9000 sends data, the REX-F9000 sends [EOT] as time-out processing to terminate the data link (time-out time: approx. 3 seconds).

(9) Indefinite response from host computer

When the response from the host computer is indefinite, the REX-F9000 sends [EOT] to terminate the data link.

(10) Data link termination [EOT]

If it is necessary to suspend communication with the REX-F9000 or to terminate the data link due to no response from the controller, the host computer sends [EOT].

■ Polling procedure example (When the host computer requests data)

● Normal transmission

Host computer send

E O T	0	1	M	1	E N Q
04H	30H	31H	4DH	31H	05H

Polling address — Identifier

S T X	M	1	0	2	3	.	0	0	0	E T X	B C C
02H	4DH	31H	30H	32H	33H	2EH	30H	30H	30H	03H	50H

REXF-9000 data send

Host computer send

A C K
06H

Host computer send

E O T
04H

S T X	A	A	0	0	0	0	0	0	0	E T X	B C C
02H	41H	41H	30H	30H	30H	30H	30H	30H	30H	03H	33H

REX-F9000 data send

● For the presence of error in data

Host computer send

E O T	0	1	M	1	E N Q
04H	30H	31H	4DH	31H	05H

Polling address — Identifier

Error data

S T X	M	1	0	2	3	.		0	0	E T X	B C C
02H	4DH	31H	30H	32H	33H	2EH		30H	30H	03H	50H

REX-F9000 data send

Host computer send

N A K
15H

Host computer send

A C K
06H

S T X	M	1	0	2	3	.	0	0	0	E T X	B C C
02H	4DH	31H	30H	32H	33H	2EH	30H	30H	30H	03H	50H

REX-F9000 data send

4.1.2 Selecting

Selecting is an operation in which the host computer selects one from among the REX-F9000s multidrop connected and then of recommending data receive. The procedure is as the following.
Due to adopted fast selecting in REX-F9000s therefore becomes the type to send the data which connected to selecting sequence.
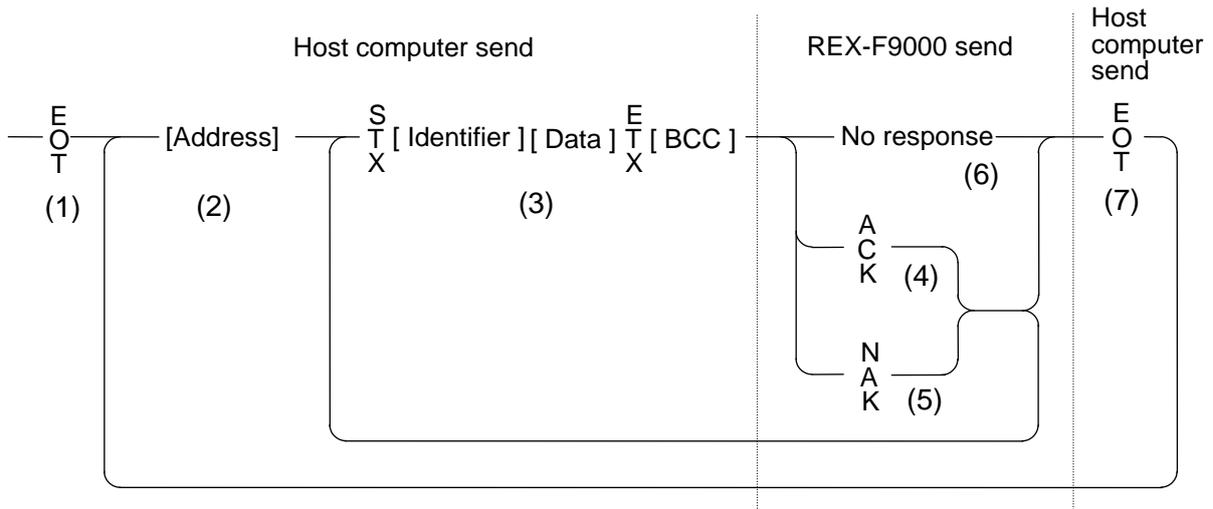
■ Selecting procedure

(1) Initialize of data link

Host computer sends [EOT] for initializing of data link before selecting sequence.

(2) Selecting address send

Send the selecting address selected as the selecting sequence from the host computer.

[Device address] (Number of digits: 2)
This data is a device address of the REX-F9000 to be selected and must be the same as the device address set value in item "3.4 Device address setting" (P. 9).

(3) Data send

Host computer to send the data with a format indicated below continuing the selecting sequence.

STX	Identifier	Data	ETX	BCC
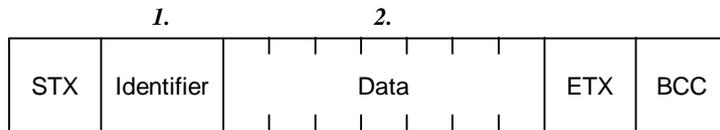
☞　For [STX], [ETX] and [BCC], see item "**4.1.1 Polling**" (P. 22).

1. **Identifier [Number of digits: 2]** (See P. 31)
This identifies the data (set value) which is sent by the host computer.

2. **Data [Number of digits: 7]**
This is the data indicated by the identifier of the REX-F9000. It is expressed in decimal ASCII code including a minus sign (−) and a decimal point. Even zero suppressed data or data whose figures below the decimal point are omitted can be received (However, the maximum number of digits is 7).

Example: When data is -1.5

−001.5 →	Receivable	−1.50 →	Receivable
−01.5 →	Receivable	−1.500 →	Receivable
−1.5 →	Receivable		

In addition, the REX-F9000 determines the receive data during selecting as follows.

Example: When setting data is between −10.00 to +10.00

When data is receivable:
−.5	→	-0.5
−.058	→	-0.05
.03	→	0.03

When data is not receivable:
−	→	Not receivable (NAK answer)
.	→	Not receivable (NAK answer)
−.	→	Not receivable (NAK answer)
+0	→	Not receivable (NAK answer)

(4) Acknowledgment [ACK]

If the REX-F9000 correctly received data sent from the host computer, send [ACK]. Then, if there is data to be sent next on the host computer side, send the data.
After the data has been sent, send [EOT] to terminate the data link.

(5) Negative acknowledge [NAK]

The REX-F9000 sends [NAK] in the following cases. Then the appropriate recovery processing steps, such as data resend on the host computer side should be taken.

- When an error occurs on the line (parity, framing error, etc.).
- When a BCC check error occurs.
- When there is no identifier.
- When receive data is not in the specified configuration
  (Text is not in the "Identifier + data construction.")
- When the number of receive data digits exceeds 7.
- When normally receive data exceeds the setting range.

(6) No response

If the selecting address is not received correctly, the REX-F9000 is set to no response, if [STX], [ETX] and [BCC] is not received correctly, the REX-F9000 is also set to no response.

(7) Data link termination [EOT]

When terminating the data link because there was no more to be sent on the host computer side or the REX-F9000 was set to no response, send [EOT] from the host computer.

■ Selecting procedure example (When the host computer sends a set value)

● Normal transmission

Host computer send

E O T	0	1	S T X	S	1	0	2	3	.	0	0	0	E T X	B C C
04H	30H	31H	02H	53H	31H	30H	32H	33H	2EH	30H	30H	30H	03H	4EH

Selecting address — Send data

A C K
06H

REX-F9000 send

Host computer send

S T X	P	1	0	3	0	.	0	0	0	E T X	B C C
02H	50H	31H	30H	33H	30H	2EH	30H	30H	30H	03H	4FH

Send data

A C K
06H

REX-F9000 send

Host computer send

E O T	0	2	S T X	....
04H	30H	32H	02H	

● For the presence of error in data

Host computer send

E O T	0	1	S T X	S	1	0		3	.	0	0	0	E T X	B C C
04H	30H	31H	02H	53H	31H	30H		33H	2EH	30H	30H	30H	03H	4EH

Selecting address — Error data — Send data

N A K
15H

REX-F9000 send

Host computer send

S T X	S	1	0	2	3	.	0	0	0	E T X	B C C
02H	53H	31H	30H	32H	33H	2EH	30H	30H	30H	03H	4EH

Resend data

A C K
06H

REX-F9000 send

Host computer send

S T X	A	1	.....
02H	41H	31H	

4.2 Communication Identifier

■ **Communication identifier list**

📖 **Before changing data corresponding to the identifiers from "XI (input type)" to "WB (alarm 2 hold action selection)," always turn the "Control RUN/STOP" mode to "STOP."**

📖 The number of digits is 7 for all data. [Except for model code (ID)]

(Attributes   RO: Read only,   R/W: Read/Write)

Name	Iden-tifier	Data range	Attribute	Factory set value
Model code	**ID**	—	RO	—
Measured value (PV)	**M1**	—	RO	—
Alarm 1 output [1]	**AA**	0: OFF 1: ON	RO	—
Alarm 2 output [2]	**AB**	0: OFF 1: ON	RO	—
Manipulated output value (MV)	**O1**	−5.0 to +105.0 % When the instrument is the manual (MAN) mode, attribute becomes results in Read/Write (R/W).	RO	—
Burnout	**B1**	0: OFF 1: ON	RO	—
Error code	**ER**	0 to 255 See **Table 1** (P. 34)	RO	—
PID/AT transfer	**G1**	0: PID 1: Autotuning (AT)	R/W	0
AUTO/MANUAL transfer	**J1**	0: AUTO 1: MANUAL	R/W	0
Control RUN/STOP	**SR**	0: RUN 1: STOP	R/W	0
Set value (SV)	**S1**	Setting limiter (low limit) to setting limiter (high limit)	R/W	0.000
Alarm 1 setting	**A1**	Process alarm: 0.000 to 50.000 °C	R/W	5.000
Alarm 2 setting	**A2**	Deviation alarm: −19.999 to +19.999 °C		
Proportional band	**P1**	0.001 to 50.000 °C (0.000 cannot be set.)	R/W	30.000
Integral time	**I1**	0.1 to 3600.0 seconds (0.0 cannot be set.)	R/W	240.0
Derivative time	**D1**	0.0 to 3600.0 seconds 0.0: Derivative action OFF	R/W	60.0

Continued from the previous page.

(Attributes   RO: Read only,   R/W: Read/Write)

Name	Iden-tifier	Data range	Attribute	Factory set value
Control response parameter	**CA**	0: Slow 1: Medium 2: Fast	R/W	0
PV bias	**PB**	−19.999 to +19.999 °C	R/W	0.000
Sensor bias	**PC**	−1.9999 to +1.9999 Ω	R/W	0.0000
Digital filter	**F1**	0.0 to 100.0 seconds 0.0: Digital filter OFF	R/W	0.0
Output limiter (high limit)	**OH**	Output limiter (low limit) to +105.0 %	R/W	100.0
Output limiter (low limit)	**OL**	−5.0 % to output limiter (high limit)	R/W	0.0
AT bias	**GB**	−19.999 to +19.999 °C	R/W	0.000
Alarm 1 differential gap [1]	**HA**	0.000 to 50.000 °C	R/W	2.000
Alarm 1 timer setting [1]	**TD**	0 to 600 seconds	R/W	0
Alarm 2 differential gap [2]	**HB**	0.000 to 50.000 °C	R/W	2.000
Alarm 2 timer setting [2]	**TG**	0 to 600 seconds	R/W	0
Analog output specification selection [3, 4]	**LA**	0: Measured value (PV) 1: Deviation (DEV) 2: Set value (SV) 4: Manipulated output value (MV)	R/W	0
Analog output scale high [3]	**HV**	See **Table 2** (P. 34)	R/W	50.000
Analog output scale low [3]	**HW**		R/W	0.000
Bar-graph display selection	**DA**	0: Manipulated output value(MV) [1 dot: 5 %] 1: Deviation (DEV) [0.01 °C/dot] 2: Deviation (DEV) [0.1 °C/dot]	R/W	0
Input type	**XI**	0: Pt100 Ω (3-wire system) 1: Pt100 Ω (4-wire system) 2: JPt100 Ω (3-wire system) 3: JPt100 Ω (4-wire system)	R/W [5]	0

Continued from the previous page.

(Attributes   RO: Read only,   R/W: Read/Write)

Name	Iden-tifier	Data range	Attribute	Factory set value
Decimal point position selection	**XU**	0: No digit below decimal-point 1: 1 digit below decimal-point 2: 2 digits below decimal-point 3: 3 digits below decimal-point	R/W [5]	3
Power supply frequency	**JT**	0: 50 Hz 1: 60 Hz 2: Auto setting [6]	R/W [5]	0
Setting limiter (high limit)	**SH**	Setting limiter (low limit) to 50.000 °C	R/W [5]	50.000
Setting limiter (low limit)	**SL**	0.000 °C to setting limiter (high limit)	R/W [5]	0.000
Output cycle time	**T0**	0.1 to 100.0 seconds	R/W [5]	0.1
Direct/reverse action selection	**XE**	0: Direct action 1: Reverse action	R/W [5]	1
Power feed forward [7]	**PF**	0: OFF 1: ON	R/W [5]	1
Alarm 1 type selection	**XA**	See **Table 3** (P. 35)	R/W [5]	0
Alarm 1 energize/de-energize selection	**NA**	0: Energize 1: De-energize	R/W [5]	0
Alarm 1 action selection at abnormality	**OA**	0: Normal action 1: Forced alarm output ON	R/W [5]	0
Alarm 1 hold action selection	**WA**	See **Table 4** (P. 35)	R/W [5]	0
Alarm 2 type selection	**XB**	See **Table 3** (P. 35)	R/W [5]	0
Alarm 2 energize/de-energize selection	**NB**	0: Energize 1: De-energize	R/W [5]	0
Alarm 2 action selection at abnormality	**OB**	0: Normal action 1: Forced alarm output ON	R/W [5]	0
Alarm 2 hold action selection	**WB**	See **Table 4** (P. 35)	R/W [5]	0
Set data lock level selection	**LK**	See **Table 5** (P. 35)	R/W	0
Mode lock level selection	**LM**	See **Table 6** (P. 35)	R/W	0

[1] This is an identifier which enables communication when there is an alarm 1.

[2] This is an identifier which enables communication when there is an alarm 2.

[3] This is an identifier which enables communication when there is an analog output.

[4] The analog output specification selection must not set 3.

[5] Data can be written only in STOP mode.

[6] Set the auto setting when the power feed forward function is used. When no power feed input is used, set the desired power frequency (0: 50 Hz or 1: 60 Hz).

📖 **When "2: Auto setting" is selected, control stops under the following condition.**
- **When no power feed input is used (no power feed transformer is connected)**
- **When power feed input voltage becomes less than 30 % of rated value**

[7] When the power feed forward function is used, the power feed input is required from the power feed transformer. When no power feed input is used, always set the power feed forward function to "0: OFF."

📖 **When the power feed forward function is set to "1: ON," control stops under the following condition.**
- **When no power feed input is used (no power feed transformer is connected)**
- **When power feed input voltage becomes less than 30 % of rated value**

Table 1: Error code

Any number other than "0" indicates errors (RAM write error, etc.) detected by the REX-F9000 self-diagnosis function. If two or more errors occur simultaneously, the sum total of all error Nos. is sent. Contact your nearest RKC sales agent or RKC sales office.

Error code	Details
—	MCU abnormality
—	MCU power supply voltage abnormality
—	Software abnormality
16	Input circuit abnormality
8	EEPROM error
4	Adjusted data destruction
2	Sensor break
1	Other abnormality

Table 2: Analog scale range

The analog output scale differs depending on the analog output specification.

Analog output specification	Analog output scale range
0: When measured value (PV) is selected.	0.000 to 50.000 °C
1: When deviation (DEV) is selected.	−19.999 to +19.999 °C
2: When set value (SV) is selected.	0.000 to 50.000 °C
3: When manipulated output (MV) is selected.	−5.0 to +105.0%

Table 3: Alarm type

Set value	Type
0	No alarm
1	Set value high alarm
2	Set value low alarm
3	Process high alarm
4	Process low alarm
5	Deviation high alarm
6	Deviation low alarm
7	Deviation high/low alarm (Absolute value setting)
8	Band alarm (Absolute value setting)

Table 4: Hold action type

Set value	Type
0	No hold action
1	Hold action is taken when the power is turned on.
2	Hold action is taken when the power is turned on or the setting changed.

Table 5: Set data lock level

Set value	Set data lock level
0	Set value (SV) and parameter cannot be set.
1	Only set value (SV) can be set.
2	Only parameter group (PG) cannot be set.

Table 6: Mode lock level

Set value	PID/AT	AUTO/MANUAL	Control RUN/STOP
0	×	×	×
1	×	—	×
2	—	×	×
3	—	—	×
4	×	×	—
5	×	—	—
6	—	×	—
7	—	—	—

—: Unsettable (Mode lock)

×: Settable (Mode unlock)

5. LADDER COMMUNICATION

5.1 Communication Protocol

Ladder communication is a communication means provided for connecting with the PLC. The REX-F9000 uses the ignored process for the ladder communication protocol.

● **Definition of protocol**

Read: Based on a data request from the PLC, data is sent to the PLC from the REX-F9000.

Write: Based on a data request from the PLC, data is received by the REX-F9000.

5.1.1 Communication data configuration

■ **PLC → REX-F9000 (During data send from PLC)**

	1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*
Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	ADR	ID	CMD	DAT	CR (0DH)	LF (0AH)

■ **REX-F9000 → PLC (During data receive by PLC)**

	1.	*2.*	*3.*	*4.*	*5.*	*4.*	*5.*		*6.*	*7.*
Number of bytes	1	1	2	2	2	2	2	......	1	1
Number of BCD digits	2	2	4	4	4	4	4	......	2	2
Details	STX (02H)	ADR	ID	CMD	DAT	CMD	DAT	......	CR (0DH)	LF (0AH)

1. **STX**

This is the transmission control character which indicates the start of the text (identifier and data). Set to STX (02H) fixed.

2. **ADR [Device address]**

This data corresponds to the device address to select one REX-F9000 from among many REX-F9000s to which the PLC is multi-drop-connected. This should be the same as the device address set value in "**3.4 Device address setting**" (P. 9).

3. **ID [Identifier]**

These are numbers used for the PLC to identify data to be requested or set to the REX-F9000.

These are numbers of four figures in the communication identifier list (P. 44).

4. **CMD [Command]**

These are commands used for the PLC to identify the details of processing and the data sing to be requested to the REX-F9000.

PLC → REX-F9000 (During data send from PLC)

Command (CMD)	Details	Identifier transfer order
(0000)	Read request	Upper byte → Lower byte
0001		
0010	Write request, write data + (Positive)	
0011	Write request, write data − (Negative)	
0100	Read request (Byte inversion)	Lower byte → Upper byte
1000	Write request, write data + (Positive)	
1100	Write request, write data − (Negative)	
Other	Usage inhibited	—

REX-F9000 → PLC (During data receive by PLC)

Command (CMD)	Details	Identifier transfer order
0000	Read response, read data + (Positive)	Data transfer order is in accordance with the command from the PLC connected to the REX-F9000.
0001	Read response, read data − (Negative)	Upper byte → Lower byte
0010	Write response, write result data + (Positive)	
0011	Write response, write result data − (Negative)	Lower byte → Upper byte
0100	Read response, read data − (Negative)	
1000	Read request, write result data + (Positive)	
1100	Read request, write result data − (Negative)	
Other	Abnormal response	—

5. **DAT [Data]**

Details of processing by PLC	Communication direction	Details of send/receive data
Polling (For data read)	PLC → REX-F9000	Number of read data (Maximum 30)
	REX-F9000 → PLC	Read data (Data such as measured value (PV), etc.)
Selecting (For data write)	PLC → REX-F9000	Write data
	REX-F9000 → PLC	Data after write execution

6. 7. **CR, LF [Delimit]**

Control characters to indicate the end of a text. The REX-F9000 judges that the text ends if it receives CR (0DH) and LF (0AH) in succession.

5.1.2 Data format

The data (DAT) format is expressed as internal data excluding the decimal point.

Example:

Data name	Actual data	Internal data
Manipulated output value (MV)	−5.0 to +105.0	−0050 to +1050
Proportional band	0.001 to 50.000	0001 to 5000
PV bias	−19.999 to +19.999	−1999 to +1999
Alarm 1 setting	Process alarm: 0.000 to 50.000 Deviation alarm: −19.999 to +19.999	Process alarm: 0000 to 5000 Deviation alarm: −1999 to +1999

5.1.3 Data read

Reads identifiers requested from the PLC by the corresponding number of data items. A response from REX-F9000 is returned as 4-digit BCD data excluding the sign data and decimal point. Number of data which can be read at a time: 1 to 30.

PLC send data

Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	Device address (ADR)	Identifier (ID)	0001	Read data	CR (0DH)	LF (0AH)

Command (CMD)   Data (DAT)
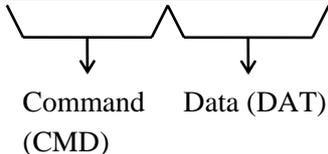
REX-F9000 response under normal operation

Number of bytes	1	1	2	2	2	2	2	.....
Number of BCD digits	2	2	4	4	4	4	4	.....
Details	STX (02H)	Device address (ADR)	Identifier (ID)	0000	dddd1	0000	dddd2	.....

This numeric value changes depending on the data sign (+ or −).   (0 or 1)

Command (CMD)   Data (DAT)   Data corresponding to identifier + 1
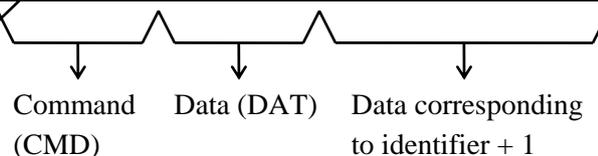
	2	2	1	1
.....	4	4	2	2
.....	0000	ddddn	CR	LF

Data corresponding to
identifier + n − 1 (n: Number of read data)

📖   If there is no identifier requested by the PLC, the REX-F9000 returns the "0000" data.

5.1.4 Data write

Writes the specified data in the specified identifier. Write data is specified by 4-digit BCD data excluding the sign data and decimal point.
The number of data which can be written at a time is 1.

PLC send data

Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	Device address (ADR)	Identifier (ID)	0010 or 0011	dddd	CR (0DH)	LF (0AH)

Command (CMD)   Setting data
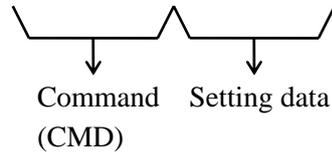
REX-F9000 response

Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	Device address (ADR)	Identifier (ID)	0010 or 0011	dddd	CR	LF

📖 The original data is returned by ignoring data write for either of the following cases.

• The data range is exceeded, or

• a write inhibit identifier is specified.

IM9000F02-E4

5.1.5 Reversal of read/write data bytes

There are two methods of sending word data: One is to send the data from the upper byte and the other is to send the data from the lower byte.

The following two items can be inverted: Identifier (ID) and data (DAT).

Only the data (DAT) can also be inverted by setting.

Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	Device address (ADR)	Identifier (ID)	Command (CMD)	Data (DAT)	CR (0DH)	LF (0AH)

These two items can be inverted.

■ Inverting method

Reversal of Identifier (ID) and data (DAT)

The usual data transfer order is reversed by the command (CMD).

PLC → REX-F9000 (During data send from PLC)

Command (CMD)	Details	Identifier transfer order
(0000)	Read request	Upper byte → Lower byte
0001		
0010	Write request, write data + (Positive)	
0011	Write request, write data − (Negative)	
0100	Read request (Byte inversion)	Lower byte → Upper byte
1000	Write request, write data + (Positive)	
1100	Write request, write data − (Negative)	
Other	Usage inhibited	—

Continued from the previous page.

REX-F9000 → PLC (During data receive by PLC)

Command (CMD)	Details	Identifier transfer order
0000	Read response, Read data + (Positive)	Data transfer order is in accordance with the command from the PLC connected to the REX-F9000.
0001	Read response, Read data − (Negative)	Upper byte → Lower byte
0010	Write response, Write result data + (Positive)	
0011	Write response, Write result data − (Negative)	Lower byte → Upper byte
0100	Read response, Read data - (Negative)	
1000	Write request, Write result data + (Positive)	
1100	Write request, Write result data − (Negative)	
Other	Abnormal response	―

■ Only data (DAT) is inverted

Change can be made by specifying "0011" to the data number (ID) and setting data on "0: High order→Low order " or "Other than 0: Low order→High order."

Number of bytes	1	1	2	2	2	1	1
Number of BCD digits	2	2	4	4	4	2	2
Details	STX (02H)	Device address (ADR)	0011	Command (CMD)	Set 0 or any number other than 0.	CR (0DH)	LF (0AH)
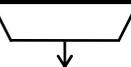
Identifier (ID)   Data (DAT)

Example: The following procedure is executed for send/receive data of 1234h.

- **When sending data from the upper byte**

When REX-F9000 sends data: Sends data in order of 12h and 34h.

When REX-F9000 receives data: When REX-F9000 receives data in order of 12h and 34h, it recognizes the data as 1234h.

- **When sending data from the lower byte**

When REX-F9000 sends data: Sends data in order of 34h and 12h.

When REX-F9000 receives data: When REX-F9000 receives data in order of 12h and 34h, it recognizes the data as 3412h.

This setting is held even if the power is turned on again.

5.1.6 REX-F9000 no response

The REX-F9000 issues no-response for any of the following cases.

- The device address sent from the PLC does not match the device address of the REX-F9000.
- "CR" and "LF" cannot be normally received.
- When there is an error in the data type.
- When a communication error occurs.

5.1.7 Example of text sent by PLC

■ Example of text

It is assumed that the address No. is 00 and that data notation is hexadecimal.

● When reading measured value (PV)

PLC send

| STX | 00 | 0100 | 0000 | 0001 | CR | LF |

- Device address
- Identifier
- Command
- Number of read data

REX-F9000 response

| STX | 00 | 0100 | 0000 | 0023 | CR | LF |

- Device address
- Identifier
- Measured value (PV)
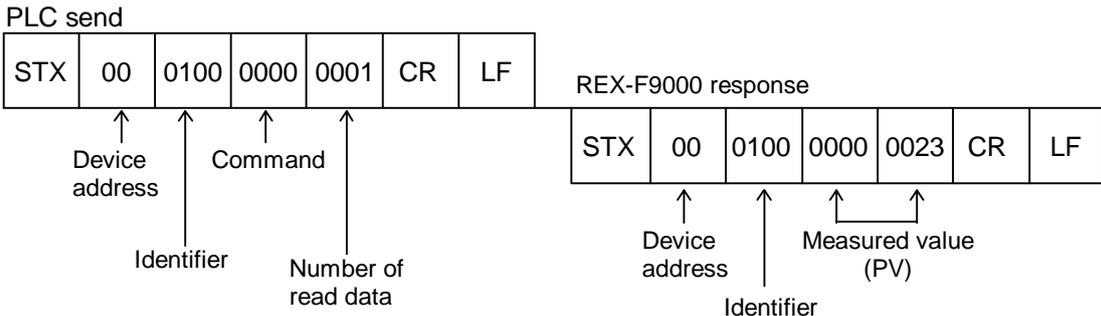
● When writing set value (SV)

PLC send

| STX | 00 | 0105 | 0010 | 0030 | CR | LF |

- Device address
- Identifier
- Command
- Write data

REX-F9000 response

| STX | 00 | 0105 | 0010 | 0030 | CR | LF |

- Device address
- Identifier
- Set value (SV)
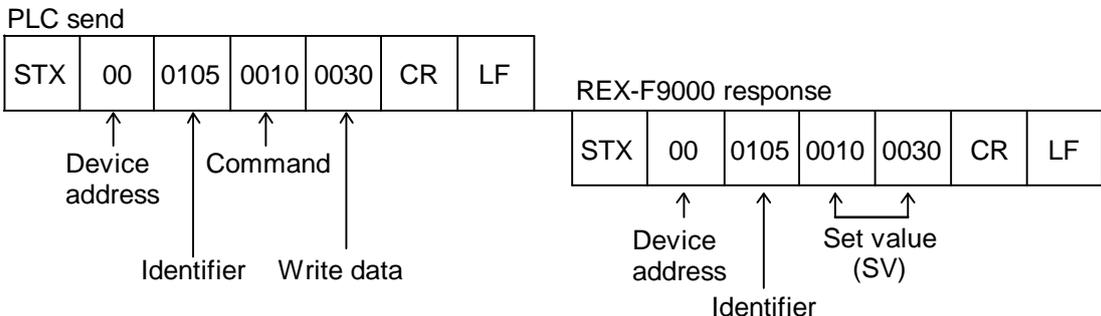
5.2 Communication Identifier

In RKC standard communication described above, each item is expressed by an identifier combined with a number and a letter (M1, S1 ...) but in ladder communication, each item is expressed only by a number.

(Attributes   RO: Read only,   R/W: Read/Write)

Item	Identifier Upper	Identifier Lower	Details of data	#1	#2	Factory set value
Measured value (PV)	01	00	Within input range	1/100 °C	RO	—
Undefined	01	01	—	—	—	—
Manipulated output value (MV)	01	02	−0050 to +1050	1/10 %	RO	—
Undefined	01	03	—	—	—	—
Alarm 1 output	01	04	See **Note 1** (P. 45)	—	RO	—
Alarm 2 output						
Burnout (Measured value)						
Set value (SV)	01	05	Setting limiter (low limit) to setting limiter (high limit)	1/100 °C	R/W	0000
Alarm 1 setting	01	06	Process alarm: 0.000 to 50.000	1/100 °C	R/W	0500
Alarm 2 setting	01	07	Deviation alarm: −19.999 to +19.999			
Undefined	01	08	—	—	—	—
	01	09				
Proportional band	01	10	0001 to 5000	°C	R/W	3000
Undefined	01	11	—	—	—	—
Integral time	01	12	0001 to 3600	second	R/W	0240
Derivative time	01	13	0000 to 3600	second	R/W	0060
PID/AT transfer	01	14	0: PID 1: Autotuning (AT)	—	R/W	0000
AUTO/MANUAL transfer	01	15	0: AUTO 1: MANUAL	—	R/W	0000
The amount of manual output	01	16	Output limiter (low limit) to output limiter (high limit)	1/10 %	R/W [1]	—

#1: Engineering unit   **#2: Attribute**

Continued from the previous page.

(Attributes   RO: Read only,   R/W: Read/Write)

| Item | Identifier | | Details of data | #1 | #2 | Factory |
	Upper	Lower				set value
PV bias	01	17	−1999 to +1999	1/100 °C	R/W	0000
Undefined	01 to 01	18 to 99	—	—	—	—
Control RUN/STOP	00	00	0: RUN 1: STOP	—	R/W	0000
Reversing the usual data transfer order [2]	00	11	0: Upper byte→Lower byte Any number other than 0: Lower byte→Upper byte	—	R/W	0000

#1: Engineering unit   #2: Attribute

Note 1: Details of the alarm 1 output, alarm 2 output and burnout

0 0 0 0

"0" Fixed
When burnout occurred = 1
When the alarm 2 occurred = 1
When the alarm 1 occurred = 1
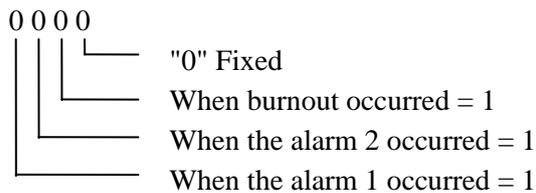
[1] Data can be written only in manual mode.

[2] Specified when only the data (DAT) block is inverted. If the inversion of transfer order is specified by the command (CMD), this setting becomes invalid.

5.3 Example of Sequence Program

5.3.1 MELSEC Series (MITSUBISHI)

The ladder communication send/receive program using the MITSUBISHI MELSEC Series (A2CCPU24) is described below.

■ Send data creation program (example)

```
M000
 |  |                                    MOVP   H0002   D11      STX setting
Send data                                                       Address setting = 01
creation switch

                                         MOVP   H0100   D12      Identifier setting
                                                                 [Measured value (PV)]

                                         MOVP   H0001   D13      Command setting [CMD]

                                         MOVP   H0001   D14      Data setting
                                                                 [Number of read data = 1]

                                         MOVP   H0A0D   D15      Termination character
                                                                 setting [CR, LF]
```

■ Send program (example)

```
M001    X1E0    Y1F0
 |  |    |/|     |/|                      MOVP   K5    D10        Data length setting
Send start Send  Send
switch  completion request

                          TOP   K61   H0   D10   K6              Transfer to send
                                                                 buffer

                                            SET    Y1F0          Send request setting

X1E0
 |  |                                       RST    Y1F0          Send request
Send completion                                                  resetting
```

■ Receive program (example)

```
X1E1
 ├─┤├────────────────────────┤ FROMP │ K61 │ H80 │ D20 │ K1  │  Acquisition of receive
Receive data                                                     character length
read request
                                        │ MOVP │ D20 │ Z   │     Stores character length
                                                                 in index register

                                 │ FROMP │ K61 │ H81 │ D21 │ K0Z │  Transfers receive data
                                                                    from receive buffer

                                                     │ Y1F1 │    Receive data read
                                                                 completion setting
```

📖 X1E0, X1E1, Y1F0, Y1F1 and K61 in the above program differ depending on the programmable controller used to communication module address.

☞ For details on setting the PLC, see the manual for "MITSUBISHI MELSEC Series."

5.3.2 C200HS (OMRON)

The communication send/receive program using the OMRON C200HS is described below.
The following types of OMRON C200HS with the built-in RS-232C post can perform non-protocol communication.

- C200HS-CPU21
- C200HS-CPU23
- C200HS-CPU31
- C200HS-CPU33

■ Send data creation program (example)

```
30000                                    ┌ MOV ┐    STX setting
 ┤├                                       │#0201│    Address setting = 01
Send data                                 └D1000┘
creation switch
                                          ┌ MOV ┐    Identifier setting
                                          │#0100│    [Measured value (PV)]
                                          └D1001┘

                                          ┌ MOV ┐    Command setting
                                          │#0001│    [CMD]
                                          └D1002┘

                                          ┌ MOV ┐    Data setting (DAT)
                                          │#0001│    [Number of read data = 1]
                                          └D1003┘

                                          ┌ MOV ┐    Termination character
                                          │#0D0A│    [CR, LF]
                                          └D1004┘
```

■ Send program (example)

```
30001      26405                          ┌ TXD ┐    Send data head register
 ┤├         ┤├                             │D1000│    Control data
Send start  Send ready                     │#0000│    Number of send data bytes
switch      flag                           └#0010┘

                                          ┌ RSET ┐    Send start reset switch
                                          └30001 ┘
```

■ **Receive program (example)**

```
26406
  | |                                              ┌ RXD ┐      Receive data head register
  Receive completion                               │ D1100 │     Control data
  flag                                             │ #0000 │     Number of stored data bytes
                                                   └ #0256 ┘
```

☞   For details on setting the PLC, see the manual for "OMRON C200HS."

6. TROUBLESHOOTING

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.

⚠ **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.

■ RKC standard communication

Problem	Possible cause	Solution
No response	Trouble with and imperfect contact of communication cable and connector	Check communication cables and connectors.
	Device address designation differs	Make reassignment after checking the device address by referring to "3.**4 Device address setting**" (P. 9).
	Incorrect communication speed	Set the communication speed suitable for the host computer by referring to "**3.5 Communication speed setting**" (P. 11).
	Incorrect data configuration setting	Make reassignment after checking the data configuration by referring to "**3.6 Data configuration setting**" (P. 13).
	Transmission line is not set to the receive state after data send	Check a program on the host computer side.
EOT return	Incorrect identifier	Make re-setting after checking the identifier by referring to "■ **Communication identifier list**" (P. 31).
	The identifier of a function not added to the REX-F9000 is specified	
NAK return	BCC error	Check BCC of the transmission data.
	Data exceeds the setting range	Check a data range.
	The identifier of a function not added to the REX-F9000 is specified	Make re-setting after checking the identifier by referring to "■ **Communication identifier list**" (P. 31).

IM9000F02-E4

■ **Ladder communication**

Problem	Possible cause	Solution
No response	Trouble wit and imperfect contact communication cable and connector	Check communication cables and connectors.
	Device address designation differs	Make reassignment after checking the device address by referring to "**3.4 Device address setting**" (P. 9).
	Incorrect communication speed	Set the communication speed suitable for the PLC by referring to "**3.5 Communication speed setting**" (P. 11).
	Incorrect data configuration setting	Make reassignment after checking the data configuration by referring to "**3.6 Data configuration setting**" (P. 13).
	Transmission line is not set to the receive state after data send	Check the program on the PLC side.
	The specified identifier is not defined.	Check the identifier.
	The number of read data exceeds the specified number.	Check the number of data.
	No command length is correct (Command length must be 10 bytes including CR and LF.)	Check the PLC side program.
No settings are written	Write data is out of the range	Check a setting range.
	An unsettable identifier (measured value, etc.) was specified.	Check whether they are identifiers corresponding to settable items.
All return characters other than STX, device address, identifier, CR and LF are set to F.	Characters other than BCD codes (0 to 9) were used for communication data (excluding STX, CR and LF)	Make conversion to BCD coded characters.

7. ASCII 7-BIT CODE TABLE

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

RKC INSTRUMENT INC.

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