Resin Pressure Digital Controller

HA430/HA930

Communication Instruction Manual

RKC® RKC INSTRUMENT INC.

IMR01N13-E2

- Modbus is a registered trademark of Schneider Electric.
- 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.
  The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage or failure, protect the power line and the input/output lines from high currents with a protection device such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- Do not connect modular connectors to telephone line.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- 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.

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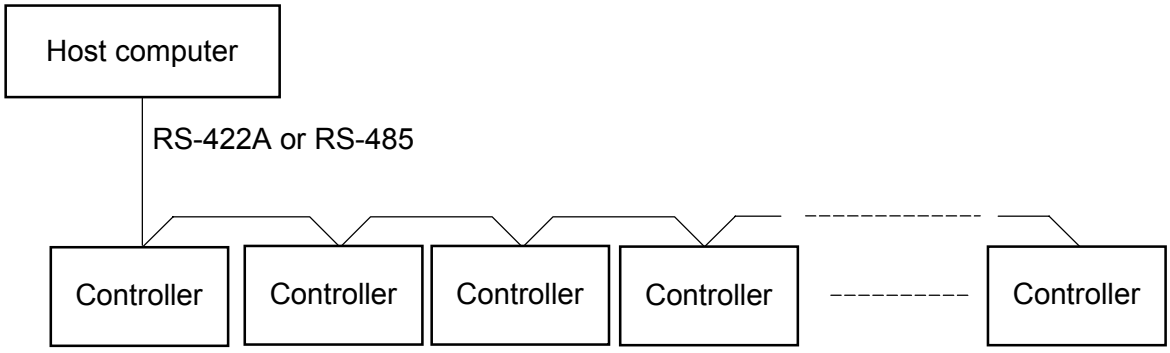
1. OUTLINE

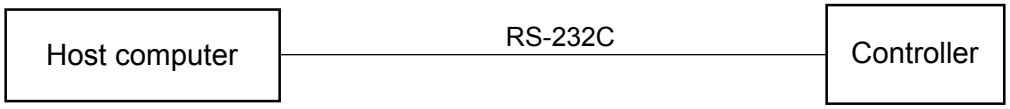
Resin Pressure Digital Controller HA430/HA930 (hereafter, called controller) interfaces with the host computer via Modbus or RKC communication protocols.
In addition, the controller have one communication port, the three types of communication interfaces are available: RS-422A, RS-485 and RS-232C.
For reference purposes, the Modbus protocol identifies the host computer as master, the controller as slave.

■ Multi-drop connection



Maximum connections: 31 instruments

■ Point-to-point connection



2. SPECIFICATIONS

■ RKC communication

Interface: Based on RS-485, EIA standard
Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
Specify when ordering

Connection method: 2-wire system, half-duplex multi-drop connection (RS-485)
4-wire system, half-duplex multi-drop connection (RS-422A)
3-wire system, point-to-point connection (RS-232C)

Synchronous method: Half-duplex start-stop synchronous type

Communication speed: 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 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: Connected to terminals (RS-485)

Xon/Xoff control:: None

Maximum connections: RS-422A, RS-485: 32 instruments maximum including a host computer
RS-232C: 1 instrument

Signal logic: RS-422A, 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.

RS-232C

Signal voltage	Logic
+3 V or more	0 (SPACE)
–3 V or less	1 (MARK)

■ Modbus

Interface:
Based on RS-485, EIA standard
Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
Specify when ordering

Connection method:
2-wire system, half-duplex multi-drop connection (RS-485)
4-wire system, half-duplex multi-drop connection (RS-422A)
3-wire system, point-to-point connection (RS-232C)

Synchronous method:
Half-duplex start-stop synchronous type

Communication speed:
2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps

Data bit configuration:
Data bit: 8 (Byte data corresponding to binary data or bit.)
Parity bit: Without, Odd or Even
Stop bit: 1 or 2 (However, with the parity bit selected: 1 bit fixed)

Protocol:
Modbus

Signal transmission mode:
Remote Terminal Unit (RTU) mode

Function code:
03H (Read holding registers)
06H (Preset single register)
08H (Diagnostics: loopback test)
10H (Preset multiple registers)

Error check method:
CRC-16

Error code:
1: Function code error
2: When any address other than 0000H to 00ADH, 0200H to 031DH, and 0500H to 0535H are specified
3: When the specified number of data items in the query message exceeds the maximum number of data items available
4: Self-diagnostic error response

Termination resistor:
Connected to terminals (RS-485)

Maximum connections:
RS-422A, RS-485: 32 instruments maximum including a host computer
RS-232C: 1 instrument

Signal logic:

RS-422A, 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.

RS-232C

Signal voltage	Logic
+3 V or more	0 (SPACE)
–3 V or less	1 (MARK)

3. WIRING

⚠ WARNING

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

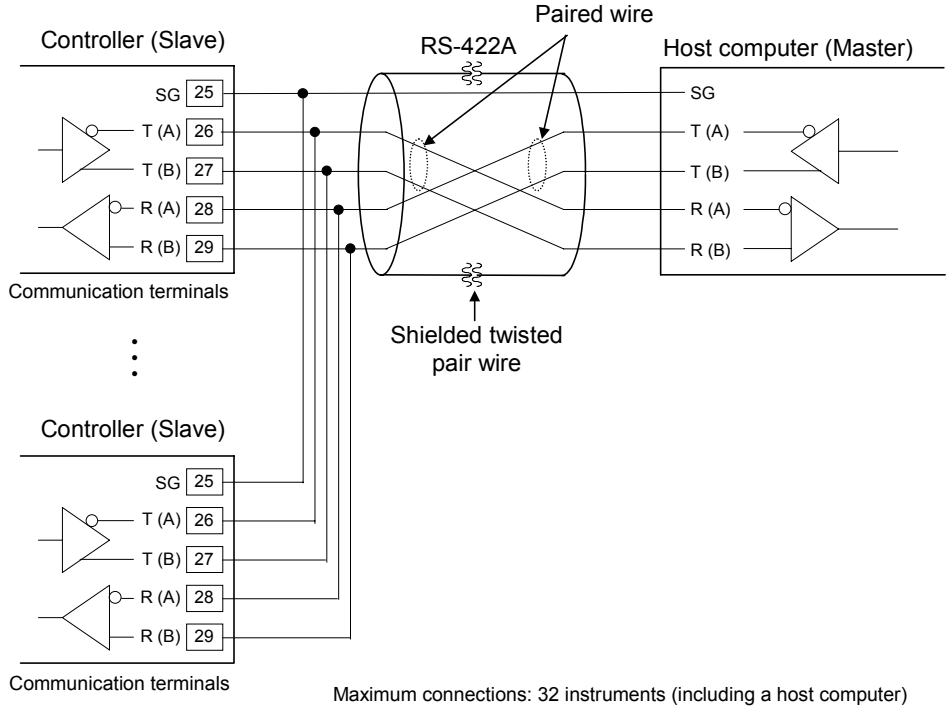
3.1 Connect the Communication

■ Connection to the RS-422A port of the host computer (master)

- **Communication terminal number and signal details**

Terminal No.	Signal name	Symbol
25	Signal ground	SG
26	Send data	T (A)
27	Send data	T (B)
28	Receive data	R (A)
29	Receive data	R (B)

- **Wiring method**



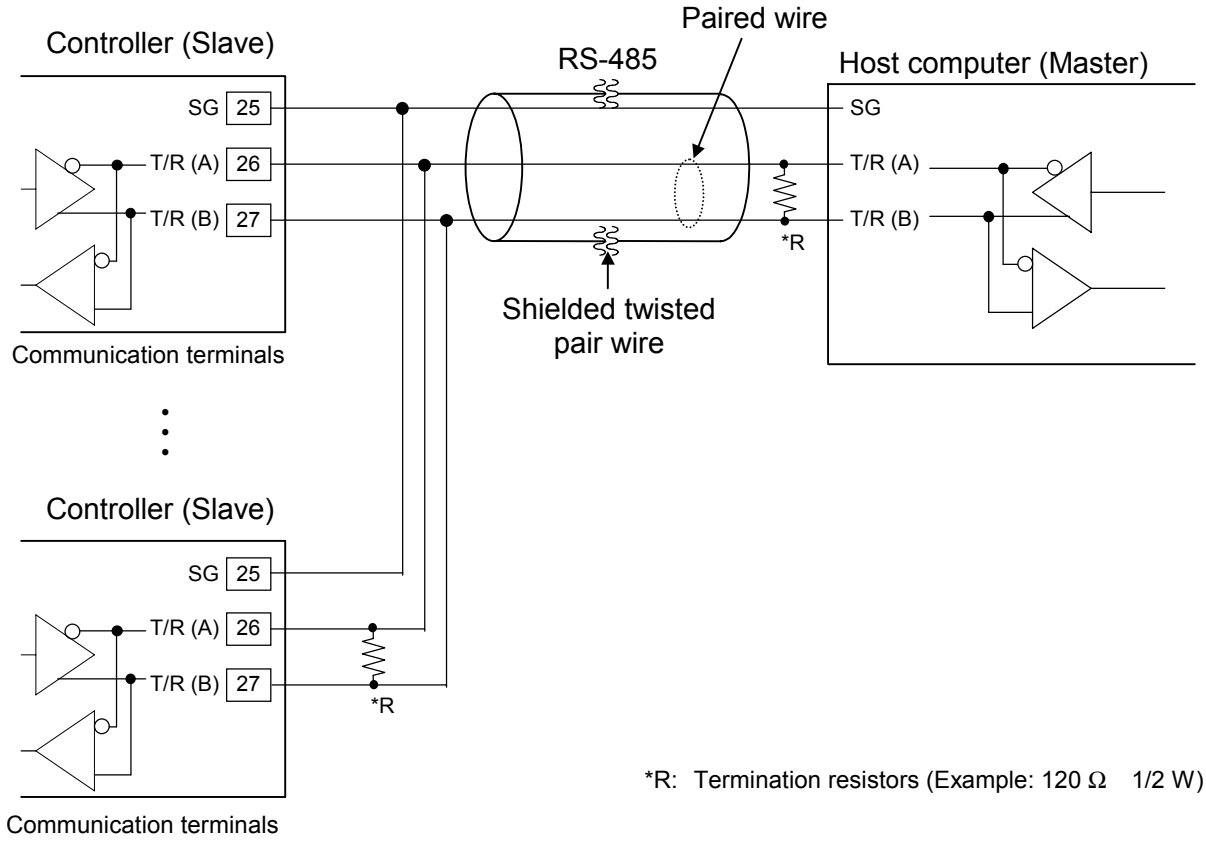
The cable is provided by the customer.

■ Connection to the RS-485 port of the host computer (master)

● Communication terminal number and signal details

Terminal No.	Signal name	Symbol
25	Signal ground	SG
26	Send data/Receive data	T/R (A)
27	Send data/Receive data	T/R (B)

● Wiring method



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

Maximum connections: 32 instruments (including a host computer)

The cable is provided by the customer.

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

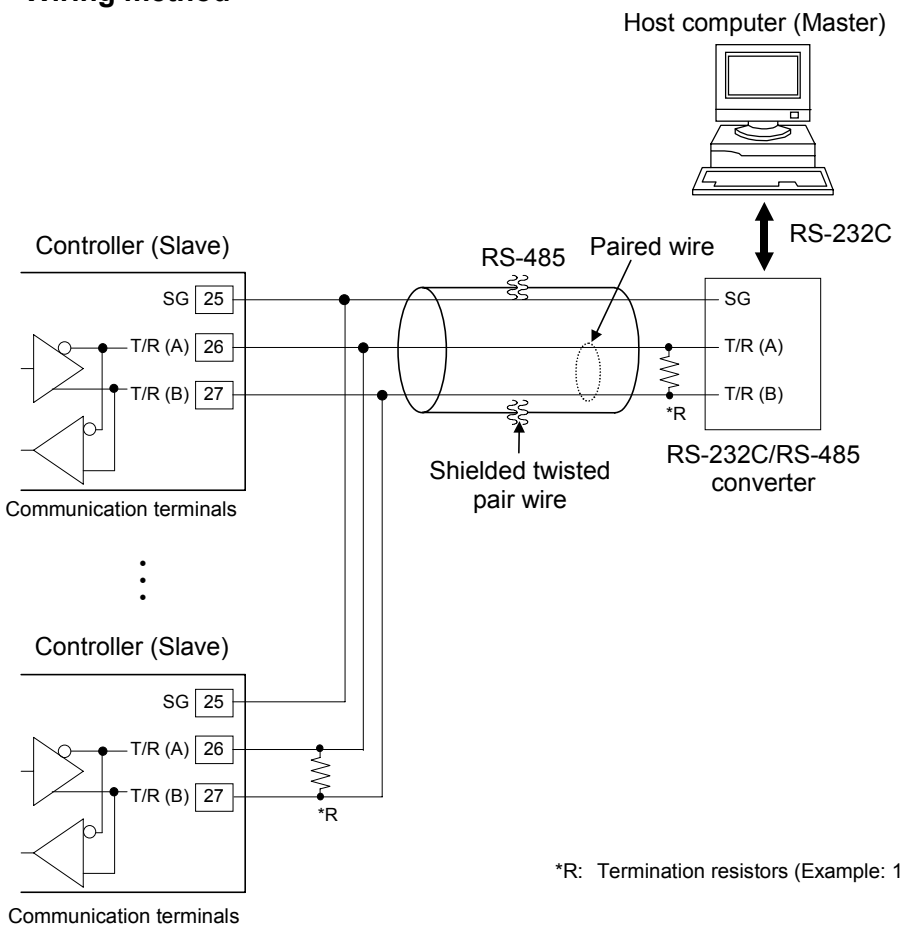
(1) Connection to the RS-485 port of the controller (slave)

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

- **Communication terminal number and signal details**

Terminal No.	Signal name	Symbol
25	Signal ground	SG
26	Send data/Receive data	T/R (A)
27	Send data/Receive data	T/R (B)

- **Wiring method**



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

Maximum connections: 32 instruments (including a host computer)

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

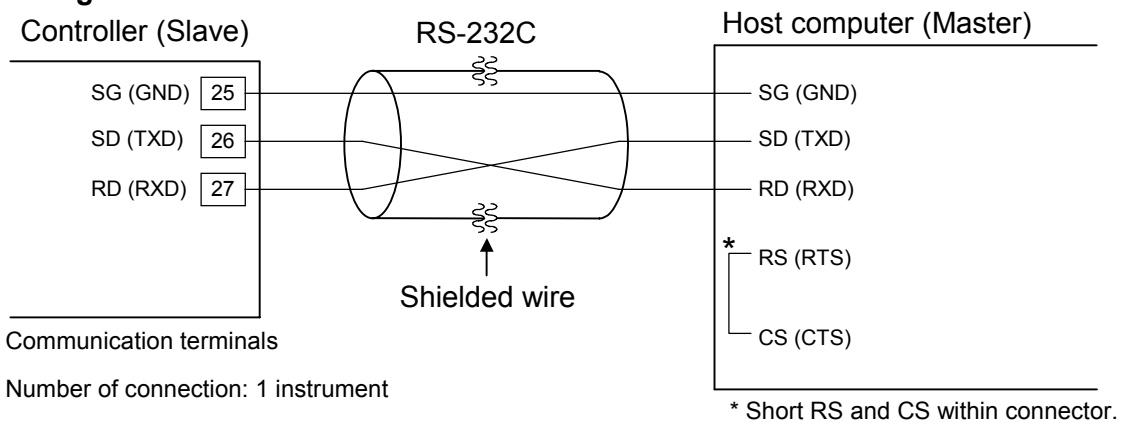
The cable is provided by the customer.

(2) Connection to the RS-232C port of the controller (slave)

- **Communication terminal number and signal details**

Terminal No.	Signal name	Symbol
25	Signal ground	SG (GND)
26	Send data	SD (TXD)
27	Receive data	RD (RXD)

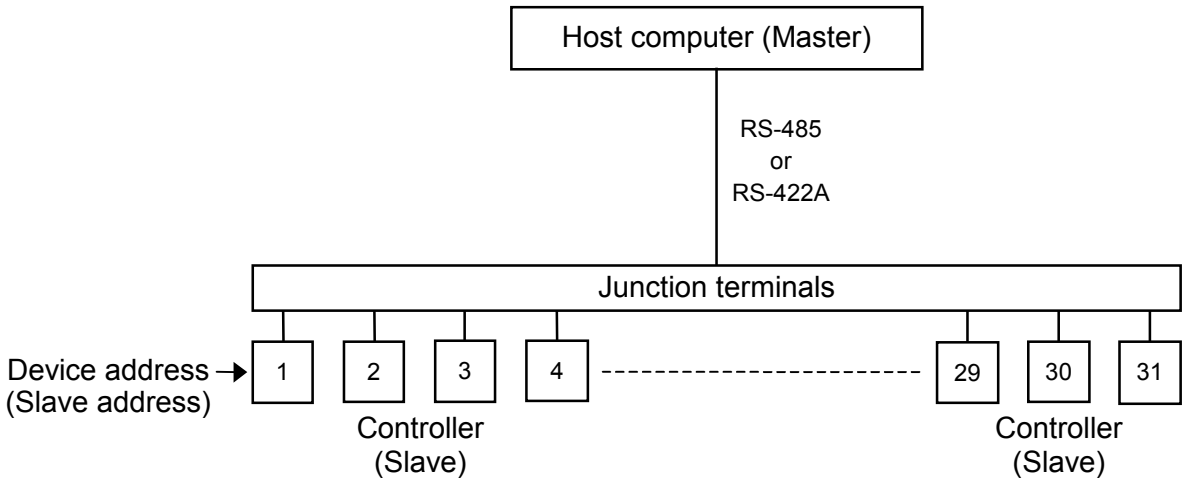
- **Wiring method**



The cable is provided by the customer.

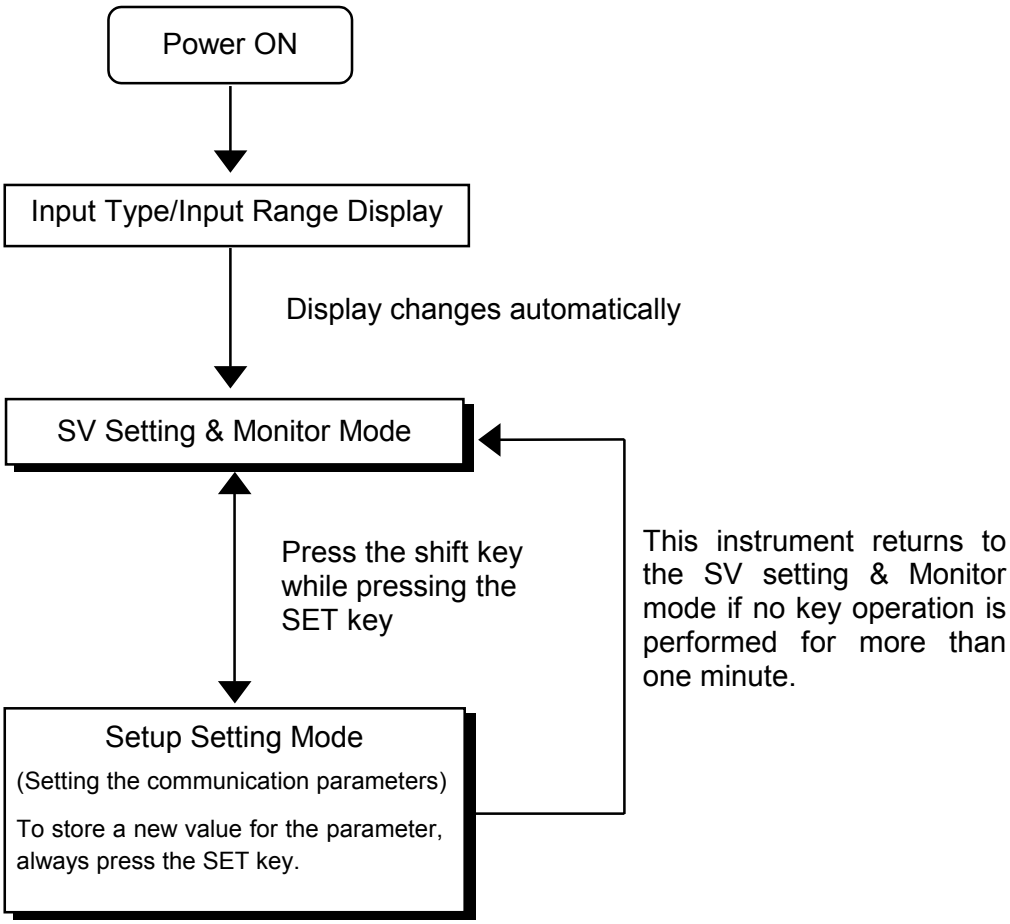
■ Wiring example

Connection with up to 32 instruments maximum including a host computer (master)



4. SETTING

To establish communication parameters between host computer (master) and controller (slave), it is necessary to set the device address (slave address), communication speed, data bit configuration and interval time on each controller (slave) in the Setup setting mode.

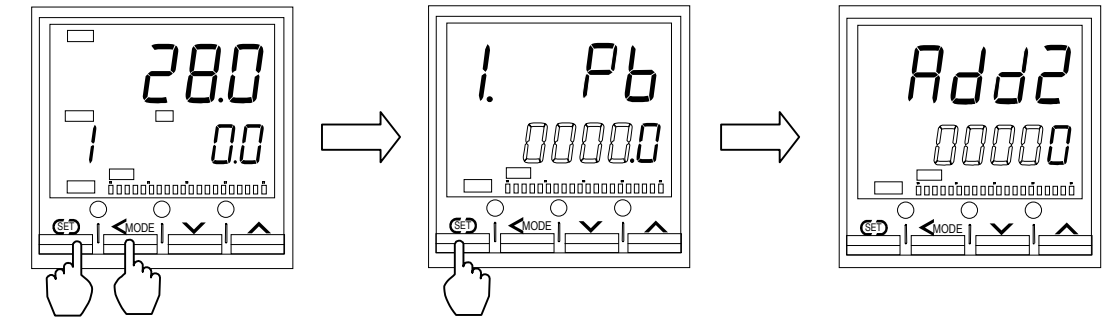


4.1 Transfer to Setup Setting Mode

The first displayed parameter in the Setup Setting mode varies depending on the instrument specification.

This item describes when the first displayed parameter in the setup setting mode is the PV bias, *Pb*.

To go the Setup Setting mode, you must be in SV setting & Monitor mode. The first parameter to be displayed will be the Input 1_PV bias, *1. Pb*. Press the SET key several times to change to the device address, *Add2*.



SV setting & monitor mode

Setup setting mode
Input 1_PV bias setting

Device address setting
(Slave address)

When let setup setting mode finish, press the shift key while pressing the SET key.
The display changes to the SV setting & Monitor mode.

HA930 is used in the above figures for explanation, but the same setting procedures also apply to HA430.

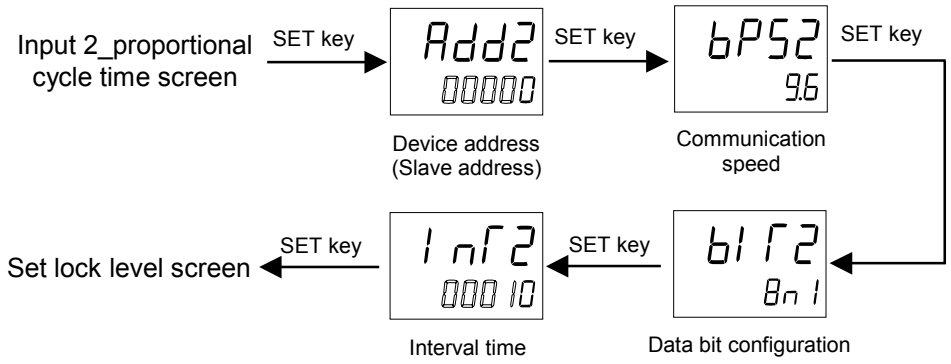
4.2 Setting the Communication Parameters

This item describes when the communication is used under the two input specification.

To select parameters in the Setup Setting mode, press the SET key.
The parameters relating to communication is shown below.

Device address (slave address), *Add2*, Communication speed, *bPS2*,
Data bit configuration, *bIT2*, Interval time, *InT2*

To be changed in the above order.



■ Setting procedure

Setting procedures vary depending on the communication parameter.

- Device address, *Add2*, interval time, *InT2*
  Operate UP, DOWN and shift key, and input numerals.
- Communication speed, *bPS2*, data bit configuration, *bIT2*
  Operate UP or DOWN key, and choose one among the displayed set value.

■ Store the set value

Press the SET key to store the new value.
After all communication parameters are set, in order to make these values thus set valid perform any of the following operations.

- The power is turned on again.
- The RUN/STOP mode is changed from STOP mode to RUN mode.

A new value will not be stored without pressing SET key after the new value is displayed on the display. No communication using the value changed can be performed even with the SET key pressed.

When the RUN/STOP mode is changed from STOP mode to RUN mode, the controller performs the same operation as that of Power-on.

After a new value has been displayed by using the UP and DOWN keys, the SET key must be pressed within one minute, or the new value is not stored and the display will return to the PV1/SV1 monitor screen.

For the RUN/STOP transfer, see **HA430/HA930 Operation Manual (IMR01N12-E□)**.

■ Description of each parameters

● Communication

Symbol	Name	Setting range	Description	Factory set value
Add2 (Add2)	Device address (Slave address)	0 to 99	Do not use the same device address for more than one controller in multi-drop connection. Each controller must have a unique address in multi-drop connection. In Modbus communication, two-way communication is not possible when the address is 0.	0
bPS2 (bPS2)	Communication speed	2.4: 2400 bps 4.8: 4800 bps 9.6: 9600 bps 19.2: 19200 bps 38.4: 38400 bps	Set the same communication speed for both the controller (slave) and the host computer (master).	9.6
bIT2 (bIT2)	Data bit configuration	See **Data bit configuration table**	Set the same data bit configuration for both the controller (slave) and the host computer (master).	8n1
InT2 (InT2)	Interval time *	0 to 250 ms	The controller's interval time must match the specifications of the host computer.	10

Data bit configuration table

Set value	Data bit	Parity bit	Stop bit
8n1 (8n1)	8	Without	1
8n2 (8n2)	8	Without	2
8E1 (8E1)	8	Even	1
8E2 (8E2)	8	Even	2
8o1 (8o1)	8	Odd	1
8o2 (8o2)	8	Odd	2
7n1 (7n1) [1]	7	Without	1
7n2 (7n2) [1]	7	Without	2
7E1 (7E1) [1]	7	Even	1
7E2 (7E2) [1]	7	Even	2
7o1 (7o1) [1]	7	Odd	1
7o2 (7o2) [1]	7	Odd	2

Setting range of Modbus

Setting range of RKC communication

[1] When the Modbus communication protocol selected, this setting becomes invalid.

* The interval time for the controller 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 status for the host. If the interval time between the two is too short, the controller 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 controller's interval time must match the specifications of the host computer.

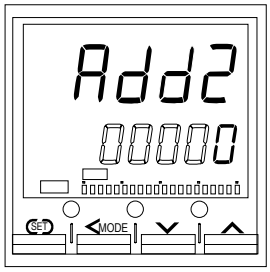
When the "1: Lock" is selected at the "Lock only setting items other than SV and events (EV1 to EV4)" in the set lock level, the communication parameters are not able to change the set values.

For the set lock level, see the **Operation Manual (IMR01N12-E□)**.

■ Setting procedure example

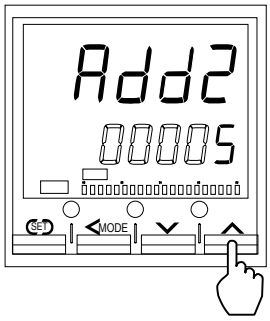
HA930 is used in the below figures for explanation, but the same setting procedures also apply to HA430.

1. Go to the Setup Setting mode. Press the shift key while pressing the SET key to go to the Setup Setting mode from the SV setting & Monitor mode. Press the SET key until "Add2" (Device address [slave address]) will be displayed.

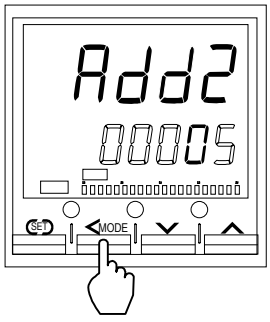


Device address setting
(Slave address)

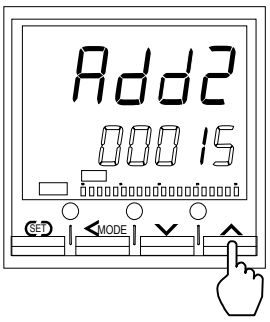
2. Set the device address (slave address). The high-lighted digit indicates which digit can be set. Press the UP key to change the number to 5.
Example: Setting the device address (slave address) to 15.



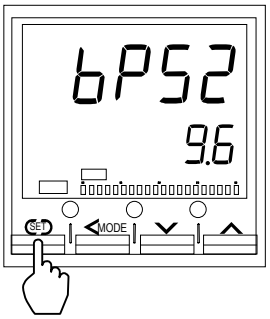
3. Press the shift key to highlight the tens digit.



4. Press the UP key to change the number to 1.



5. Press the SET key to store the new set value. The display goes to the next communication parameter. It the SET key is not pressed within one minute, the present display returns to the SV setting & Monitor mode and the value set here returns to that before the setting is changed.



6. After completing all communication parameter settings, return the SV setting & Monitor mode, and communication is mode using the set value changed.

4.3 Communication Requirements

■ Processing times during data send/receive

The controller 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 controller to send data:

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

RKC communication (Polling procedure)

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after controller receives ENQ	1	2	4
Response send time after controller receives ACK	1	—	4
Response send time after controller receives NAK	1	—	4
Response send time after controller sends BCC	—	—	1

RKC communication (Selecting procedure)

Procedure details	Time (ms)		
	MIN	TYP	MAX
Response send time after controller receives BCC	1	2	3
Response wait time after controller sends ACK	—	—	1
Response wait time after controller sends NAK	—	—	1

Modbus

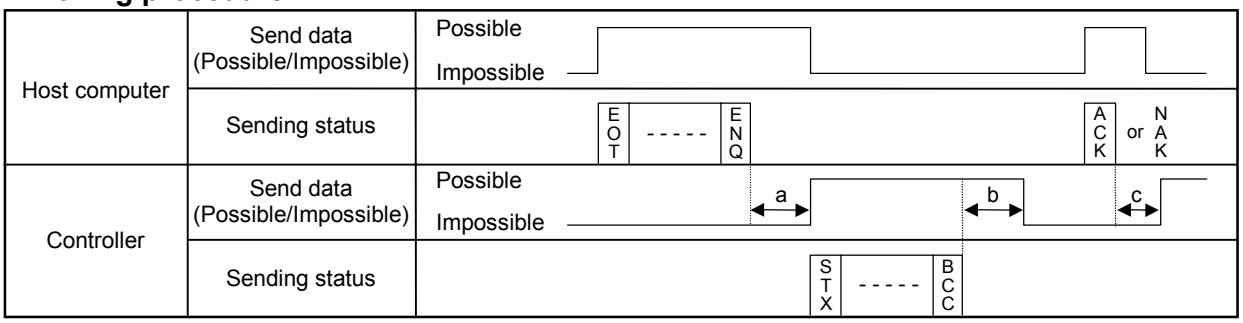
Procedure details	Time
Read holding registers [03H] Response transmission time after the slave receives the query message	20 ms max.
Preset single register [06H] Response transmission time after the slave receives the query message	3 ms max.
Diagnostics (loopback test) [08H] Response transmission time after the slave receives the query message	3 ms max.
Preset multiple registers [10H] Response transmission time after the slave receives the query message	20 ms max.

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

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

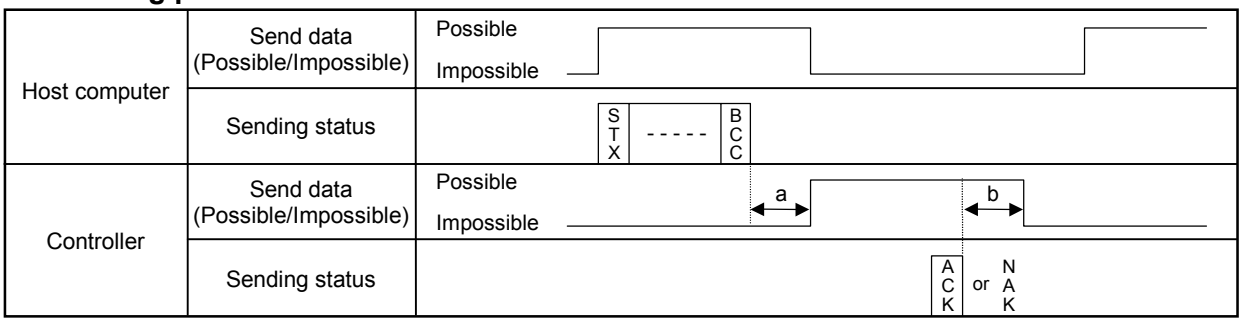
The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Typical polling and selecting procedures between the host computer and the controller are described below:

● Polling procedure



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

● Selecting procedure



a: Response send time after the controller receives BCC + Interval time
b: Response wait time after the controller sends ACK or Response wait time after the controller 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 the controller to send data:
- Response wait time after the controller sends BCC in polling procedure
- Response wait time after the controller sends ACK or NAK in selecting procedure

■ 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.

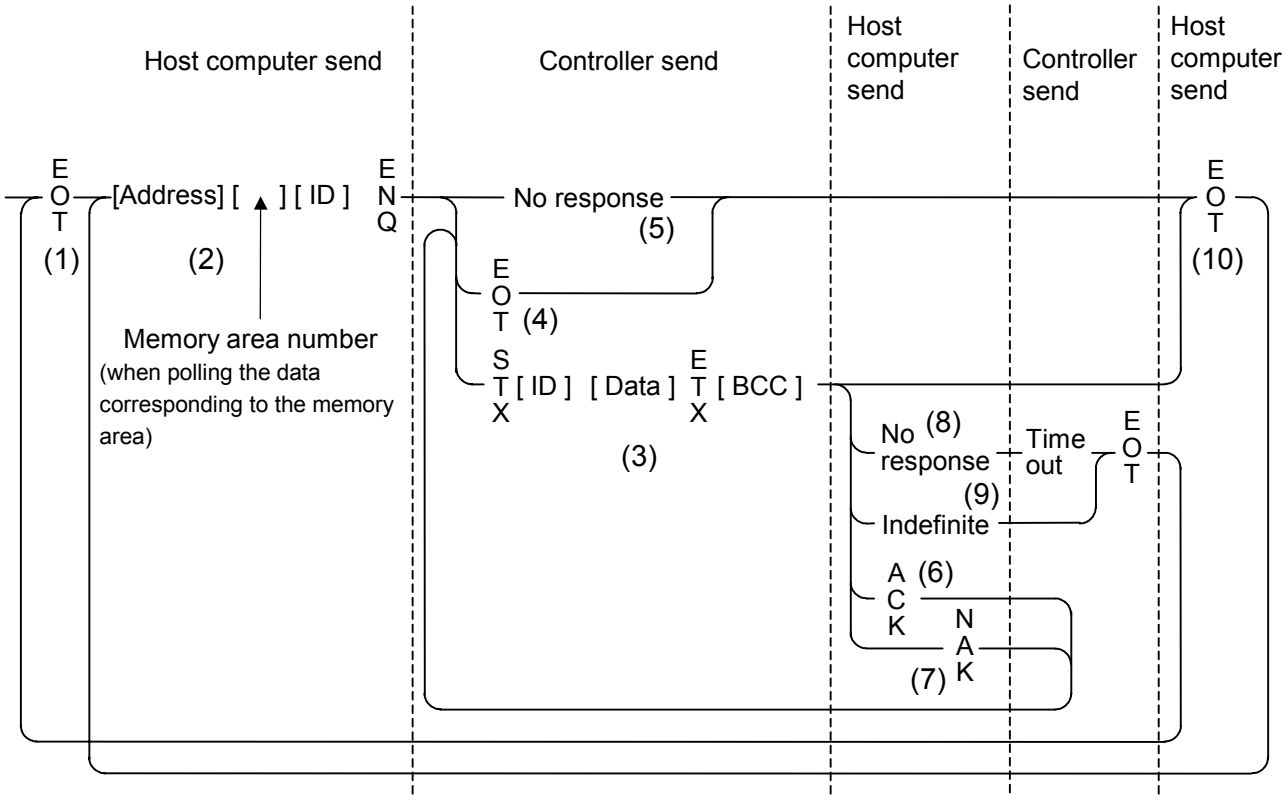
5. RKC COMMUNICATION PROTOCOL

The HA430/HA930 (hereafter, called controller) uses the polling/selecting method to establish a data link. The basic procedure is followed ANSI X3.28 subcategory 2.5, A4 basic mode data transmission control procedure (Fast selecting is the selecting method used in this controller).

- 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 controller 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 controllers 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 controllers to initiate data link before polling sequence.

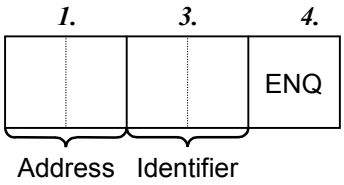
(2) Data sent from host computer - Polling sequence

The host computer sends the polling sequence in the following two types of formats:

- Format in which no memory area number is specified, and
- Format in which the memory area number is specified.

■ **When no memory area number is specified**

To be sent in this format for any identifier not corresponding to the memory area.

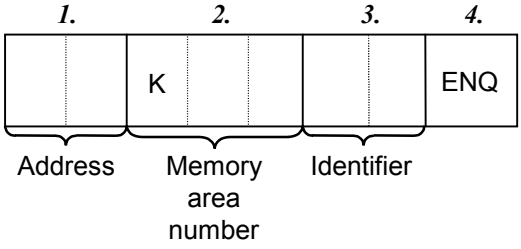


Example:

0	1	M	1	ENQ

■ **When the memory area number is specified**

To be sent in this format for any identifier corresponding to the memory area.



Example:

0	1	K	0	1	S	1	ENQ

1. Address (2 digits)

The device address specifies the controller to be polled and each controller must have its own unique device address.

📖 **Specify 00 not to omit device address in RS-232C specification.**

📖 The polling address which transmitted a message once becomes effective so long as data link is not initialized by transmit and receive of EOT.

☞ For details, see **4.2 Setting the Communication Parameters (P. 11)**.

2. Memory area number (3 digits)
This is the identifier to specify the memory area number. It is expressed by "K01" to "K16" to each memory area number (from 1 to 16). When one column of memory area number (1 to 9) is specified, it can be specified with "K1" to "K9." In addition, if the memory area number is assigned with "K0" or "K00," this represents that control area is specified.

- The memory area now used for control is called "Control area."
- If the memory area number is not specified when polling the identifier corresponding to the memory area, this represents that the control area is specified.
- If any identifier not corresponding to the memory area is assigned with a memory area number, this memory area number is ignored.

3. Identifier (2 digits)
The identifier specifies the type of data that is requested from the controller. Always attach the ENQ code to the end of the identifier.

☞ For details, see **5.4 Communication Items List (P. 32)**.

4. 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 controller.

(3) Data sent from the controller

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

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

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

2. Identifier (2 digits)
The identifier indicates the type of data (measured value, status and set value) sent to the host computer.

☞ For details, see **5.4 Communication Items List (P. 32)**.

3. Data (7 digits)

Data which is indicated by an identifier of the controller, consisting of channel numbers, data, etc. It is expressed in decimal ASCII code including a minus sign (–) and a decimal point. Data is not zero-suppressed.

Only Model codes (ID) , the number of data digits (length) is 32 digits.

Memory area soak time monitor and area soak time become the following data:

- When data range is 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds: Data range is 0:00:00 to 9:59:59, punctuation of time unit is expressed in colon (:).
- When data range is 0 minute 00.00 second to 9 minutes 59.99 seconds: Data range is 0:00.00 to 9:59.99, punctuation of time unit is expressed in colon (:) and period (.).

4. ETX

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

5. BCC

BCC (Block Check Character) detects error by using 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	1	0	0	.	0	ETX	BCC
	4DH	31H	30H	30H	31H	30H	30H	2EH	30H	03H	← Hexadecimal numbers

BCC＝4DH ⊕ 31H ⊕ 30H ⊕ 30H ⊕ 31H ⊕ 30H ⊕ 30H ⊕ 2EH ⊕ 30H ⊕ 03H＝50H

(⊕: *Exclusive OR*)

Value of BCC becomes 50H.

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

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

- When the specified identifier is invalid
- When there is an error in the data type
- When data is not sent from the host computer even if the data link is initialized
- When all the data has been sent

(5) No response from the controller

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

(6) ACK (Acknowledgment)

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

☞ For the identifier, see **5.4 Communication Items list (P. 32)**.

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

(9) Indefinite response from host computer

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

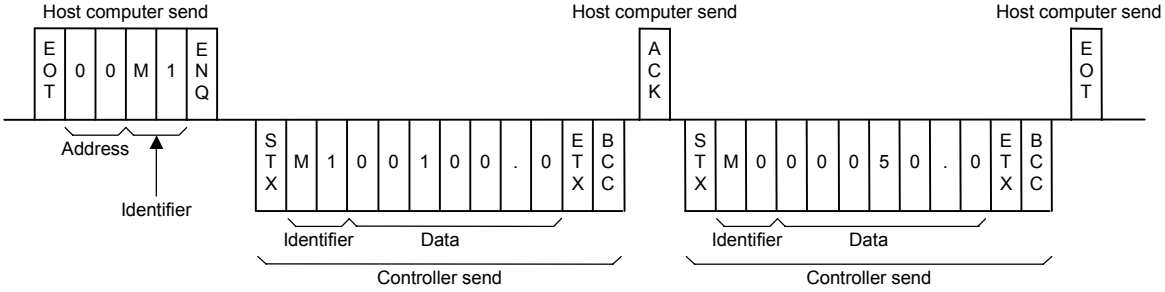
(10) EOT (Data link termination)

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

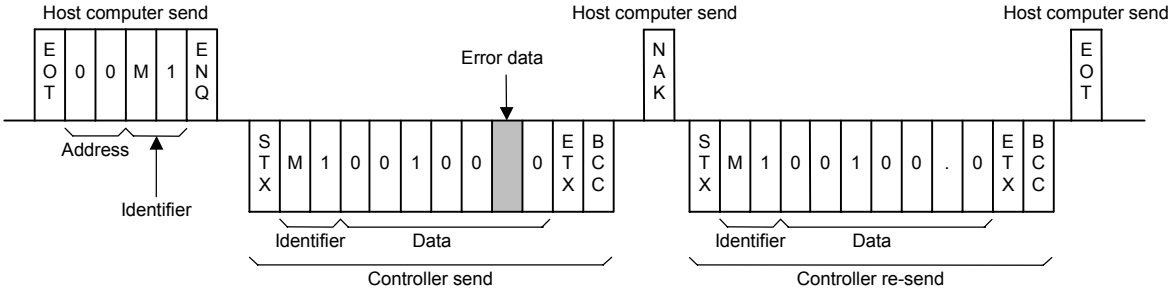
5.1.2 Polling procedure example

(1) When the monitored items is polled [Example: measured value (PV1) monitor M1]

■ **Normal transmission**

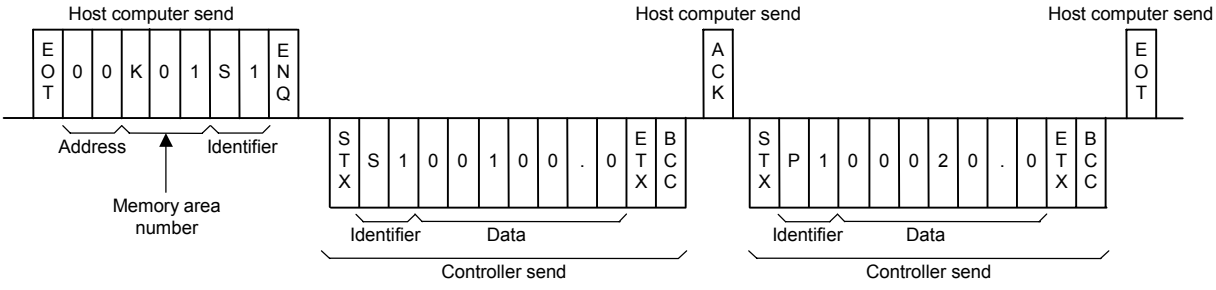


■ **Error transmission**

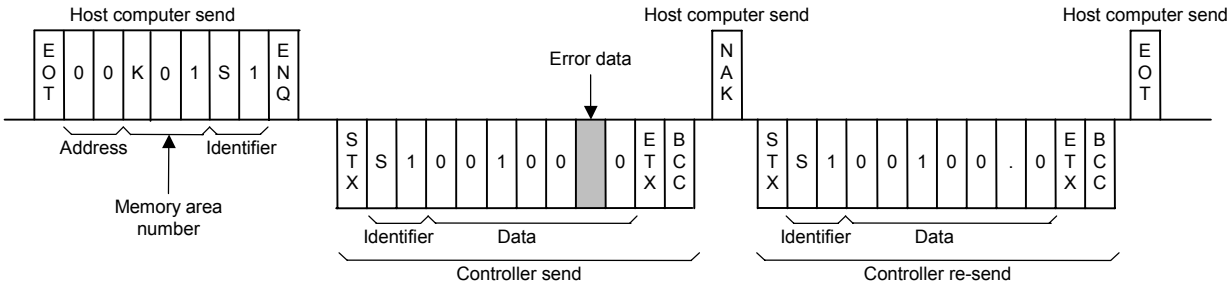


(2) When the items corresponding to the memory area is polled [Example: set value (SV1) S1]

■ **Normal transmission**

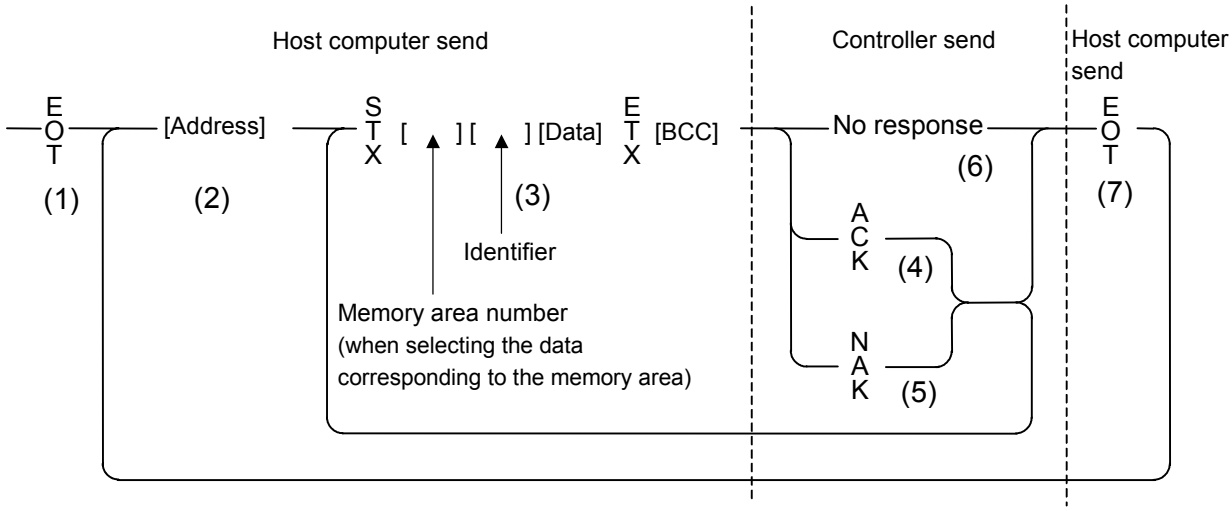


■ **Error transmission**



5.2 Selecting

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

(2) Sending selecting address from the host computer

Host computer sends selecting address for the selecting sequence.

■ **Address (2 digits)**

This data is a device address of the controller to be selected and must be the same as the device address set value in item **4.2 Setting the Communication Parameters (P. 11)**.

📖 **Specify 00 not to omit device address with the RS-232C specification.**

📖 As long as the data link is not initialized by sending or receiving EOT, the selecting address once sent becomes valid.

(3) Data sent from the host computer

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

■ When no memory area number is specified

	2.	*3.*		
STX	Identifier	Data	ETX	BCC

■ When the memory area number is specified

	1.	*2.*	*3.*		
STX	Memory area number	Identifier	Data	ETX	BCC

☞ For the STX, ETX and BCC, see **5.1 Polling (P. 17)**.

1. Memory area number (3 digits)

This is the identifier to specify the memory area number. It is expressed by "K01" to "K16" to each memory area number (from 1 to 16). When one column of memory area number (1 to 9) is specified, it can be specified with "K1" to "K9." In addition, if the memory area number is assigned with "K0" or "K00," this represents that control area is specified.

📖 The memory area now used for control is called "Control area."

📖 If the memory area number is not specified when selecting the identifier corresponding to the memory area, selecting is made to the memory area.

📖 If any identifier not corresponding to the memory area is assigned with a memory area number, this memory area number is ignored.

2. Identifier (2 digits)

The identifier specifies the type of data that is requested from the controller, such as set value.

☞ For details, see **5.4 Communication Items List (P. 32)**.

3. Data

Data which is indicated by an identifier of the controller. It is expressed in decimal ASCII code including a minus sign (−) and a decimal point. The channel number can be zero-suppressed.
The number of digits varies depending on the type of identifier. (Within 7 digits)

📖 Area soak time set data as the following:

- When data range is 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds: Data range is 0:00:00 to 9:59:59, punctuation of time unit is expressed in colon (:).
- When data range is 0 minute 00.00 second to 9 minutes 59.99 seconds: Data range is 0:00.00 to 9:59.99, punctuation of time unit is expressed in colon (:) and period (.).

In addition to above, when minute and second data are set in more than 60, become as the following:
Example: 0: 65.00 (0 minute 65.00 seconds) → 1:05.00 (1 minute 05.00 seconds)
1: 65:00 (1 hour 65 minutes 00 second) →
2:05:00 (2 hours 05 minutes 00 second)

- **About numerical data**

The data that receipt of letter is possible

- Data with numbers below the decimal point omitted or zero-suppressed data can be received.
  (Number of digits: Within 7 digits)
  <Example> When data send with −001.5, −01.5, −1.5, −1.50, −1.500 at the time of −1.5, controller can receive a data.
- When the host computer sends data with decimal point to item of without decimal point, the controller receives a message with the value that cut off below the decimal point.
  <Example> When setting range is 0 to 200, the controller receives as a following.

Send data	0.5	100.5
Receive data	0	100

- The controller 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, the controller 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

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

(5) NAK (Negative acknowledge)

If the controller 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 controller 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
- When receive data is the identifier of RO (read only)

(6) No response from controller

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

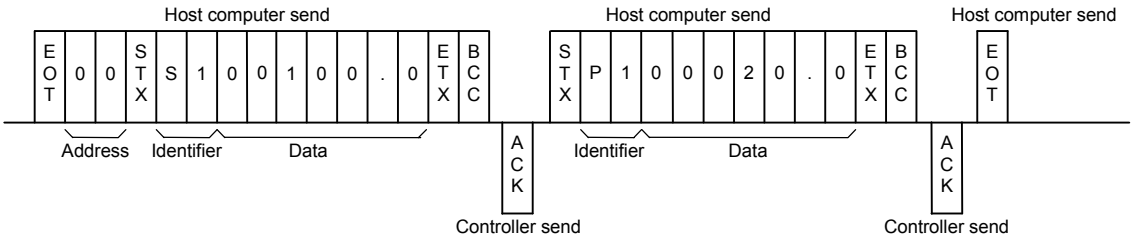
(7) EOT (Data link termination)

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 controller.

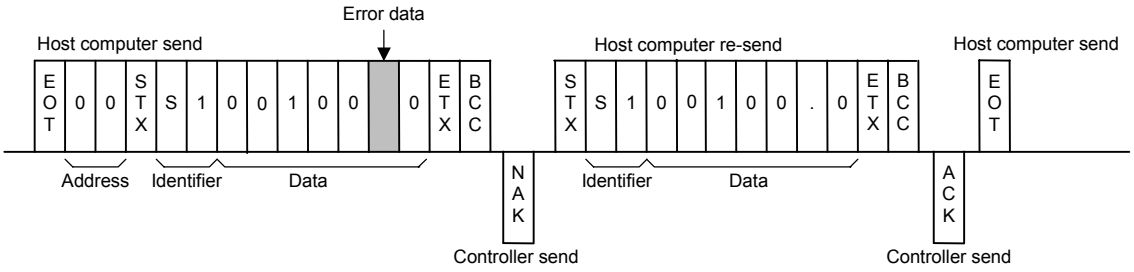
5.2.2 Selecting procedure example

(1) When the items corresponding to the control area is selected [Example: set value (SV1) S1]

■ **Normal transmission**

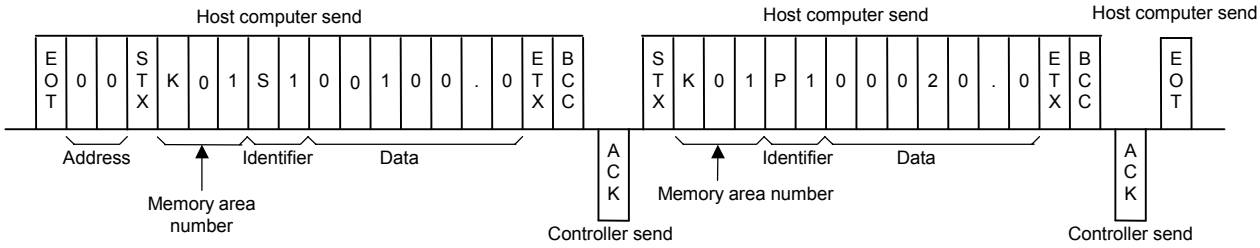


■ **Error transmission**

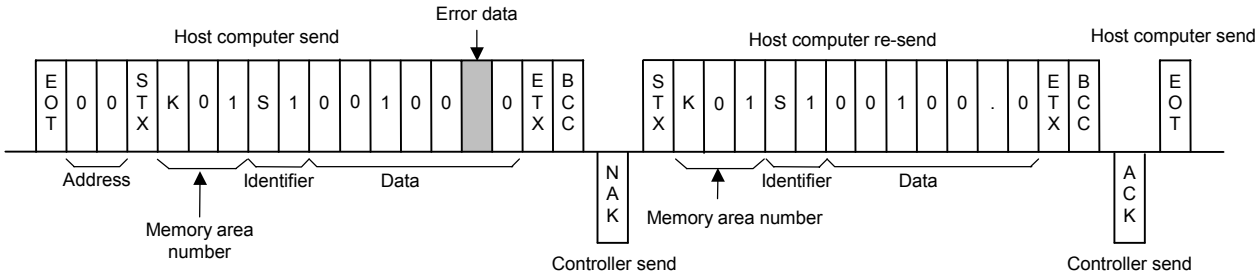


(2) When the items corresponding to the memory area is selected [Example: set value (SV1) S1]

■ **Normal transmission**



■ **Error transmission**



5.3 Examples of Polling and Selecting Check Programs

The following is the sample program for NEC PC-9800 series computers in BASIC language for carrying out polling and selecting checking by RS-232C specification. There will be some differences in the computer languages according to the type of computer. Before executing the program, confirm that there is no mistake in the wiring of the communications cable and check that the instrument data bit configuration is set to *8* for data bit and *Without* for parity bit. In addition, the communications speed setting should be set to match the host computer speed setting.

When this program example is used for RS-485, the automatic sending/receiving selection type of RS-232C/RS-485 is required.
(Recommended: CD485, CD485/V manufactured by Data Link, Inc. or equivalent.)

5.3.1 Example of temperature set values polling check program

```
1000 '---------------------- Identifier setting ----------------------
1010    ID$="S1"                                                          Identifier setting
1020 '
1030 '-------------------- Communications initial setting --------------------
1040 CM$="N81NN"                                                          Communications data configuration setting
1050 INPUT " Device address=";ADD$                                        Device address input
1060 STX$=CHR$(&H2) : EOT$=CHR$(&H4) : ENQ$=CHR$(&H5)                     Communications character setting
1070 ACK$=CHR$(&H6) : NAK$=CHR$(&H15): ETX$=CHR$(&H3)
1080 OPEN "COM1:"+CM$    AS #1                                            Open RS-232C circuit
1090 CONSOLE ,,,1
1100 COLOR 7:CLS 3
1110 '
1120 '------------------- Program main routine ----------------------
1130 *POL
1140        PRINT "              (Polling check)              "
1150        PRINT "*********** Receiving the set values ************"
1160        PRINT "                                                   "
1170        DT$=EOT$+ADD$+ID$+ENQ$                                        Data configuration setting
1180        GOSUB *TEXT
1190        GOSUB *RXDT
1200 '
1210 *J10
1220        J=0
1230 '
1240 *IF1
1250        IF LOC(1)=0 THEN J=J+1:IF J<500 THEN *IF1 ELSE PRINT "        Setting of the receiving waiting time *
TIME OUT ":END                                                            (Timeout processing)
1260 '
1270        K$=INPUT$(1,#1)
1280              IF K$=ETX$ GOTO *ETXRX                                  Communications condition checking
1290              IF K$=NAK$ THEN PRINT "     NAK":END
1300              IF K$=EOT$ THEN PRINT "     EOT":END
1310              IF K$=ACK$ THEN PRINT "     ACK":END
```

* Setting of the receiving waiting time:
If time out occurs in using high speed computer (Except no response), the numeral value of 500 in the program should be changed to an appropriately-sized numeral value.

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```
1320 '
1330      DT$=DT$+K$
1340      GOTO *J10
1350 '
1360 *ETXRX
1370      DT$=DT$+K$
1380            BCCRX$=INPUT$(1,#1)
1390            BCCRX=ASC(BCCRX$)                    BCC checking
1400            GOSUB *BCCCH
1410      IF BCC<>BCCRX THEN GOSUB *NAKTX
1420      IF BCC<>BCCRX THEN GOSUB *RXDT: GOTO *J10
1430 '
1440      PRINT "Data has been correctly received"   Display of received data and
1450      PRINT "Received data=";DT$ : END           closing of RS-232C circuit
1460 '
1470 '---------------------- Sub-routine ----------------------
1480 '
1490 *NAKTX                                          Processing on occurrence of a BCC error
1500      PRINT "BCC error"
1510      DT$=NAK$
1520            GOSUB *TEXT
1530      RETURN
1540 '
1550 *RXDT
1560      DT$=""                                     Clearing of circuit buffer
1570      RETURN
1580 '
1590 *TEXT
1600      PRINT #1,DT$;                              Transfer of polling identifier
1610      RETURN
1620 '
1630 *BCCCH                                          BCC calculation
1640      FOR II=1 TO LEN(DT$)
1650            BCCA$=MID$(DT$,II,1)
1660            IF BCCA$=STX$ THEN BCC=0 : GOTO *IINEXT
1670            BCC=BCC XOR ASC(BCCA$)
1680 *IINEXT
1690      NEXT II
1700      RETURN
```

5.3.2 Example of temperature set values selecting checking program

```
1000 '---------- Identifier setting ----------                    
1010   ID$="S1"                                                   Identifier setting
1020 '
1030 '---------- Communications initial setting ----------
1040 CM$="N81NN"                                                  Communications data configuration setting
1050 STX$=CHR$(&H2) : EOT$=CHR$(&H4) : ENQ$=CHR$(&H5)             Communications character setting
1060 ACK$=CHR$(&H6) : NAK$=CHR$(&H15): ETX$=CHR$(&H3)
1070 OPEN "COM1:"+CM$    AS #1                                    Opening of RS-232C circuit
1080 CONSOLE ,,,1
1090 COLOR 7:CLS 3
1100 '
1110 '---------- Program main routine ----------
1120 *SEL
1130      PRINT "          (Selection check)          "
1140      PRINT "********** Transmission of set values **********"
1150      PRINT "
1160      INPUT "Device address=";ADD$                            Input of the device address,
          :INPUT "Set value=";S$                                  and the temperature set value
1170      DT$=EOT$+ADD$+STX$+Z$+C$+" "+S$+ETX$                    Data configuration setting 1
1180      PRINT "Transmitting data=";DT$                          Display of transmitting data
1190      GOSUB *BCCCH
1200      DT$=DT$+CHR$(BCC)                                       Data configuration setting 2
1210      GOSUB *TEXT
1220      GOSUB *RXDT
1230 '
1240 *J20
1250      J=0
1260 '
1270 *IF2
1280      IF LOC(1)=0 THEN J=J+1:IF J<500 THEN *IF2 ELSE PRINT " TIME   Setting of the receiving waiting time *
          OUT ":END                                               (Timeout processing)
1290 '
1300      K$=INPUT$(1,#1)                                         Communications condition check,
1310      IF K$=NAK$ THEN PRINT "      NAK":END                   Display of communication result,
1320      IF K$=ACK$ THEN PRINT "Control unit has received the data"  and closing of RS-232C circuit
          :END
1330 '
1340 '
1350 '
```

* Setting of the receiving waiting time:
  If time out occurs in using high speed computer (Except no response), the numeral value of 500 in the program should be changed to an appropriately-sized numeral value.

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```
1360 '---------------------- Sub-routine ----------------------
1370 '
1380 *RXDT'
1390       DT$=""                                                    Clearing of circuit buffer
1400       RETURN
1410 '
1420 *TEXT
1430       PRINT #1,DT$;
1440       RETURN                                                    Transfer of selection data
1450 '
1460 *BCCCH                                                          BCC calculation
1470       FOR II=1 TO LEN(DT$)
1480             BCCA$=MID$(DT$,II,1)
1490             IF BCCA$=STX$ THEN BCC=0 : GOTO *IINEXT
1500             BCC=BCC XOR ASC(BCCA$)
1510 *IINEXT
1520       NEXT II
1530       RETURN
```

5.4 Communication Items List

Each item whose name is described as "Unused" in the following list is not used for the HA430/HA930. However, indefinite data is sent when data is sent by ACK (acknowledge) from the host computer.

RO: Read only R/W: Read and Write

No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
1	Model codes	**ID**	RO	Model character codes	—	P. 101
2	Input 1_measured value (PV1) monitor	**M1**	RO	Input 1_input scale low to Input 1_input scale high	—	P. 101
3	Input 2_measured value (PV2) monitor	**M0**	RO	Input 2_input scale low to Input 2_input scale high	—	P. 101
4	Unused	**M2**	—	—	—	—
5	Unused	**M3**	—	—	—	—
6	Unused	**M4**	—	—	—	—
7	Input 1_ set value (SV1) monitor	**MS**	RO	Input 1_setting limiter (low) to Input 1_setting limiter (high)	—	P. 101
8	Input 2_ set value (SV2) monitor	**MT**	RO	Input 2_setting limiter (low) to Input 2_setting limiter (high)	—	P. 101
9	Remote input value monitor	**S2**	RO	Input 1_setting limiter (low) to Input 1_setting limiter (high)	—	P. 102
10	Unused	**KH**	—	—	—	—
11	Input 1_burnout state	**B1**	RO	0: OFF 1: ON	—	P. 102
12	Input 2_burnout state	**B0**	RO		—	P. 102
13	Unused	**B2**	—	—	—	—
14	Event 1 state	**AA**	RO	0: OFF 1: ON	—	P. 103
15	Event 2 state	**AB**	RO		—	P. 103
16	Event 3 state	**AC**	RO		—	P. 103
17	Event 4 state	**AD**	RO		—	P. 103
18	Unused	**AE**	—	—	—	—
19	Unused	**AF**	—	—	—	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
20	Input 1_manipulated output value (MV1) monitor	**O1**	RO	−5.0 to +105.0 %	—	P. 103
21	Input 2_manipulated output value (MV2) monitor	**O0**	RO		—	P. 103
22	Error code	**ER**	RO	1: Adjustment data error 2: EEPROM error 4: A/D conversion error 8: RAM check error 16: Hardware configuration error 32: Software configuration error 128: Watchdog timer error 2048: Program busy	—	P. 104
23	Event input (DI) state	**L1**	RO	Least significant digit: The state of DI1 2nd digit: The state of DI2 3rd digit: The state of DI3 4th digit: The state of DI4 5th digit: The state of DI5 6th digit and Most significant digit: Unused Data 0: Contact open 1: Contact closed	—	P. 105
24	Operation mode state	**L0**	RO	Least significant digit: Control STOP 2nd digit: Control RUN 3rd digit: Input 1_Manual mode (Including Input 1_Remote mode) 4th digit: Input 2_Manual mode (Including Input 2_Remote mode) 5th digit: Remote mode 6th digit and Most significant digit: Unused Data 0: OFF 1: ON	—	P. 106
25	Memory area soak time monitor	**TR**	RO	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	—	P. 107

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
26	Input 1_PID/AT transfer	**G1**	R/W	0: PID control 1: Autotuning (AT) No PID/AT transfer is valid prior to factory shipment.	0	P. 107
27	Input 2_PID/AT transfer	**G0**	R/W	The transfer becomes valid only when "1: AT function (PI)" or "0: AT function (PID)" is selected in AT action selection.	0	P. 107
28	Input 1_ Auto/Manual transfer	**J1**	R/W	0: Auto mode 1: Manual mode	1	P. 109
29	Input 2_ Auto/Manual transfer	**J0**	R/W		1	P. 109
30	Remote/Local transfer	**C1**	R/W	0: Local mode 1: Remote mode	0	P. 109
31	RUN/STOP transfer	**SR**	R/W	0: Control RUN 1: Control STOP	0	P. 110
32	Memory area selection	**ZA**	R/W	1 to 16	1	P. 110
33	Event 1 set value	**A1**	R/W	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 111
34	Event 2 set value	**A2**	R/W		50.0	P. 111
35	Event 3 set value	**A3**	R/W		50.0	P. 111
36	Control loop break alarm 1 (LBA1) time	**A5**	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 112
37	LBA1 deadband	**N1**	R/W	0.0 to Input span	0.0	P. 112
38	Event 4 set value	**A4**	R/W	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 111
39	Control loop break alarm 2 (LBA2) time	**A6**	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 112
40	LBA2 deadband	**N2**	R/W	0.0 to Input span	0.0	P. 112
41	Input 1_set value (SV1)	**S1**	R/W	Input 1_setting limiter (low) to Input 1_setting limiter (high)	0.0	P. 115
42	Input 1_proportional band	**P1**	R/W	0.0 to 1000.0 % of input span (0 or 0.0: ON/OFF action)	100.0	P. 115

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
43	Input 1_integral time	**I1**	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PD action) * Varies with the setting of the integral/derivative time decimal point position selection.	5.00	P. 116
44	Input 1_derivative time	**D1**	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PI action) * Varies with the setting of the integral/derivative time decimal point position selection.	0.00 (PI action)	P. 116
45	Input 1_ control response parameter	**CA**	R/W	0: Slow 1: Medium 2: Fast	0	P. 117
46	Input 2_set value (SV2)	**S0**	R/W	Input 2_setting limiter (low) to Input 2_setting limiter (high)	0.0	P. 115
47	Input 2_proportional band	**P0**	R/W	TC/RTD inputs: 0 to Input span Voltage/current inputs: 0.0 to 1000.0 % of input span (0 or 0.0: ON/OFF action)	30.0	P. 115
48	Input 2_integral time	**I0**	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PD action) * Varies with the setting of the integral/derivative time decimal point position selection.	240.00	P. 116
49	Input 2_derivative time	**D0**	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PI action) * Varies with the setting of the integral/derivative time decimal point position selection.	60.00	P. 116
50	Input 2_control response parameter	**C9**	R/W	0: Slow 1: Medium 2: Fast	0	P. 117

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
51	Input 1_setting change rate limiter (up)	**HH**	R/W	0.0 to Input span/unit time * 0.0: OFF (Unused)	0.0	P. 118
52	Input 1_setting change rate limiter (down)	**HL**	R/W	* Unit time: 60 seconds (factory set value)	0.0	P. 118
53	Input 2_setting change rate limiter (up)	**HX**	R/W		0.0	P. 118
54	Input 2_setting change rate limiter (down)	**HY**	R/W		0.0	P. 118
55	Area soak time	**TM**	R/W	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	0.00.00	P. 120
56	Link area number	**LP**	R/W	0 to 16 0: OFF (No link)	0	P. 121
57	Unused	**A7**	—	—	—	—
58	Unused	**A8**	—	—	—	—
59	Input 1_PV bias	**PB**	R/W	−Input span to +Input span	0	P. 122
60	Input 1_PV digital filter	**F1**	R/W	0.00 to 10.00 seconds 0.00: OFF (Unused)	0.00	P. 122
61	Input 1_PV ratio	**PR**	R/W	0.500 to 1.500	1.000	P. 123
62	Input 1_ PV low input cut-off	**DP**	R/W	0.00 to 25.00 % of input span	0.00	P. 124
63	Input 1_ proportional cycle time	**T0**	R/W	0.1 to 100.0 seconds	Relay contact output: 20.0 seconds Voltage pulse output and triac output: 2.0 seconds	P. 125
64	Input 1_ manual output value	**ON**	R/W	MV scaling low to MV scaling high	0	P. 125
65	Input 2_PV bias	**PA**	R/W	−Input span to +Input span	0	P. 122
66	Input 2_PV digital filter	**F0**	R/W	0.00 to 10.00 seconds 0.00: OFF (Unused)	0.00	P. 122

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
67	Input 2_PV ratio	**PQ**	R/W	0.500 to 1.500	1.000	P. 123
68	Input 2_ PV low input cut-off	**DO**	R/W	0.00 to 25.00 % of input span	0.00	P. 124
69	Input 2_ proportional cycle time	**T2**	R/W	0.1 to 100.0 seconds	Relay contact output: 20.0 seconds Voltage pulse output and triac output: 2.0 seconds	P. 125
70	Input 2_ manual output value	**OM**	R/W	Input 2_output limiter (low) to Input 2_output limiter (high)	0.0	P. 125
71	Set lock level	**LK**	R/W	Least significant digit: Lock only setting items other than SV and events (EV1 to EV4). 0: Unlock, 1: Lock 2nd digit: Lock only events (EV1 to EV4). 0: Unlock, 1: Lock 3rd digit: Lock only set value (SV). 0: Unlock, 1: Lock 4th digit to Most significant digit: Unused	0	P. 126
72	EEPROM storage state	**EM**	RO	0: The content of the EEPROM does not coincide with that of the RAM. 1: The content of the EEPROM coincides with that of the RAM.	—	P. 127
73	EEPROM storage mode	**EB**	R/W	0: Set values are store to the EEPROM when set values are changed. 1: Not set values are store to the EEPROM when set values are changed.	0	P. 127
74	Unused	**NE**	—	—	—	—
75	Unused	**NF**	—	—	—	—
76	Unused	**NH**	—	—	—	—
77	Unused	**NI**	—	—	—	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
78	PV1 peak hold value monitor	**HP**	RO	Input 1_input scale low to Input 1_input scale high Displays the maximum PV of Input 1.	—	P. 128
79	PV1 bottom hold value monitor	**HQ**	RO	Input 1_input scale low to Input 1_input scale high Displays the minimum PV of Input 1.	—	P. 129
80	PV1 hold reset	**HR**	R/W	0, 1 0: Hold reset execution If 0 is written, the hold value is reset to return to 1. The polling of "1" is always made.	1	P. 130
81	PV2 peak hold value monitor	**FP**	RO	Input 2_input scale low to Input 2_input scale high Displays the maximum PV of Input 2.	—	P. 128
82	PV2 bottom hold value monitor	**FQ**	RO	Input 2_input scale low to Input 2_input scale high Displays the minimum PV of Input 2.	—	P. 129
83	PV2 hold reset	**FR**	R/W	0, 1 0: Hold reset execution If 0 is written, the hold value is reset to return to 1. The polling of "1" is always made.	1	P. 130
84	Interlock release	**IL**	R/W	0, 1 0: Interlock release execution If 0 is written, the interlock is released.	1	P. 131
85	Auto-zero (Input 1)	**AZ**	R/W	0, 1, 3 1: Zero point adjustment execution Writing "1" starts zero point adjustment, and then "1" returns to "0" after the adjustment is finished. 3: Adjustment error Writing "0" returns to a normal state. Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors	0	P. 131

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
86	Auto calibration (Input 1)	**FS**	R/W	0 to 3 1: Auto calibration execution Writing "1" starts auto calibration, and it changes to "2" during the adjustment and returns to "0" after the adjustment is finished. 3: Adjustment error Writing "0" returns to a normal state. Relevant pressure sensors: CZ-GP100 (without amplifier), the other strain gauge type sensors	0	P. 132
87	STOP display selection	**DX**	R/W	0: Displays on the measured value (PV1/PV2) unit 1: Displays on the set value (SV) unit	0	P. 133
88	Bar graph display selection	**DA**	R/W	0: No display 1: Input 1_ manipulated output value (MV) 2: Input 1_measured value (PV) 3: Input 1_set value (SV) 4: Input 1_deviation value 5: Unused (Not available) 6: Input 2_ manipulated output value (MV) 7: Input 2_measured value (PV) 8: Input 2_set value (SV) 9: Input 2_deviation value	0	P. 134
89	Bar graph resolution setting	**DE**	R/W	1 to 100 digit/dot	100	P. 135
90	Auto/Manual transfer key operation selection (A/M)	**DK**	R/W	0: Unused 1: Auto/Manual transfer for input 1 2: Auto/Manual transfer for input 2 3: Auto/Manual transfer for input 1 and input 2	3	P. 135
91	Remote/Local transfer key operation selection (R/L)	**DL**	R/W	0: Unused 1: Remote/Local transfer	1	P. 136
92	RUN/STOP transfer key operation selection (R/S)	**DM**	R/W	0: Unused 1: RUN/STOP transfer	1	P. 136

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
93	Input 1_ input type selection	**XI**	R/W	Voltage (V)/current (I) inputs −19999 to +99999 14: 0 to 20 mA DC 24: ±100 mV DC 15: 4 to 20 mA DC 25: ±10 mV DC 16: 0 to 10 V DC 26: ±10 V DC 17: 0 to 5 V DC 27: ±5 V DC 18: 1 to 5 V DC 28: ±1 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC Relevant pressure sensors: CZ-GP100, the other voltage/current type sensors Pressure sensor input 0.0 to 250.0 MPa 29: Resin pressure sensor Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors 22, 23: Unused (Not available)	Depends on model code. When not specifying: Pressure sensor input	P. 137
94	Input 1_ display unit selection	**PU**	R/W	2: MPa 3: bar 4: kgf/cm^2 5: psi	Pressure sensor input: 2 V/I: 0	P. 138
95	Input 1_ decimal point position	**XU**	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places * Less than 1 MPa: Decimal point position 0 to 4 Less than 10 MPa: Decimal point position 0 to 3 Less than 100 MPa: Decimal point position 0 to 2 100 MPa or more: Decimal point position 0 or 1 Voltage (V)/current (I) inputs: Decimal point position 0 to 4	1	P. 139
96	Input 1_input scale high	**XV**	R/W	Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	Pressure sensor input: 50.0 V/I: 100.0	P. 140

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
97	Input 1_input scale low	**XW**	R/W	Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	Pressure sensor input: 0.0 V/I: 0.0	P. 141
98	Input 1_input error determination point (high)	**AV**	R/W	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	Pressure sensor input: Input scale high + (5 % of input span) V/I: 105.0	P. 142
99	Input 1_input error determination point (low)	**AW**	R/W		Pressure sensor input: Input scale low − (5 % of input span) V/I: −5.0	P. 143
100	Input 1_burnout direction	**BS**	R/W	0: Upscale 1: Downscale	0	P. 144
101	Input 1_square root extraction selection	**XH**	R/W	0: Unused 1: Used	0	P. 145
102	Power supply frequency selection	**JT**	R/W	0: 50 Hz 1: 60 Hz	0	P. 145
103	Input 2_input type selection	**XJ**	R/W	TC input 0: K −200 to +1372 °C −328.0 to +2501.6 °F 1: J −200 to +1200 °C −328.0 to +2192.0 °F 2: R −50 to +1768 °C −58.0 to +3214.4 °F 3: S −50 to +1768 °C −58.0 to +3214.4 °F 4: B 0 to 1800 °C 32.0 to 3272.0 °F 5: E −200 to +1000 °C −328.0 to +1832.0 °F 6: N 0 to 1300 °C 32.0 to 2372.0 °F 7: T −200 to +400 °C −328.0 to +752.0 °F 8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F 9: PLII 0 to 1390 °C 32.0 to 2534.0 °F	Depend on model code. When not specifying: Type K	P. 137

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
103	Input 2_ input type selection	**XJ**	R/W	RTD input (3-wire system) 12: Pt100 −200 to +850 °C −328.0 to +1562.0 °F 13: JPt100 −200 to +600 °C −328.0 to +1112.0 °F Voltage (V)/current (I) inputs −19999 to +99999 14: 0 to 20 mA DC 24: ±100 mV DC 15: 4 to 20 mA DC 25: ±10 mV DC 16: 0 to 10 V DC 26: ±10 V DC 17: 0 to 5 V DC 27: ±5 V DC 18: 1 to 5 V DC 28: ±1 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC 22, 23: Unused (Not available)	Depends on model code. When not specifying: Type K	P. 137
104	Input 2_ display unit selection	**PT**	R/W	0: °C 1: °F	0	P. 138
105	Input 2_ decimal point position	**XT**	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1	P. 139
106	Input 2_input scale high	**XX**	R/W	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	TC/RTD: Maximum value of the selected input range V/I: 100.0	P. 140
107	Input 2_input scale low	**XY**	R/W	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	TC/RTD: Minimum value of the selected input range V/I: 0.0	P. 141

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
108	Input 2_input error determination point (high)	**AX**	R/W	Input scale low – (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale high + (5 % of input span) V/I: 105.0	P. 142
109	Input 2_input error determination point (low)	**AY**	R/W		TC/RTD: Input scale low – (5 % of input span) V/I: –5.0	P. 143
110	Input 2_ burnout direction	**BR**	R/W	0: Upscale 1: Downscale	0	P. 144
111	Input 2_square root extraction selection	**XG**	R/W	0: Unused 1: Used	0	P. 145
112	Event input logic selection	**H2**	R/W	0 to 15	1	P. 146
113	Output logic selection	**E0**	R/W	3 to 8, 11 1, 2, 9 and 10: Unused (Not available)	1-input controller: 3 2-input controller: 5	P. 149
114	Output 1 timer setting	**TD**	R/W	0.0 to 600.0 seconds	0.0	P. 151
115	Output 2 timer setting	**TG**	R/W		0.0	P. 151
116	Output 3 timer setting	**TH**	R/W		0.0	P. 151
117	Output 4 timer setting	**TI**	R/W		0.0	P. 151
118	Output 5 timer setting	**TJ**	R/W		0.0	P. 151
119	Transmission output 1_ type selection	**LA**	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
120	Transmission output 1_ scale high	**HV**	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
121	Transmission output 1_ scale low	**HW**	R/W		PV/SV: Input scale low MV: 0.0 Deviation: −Input span	P. 155
122	Transmission output 2_ type selection	**LB**	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153
123	Transmission output 2_ scale high	**CV**	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
124	Transmission output 2_ scale low	**CW**	R/W		PV/SV: Input scale low MV: 0.0 Deviation: −Input span	P. 155

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
125	Transmission output 3_ type selection	**LC**	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153
126	Transmission output 3_ scale high	**EV**	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
127	Transmission output 3_ scale low	**EW**	R/W		PV/SV: Input scale low MV: 0.0 Deviation: −Input span	P. 155
128	Event 1 type selection	**XA**	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0	P. 156
129	Event 1 hold action	**WA**	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
130	Event 1 differential gap	**HA**	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
131	Event 1 action at input error	**OA**	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
132	Event 1 assignment	**FA**	R/W	1: For input 1 2: For input 2	1	P. 165
133	Event 2 type selection	**XB**	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0	P. 156
134	Event 2 hold action	**WB**	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
135	Event 2 differential gap	**HB**	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
136	Event 2 action at input error	**OB**	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
137	Event 2 assignment	**FB**	R/W	1: For input 1 2: For input 2	1	P. 165
138	Event 3 type selection	**XC**	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break alarm (LBA)	0	P. 156

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
139	Event 3 hold action	**WC**	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
140	Event 3 differential gap	**HC**	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
141	Event 3 action at input error	**OC**	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
142	Event 3 assignment	**FC**	R/W	1: For input 1 2: For input 2	1	P. 165
143	Event 4 type selection	**XD**	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break alarm (LBA)	0	P. 156
144	Event 4 hold action	**WD**	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
145	Event 4 differential gap	**HD**	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
146	Event 4 action at input error	**OD**	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
147	Event 4 assignment	**FD**	R/W	1: For input 1 2: For input 2	1	P. 165

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
148	Unused	**XR**	—	—	—	—
149	Unused	**ZF**	—	—	—	—
150	Unused	**XS**	—	—	—	—
151	Unused	**ZG**	—	—	—	—
152	Hot/Cold start selection	**XN**	R/W	Power failure less than 3 seconds: 0: Hot 1 5: Cold 1: Hot 1 6: Hot 1 2: Hot 1 7: Hot 2 3: Hot 2 8: Stop 4: Hot 2 Power failure 3 seconds or more: 0: Hot 1 5: Cold 1: Hot 2 6: Stop 2: Cold 7: Stop 3: Hot 2 8: Stop 4: Cold	5	P. 166
153	Input 2_use selection	**KM**	R/W	0: Single loop control 1: Remote input	0	P. 167
154	Unused	**RR**	—	—	—	—
155	Unused	**RB**	—	—	—	—
156	SV tracking	**XL**	R/W	0: Unused 1: Used	1	P. 167
157	Input 1_control action type selection	**XE**	R/W	0: Direct action 1: Reverse action	1	P. 168
158	Input 1_integral/derivative time decimal point position selection	**PK**	R/W	0: No decimal place 1: One decimal place 2: Two decimal places	2	P. 169
159	Input 1_derivative gain	**DG**	R/W	0.1 to 10.0	6.0	P. 169
160	Input 1_ON/OFF action differential gap (upper)	**IV**	R/W	0 to Input span	Pressure sensor input: 1.0 MPa V/I: 0.1 % of input span	P. 170
161	Input 1_ON/OFF action differential gap (lower)	**IW**	R/W		Pressure sensor input: 1.0 MPa V/I: 0.1 % of input span	P. 171

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
162	Input 1_action at input error (high)	**WH**	R/W	0: Normal control 1: Manipulated Output Value at Input Error	0	P. 172
163	Input 1_action at input error (low)	**WL**	R/W		0	P. 173
164	Input 1_manipulated output value at input error	**OE**	R/W	−5.0 to +105.0 %	−5.0	P. 173
165	Input 1_output change rate limiter (up)	**PH**	R/W	0.0 to 1000.0 %/second 0.0: OFF	0.0	P. 174
166	Input 1_output change rate limiter (down)	**PL**	R/W		0.0	P. 174
167	Input 1_output limiter (high)	**OH**	R/W	Input 1_output limiter (low) to 105.0 %	105.0	P. 176
168	Input 1_output limiter (low)	**OL**	R/W	−5.0 % to Input 1_output limiter (high)	−5.0	P. 176
169	Unused	**PF**	—	—	—	—
170	Input 2_control action type selection	**XF**	R/W	0: Direct action 1: Reverse action	1	P. 168
171	Input 2_integral/derivative time decimal point position selection	**PJ**	R/W	0: No decimal place 1: One decimal place 2: Two decimal places	2	P. 169
172	Input 2_derivative gain	**DJ**	R/W	0.1 to 10.0	6.0	P. 169
173	Input 2_ON/OFF action differential gap (upper)	**IX**	R/W	0 to Input span	TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span	P. 170
174	Input 2_ON/OFF action differential gap (lower)	**IY**	R/W		TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span	P. 171
175	Input 2_action at input error (high)	**WX**	R/W	0: Normal control 1: Manipulated Output Value at Input Error	0	P. 172
176	Input 2_action at input error (low)	**WY**	R/W		0	P. 173
177	Input 2_manipulated output value at input error	**OF**	R/W	−5.0 to +105.0 %	−5.0	P. 173

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
178	Input 2_output change rate limiter (up)	**PX**	R/W	0.0 to 1000.0 %/second 0.0: OFF	0.0	P. 174
179	Input 2_output change rate limiter (down)	**PY**	R/W		0.0	P. 174
180	Input 2_output limiter (high)	**OX**	R/W	Input 2_output limiter (low) to 105.0 %	105.0	P. 176
181	Input 2_output limiter (low)	**OY**	R/W	−5.0 % to Input 2_output limiter (high)	−5.0	P. 176
182	Unused	**PG**	—	—	—	—
183	Input 1_AT bias	**GB**	R/W	−Input span to +Input span	0	P. 177
184	Input 1_AT cycle	**G3**	R/W	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1	P. 178
185	Input 1_ AT differential gap time	**GH**	R/W	0.00 to 50.00 seconds	0.10	P. 179
186	Input 2_AT bias	**GA**	R/W	−Input span to +Input span	0	P. 177
187	Input 2_AT cycle	**G2**	R/W	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1	P. 178
188	Input 2_ AT differential gap time	**GG**	R/W	0.00 to 50.00 seconds	0.10	P. 179
189	Unused	**V2**	—	—	—	—
190	Unused	**VH**	—	—	—	—
191	Unused	**SY**	—	—	—	—
192	Unused	**FV**	—	—	—	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
193	Setting change rate limiter unit time	**HU**	R/W	1 to 3600 seconds	60	P. 181
194	Soak time unit selection	**RU**	R/W	0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds 2: 0 minutes 00.00 seconds to 9 minutes 59.99 seconds	2	P. 181
195	Input 1_setting limiter (high)	**SH**	R/W	Input 1_setting limiter (low) to Input 1_input scale high	Input 1_ input scale high	P. 182
196	Input 1_setting limiter (low)	**SL**	R/W	Input 1_input scale low to Input 1_setting limiter (high)	Input 1_ input scale low	P. 183
197	Input 2_setting limiter (high)	**ST**	R/W	Input 2_setting limiter (low) to Input 2_input scale high	Input 2_ input scale high	P. 182
198	Input 2_setting limiter (low)	**SU**	R/W	Input 2_input scale low to Input 2_setting limiter (high)	Input 2_ input scale low	P. 183
199	ROM version display	**VR**	RO	Display the version of loading software.	—	P. 184
200	Integrated operating time display	**UT**	RO	0 to 99999 hours	—	P. 184
201	Holding peak value ambient temperature display	**Hp**	RO	−10.0 to +100.0 °C	—	P. 184
202	Unused	**HM**	—	—	—	—
203	Unused	**VG**	—	—	—	—
204	Unused	**PZ**	—	—	—	—
205	Unused	**PW**	—	—	—	—
206	Unused	**ND**	—	—	—	—
207	Unused	**DH**	—	—	—	—
208	Unused	**NG**	—	—	—	—
209	Unused	**DF**	—	—	—	—

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No.	Name	Identifier	Attribute	Data range	Factory set value	Reference page
210	Alarm lamp lighting condition setting	**LY**	R/W	Least significant digit: Event 1 0: ALM lamp is not lit, 1: ALM lamp is lit 2nd digit: Event 2 0: ALM lamp is not lit, 1: ALM lamp is lit 3rd digit: Event 3 0: ALM lamp is not lit, 1: ALM lamp is lit 4th digit: Event 4 0: ALM lamp is not lit, 1: ALM lamp is lit 5th digit to Most significant digit: Unused	1111	P. 185
211	Unused	**LZ**	—	—	—	—
212	Input 1_ PV1 hold function	**HT**	R/W	0: Unused 1: Used	0	P. 186
213	Input 2_ PV2 hold function	**FT**	R/W		0	P. 186
214	Gain setting (Input 1)	**OG**	R/W	0.500 to 4.000 mV/V Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors	CZ-100P/ CZ-200P: 1.500 CZ-GP100 (without amplifier), the other strain gauge type sensors: 3.330	P. 186
215	Linearize type selection (Input 1)	**LI**	R/W	0: Unused 1 to 20: Used Relevant pressure sensors: CZ-100P, CZ-200P	0	P. 187
216	Shunt resistance output value (Input 1)	**OR**	R/W	40.0 to 100.0 % Relevant pressure sensors: CZ-GP100 (without amplifier), the other strain gauge type sensors	80.0	P. 188

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
217	Input 1_ PV transfer function	**TS**	R/W	0: Unused 1: Used	0	P. 188
218	Input 2_ PV transfer function	**US**	R/W		0	P. 188
219	Input 1_ MV scaling high (Input 1)	**RH**	R/W	−1999.9 to +9999.9	100.0	P. 189
220	Input 1_ MV scaling low (Input 1)	**RL**	R/W		0.0	P. 190
221	Decimal point position of MV scaling (Input 1)	**RP**	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1	P. 190
222	Input 1_AT action	**JI**	R/W	0: AT function (PID) 1: AT function (PI) 2: No AT function	2	P. 191
223	Input 2_AT action	**JJ**	R/W		2	P. 191
224	Input 1_manipulated output value when transferred to Auto from Manual	**OI**	RO	−5.0 to +105.0 %	—	P. 191
225	Input 2_manipulated output value when transferred to Auto from Manual	**OJ**	RO		—	P. 191
226	Interlock function	**QA**	R/W	Least significant digit: OUT1 0: Unused, 1: Used 2nd digit: OUT2 0: Unused, 1: Used 3rd digit: OUT3 0: Unused, 1: Used 4th digit: OUT4 0: Unused, 1: Used 5th digit: OUT5 0: Unused, 1: Used 6th digit to Most significant digit: Unused	00000	P. 192
227	Input 1_ MV transfer function	**OT**	R/W	0: Unused 1: Used	0	P. 194
228	Input 2_ MV transfer function	**OU**	R/W		0	P. 194

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value	Refer-ence page
229	Unused	**MY**	—	—	—	—
230	Unused	**NY**	—	—	—	—
231	Unused	**MZ**	—	—	—	—
232	Unused	**NZ**	—	—	—	—

6. MODBUS COMMUNICATION PROTOCOL

The master controls communication between master and slave. A typical message consists of a request (query message) sent from the master followed by an answer (response message) from the slave. When master begins data transmission, a set of data is sent to the slave in a fixed sequence. When it is received, the slave decodes it, takes the necessary action, and returns data to the master.

6.1 Message Format

The message consists of four parts: slave address, function code, data, and error check code which are always transmitted in the same sequence.

Slave address
Function code
Data
Error check CRC-16

Message format

■ Slave address

The slave address is a number from 1 to 99 manually set at the controller address setting switch located at the front of the controller.

☞ For details, see **4.2 Setting the Communication Parameters (P. 11)**.

Although all connected slave units receive the query message sent from the master, only the slave with the slave address coinciding with the query message will accept the message.

■ Function code

The function codes are the instructions set at the master and sent to the slave describing the action to be executed. The function codes are included when the slave responds to the master.

☞ For details, see **6.2 Function Code (P. 56)**.

■ Data

The data to execute the function specified by the function code is sent to the slave and corresponding data returned to the master from the slave.

☞ For details, see **6.6 Message Format (P. 61)**, **6.7 Data Configuration (P. 65)** and **6.8 Data Map List (P. 70)**.

■ Error check

An error checking code (CRC-16: Cyclic Redundancy Check) is used to detect an error in the signal transmission.

☞ For details, see **6.5 Calculating CRC-16 (P. 58)**.

6.2 Function Code

Function code contents

Function code (Hexadecimal)	Function	Contents
03H	Read holding registers	Measured value, control output value, current transformer input measured value, Event status, etc.
06H	Preset single register	Set value, PID constants, event set value, etc.
08H	Diagnostics (loopback test)	Loopback test
10H	Preset multiple registers	Set value, PID constants, event set value, etc.

Message length of each function (Unit: byte)

Function code (Hexadecimal)	Function	Query message		Response message	
		Min	Max	Min	Max
03H	Read holding registers	8	8	7	255
06H	Preset single register	8	8	8	8
08H	Diagnostics (loopback test)	8	8	8	8
10H	Preset multiple registers	11	255	8	8

6.3 Communication Mode

Signal transmission between the master and slaves is conducted in Remote Terminal Unit (RTU) mode.

Items	Contents
Data bit length	8-bit (Binary)
Start mark of message	Unused
End mark of message	Unused
Message length	See **6.2 Function code**
Data time interval	Less than 24 bits' time *
Error check	CRC-16 (Cyclic Redundancy Check)

* When sending a command message from the master, set intervals of data configuring one message to time shorter than the 24 bits' time or the 24 bits' time plus a few milliseconds. If time intervals become time longer than the 24 bits' time or the 24 bits' time plus a few milliseconds, the relevant slave assumes that message sending from the master is terminated to deform the message format. As a result, the slave does not make a response.

6.4 Slave Responses

(1) Normal response

- In the response message of the Read Holding Registers, the slave returns the read out data and the number of data items with the same slave address and function code as the query message.
- In the response message of the Preset Single Register, the slave returns the same message as the query message.
- In the response message of the Diagnostics (Loopback test), the slave returns the same message as the query message.
- In the response message of the Preset Multiple Registers, the slave returns the slave address, the function code, starting number, and number of holding registers in the multi-query message.

(2) Defective message response

- If the query message from the master is defective, except for transmission error, the slave returns the error response message without any action.

Slave address
Function code
Error code
Error check CRC-16

Error response message

- If the self-diagnostic function of the slave detects an error, the slave will return an error response message to all query messages.
- The function code of each error response message is obtained by adding 80H to the function code of the query message.

Error code	Contents
1	Function code error (An unsupported function code was specified)
2	When any address other than 0000H to 00ADH, 0200H to 031DH, and 0500H to 0535H are specified.
3	When the specified number of data items in the query message exceeds the maximum number of data items available
4	Self-diagnostic error response

(3) No response

The slave ignores the query message and does not respond when:

- The slave address in the query message does not coincide with any slave address settings.
- The CRC code of the master does not coincide with that of the slave.
- Transmission error such as overrun, framing, parity and etc., is found in the query message.
- Data time interval in the query message from the master exceeds 24 bit's time. *

* When this case is operated, there is when the slave does not sometimes make a response.

6.5 Calculating CRC-16

The Cyclic Redundancy Check (CRC) is a 2 byte (16-bit) error check code. After constructing the data message, not including start, stop, or parity bit, the master calculates a CRC code and appends this to the end of the message. The slave will calculate a CRC code from the received message, and compare it with the CRC code from the master. If they do not coincide, a communication error has occurred and the slave does not respond.

The CRC code is formed in the following sequence:

1. Load a 16-bit CRC register with FFFFH.

2. *Exclusive OR* (⊕) the first byte (8 bits) of the message with the CRC register. Return the result to the CRC register.

3. Shift the CRC register 1 bit to the right.

4. If the carry flag is 1, *exclusive OR* the CRC register with A001 hexadecimal and return the result to the CRC register. If the carry flag is 0, repeat step ***3***.

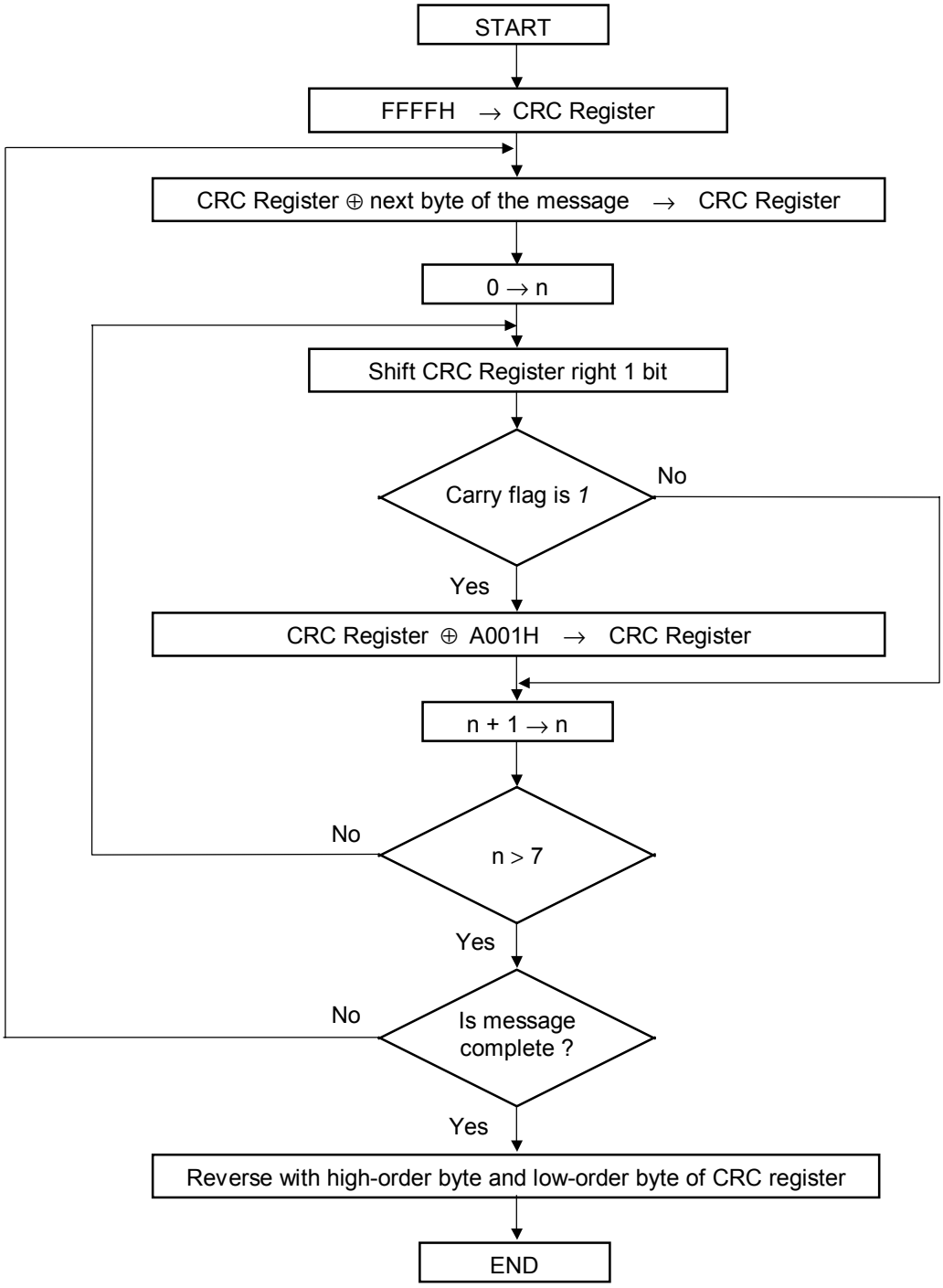
5. Repeat step ***3*** and ***4*** until there have been 8 shifts.

6. *Exclusive OR* the next byte (8 bits) of the message with the CRC register.

7. Repeat step ***3*** through ***6*** for all bytes of the message (except the CRC).

8. The CRC register contains the 2 byte CRC error code. When they are appended to the message, the low-order byte is appended first, followed by the high-order byte.

■ The flow chart of CRC-16



The ⊕ symbol indicates an *exclusive OR* operation. The symbol for the number of data bits is *n*.

■ Example of a CRC calculation in the 'C' language

This routine assumes that the data types 'uint16' and 'uint8' exists. Theses are unsigned 16-bit integer (usually an 'unsigned short int' for most compiler types) and unsigned 8-bit integer (unsigned char). 'z_p' is a pointer to a Modbus message, and 'z_messaage_length' is its length, excluding the CRC. Note that the Modbus message will probably contain NULL characters and so normal C string handling techniques will not work.

uint16 calculate_crc （byte *z_p, unit16 z_message_length）

```
/* CRC runs cyclic Redundancy Check Algorithm on input z_p  */
/* Returns value of 16 bit CRC after completion and         */
/* always adds 2 crc bytes to message                       */
/* returns 0 if incoming message has correct CRC            */

{
    uint16 CRC= 0xffff;
    uint16 next;
    uint16 carry;
    uint16 n;
    uint8 crch, crcl;

    while (z_messaage_length--) {
        next = (uint16) *z_p;
        CRC ^= next;
        for (n = 0; n < 8; n++) {
            carry = CRC & 1;
            CRC >>= 1;
            if (carry) {
              CRC ^= 0xA001;
            }
        }
        z_p++;
    }
    crch = CRC / 256;
    crcl = CRC % 256
    z_p [z_messaage_length++] = crcl;
    z_p [z_messaage_length] = crch;
    return CRC;
}
```

6.6 Message Format

6.6.1 Read holding registers [03H]

The query message specifies the starting register address and quantity of registers to be read.
The contents of the holding registers are entered in the response message as data, divided into two parts: the high-order 8-bit and the low-order 8-bit, arranged in the order of the register numbers.

Example: The contents of the four holding registers from 0000H to 0003H are the read out from slave address 2.

Query message

Slave address		02H	
Function code		03H	
Starting No.	High	00H	First holding register address
	Low	00H	
Quantity	High	00H	The setting must be between 1 (0001H) and 125 (007DH).
	Low	04H	
CRC-16	High	44H	
	Low	3AH	

Normal response message

Slave address		02H	
Function code		03H	
Number of data		08H	→ Number of holding registers × 2
First holding register contents	High	00H	
(Low-order word of the first data)	Low	19H	
Next holding register contents	High	00H	
(High-order word of the first data)	Low	00H	
Next holding register contents	High	00H	
(Low-order word of the next data)	Low	19H	
Next holding register contents	High	00H	
(High-order word of the next data)	Low	00H	
CRC-16	High	C3H	
	Low	95H	

Error response message

Slave address		02H
80H + Function code		83H
Error code		03H
CRC-16	High	F1H
	Low	31H

6.6.2 Preset single register [06H]

The query message specifies data to be written into the designated holding register. The write data is arranged in the query message with high-order 8-bit first and low-order 8-bit next. Only R/W holding registers can be specified.

Example: Data is written into the holding register 0049H of slave address 1.

Query message

Slave address		01H
Function code		06H
Holding register number	High	00H
	Low	49H
Write data	High	00H
	Low	64H
CRC-16	High	59H
	Low	F7H

} Any data within the range

Normal response message

Slave address		01H
Function code		06H
Holding register number	High	00H
	Low	49H
Write data	High	00H
	Low	64H
CRC-16	High	59H
	Low	F7H

} Contents will be the same as query message data.

Error response message

Slave address		01H
80H + Function code		86H
Error code		02H
CRC-16	High	C3H
	Low	A1H

6.6.3 Diagnostics (Loopback test) [08H]

The master's query message will be returned as the response message from the slave.
This function checks the communication system between the master and slave (the controller).

Example: Loopback test for slave address 1

Query message

Slave address		01H	
Function code		08H	
Test code	High	00H	Test code must be set to 00.
	Low	00H	
Data	High	1FH	Any pertinent data
	Low	34H	
CRC-16	High	E9H	
	Low	ECH	

Normal response message

Slave address		01H	Contents will be the same as query message data.
Function code		08H	
Test code	High	00H	
	Low	00H	
Data	High	1FH	
	Low	34H	
CRC-16	High	E9H	
	Low	ECH	

Error response message

Slave address		01H
80H + Function code		88H
Error code		03H
CRC-16	High	06H
	Low	01H

6.6.4 Preset multiple registers [10H]

The query message specifies the starting register address and quantity of registers to be written.
The write data is arranged in the query message with high-order 8-bit first and low-order 8-bit next.
Only R/W holding registers can be specified.

Example: Data is written into the two holding registers from 0048H to 0049H of slave address 1.

Query message

Slave address		01H	
Function code		10H	
Starting number	High	00H	First holding register address
	Low	48H	
Quantity	High	00H	The setting must be between 1 (0001H) and 100 (0064H).
	Low	02H	
Number of data		04H	→ Number of holding registers × 2
Data to first register	High	00H	Any pertinent data
(Low-order word)	Low	64H	
Data to next register	High	00H	
(High-order word)	Low	00H	
CRC-16	High	B7H	
	Low	E6H	

Normal response message

Slave address		01H
Function code		10H
Starting number	High	00H
	Low	48H
Quantity	High	00H
	Low	02H
CRC-16	High	C1H
	Low	DEH

Error response message

Slave address		01H
80H + Function code		90H
Error code		02H
CRC-16	High	CDH
	Low	C1H

6.7 Data Configuration

6.7.1 Data scale

The numeric range of data used in Modbus protocol is 0000H to FFFFH. Only the set value within the setting range is effective.

📖 FFFFH represents −1.

■ Data processing with decimal points

The Modbus protocol does not recognize data with decimal points during communication.

- **Data with one decimal place**

Input 1_manipulated output value (MV1) monitor
Input 2_manipulated output value (MV2) monitor
LBA1 deadband
LBA2 deadband
Input 1_setting change rate limiter (up)
Input 1_setting change rate limiter (down)
Input 2_setting change rate limiter (up)
Input 2_setting change rate limiter (down)
Input 1_proportional cycle time
Input 1_manipulated output value
Input 2_ proportional cycle time
Input 2_manipulated output value
Output 1 timer setting
Output 2 timer setting
Output 3 timer setting
Output 4 timer setting
Output 5 timer setting
Input 1_derivative gain
Input 1_manipulated output value at input error
Input 1_output change rate limiter (up)
Input 1_output change rate limiter (down)
Input 1_output limiter (high)
Input 1_output limiter (low)
Input 2_derivative gain
Input 2_manipulated output value at input error
Input 2_output change rate limiter (up)
Input 2_output change rate limiter (down)
Input 2_output limiter (high)
Input 2_output limiter (low)
Holding peak value ambient temperature display
Shunt resistance output value (Input 1)
MV scaling high (Input 1)
MV scaling low (Input 1)
Input 1_manipulated output value when transferred to Auto from Manual
Input 2_manipulated output value when transferred to Auto from Manual

Example: When Input 1_manipulated output value (MV1) is 5.0 %, 5.0 is processed as 50, 50 = 0032H

Input 1_ manipulated output value	High	00H
	Low	32H

- **Data with two decimal places**

Memory area soak time monitor
Area soak time
Input 1_PV digital filter
Input 1_PV low input cut-off
Input 2_PV digital filter
Input 2_PV low input cut-off
Input 1_AT differential gap time
Input 2_AT differential gap time

Example: When Input 1_PV digital filter is 0.55 second, 0.55 is processed as 55,
55 = 0037H

Input 1_PV digital filter	High	00H
	Low	37H

- **Data with three decimal places**

Input 1_PV ratio
Input 2_PV ratio
Gain setting (Input 1)

Example: When Input 1_PV ratio is 0.555, 0.555 is processed as 555,
555 = 022BH

Input 1_PV ratio	High	02H
	Low	2BH

- **Data whose decimal point's presence and/or position depends on integral/derivative time decimal point position selection**

The position of the decimal point changes depending on the integral/derivative time decimal point position selection type because the Modbus protocol does not recognize data with decimal points during communication.

[Type of decimal points position]

No decimal place, One decimal place, Two decimal places

Input 1_integral time
Input 1_derivative time
Input 2_integral time
Input 2_derivative time

Example: When Input 1_integral time is 5.00 seconds, 5.00 is processed as 500,
500 = 01F4H

Input 1_integral time	High	01H
	Low	F4H

● Data whose decimal point's presence and/or position depends on input range

The position of the decimal point changes depending on the input range type because the Modbus protocol does not recognize data with decimal points during communication.

[Type of decimal points position]

Temperature input: No decimal place, One decimal place, Two decimal places
Voltage/current input: No decimal place, One decimal place, Two decimal places, Three decimal places, Four decimal places

☞ For details, see **Input range table (P. 137)**.

Input 1_measured value (PV1)
Input 2_measured value (PV2)
Input 1_set value (SV1) monitor
Input 2_set value (SV2) monitor
Remote input value monitor
Event 1 set value
Event 2 set value
Event 3 set value
Event 4 set value
Input 1_set value (SV1)
Input 1_proportional band
Input 2_set value (SV2)
Input 2_proportional band
Input 1_PV bias
Input 2_PV bias
PV1 peak hold value monitor
PV1 bottom hold value monitor
PV2 peak hold value monitor
PV2 bottom hold value monitor
Input 1_input scale high
Input 1_input scale low
Input 1_input error determination point (high)
Input 1_input error determination point (low)
Input 2_input scale high
Input 2_input scale low
Input 2_input error determination point (high)
Input 2_input error determination point (low)
Transmission output 1_scale high
Transmission output 1_scale low
Transmission output 2_scale high
Transmission output 2_scale low
Transmission output 3_scale high
Transmission output 3_scale low
Event 1 differential gap
Event 2 differential gap
Event 3 differential gap
Event 4 differential gap
Input 1_ON/OFF action differential gap (upper)
Input 1_ON/OFF action differential gap (lower)
Input 2_ON/OFF action differential gap (upper)
Input 2_ON/OFF action differential gap (lower)
Input 1_AT bias
Input 2_AT bias
Input 1_setting limiter (high)
Input 1_setting limiter (low)
Input 2_setting limiter (high)
Input 2_setting limiter (low)

Example: When Input 2_measured value (PV2) is −20.0 °C, −20.0 is processed as −200,
−200 = 0000H − 00C8H = FF38H

Input 2_measured value (PV2)	High	FFH
	Low	38H

● Data with no decimal place

Model codes
Input 1_burnout state
Input 2_burnout state
Event 1 state
Event 2 state
Event 3 state
Event 4 state
Error codes
Event input (DI) state
Operation mode state
Memory area soak time monitor
Input 1_PID/AT transfer
Input 2_PID/AT transfer
Input 1_Auto/Manual transfer
Input 2_Auto/Manual transfer
Remote/Local transfer
RUN/STOP transfer
Memory area selection
Control loop break alarm 1 (LBA1)
Control loop break alarm 2 (LBA2)
Input 1_control response parameter
Input 2_control response parameter
Area soak time
Link area number
Set lock level
EEPROM storage state
EEPROM storage mode
PV1 hold reset
PV2 hold reset
Interlock release
Auto-Zero (Input 1)
Auto calibration (Input 1)
STOP display selection
Bar graph display selection
Bar graph resolution setting
Auto/Manual transfer key operation selection (A/M)
Remote/Local transfer key operation selection (R/L)
RUN/STOP transfer key operation selection (R/S)
Input 1_input type selection
Input 1_display unit selection
Input 1_decimal point position
Input 1_burnout direction
Input 1_square root extraction selection
Power supply frequency selection
Input 2_ input type selection
Input 2_ display unit selection
Input 2_decimal point position
Input 2_burnout direction
Input 2_square root extraction selection
Event input logic selection
Output logic selection
Transmission output 1_type selection
Transmission output 2_type selection
Transmission output 3_type selection
Event 1 type selection
Event 1 hold action
Event 1 action at input error
Event 1 assignment
Event 2 type selection
Event 2 hold action
Event 2 action at input error
Event 2 assignment
Event 3 type selection
Event 3 hold action
Event 3 action at input error
Event 3 assignment
Event 4 type selection
Event 4 hold action
Event 4 action at input error
Event 4 assignment
Hot/Cold start selection
Input 2_use selection
SV tracking
Input 1_control action type selection
Input 1_integral/derivative time decimal point position selection
Input 1_action at input error (high)
Input 1_action at input error (low)
Input 2_control action type selection
Input 2_integral/derivative time decimal point position selection
Input 2_action at input error (high)
Input 2_action at input error (low)
Input 1_AT cycle
Input 2_AT cycle
Setting change rate limiter unit time
Soak time unit selection
ROM version display
Integrated operating time display
Alarm lamp lighting condition setting
Input 1_PV1 hold function
Input 2_PV2 hold function
Linearize type
Input 1_PV transfer function
Input 2_PV transfer function
Decimal point position of MV scaling (Input 1)
Input 1_AT action
Input 2_AT action
Interlock function
Input 1_MV transfer function
Input 2_MV transfer function

Continued on the next page.

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Example: When Integrated operating time display is 72 hour,
72 = 0048H

Integrated operating time display	High	00H
	Low	48H

6.7.2 Caution for handling communication data

- In this communication, the variable is handled as 4 bytes data.
- In this communication, one variable use two register addresses (Address of high-order word, Address of low-order word).
- Tow-word data is read and written from low-order words to high-order words in order.

  If Modbus 1 is selected in the communication protocol selection of the engineering mode, data is read and written from high-order words to low-order words in order.
- In this communication, the variables that memory area includes handles different address with for control area and for setting area.
- There is the following constraint in writing data in order to treat the variable as 4 bytes data in this communication.
  - It is not possible to write only of high-order word. The communication response becomes normal response, but do not writing.
  - A writing only of low-order word does sign extend and does it.

    Example 1: When did a writing only of “0020H” in low-order word.
    The controller interprets high-order word as “0000H.”

    Example 2: When did a writing only of “FFFFH (–1) ” in low-order word.
    The controller interprets high-order word as “FFFFH.”
- Addresses in which data (holding register) is accessible are from 0000H to 00ADH, from 0200H to 031DH, and from 0500H to 0535H. If any address other than 0000H to 00ADH, 0200H to 031DH, and 0500H to 0535H is accessed, an error response message returns.
- Read data of unused item is a default value.
- Any attempt to write to an unused item is not processed as an error. Data can not be written into an unused item.
- If data range or address error occurs during data writing, it is not processed as an error. Except the data that error occurred, normal data is written in data register. Therefore, it is necessary to confirm data after the end of setting data.
- Communication data includes data that becomes RO (read only) depending on the specification. No error occurs even if data is written when set to RO. However in this case, no data is written.

  For details, see **6.8 Data Map List (P. 70)**.
- Send the next command message at time intervals of 30 bits after the master receives the response message.

6.8 Data Map List

- In this communication, the variable is handled as 4 bytes data.
- In this communication, one variable use two register addresses (Address of high-order word, Address of low-order word).
- Tow-word data is read and written from low-order words to high-order words in order. *

  * If Modbus 1 is selected in the communication protocol selection of the engineering mode, data is read and written from high-order words to low-order words in order.
- Register address 0500H to 0535H handles it when I do confirmation and change of set value belonging to memory area except control area. (See P. 97)

RO: Read only R/W: Read and Write

Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_measured value (PV1) monitor	0000	0001	0	1	RO	Input 1_input scale low to Input 1_input scale high	—	P. 101
Input 2_measured value (PV2) monitor	0002	0003	2	3	RO	Input 2_input scale low to Input 2_input scale high	—	P. 101
Unused	0004	0005	4	5	—	—	—	—
Unused	0006	0007	6	7	—	—	—	—
Unused	0008	0009	8	9	—	—	—	—
Input 1_ set value (SV1) monitor	000A	000B	10	11	RO	Input 1_setting limiter (low) to Input 1_setting limiter (high)	—	P. 101
Input 2_ set value (SV2) monitor	000C	000D	12	13	RO	Input 2_setting limiter (low) to Input 2_setting limiter (high)	—	P. 101
Remote input value monitor	000E	000F	14	15	RO	Input 1_setting limiter (low) to Input 1_setting limiter (high)	—	P. 102

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Unused	0010	0011	16	17	—	—	—	—
Input 1_burnout state	0012	0013	18	19	RO	0: OFF 1: ON	—	P. 102
Input 2_burnout state	0014	0015	20	21	RO		—	P. 102
Unused	0016	0017	22	23	—	—	—	—
Event 1 state	0018	0019	24	25	RO	0: OFF 1: ON	—	P. 103
Event 2 state	001A	001B	26	27	RO		—	P. 103
Event 3 state	001C	001D	28	29	RO		—	P. 103
Event 4 state	001E	001F	30	31	RO		—	P. 103
Unused	0020	0021	32	33	—	—	—	—
Unused	0022	0023	34	35	—	—	—	—
Input 1_ manipulated output value (MV1) monitor	0024	0025	36	37	RO	−5.0 to +105.0 %	—	P. 103
Input 2_ manipulated output value (MV2) monitor	0026	0027	38	39	RO		—	P. 103

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Error code	0028	0029	40	41	RO	Bit data b0: Adjustment data error b1: EEPROM error b2: A/D conversion error b3: RAM check error b4: Hardware configuration error b5: Software configuration error b6: Unused b7: Watchdog timer error b8 to b10: Unused b11: Program busy b12 to b31: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095]	—	P. 104
Event input (DI) state	002A	002B	42	43	RO	Bit data b0: DI 1 state b1: DI 2 state b2: DI 3 state b3: DI 4 state b4: DI 5 state b5 to b31: Unused Data 0: Contact open 1: Contact closed [Decimal number: 0 to 31]	—	P. 105
Operation mode state	002C	002D	44	45	RO	Bit data b0: Control STOP b1: Control RUN b2: Input 1_Manual mode (Including Input 1_ Remote mode) b3: Input 2_Manual mode (Including Input 2_ Remote mode) b4: Remote mode b5 to b31: Unused Data 0: OFF 1: ON [Decimal number: 0 to 31]	—	P. 106

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Memory area soak time monitor	002E	002F	46	47	RO	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	—	P. 107
Input 1_PID/AT transfer	0030	0031	48	49	R/W	0: PID control 1: Autotuning (AT) No PID/AT transfer is valid prior to factory shipment. The transfer becomes valid only when "1: AT function (PI)" or "0: AT function (PID)" is selected in AT action selection.	0	P. 107
Input 2_PID/AT transfer	0032	0033	50	51	R/W		0	P. 107
Input 1_ Auto/Manual transfer	0034	0035	52	53	R/W	0: Auto mode 1: Manual mode	1	P. 109
Input 2_ Auto/Manual transfer	0036	0037	54	55	R/W		1	P. 109
Remote/Local transfer	0038	0039	56	57	R/W	0: Local mode 1: Remote mode	0	P. 109
RUN/STOP transfer	003A	003B	58	59	R/W	0: Control RUN 1: Control STOP	0	P. 110
Memory area selection	003C	003D	60	61	R/W	1 to 16	1	P. 110
Event 1 set value	003E	003F	62	63	R/W	Deviation: –Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 111
Event 2 set value	0040	0041	64	65	R/W		50.0	P. 111
Event 3 set value	0042	0043	66	67	R/W		50.0	P. 111

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Control loop break alarm 1 (LBA1) time	0044	0045	68	69	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 112
LBA1 deadband	0046	0047	70	71	R/W	0.0 to Input span	0.0	P. 112
Event 4 set value	0048	0049	72	73	R/W	Deviation: –Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 111
Control loop break alarm 2 (LBA2) time	004A	004B	74	75	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 112
LBA2 deadband	004C	004D	76	77	R/W	0.0 to Input span	0.0	P. 112
Input 1_set value (SV1)	004E	004F	78	79	R/W	Input 1_setting limiter (low) to Input 1_ setting limiter (high)	0.0	P. 115
Input 1_ proportional band	0050	0051	80	81	R/W	0.0 to 1000.0 % of input span 0 or 0.0: ON/OFF action	100.0	P. 115
Input 1_integral time	0052	0053	82	83	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * 0, 0.0 or 0.00: PD action *Varies with the setting of the integral/derivative time decimal point position selection.	5.00	P. 116
Input 1_derivative time	0054	0055	84	85	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * 0, 0.0 or 0.00: PI action *Varies with the setting of the integral/derivative time decimal point position selection.	0.00 (PI action)	P. 116
Input 1_control response parameter	0056	0057	86	87	R/W	0: Slow 1: Medium 2: Fast	0	P. 117

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Unused	0058	0059	88	89	—	—	—	—
Input 2_set value (SV2)	005A	005B	90	91	R/W	Input 2_setting limiter (low) to Input 2_ setting limiter (high)	0.0	P. 115
Input 2_ proportional band	005C	005D	92	93	R/W	TC/RTD inputs: 0 to Input span Voltage/current inputs: 0.0 to 1000.0 % of Input span 0 or 0.0: ON/OFF action	30.0	P. 115
Input 2_integral time	005E	005F	94	95	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * 0, 0.0 or 0.00: PD action *Varies with the setting of the integral/derivative time decimal point position selection.	240.00	P. 116
Input 2_derivative time	0060	0061	96	97	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * 0, 0.0 or 0.00: PI action *Varies with the setting of the integral/derivative time decimal point position selection.	60.00	P. 116
Input 2_control response parameter	0062	0063	98	99	R/W	0: Slow 1: Medium 2: Fast	0	P. 117
Unused	0064	0065	100	101	—	—	—	—
Input 1_setting change rate limiter (up)	0066	0067	102	103	R/W	0.0 to Input span/unit time * 0.0: OFF (Unused) * Unit time: 60 seconds (factory set value)	0.0	P. 118
Input 1_setting change rate limiter (down)	0068	0069	104	105	R/W		0.0	P. 118

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_setting change rate limiter (down)	006A	006B	106	107	R/W	0.0 to Input span/unit time * 0.0: OFF (Unused) * Unit time: 60 seconds (factory set value)	0.0	P. 118
Input 2_setting change rate limiter (down)	006C	006D	108	109	R/W		0.0	P. 118
Area soak time	006E	006F	110	111	R/W	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	0.00.00	P. 120
Link area number	0070	0071	112	1113	R/W	0 to 16 0: OFF (No link)	0	P. 121
Unused	0072	0073	114	115	—	—	—	—
Unused	0074	0075	116	117	—	—	—	—
Input 1_PV bias	0076	0077	118	119	R/W	–Input span to +Input span	0	P. 122
Input 1_PV digital filter	0078	0079	120	121	R/W	0.00 to 10.00 seconds 0.00: OFF (Unused)	0.00	P. 122
Input 1_PV ratio	007A	007B	122	123	R/W	0.500 to 1.500	1.000	P. 123
Input 1_ PV low input cut-off	007C	007D	124	125	R/W	0.00 to 25.00 % of input span	0.00	P. 124
Input 1_ proportional cycle time	007E	007F	126	127	R/W	0.1 to 100.0 seconds	Relay contact output: 20.0 seconds Voltage pulse output and triac output: 2.0 seconds	P. 125
Input 1_ manual output value	0080	0081	128	129	R/W	MV scaling low to MV scaling high	0.0	P. 125

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_PV bias	0082	0083	130	131	R/W	–Input span to +Input span	0	P. 122
Input 2_PV digital filter	0084	0085	132	133	R/W	0.00 to 10.00 seconds 0.00: OFF (Unused)	0.00	P. 122
Input 2_PV ratio	0086	0087	134	135	R/W	0.500 to 1.500	1.000	P. 123
Input 2_ PV low input cut-off	0088	0089	136	137	R/W	0.00 to 25.00 % of input span	0.00	P. 124
Input 2_ proportional cycle time	008A	008B	138	139	R/W	0.1 to 100.0 seconds	Relay contact output: 20.0 seconds Voltage pulse output and triac output: 2.0 seconds	P. 125
Input 2_ manual output value	008C	008D	140	141	R/W	Input 2_output limiter (low) to Input 2_output limiter (high)	0.0	P. 125
Set lock level	008E	008F	142	143	R/W	Bit data b0: Lock only setting items other than SV and events (EV1 to EV4). b1: Lock only events (EV1 to EV4). b2: Lock only set value (SV). b3 to b31: Unused Data 0: Unlock 1: Lock [Decimal number: 0 to 7]	0	P. 126

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
EEPROM storage state	0090	0091	144	145	RO	0: The content of the EEPROM does not coincide with that of the RAM. 1: The content of the EEPROM coincides with that of the RAM.	—	P. 127
EEPROM storage mode	0092	0093	146	147	R/W	0: Set values are store to the EEPROM when set values are changed. 1: Not set values are store to the EEPROM when set values are changed.	0	P. 127
Unused	0094	0095	148	149	—	—	—	—
Unused	0096	0097	150	151	—	—	—	—
Unused	0098	0099	152	153	—	—	—	—
Unused	009A	009B	154	155	—	—	—	—
PV1_ peak hold value monitor	009C	009D	156	157	RO	Input 1_input scale low to Input 1_input scale high Displays the maximum PV of Input 1.	—	P. 128
PV1_bottom hold value monitor	009E	009F	158	159	RO	Input 1_input scale low to Input 1_input scale high Displays the minimum PV of Input 1.	—	P. 129
PV1_hold reset	00A0	00A1	160	161	R/W	0, 1 0: Hold reset execution If 0 is written, the hold value is reset to return to 1. The polling of "1" is always made.	1	P. 130

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
PV2_ peak hold value monitor	00A2	00A3	162	163	RO	Input 2_input scale low to Input 2_input scale high Displays the maximum PV of Input 2.	—	P. 128
PV2_bottom hold value monitor	00A4	00A5	164	165	RO	Input 2_input scale low to Input 2_input scale high Displays the minimum PV of Input 2.	—	P. 129
PV2_hold reset	00A6	00A7	166	167	R/W	0, 1 0: Hold reset execution If 0 is written, the hold value is reset to return to 1. The polling of "1" is always made.	1	P. 130
Interlock release	00A8	00A9	168	169	R/W	0, 1 0: Interlock release execution If 0 is written, the interlock is released.	1	P. 131
Auto-zero (Input 1)	00AA	00AB	170	171	R/W	0, 1, 3 1: Zero point adjustment execution Writing "1" starts zero point adjustment, and then "1" returns to "0" after the adjustment is finished. 3: Adjustment error Writing "0" returns to a normal state. Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors	0	P. 131

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Auto calibration (Input 1)	00AC	00AD	172	173	R/W	0 to 3 1: Auto calibration execution Writing "1" starts auto calibration, and it changes to "2" during the adjustment and returns to "0" after the adjustment is finished. 3: Adjustment error Writing "0" returns to a normal state. Relevant pressure sensors: CZ-GP100 (without amplifier), the other strain gauge type sensors	0	P. 132
Unused	00AE ⋮ 01FE	00AF ⋮ 01FF	174 ⋮ 510	175 ⋮ 511	—	—	—	—
STOP display selection	0200	0201	512	513	R/W	0: Displays on the measured value (PV1/PV2) unit 1: Displays on the set value (SV) unit	0	P. 133
Bar graph display selection	0202	0203	514	515	R/W	0: No display 1: Input 1_manipulated output value (MV) 2: Input 1_measured value (PV) 3: Input 1_set value (SV) 4: Input 1_deviation value 5: Unused (Not available) 6: Input 2_manipulated output value (MV) 7: Input 2_measured value (PV) 8: Input 2_set value (SV) 9: Input 2_deviation value	0	P. 134
Bar graph resolution setting	0204	0205	516	517	R/W	1 to 100 digit/dot	100	P. 135
Unused	0206	0207	518	519	—	—	—	—

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Auto/Manual transfer key operation selection (A/M)	0208	0209	520	521	R/W	0: Unused 1: Auto/Manual transfer for input 1 2: Auto/Manual transfer for input 2 3: Auto/Manual transfer for input 1 and input 2	3	P. 135
Remote/Local transfer key operation selection (R/L)	020A	020B	522	523	R/W	0: Unused 1: Remote/Local transfer	1	P. 136
RUN/STOP transfer key operation selection (R/S)	020C	020D	524	525	R/W	0: Unused 1: RUN/STOP transfer	1	P. 136
Input 1_ input type selection	020E	020F	526	527	R/W	Voltage (V)/current (I) inputs −19999 to +99999 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC 24: ±100 mV DC 25: ±10 mV DC 26: ±10 V DC 27: ±5 V DC 28: ±1 V DC Relevant pressure sensors: CZ-GP100, the other voltage/current type sensors Pressure sensor input 0.0 to 250.0 MPa 29: Resin pressure sensor Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors 22, 23: Unused (Not available)	Depends on model code. When not specifying: Pressure sensor input	P. 137

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_ display unit selection	0210	0211	528	529	R/W	2: MPa 3: bar 4: kgf/cm^2 5: psi	Pressure sensor input: 2 V/I: 0	P. 138
Input 1_ decimal point position	0212	0213	530	531	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places * Less than 1 MPa: Decimal point position 0 to 4 Less than 10 MPa: Decimal point position 0 to 3 Less than 100 MPa: Decimal point position 0 to 2 100 MPa or more: Decimal point position 0 or 1 Voltage (V)/current (I) inputs: Decimal point position 0 to 4	1	P. 139
Input 1_input scale high	0214	0215	532	533	R/W	Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	Pressure sensor input: 50.0 V/I: 100.0	P. 140
Input 1_input scale low	0216	0217	534	535	R/W	Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	Pressure sensor input: 0.0 V/I: 0.0	P. 141
Input 1_input error determination point (high)	0218	0219	536	537	R/W	Input scale low – (5 % of input span) to Input scale high + (5 % of input span)	Pressure sensor input: Input scale high + (5 % of input span) V/I: 105.0	P. 142
Input 1_input error determination point (low)	021A	021B	538	539	R/W		Pressure sensor input: Input scale low – (5 % of input span) V/I: −5.0	P. 143
Input 1_ burnout direction	021C	021D	540	541	R/W	0: Upscale 1: Downscale	0	P. 144
Input 1_square root extraction selection	021E	021F	542	543	R/W	0: Unused 1: Used	0	P. 145
Power supply frequency selection	0220	0221	544	545	R/W	0: 50 Hz 1: 60 Hz	0	P. 145

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_ input type selection	0222	0223	546	547	R/W	TC input 0: K −200 to +1372 °C −328.0 to +2501.6 °F 1: J −200 to +1200 °C −328.0 to +2192.0 °F 2: R −50 to +1768 °C −58.0 to +3214.4 °F 3: S −50 to +1768 °C −58.0 to +3214.4 °F 4: B 0 to 1800 °C 32.0 to 3272.0 °F 5: E −200 to +1000 °C −328.0 to +1832.0 °F 6: N 0 to 1300 °C 32.0 to 2372.0 °F 7: T −200 to +400 °C −328.0 to +752.0 °F 8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F 9: PLII 0 to 1390 °C 32.0 to 2534.0 °F RTD input (3-wire system) 12: Pt100 −200 to +850 °C −328.0 to +1562.0 °F 13: JPt100 −200 to +600 °C −328.0 to +1112.0 °F Voltage (V)/ current (I) inputs: −19999 to +99999 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC 24: ±100 mV DC 25: ±10 mV DC 26: ±10 V DC 27: ±5 V DC 28: ±1 V DC 22, 23: Unused (Not available)	Depend on the model code. When not specifying: Type K	P. 137

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_ display unit selection	0224	0225	548	549	R/W	0: °C 1: °F	0	P. 138
Input 2_ decimal point position	0226	0227	550	551	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1	P. 139
Input 2_input scale high	0228	0229	552	553	R/W	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	TC/RTD: Maximum value of the selected input range V/I: 100.0	P. 140
Input 2_input scale low	022A	022B	554	555	R/W	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 * Varies with the setting of the decimal point position	TC/RTD: Minimum value of the selected input range V/I: 0.0	P. 141
Input 2_input error determination point (high)	022C	022D	556	557	R/W	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale high + (5 % of input span) V/I: 105.0	P. 142
Input 2_input error determination point (low)	022E	022F	558	559	R/W		TC/RTD: Input scale low − (5 % of input span) V/I: −5.0	P. 143

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_ burnout direction	0230	0231	560	561	R/W	0: Upscale 1: Downscale	0	P. 144
Input 2_square root extraction selection	0232	0233	562	563	R/W	0: Unused 1: Used	0	P. 145
Event input logic selection	0234	0235	564	565	R/W	0 to 15	1	P. 146
Output logic selection	0236	0237	566	567	R/W	3 to 8, 11 1, 2, 9, and 10: Unused (Not available)	1-input controller: 3 2-input controller: 5	P. 149
Output 1 timer setting	0238	0239	568	569	R/W	0.0 to 600.0 seconds	0.0	P. 151
Output 2 timer setting	023A	023B	570	571	R/W		0.0	P. 151
Output 3 timer setting	023C	023D	572	573	R/W		0.0	P. 151
Output 4 timer setting	023E	023F	574	575	R/W		0.0	P. 151
Output 5 timer setting	0240	0241	576	577	R/W		0.0	P. 151
Transmission output 1_ type selection	0242	0243	578	579	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Transmission output 1_ scale high	0244	0245	580	581	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): –5.0 to +105.0 % Deviation: –Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
Transmission output 1_ scale low	0246	0247	582	583	R/W		PV/SV: Input scale low MV: 0.0 Deviation: –Input span	P. 155
Transmission output 2_ type selection	0248	0249	584	585	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153
Transmission output 2_ scale high	024A	024B	586	587	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): –5.0 to +105.0 % Deviation: –Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
Transmission output 2_ scale low	024C	024D	588	589	R/W		PV/SV: Input scale low MV: 0.0 Deviation: –Input span	P. 155

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Transmission output 3_ type selection	024E	024F	590	591	R/W	0: None 1: Input 1_measured value (PV) 2: Input 1_set value (SV) 3: Input 1_deviation value 4: Input 1_manipulated output value (MV) 5: Input 2_measured value (PV) 6: Input 2_set value (SV) 7: Input 2_deviation value 8: Input 2_manipulated output value (MV) 9: Unused (Not available)	0	P. 153
Transmission output 3_ scale high	0250	0251	592	593	R/W	Measured value (PV) and set value (SV): Input scale low to Input scale high Manipulated output value (MV): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV: 100.0 Deviation: +Input span	P. 154
Transmission output 3_ scale low	0252	0253	594	595	R/W		PV/SV: Input scale low MV: 0.0 Deviation: −Input span	P. 155
Event 1 type selection	0254	0255	596	597	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0	P. 156
Event 1 hold action	0256	0257	598	599	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Event 1 differential gap	0258	0259	600	601	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
Event 1 action at input error	025A	025B	602	603	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
Event 1 assignment	025C	025D	604	605	R/W	1: For input 1 2: For input 2	1	P. 165
Event 2 type selection	025E	025F	606	607	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0	P. 156
Event 2 hold action	0260	0261	608	609	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
Event 2 differential gap	0262	0263	610	611	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
Event 2 action at input error	0264	0265	612	613	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
Event 2 assignment	0266	0267	614	615	R/W	1: For input 1 2: For input 2	1	P. 165

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Event 3 type selection	0268	0269	616	617	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break alarm (LBA)	0	P. 156
Event 3 hold action	026A	026B	618	619	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
Event 3 differential gap	026C	026D	620	621	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
Event 3 action at input error	026E	026F	622	623	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
Event 3 assignment	0270	0271	624	625	R/W	1: For input 1 2: For input 2	1	P. 165
Event 4 type selection	0272	0273	626	627	R/W	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break alarm (LBA)	0	P. 156

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Event 4 hold action	0274	0275	628	629	R/W	0: OFF 1: ON 2: Re-hold action ON	0	P. 159
Event 4 differential gap	0276	0277	630	631	R/W	0 to Input span	Pressure sensor input: 2.0 MPa TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span	P. 161
Event 4 action at input error	0278	0279	632	633	R/W	0: Normal processing 1: Turn the event output ON	0	P. 163
Event 4 assignment	027A	027B	634	635	R/W	1: For input 1 2: For input 2	1	P. 165
Unused	027C	027D	636	637	—	—	—	—
Unused	027E	027F	638	639	—	—	—	—
Unused	0280	0281	640	641	—	—	—	—
Unused	0282	0283	642	643	—	—	—	—
Hot/Cold start selection	0284	0285	644	645	R/W	Power failure less than 3 seconds: 0: Hot 1 5: Cold 1: Hot 1 6: Hot 1 2: Hot 1 7: Hot 2 3: Hot 2 8: Stop 4: Hot 2 Power failure 3 seconds or more: 0: Hot 1 5: Cold 1: Hot 2 6: Stop 2: Cold 7: Stop 3: Hot 2 8: Stop 4: Cold	5	P. 166

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_use selection	0286	0287	646	647	R/W	0: Single loop control 1: Remote input	0	P. 167
Unused	0288	0289	648	649	—	—	—	—
Unused	028A	028B	650	651	—	—	—	—
SV tracking	028C	028D	652	653	R/W	0: Unused 1: Used	1	P. 167
Input 1_control action type selection	028E	028F	654	655	R/W	0: Direct action 1: Reverse action	1	P. 168
Input 1_ integral/derivative time decimal point position selection	0290	0291	656	657	R/W	0: No decimal place 1: One decimal place 2: Two decimal places	2	P. 169
Input 1_derivative gain	0292	0293	658	659	R/W	0.1 to 10.0	6.0	P. 169
Input 1_ON/OFF action differential gap (upper)	0294	0295	660	661	R/W	0 to Input span	Pressure sensor input: 1.0 MPa V/I: 0.1 % of input span	P. 170
Input 1_ON/OFF action differential gap (lower)	0296	0297	662	663	R/W		Pressure sensor input: 1.0 MPa V/I: 0.1 % of input span	P. 171
Input 1_action at input error (high)	0298	0299	664	665	R/W	0: Normal control 1: Manipulated Output Value at Input Error	0	P. 172
Input 1_action at input error (low)	029A	029B	666	667	R/W		0	P. 173
Input 1_manipulated output value at input error	029C	029D	668	669	R/W	–5.0 to +105.0 %	–5.0	P. 173
Input 1_output change rate limiter (up)	029E	029F	670	671	R/W	0.0 to 1000.0 %/second 0.0: OFF	0.0	P. 174
Input 1_output change rate limiter (down)	02A0	02A1	672	673	R/W		0.0	P. 174
Input 1_output limiter (high)	02A2	02A3	674	675	R/W	Input 1_output limiter (low) to 105.0 %	105.0	P. 176
Input 1_output limiter (low)	02A4	02A5	676	677	R/W	–5.0 % to Input 1_ output limiter (high)	–5.0	P. 176
Unused	02A6	02A7	678	679	—	—	—	—

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_control action type selection	02A8	02A9	680	681	R/W	0: Direct action 1: Reverse action	1	P. 168
Input 2_ integral/derivative time decimal point position selection	02AA	02AB	682	683	R/W	0: No decimal place 1: One decimal place 2: Two decimal places	2	P. 169
Input 2_derivative gain	02AC	02AD	684	685	R/W	0.1 to 10.0	6.0	P. 169
Input 2_ON/OFF action differential gap (upper)	02AE	02AF	686	687	R/W	0 to Input span	TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span	P. 170
Input 2_ON/OFF action differential gap (lower)	02B0	02B1	688	689	R/W		TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span	P. 171
Input 2_action at input error (high)	02B2	02B3	690	691	R/W	0: Normal control 1: Manipulated Output Value at Input Error	0	P. 172
Input 2_action at input error (low)	02B4	02B5	692	693	R/W		0	P. 173
Input 2_manipulated output value at input error	02B6	02B7	694	695	R/W	–5.0 to +105.0 %	–5.0	P. 173
Input 2_output change rate limiter (up)	02B8	02B9	696	697	R/W	0.0 to 1000.0 %/second 0.0: OFF	0.0	P. 174
Input 2_output change rate limiter (down)	02BA	02BB	698	699	R/W		0.0	P. 174
Input 2_output limiter (high)	02BC	02BD	700	701	R/W	Input 2_output limiter (low) to 105.0 %	105.0	P. 176
Input 2_output limiter (low)	02BE	02BF	702	703	R/W	–5.0 % to Input 2_ output limiter (high)	–5.0	P. 176
Unused	02C0	02C1	704	705	—	—	—	—
Input 1_AT bias	02C2	02C3	706	707	R/W	–Input span to +Input span	0	P. 177
Input 1_AT cycle	02C4	02C5	708	709	R/W	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1	P. 178

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_ AT differential gap time	02C6	02C7	710	711	R/W	0.00 to 50.00 seconds	0.10	P. 179
Input 2_AT bias	02C8	02C9	712	713	R/W	–Input span to +Input span	0	P. 177
Input 2_AT cycle	02CA	02CB	714	715	R/W	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1	P. 178
Input 2_ AT differential gap time	02CC	02CD	716	717	R/W	0.00 to 50.00 seconds	0.10	P. 179
Unused	02CE	02CF	718	719	—	—	—	—
Unused	02D0	02D1	720	721	—	—	—	—
Unused	02D2	02D3	722	723	—	—	—	—
Unused	02D4	02D5	724	725	—	—	—	—
Setting change rate limiter unit time	02D6	02D7	726	727	R/W	1 to 3600 seconds	60	P. 181
Soak time unit selection	02D8	02D9	728	729	R/W	0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds 2: 0 minutes 00.00 seconds to 9 minutes 59.99 seconds	2	P. 181
Input 1_setting limiter (high)	02DA	02DB	730	731	R/W	Input 1_setting limiter (low) to Input 1_input scale high	Input 1_ input scale high	P. 182
Input 1_setting limiter (low)	02DC	02DD	732	733	R/W	Input 1_input scale low to Input 1_setting limiter (high)	Input 1_ input scale low	P. 183
Input 2_setting limiter (high)	02DE	02DF	734	735	R/W	Input 2_setting limiter (low) to Input 2_input scale high	Input 2_ input scale high	P. 182

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_setting limiter (low)	02E0	02E1	736	737	R/W	Input 2_input scale low to Input 2_setting limiter (high)	Input 2_ input scale low	P. 183
ROM version display	02E2	02E3	738	739	RO	Display the version of loading software.	—	P. 184
Integrated operating time display	02E4	02E5	740	741	RO	0 to 99999 hours	—	P. 184
Holding peak value ambient temperature display	02E6	02E7	742	743	RO	−10.0 to +100.0 °C	—	P. 184
Unused	02E8	02E9	744	745	—	—	—	—
Unused	02EA	02EB	746	747	—	—	—	—
Unused	02EC	02ED	748	749	—	—	—	—
Unused	02EE	02EF	750	751	—	—	—	—
Unused	02F0	02F1	752	753	—	—	—	—
Unused	02F2	02F3	754	755	—	—	—	—
Unused	02F4	02F5	756	757	—	—	—	—
Unused	02F6	02F7	758	759	—	—	—	—
Alarm lamp lighting condition setting	02F8	02F9	760	761	R/W	Bit data b0: Event 1 b1: Event 2 b2: Event 3 b3: Event 4 b4 to b31: Unused Data 0: ALM lamp is not lit 1: ALM lamp is lit [Decimal number: 0 to 15]	15	P. 185
Unused	02FA	02FB	762	763	—	—	—	—

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_ PV1 hold function	02FC	02FD	764	765	R/W	0: Unused 1: Used	0	P. 186
Input 2_ PV2 hold function	02FE	02FF	766	767	R/W		0	P. 186
Gain setting (Input 1)	0300	0301	768	769	R/W	0.500 to 4.000 mV/V Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), the other strain gauge type sensors	CZ-100P/ CZ-200P: 1.500 CZ-GP100 (without amplifier), the other strain gauge type sensors: 3.330	P. 186
Linearize type selection (Input 1)	0302	0303	770	771	R/W	0: Unused 1 to 20: Used Relevant pressure sensors: CZ-100P, CZ-200P	0	P. 187
Shunt resistance output value (Input 1)	0304	0305	772	773	R/W	40.0 to 100.0 % Relevant pressure sensors: CZ-GP100 (without amplifier), the other strain gauge type sensors	80.0	P. 188
Input 1_ PV transfer function	0306	0307	774	775	R/W	0: Unused 1: Used	0	P. 188
Input 2_ PV transfer function	0308	0309	776	777	R/W		0	P. 188
Input 1_MV scaling high (Input 1)	030A	030B	778	779	R/W	–1999.9 to +9999.9	100.0	P. 189
Input 1_MV scaling low (Input 1)	030C	030D	780	781	R/W		0.0	P. 190
Decimal point position of MV scaling (Input 1)	030E	030F	782	783	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1	P. 190

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_AT action	0310	0311	784	785	R/W	0: AT function (PID) 1: AT function (PI) 2: No AT function	2	P. 191
Input 2_AT action	0312	0313	786	787	R/W		2	P. 191
Input 1_manipulated output value when transferred to Auto from Manual	0314	0315	788	789	RO	−5.0 to +105.0 %	—	P. 191
Input 2_manipulated output value when transferred to Auto from Manual	0316	0317	790	791	RO		—	P. 191
Interlock function	0318	0319	792	793	R/W	Bit data b0: OUT1 b1: OUT2 b2: OUT3 b3: OUT4 b4: OUT5 b5 to b31: Unused Data 0: No Interlock function 1: Interlock function [Decimal number: 0 to 31]	0	P. 192
Input 1_ MV transfer function	031A	031B	794	795	R/W	0: Unused 1: Used	0	P. 194
Input 2_ MV transfer function	031C	031D	796	797	R/W		0	P. 194
Unused	031C ⋮ 04FE	031F ⋮ 04FF	794 ⋮ 1278	795 ⋮ 1279	—	—	—	—

Items relating to the memory area other than the control area

Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Memory area selection	0500	0501	1280	1281	R/W	1 to 16	1	P. 195
Event 1 set value	0502	0503	1282	1283	R/W	Deviation: –Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 195
Event 2 set value	0504	0505	1284	1285	R/W		50.0	P. 195
Event 3 set value	0506	0507	1286	1287	R/W		50.0	P. 195
Control loop break alarm 1 (LBA1) time	0508	0509	1288	1289	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 196
LBA1 deadband	050A	050B	1290	1291	R/W	0.0 to Input span	0.0	P. 197
Event 4 set value	050C	050D	1292	1293	R/W	Deviation: –Input span to +Input span Process/SV: Input scale low to Input scale high	50.0	P. 195
Control loop break alarm 2 (LBA2) time	050E	050F	1294	1295	R/W	0 to 7200 seconds 0: OFF (Unused)	480	P. 196
LBA2 deadband	0510	0511	1296	1297	R/W	0.0 to Input span	0.0	P. 197
Input 1_set value (SV1)	0512	0513	1298	1299	R/W	Input 1_setting limiter (low) to Input 1_setting limiter (high)	0.0	P. 197
Input 1_ proportional band	0514	0515	1300	1301	R/W	0.0 to 1000.0 % of input span (0 or 0.0: ON/OFF action)	100.0	P. 198
Input 1_integral time	0516	0517	1302	1303	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PD action) *Varies with the setting of the integral/derivative time decimal point position selection.	5.00	P. 198

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Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 1_derivative time	0518	0519	1304	1305	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PI action) *Varies with the setting of the integral/derivative time decimal point position selection.	0.00	P. 199
Input 1_control response parameter	051A	051B	1306	1307	R/W	0: Slow 1: Medium 2: Fast	0	P. 199
Unused	051C	051D	1308	1309	—	—	—	—
Input 2_set value (SV2)	051E	051F	1310	1311	R/W	Input 2_setting limiter (low) to Input 2_setting limiter (high)	0.0	P. 197
Input 2_ proportional band	0520	0521	1312	1313	R/W	TC/RTD inputs: 0 to Input span Voltage/current inputs: 0.0 to 1000.0 % of input span (0 or 0.0: ON/OFF action)	30.0	P. 198
Input 2_integral time	0522	0523	1314	1315	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PD action) *Varies with the setting of the integral/derivative time decimal point position selection.	240.00	P. 198
Input 2_derivative time	0524	0525	1316	1317	R/W	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds * (0, 0.0 or 0.00: PI action) *Varies with the setting of the integral/derivative time decimal point position selection.	60.00	P. 199

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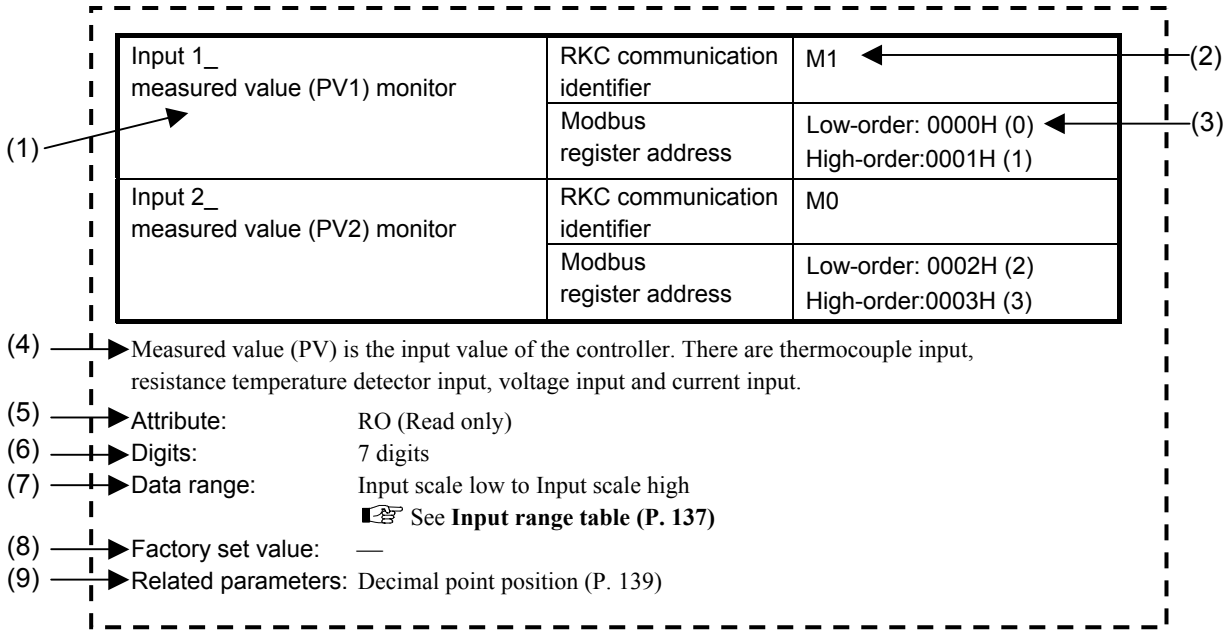
Name	Register address				Attribute	Data range	Factory set value	Reference page
	Hexadecimal		Decimal					
	Low-order	High-order	Low-order	High-order				
Input 2_control response parameter	0526	0527	1318	1319	R/W	0: Slow 1: Medium 2: Fast	0	P. 199
Unused	0528	0529	1320	1321	—	—	—	—
Input 1_setting change rate limiter (up)	052A	052B	1322	1323	R/W	0.0 to Input span/unit time * 0.0: OFF (Unused) * Unit time: 60 seconds (factory set value)	0.0	P. 200
Input 1_setting change rate limiter (down)	052C	052D	1324	1325	R/W		0.0	P. 200
Input 2_setting change rate limiter (up)	052E	052F	1326	1327	R/W		0.0	P. 200
Input 2_setting change rate limiter (down)	0530	0531	1328	1329	R/W		0.0	P. 200
Area soak time	0532	0533	1330	1331	R/W	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	0.00.00	P. 201
Link area number	0534	0535	1332	1333	R/W	0 to 16 0: OFF (No link)	0	P. 201

7. COMMUNICATION DATA DESCRIPTION

■ Reference to communication data contents



(1) Name: Communication data name is written.

(2) RKC communication identifier:
Communication identifier of RKC communication is written.

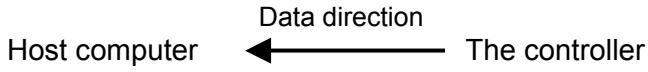
(3) Modbus register address:
Modbus communication data register addresses are written. These register addresses are written using both of hexadecimal and decimal (in parentheses) numbers.

If Modbus 1 is selected in the communication protocol selection of the engineering mode, the address of high-order words and that of low-order words are reversed.

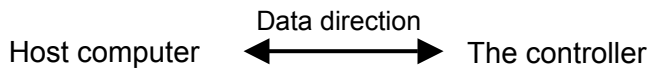
(4) Description: A short description of the communication data item is written.

(5) Attribute: A method of how communication data items are read or written when viewed from the host computer is described.

RO: Only reading data is possible.



R/W: Reading and writing data is possible.



(6) Digits: The data number of digits in RKC communication is written.

(7) Data range: The reading range or the writing range of communication data is written.

(8) Factory set value: The factory set value of communication data is written.

(9) Related parameters: A name and a page of related parameters are written.

There is item including the functional description.

Model codes	RKC communication identifier	ID
	Modbus register address	Absence

This value is the type identifier code of the controller. It is the same content as a stuck imprint in side face of the case.

Attribute: RO (Read only)
Digits: 32 digits
Data range: —
Factory set value: —

Input 1_ measured value (PV1) monitor	RKC communication identifier	M1
	Modbus register address	Low-order: 0000H (0) High-order: 0001H (1)
Input 2_ measured value (PV2) monitor	RKC communication identifier	M0
	Modbus register address	Low-order: 0002H (2) High-order: 0003H (3)

Measured value (PV) is an input value of the controller. There are pressure sensor input (Input 1 only), thermocouple input (TC), resistance temperature detector input (RTD), voltage input (V) and current input (I).

Attribute: RO (Read only)
Digits: 7 digits
Data range: Input scale low to Input scale high
☞ See **Input range table (P. 137)**
Factory set value: —
Related parameters: Decimal point position (P. 139)

Input 1_set value (SV1) monitor	RKC communication identifier	MS
	Modbus register address	Low-order: 000AH (10) High-order: 000BH (11)
Input 2_set value (SV2) monitor	RKC communication identifier	MT
	Modbus register address	Low-order: 000CH (12) High-order: 000DH (13)

This value is a monitor of the set value (SV) that is a desired value for control.

Attribute: RO (Read only)
Digits: 7 digits
Data range: Setting limiter (low) to Setting limiter (high)
☞ See **Input range table (P. 137)**
Factory set value: —
Related parameters: Decimal point position (P. 139)

Remote input value monitor	RKC communication identifier	S2
	Modbus register address	Low-order: 000EH (14) High-order: 000FH (15)

This value is an input value that is used for remote input function.

Attribute: RO (Read only)
Digits: 7 digits
Data range: Input 1_setting limiter (low) to Input 1_setting limiter (high)
☞ See **Input range table (P. 137)**
Factory set value: —

Input 1_burnout state	RKC communication identifier	B1
	Modbus register address	Low-order: 0012H (18) High-order: 0013H (19)
Input 2_burnout state	RKC communication identifier	B0
	Modbus register address	Low-order: 0014H (20) High-order: 0015H (21)

This value expresses a state in input break.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Burnout direction (P. 144)

Event 1 state	RKC communication identifier	AA
	Modbus register address	Low-order: 0018H (24) High-order: 0019H (25)
Event 2 state	RKC communication identifier	AB
	Modbus register address	Low-order: 001AH (26) High-order: 001BH (27)
Event 3 state	RKC communication identifier	AC
	Modbus register address	Low-order: 001CH (28) High-order: 001DH (29)
Event 4 state	RKC communication identifier	AD
	Modbus register address	Low-order: 001EH (30) High-order: 001FH (31)

This value expresses a state of the event ON/OFF.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Event set value (P. 111), Output logic selection (P. 149), Event type selection (P. 156), Event hold action (P. 159), Event differential gap (P. 161), Event action at input error (P. 163), Event assignment (P. 165)

Input 1_ manipulated output value (MV1) monitor	RKC communication identifier	O1
	Modbus register address	Low-order: 0024H (36) High-order: 0025H (37)
Input 2_ manipulated output value (MV2) monitor	RKC communication identifier	O0
	Modbus register address	Low-order: 0026H (38) High-order: 0027H (39)

This value is an output value of the controller.

Attribute: RO (Read only)
Digits: 7 digits
Data range: −5.0 to +105.0 %
Factory set value: —
Related parameters: Manual output value (P. 125), Output logic selection (P. 149), Output change rate limiter (up/down) (P. 174), Output limiter (high/low) (P. 176)

Error code	RKC communication identifier	ER
	Modbus register address	Low-order: 0028H (40) High-order: 0029H (41)

Each error state of the controller is expressed in bit data items.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0 to 4095 (bit data)
The error state is assigned as a bit image in binary numbers.
However, send data from the controller be changed to decimal ASCII code from the bit image in binary numbers for RKC communication.

Bit image: 000000000000
bit 11 ····· bit 0

Bit data: 0: OFF 1: ON

bit 0: Adjustment data error
bit 1: EEPROM error
bit 2: A/D conversion error
bit 3: RAM check error
bit 4: Hardware configuration error
bit 5: Software configuration error
bit 6: Unused
bit 7: Watchdog timer error
bit 8 to bit 10:
Unused
bit 11: Program busy
bit 12 to bit 31:
Unused

Factory set value: —

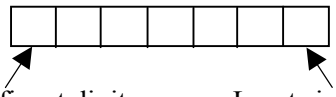
Event input (DI) state	RKC communication identifier	L1
	Modbus register address	Low-order: 002AH (42) High-order: 002BH (43)

Each event input state of the controller is expressed in bit data items.

Attribute: RO (Read only)
Digits: 7 digits
Data range: **RKC communication:** ASCII code data of 7 digits

The event input state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit ····· Least significant digit

Data: 0: Contact open
1: Contact closed

Least significant digit: The state of DI 1
2nd digit: The state of DI 2
3rd digit: The state of DI 3
4th digit: The state of DI 4
5th digit: The state of DI 5
6th digit: Unused
Most significant digit: Unused

Modbus: 0 to 31 (bit data)

The event input state is assigned as a bit image in binary numbers.

Bit image: 00000

bit 4 ····· bit 0

Bit data: 0: Contact open
1: Contact closed

bit 0: The state of DI 1
bit 1: The state of DI 2
bit 2: The state of DI 3
bit 3: The state of DI 4
bit 4: The state of DI 5
bit 5 to bit 31:
Unused

Factory set value: —
Related parameters: Event input logic selection (P. 146)

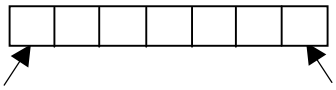
Operation mode state	RKC communication identifier	L0
	Modbus register address	Low-order: 002CH (44) High-order: 002DH (45)

Each operation mode state of the controller is expressed in bit data items.

Attribute: RO (Read only)
Digits: 7 digits
Data range: **RKC communication:** ASCII code data of 7 digits

The operation mode state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit·····Least significant digit

Data: 0: OFF
1: ON

Least significant digit:	Control STOP
2nd digit:	Control RUN
3rd digit:	Input 1_Manual mode (Including Input 1_Remote mode)
4th digit:	Input 2_Manual mode (Including Input 2_Remote mode)
5th digit:	Remote mode
6th digit and Most significant digit:	Unused

Modbus: 0 to 31 (bit data)

The operation mode state is assigned as a bit image in binary numbers.

Bit image: 00000

bit 4 bit 0

Bit data: 0: OFF
1: ON

bit 0:	Control STOP
bit 1:	Control RUN
bit 2:	Input 1_Manual mode (Including Input 1_Remote mode)
bit 3:	Input 2_Manual mode (Including Input 2_Remote mode)
bit 4:	Remote mode
bit 5 to bit 31:	Unused

Factory set value: —
Related parameters: Auto/Manual transfer (P. 109), Remote/Local transfer (P. 109), RUN/STOP transfer (P. 110), Input 2_use selection (P. 167)

Memory area soak time monitor	RKC communication identifier	TR
	Modbus register address	Low-order: 002EH (46) High-order: 002FH (47)

Monitors the time elapsed for memory area operation (soak time) when ramp/soak control by using Multi-memory Area is performed.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0 minute 00.00 second to 9 minutes 59.99 seconds or
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds

Memory area soak time monitor is expressed in second unit for Modbus.
0 minute 00.00 second to 9 minutes 59.99 seconds: 0 to 59999 seconds
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds:
0 to 35999 seconds

Factory set value: —
Related parameters: Area soak time (P. 120), Soak time unit selection (P. 181)

As the area soak time for the memory area linked last becomes invalid, no area soak time is monitored.

Input 1_PID/AT transfer	RKC communication identifier	G1
	Modbus register address	Low-order: 0030H (48) High-order: 0031H (49)
Input 2_PID/AT transfer	RKC communication identifier	G0
	Modbus register address	Low-order: 0032H (50) High-order: 0033H (51)

This item transfers PID control and autotuning (AT).

Attribute: R/W (Read and Write)

Input 1_PID/AT transfer (G1) becomes RO (Read only) when "2: No AT function" is selected in "Input 1_AT action (JI)."

Input 2_PID/AT transfer (G0) becomes RO (Read only) when "2: No AT function" is selected in "Input 2_AT action (JJ)."

Input 2_PID/AT transfer (G0) becomes RO (Read only) for 1-input controller.

Digits: 7 digits
Data range: 0: PID control
1: Autotuning (AT)

Continued on the next page.

Continued from the previous page.

Factory set value: Input 1_PID/AT transfer: 0
Input 2_PID/AT transfer: 0

📖 No PID/AT transfer is valid prior to factory shipment. The transfer becomes valid only when "1: AT function (PI)" or "0: AT function (PID)" is selected in AT action selection.

Related parameters: AT bias (P. 177), AT cycle (P. 178), AT differential gap time (P. 179), AT action (P. 191)

Functional description:

Autotuning (AT):
Autotuning (AT) automatically measures, calculates and sets the optimum PID (PI) constants. The following conditions are necessary to carry out autotuning and the conditions which will cause the autotuning to stop.

Requirements for AT start:
Start the autotuning when all following conditions are satisfied:

- Operation mode conditions are as follows:
  – Auto/Manual transfer → Auto mode
  – Remote/Local transfer → Local mode
  – PID/AT transfer → PID control
  – RUN/STOP transfer → Control RUN
- The measured value (PV) is not underscale or overscale.
- The output limiter high limit is 0.1 % or higher and the output limiter low limit is 99.9 % or less.

📖 When the autotuning is finished, the controller will automatically returns to PID (PI) control.

Requirements for AT cancellation:
The autotuning is canceled if any of the following conditions are exist:

- When the temperature set value (SV) is changed.
- When the control area is changed.
- When the output limiter high limit or the output limiter low limit is changed.
- When the PV bias, the PV digital filter, or the PV ratio is changed.
- When the Auto/Manual mode is changed to the Manual mode.
- When the Remote/Local mode is changed to the Remote mode.
- When the measured value (PV) goes to underscale or overscale.
- When the power failure occurs.
- When the instrument is in the FAIL state.
- When the PID/AT transfer is changed to the PID control.
- When the RUN/STOP mode is changed to the control STOP.

📖 **If the AT is canceled, the controller immediately changes to PID (PI) control. The PID (PI) values will be the same as before AT was activated.**

Input 1_Auto/Manual transfer	RKC communication identifier	J1
	Modbus register address	Low-order: 0034H (52) High-order: 0035H (53)
Input 2_Auto/Manual transfer	RKC communication identifier	J0
	Modbus register address	Low-order: 0036H (54) High-order: 0037H (55)

This item transfers the automatic (AUTO) control and the manual (MAN) control.

Attribute: R/W (Read and Write)

The Input 2_Auto/Manual transfer (J0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0: Auto mode
1: Manual mode
Factory set value: Input 1_Auto/Manual transfer: 1
Input 2_Auto/Manual transfer: 1
Related parameters: Operation mode state (P. 106)

Remote/Local transfer	RKC communication identifier	C1
	Modbus register address	Low-order: 0038H (56) High-order: 0039H (57)

This item selects to use the set value of local or remote input.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) besides the remote input specification.

Digits: 7 digits
Data range: 0: Local mode
1: Remote mode
Factory set value: 0
Related parameters: Operation mode state (P. 106)

RUN/STOP transfer	RKC communication identifier	SR
	Modbus register address	Low-order: 003AH (58) High-order: 003BH (59)

This item transfers Control RUN and Control STOP.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0: Control RUN
1: Control STOP
Factory set value: 0
Related parameters: Operation mode state (P. 106)

If the controller is transferred to STOP mode from RUN mode, the controller status is the same as the Power-off. However for the specification with current output (other than 0 to 20 mA) or voltage output, an output of −5 % is fed when at STOP.

Operation when transferred RUN from STOP is in accordance with the HOT/COLD start selection* setting.

* Cold start (factory shipment): The controller will automatically go to Manual mode and output from the low output limit value (factory set value: −5.0 %).

Memory area selection	RKC communication identifier	ZA
	Modbus register address	Low-order: 003CH (60) High-order: 003DH (61)

This item selects the memory area to use for control.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 1 to 16
Factory set value: 1

Event 1 set value	RKC communication identifier	A1
	Modbus register address	Low-order: 003EH (62) High-order: 003FH (63)
Event 2 set value	RKC communication identifier	A2
	Modbus register address	Low-order: 0040H (64) High-order: 0041H (65)
Event 3 set value	RKC communication identifier	A3
	Modbus register address	Low-order: 0042H (66) High-order: 0043H (67)
Event 4 set value	RKC communication identifier	A4
	Modbus register address	Low-order: 0048H (72) High-order: 0049H (73)

Event 1 through Event 4 are set values of the event action.

Attribute: R/W (Read and Write)

The event 3 set value (A3) becomes RO (Read only) when it was selected "9: Control loop break alarm (LBA)" from the event 3 type selection (XC).

The event 4 set value (A4) becomes RO (Read only) when it was selected "9: Control loop break alarm (LBA)" from the event 4 type selection (XD).

Digits: 7 digits

Data range: Deviation: −Input span to +Input span
Process: Input scale low to Input scale high
SV: Input scale low to Input scale high

Factory set value: 50.0

Related parameters: Event state (P. 103), Event type selection (P. 156), Event hold action (P. 159), Event differential gap (P. 161), Event action at input error (P. 163), Event assignment (P. 165)

Control loop break alarm 1 (LBA1) time	RKC communication identifier	A5
	Modbus register address	Low-order: 0044H (68) High-order: 0045H (69)
Control loop break alarm 2 (LBA2) time	RKC communication identifier	A6
	Modbus register address	Low-order: 004AH (74) High-order: 004BH (75)

The LBA time sets the time required for the LBA function to determine there is a loop failure. When the LBA is output (under alarm status), the LBA function still monitors the measured value (PV) variation at an interval of the LBA time.

Attribute: R/W (Read and Write)

The control loop break alarm 1 (LBA1) time (A5) becomes RO (Read only) when it was selected "1 to 8" from the event 3 type selection (XC).

The control loop break alarm 2 (LBA2) time (A6) becomes RO (Read only) when it was selected "1 to 8" from the event 4 type selection (XD).

Digits: 7 digits
Data range: 0 to 7200 seconds (0: Unused)
Factory set value: 480
Related parameters: Event state (P. 103), Event assignment (P. 165), LBA deadband (P. 112)
LBA Function: See the next page.

LBA1 deadband	RKC communication identifier	N1
	Modbus register address	Low-order: 0046H (70) High-order: 0047H (71)
LBA2 deadband	RKC communication identifier	N2
	Modbus register address	Low-order: 004CH (76) High-order: 004DH (77)

The LBA deadband gives a neutral zone to prevent the control loop break alarm (LBA) from malfunctioning caused by disturbance.

Attribute: R/W (Read and Write)

The LBA1 deadband (N1) becomes RO (Read only) when it was selected "1 to 8" from the event 3 type selection (XC).

The LBA2 deadband (N2) becomes RO (Read only) when it was selected "1 to 8" from the event 4 type selection (XD).

Digits: 7 digits
Data range: 0.0 to Input span
Factory set value: 0.0
Related parameters: Event state (P. 103), Event assignment (P. 165), Control loop break alarm (LBA) time (P. 112)
LBA Deadband function: See the next page.

■ LBA Function

Control loop break alarm (LBA):

The control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

[Alarm action]

LBA determination range: Temperature input: 2 °C [2 °F] fixed
Voltage/current input: 0.2 % fixed

- **When the output reaches 0 % (low limit with output limit function)**

For direct action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

- **When the output exceeds 100 % (high limit with output limit function)**

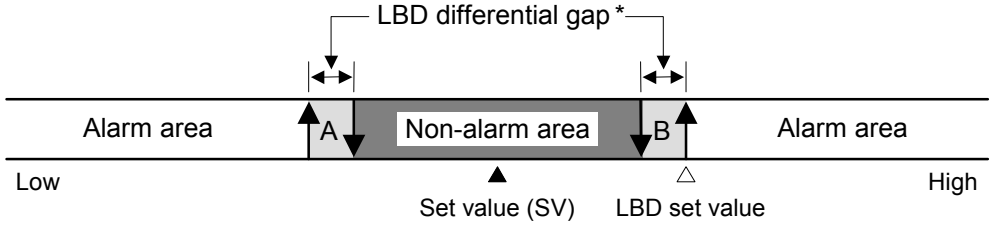
For direct action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

If the autotuning function is used, the LBA time is automatically set twice as large as the integral time. The LBA setting time will not be changed even if the integral time is changed.

LBA Deadband function:

The LBA may malfunction due to external disturbances. To prevent malfunctioning due to external disturbance, LBA deadband (LBD) sets a neutral zone in which LBA is not activated. When the measured value (PV) is within the LBD area, LBA will not be activated. If the LBD setting is not correct, the LBA will not work correctly.



A: During temperature rise: Alarm area
During temperature fall: Non-alarm area

B: During temperature rise: Non-alarm area
During temperature fall: Alarm area

* LBD differential gap: TC/RTD input: 0.8 °C [°F] (Fixed)
Voltage/current input: 0.8 % of input span (Fixed)

Continued on the next page.

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- If the LBA function detects an error occurring in the control loop, but cannot specify the location, a check of the control loop in order. The LBA function does not detect a location which causes alarm status. If LBA alarm is ON, check each device or wiring of the control loop.
- When AT function is activated or the controller is in STOP mode, the LBA function is not activated.
- If the LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate times or not turning on at all.
- While the LBA is ON (under alarm status), the following conditions cancel the alarm status and LBA will be OFF.
  - The measured value (PV) rises beyond (or falls below) the LBA determination range within the LBA time.
  - The measured value (PV) enters within the LBA deadband.

Input 1_set value (SV1)	RKC communication identifier	S1
	Modbus register address	Low-order: 004EH (78) High-order: 004FH (79)
Input 2_set value (SV2)	RKC communication identifier	S0
	Modbus register address	Low-order: 005AH (90) High-order: 005BH (91)

The set value (SV) is a desired value of the control.

Attribute: R/W (Read and Write)

📖 **The Input 2_set value (SV2: S0) becomes RO (Read only) for the 1-input controller.**

Digits: 7 digits
Data range: Setting limiter (low) to Setting limiter (high)
☞ See **Input range table (P. 137)**
Factory set value: Input 1_set value (SV1): 0
Input 2_set value (SV2): 0
Related parameters: Setting limiter (high) (P. 182), Setting limiter (low) (P. 183)

Input 1_proportional band	RKC communication identifier	P1
	Modbus register address	Low-order: 0050H (80) High-order: 0051H (81)
Input 2_proportional band	RKC communication identifier	P0
	Modbus register address	Low-order: 005CH (92) High-order: 005DH (93)

This value expresses a proportional band of the PI and PID control.

Attribute: R/W (Read and Write)

📖 **The Input 2_proportional band (P0) becomes RO (Read only) for the 1-input controller.**

Digits: 7 digits
Data range: Pressure sensor input: 0.0 to 1000.0 % of input span
Thermocouple (TC)/RTD inputs: 0 to Input span
Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of input span
0 (0.0): ON/OFF action
Factory set value: Input 1_proportional band: 100.0
Input 2_proportional band: 30.0
Related parameters: ON/OFF action differential gap (upper) (P. 170),
ON/OFF action differential gap (lower) (P. 171)

Input 1_integral time	RKC communication identifier	I1
	Modbus register address	Low-order: 0052H (82) High-order: 0053H (83)
Input 2_integral time	RKC communication identifier	I0
	Modbus register address	Low-order: 005EH (94) High-order: 005FH (95)

Integral action is to eliminate offset between SV and PV by proportional action. The degree of Integral action is set by time in seconds.

Attribute: R/W (Read and Write)

The Input 2_integral time (I0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0 to 3600 seconds, 0.0 to 3600.0 seconds, or 0.00 to 360.00 seconds
(0, 0.0 or 0.00: PD action)
Factory set value: Input 1_integral time: 5.00
Input 2_integral time: 240.00
Related parameters: Integral/derivative time decimal point position selection (P. 169)

Input 1_derivative time	RKC communication identifier	D1
	Modbus register address	Low-order: 0054H (84) High-order: 0055H (85)
Input 2_derivative time	RKC communication identifier	D0
	Modbus register address	Low-order: 0060H (96) High-order: 0061H (97)

Derivative action is to prevent rippling and make control stable by monitoring output change. The degree of Derivative action is set by time in seconds.

Attribute: R/W (Read and Write)

The Input 2_derivative time (D0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0 to 3600 seconds, 0.0 to 3600.0 seconds, or 0.00 to 360.00 seconds
(0, 0.0 or 0.00: PI action)
Factory set value: Input 1_derivative time: 0.00 (PI action)
Input 2_derivative time: 60.00
Related parameters: Integral/derivative time decimal point position selection (P. 169)

Input 1_control response parameter	RKC communication identifier	CA
	Modbus register address	Low-order: 0056H (86) High-order: 0057H (87)
Input 2_control response parameter	RKC communication identifier	C9
	Modbus register address	Low-order: 0062H (98) High-order: 0063H (99)

The control response for the set value (SV) change can be selected among Slow, Medium, and Fast.

Attribute: R/W (Read and Write)

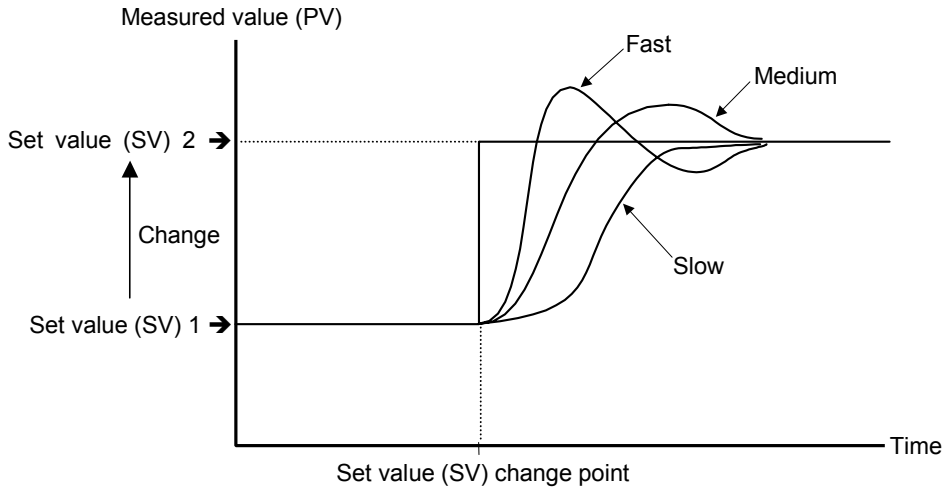
The Input 2_control response parameter (C9) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0: Slow
1: Medium
2: Fast

Factory set value: Input 1_control response parameter: 0
Input 2_control response parameter: 0

Control Response: The control response for the set value (SV) change can be selected among Slow, Medium, and Fast. If a fast response is required, Fast is chosen. Fast may cause overshoot. If overshoot is critical, Slow is chosen.



Input 1_ setting change rate limiter (up)	RKC communication identifier	HH
	Modbus register address	Low-order: 0066H (102) High-order: 0067H (103)
Input 2_ setting change rate limiter (up)	RKC communication identifier	HX
	Modbus register address	Low-order: 006AH (106) High-order: 006BH (107)

This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV).

Attribute: R/W (Read and Write)

The Input 2_setting change rate limiter up (HX) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0.0 to Input span/unit time * * Unit time: 60 seconds (factory set value)
0.0: OFF (Unused)

Factory set value: Input 1_setting change rate limiter (up): 0.0
Input 2_setting change rate limiter (up): 0.0

Related parameters: Setting change rate limiter unit time (P. 181)

Input 1_ setting change rate limiter (down)	RKC communication identifier	HL
	Modbus register address	Low-order: 0068H (104) High-order: 0069H (105)
Input 2_ setting change rate limiter (down)	RKC communication identifier	HY
	Modbus register address	Low-order: 006CH (108) High-order: 006DH (109)

This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV).

Attribute: R/W (Read and Write)

The Input 2_setting change rate limiter down (HY) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0.0 to Input span/unit time * * Unit time: 60 seconds (factory set value)
0.0: OFF (Unused)

Factory set value: Input 1_setting change rate limiter (down): 0.0
Input 2_setting change rate limiter (down): 0.0

Related parameters: Setting change rate limiter unit time (P. 181)

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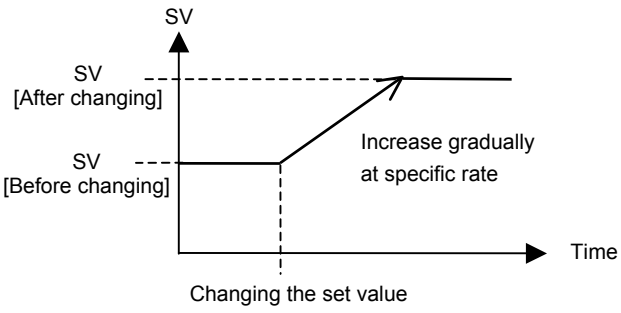
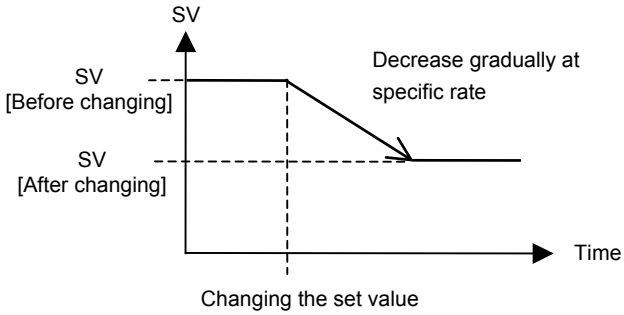
■ Setting change rate limiter

Application examples of setting change rate limiter:

● **Increasing the SV to a higher value**



● **Decreasing the SV to a lower value**



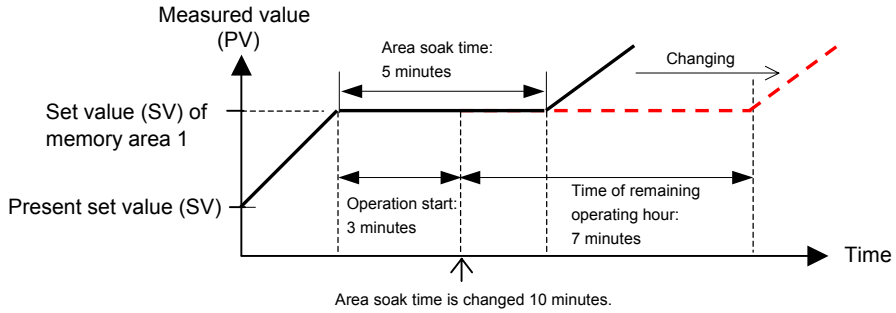
- When the setting change rate limiter is used, the SV will also ramp up or ramp down by the function at power-on and operation mode change from STOP to RUN.
- If the autotuning (AT) function is activated while the SV is ramping up or ramping down by the setting change rate limiter, AT will starts after the SV finishes ramp-up or ramp-down by the limiter, and the controller is in PID control mode until AT starts.
- When the value of setting change rate limiter is changed during normal operation, the ramp-up or ramp-down rate will be changed unless the SV already has finished ramp-up or ramp-down by the function.
- If the rate of setting change limiter is set to any value other than “0.0: OFF (Unused),” the event re-hold action to be taken by a set value (SV) change becomes invalid.

Area soak time	RKC communication identifier	TM
	Modbus register address	Low-order: 006EH (110) High-order: 006FH (111)

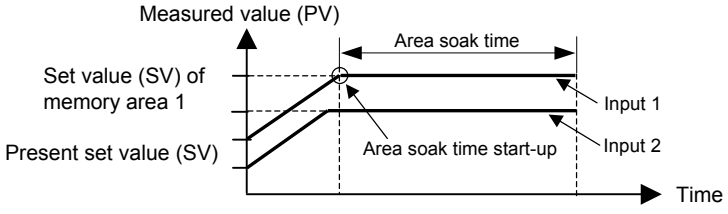
Area Soak Time is used for ramp/soak control function in conjunction with Link Area Number and Setting Change Rate Limiter (up/down). (see P. 118)

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0 minute 00.00 second to 9 minutes 59.99 seconds or
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds
Factory set value: 0.00.00 (0 minute 00.00 second to 9 minute 59.99 seconds)
Related parameters: Soak time unit selection (P. 181)

The Area Soak Time can be changed during normal operation with ramp/soak control function, but Read the following example carefully how the time change affects ramp/soak control time. For example, the Memory area which has 5-minute soak time is executed. When 3 minutes passed, the Area Soak Time is changed from 5 minutes to 10 minutes. The remaining time of the currently executed Memory Area is calculated as follows.
(The new soak time 10 minutes) – (lapsed time 3 minutes) = (remaining time 7 minutes)
The old soak time does not have any effect on remaining time.



For the instrument with the 2-input specification, its area soaking starts based on the arrival at the memory area set value of Input 1 or that of Input 2, whichever later.



Link area number	RKC communication identifier	LP
	Modbus register address	Low-order: 0070H (112) High-order: 0071H (113)

Link Area Number is used for ramp/soak control function in conjunction with Area Soak Time and Setting Change Rate Limiter (up/down).

Attribute: R/W (Read and Write)

Digits: 7 digits

Data range: 0 to 16

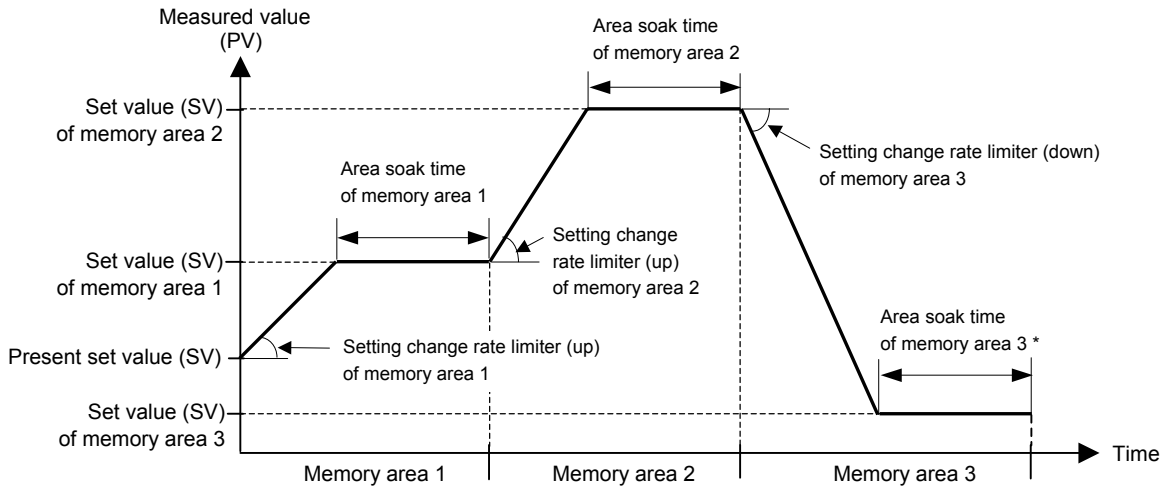
0: OFF (No link)

Factory set value: 0

Ramp/Soak Control Function:

Ramp/soak control is possible by using Area Soak Time, Link Area Number and Setting Change Rate Limiter (up/down) in Parameter Setting mode.

[Usage example]



* The area soak time for the memory area linked last becomes invalid to continue the state of the set value (SV) reached.

Input 1_PV bias	RKC communication identifier	PB
	Modbus register address	Low-order: 0076H (118) High-order: 0077H (119)
Input 2_ PV bias	RKC communication identifier	PA
	Modbus register address	Low-order: 0082H (130) High-order: 0083H (131)

PV bias adds bias to the measured value (PV). The PV bias is used to compensate the individual variations of the sensors or correct the difference between the measured value (PV) of other instruments.

Attribute: R/W (Read and Write)

The Input 2_PV bias (PA) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: –Input span to +Input span

Factory set value: Input 1_PV bias: 0
Input 2_PV bias: 0

Related parameter: Auto-zero (P. 131)

The Input 1_PV bias value is also reflected to the result of Auto-zero adjustment. Manual zero point adjustment can be performed by changing this PV bias value*.

* Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), or the other strain gauge type sensors

Input 1_PV digital filter	RKC communication identifier	F1
	Modbus register address	Low-order: 0078H (120) High-order: 0079H (121)
Input 2_PV digital filter	RKC communication identifier	F0
	Modbus register address	Low-order: 0084H (132) High-order: 0085H (133)

This item is the time of the first-order lag filter eliminate noise against the measured input.

Attribute: R/W (Read and Write)

The Input 2_PV digital filter (F0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0.00 to 10.00 seconds
0.00: OFF (Unused)

Factory set value: Input 1_PV digital filter: 0.00
Input 2_PV digital filter: 0.00

Input 1_PV ratio	RKC communication identifier	PR
	Modbus register address	Low-order: 007AH (122) High-order: 007BH (123)
Input 2_PV ratio	RKC communication identifier	PQ
	Modbus register address	Low-order: 0086H (134) High-order: 0087H (135)

PV ratio is a multiplier to be applied to the measured value (PV). The PV ratio is used to compensate the individual variations of the sensors or correct the difference between the measured value (PV) of other instruments.

Attribute: R/W (Read and Write)

The Input 2_PV ratio (PQ) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0.500 to 1.500
Factory set value: Input 1_PV ratio: 1.000
Input 2_PV ratio: 1.000
Related parameter: Auto calibration (P. 132)

When using our CZ-100P or CZ-200P:
- Explosionproof specification type:
  Set the desired correction factor of our safety barrier RZB-001 to the Input 1_PV ratio. Thus, an indicated error caused by the use of the safety barrier is corrected. The correction factor is described in the nameplate attached to the safety barrier (RZB-001).
- Non-explosionproof specification type:
  As the Input 1_PV ratio, use a factory set value of "1.000" with this value left intact.

When using our CZ-GP100 (without amplifier) or the other strain gauge type sensors:
The result obtained by Auto calibration is reflected to the Input 1_PV ratio. Manual full scale point adjustment can be performed by changing this PV ratio.

Input 1_PV low input cut-off	RKC communication identifier	DP
	Modbus register address	Low-order: 007CH (124) High-order: 007DH (125)
Input 2_PV low input cut-off	RKC communication identifier	DO
	Modbus register address	Low-order: 0088H (136) High-order: 0089H (137)

PV low input cut-off is used with Square Root Extraction function. The measured value less than the PV low input cut-off is ignored to prevent control disturbance caused by input variation at low measured value range.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

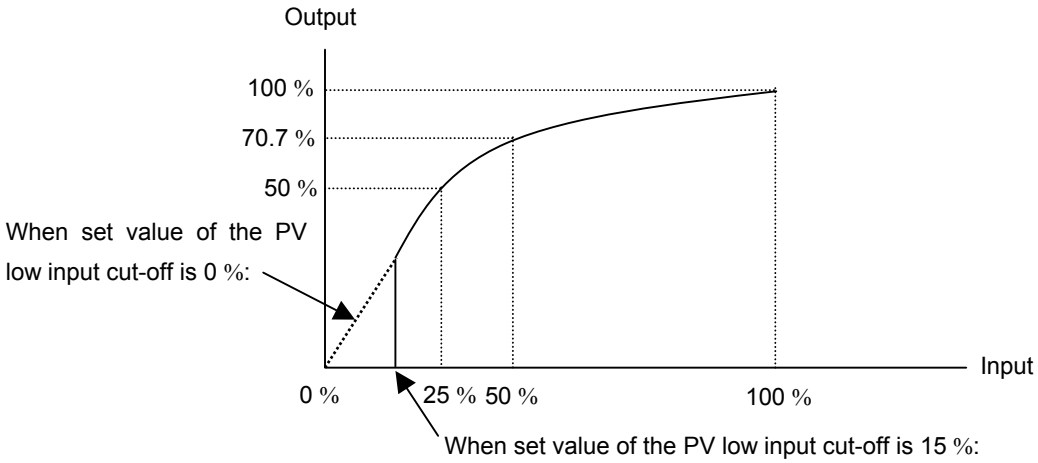
Digits: 7 digits

Data range: 0.00 to 25.00 % of input span

Factory set value: Input 1_PV low input cut-off: 0.00
Input 2_PV low input cut-off: 0.00

PV Low Input Cut-off Function:

When input signal square root extraction is used for flow control, etc., the square root extraction result varies widely at the low measured value range. The measured value less than the PV low input cut-off is ignored to calculate control output in order to prevent control disturbance caused by input variation at low measured value range.



Input 1_proportional cycle time	RKC communication identifier	T0
	Modbus register address	Low-order: 007EH (126) High-order: 007FH (127)
Input 2_proportional cycle time	RKC communication identifier	T2
	Modbus register address	Low-order: 008AH (138) High-order: 008BH (139)

Proportional Cycle Time is to set control cycle time for time based control output such as voltage pulse for SSR, triac and relay output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) for the voltage/current output specification.

Digits: 7 digits
Data range: 0.1 to 100.0 seconds
Factory set value: Input 1_proportional cycle time:
Relay contact output: 20.0 seconds
Voltage pulse output and triac output: 2.0 seconds
Input 2_proportional cycle time:
Relay contact output: 20.0 seconds
Voltage pulse output and triac output: 2.0 seconds

The proportional cycle time becomes invalid when the voltage/current output is selected as control output type.

Input 1_manual output value	RKC communication identifier	ON
	Modbus register address	Low-order: 0080H (128) High-order: 0081H (129)
Input 2_manual output value	RKC communication identifier	OM
	Modbus register address	Low-order: 008CH (140) High-order: 008DH (141)

This item is the output value in the manual (MAN) control.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) for the automatic (AUTO) control.

Digits: 7 digits
Data range: Input 1_manual output value: MV scaling low to MV scaling high
Input 2_manual output value: Output limiter (low) to Output limiter (high)
Factory set value: 0.0
Related parameters: Output limiter (high/low) (P. 176), MV scaling (high/low) (P. 189, P. 190)

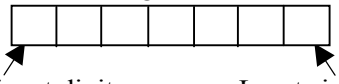
Set lock level	RKC communication identifier	LK
	Modbus register address	Low-order: 008EH (142) High-order: 008FH (143)

The set lock level restricts parameter setting changes by key operation (Set data lock function). This function prevents the operator from making errors during operation.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: **RKC communication:** ASCII code data of 7 digits

The set lock level is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit·····Least significant digit

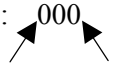
Least significant digit: Lock only setting items other than SV and events (EV1 to EV4).
2nd digit: Lock only events (EV1 to EV4).
3rd digit: Lock only set value (SV).
4th digit to Most significant digit: Unused

Data: 0: Unlock 1: Lock

Modbus: 0 to 7 (bit data)

The set lock level is assigned as a bit image in binary numbers.

Bit image: 000



bit 2·····bit 0

bit 0: Lock only setting items other than SV and events (EV1 to EV4).
bit 1: Lock only events (EV1 to EV4).
bit 2: Lock only set value (SV).
bit 3 to bit 31: Unused

Bit data: 0: Unlock 1: Lock

Factory set value: 0

EEPROM storage state	RKC communication identifier	EM
	Modbus register address	Low-order: 0090H (144) High-order: 0091H (145)

The contents of the RAM and those of the EEPROM can be checked.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0: The content of the EEPROM does not coincide with that of the RAM.
- As data is being written to the EEPROM when the EEPROM storage mode is selected "0: Set values are store to the EEPROM when set values are changed," do not turn the power off. If turned off, no set values are stored.
- If the EEPROM storage mode is changed after "0: Set values are store to the EEPROM when set values are changed" is changed to "1: Not set values are store to the EEPROM when set values are changed," *0* is set (mismatch). As the set value changed is not backup, select the backup mode if necessary.

1: The content of the EEPROM coincides with that of the RAM.
The contents of the RAM match with those of the EEPROM.
(Data write to the EEPROM is completed.)

Factory set value: —

EEPROM storage mode	RKC communication identifier	EB
	Modbus register address	Low-order: 0092H (146) High-order: 0093H (147)

It is set whether the data storage in the non-volatile memory (EEPROM) is executed or not.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0: Set values are store to the EEPROM when set values are changed.
1: Not set values are store to the EEPROM when set values are changed.
Factory set value: 0

When the memory is used to frequently change the set value via communication, select "1: Not set values are store to the EEPROM when set values are changed."

For the following case, data is stored into the EEPROM regardless of the EEPROM mode setting.
- **When the data is changed through key operation**
- **Data written into the controller by specifying the memory area number**

The non-volatile memory (EEPROM) has limitations on the number of memory rewrite times. If "1: Not set values are store to the EEPROM when set values are changed" is selected as the EEPROM storage mode, all of the set values changed are not written to the EEPROM and thus a problem of limitations on the number of memory rewrite times can be solved.

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When selecting any EEPROM storage mode, take notice of the following.

- If power failure occurs while "1: Not set values are store to the EEPROM when set values are changed" is selected, the set value returns to the value before the storage mode is selected.
- If "1: Not set values are store to the EEPROM when set values are changed" is changed to "0: Set values are store to the EEPROM when set values are changed," all of the set values at that time are stored to the EEPROM. If necessary to backup the final value of each set item, select "0: Set values are store to the EEPROM when set values are changed."
- When the power is turned on, "0: Set values are store to the EEPROM when set values are changed" is always set.

PV1 peak hold value monitor	RKC communication identifier	HP
	Modbus register address	Low-order: 009CH (156) High-order: 009DH (157)
PV2 peak hold value monitor	RKC communication identifier	FP
	Modbus register address	Low-order: 00A2H (162) High-order: 00A3H (163)

The maximum PV value (peak value) of Input 1 (Input 2) is held and displayed.

Attribute: RO (Read only)
Digits: 7 digits
Data range: Input scale low to Input scale high
Factory set value: —
Related parameters: PV1/PV2 bottom hold value monitor (P. 129), PV1/ PV2 hold reset (P. 130), Input 1_PV1 hold function (P. 186), Input 2_PV2 hold function (P. 186)

Peak Hold Function: The Peak Hold function is used to store (hold) the maximum (peak) measured value (PV). The peak hold value is updated regardless of the STOP or RUN state if the power to this controller is turned on. Each of this value is updated when the measured value (PV) becomes more than the value now being held. However, if the following operation is performed, the value now being held is reset and as a result the measured value (PV) just when reset becomes the peak hold value.

- When the power is turned on or it is turned on again
- When operation mode is changed from STOP to RUN
- When hold reset

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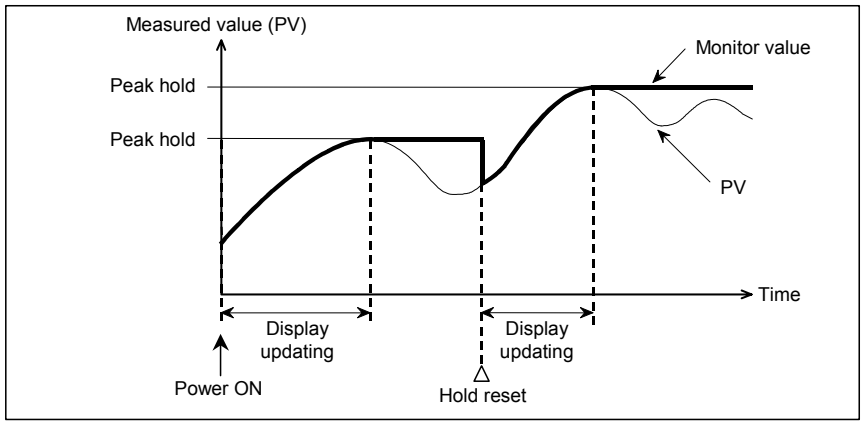
Peak hold value is not backed up.



PV1 bottom hold value monitor	RKC communication identifier	HQ
	Modbus register address	Low-order: 009EH (158) High-order: 009FH (159)
PV2 bottom hold value monitor	RKC communication identifier	FQ
	Modbus register address	Low-order: 00A4H (164) High-order: 00A5H (165)

The minimum PV value (bottom value) of Input 1 (Input 2) is held and displayed.

Attributer: RO (Read only)
Digits: 7 digits
Data range: Input scale low to Input scale high
Factory set value: —
Related parameters: PV1/PV2 peak hold value monitor (P. 128), PV1/ PV2 hold reset (P. 130), Input 1_PV1 hold function (P. 186), Input 2_PV2 hold function (P. 186)

Bottom Hold Function:

The Bottom Hold function is used to store (hold) the minimum (bottom) measured value (PV). The bottom hold value is updated regardless of the STOP or RUN state if the power to this controller is turned on. Each of this value is updated when the measured value (PV) becomes less than the value now being held. However, if the following operation is performed, the value now being held is reset and as a result the measured value (PV) just when reset becomes the bottom hold value.

- When the power is turned on or it is turned on again
- When operation mode is changed from STOP to RUN
- When hold reset

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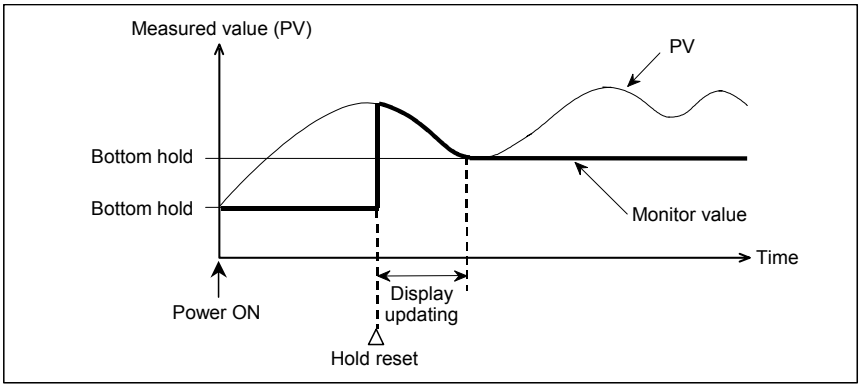
Bottom hold value is not backed up.



PV1 hold reset	RKC communication identifier	HR
	Modbus register address	Low-order: 00A0H (160) High-order: 00A1H (161)
PV2 hold reset	RKC communication identifier	FR
	Modbus register address	Low-order: 00A6H (166) High-order: 00A7H (167)

The maximum (peak hold) and minimum (bottom hold) PV values are reset.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0, 1
0: Hold reset execution
If 0 is written, the hold value is reset to return to 1.
The polling of "1" is always made.
Factory set value: —
Related parameters: PV1/PV2 peak hold value monitor (P. 128),
PV1/PV2 bottom hold value monitor (P. 129),
Input 1_PV1 hold function (P. 186), Input 2_PV2 hold function (P. 186)

Interlock release	RKC communication identifier	IL
	Modbus register address	Low-order: 00A8H (168) High-order: 00A9H (169)

Interlock status is release.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0, 1
0: Interlock release execution
If 0 is written, the interlock is released.
Factory set value: —
Related parameters: Interlock function (P. 192)

Auto-zero	RKC communication identifier	AZ
	Modbus register address	Low-order: 00AAH (170) High-order: 00ABH (171)

Adjust the zero point of the measured value (PV1) on the Input 1 (Pressure sensor input*) side.
* Relevant pressure sensors: CZ-100P, CZ-200P, CZ-GP100 (without amplifier), or the other strain gauge type sensors

Before conducting Auto-zero adjustment, always change RUN to STOP. In addition, before conducting Auto-zero adjustment, check that no load is applied to the pressure sensor; the equipment is at the operating temperature; and also the wiring is correctly made.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0, 1, 3
1: Zero point adjustment execution
Writing "1" starts zero point adjustment, and then "1" returns to "0" after the adjustment is finished.
3: Adjustment error
Writing "0" returns to a normal state.

The result of Auto-zero adjustment is also reftected to the Input 1_PV bias value. Manual zero point adjustment can be performed by changing this PV bias value.

Factory set value: —
Related parameters: PV bias (P. 122)

Auto calibration	RKC communication identifier	FS
	Modbus register address	Low-order: 00ACH (172) High-order: 00ADH (173)

Adjust the full scale point of the measured value (PV1) on the Input 1 (Pressure sensor input*) side.
* Relevant pressure sensor: CZ-GP100 (without amplifier) or the other strain gauge type sensors

Before conducting Auto calibration, always change RUN to STOP. In addition, before conducting Auto calibration, check that no load is applied to the pressure sensor; the equipment is at the operating temperature; and also the wiring is correctly made.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0 to 3
1: Auto calibration execution
Writing "1" starts auto calibration, and it changes to "2" during the adjustment and returns to "0" after the adjustment is finished.
3: Adjustment error
Writing "0" returns to a normal state.

The result obtained by Auto calibration is reflected to the Input 1_PV ratio. Manual full scale point adjustment can be performed by changing this PV ratio.

For this product, in order to generate the R-cal output it is not necessary to short the cables (blue and orange) on the pressure sensor side.

Factory set value: —

STOP display selection	RKC communication identifier	DX
	Modbus register address	Low-order: 0200H (512) High-order: 0201H (513)

STOP message for control STOP mode can be displayed either on the upper display or the lower display. This item is to select the display to show the STOP message.

Attribute: R/W (Read and Write)

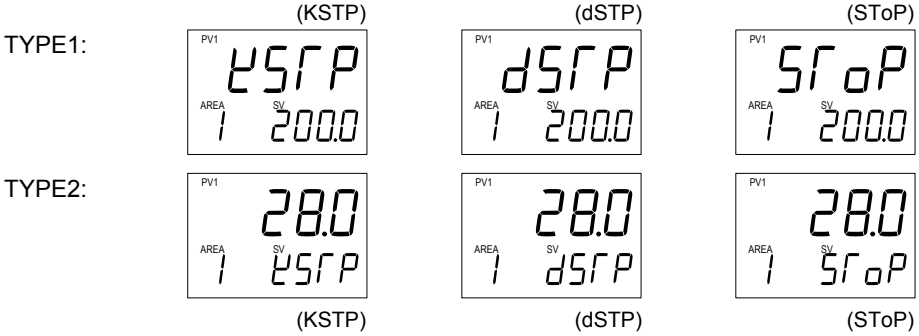
This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Displays on the measured value (PV1/PV2) unit (TYPE 1)
1: Displays on the set value (SV) unit (TYPE 2)

Factory set value: 0

There are three different Characters for STOP mode depending on how to be transferred from RUN to STOP.



Bar graph display selection	RKC communication identifier	DA
	Modbus register address	Low-order: 0202H (514) High-order: 0203H (515)

Use to select the contents of the bar graph display.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

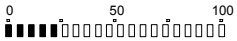
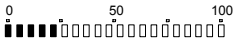
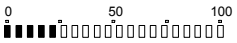
Digits: 7 digits

Data range: 0: No display
1: Input 1_manipulated output value (MV)
2: Input 1_measured value (PV)
3: Input 1_set value (SV)
4: Input 1_deviation value
5: Unused (Not available)
6: Input 2_manipulated output value (MV)
7: Input 2_measured value (PV)
8: Input 2_set value (SV)
9: Input 2_deviation value

Factory set value: 0

Related parameters: Bar graph resolution setting (P. 135)

Bar graph display explanation:

Manipulated output value (MV) display	Displays the manipulated output value (MV). When manipulated output value (MV) is at 0 % or less, the left-end dot of the bar-graph flashes. When MV exceeds 100 %, the right-end dot flashes. [Display example] 
Measured value (PV) display	Scaling is available within the input range. [Display example] 
Set value (SV) display	Scaling is available within the input range. [Display example] 
Deviation value display	Displays the deviation between the measured value (PV) and the set value (SV). When the Deviation display is selected, the dots at both ends of bar-graph light. A display resolution per dot is settable from 1 to 100. [Display example] 

The number of dot points: 10 dots (HA430) 20 dots (HA930)

Bar graph resolution setting	RKC communication identifier	DE
	Modbus register address	Low-order: 0204H (516) High-order: 0205H (517)

Use to set the bar graph display resolution for the deviation display. However, this set value becomes valid only when the bar graph display selection is "4: Input 1_deviation value" or "9: Input 2_deviation value."

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 1 to 100 digit/dot
Sets several digit per 1 dots of the bar graph.
Factory set value: 100
Related parameters: Bar graph display selection (P. 134)

Auto/Manual transfer key operation selection (A/M)	RKC communication identifier	DK
	Modbus register address	Low-order: 0208H (520) High-order: 0209H (521)

Use to select Use/Unuse of Auto/Manual transfer key (A/M).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: Unused
1: Auto/Manual transfer for input 1
2: Auto/Manual transfer for input 2
3: Common Auto/Manual transfer for input 1 and input 2
Factory set value: 3

Remote/Local transfer key operation selection (R/L)	RKC communication identifier	DL
	Modbus register address	Low-order: 020AH (522) High-order: 020BH (523)

Use to select Use/Unuse of Remote/Local transfer key (R/L).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Unused
1: Remote/Local transfer

Factory set value: 1

RUN/STOP transfer key operation selection (R/S)	RKC communication identifier	DM
	Modbus register address	Low-order: 020CH (524) High-order: 020DH (525)

Use to select Use/Unuse of RUN/STOP transfer key (R/S).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Unused
1: RUN/STOP transfer

Factory set value: 1

Input 1_input type selection	RKC communication identifier	XI
	Modbus register address	Low-order: 020EH (526) High-order: 020FH (527)
Input 2_ input type selection	RKC communication identifier	XJ
	Modbus register address	Low-order: 0222H (546) High-order: 0223H (547)

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:

Input 1: 14 to 29 (22, 23: Not available)

[Input Range Table]

Set value	Input type		Input range	Hardware
19	Voltage (Low) input	0 to 1 V	Programmable range (–19999 to +99999)	Voltage (Low) input group
20		0 to 100 mV		
21		0 to 10 mV		
24		±100 mV		
25		±10 mV		
14	Current input	0 to 20 mA		
15		4 to 20 mA		
16	Voltage (High) input	0 to 10 V		Voltage (High) input group
17		0 to 5 V		
18		1 to 5 V		
26		±10 V		
27		±5 V		
28		±1 V		
29	Pressure sensor input	Resin Pressure Sensor	0.0 to 250.0 MPa	Pressure group
22	Unused (Not available)			
23				

Input 2: 0 to 28 (22, 23: Not available)

[Input Range Table]

Set value	Input type		Input range	Hardware
0	TC input	K	–200 to +1372 °C or –328.0 to +2501.6 °F	Voltage (Low) input group
1		J	–200 to +1200 °C or –328.0 to +2192.0 °F	
2		R	–50 to +1768 °C or –58.0 to +3214.4 °F	
3		S	–50 to +1768 °C or –58.0 to +3214.4 °F	
4		B	0 to 1800 °C or 32.0 to 3272.0 °F	
5		E	–200 to +1000 °C or –328.0 to +1832.0 °F	
6		N	0 to 1300 °C or 32.0 to 2372.0 °F	
7		T	–200 to +400 °C or –328.0 to +752.0 °F	
8		W5Re/W26Re	0 to 2300 °C or 32.0 to 4172.0 °F	
9		PLII	0 to 1390 °C or 32.0 to 2534.0 °F	
12	RTD input	3-wire system Pt100	–200 to +850 °C or –328.0 to +1562.0 °F	
13		3-wire system JPt100	–200 to +600 °C or –328.0 to +1112.0 °F	
22	Unused (Not available)			
23				

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Set value	Input type		Input range	Hardware
19	Voltage (Low) input	0 to 1 V	Programmable range (–19999 to +99999)	Voltage (Low) input group
20		0 to 100 mV		
21		0 to 10 mV		
24		±100 mV		
25		±10 mV		
14	Current input	0 to 20 mA		
15		4 to 20 mA		
16	Voltage (High) input	0 to 10 V		Voltage (High) input group
17		0 to 5 V		
18		1 to 5 V		
26		±10 V		
27		±5 V		
28		±1 V		

An input type change may only be made within the hardware groups as shown above.

Do not set to any number (including 10 and 11) and Input 1 range number (22 or 23) which is not described in the input range table above. This may cause malfunctioning.

See the above input range table to select input type of the remote input. Input range 0 through 13, 22 or 23 cannot be selected for the remote input.

Factory set value: Input 1_input type selection: Depend on model code
(When not specifying: Pressure sensor input)
Input 2_input type selection: Depend on model code
(When not specifying: Type K)

Related parameters: Display unit selection (P. 138), Decimal point position (P. 139), Input scale high (P. 140), Input scale low (P. 141)

Input 1_display unit selection	RKC communication identifier	PU
	Modbus register address	Low-order: 0210H (528) High-order: 0211H (529)
Input 2_ display unit selection	RKC communication identifier	PT
	Modbus register address	Low-order: 0224H (548) High-order: 0225H (549)

These are the units of display for Input 1 and Input 2.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: Input 1_display unit selection: 2: MPa 3: bar 4: kgf/cm^2 5: psi

1 MPa = 10 bar = 10.1972 kgf/cm^2 = 145.038 psi

Input 2_display unit selection: 0: °C 1: °F

Factory set value: Input 1_display unit selection: Pressure Sensor input: 2
Voltage (V)/current (I) inputs: 0
Input 2_display unit selection: 0

The display unit selection becomes invalid when the voltage/current input is selected as input type.

Input 1_decimal point position	RKC communication identifier	XU
	Modbus register address	Low-order: 0212H (530) High-order: 0213H (531)
Input 2_decimal point position	RKC communication identifier	XT
	Modbus register address	Low-order: 0226H (550) High-order: 0227H (551)

Use to select the decimal point position of the input range.

Attribute: R/W (Read and Write)

 **This item becomes RO (Read only) during control RUN.**

Digits: 7 digits

Data range: 0: No decimal place
1: One decimal place
2: Two decimal places
3: Three decimal places
4: Four decimal places

Input 1_decimal point position:
- Pressure Sensor input
  - Less than 1 MPa (Rated pressure): 0 to 4
  - Less than 10 MPa (Rated pressure): 0 to 3
  - Less than 100 MPa (Rated pressure): 0 to 2
  - 100 MPa or more (Rated pressure): 0 or 1
- Voltage (V)/current (I) inputs: 0 to 4

Input 2_decimal point position:
- Thermocouple (TC) inputs: 0 or 1
- RTD inputs: 0 to 2
- Voltage (V)/current (I) inputs: 0 to 4

Factory set value: Input 1_decimal point position: 1
Input 2_decimal point position: 1

Related parameters: Input type selection (P. 137), Input scale high (P. 140), Input scale low (P. 141)

Input 1_input scale high	RKC communication identifier	XV
	Modbus register address	Low-order: 0214H (532) High-order: 0215H (533)
Input 2_input scale high	RKC communication identifier	XX
	Modbus register address	Low-order: 0228H (552) High-order: 0229H (553)

This value is high limit of the input scale range.

Attribute: R/W (Read and Write)

📖 **This item becomes RO (Read only) during control RUN.**

Digits: 7 digits

Data range: Pressure sensor input:
Input scale low to Maximum value of the selected input range
Thermocouple (TC)/RTD inputs:
Input scale low to Maximum value of the selected input range
Voltage (V)/current (I) inputs:
–19999 to +99999 (Varies with the setting of the decimal point position)

Factory set value: Input 1_input scale high:
Pressure sensor input: 50.0
Voltage (V)/current (I) inputs: 100.0
Input 2_input scale high:
Thermocouple (TC)/RTD inputs: Maximum value of the selected input range
Voltage (V)/current (I) inputs: 100.0

Related parameters: Input type selection (P. 137), Decimal point position (P. 139), Input scale low (P. 141)

Input Scale High Function:
The input scale range can be easily set by setting the input scale high limit/low limit.

📖 When a voltage/current input type is selected, the input scale high limit can be set lower than the input scale low limit. (Input scale high limit < Input scale low limit)

Input 1_input scale low	RKC communication identifier	XW
	Modbus register address	Low-order: 0216H (534) High-order: 0217H (535)
Input 2_input scale low	RKC communication identifier	XY
	Modbus register address	Low-order: 022AH (554) High-order: 022BH (555)

This value is to set the low limit of the input scale range.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: Pressure sensor input:
Minimum value of the selected input range to Input scale high
Thermocouple (TC)/RTD inputs:
Minimum value of the selected input range to Input scale high
Voltage (V)/current (I) inputs:
−19999 to +99999 (Varies with the setting of the decimal point position)

Factory set value: Input 1_input scale low:
Pressure sensor input: 0.0
Voltage (V)/current (I) inputs: 0.0
Input 2_input scale low:
Thermocouple (TC)/RTD inputs: Minimum value of the selected input range
Voltage (V)/current (I) inputs: 0.0

Related parameters: Input type selection (P. 137), Decimal point position (P. 139),
Input scale high (P. 140)

Input Scale Low Function:
See the Input Scale High.

Input 1_input error determination point (high)	RKC communication identifier	AV
	Modbus register address	Low-order: 0218H (536) High-order: 0219H (537)
Input 2_input error determination point (high)	RKC communication identifier	AX
	Modbus register address	Low-order: 022CH (556) High-order: 022DH (557)

Use to set Input Error Determination Point (high). Input Error Determination function is activated when a measured value reaches the limit, and control output value selected by Action at input error will be output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

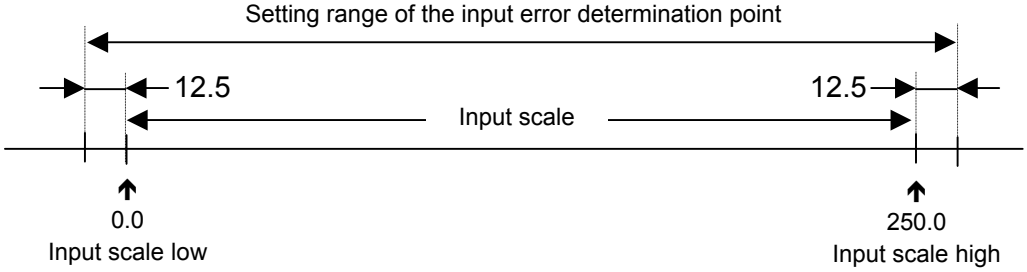
Data range: Input scale low − (5 % of input span) to Input scale high + (5 % of input span)

Factory set value: Input 1_input error determination point (high):
Pressure sensor input: Input scale high + (5 % of input span)
Voltage (V)/current (I) inputs: 105.0

Input 2_input error determination point (high):
Thermocouple (TC)/RTD inputs: Input scale high + (5 % of input span)
Voltage (V)/current (I) inputs: 105.0

Related parameters: Input error determination point (low) (P. 143),
Action at input error (high) (P. 172), Action at input error (low) (P. 173),
Manipulated output value at input error (P. 173)

[Example] When the input scale is 0.0 to 250.0:
Input span: 250.0
5 % of input span: 12.5
Setting range: −12.5 to +262.5



Input 1_input error determination point (low)	RKC communication identifier	AW
	Modbus register address	Low-order: 021AH (538) High-order: 021BH (539)
Input 2_input error determination point (low)	RKC communication identifier	AY
	Modbus register address	Low-order: 022EH (558) High-order: 022FH (559)

Use to set Input Error Determination Point (low). Input Error Determination function is activated when a measured value reaches the limit, and control output value selected by Action at input error will be output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: Input scale low – (5 % of input span) to Input scale high + (5 % of input span)

Factory set value: Input 1_input error determination point (low):

Pressure sensor input: Input scale low – (5 % of input span)

Voltage (V)/current (I) inputs: –5.0

Input 2_input error determination point (low):

Thermocouple (TC)/RTD inputs: Input scale low – (5 % of input span)

Voltage (V)/current (I) inputs: –5.0

Related parameters: Input error determination point (high) (P. 142),
Action at input error (high) (P. 172), Action at input error (low) (P. 173),
Manipulated output value at input error (P. 173)

Input 1_burnout direction	RKC communication identifier	BS
	Modbus register address	Low-order: 021CH (540) High-order: 021DH (541)
Input 2_burnout direction	RKC communication identifier	BR
	Modbus register address	Low-order: 0230H (560) High-order: 0231H (561)

Use to select Burnout Direction in input break. When input break is detected by the controller, the measured value go either Upscale or Downscale according to the Burnout Direction setting.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:

Pressure sensor input:	0 (Upscale), 1 (Downscale)
Thermocouple (TC) input:	0 (Upscale), 1 (Downscale)
RTD input:	0 (Upscale)
Voltage (Low) input:	0 (Upscale), 1 (Downscale)
Voltage (High) input:	1 (Downscale)
Current (I) input:	1 (Downscale)

Factory set value:

Input 1_burnout direction:	0 (Upscale)
Input 2_burnout direction:	0 (Upscale)

The action in the input breaks fix regardless of setting a burnout direction about the following input.

- **RTD inputs: Upscale**
- **Voltage (High) inputs: Downscale (Indicates value near 0 V.)**
- **Current (I) inputs: Downscale (Indicates value near 0 mA.)**

Input 1_square root extraction selection	RKC communication identifier	XH
	Modbus register address	Low-order: 021EH (542) High-order: 021FH (543)
Input 2_square root extraction selection	RKC communication identifier	XG
	Modbus register address	Low-order: 0232H (562) High-order: 0233H (563)

Use to select Use/Unuse of the square root extraction for the measured value.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Unused
1: Used

Factory set value: Input 1_square root extraction selection: 0
Input 2_square root extraction selection: 0

Related parameters: Input 1_PV low input cut-off (P. 124), Input 2_PV low input cut-off (P. 124)

Square Root Extraction Function:

The controller can receive the input signal directly from a differential pressure type flow transmitter by using Square Root Extraction Function without using a square root extractor.

Power supply frequency selection	RKC communication identifier	JT
	Modbus register address	Low-order: 0220H (544) High-order: 0221H (545)

Use to select the power supply frequency of the controller suited to the application.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: 50 Hz
1: 60 Hz

Factory set value: 0

Event input logic selection	RKC communication identifier	H2
	Modbus register address	Low-order: 0234H (564) High-order: 0235H (565)

Use to assign the function (memory area, operation mode) for the event inputs (DI 1 to DI 5).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

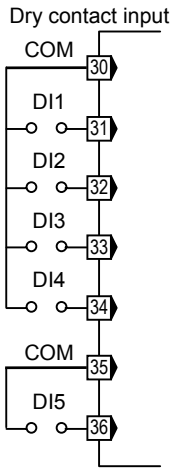
Digits: 7 digits
Data range: 0 to 15 (see the following table)

[Function Assignment Table]

Set value	DI 1	DI 2	DI 3	DI 4	DI 5
	Terminal No. 30-31	Terminal No. 30-32	Terminal No. 30-33	Terminal No. 30-34	Terminal No. 35-36
0	Unused (No function assignment)				
1	Memory area number selection (1 to 16)				Memory area set
2	Memory area number selection (1 to 16)				Memory area set
3	Memory area number selection (1 to 16)				Memory area set
4	Memory area number selection (1 to 8)			Memory area set	RUN/STOP transfer
5	Memory area number selection (1 to 8)			Memory area set	Remote/Local transfer
6	Memory area number selection (1 to 8)			Memory area set	Auto/Manual transfer
7	Memory area number selection (1 to 8)			Memory area set	Hold reset
8	Memory area number selection (1 to 8)			Memory area set	Interlock release
9	Memory area number selection (1 to 4)		Memory area set	RUN/STOP transfer	Auto/Manual transfer
10	Memory area number selection (1 to 4)		Memory area set	RUN/STOP transfer	Remote/Local transfer
11	Memory area number selection (1 to 4)		Memory area set	Remote/Local transfer	Auto/Manual transfer
12	Memory area number selection (1 to 4)		Memory area set	Hold reset	Interlock release
13	Auto/Manual transfer	RUN/STOP transfer	Remote/Local transfer	Hold reset	Interlock release
14	Auto/Manual transfer	Input 1_manual output down (motor RPM down) [1]	Input 1_manual output up (motor RPM up) [2]	Input 1_manual output 0 % reset (motor RPM reset) [3]	RUN/STOP transfer
15	Auto/Manual transfer	Input 2_manual output down (motor RPM down) [1]	Input 2_manual output up (motor RPM up) [2]	Input 2_manual output 0 % reset (motor RPM reset) [3]	RUN/STOP transfer

[1] Decreases manipulated output value (motor RPM) under Manual control with contacts closed.
[2] Increases manipulated output value (motor RPM) under Manual control with contacts closed.
[3] The manipulated output value (motor RPM) is reset to 0 % based on the edge discrimination of "open" to "closed." In addition, switched to "Manual Control" regardless of Auto/Manual transfer setting.

Event input terminals



Contact input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should meet the specification below.
Contact resistance: At OFF (contact open) 500 kΩ or more
At ON (contact closed) 10 Ω or less

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Factory set value: 1

Event Input Function: See below.

- Contact status of memory area number selection

To store a new Memory Area number as the Control Area, close the DI for Memory Area Set.

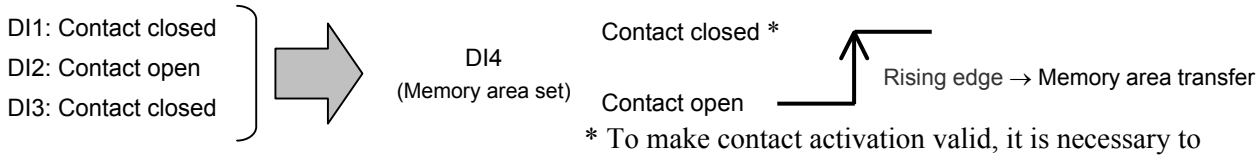
Event input	Memory area number															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DI 1	×	–	×	–	×	–	×	–	×	–	×	–	×	–	×	–
DI 2	×	×	–	–	×	×	–	–	×	×	–	–	×	×	–	–
DI 3	×	×	×	×	–	–	–	–	×	×	×	×	–	–	–	–
DI 4	×	×	×	×	×	×	×	×	–	–	–	–	–	–	–	–

×: Contact open –: Contact closed

Transfer timing of memory area number:

[Example] Change the memory area number to 6
(when "4" is selected in "Event input logic selection")

First, close the contacts between DI1 and DI3 and the common terminal. Next, open the contact between DI2 and the common. Then, close the contact between DI4 and the common from open status, the memory area in the controller will change to "6".



* To make contact activation valid, it is necessary to maintain the same contact state (contact closed) for more than 200 ms.

- **Relationship between contact state and each operation state**

	Contact closed	Contact open	No event input or not selected
RUN/STOP transfer	RUN (Control RUN)	STOP (Control STOP)	RUN (Control RUN)
Auto/Manual transfer	Auto	Manual	Auto
Remote/Local transfer	Remote or cascade control	Local	Local
Hold reset	Hold reset execution	—	By key operation
Interlock release	Interlock release execution	—	
Manual output down (Motor RPM down) [1]	Manual output down (Motor RPM down)	—	
Manual output up (Motor RPM up) [2]	Manual output up (Motor RPM up)	—	
Manual output 0 % reset (Motor RPM reset) [3]	Manual output 0 % reset (Motor RPM reset)	—	—

[1] Decreases manipulated output value (motor RPM) under Manual control with contacts closed.
[2] Increases manipulated output value (motor RPM) under Manual control with contacts closed.
[3] The manipulated output value (motor RPM) is reset to 0 % based on the edge discrimination of "open" to "closed." In addition, switched to "Manual Control" regardless of Auto/Manual transfer setting.

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- **RUN/STOP transfer**

Mode select from front key or communication	Status of event input (DI)	Actual operation mode
RUN (Control RUN)	Contact closed	RUN (Control RUN)
	Contact open	STOP (Control STOP)
STOP (Control STOP)	Contact closed	
	Contact open	

- **Auto/Manual transfer**

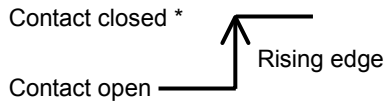
Mode select from front key or communication	Status of event input (DI)	Actual operation mode
Auto	Contact closed	Auto
	Contact open	Manual
Manual	Contact closed	
	Contact open	

- **Remote/Local transfer**

Mode select from front key or communication	Status of event input (DI)	Actual operation mode
Remote	Contact closed	Remote
	Contact open	Local
Local	Contact closed	
	Contact open	

Transfer timing of RUN/STOP, Auto/Manual, and Remote/Local:

The selection operation is taken when DI contact is closed from the open condition (Rising edge).



* To make contact activation valid, it is necessary to maintain the same contact state (contact closed) for more than 200 ms.

Output logic selection	RKC communication identifier	E0
	Modbus register address	Low-order: 0236H (566) High-order: 0237H (567)

This is used to assign the output function (control output, event, etc.) for the output (OUT1 to OUT5).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 3 to 8, 11 (see the following table)
1, 2, 9 and 10: Unused (Not available)

(M: Relay contact output, V: Voltage pulse output, R: Current output, E: Voltage, T: Triac output)

Set value	OUT1 (M/ V / R/ E/ T)	OUT2 (M/ V/ R/ E/ T)	OUT3 (M/ V/ R/ E/ T)	OUT4 (M)	OUT5 (M)	Remarks
1	**This set value is not used for the HA430/HA930.**					—
2	**This set value is not used for the HA430/HA930.**					—
3	MV 1	EV 3 (Energized) or EV 4 (Energized)	EV 2 (Energized)	EV 1 (Energized)	FAIL (De-energized)	Energized alarm corresponding to FAIL output
4	MV 1	EV 3 (De-energized) or EV 4 (De-energized)	EV 2 (De-energized)	EV 1 (De-energized)	FAIL (De-energized)	De-energized alarm corresponding to FAIL output
5	MV 1	MV 2	EV 4 (Energized)	EV 3 (Energized)	EV 1 (Energized) or EV2 (Energized)	Energized alarm corresponding to two loops control
6	MV 1	MV 2	EV 4 (De-energized)	EV 3 (De-energized)	EV 1 (De-energized) or EV 2 (De-energized)	De-energized alarm corresponding to two loops control
7	MV 1	MV 2	EV 3 (Energized) or EV 4 (Energized)	EV 2 (Energized)	EV 1 (Energized)	Energized alarm corresponding to two loops control
8	MV 1	MV 2	EV 3 (De-energized) or EV 4 (De-energized)	EV 2 (De-energized)	EV 1 (De-energized)	De-energized alarm corresponding to two loops control
9	**This set value is not used for the HA430/HA930.**					—
10	**This set value is not used for the HA430/HA930.**					—
11	MV 1	EV 4 (Energized)	EV 3 (Energized)	EV 2 (Energized)	EV 1 (Energized)	Energized alarm

MV 1 = Manipulated output value of Input 1, MV 2 = Manipulated output value of Input 2,
EV 1 = Output of Event 1, EV 2 = Output of Event 2, EV 3 = Output of Event 3, EV 4 = Output of Event 4, FAIL = FAIL output

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- An output logic becomes *OR* output when two or more output functions are assigned to one output.
- When three transmission outputs are selected, the transmission outputs are automatically assigned to OUT1 through OUT3 and it has priority over the Output Logic Selection. To select Manipulated Output Value of Input 1 or Input 2 as output type of OUT1, OUT2 or OUT3, select "4: Input 1_manipulated output value (MV)" or "8: Input 2_manipulated output value (MV)" at the parameters of Transmission Output Type Selection.

Transmission output type	Assign location of output
Transmission output 1	Output 1 (OUT1)
Transmission output 2	Output 2 (OUT2)
Transmission output 3	Output 3 (OUT3)

- The OUT3 output terminals (Nos. 7 and 8) are used when any sensor power supply is specified. The use of this function disables the use of OUT3 to OUT5 as control output, event output and transmission output. In addition, the number of transmission output points becomes 2 maximum.

Factory set value: For 1-input controller: 3
For 2-input controller: 5

Related parameters: Output timer setting (P. 151), Transmission output type selection (P. 153), Event input logic selection (P. 146), Alarm lamp lighting condition setting (P. 185)

Output 1 timer setting	RKC communication identifier	TD
	Modbus register address	Low-order: 0238H (568) High-order: 0239H (569)
Output 2 timer setting	RKC communication identifier	TG
	Modbus register address	Low-order: 023AH (570) High-order: 023BH (571)
Output 3 timer setting	RKC communication identifier	TH
	Modbus register address	Low-order: 023CH (572) High-order: 023DH (573)
Output 4 timer setting	RKC communication identifier	TI
	Modbus register address	Low-order: 023EH (574) High-order: 023FH (575)
Output 5 timer setting	RKC communication identifier	TJ
	Modbus register address	Low-order: 0240H (576) High-order: 0241H (577)

Output Timer Setting is to set an output delay time for event outputs.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0.0 to 600.0 seconds

Factory set value: 0.0

Related parameters: Output logic selection (P. 149), Event type selection (P. 156)
Alarm lamp lighting condition setting (P. 185)

Output Timer Setting Function:

See the next page.

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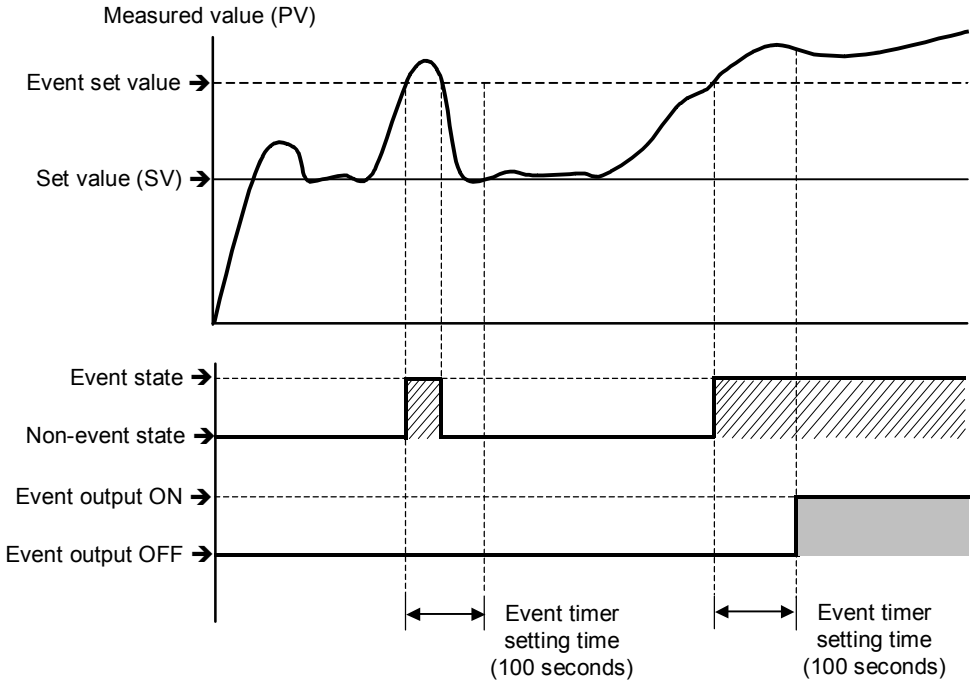
When an event condition becomes ON status, the output is suppressed until the Output Timer set time elapses. After the time is up, if the event output is still ON status, the output will be produced.

Example: When set the event timer to 100.0 seconds.



Transmission output 1_ type selection	RKC communication identifier	LA
	Modbus register address	Low-order: 0242H (578) High-order: 0243H (579)
Transmission output 2_ type selection	RKC communication identifier	LB
	Modbus register address	Low-order: 0248H (584) High-order: 0249H (585)
Transmission output 3_ type selection	RKC communication identifier	LC
	Modbus register address	Low-order: 024EH (590) High-order: 024FH (591)

Use to select the transmission output type.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:
0: None
1: Input 1_measured value (PV)
2: Input 1_set value (SV)
3: Input 1_deviation value
4: Input 1_manipulated output value (MV)
5: Input 2_measured value (PV)
6: Input 2_set value (SV)
7: Input 2_deviation value
8: Input 2_manipulated output value (MV)
9: Unused (Not available)

Factory set value: 0

Related parameters: Transmission output scale high (P. 154),
Transmission output scale low (P. 155)

Specify the output type of the transmission output when ordering.

When transmission outputs are selected and used, the outputs are allocated as follows.
- Transmission output 1: Output 1 (OUT1)
- Transmission output 2: Output 2 (OUT2)
- Transmission output 3: Output 3 (OUT3)

The transmission has priority over the Output Logic Selection.

Transmission output 1_scale high	RKC communication identifier	HV
	Modbus register address	Low-order: 0244H (580) High-order: 0245H (581)
Transmission output 2_scale high	RKC communication identifier	CV
	Modbus register address	Low-order: 024AH (586) High-order: 024BH (587)
Transmission output 3_scale high	RKC communication identifier	EV
	Modbus register address	Low-order: 0250H (592) High-order: 0251H (593)

Use to set a scale high limit value of the transmission output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:
- Measured value (PV) and set value (SV): Input scale low to Input scale high
- Manipulated output value (MV): –5.0 to +105.0 %
- Deviation: –Input span to +Input span

Factory set value:
- Measured value (PV) and set value (SV): Input scale high
- Manipulated output value (MV): 100.0
- Deviation: + Input span

Related parameters: Transmission output type selection (P. 153),
Transmission output scale low (P. 155)

Transmission output 1_scale low	RKC communication identifier	HW
	Modbus register address	Low-order: 0246H (582) High-order: 0247H (583)
Transmission output 2_scale low	RKC communication identifier	CW
	Modbus register address	Low-order: 024CH (588) High-order: 024DH (589)
Transmission output 3_scale low	RKC communication identifier	EW
	Modbus register address	Low-order: 0252H (594) High-order: 0253H (595)

Use to set a scale low limit value of the transmission output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:
- Measured value (PV) and set value (SV): Input scale low to Input scale high
- Manipulated output value (MV): –5.0 to +105.0 %
- Deviation: –Input span to +Input span

Factory set value:
- Measured value (PV) and set value (SV): Input scale low
- Manipulated output value (MV): 0.0
- Deviation: –Input span

Related parameters: Transmission output type selection (P. 153),
Transmission output scale high (P. 154)

Event 1 type selection	RKC communication identifier	XA
	Modbus register address	Low-order: 0254H (596) High-order: 0255H (597)
Event 2 type selection	RKC communication identifier	XB
	Modbus register address	Low-order: 025EH (606) High-order: 025FH (607)
Event 3 type selection	RKC communication identifier	XC
	Modbus register address	Low-order: 0268H (616) High-order: 0269H (617)
Event 4 type selection	RKC communication identifier	XD
	Modbus register address	Low-order: 0272H (626) High-order: 0273H (627)

Use to select a type of the event 1, 2, 3 and 4.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range:
0: None
1: Deviation high [1]
2: Deviation low [1]
3: Deviation high/low [1]
4: Band [1]
5: Process high [1]
6: Process low [1]
7: SV high
8: SV low
9: Control loop break alarm (LBA) [2]

[1] Event hold action is available.

[2] The "9: Control loop break alarm (LBA)" can be selected only for event 3 and event 4.

Factory set value: 0

Related parameters: Event set value (P. 111), Control loop break alarm (LBA) time (P. 112), LBA deadband (P. 112), Output logic selection (P. 149), Output timer setting (P. 151), Event hold action (P. 159), Event differential gap (P. 161), Event action at input error (P. 163), Event assignment (P. 165), Alarm lamp lighting condition setting (P. 185)

Functional description:

See the next page.

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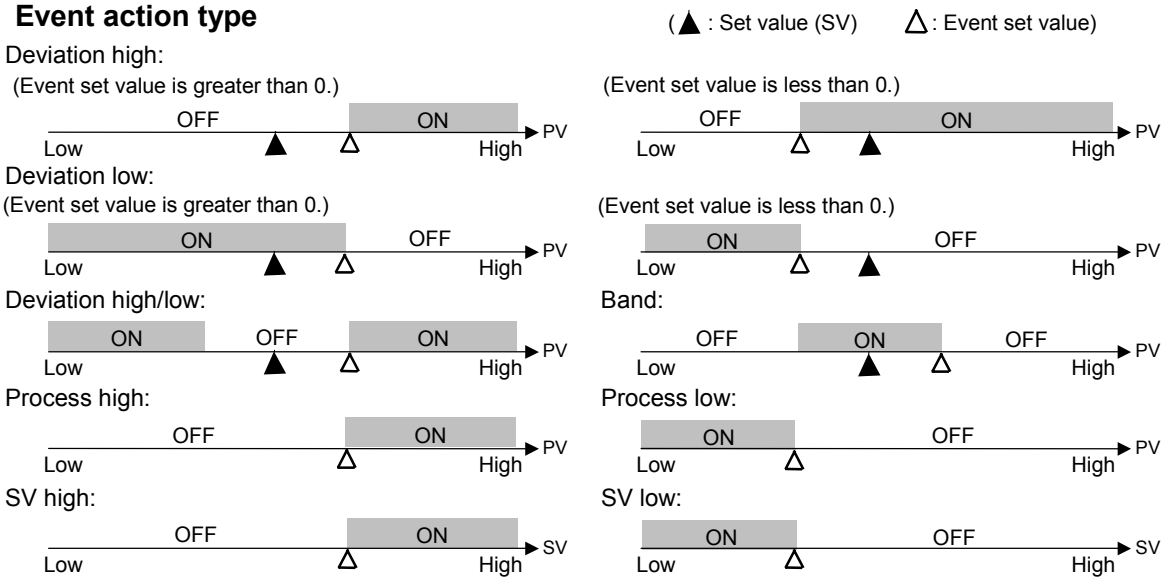
- **Event action type**



- **Control loop break alarm (LBA)**

The control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

[Alarm action]

The LBA function produces the alarm when any of the following conditions occurs.

LBA determination range: Temperature input: 2 °C [2 °F] fixed
Voltage/current input: 0.2 % fixed

- **When the control output reaches 0 % (low limit with output limit function)**

For direct action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

- **When the output exceeds 100 % (low limit with output high function)**

For direct action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

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- If the autotuning function is used, the LBA time is automatically set twice as large as the integral time. The LBA setting time will not be changed even if the integral time is changed.
- When AT function is activated or the controller is in STOP mode, the LBA function is not activated.
- The LBA function does not detect a location which causes alarm status. If LBA alarm is ON, check each device or wiring of the control loop.
- While the LBA is ON (under alarm status), the following conditions cancel the alarm status and LBA will be OFF.
  - The measured value (PV) rises beyond (or falls below) the LBA determination range within the LBA time.
  - The measured value (PV) enters within the LBA deadband.

Event 1 hold action	RKC communication identifier	WA
	Modbus register address	Low-order: 0256H (598) High-order: 0257H (599)
Event 2 hold action	RKC communication identifier	WB
	Modbus register address	Low-order: 0260H (608) High-order: 0261H (609)
Event 3 hold action	RKC communication identifier	WC
	Modbus register address	Low-order: 026AH (618) High-order: 026BH (619)
Event 4 hold action	RKC communication identifier	WD
	Modbus register address	Low-order: 0274H (628) High-order: 0275H (629)

Use to set a event hold action for the Event 1, 2, 3 or 4.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: OFF
1: ON
2: Re-hold action ON

Factory set value: 0

Related parameters: Event set value (P. 111), Event type selection (P. 156),
Event differential gap (P. 161), Event action at input error (P. 163),
Event assignment (P. 165)

Functional description:

See the next page.

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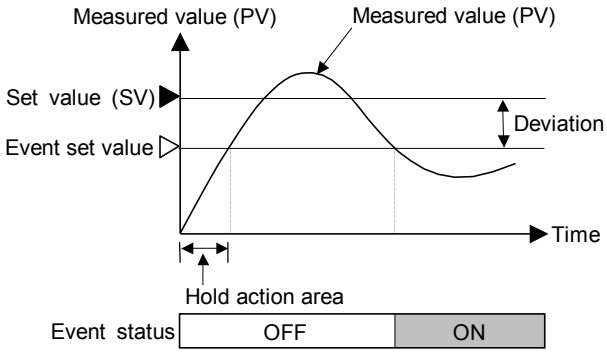
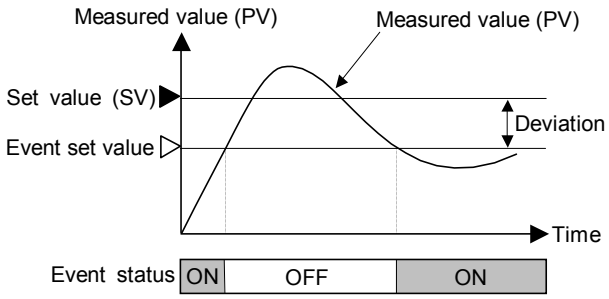
● Hold action

When Hold action is ON, the event action is suppressed at start-up or STOP to RUN until the measured value has entered the non-event range.

[With hold action]



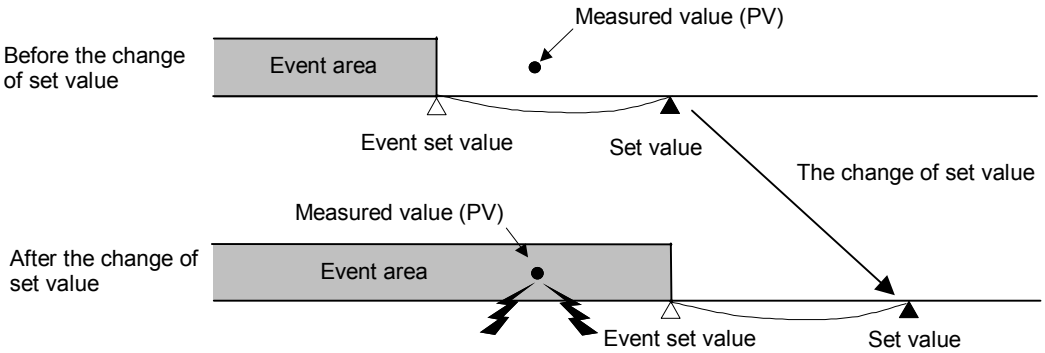
[Without hold action]



● Re-hold action

When Re-hold action is ON, the event action is also suppressed at the control set value change as well as start-up and STOP to RUN until the measured value has entered the non-event range. However, if the rate of setting change limiter is set to any function other than "0.0: OFF (Unused)" or in the remote setting, the re-hold action becomes invalid.

Example: When Re-hold action is OFF and event output type is deviation, the event output is produced due to the set value change. The Re-hold action suppresses the alarm output until the measured value has entered the non-event range again.



Event 1 differential gap	RKC communication identifier	HA
	Modbus register address	Low-order: 0258H (600) High-order: 0259H (601)
Event 2 differential gap	RKC communication identifier	HB
	Modbus register address	Low-order: 0262H (610) High-order: 0263H (611)
Event 3 differential gap	RKC communication identifier	HC
	Modbus register address	Low-order: 026CH (620) High-order: 026DH (621)
Event 4 differential gap	RKC communication identifier	HD
	Modbus register address	Low-order: 0276H (630) High-order: 0277H (631)

Use to set a differential gap of the event 1, 2, 3 or 4.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0 to Input span

Factory set value:
Pressure sensor input [Input 1]: 2.0 MPa
Thermocouple (TC)/RTD inputs [Input 2]: 2.0 °C [°F]
Voltage (V)/current (I) inputs [Input 1, Input 2]: 0.2 % of input span

Related parameters: Event set value (P. 111), Event type selection (P. 156), Event hold action (P. 159), Event action at input error (P. 163), Event assignment (P. 165)

Event Differential Gap Function:

See the next page.

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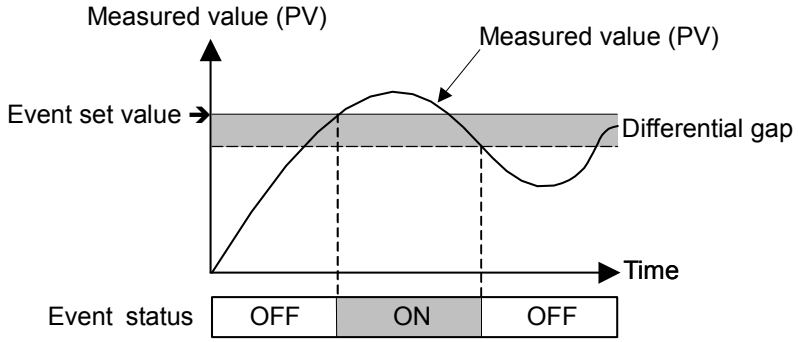
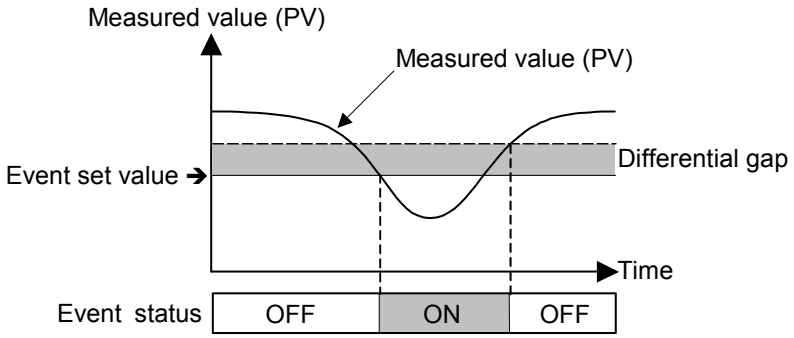
It prevents chattering of event output due to the measured value fluctuation around the event set value.

[Event high]



[Event low]



Event 1 action at input error	RKC communication identifier	OA
	Modbus register address	Low-order: 025AH (602) High-order: 025BH (603)
Event 2 action at input error	RKC communication identifier	OB
	Modbus register address	Low-order: 0264H (612) High-order: 0265H (613)
Event 3 action at input error	RKC communication identifier	OC
	Modbus register address	Low-order: 026EH (622) High-order: 026FH (623)
Event 4 action at input error	RKC communication identifier	OD
	Modbus register address	Low-order: 0278H (632) High-order: 0279H (633)

Event action at input error is to select the event action when the measured value reaches the input error determination point (high or low limit).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Normal processing
1: Turn the event output ON

Factory set value: 0

Related parameters: Input error determination point (high) (P. 142),
Input error determination point (low) (P. 143)

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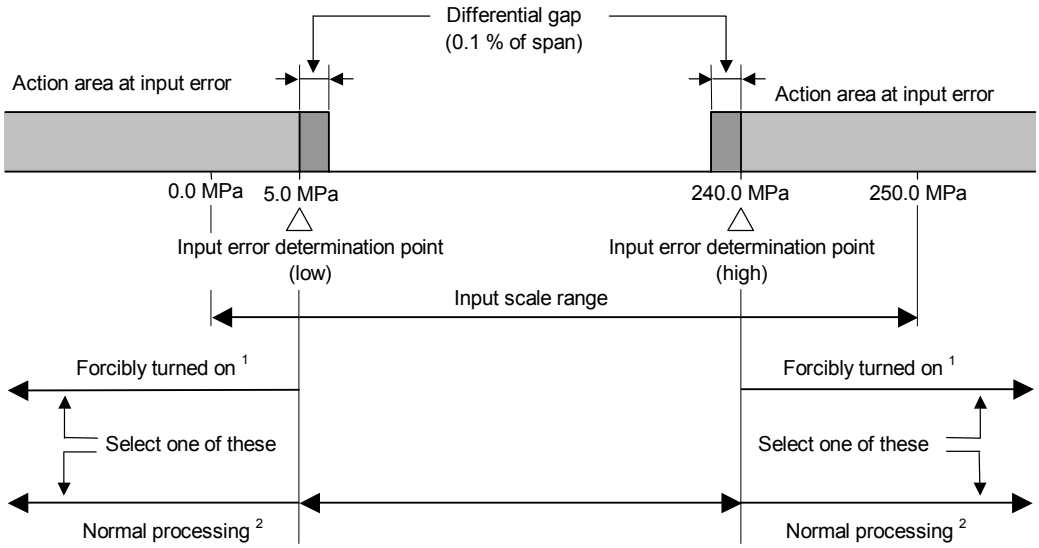
Event action at input error:

Example: Input range: 0.0 to 250.0 MPa
Input error determination point (high): 240.0 MPa
Input error determination point (low): 5.0 MPa



[1] The event output is forcibly turned on regardless of the selected event action status when the input is abnormal.

[2] The event output is produced depending on the selected event action status even if the input is abnormal.

Event 1 assignment	RKC communication identifier	FA
	Modbus register address	Low-order: 025CH (604) High-order: 025DH (605)
Event 2 assignment	RKC communication identifier	FB
	Modbus register address	Low-order: 0266H (614) High-order: 0267H (615)
Event 3 assignment	RKC communication identifier	FC
	Modbus register address	Low-order: 0270H (624) High-order: 0271H (625)
Event 4 assignment	RKC communication identifier	FD
	Modbus register address	Low-order: 027AH (634) High-order: 027BH (635)

Use to assign event outputs to either Input 1 or Input 2.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 1: For input 1
2: For input 2

Factory set value: 1

Related parameters: Event set value (P. 111), Event type selection (P. 156), Event hold action (P. 159), Event differential gap (P. 161), Event action at input error (P. 163)

Hot/Cold start selection	RKC communication identifier	XN
	Modbus register address	Low-order: 0284H (644) High-order: 0285H (645)

Use to select the start mode at power recovery.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0 to 5 (see the following table)

Set value	Power failure less than 3 seconds	Power failure 3 seconds or more
0	Hot start 1	Hot start 1
1	Hot start 1	Hot start 2
2	Hot start 1	Cold start
3	Hot start 2	Hot start 2
4	Hot start 2	Cold start
5	Cold start	Cold start
6	Hot start 1	Stop start
7	Hot start 2	Stop start
8	Stop start	Stop start

Factory set value: 5

Hot/Cold Start Function:

After the power failure, when power is back to the controller,

Hot start 1: the controller will return to the same operation mode and the same manipulated value which were used or calculated by the controller before power failure.

Hot start 2: the controller will return to the same operation mode which was used by the controller before power failure.

- In the Manual mode, the output value will be at the low output limit value.
- In the Auto mode, the controller will calculate the manipulated output value regardless that before power failure. So, the manipulated output varies.

Cold start: the controller will automatically go to Manual mode and output the low output limit value.

Stop start: Started in the control stop (STOP) state regardless of the RUN mode (Auto/Manual) before power failure. Set to the RUN mode before power failure when changed to RUN from STOP by RUN/STOP selection.

Input 2_use selection	RKC communication identifier	KM
	Modbus register address	Low-order: 0286H (646) High-order: 0287H (647)

Use to select the usage of Input 2.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Single loop control
1: Remote input

Factory set value: 0

SV tracking	RKC communication identifier	XL
	Modbus register address	Low-order: 028CH (652) High-order: 028DH (653)

To select Use/Unuse of SV tracking.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

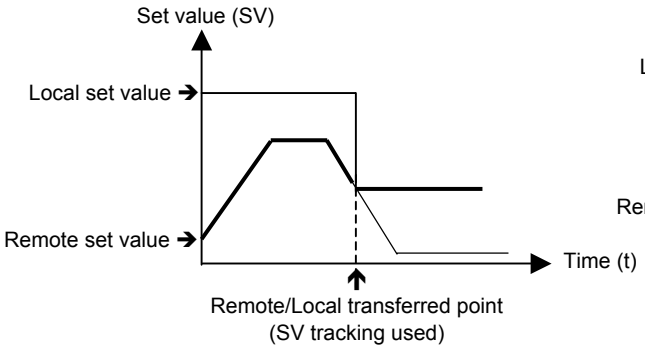
Data range: 0: Unused
1: Used

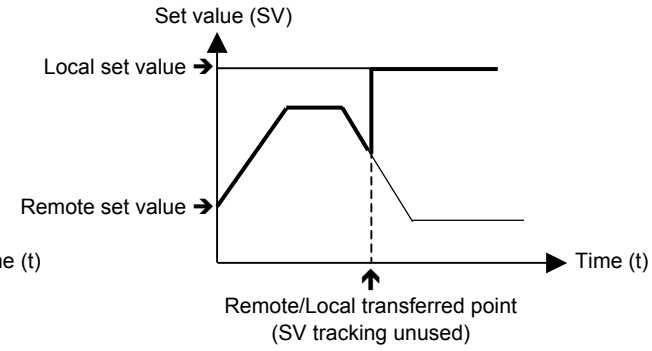
Factory set value: 1

SV Tracking Function:

With SV Tracking function, when Remote/Local mode is transferred from Remote to Local, the set value used in Remote mode before the mode transfer will be kept using in Local mode to prevent rapid set value change.

Operation mode:	Local →	Remote →	Local
Set value used	Local set value	Remote set value	Local set value
SV tracking used	Local set value ≠ Remote set value	Local set value = Remote set value	Local set value = Remote set value
SV tracking unused	Local set value ≠ Remote set value	Local set value ≠ Remote set value	Local set value ≠ Remote set value





Input 1_control action type selection	RKC communication identifier	XE
	Modbus register address	Low-order: 028EH (654) High-order: 028FH (655)
Input 2_control action type selection	RKC communication identifier	XF
	Modbus register address	Low-order: 02A8H (680) High-order: 02A9H (681)

Use to select direct action/reverse action.

Attribute: R/W (Read and Write)

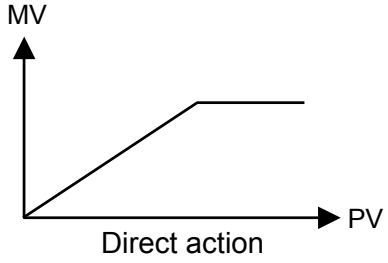
This item becomes RO (Read only) during control RUN.

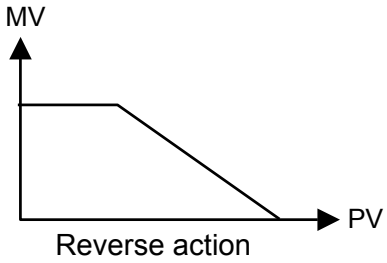
Digits: 7 digits

Data range: 0: Direct action
1: Reverse action

Factory set value: Input 1_control action type selection: 1
Input 2_control action type selection: 1

Control Action Type: Direct action: The manipulated output value (MV) increases as the measured value (PV) increases. This action is used generally for cool control.
Reverse action: The manipulated output value (MV) decreases as the measured value (PV) increases. This action is used generally for heat control.





Input 1_integral/derivative time decimal point position selection	RKC communication identifier	PK
	Modbus register address	Low-order: 0290H (656) High-order: 0291H (657)
Input 2_integral/derivative time decimal point position selection	RKC communication identifier	PJ
	Modbus register address	Low-order: 02AAH (682) High-order: 02ABH (683)

Use to select a decimal point position of integral time and derivative time in PID control.

Attribute: R/W (Read and Write)

📖 **This item becomes RO (Read only) during control RUN.**

Digits: 7 digits

Data range: 0: No decimal place
1: One decimal place
2: Two decimal places

Factory set value: Input 1_integral/derivative time decimal point position selection: 2
Input 2_integral/derivative time decimal point position selection: 2

Related parameters: Integral time (P. 116), Derivative time (P. 116)

Input 1_derivative gain	RKC communication identifier	DG
	Modbus register address	Low-order: 0292H (658) High-order: 0293H (659)
Input 2_derivative gain	RKC communication identifier	DJ
	Modbus register address	Low-order: 02ACH (684) High-order: 02ADH (685)

Use to set a gain used for derivative action in PID control. Derivative gain should not be changed under ordinary operation.

Attribute: R/W (Read and Write)

📖 **This item becomes RO (Read only) during control RUN.**

Digits: 7 digits

Data range: 0.1 to 10.0

Factory set value: Input 1_derivative gain: 6.0
Input 2_derivative gain: 6.0

📖 Under ordinary operation, it is not necessary to change Derivative gain set value.

Input 1_ON/OFF action differential gap (upper)	RKC communication identifier	IV
	Modbus register address	Low-order: 0294H (660) High-order: 0295H (661)
Input 2_ON/OFF action differential gap (upper)	RKC communication identifier	IX
	Modbus register address	Low-order: 02AEH (686) High-order: 02AFH (687)

Use to set the ON/OFF control differential gap (upper).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0 to Input span

Factory set value: Input 1_ON/OFF action differential gap (upper):

Pressure sensor input: 1.0 MPa

Voltage (V)/current (I) inputs: 0.1 % of input span

Input 2_ON/OFF action differential gap (upper):

Thermocouple (TC) /RTD inputs: 1.0 °C [°F]

Voltage (V)/current (I) inputs: 0.1 % of input span

Related parameters: ON/OFF action differential gap (lower) (P. 171)

ON/OFF Action Differential Gap:

See the ON/OFF action differential gap (lower).

Input 1_ON/OFF action differential gap (lower)	RKC communication identifier	IW
	Modbus register address	Low-order: 296H (662) High-order: 0297H (663)
Input 2_ON/OFF action differential gap (lower)	RKC communication identifier	IY
	Modbus register address	Low-order: 02B0H (688) High-order: 02B1H (689)

Use to set the ON/OFF control differential gap (lower).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0 to Input span

Factory set value: Input 1_ON/OFF action differential gap (lower):

Pressure sensor input: 1.0 MPa

Voltage (V)/current (I) inputs: 0.1 % of input span

Input 2_ON/OFF action differential gap (lower):

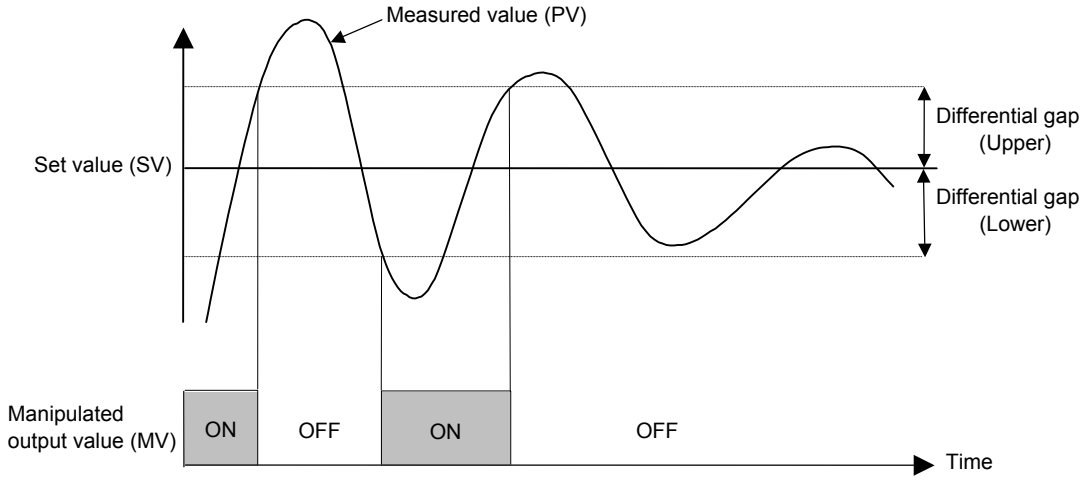
Thermocouple (TC) /RTD inputs: 1.0 °C [°F]

Voltage (V)/current (I) inputs: 0.1 % of input span

Related parameters: ON/OFF action differential gap (upper) (P. 170)

ON/OFF Action Differential Gap:

ON/OFF control is possible when the proportional band is set to "0" or "0.0." In ON/OFF control with Reverse action, when the measured value (PV) is smaller than the set value (SV), the manipulated output (MV) is 100 % or ON. When the PV is higher than the SV, the MV is 0 % or OFF. Differential gap setting prevents control output from repeating ON and OFF too frequently.



Input 1_ action at input error (high)	RKC communication identifier	WH
	Modbus register address	Low-order: 0298H (664) High-order: 0299H (665)
Input 2_ action at input error (high)	RKC communication identifier	WX
	Modbus register address	Low-order: 02B2H (690) High-order: 02B3H (691)

Use to select the action when the measured value reaches the input error determination point (high).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

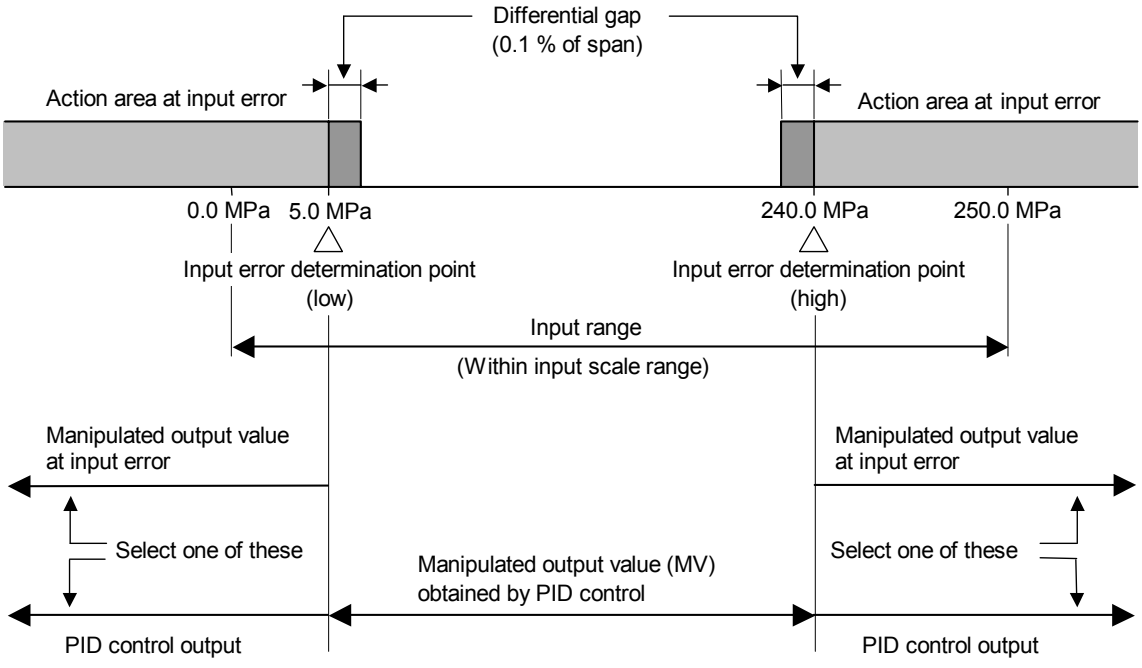
Data range: 0: Normal control
1: Manipulated Output Value at Input Error

Factory set value: Input 1_action at input error (high): 0
Input 2_action at input error (high): 0

Related parameters: Input error determination point (high) (P. 142),
Manipulated output value at input error (P. 173)

Input Error Determination:

Example: Input range: 0.0 to 250.0 MPa
Input error determination point (high): 240.0 MPa
Input error determination point (low): 5.0 MPa



Input 1_action at input error (low)	RKC communication identifier	WL
	Modbus register address	Low-order: 029AH (666) High-order: 029BH (667)
Input 2_action at input error (low)	RKC communication identifier	WY
	Modbus register address	Low-order: 02B4H (692) High-order: 02B5H (693)

Use to select the action when the measured value reaches the input error determination point (low).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: Normal control
1: Manipulated Output Value at Input Error
Factory set value: Input 1_action at input error (low): 0
Input 2_action at input error (low): 0
Related parameters: Input error determination point (low) (P. 143),
Manipulated output value at input error (P. 173)
Input Error Determination:
See the action at input error (high).

Input 1_manipulated output value at input error	RKC communication identifier	OE
	Modbus register address	Low-order: 029CH (668) High-order: 029DH (669)
Input 2_manipulated output value at input error	RKC communication identifier	OF
	Modbus register address	Low-order: 02B6H (694) High-order: 02B7H (695)

When the measured value reaches Input Error Determination Point and Action at Input Error is set to "1," this manipulated value is output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: –5.0 to +105.0 %
Factory set value: Input 1_manipulated output value at input error: –5.0
Input 2_manipulated output value at input error: –5.0
Related parameters: Input error determination point (high) (P. 142),
Input error determination point (low) (P. 143),
Action at input error (high) (P. 172), Action at input error (low) (P. 173)

Input 1_output change rate limiter (up)	RKC communication identifier	PH
	Modbus register address	Low-order: 029EH (670) High-order: 029FH (671)
Input 2_output change rate limiter (up)	RKC communication identifier	PX
	Modbus register address	Low-order: 02B8H (696) High-order: 02B9H (697)

Use to set the output change rate limiter (upward side) to limit of the variation of output is set.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0.0 to 1000.0 %/second
0.0: OFF (Unused)

Factory set value: Input 1_output change rate limiter (up): 0.0
Input 2_output change rate limiter (up): 0.0

Related parameters: Output change rate limiter (down) (P. 174), Output limiter (high) (P. 176), Output limiter (low) (P. 176)

Output Change Rate Limiter:
See the next page.

Input 1_ output change rate limiter (down)	RKC communication identifier	PL
	Modbus register address	Low-order: 02A0H (672) High-order: 02A1H (673)
Input 2_ output change rate limiter (down)	RKC communication identifier	PY
	Modbus register address	Low-order: 02BAH (698) High-order: 02BBH (699)

Use to set the output change rate limiter (down).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0.0 to 1000.0 %/second
0.0: OFF (Unused)

Factory set value: Input 1_output change rate limiter (down): 0.0
Input 2_output change rate limiter (down): 0.0

Related parameters: Output change rate limiter (up) (P. 174), Output limiter (high) (P. 176), Output limiter (low) (P. 176)

Output Change Rate Limiter:
See the next page.

Continued on the next page.

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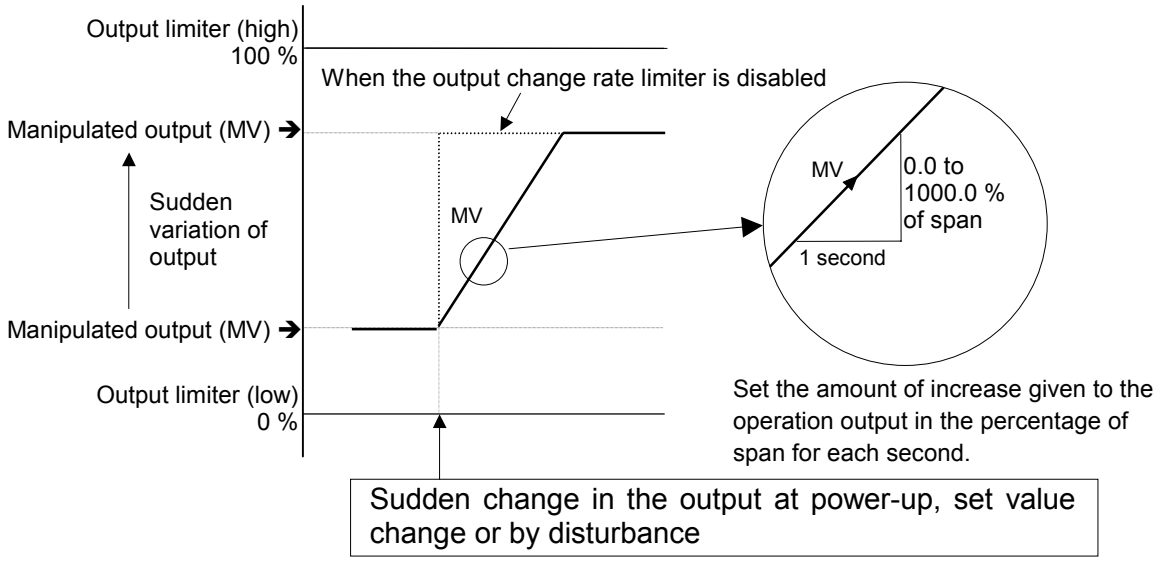
Output Change Rate Limiter:

The output change rate limiter limits the variation of manipulated output (MV) per second. This function is suitable for an application in which a sudden MV change is not acceptable.

[Example]

The output change rate limiter is effective

- The MV reaches 100 % when the power is turned on to the controller and such a sudden output change is not acceptable in the application.
- A sudden output change occurs at the SV change and it is not acceptable in the application.



The output changes at specific rates set by Output Change Rate Limiter (up) even under the situations where a sudden output change would occur without Output Change Rate Limiter function. There is also independent Output Change Rate Limiter (down).

- If the Output Change Rate is set smaller, it will cause slow control response and affect Derivative action.
- When the Output Change Rate Limiter is used, you may not be able to obtain appropriate PID constants by autotuning.
- The Output Change Rate Limiter is particularly effective when a sudden MV change may create uncontrollable situation cause a large current flow. Also, it is very effective current output or voltage output is used as control output.

Input 1_output limiter (high)	RKC communication identifier	OH
	Modbus register address	Low-order: 02A2H (674) High-order: 02A3H (675)
Input 2_output limiter (high)	RKC communication identifier	OX
	Modbus register address	Low-order: 02BCH (700) High-order: 02BDH (701)

Use to set the high limit value of manipulated output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: Output limiter (low) to 105.0 %
Factory set value: Input 1_output limiter (high): 105.0
Input 2_output limiter (high): 105.0
Related parameters: Output change rate limiter (up) (P. 174),
Output change rate limiter (down) (P. 174), Output limiter (low) (P. 176)

Input 1_output limiter (low)	RKC communication identifier	OL
	Modbus register address	Low-order: 02A4H (676) High-order: 02A5H (677)
Input 2_output limiter (low)	RKC communication identifier	OY
	Modbus register address	Low-order: 02BEH (702) High-order: 02BFH (703)

Use to set the low limit value of manipulated output.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: –5.0 % to Output limiter (high)
Factory set value: Input 1_output limiter (low): –5.0
Input 2_output limiter (low): –5.0
Related parameters: Output change rate limiter (up) (P. 174),
Output change rate limiter (down) (P. 174), Output limiter (high) (P. 176)

Input 1_AT bias	RKC communication identifier	GB
	Modbus register address	Low-order: 02C2H (706) High-order: 02C3H (707)
Input 2_AT bias	RKC communication identifier	GA
	Modbus register address	Low-order: 02C8H (712) High-order: 02C9H (713)

Use to set a bias to move the set value only when autotuning is activated.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: –Input span to +Input span

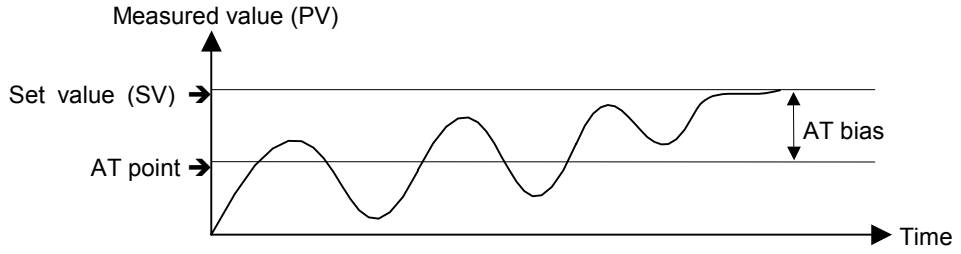
Factory set value: Input 1_AT bias: 0
Input 2_AT bias: 0

Related parameters: PID/AT transfer (P. 107)

Functional description:

The AT bias is used to prevent overshoot during autotuning in the application which does not allow overshoot even during autotuning. RKC autotuning method uses ON/OFF control at the set value to calculate the PID values. However, if overshoot is a concern during autotuning, the desired AT bias should be set to lower the set point during autotuning so that overshoot is prevented.

Example: When AT bias is set to the minus (–) side



Input 1_AT cycle	RKC communication identifier	G3
	Modbus register address	Low-order: 02C4H (708) High-order: 02C5H (709)
Input 2_AT cycle	RKC communication identifier	G2
	Modbus register address	Low-order: 02CAH (714) High-order: 02CBH (715)

Use to select the number of ON/OFF cycles used to calculate PID values during autotuning.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

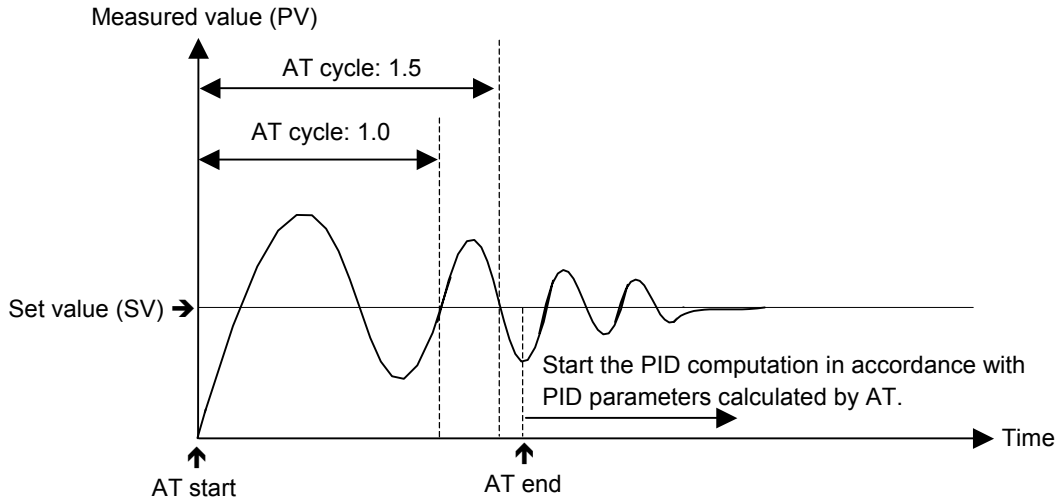
Digits: 7 digits

Data range: 0: 1.5 cycles
1: 2.0 cycles
2: 2.5 cycles
3: 3.0 cycles

Factory set value: Input 1_AT cycle: 1
Input 2_AT cycle: 1

Related parameters: PID/AT transfer (P. 107)

Example: When the AT cycle is set to 1.5 cycle and the autotuning (AT) function is executed just after the power is turned on.



Input 1_AT differential gap time	RKC communication identifier	GH
	Modbus register address	Low-order: 02C6H (710) High-order: 02C7H (711)
Input 2_AT differential gap time	RKC communication identifier	GG
	Modbus register address	Low-order: 02CCH (716) High-order: 02CDH (717)

Use to set an ON/OFF action differential gap time for autotuning. This function prevents the AT function from malfunctioning caused by noise.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0.00 to 50.00 seconds

Factory set value: Input 1_AT differential gap time: 0.10
Input 2_AT differential gap time: 0.10

Related parameters: PID/AT transfer (P. 107)

Functional description:

In order to prevent the output from chattering due to the fluctuation of a measured value (PV) caused by noise during autotuning, the output on or off state is held until "AT differential gap time" has passed after the output on/off state is changed to the other. Set "AT differential gap time" to "1/100 × Time required for temperature rise."

Continued on the next page.

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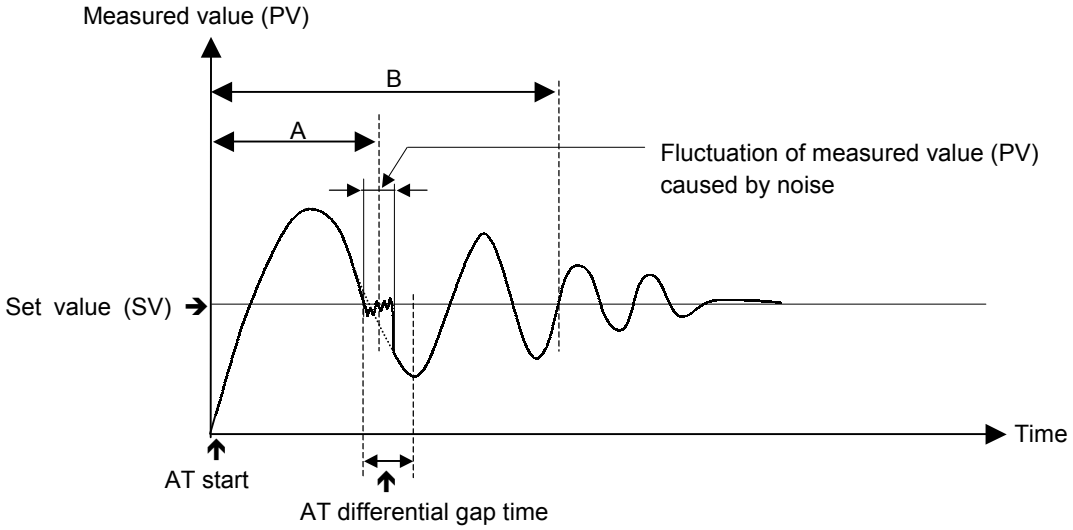
Example:

A: AT cycle time when the AT differential gap time is set to 0.00 second
The output chatters due to the fluctuation of the measured value (PV) caused by noise, and autotuning function is not able to monitor appropriate cycles to calculate suitable PID values.

B: AT cycle time when the AT differential gap time is set to "Time corresponding to 0.25 cycles."
The fluctuation of a measured value (PV) caused by noise is ignored and as a result autotuning function is able to monitor appropriate cycles to calculate suitable PID values.



The factory set value of the AT cycle is 2 cycles.

Setting change rate limiter unit time	RKC communication identifier	HU
	Modbus register address	Low-order: 02D6H (726) High-order: 02D7H (727)

Set the time unit for Setting Change Rate Limiter (UP/DOWN).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 1 to 3600 seconds

Factory set value: 60

Related parameters: Setting change rate limiter (up/down) (P. 118)

Soak time unit selection	RKC communication identifier	RU
	Modbus register address	Low-order: 02D8H (728) High-order: 02D9H (729)

Use to select the time unit for Area Soak Time.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds
2: 0 minutes 00.00 seconds to 9 minutes 59.99 seconds

Factory set value: 2

Related parameters: Area soak time (P. 120)

Input 1_setting limiter (high)	RKC communication identifier	SH
	Modbus register address	Low-order: 02DAH (730) High-order: 02DBH (731)
Input 2_setting limiter (high)	RKC communication identifier	ST
	Modbus register address	Low-order: 02DEH (734) High-order: 02DFH (735)

Use to set a high limit of the set value.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

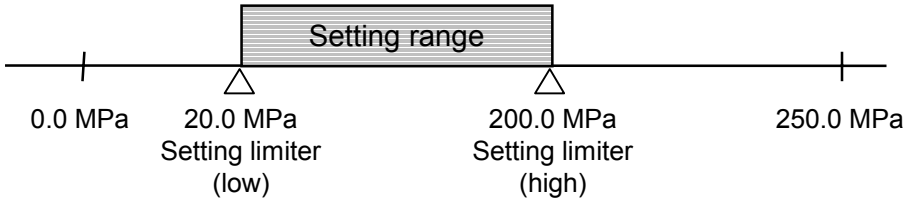
Data range: Setting limiter (low) to Input scale high

Factory set value: Input 1_setting limiter (high): Input 1_input scale high
Input 2_setting limiter (high): Input 2_input scale high

Related parameters: Decimal point position (P. 139), Input scale high (P. 140), Setting limiter (low) (P. 183)

Setting Limiter: Setting Limiter is to set the range of the set value (SV).

Example: The input range (input scale range) is from 0.0 to 250.0 MPa, the setting limiter (high) is 200.0 MPa, and the setting limiter (low) is 20.0 MPa.



Input 1_setting limiter (low)	RKC communication identifier	SL
	Modbus register address	Low-order: 02DCH (732) High-order: 02DDH (733)
Input 2_setting limiter (low)	RKC communication identifier	SU
	Modbus register address	Low-order: 02E0H (736) High-order: 02E1H (737)

Use to set a low limit of the set value.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: Input scale low to Setting limiter (high)

Factory set value: Input 1_setting limiter (low): Input 1_input scale low
Input 2_setting limiter (low): Input 2_input scale low

Related parameters: Decimal point position (P. 139), Input scale low (P. 141), Setting limiter (high) (P. 182)

Functional description:

See the setting limiter (high).

ROM version display	RKC communication identifier	VR
	Modbus register address	Low-order: 02E2H (738) High-order: 02E3H (739)

This value is a version of the ROM loaded on the controller.

Attribute: RO (Read only)
Digits: 7 digits
Data range: Display the version of loading software.
Factory set value: —

Integrated operating time display	RKC communication identifier	UT
	Modbus register address	Low-order: 02E4H (740) High-order: 02E5H (741)

This value is an integrated operating time of the controller.

Attribute: RO (Read only)
Digits: 7 digits
Data range: 0 to 99999 hours
Factory set value: —

Holding peak value ambient temperature display	RKC communication identifier	Hp
	Modbus register address	Low-order: 02E6H (742) High-order: 02E7H (743)

This value is a maximum ambient temperature on the rear terminal board of the instrument.

Attribute: RO (Read only)
Digits: 7 digits
Data range: −10.0 to +100.0 °C
Factory set value: —

Alarm lamp lighting condition setting	RKC communication identifier	LY
	Modbus register address	Low-order: 02F8 (760) High-order: 02F9 (761)

Use to set an alarm (ALM) lamp lighting conditions to Event 1 to Event 4.

Attribute: R/W (Read and Write)

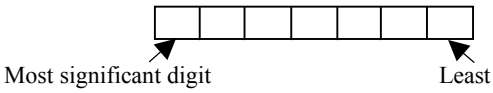
This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: **RKC communication:** ASCII code data of 7 digits

The alarm lamp lighting condition setting is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit — Least significant digit

[Alarm lamp lighting condition setting]
Least significant digit: Event 1
2nd digit: Event 2
3rd digit: Event 3
4th digit: Event 4
5th digit to Most significant digit: Unused

Data:
0: ALM lamp is not lit
1: ALM lamp is lit

MODBUS* : 0 to 15 (bit data)

Bit image: 0000

bit 3 bit 0

[Alarm lamp lighting condition setting 1]
bit 0: Event 1
bit 1: Event 2
bit 2: Event 3
bit 3: Event 4
bit 4 to bit 31: Unused

Bit data:
0: ALM lamp is not lit
1: ALM lamp is lit

* The alarm lamp lighting condition setting is assigned as a bit image in binary numbers.

Factory set value: Event 1 to Event 4: 1 (ALM lamp is lit)

Related parameters: Output logic selection (P. 149), Output timer setting (P. 151), Event type selection (P. 156)

The alarm lamp is lit through the *OR* operation of Event 1 to Event 4 each of which is set to "1: ALM lamp is lit."

Input 1_PV1 hold function	RKC communication identifier	HT
	Modbus register address	Low-order: 02FC (764) High-order: 02FD (765)
Input 2_PV2 hold function	RKC communication identifier	FT
	Modbus register address	Low-order: 02FE (766) High-order: 02FF (767)

Use to select Use/Unuse of the peak hold/bottom hold function for a measured value (PV).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: Unused
1: Used
Factory set value: Input 1_PV1 hold function: 0
Input 2_PV2 hold function: 0
Related parameters: PV1/PV2 peak hold value monitor (P. 128),
PV1/PV2 bottom hold value monitor (P. 129),
PV1/PV2 hold reset (P. 130)

Gain setting	RKC communication identifier	OG
	Modbus register address	Low-order: 0300 (768) High-order: 0301 (769)

Use to set the gain of the pressure sensor.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0.500 to 4.000 mV/V
Factory set value: CZ-100P, CZ-200P: 1.500 mV/V
CZ-GP100 (without amplifier),
the other strain gauge type sensors: 3.330 mV/V

- **CZ-100P, CZ-200P, CZ-GP100 (without amplifier):**
  Set the rated output value (mV/V) engraved on the rated nameplate attached to the pressure sensor housing.

(Example of the rated nameplate)

Continued on the next page.

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The rated output value (mV/V) of the CZ-100P/CZ-200P is when the cable is at a length of 5 m. If the cable is extended, correct the rated output value using the following equation. Set the correction value thus calculated to "Gain setting (OG)."

Correction equation: $e1 = e2\ (1 + K \cdot L) \longrightarrow e2 = \dfrac{e1}{1 + K \cdot L}$

e1: Rated output in standard-cable length 5 m (mV/V is described on the nameplate of the sensor)
e2: Rated output after extension
K: Correction factor* 1.96×10^{-4}/m [Non-explosionproof specification type],
1.40×10^{-4}/m [Explosionproof specification type]
* When using 0.5 $mm^2 \times$ 4-core shielded cable (standard-cable) or equal.
L: Extended cable length (m)

● **Strain gauge type sensor other than CZ-100P, CZ-200P and CZ-GP100:**
Set the rated output value (mV/V). The rated output value depends on the sensors, refer to the instruction manual for each sensor being used.

Linearize type selection	RKC communication identifier	LI
	Modbus register address	Low-order: 0302 (770) High-order: 0303 (771)

Use to select the linearizing type of our pressure sensor CZ-100P/CZ-200P.

Attribute: R/W (Read and Write)

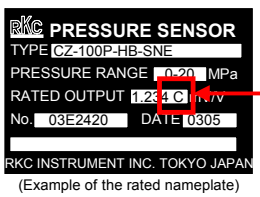
This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: Unused
1 to 20: Used

[Linearizing type selection table]

Set Value	Linearzing type symbol	Set Value	Linearzing type symbol	Set Value	Linearzing type symbol
0	No symbol	7	J	14	S
1	C	8	K	15	T
2	D	9	L	16	U
3	E	10	M	17	V
4	F	11	P	18	W
5	G	12	Q	19	X
6	H	13	R	20	Y

Select the linearizing type symbol engraved on the rated nameplate attached to the CZ-100P or CZ-200P housing.



(Example of the rated nameplate)

The symbol described at the end of the rated output value denotes the linearizing type.
In the example at the left, "C" is the symbol of denoting the linearizing type.

This setting does not used to our CZ-GP100 and the other strain gauge type sensors. Set it to "0" fixed.

Factory set value: 0

Shunt resistance output value	RKC communication identifier	OR
	Modbus register address	Low-order: 0304 (772) High-order: 0305 (773)

When our CZ-GP100 (without amplifier) or the other strain gauge type sensors is used, it is set "What percentage of the rated output" is output when the full scale point of the Input 1_measured value (PV1) is adjusted by Auto calibration.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 40.0 to 100.0 %
Factory set value: 80.0

For details of the shunt resistance output value, refer to Instruction Manual for each sensor being used.

Input 1_PV transfer function	RKC communication identifier	TS
	Modbus register address	Low-order: 0306 (774) High-order: 0307 (775)
Input 2_PV transfer function	RKC communication identifier	US
	Modbus register address	Low-order: 0308 (776) High-order: 0309 (777)

It is selected whether or not PV with the control mode transferred to Auto control from Manual control is used as SV. It is possible to prevent a manipulated output value (MV) from its sudden change by substituting PV for SV.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: Unused
1: Used
Factory set value: Input 1_PV transfer function: 0
Input 2_PV transfer function: 0
Related parameters: Input 1_Auto/Manual transfer (P. 109),
Input 2_Auto/Manual transfer (P. 109)

MV scaling high	RKC communication identifier	RH
	Modbus register address	Low-order: 030A (778) High-order: 030B (779)

This value is to set the high limit value of MV scaling monitor value.
Set the motor RPM when MV1 = 100 %.

Attribute: R/W (Read and Write)

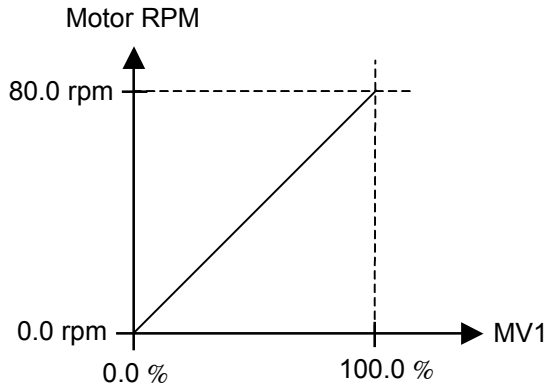
This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: −1999.9 to +9999.9
Factory set value: 100.0
Related parameters: MV scaling low (P. 190), Decimal point position of MV scaling (P.190)
MV Scaling Function: The MV Scaling function is used to make scaling of manipulated output value 1 (MV1) from 0 to 100 % between the high and low MV scaling limits as the RPM of extruder's main motor.

MV scaling high: Sets the value corresponding to the RPM of extruder's main motor at the high limit of control output.
Setting range: −1999.9 to +9999.9

MV scaling low: Sets the value corresponding to the RPM of extruder's main motor at the low limit of control output.
Setting range: −1999.9 to +9999.9

[Example] MV1 = If the motor RPM is set to 80.0 rpm when MV1 = 100.0 %
Decimal point position of MV scaling: One decimal place
MV scaling high (MV1 = 0.0 %): 0.0 rpm
MV scaling high (MV1 = 100.0 %): 80.0 rpm



MV scaling low	RKC communication identifier	RL
	Modbus register address	Low-order: 030C (780) High-order: 030D (781)

This value is to set the low limit value of MV scaling monitor value.
Set the motor RPM when MV1 = 0 %.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: –1999.9 to +9999.9
Factory set value: 0.0
Related parameters: MV scaling high (P. 189), Decimal point position of MV scaling (P.190)
MV Scaling Function: See the MV scaling high.

Decimal point position of MV scaling	RKC communication identifier	RP
	Modbus register address	Low-order: 030E (782) High-order: 030F (783)

Use to select the decimal point position of the MV scaling function.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits
Data range: 0: No decimal place
1: One decimal place
2: Two decimal places
3: Three decimal places
4: Four decimal places
Factory set value: 1
Related parameters: MV scaling high (P.189), MV scaling low (P.190)

Input 1_AT action	RKC communication identifier	JI
	Modbus register address	Low-order: 0310 (784) High-order: 0311 (785)
Input 2_AT action	RKC communication identifier	JJ
	Modbus register address	Low-order: 0312 (786) High-order: 0313 (787)

Use to select the auto-tuning (AT) function.

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: AT function (PID)
(AT result is reflected to derivative time.)
1: AT function (PI)
(no AT result is reflected to derivative time.)
2: No AT function

Factory set value: Input 1_AT action: Pressure sensor input: 2
Input 2_AT action: TC/RTD/Voltage/current input: 2

Input 1_Manipulated output value when transferred to Auto from Manual	RKC communication identifier	OI
	Modbus register address	Low-order: 0314 (788) High-order: 0315 (789)
Input 2_Manipulated output value when transferred to Auto from Manual	RKC communication identifier	OJ
	Modbus register address	Low-order: 0316 (790) High-order: 0317 (791)

This is the final manipulated output value used under Manual control when the control mode is transferred to Auto control from Manual control.

Attribute: RO (Read only)
Digits: 7 digits
Data range: −5.0 to +105.0 %
Factory set value: —
Related parameters: Input 1_ MV transfer function (P. 194),
Input 2_ MV transfer function (P. 194)

This manipulated output value is used as a manipulated output value under Manual control when transferred to Manual control from Auto control for event input with “MV transfer function provided” selected.

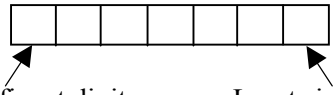
Interlock function	RKC communication identifier	QA
	Modbus register address	Low-order: 0318 (792) High-order: 0319 (793)

Use to select the interlock function to output 1 (OUT1) to output 5 (OUT5).

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: **RKC communication:** ASCII code data of 7 digits

The interlock function selection is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit·····Least significant digit

Data 0: Unused
1: Used

Least significant digit: OUT1
2nd digit: OUT2
3th digit: OUT3
4th digit: OUT4
5th digit: OUT5
6th digit to Most significant digit: Unused

Modbus: 0 to 31 (bit data)

The interlock function selection is assigned as a bit image in binary numbers.

Bit image: 00000

bit 4 bit 0

bit 0: OUT1
bit 1: OUT2
bit 2: OUT3
bit 3: OUT4
bit 4: OUT5
bit 5 to bit 31: Unused

Bit data 0: Unused 1: Used

Continued on the next page.

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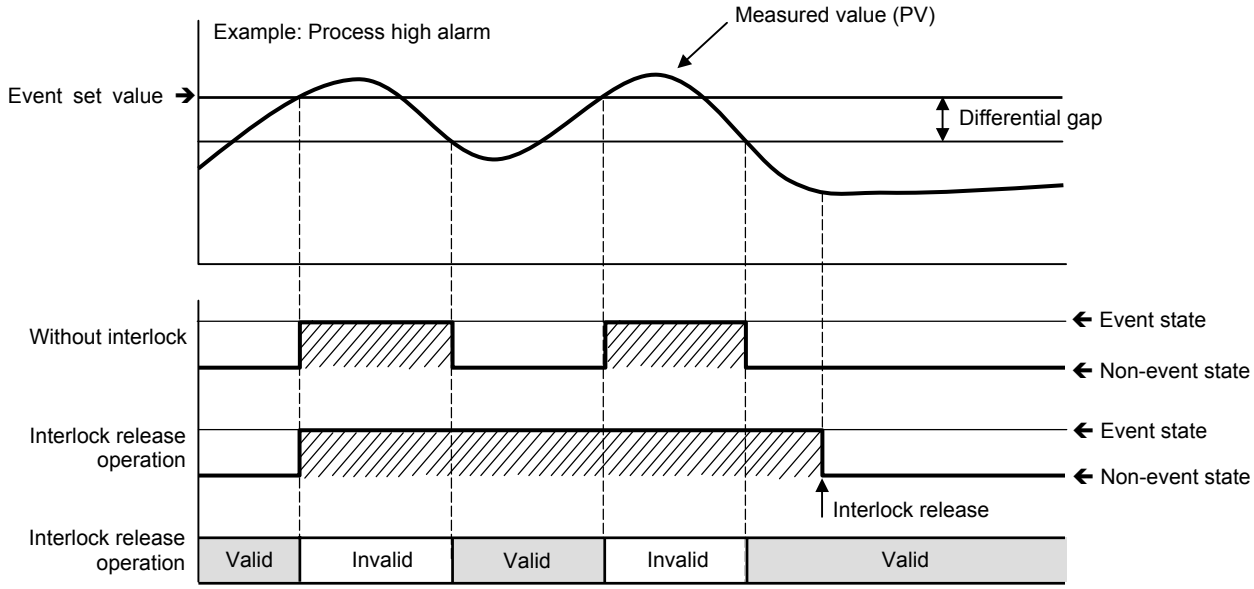
Factory set value: 0
Related parameters: Interlock release (P. 131)
Interlock Function Selection:

The interlock action holds the event state even if the measured value is out of the event zone after it enters the event zone once. This interlock is released through key operation, event input (option), or communication (option).



- The interlock function is released for any of the following.
  - When the power is turn on. (However, the interlock becomes ON when set to the event state simultaneously with the control started.)
  - When the control is stopped.
- Burnout results in the event state and also activating the interlock function.

Input 1_MV transfer function	RKC communication identifier	OT
	Modbus register address	Low-order: 031A (794) High-order: 031B (795)
Input 2_MV transfer function	RKC communication identifier	OU
	Modbus register address	Low-order: 031C (796) High-order: 031D (797)

The final Manipulated output value (MV) used under Manual control with the control mode transferred to Auto control from Manual control is stored to the Manipulated output value (**ON**) when transferred to Auto control from Manual control. It is selected whether or not this Manipulated output value (MV) is used only as a Manipulated output value (MV) under Manual control when transferred to Manual control from Auto control for event input (DI).

Attribute: R/W (Read and Write)

This item becomes RO (Read only) during control RUN.

Digits: 7 digits

Data range: 0: Unused
1: Used

Factory set value: Input 1_MV transfer function: 0
Input 2_MV transfer function: 0

Related parameters: Input 1_Manipulated output value when transferred to Auto from Manual (P. 191),
Input 2_Manipulated output value when transferred to Auto from Manual (P. 191)

This function does not act as an original function when transferred to Manual control from Auto control through transfer operation by the direct key or on the operation mode screen.

Items relating to the memory area other than the control area:

Register addresses (0500H to 0535H) are used for checked and changed the set value relating to the memory area other than the control area.

Memory area selection	RKC communication identifier	ZA
	Modbus register address	Low-order: 0500H (1280) High-order: 0501H (1281)

This item specifies a number of the memory area other than the control area.

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 1 to 16
Factory set value: 1

Event 1 set value	RKC communication identifier	A1
	Modbus register address	Low-order: 0502H (1282) High-order: 0503H (1283)
Event 2 set value	RKC communication identifier	A2
	Modbus register address	Low-order: 0504H (1284) High-order: 0505H (1285)
Event 3 set value	RKC communication identifier	A3
	Modbus register address	Low-order: 0506H (1286) High-order: 0507H (1287)
Event 4 set value	RKC communication identifier	A4
	Modbus register address	Low-order: 050CH (1292) High-order: 050DH (1293)

Event 1 through Event 4 are set values of the event action.

Attribute: R/W (Read and Write)

The event 3 set value (A3) becomes RO (Read only) when it was selected "9: Control loop break alarm (LBA) " from the event 3 type selection (XC).

The event 4 set value (A4) becomes RO (Read only) when it was selected "9: Control loop break alarm (LBA) " from the event 4 type selection (XD).

Continued on the next page.

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Digits: 7 digits
Data range: Deviation: –Input span to +Input span
Process: Input scale low to Input scale high
SV: Input scale low to Input scale high
Factory set value: 50.0
Related parameters: Event state (P. 103), Event type selection (P. 156), Event hold action (P. 159), Event differential gap (P. 161), Event action at input error (P. 163), Event assignment (P. 165)

Control loop break alarm 1 (LBA1) time	RKC communication identifier	A5
	Modbus register address	Low-order: 0508H (1288) High-order: 0509H (1289)
Control loop break alarm 2 (LBA2) time	RKC communication identifier	A6
	Modbus register address	Low-order: 050EH (1294) High-order: 050FH (1295)

The LBA time sets the time required for the LBA function to determine there is a loop failure. When the LBA is output (under alarm status), the LBA function still monitors the measured value (PV) variation at an interval of the LBA time.

Attribute: R/W (Read and Write)

The control loop break alarm 1 (LBA1) time (A5) becomes RO (Read only) when it was selected "1 to 8" from the event 3 type selection (XC).

The control loop break alarm 2 (LBA2) time (A6) becomes RO (Read only) when it was selected "1 to 8" from the event 4 type selection (XD).

Digits: 7 digits
Data range: 0 to 7200 seconds (0: Unused)
Factory set value: 480
Related parameters: Event state (P. 103), Event assignment (P. 165), LBA deadband (P. 112)

LBA1 deadband	RKC communication identifier	N1
	Modbus register address	Low-order: 050AH (1290) High-order: 050BH (1291)
LBA2 deadband	RKC communication identifier	N2
	Modbus register address	Low-order: 0510H (1296) High-order: 0511H (1297)

The LBA deadband gives a neutral zone to prevent the control loop break alarm (LBA) from malfunctioning caused by disturbance.

Attribute: R/W (Read and Write)

📖 **The LBA1 deadband (N1) becomes RO (Read only) when it was selected "1 to 8" from the event 3 type selection (XC).**

📖 **The LBA2 deadband (N2) becomes RO (Read only) when it was selected "1 to 8" from the event 4 type selection (XD).**

Digits: 7 digits
Data range: 0.0 to Input span
Factory set value: 0.0
Related parameters: Event state (P. 103), Event assignment (P. 165), Control loop break alarm (LBA) time (P. 112)

Input 1_set value (SV1)	RKC communication identifier	S1
	Modbus register address	Low-order: 0512H (1298) High-order: 0513H (1299)
Input 2_set value (SV2)	RKC communication identifier	S0
	Modbus register address	Low-order: 051EH (1310) High-order: 051FH (1311)

The set value (SV) is a desired value of the control.

Attribute: R/W (Read and Write)

📖 **The Input 2_set value (SV2: S0) becomes RO (Read only) for the 1-input controller.**

Digits: 7 digits
Data range: Setting limiter (low) to Setting limiter (high)
☞ See **Input range table (P. 137)**
Factory set value: Input 1_set value (SV1): 0
Input 2_set value (SV2): 0
Related parameters: Setting limiter (high) (P. 182), Setting limiter (low) (P. 183)

Input 1_proportional band	RKC communication identifier	P1
	Modbus register address	Low-order: 0514H (1300) High-order: 0515H (1301)
Input 2_proportional band	RKC communication identifier	P0
	Modbus register address	Low-order: 0520H (1312) High-order: 0521H (1313)

This value expresses a proportional band of the PI and PID control.

Attribute: R/W (Read and Write)

The Input 2_proportional band (P0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: Pressure sensor input: 0.0 to 1000.0 % of input span
TC/RTD input: 0 to Input span
Voltage/current input: 0.0 to 1000.0 % of input span
0 (0.0): ON/OFF action

Factory set value: Input 1_proportional band: 100.0
Input 2_proportional band: 30.0

Related parameters: ON/OFF action differential gap (upper) (P. 170),
ON/OFF action differential gap (lower) (P. 171)

Input 1_integral time	RKC communication identifier	I1
	Modbus register address	Low-order: 0516H (1302) High-order: 0517H (1303)
Input 2_integral time	RKC communication identifier	I0
	Modbus register address	Low-order: 0522H (1314) High-order: 0523H (1315)

Integral action is to eliminate offset between SV and PV by proportional action. The degree of Integral action is set by time in seconds.

Attribute: R/W (Read and Write)

The Input 2_integral time (I0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0 to 3600 seconds, 0.0 to 3600.0 seconds, or 0.00 to 360.00 seconds
0, 0.0 or 0.00: PD action

Factory set value: Input 1_integral time: 5.00
Input 2_integral time: 240.00

Related parameters: Integral/derivative time decimal point position selection (P. 169)

Input 1_derivative time	RKC communication identifier	D1
	Modbus register address	Low-order: 0518H (1304) High-order: 0519H (1305)
Input 2_derivative time	RKC communication identifier	D0
	Modbus register address	Low-order: 0524H (1316) High-order: 0525H (1317)

Derivative action is to prevent rippling and make control stable by monitoring output change. The degree of Derivative action is set by time in seconds.

Attribute: R/W (Read and Write)

The Input 2_derivative time (D0) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0 to 3600 seconds, 0.0 to 3600.0 seconds, or 0.00 to 360.00 seconds
0, 0.0 or 0.00: PI action
Factory set value: Input 1_derivative time: 0.00 (PI action)
Input 2_derivative time: 60.00
Related parameters: Integral/derivative time decimal point position selection (P. 169)

Input 1_control response parameter	RKC communication identifier	CA
	Modbus register address	Low-order: 051AH (1306) High-order: 051BH (1307)
Input 2_control response parameter	RKC communication identifier	C9
	Modbus register address	Low-order: 0526H (1318) High-order: 0527H (1319)

The control response for the set value (SV) change can be selected among Slow, Medium, and Fast.

Attribute: R/W (Read and Write)

The Input 2_control response parameter (C9) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits
Data range: 0: Slow
1: Medium
2: Fast
Factory set value: Input 1_control response parameter: 0
Input 2_control response parameter: 0

Input 1_ setting change rate limiter (up)	RKC communication identifier	HH
	Modbus register address	Low-order: 052AH (1322) High-order: 052BH (1323)
Input 2_ setting change rate limiter (up)	RKC communication identifier	HX
	Modbus register address	Low-order: 052EH (1326) High-order: 052FH (1327)

This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV).

Attribute: R/W (Read and Write)

The Input 2_setting change rate limiter up (HX) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0.0 to Input span/unit time * * Unit time: 60 seconds (factory set value)
0.0: OFF (Unused)

Factory set value: Input 1_setting change rate limiter (up): 0.0
Input 2_setting change rate limiter (up): 0.0

Related parameters: Setting change rate limiter unit time (P. 181)

Input 1_ setting change rate limiter (down)	RKC communication identifier	HL
	Modbus register address	Low-order: 052CH (1324) High-order: 052DH (1325)
Input 2_ setting change rate limiter (down)	RKC communication identifier	HY
	Modbus register address	Low-order: 0530H (1328) High-order: 0531H (1329)

This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV).

Attribute: R/W (Read and Write)

The Input 2_setting change rate limiter down (HY) becomes RO (Read only) for the 1-input controller.

Digits: 7 digits

Data range: 0.1 to Input span/unit time * * Unit time: 60 seconds (factory set value)
0.0: OFF (Unused)

Factory set value: Input 1_setting change rate limiter (down): 0.0
Input 2_setting change rate limiter (down): 0.0

Related parameters: Setting change rate limiter unit time (P. 181)

Area soak time	RKC communication identifier	TM
	Modbus register address	Low-order: 0532H (1330) High-order: 0533H (1331)

Area Soak Time is used for ramp/soak control function in conjunction with Link Area Number and Setting Change Rate Limiter (up/down). (see P. 118)

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0 minute 00.00 second to 9 minutes 59.99 seconds, or
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds
Factory set value: 0.00.00 (0 minute 00.00 second to 9 minute 59.99 seconds)
Related parameters: Soak time unit selection (P. 181)

Link area number	RKC communication identifier	LP
	Modbus register address	Low-order: 0534H (1332) High-order: 0535H (1333)

Link Area Number is used for ramp/soak control function in conjunction with Area Soak Time and Setting Change Rate Limiter (up/down) (see P. 118)

Attribute: R/W (Read and Write)
Digits: 7 digits
Data range: 0 to 16
0: OFF (No link)
Factory set value: 0

The area soak time for the memory area linked last becomes invalid to continue the state of the set value (SV) reached.

8. 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 cannot 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	

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

■ Modbus

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	
	A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message	Re-transmit after time-out occurs or verify communication program
	The time interval between adjacent data in the query message is too long, exceeding 24 bit's time	
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When any address other than 0000H to 00ADH, 0200H to 031DH, and 0500H to 0535H are specified	Confirm the address of holding register
Error code 3	When the specified number of data items in the query message exceeds the maximum number of data items available	Confirm the setting data
Error code 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, please contact RKC sales office or the agent.

9. ASCII 7-BIT CODE TABLE

This table is only for use with RKC communication.

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

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