Digital Controller

HA400/HA900
HA401/HA901

Communication Instruction Manual
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.
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

Digital Controller HA400/HA900/HA401/HA901 (hereafter, called controller) interfaces with the host computer via Modbus or RKC communication protocols. In addition, the controller has two communication ports, 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**
  
  ![Multi-drop connection Diagram](image)

- **Point-to-point connection**
  
  ![Point-to-point connection Diagram](image)

- **Usage example of two communication ports**
  
  ![Usage example Diagram](image)
2. SPECIFICATIONS

RKC communication

Interface: Communication 1: Based on RS-485, EIA standard
Based on RS-232C, EIA standard
Communication 2: Based on RS-485, EIA standard
Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
Specify the communication 1 and communication 2 separately 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

<table>
<thead>
<tr>
<th>Signal voltage</th>
<th>Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (A) − V (B) ≥ 2 V</td>
<td>0 (SPACE)</td>
</tr>
<tr>
<td>V (A) − V (B) ≤ −2 V</td>
<td>1 (MARK)</td>
</tr>
</tbody>
</table>

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

RS-232C

<table>
<thead>
<tr>
<th>Signal voltage</th>
<th>Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3 V or more</td>
<td>0 (SPACE)</td>
</tr>
<tr>
<td>−3 V or less</td>
<td>1 (MARK)</td>
</tr>
</tbody>
</table>
2. SPECIFICATIONS

- **Modbus**

  **Interface:**
  - Communication 1: Based on RS-485, EIA standard
    - Based on RS-232C, EIA standard
  - Communication 2: Based on RS-485, EIA standard
    - Based on RS-422A, EIA standard
    - Based on RS-232C, EIA standard
  
  Specify the communication 1 and communication 2 separately 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 0093H, 0200H to 02E9H, 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

<table>
<thead>
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<th>Signal voltage</th>
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<td>0 (SPACE)</td>
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<td>1 (MARK)</td>
</tr>
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Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

RS-232C

<table>
<thead>
<tr>
<th>Signal voltage</th>
<th>Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3 V or more</td>
<td>0 (SPACE)</td>
</tr>
<tr>
<td>−3 V or less</td>
<td>1 (MARK)</td>
</tr>
</tbody>
</table>
3. WIREDING

⚠️ 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 1

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

- Communication terminal number and signal details

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Signal ground</td>
<td>SG</td>
</tr>
<tr>
<td>14</td>
<td>Send data/Receive data</td>
<td>T/R (A)</td>
</tr>
<tr>
<td>15</td>
<td>Send data/Receive data</td>
<td>T/R (B)</td>
</tr>
</tbody>
</table>

- Wiring method

The cable is provided by the customer.

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

Maximum connections: 32 instruments (including a host computer)
3. WIRING

- 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

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Signal ground</td>
<td>SG</td>
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<td>T/R (A)</td>
</tr>
<tr>
<td>15</td>
<td>Send data/Receive data</td>
<td>T/R (B)</td>
</tr>
</tbody>
</table>

- Wiring method

![Wiring Diagram]

Host computer (Master)

Controller (Slave)

RS-232C

RS-485

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

Maximum connections: 32 instruments (including a host computer)

Continued on the next page.
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**

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Signal ground</td>
<td>SG (GND)</td>
</tr>
<tr>
<td>14</td>
<td>Send data</td>
<td>SD (TXD)</td>
</tr>
<tr>
<td>15</td>
<td>Receive data</td>
<td>RD (RXD)</td>
</tr>
</tbody>
</table>

**Wiring method**

Controller (Slave)  
RS-232C  
Host computer (Master)

- SG (GND)  
- SD (TXD)  
- RD (RXD)  

Communication terminals (communication 1 side)  
Number of connection: 1 instrument

* Short RS and CS within connector.

The cable is provided by the customer.
3.2 Connect the Communication 2

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

- **Communication terminal number and signal details**

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Signal ground</td>
<td>SG</td>
</tr>
<tr>
<td>26</td>
<td>Send data</td>
<td>T (A)</td>
</tr>
<tr>
<td>27</td>
<td>Send data</td>
<td>T (B)</td>
</tr>
<tr>
<td>28</td>
<td>Receive data</td>
<td>R (A)</td>
</tr>
<tr>
<td>29</td>
<td>Receive data</td>
<td>R (B)</td>
</tr>
</tbody>
</table>

- **Wiring method**

The cable is provided by the customer.
3. WIRING

- Connection to the RS-485 port of the host computer (master)
- Communication terminal number and signal details

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Signal ground</td>
<td>SG</td>
</tr>
<tr>
<td>26</td>
<td>Send data/Receive data</td>
<td>T/R (A)</td>
</tr>
<tr>
<td>27</td>
<td>Send data/Receive data</td>
<td>T/R (B)</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Signal ground</td>
<td>SG</td>
</tr>
<tr>
<td>26</td>
<td>Send data/Receive data</td>
<td>T/R (A)</td>
</tr>
<tr>
<td>27</td>
<td>Send data/Receive data</td>
<td>T/R (B)</td>
</tr>
</tbody>
</table>

#### Wiring method

**Host computer (Master)**

- RS-232C
- RS-232C/RS-485 converter

**Controller (Slave)**

- Communication terminals (communication 2 side)
  - SG 25
  - T/R (A) 26
  - T/R (B) 27

**RS-485**

- Paired wire
- Shielded twisted pair wire

**RS-232C/RS-485 converter**

- SG
- T/R (A)
- T/R (B)

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

Maximum connections: 32 instruments (including a host computer)

Continued on the next page.
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

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Signal ground</td>
<td>SG (GND)</td>
</tr>
<tr>
<td>26</td>
<td>Send data</td>
<td>SD (TXD)</td>
</tr>
<tr>
<td>27</td>
<td>Receive data</td>
<td>RD (RXD)</td>
</tr>
</tbody>
</table>

- Wiring method

The cable is provided by the customer.
3. WIRING

- **Wiring example**
  
  Connection with up to 31 controller (slaves) and one host computer (master)

![Diagram of wiring example]

- Host computer (Master)
- RS-485 or RS-422A (possible to use only when the communication 2 is selected)
- Junction terminals
- Device address (Slave address)
- Controllers (Slaves)
- 1 2 3 4
- 29 30 31
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.

- **Power ON**
- **Input Type/Input Range Display** (Display for approx. 4 seconds)
- **SV Setting & Monitor Mode**
  - Press and hold the SET key and press the shift key at the same time
  - Display changes automatically
- **Setup setting Mode** (Setting the communication parameters)
  - The set value is registered at the point of pressed the SET key

If the key is not pressed for more than one minute, the display will automatically return to the PV/SV display mode.
4. SETTING

4.1 Transfer to Setup Setting Mode

The first displayed parameter in setup setting mode varies depending on the instrument specification.

This item describes when the first displayed parameter in 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, \( I. Pb \). Press the SET key several times to change to the device address 1, \( Add1 \).

When let setup setting mode finish, press and hold the SET key and press the shift key at the same time. The display changes to the SV setting & monitor mode.

HA900/HA901 is used in the above figures for explanation, but the same setting procedures also apply to HA400/HA401.
4.2 Setting the Communication Parameters

This item describes when the communication 1 and communication 2 is used under the two input specification.

To select parameters in setup setting mode, press the SET key.
The parameters relating to communication is shown below.
- Communication 1 side: Device address 1 (slave address 1), Add1, Communication speed 1, bPS1, Data bit configuration 1, bIT1, Interval time 1, InT1.
- Communication 2 side: Device address 2 (slave address 2), Add2, Communication speed 2, bPS2, Data bit configuration 2, bIT2, Interval time 2, InT2

To be changed in the above order.

Press the SET key
4. SETTING

■ Setting procedure

Setting procedures vary depending on the communication parameter.

- Device address, Add\textsuperscript{□}, interval time, InT\textsuperscript{□} (\textsuperscript{□}: 1,2)
  Operate UP, DOWN and shift key, and input numerals.

- Communication speed, bPS\textsuperscript{□}, data bit configuration, bIT\textsuperscript{□} (\textsuperscript{□}: 1,2)
  Operate UP or DOWN key, and choose one among the displayed set value.

■ Registration of set value

The set value is registered at the point of pressed the SET key. After completing all communication parameter settings, return the SV setting & monitor mode, and communication is mode using the set value changed.

📖 Even if the UP and DOWN key are operated, the contents of the set value changed are not registered.

📖 If the register procedure is not performed for more than one minute, return the Input 1 measured value (PV1)/set value (SV1) monitor screen. In this case, the contents of the set value changed are not registered.
### Description of each parameters

#### Communication 1

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add1</td>
<td>Device address 1</td>
<td>0 to 99</td>
<td>Set it not to duplication in multi-drop connection. If the slave address is set to 0 in Modbus, two-way communication cannot be performed.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(Slave address 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bPS1</td>
<td>Communication speed 1</td>
<td>2.4: 2400 bps</td>
<td>Set the same communication speed for both the controller (slave) and the host computer (master).</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>(bPS1)</td>
<td>4.8: 4800 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.6: 9600 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>19.2: 19200 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.4: 38400 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bIT1</td>
<td>Data bit configuration 1</td>
<td>See data bit configuration table</td>
<td>Set the same data bit configuration for both the controller (slave) and the host computer (master).</td>
<td>8n1</td>
</tr>
<tr>
<td></td>
<td>(bIT1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InT1</td>
<td>Interval time 1 *</td>
<td>0 to 250 ms</td>
<td>The controller’s interval time must match the specifications of the host computer.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(InT1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Communication 2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add2</td>
<td>Device address 2</td>
<td>0 to 99</td>
<td>Set it not to duplication in multi-drop connection. If the slave address is set to 0 in Modbus, two-way communication cannot be performed.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(Slave address 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bPS2</td>
<td>Communication speed 2</td>
<td>2.4: 2400 bps</td>
<td>Set the same communication speed for both the controller (slave) and the host computer (master).</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>(bPS2)</td>
<td>4.8: 4800 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.6: 9600 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>19.2: 19200 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.4: 38400 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bIT2</td>
<td>Data bit configuration 2</td>
<td>See data bit configuration table</td>
<td>Set the same data bit configuration for both the controller (slave) and the host computer (master).</td>
<td>8n1</td>
</tr>
<tr>
<td></td>
<td>(bIT2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InT2</td>
<td>Interval time 2 *</td>
<td>0 to 250 ms</td>
<td>The controller’s interval time must match the specifications of the host computer.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(InT2)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Data bit configuration table

<table>
<thead>
<tr>
<th>Set value</th>
<th>Data bit</th>
<th>Parity bit</th>
<th>Stop bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>8n1 (8n1)</td>
<td>8</td>
<td>Without</td>
<td>1</td>
</tr>
<tr>
<td>8n2 (8n2)</td>
<td>8</td>
<td>Without</td>
<td>2</td>
</tr>
<tr>
<td>8E1 (8E1)</td>
<td>8</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>8E2 (8E2)</td>
<td>8</td>
<td>Even</td>
<td>2</td>
</tr>
<tr>
<td>8o1 (8o1)</td>
<td>8</td>
<td>Odd</td>
<td>1</td>
</tr>
<tr>
<td>8o2 (8o2)</td>
<td>8</td>
<td>Odd</td>
<td>2</td>
</tr>
<tr>
<td>7n1 (7n1)</td>
<td>7</td>
<td>Without</td>
<td>1</td>
</tr>
<tr>
<td>7n2 (7n2)</td>
<td>7</td>
<td>Without</td>
<td>2</td>
</tr>
<tr>
<td>7E1 (7E1)</td>
<td>7</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>7E2 (7E2)</td>
<td>7</td>
<td>Even</td>
<td>2</td>
</tr>
<tr>
<td>7o1 (7o1)</td>
<td>7</td>
<td>Odd</td>
<td>1</td>
</tr>
<tr>
<td>7o2 (7o2)</td>
<td>7</td>
<td>Odd</td>
<td>2</td>
</tr>
</tbody>
</table>

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 data. 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: Not settable (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 (IMR01N02-J).
### Setting procedure example

- HA900/HA901 is used in the below figures for explanation, but the same setting procedures also apply to HA400/HA401.

1. Go to the setup setting mode so that device address 1 (slave address 1), *Add1*, is displayed. Present set value is displayed, and the least significant digit light brightly.

2. Set the device address 1. Press the UP key to enter 5 at the least significant digit. Example: Setting the device address 1 (slave address 1) to 15.

3. Press the shift key to brightly light the tens digit.
4. Press the UP key to enter \( i \) at the tens digit.

5. Press the SET key to set the value thus set. The display changes to the next communication parameter. If the SET key is not pressed within 1 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)

<table>
<thead>
<tr>
<th>Procedure details</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response send time after controller receives ENQ</td>
<td>MIN 1</td>
</tr>
<tr>
<td></td>
<td>TYP 2</td>
</tr>
<tr>
<td></td>
<td>MAX 4</td>
</tr>
<tr>
<td>Response send time after controller receives ACK</td>
<td>MIN 1</td>
</tr>
<tr>
<td></td>
<td>TYP —</td>
</tr>
<tr>
<td></td>
<td>MAX 4</td>
</tr>
<tr>
<td>Response send time after controller receives NAK</td>
<td>MIN 1</td>
</tr>
<tr>
<td></td>
<td>TYP —</td>
</tr>
<tr>
<td></td>
<td>MAX 4</td>
</tr>
<tr>
<td>Response send time after controller sends BCC</td>
<td>MIN —</td>
</tr>
<tr>
<td></td>
<td>TYP —</td>
</tr>
<tr>
<td></td>
<td>MAX 1</td>
</tr>
</tbody>
</table>

### RKc communication (Selecting procedure)

<table>
<thead>
<tr>
<th>Procedure details</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response send time after controller receives BCC</td>
<td>MIN 1</td>
</tr>
<tr>
<td></td>
<td>TYP 2</td>
</tr>
<tr>
<td></td>
<td>MAX 3</td>
</tr>
<tr>
<td>Response wait time after controller sends ACK</td>
<td>MIN —</td>
</tr>
<tr>
<td></td>
<td>TYP —</td>
</tr>
<tr>
<td></td>
<td>MAX 1</td>
</tr>
<tr>
<td>Response wait time after controller sends NAK</td>
<td>MIN —</td>
</tr>
<tr>
<td></td>
<td>TYP —</td>
</tr>
<tr>
<td></td>
<td>MAX 1</td>
</tr>
</tbody>
</table>

### Modbus

<table>
<thead>
<tr>
<th>Procedure details</th>
<th>時 間</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read holding registers [03H]</td>
<td>20 ms max.</td>
</tr>
<tr>
<td>Response transmission time after the slave receives the query message</td>
<td></td>
</tr>
<tr>
<td>Preset single register [06H]</td>
<td>3 ms max.</td>
</tr>
<tr>
<td>Response transmission time after the slave receives the query message</td>
<td></td>
</tr>
<tr>
<td>Diagnostics (loopback test) [08H]</td>
<td>3 ms max.</td>
</tr>
<tr>
<td>Response transmission time after the slave receives the query message</td>
<td></td>
</tr>
<tr>
<td>Preset multiple registers [10H]</td>
<td>20 ms max.</td>
</tr>
<tr>
<td>Response transmission time after the slave receives the query message</td>
<td></td>
</tr>
</tbody>
</table>

📚 Response send time is time at having set interval time in 0 ms.
**RS-485 (2-wire system) send/receive timing**

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

- **Polling procedure**

<table>
<thead>
<tr>
<th>Host computer</th>
<th>Send data (Possible/Impossible)</th>
<th>Possible</th>
<th>Impossible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending status</td>
<td>E O T</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Controller**

<table>
<thead>
<tr>
<th>Send data (Possible/Impossible)</th>
<th>Possible</th>
<th>Impossible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending status</td>
<td>STX</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Polling procedure details**
  - 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**

<table>
<thead>
<tr>
<th>Host computer</th>
<th>Send data (Possible/Impossible)</th>
<th>Possible</th>
<th>Impossible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending status</td>
<td>STX</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Controller**

<table>
<thead>
<tr>
<th>Send data (Possible/Impossible)</th>
<th>Possible</th>
<th>Impossible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending status</td>
<td>STX</td>
<td>-</td>
</tr>
</tbody>
</table>

- **Selecting procedure details**
  - 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

- **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.

- **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
5. RKC COMMUNICATION

The HA400/HA900/HA401/HA901 (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:

![Polling Diagram]

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 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.

☛ For details, see 4.2 Setting the Communication Parameters (P. 15).

Please 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.

Continued on the next page.
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. 38).

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:

<table>
<thead>
<tr>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STX</td>
<td>Identifier</td>
<td>Data</td>
<td>ETX</td>
<td>BCC</td>
</tr>
</tbody>
</table>

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. 38).

Continued on the next page.
Continued from the previous page.

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 using horizontal parity and is calculated by horizontal parity (even number).

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

   Example:

   \[
   \text{BCC} = \text{4DH} \oplus \text{31H} \oplus \text{30H} \oplus \text{30H} \oplus \text{35H} \oplus \text{30H} \oplus \text{30H} \oplus \text{03H} = \text{7AH}
   \]
   Value of BCC becomes 7AH.

(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. 38).

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**

   Host computer send
   ![Diagram showing normal transmission]

   Host computer send
   ![Diagram showing normal transmission]

   Host computer send
   ![Diagram showing normal transmission]

   - **Error transmission**

   Host computer send
   ![Diagram showing error transmission]

   Host computer send
   ![Diagram showing error transmission]

   Host computer send
   ![Diagram showing error transmission]

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

   Host computer send
   ![Diagram showing normal transmission]

   Host computer send
   ![Diagram showing normal transmission]

   Host computer send
   ![Diagram showing normal transmission]

   - **Error transmission**

   Host computer send
   ![Diagram showing error transmission]

   Host computer send
   ![Diagram showing error transmission]

   Host computer send
   ![Diagram showing 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. 15).

  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**

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

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

  1. STX
  2. Memory area number
  3. Identifier
  4. Data
  5. ETX
  6. BCC

   For the STX, ETX and BCC, see **5.1 Polling (P. 23)**.

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. 38)**.

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.

<table>
<thead>
<tr>
<th>Send data</th>
<th>0.5</th>
<th>100.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive data</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th>Send data</th>
<th>−.5</th>
<th>−0.058</th>
<th>.05</th>
<th>−0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive data</td>
<td>−0.50</td>
<td>−0.05</td>
<td>0.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>

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

(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**

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | Address | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | S | T | X | P | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | E | T | X | C |
    | ACK | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X |
    |---|---|---|---|---|---|---|
    | ACK | Identifier | Data |

- **Error transmission**

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | Address | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | S | T | X | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | NAK | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X |
    |---|---|---|---|---|---|---|
    | ACK | Identifier | Data |

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

- **Normal transmission**

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X | K | 0 | 1 | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | Address | Memory area number | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | S | T | X | K | 0 | 1 | P | 1 | 0 | 0 | 0 | 2 | 0 | 0 | E | T | X | C |
    | ACK | Memory area number | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X |
    |---|---|---|---|---|---|---|
    | ACK | Memory area number | Identifier | Data |

- **Error transmission**

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X | K | 0 | 1 | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | Address | Memory area number | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | S | T | X | S | 1 | 0 | 0 | 1 | 0 | 0 | 0 | E | T | X | C |
    | NAK | Memory area number | Identifier | Data |

  - **Host computer send**
    
    | E | O | T | 0 | 0 | S | T | X |
    |---|---|---|---|---|---|---|
    | ACK | Memory area number | Identifier | Data |
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$="S1"
1020 '------------------- Communications initial setting --------------------
1030 '------------------ Program main routine ---------------------
1130 *POL
1140    PRINT "        (Polling check)        "
1150    PRINT "*********** Receiving the set values ************"
1160    PRINT "                                   "
1170    DT$=EOT$+ADD$+ID$+ENQ$
1180    GOSUB *TEXT
1190    GOSUB *RXDT

1200 ' Setting of the receiving waiting time:
1210  *J10
1220    J=0
1230 ' Setting of the sending waiting time:
1240  *IF1
1250    IF LOC(1)=0 THEN J=J+1:IF J<500 THEN *IF1 ELSE PRINT "TIME OUT " :END
1260 ' (Timeout processing)
1270 ' Setting of the sending waiting time:
1280  ' Setting of the receiving waiting time:
1290  *IF1
1300    IF KS=NAK$ THEN PRINT " NAK":END
1310    IF KS=ACK$ THEN PRINT " ACK":END
```

1 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.

Continued on the next page.
Continued from the previous page.

1320 '
1330 DT$=DT$+KS
1340 GOTO *J10
1350 '
1360 *ETXRX
1370 DT$=DT$+KS
1380 BCCRXS=INPUT$(1,#1)
1390 BCCRX=ASC(BCCRXS)
1400 GOSUB *BCCCH
1410 IF BCC<>BCCRX THEN GOSUB *NAKTX
1420 IF BCC<>BCCRX THEN GOSUB *RXDT: GOTO *J10
1430 '
1440 PRINT "Data has been correctly received"
1450 PRINT "Received data =", DT$ : END
1460 '
1470 '--------------------- Sub-routine ----------------------
1480 '
1490 *NAKTX
1500 PRINT "BCC error"
1510 DT$=NAK$
1520 GOSUB *TEXT
1530 RETURN
1540 '
1550 *RXDT
1560 DT$=""
1570 RETURN
1580 '
1590 *TEXT
1600 PRINT #1, DT$;
1610 RETURN
1620 '
1630 *BCCCH
1640 FOR II=1 TO LEN(DT$)
1650 BCCAS=MID$(DT$,II,1)
1660 IF BCCAS=STX$ THEN BCC=0 : GOTO *IINEXT
1670 BCC=BCC XOR ASC(BCCAS)
1680 *IINEXT
1690 NEXT II
1700 RETURN
### 5.3.2 Example of temperature set values selecting checking program

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

---

**Identifier setting**

**Communications data configuration setting**

**Communications character setting**

**Opening of RS-232C circuit**

**Input of the device address,**

and the temperature set value

**Data configuration setting 1**

**Display of transmitting data**

**Data configuration setting 2**

**Setting of the receiving waiting time:**

(*Timeout processing*)

**Communications condition check,**

**Display of communication result,**

and closing of RS-232C circuit

---

1 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.

---

Continued on the next page.
Continued from the previous page.

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Model codes</td>
<td>ID</td>
<td>RO</td>
<td>Model character codes</td>
<td>—</td>
<td>P. 100</td>
</tr>
<tr>
<td>2</td>
<td>Input 1_measured value (PV1) monitor</td>
<td>M1</td>
<td>RO</td>
<td>Input 1_input scale low to Input 1_input scale high</td>
<td>—</td>
<td>P. 100</td>
</tr>
<tr>
<td>3</td>
<td>Input 2_measured value (PV2) monitor</td>
<td>M0</td>
<td>RO</td>
<td>Input 2_input scale low to Input 2_input scale high</td>
<td>—</td>
<td>P. 100</td>
</tr>
<tr>
<td>4</td>
<td>Feedback resistance input value monitor</td>
<td>M2</td>
<td>RO</td>
<td>0.0 to 100.0 %</td>
<td>—</td>
<td>P. 100</td>
</tr>
<tr>
<td>5</td>
<td>Current transformer input value 1 (CT1) monitor</td>
<td>M3</td>
<td>RO</td>
<td>0.0 to 30.0 A or 0.0 to 100.0 A</td>
<td>—</td>
<td>P. 101</td>
</tr>
<tr>
<td>6</td>
<td>Current transformer input value 2 (CT2) monitor</td>
<td>M4</td>
<td>RO</td>
<td>0.0 to 30.0 A or 0.0 to 100.0 A</td>
<td>—</td>
<td>P. 101</td>
</tr>
<tr>
<td>7</td>
<td>Input 1_set value (SV1) monitor</td>
<td>MS</td>
<td>RO</td>
<td>Input 1_setting limiter (low limit) to Input 1_setting limiter (high limit)</td>
<td>—</td>
<td>P. 101</td>
</tr>
<tr>
<td>8</td>
<td>Input 2_set value (SV2) monitor</td>
<td>MT</td>
<td>RO</td>
<td>Input 2_setting limiter (low limit) to Input 2_setting limiter (high limit)</td>
<td>—</td>
<td>P. 101</td>
</tr>
<tr>
<td>9</td>
<td>Remote input value monitor</td>
<td>S2</td>
<td>RO</td>
<td>Input 1_setting limiter (low limit) to Input 1_setting limiter (high limit)</td>
<td>—</td>
<td>P. 102</td>
</tr>
<tr>
<td>10</td>
<td>Cascade monitor</td>
<td>KH</td>
<td>RO</td>
<td>Input 2_setting limiter (low limit) to Input 2_setting limiter (high limit)</td>
<td>—</td>
<td>P. 102</td>
</tr>
<tr>
<td>11</td>
<td>Input 1_burnout state</td>
<td>B1</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 102</td>
</tr>
<tr>
<td>12</td>
<td>Input 2_burnout state</td>
<td>B0</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 102</td>
</tr>
<tr>
<td>13</td>
<td>Feedback resistance input burnout state</td>
<td>B2</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 103</td>
</tr>
<tr>
<td>14</td>
<td>Event 1 state</td>
<td>AA</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 103</td>
</tr>
<tr>
<td>15</td>
<td>Event 2 state</td>
<td>AB</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 103</td>
</tr>
<tr>
<td>16</td>
<td>Event 3 state</td>
<td>AC</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
<td>P. 103</td>
</tr>
<tr>
<td>17</td>
<td>Event 4 state</td>
<td>AD</td>
<td>RO</td>
<td>0: OFF 1: ON</td>
<td>—</td>
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<th>Factory set value</th>
<th>Reference page</th>
</tr>
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<tbody>
<tr>
<td>18</td>
<td>Heater break alarm 1 (HBA1) state</td>
<td>AE</td>
<td>RO</td>
<td>0: OFF</td>
<td></td>
<td>—</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1: ON</td>
<td></td>
<td>P. 104</td>
</tr>
<tr>
<td>19</td>
<td>Heater break alarm 2 (HBA2) state</td>
<td>AF</td>
<td>RO</td>
<td>0: OFF</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>1: ON</td>
<td></td>
<td>P. 104</td>
</tr>
<tr>
<td>20</td>
<td>Input 1_manipulated output value (MV1) monitor</td>
<td>O1</td>
<td>RO</td>
<td>−5.0 to +105.0 %</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td>21</td>
<td>Input 2_manipulated output value (MV2) monitor</td>
<td>O0</td>
<td>RO</td>
<td>−5.0 to +105.0 %</td>
<td></td>
<td>—</td>
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<tr>
<td>22</td>
<td>Error codes</td>
<td>ER</td>
<td>RO</td>
<td>1: Adjustment data error</td>
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<td>—</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2: EEPROM error</td>
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<td>P. 105</td>
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<td></td>
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<td></td>
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<td>4: A/D conversion error</td>
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<td>8: RAM check error</td>
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<td></td>
<td>16: Hard configuration error</td>
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<td></td>
<td>32: Soft configuration error</td>
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<td></td>
<td>128: Watchdog timer error</td>
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<td></td>
<td>2048: Program busy</td>
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<td></td>
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<tr>
<td>23</td>
<td>Event input state</td>
<td>L1</td>
<td>RO</td>
<td>Least significant digit (DI 1) :</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0: Open, 1: Close</td>
<td></td>
<td>P. 106</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd digit (DI2) :</td>
<td></td>
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<td></td>
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<td></td>
<td>0: Open, 1: Close</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>3rd digit (DI3) :</td>
<td></td>
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<td></td>
<td>0: Open, 1: Close</td>
<td></td>
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<td></td>
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<td></td>
<td>4th digit (DI4) :</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0: Open, 1: Close</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5th digit (DI5) :</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>0: Open, 1: Close</td>
<td></td>
<td></td>
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<td>6th digit (DI6) :</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>0: Open, 1: Close</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Most significant digit (DI7) :</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>0: Open, 1: Close</td>
<td></td>
<td></td>
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<th>Identifier</th>
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<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Memory area soak time monitor</td>
<td>TR</td>
<td>RO</td>
<td>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</td>
<td>—</td>
<td>P. 108</td>
</tr>
<tr>
<td>26</td>
<td>Input 1_PID/AT transfer</td>
<td>G1</td>
<td>R/W</td>
<td>0: PID control 1: Autotuning (AT)</td>
<td>0</td>
<td>P. 108</td>
</tr>
<tr>
<td>27</td>
<td>Input 2_PID/AT transfer</td>
<td>G0</td>
<td>R/W</td>
<td>0: PID control 1: Autotuning (AT)</td>
<td>0</td>
<td>P. 108</td>
</tr>
<tr>
<td>28</td>
<td>Input 1_Auto/Manual transfer</td>
<td>J1</td>
<td>R/W</td>
<td>0: Input 1_Auto mode 1: Input 1_Manual mode</td>
<td>0</td>
<td>P. 110</td>
</tr>
<tr>
<td>29</td>
<td>Input 2_Auto/Manual transfer</td>
<td>J0</td>
<td>R/W</td>
<td>0: Input 2_Auto mode 1: Input 2_Manual mode</td>
<td>0</td>
<td>P. 110</td>
</tr>
<tr>
<td>30</td>
<td>Remote/Local transfer</td>
<td>C1</td>
<td>R/W</td>
<td>0: Local mode 1: Remote mode or Cascade control</td>
<td>0</td>
<td>P. 111</td>
</tr>
<tr>
<td>31</td>
<td>RUN/STOP transfer</td>
<td>SR</td>
<td>R/W</td>
<td>0: Control RUN 1: Control STOP</td>
<td>0</td>
<td>P. 111</td>
</tr>
<tr>
<td>32</td>
<td>Memory area selection</td>
<td>ZA</td>
<td>R/W</td>
<td>1 to 16</td>
<td>1</td>
<td>P. 111</td>
</tr>
<tr>
<td>33</td>
<td>Event 1 set value</td>
<td>A1</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 112</td>
</tr>
<tr>
<td>34</td>
<td>Event 2 set value</td>
<td>A2</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 112</td>
</tr>
</tbody>
</table>

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<table>
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<tr>
<th>No.</th>
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<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
</table>
| 35  | Event 3 set value           | A3         | R/W       | Deviation:  
- Input span to +input span  
Process/SV:  
Input scale low to input scale high | 50.0              | P. 112       |
| 36  | Control loop break alarm 1 (LBA1) time | A5         | R/W       | 0: OFF (Not provided)  
1 to 7200 seconds           | 480               | P. 113       |
| 37  | LBA1 deadband               | N1         | R/W       | 0.0 to input span              | 0.0               | P. 113       |
| 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. 112       |
| 39  | Control loop break alarm 2 (LBA2) time | A6         | R/W       | 0: OFF (Not provided)  
1 to 7200 seconds           | 480               | P. 113       |
| 40  | LBA2 deadband               | N2         | R/W       | 0.0 to input span              | 0.0               | P. 113       |
| 41  | Input 1_set value (SV1)     | S1         | R/W       | Input 1_setting limiter (low limit) to input 1_setting limiter (high limit) | 0.0               | P. 116       |
| 42  | Input 1_proportional band   | P1         | R/W       | TC/RTD input:  
0 to input span  
Voltage/current input:  
0.0 to 1000.0 % of input span | 30.0              | P. 116       |
| 43  | Input 1_integral time       | I1         | R/W       | 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds  
(0.0 or 0.00: PD action)  
0.00 to 360.00 seconds  
(0.0 or 0.00: PI action) | 240.00            | P. 117       |
| 44  | Input 1_derivative time     | D1         | R/W       | 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds  
(0.0 or 0.00: PD action)  
0.00 to 360.00 seconds  
(0.0 or 0.00: PI action) | 60.00             | P. 117       |
| 45  | Input 1_control response parameter | CA     | R/W       | 0: Slow  
1: Medium  
2: Fast | 0               | P. 118       |
| 46  | Input 2_set value (SV2)     | S0         | R/W       | Input 2_setting limiter (low limit) to input 2_setting limiter (high limit) | 0.0               | P. 116       |

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<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
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<tbody>
<tr>
<td>47</td>
<td>Input 2_proportional band</td>
<td>P0</td>
<td>R/W</td>
<td>TC/RTD input: 0 to input span Voltage/current input: 0.0 to 1000.0 % of input span</td>
<td>30.0</td>
<td>P. 116</td>
</tr>
<tr>
<td>48</td>
<td>Input 2_integral time</td>
<td>I0</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PD action)</td>
<td>240.00</td>
<td>P. 117</td>
</tr>
<tr>
<td>49</td>
<td>Input 2_derivative time</td>
<td>D0</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PI action)</td>
<td>60.00</td>
<td>P. 117</td>
</tr>
<tr>
<td>50</td>
<td>Input 2_control response parameter</td>
<td>C9</td>
<td>R/W</td>
<td>0: Slow 1: Medium 2: Fast</td>
<td>0</td>
<td>P. 118</td>
</tr>
<tr>
<td>51</td>
<td>Input 1_setting change rate limiter (up)</td>
<td>HH</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 119</td>
</tr>
<tr>
<td>52</td>
<td>Input 1_setting change rate limiter (down)</td>
<td>HL</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 119</td>
</tr>
<tr>
<td>53</td>
<td>Input 2_setting change rate limiter (up)</td>
<td>HX</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
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</tr>
<tr>
<td>54</td>
<td>Input 2_setting change rate limiter (down)</td>
<td>HY</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
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</tr>
<tr>
<td>55</td>
<td>Area soak time</td>
<td>TM</td>
<td>R/W</td>
<td>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</td>
<td>0.00.00</td>
<td>P. 121</td>
</tr>
<tr>
<td>56</td>
<td>Link area number</td>
<td>LP</td>
<td>R/W</td>
<td>0: OFF (No link) 1 to 16</td>
<td>0</td>
<td>P. 122</td>
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<tr>
<td>57</td>
<td>Heater break alarm 1 (HBA1) set value</td>
<td>A5</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to 30.0 A or 0.1 to 100.0 A</td>
<td>0.0</td>
<td>P. 123</td>
</tr>
<tr>
<td>58</td>
<td>Heater break alarm 2 (HBA2) set value</td>
<td>A6</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to 30.0 A or 0.1 to 100.0 A</td>
<td>0.0</td>
<td>P. 123</td>
</tr>
<tr>
<td>59</td>
<td>Input 1_PV bias</td>
<td>PB</td>
<td>R/W</td>
<td>-Input span to +input span</td>
<td>0</td>
<td>P. 124</td>
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<tr>
<td>60</td>
<td>Input 1_PV digital filter</td>
<td>F1</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.01 to 10.00 seconds</td>
<td>Note1 P. 124</td>
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<tr>
<td>61</td>
<td>Input 1_PV ratio</td>
<td>PR</td>
<td>R/W</td>
<td>0.500 to 1.500</td>
<td>1.000 P. 125</td>
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<tr>
<td>62</td>
<td>Input 1_PV low input cut-off</td>
<td>DP</td>
<td>R/W</td>
<td>0.00 to 25.00 % of input span</td>
<td>0.00 P. 126</td>
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<tr>
<td>63</td>
<td>Input 1_proportional cycle time</td>
<td>T0</td>
<td>R/W</td>
<td>0.1 to 100.0 seconds Other outputs: Voltage pulse output and triac output</td>
<td>Note2 P. 127</td>
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<tr>
<td>64</td>
<td>Input 1_manipulated output value</td>
<td>ON</td>
<td>R/W</td>
<td>Input 1_output limiter (low limit) to Input 1_output limiter (high limit)</td>
<td>0 P. 127</td>
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<tr>
<td>65</td>
<td>Input 2_PV bias</td>
<td>PA</td>
<td>R/W</td>
<td>-Input span to +input span</td>
<td>0 P. 124</td>
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<tr>
<td>66</td>
<td>Input 2_PV digital filter</td>
<td>F0</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.01 to 10.00 seconds</td>
<td>Note1 P. 124</td>
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<td>67</td>
<td>Input 2_PV ratio</td>
<td>PQ</td>
<td>R/W</td>
<td>0.500 to 1.500</td>
<td>1.000 P. 125</td>
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<td>68</td>
<td>Input 2_PV low input cut-off</td>
<td>DO</td>
<td>R/W</td>
<td>0.00 to 25.00 % of input span</td>
<td>0.00 P. 126</td>
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<td>69</td>
<td>Input 2_proportional cycle time</td>
<td>T2</td>
<td>R/W</td>
<td>0.1 to 100.0 seconds Other outputs: Voltage pulse output and triac output</td>
<td>Note2 P. 127</td>
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<tr>
<td>70</td>
<td>Input 2_manipulated output value</td>
<td>OM</td>
<td>R/W</td>
<td>Input 2_output limiter (low limit) to Input 2_output limiter (high limit)</td>
<td>0.0 P. 127</td>
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<tr>
<td>71</td>
<td>Set lock level</td>
<td>LK</td>
<td>R/W</td>
<td>Least significant digit: Lock only setting items other than SV and events (EV1 to EV4). 0: Settable, 1: Not settable (Lock) 2nd digit: Lock only events (EV1 to EV4). 0: Settable, 1: Not settable (Lock) 3rd digit: Lock only set value (SV). 0: Settable, 1: Not settable (Lock) 4th digit to Most significant digit: Unused</td>
<td>0 P. 128</td>
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</table>

Note1 HA400/HA900: 0.00 HA401/HA901: 1.00
Note2 Relay contact output: 20.0 sec Other outputs: 2.0 sec

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<tr>
<td>72</td>
<td>EEPROM storage state</td>
<td>EM</td>
<td>RO</td>
<td>0: The content of the EEPROM does not coincide with that of the RAM.</td>
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<td>P. 129</td>
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<td>1: The content of the EEPROM coincides with that of the RAM.</td>
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<td>73</td>
<td>EEPROM storage mode</td>
<td>EB</td>
<td>R/W</td>
<td>0: Set values are store to the EEPROM when set values are changed.</td>
<td>0</td>
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<td>1: Not set values are store to the EEPROM when set values are changed.</td>
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<td>74</td>
<td>STOP display selection</td>
<td>DX</td>
<td>R/W</td>
<td>0: Displays on the measured value (PV1/PV2) unit</td>
<td>0</td>
<td>P. 130</td>
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<td>1: Displays on the set value (SV) unit</td>
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<td>75</td>
<td>Bar graph display selection</td>
<td>DA</td>
<td>R/W</td>
<td>0: No display</td>
<td>0</td>
<td>P. 131</td>
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<td>1: Input 1 manipulated output value (MV)</td>
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<td>2: Input 1 measured value (PV)</td>
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<td>3: Input 1 set value (SV)</td>
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<td>4: Input 1 deviation value</td>
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<td>5: Feedback resistance input value (POS)</td>
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<td>6: Input 2 manipulated output value (MV)</td>
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<td>7: Input 2 measured value (PV)</td>
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<td>8: Input 2 set value (SV)</td>
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<td>9: Input 2 deviation value</td>
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<td>76</td>
<td>Bar graph resolution setting</td>
<td>DE</td>
<td>R/W</td>
<td>1 to 100 digit/dot</td>
<td>100</td>
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<td>77</td>
<td>Auto/Manual transfer key operation selection (A/M)</td>
<td>DK</td>
<td>R/W</td>
<td>0: No direct key operation</td>
<td>0</td>
<td>P. 132</td>
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<tr>
<td>78</td>
<td>Remote/Local transfer key operation selection (R/L)</td>
<td>DL</td>
<td>R/W</td>
<td>0: No direct key operation</td>
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<td>P. 133</td>
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<tr>
<td>79</td>
<td>RUN/STOP transfer key operation selection (R/S)</td>
<td>DM</td>
<td>R/W</td>
<td>0: No direct key operation</td>
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<td>P. 133</td>
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<tr>
<td>80</td>
<td>Input 1_input type selection</td>
<td>XI</td>
<td>R/W</td>
<td>TC input</td>
<td>Depend on model code</td>
<td>P. 134</td>
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<td>0: K −200 to +1372 °C −328.0 to 2501.6 °F</td>
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<td>1: J −200 to +1200 °C −328.0 to 2192.0 °F</td>
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<td>2: R −50 to +1768 °C −58.0 to 3214.4 °F</td>
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<td>3: S −50 to +1768 °C −58.0 to 3214.4 °F</td>
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<td>4: B 0 to 1800 °C 32.0 to 3272.0 °F</td>
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<td>5: E −200 to +1000 °C −328.0 to 1832.0 °F</td>
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<td>6: N 0 to 1300 °C 32.0 to 2372.0 °F</td>
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<td>7: T −200 to +400 °C −328.0 to 752.0 °F</td>
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<td>8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F</td>
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<td>9: PLII 0 to 1390 °C 32.0 to 2534.0 °F</td>
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<td>RTD input (3-wire system)</td>
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<td>12: Pt100 −200 to +850 °C −328.0 to 1562.0 °F</td>
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<td>13: JPt100 −200 to +600 °C −328.0 to 1112.0 °F</td>
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<td>Voltage (V)/current (I) inputs</td>
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<td>−199999 to +999999</td>
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<td>14: 0 to 20 mA DC</td>
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<td>15: 4 to 20 mA DC</td>
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<td>16: 0 to 10 V DC</td>
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<td>17: 0 to 5 V DC</td>
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<td>18: 1 to 5 V DC</td>
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<td>19: 0 to 1 V DC</td>
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<td>20: 0 to 100 mV DC</td>
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<td>21: 0 to 10 mV DC</td>
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<td>RTD input (4-wire system)</td>
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<td>22: Pt100 −200 to +850 °C −328.0 to 1562.0 °F</td>
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<td>23: JPt100 −200 to +600 °C −328.0 to 1112.0 °F</td>
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<td>81</td>
<td>Input 1_display unit selection</td>
<td>PU</td>
<td>R/W</td>
<td>0: °C 1: °F</td>
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</table>
| 82  | Input 1_decimal point position            | XU         | R/W       | 0: No digit below decimal point  
1: 1 digit below decimal point  
2: 2 digits below decimal point  
3: 3 digits below decimal point  
4: 4 digits below decimal point | 1                  | P. 136      |
| 83  | Input 1_input scale high                  | XV         | R/W       | TC/RTD input:  
Input scale low to maximum value of input range  
Voltage (V)/current (I) input:  
−19999 to +99999  
(Varies depending on the position of the decimal point setting) | Note1               | P. 137      |
| 84  | Input 1_input scale low                   | XW         | R/W       | TC/RTD input:  
Minimum value of input range to input scale high  
Voltage (V)/current (I) input:  
−19999 to +99999  
(Varies depending on the position of the decimal point setting) | Note2               | P. 138      |
| 85  | Input 1_input error determination point (high limit) | AV         | R/W       | Input scale low – (5 % of input span) to input scale high + (5 % of input span) | Note3               | P. 139      |
| 86  | Input 1_input error determination point (low limit) | AW        | R/W       | Input scale low – (5 % of input span) to input scale high + (5 % of input span) | Note4               | P. 140      |
| 87  | Input 1_burnout direction                 | BS         | R/W       | 0: Upscale  
1: Downscale  
TC/RTD:  
0  
V/I: 1 | P. 140      |
| 88  | Input 1_square root extraction selection | XH         | R/W       | 0: Not provided  
1: Provided | P. 141      |
| 89  | Power supply frequency selection          | JT         | R/W       | 0: 50 Hz  
1: 60 Hz | P. 141      |

Note1 TC/RTD: Maximum value of input range  
V/I: 100.0  
Note2 TC/RTD: Minimum value of input range  
V/I: 0.0  
Note3 TC/RTD: Input scale high + (5 % of input span)  
V/I: 105.0  
Note4 TC/RTD: Input scale low – (5 % of input span)  
V/I: −5.0

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<td>Input 2_ input type selection</td>
<td>XJ</td>
<td>R/W</td>
<td>TC input</td>
<td>Depend on model code</td>
<td>P. 134</td>
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<td>0: K −200 to +1372 °C&lt;br&gt;−328.0 to 2501.6 °F</td>
<td>When not specifying: Type K</td>
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<tr>
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<td>1: J −200 to +1200 °C&lt;br&gt;−328.0 to 2192.0 °F</td>
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<td>2: R −50 to +1768 °C&lt;br&gt;−58.0 to 3214.4 °F</td>
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<td>3: S −50 to +1768 °C&lt;br&gt;−58.0 to 3214.4 °F</td>
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<td>4: B 0 to 1800 °C&lt;br&gt;32.0 to 3272.0 °F</td>
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<td>5: E −200 to +1000 °C&lt;br&gt;−328.0 to 1832.0 °F</td>
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<td>6: N 0 to 1300 °C&lt;br&gt;32.0 to 2372.0 °F</td>
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<td>7: T −200 to +400 °C&lt;br&gt;−328.0 to 752.0 °F</td>
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<td>8: W5Re/W26Re&lt;br&gt;0 to 2300 °C&lt;br&gt;32.0 to 4172.0 °F</td>
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<td>9: PLII 0 to 1390 °C&lt;br&gt;32.0 to 2534.0 °F</td>
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## 5. RKC COMMUNICATION

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| 92  | Input 2 _decimal point position           | XT         | R/W       | 0: No digit below decimal point  
1: 1 digit below decimal point  
2: 2 digits below decimal point  
3: 3 digits below decimal point  
4: 4 digits below decimal point                                           | 1 P. 136     |
| 93  | Input 2 _input scale high                 | XX         | R/W       | TC/RTD input:  
Input scale low to maximum value of input range  
Voltage (V)/current (I) input:  
−19999 to +99999  
(Varies depending on the position of the decimal point setting) | Note1 P. 137 |
| 94  | Input 2 _input scale low                  | XY         | R/W       | TC/RTD input:  
Input scale low − (5 % of input span) to input scale high + (5 % of input span)  
Voltage (V)/current (I) input:  
−19999 to +99999  
(Varies depending on the position of the decimal point setting) | Note2 P. 138 |
| 95  | Input 2 _input error determination point (high limit) | AX         | R/W       | Input scale low − (5 % of input span) to input scale high + (5 % of input span) | Note3 P. 139     |
| 96  | Input 2 _input error determination point (low limit) | AY         | R/W       | Input scale low − (5 % of input span) to input scale high + (5 % of input span) | Note4 P. 140     |
| 97  | Input 2 _burnout direction                | BR         | R/W       | 0: Upscale  
1: Downscale  
TC/RTD:  
0 V/I: 1 | P. 140     |
| 98  | Input 2 _square root extraction selection | XG         | R/W       | 0: Not provided  
1: Provided | 0 P. 141     |
| 99  | Event input logic selection               | H2         | R/W       | 0 to 6 | 1 P. 142     |
| 100 | Output logic selection                    | E0         | R/W       | 1 to 10 | Note5 P. 144 |
| 101 | Output 1 timer setting                    | TD         | R/W       | 0.0 to 600.0 seconds | 0.0 P. 146     |
| 102 | Output 2 timer setting                    | TG         | R/W       | 0.0 to 600.0 seconds | 0.0 P. 146     |
| 103 | Output 3 timer setting                    | TH         | R/W       | 0.0 to 600.0 seconds | 0.0 P. 146     |

**Note1** TC/RTD: Maximum value of input range  
V/I: 100.0

**Note2** TC/RTD: Minimum value of input range  
V/I: 0.0

**Note3** TC/RTD: Input scale high + (5 % of input span)  
V/I: 105.0

**Note4** TC/RTD: Input scale low − (5 % of input span)  
V/I: −5.0

**Note5** 1 input: 1  
2 input: 5

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### 5. RKC COMMUNICATION

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<td>105</td>
<td>Output 5 timer setting</td>
<td>TJ</td>
<td>R/W</td>
<td>0.0 to 600.0 seconds</td>
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| 106 | 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
4: Input 1_manipulated output value (MV)
5: Input 2_measured value (PV)
6: Input 2_set value (SV)
7: Input 2_deviation
8: Input 2_manipulated output value (MV) | 0 | P. 148 |
| 107 | Transmission output 1_ scale high | KA | 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 | Note1 | P. 149 |
| 108 | Transmission output 1_ scale low | NA | 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 | Note2 | P. 150 |
| 109 | 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
4: Input 1_manipulated output value (MV)
5: Input 2_measured value (PV)
6: Input 2_set value (SV)
7: Input 2_deviation
8: Input 2_manipulated output value (MV) | 0 | P. 148 |

Note1 PV/SV: Input scale high
MV: 100.0
Deviation: +Input span

Note2 PV/SV: Input scale low
MV: 0.0
Deviation: −Input span

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<td>Deviation: −Input span to +Input span</td>
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Note1 PV/SV: Input scale high MV: 100.0 Deviation: +Input span
Note2 PV/SV: Input scale low MV: 0.0 Deviation: −Input span

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Note1  PV/SV: Input scale low  
MV: 0.0  Deviation: −Input span

Note2  TC/RTD: 2.0 °C  
V/I: 0.2 % of input span

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<td>R/W</td>
<td>0: Normal processing 1: Forcibly turned on</td>
<td>0</td>
<td>P. 158</td>
</tr>
<tr>
<td>134</td>
<td>Event 4 assignment</td>
<td>FD</td>
<td>R/W</td>
<td>1: For input 1 2: For input 2</td>
<td>0</td>
<td>P. 160</td>
</tr>
<tr>
<td>135</td>
<td>CT1 ratio</td>
<td>XR</td>
<td>R/W</td>
<td>0 to 9999</td>
<td></td>
<td>P. 161</td>
</tr>
</tbody>
</table>

Note1  TC/RTD: 2.0 °C  V/I: 0.2 % of input span

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<table>
<thead>
<tr>
<th>No.</th>
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<th>Reference page</th>
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<tbody>
<tr>
<td>136</td>
<td>CT1 assignment</td>
<td>ZF</td>
<td>R/W</td>
<td>0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4 5: OUT5</td>
<td>Note1</td>
<td>P. 162</td>
</tr>
<tr>
<td>137</td>
<td>CT2 ratio</td>
<td>XS</td>
<td>R/W</td>
<td>0 to 9999</td>
<td>Depend on model code</td>
<td>P. 161</td>
</tr>
<tr>
<td>138</td>
<td>CT2 assignment</td>
<td>ZG</td>
<td>R/W</td>
<td>0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4 5: OUT5</td>
<td>Note2</td>
<td>P. 162</td>
</tr>
<tr>
<td>139</td>
<td>Hot/Cold start selection</td>
<td>XN</td>
<td>R/W</td>
<td>Power failure of 3 seconds or less 0: Hot 1 1: Hot 1 2: Hot 1 3: Hot 2 4: Hot 2 5: Cold</td>
<td>0</td>
<td>P. 163</td>
</tr>
<tr>
<td>140</td>
<td>Input 2_use selection</td>
<td>KM</td>
<td>R/W</td>
<td>0: Single loop control 1: Remote input 2: Cascade control (Slave)</td>
<td>0</td>
<td>P. 164</td>
</tr>
<tr>
<td>141</td>
<td>Cascade ratio</td>
<td>RR</td>
<td>R/W</td>
<td>0.000 to 1.500</td>
<td>1.000</td>
<td>P. 165</td>
</tr>
<tr>
<td>142</td>
<td>Cascade bias</td>
<td>RB</td>
<td>R/W</td>
<td>–Input span to +input span</td>
<td>0.0</td>
<td>P. 165</td>
</tr>
<tr>
<td>143</td>
<td>SV tracking</td>
<td>XL</td>
<td>R/W</td>
<td>0: Not provided 1: Provided</td>
<td>1</td>
<td>P. 167</td>
</tr>
<tr>
<td>144</td>
<td>Input 1_control action type selection</td>
<td>XE</td>
<td>R/W</td>
<td>0: Direct action 1: Reverse action</td>
<td>1</td>
<td>P. 168</td>
</tr>
<tr>
<td>145</td>
<td>Input 1_integral/derivative time decimal point position selection</td>
<td>PK</td>
<td>R/W</td>
<td>0: No digit below decimal point 1: 1 digit below decimal point 2: 2 digits below decimal point</td>
<td>2</td>
<td>P. 169</td>
</tr>
<tr>
<td>146</td>
<td>Input 1_derivative gain</td>
<td>DG</td>
<td>R/W</td>
<td>0.1 to 10.0</td>
<td>6.0</td>
<td>P. 170</td>
</tr>
<tr>
<td>147</td>
<td>Input 1_ON/OFF action differential gap (upper)</td>
<td>IV</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note3</td>
<td>P. 170</td>
</tr>
<tr>
<td>148</td>
<td>Input 1_ON/OFF action differential gap (lower)</td>
<td>IW</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note3</td>
<td>P. 171</td>
</tr>
<tr>
<td>149</td>
<td>Input 1_action at input error (high limit)</td>
<td>WH</td>
<td>R/W</td>
<td>0: Normal control (present output) 1: Manipulated output value at input error</td>
<td>0</td>
<td>P. 172</td>
</tr>
</tbody>
</table>

Note1 CT1 provided: 1 CT1 not provided: 0
Note2 CT2 provided: 1 CT2 not provided: 0
Note3 TC/RTD: 1.0 °C V/I: 0.1 % of input span

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<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>Input 1_action at input error (low limit)</td>
<td>WL</td>
<td>R/W</td>
<td>0: Normal control (present output)</td>
<td>0</td>
<td>P. 173</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1: Manipulated output value at input error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>151</td>
<td>Input 1_manipulated output value at input error</td>
<td>OE</td>
<td>R/W</td>
<td>−5.0 to +105.0 %</td>
<td>−5.0</td>
<td>P. 173</td>
</tr>
<tr>
<td>152</td>
<td>Input 1_output change rate limiter (up)</td>
<td>PH</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
<tr>
<td>153</td>
<td>Input 1_output change rate limiter (down)</td>
<td>PL</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
<tr>
<td>154</td>
<td>Input 1_output limiter (high limit)</td>
<td>OH</td>
<td>R/W</td>
<td>Input 1_output limiter (low limit) to 105.0 %</td>
<td>105.0</td>
<td>P. 176</td>
</tr>
<tr>
<td>155</td>
<td>Input 1_output limiter (low limit)</td>
<td>OL</td>
<td>R/W</td>
<td>−5.0 % to input 1_output limiter (high limit)</td>
<td>−5.0</td>
<td>P. 176</td>
</tr>
<tr>
<td>156</td>
<td>Input 1_power feed forward</td>
<td>PF</td>
<td>R/W</td>
<td>0: Not provided</td>
<td></td>
<td>Note1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1: Provided</td>
<td></td>
<td>P. 177</td>
</tr>
<tr>
<td>157</td>
<td>Input 2_control action type selection</td>
<td>XF</td>
<td>R/W</td>
<td>0: Direct action</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1: Reverse action</td>
<td></td>
<td>P. 168</td>
</tr>
<tr>
<td>158</td>
<td>Input 2_integral/derivative time</td>
<td>PJ</td>
<td>R/W</td>
<td>0: No digit below decimal point</td>
<td></td>
<td>Note2</td>
</tr>
<tr>
<td></td>
<td>decimal point position selection</td>
<td></td>
<td></td>
<td>1: 1 digit below decimal point</td>
<td></td>
<td>P. 169</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2: 2 digits below decimal point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>159</td>
<td>Input 2_derivative gain</td>
<td>DJ</td>
<td>R/W</td>
<td>0.1 to 10.0</td>
<td>6.0</td>
<td>P. 170</td>
</tr>
<tr>
<td>160</td>
<td>Input 2_ON/OFF action differential gap (upper)</td>
<td>IX</td>
<td>R/W</td>
<td>0 to input span</td>
<td></td>
<td>Note2</td>
</tr>
<tr>
<td>161</td>
<td>Input 2_ON/OFF action differential gap (lower)</td>
<td>IY</td>
<td>R/W</td>
<td>0 to input span</td>
<td></td>
<td>P. 171</td>
</tr>
<tr>
<td>162</td>
<td>Input 2_action at input error (high limit)</td>
<td>WX</td>
<td>R/W</td>
<td>0: Normal control (present output)</td>
<td>0</td>
<td>P. 172</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1: Manipulated output value at input error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>163</td>
<td>Input 2_action at input error (low limit)</td>
<td>WY</td>
<td>R/W</td>
<td>0: Normal control (present output)</td>
<td>0</td>
<td>P. 173</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1: Manipulated output value at input error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>164</td>
<td>Input 2_manipulated output value at input error</td>
<td>OF</td>
<td>R/W</td>
<td>−5.0 to +105.0 %</td>
<td>−5.0</td>
<td>P. 173</td>
</tr>
<tr>
<td>165</td>
<td>Input 2_output change rate limiter (up)</td>
<td>PX</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
</tbody>
</table>

Note1: Not provided: 0 Provided: 1
Note2: TC/RTD: 1.0 °C V/I: 0.1 % of input span

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<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>166</td>
<td>Input 2_output change rate limiter (down)</td>
<td>PY</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
<tr>
<td>167</td>
<td>Input 2_output limiter (high limit)</td>
<td>OX</td>
<td>R/W</td>
<td>Input 2_output limiter (low limit) to 105.0 %</td>
<td>105.0</td>
<td>P. 176</td>
</tr>
<tr>
<td>168</td>
<td>Input 2_output limiter (low limit)</td>
<td>OY</td>
<td>R/W</td>
<td>−5.0 % to input 2_output limiter (high limit)</td>
<td>−5.0</td>
<td>P. 176</td>
</tr>
<tr>
<td>169</td>
<td>Input 2_power feed forward</td>
<td>PG</td>
<td>R/W</td>
<td>0: Not provided 1: Provided</td>
<td>Note1</td>
<td>P. 177</td>
</tr>
<tr>
<td>170</td>
<td>Input 1_AT bias</td>
<td>GB</td>
<td>R/W</td>
<td>−Input span to +input span</td>
<td>0</td>
<td>P. 178</td>
</tr>
<tr>
<td>171</td>
<td>Input 1_AT cycle</td>
<td>G3</td>
<td>R/W</td>
<td>0: 1.5 cycle 1: 2.0 cycle 2: 2.5 cycle 3: 3.0 cycle</td>
<td>1</td>
<td>P. 179</td>
</tr>
<tr>
<td>172</td>
<td>Input 1_AT differential gap time</td>
<td>GH</td>
<td>R/W</td>
<td>0.00 to 50.00 seconds</td>
<td>Note2</td>
<td>P. 180</td>
</tr>
<tr>
<td>173</td>
<td>Input 2_AT bias</td>
<td>GA</td>
<td>R/W</td>
<td>−Input span to +input span</td>
<td>0</td>
<td>P. 178</td>
</tr>
<tr>
<td>174</td>
<td>Input 2_AT cycle</td>
<td>G2</td>
<td>R/W</td>
<td>0: 1.5 cycle 1: 2.0 cycle 2: 2.5 cycle 3: 3.0 cycle</td>
<td>1</td>
<td>P. 179</td>
</tr>
<tr>
<td>175</td>
<td>Input 2_AT differential gap time</td>
<td>GG</td>
<td>R/W</td>
<td>0.00 to 50.00 seconds</td>
<td>Note2</td>
<td>P. 180</td>
</tr>
<tr>
<td>176</td>
<td>Open/Close output neutral zone</td>
<td>V2</td>
<td>R/W</td>
<td>0.1 to 10.0 %</td>
<td>10.0</td>
<td>P. 182</td>
</tr>
<tr>
<td>177</td>
<td>Open/Close output differential gap</td>
<td>VH</td>
<td>R/W</td>
<td>0.1 to 5.0 %</td>
<td>0.2</td>
<td>P. 183</td>
</tr>
<tr>
<td>178</td>
<td>Action at feedback resistance (FBR) input error</td>
<td>SY</td>
<td>R/W</td>
<td>0: Close-side output ON, Open-side output OFF 1: Close-side output OFF, Open-side output OFF 2: Close-side output OFF, Open-side output ON</td>
<td>0</td>
<td>P. 184</td>
</tr>
<tr>
<td>179</td>
<td>Feedback adjustment</td>
<td>FV</td>
<td>R/W</td>
<td>0: Adjustment end 1: During the Open-side adjusting 2: During the Close-side adjusting</td>
<td>—</td>
<td>P. 185</td>
</tr>
<tr>
<td>180</td>
<td>Setting change rate limiter unit time</td>
<td>HU</td>
<td>R/W</td>
<td>1 to 3600 seconds</td>
<td>60</td>
<td>P. 186</td>
</tr>
</tbody>
</table>

Note1: Not provided: 0 Provided: 1
Note2: HA400/HA900: 0.10 HA401/HA901: 10.00

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<tr>
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<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>181</td>
<td>Soak time unit selection</td>
<td>RU</td>
<td>R/W</td>
<td>0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds</td>
<td>2</td>
<td>P. 186</td>
</tr>
<tr>
<td>182</td>
<td>Input 1_setting limiter (high limit)</td>
<td>SH</td>
<td>R/W</td>
<td>Input 1_setting limiter (low limit) to input 1_input scale high</td>
<td></td>
<td>P. 187</td>
</tr>
<tr>
<td>183</td>
<td>Input 1_setting limiter (low limit)</td>
<td>SL</td>
<td>R/W</td>
<td>Input 1_input scale low to input 1_setting limiter (high limit)</td>
<td></td>
<td>P. 188</td>
</tr>
<tr>
<td>184</td>
<td>Input 2_setting limiter (high limit)</td>
<td>ST</td>
<td>R/W</td>
<td>Input 2_setting limiter (low limit) to input 2_input scale high</td>
<td></td>
<td>P. 187</td>
</tr>
<tr>
<td>185</td>
<td>Input 2_setting limiter (low limit)</td>
<td>SU</td>
<td>R/W</td>
<td>Input 2_input scale low to input 2_setting limiter (high limit)</td>
<td></td>
<td>P. 188</td>
</tr>
<tr>
<td>186</td>
<td>ROM version display</td>
<td>VR</td>
<td>RO</td>
<td>Display the version of loading software.</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>187</td>
<td>Integrated operating time display</td>
<td>UT</td>
<td>RO</td>
<td>0 to 99999 hours</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>188</td>
<td>Holding peak value ambient temperature display</td>
<td>Hp</td>
<td>RO</td>
<td>−10.0 to +100.0 °C</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>189</td>
<td>Power feed transformer input value monitor</td>
<td>HM</td>
<td>RO</td>
<td>0.0 to 160.0 % (Display in the engineering unit of % corresponding to the rated value.) The input value of a power feed transformer is displayed.</td>
<td>—</td>
<td>P. 190</td>
</tr>
</tbody>
</table>
6. MODBUS

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.

<table>
<thead>
<tr>
<th>Slave address</th>
<th>Function code</th>
<th>Data</th>
<th>Error check CRC-16</th>
</tr>
</thead>
</table>

**Slave address**

The slave address is a number from 0 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. 15).** 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. 58).**

**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. 63), 6.7 Data Configuration (P. 67) and 6.8 Data Map List (P. 72).**

**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. 60).**
6.2 Function Code

Function code contents

<table>
<thead>
<tr>
<th>Function code (Hexadecimal)</th>
<th>Function</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>03H</td>
<td>Read holding registers</td>
<td>Measured value, control output value, current transformer input measured value, Event status, etc.</td>
</tr>
<tr>
<td>06H</td>
<td>Preset single register</td>
<td>Set value, PID constants, event set value, etc.</td>
</tr>
<tr>
<td>08H</td>
<td>Diagnostics (loopback test)</td>
<td>loopback test</td>
</tr>
<tr>
<td>10H</td>
<td>Preset multiple registers</td>
<td>Set value, PID constants, event set value, etc.</td>
</tr>
</tbody>
</table>

Message length of each function (Unit: byte)

<table>
<thead>
<tr>
<th>Function code (Hexadecimal)</th>
<th>Function</th>
<th>Query message</th>
<th>Response message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>03H</td>
<td>Read holding registers</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>06H</td>
<td>Preset single register</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>08H</td>
<td>Diagnostics (loopback test)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>10H</td>
<td>Preset multiple registers</td>
<td>11</td>
<td>255</td>
</tr>
</tbody>
</table>

6.3 Communication Mode

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

<table>
<thead>
<tr>
<th>Items</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data bit length</td>
<td>8-bit (Binary)</td>
</tr>
<tr>
<td>Start mark of message</td>
<td>Unused</td>
</tr>
<tr>
<td>End mark of message</td>
<td>Unused</td>
</tr>
<tr>
<td>Message length</td>
<td>See 6.2 Function code</td>
</tr>
<tr>
<td>Data time interval</td>
<td>Less than 24 bits’ time *</td>
</tr>
<tr>
<td>Error check</td>
<td>CRC-16 (Cyclic Redundancy Check)</td>
</tr>
</tbody>
</table>

* 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.

<table>
<thead>
<tr>
<th>Slave address</th>
<th>Function code</th>
<th>Error code</th>
<th>Error check CRC-16</th>
</tr>
</thead>
</table>
| 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.

<table>
<thead>
<tr>
<th>Error code</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Function code error (An unsupported function code was specified)</td>
</tr>
<tr>
<td>2</td>
<td>When any address other than 0000H to 0093H, 0200H to 02E9H, and 0500H to 0535H are specified.</td>
</tr>
<tr>
<td>3</td>
<td>When the specified number of data items in the query message exceeds the maximum number of data items available</td>
</tr>
<tr>
<td>4</td>
<td>Self-diagnostic error response</td>
</tr>
</tbody>
</table>
(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.

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

START

FFFFH → CRC Register

CRC Register ⊕ next byte of the message → CRC Register

0 → n

Shift CRC Register right 1 bit

Yes

Carry flag is 1

CRC Register ⊕ A001H → CRC Register

n + 1 → n

No

n > 7

Yes

Is message complete?

No

Reverse with high-order byte and low-order byte of CRC register

END

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_message_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.

```c
uint16 calculate_crc (byte *z_p, unit16 z_message_length)
{
    uint16 CRC= 0xffff;
    uint16 next;
    uint16 carry;
    uint16 n;
    uint8 crch, crcl;
    while (z_message_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_message_length++] = crcl;
    z_p [z_message_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.

<table>
<thead>
<tr>
<th>Query message</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave address</td>
<td>02H</td>
</tr>
<tr>
<td>Function code</td>
<td>03H</td>
</tr>
<tr>
<td>Starting No.</td>
<td>High 00H, Low 00H</td>
</tr>
<tr>
<td>Quantity</td>
<td>High 00H, Low 04H</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High 44H, Low 3AH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Normal response message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave address</td>
</tr>
<tr>
<td>Function code</td>
</tr>
<tr>
<td>Number of data</td>
</tr>
<tr>
<td>First holding register contents (High order word of the first data)</td>
</tr>
<tr>
<td>Next holding register contents (Low order word of the first data)</td>
</tr>
<tr>
<td>Next holding register contents (High order word of the next data)</td>
</tr>
<tr>
<td>Next holding register contents (Low order word of the next data)</td>
</tr>
<tr>
<td>CRC-16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error response message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave address</td>
</tr>
<tr>
<td>80H + Function code</td>
</tr>
<tr>
<td>Error code</td>
</tr>
<tr>
<td>CRC-16</td>
</tr>
</tbody>
</table>

First holding register address
The setting must be between 1 (0001H) and 125 (007DH).

Number of holding registers × 2
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**

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>06H</td>
</tr>
<tr>
<td>Holding register number</td>
<td>High 00H</td>
</tr>
<tr>
<td></td>
<td>Low 49H</td>
</tr>
<tr>
<td>Write data</td>
<td>High 00H</td>
</tr>
<tr>
<td></td>
<td>Low 64H</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High 59H</td>
</tr>
<tr>
<td></td>
<td>Low F7H</td>
</tr>
</tbody>
</table>

### Any data within the range

**Normal response message**

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>06H</td>
</tr>
<tr>
<td>Holding register number</td>
<td>High 00H</td>
</tr>
<tr>
<td></td>
<td>Low 49H</td>
</tr>
<tr>
<td>Write data</td>
<td>High 00H</td>
</tr>
<tr>
<td></td>
<td>Low 64H</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High 59H</td>
</tr>
<tr>
<td></td>
<td>Low F7H</td>
</tr>
</tbody>
</table>

### Contents will be the same as query message data

**Error response message**

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>80H + Function code</td>
<td>86H</td>
</tr>
<tr>
<td>Error code</td>
<td>02H</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High C3H</td>
</tr>
<tr>
<td></td>
<td>Low A1H</td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>08H</td>
</tr>
<tr>
<td>Test code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 00H</td>
</tr>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 1FH</td>
</tr>
<tr>
<td>CRC-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High E9H</td>
</tr>
</tbody>
</table>

#### Normal response message

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>08H</td>
</tr>
<tr>
<td>Test code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 00H</td>
</tr>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 1FH</td>
</tr>
<tr>
<td>CRC-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High E9H</td>
</tr>
</tbody>
</table>

#### Error response message

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>80H + Function code</td>
<td>88H</td>
</tr>
<tr>
<td>Error code</td>
<td>03H</td>
</tr>
<tr>
<td>CRC-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 06H</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Query message</th>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function code</td>
<td>10H</td>
</tr>
<tr>
<td></td>
<td>Starting number</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Quantity</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Number of data</td>
<td>04H</td>
</tr>
<tr>
<td></td>
<td>Data to first register</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Data to next register</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>CRC-16</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>

Normal response message

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>10H</td>
</tr>
<tr>
<td>Starting number</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Quantity</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>

Error response message

<table>
<thead>
<tr>
<th>Slave address</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>80H + Function code</td>
<td>90H</td>
</tr>
<tr>
<td>Error code</td>
<td>02H</td>
</tr>
<tr>
<td>CRC-16</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
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 1 digit below decimal point

<table>
<thead>
<tr>
<th>Feedback resistance input value</th>
<th>Output 3 timer setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current transformer input value 1 (CT1)</td>
<td>Output 4 timer setting</td>
</tr>
<tr>
<td>Current transformer input value 2 (CT2)</td>
<td>Output 5 timer setting</td>
</tr>
<tr>
<td>Input 1_manipulated output value (MV1) monitor</td>
<td>Input 1_derivative gain</td>
</tr>
<tr>
<td>Input 2_manipulated output value (MV2) monitor</td>
<td>Input 1_manipulated output value at input error</td>
</tr>
<tr>
<td>LBA1 deadband</td>
<td>Input 1_output change rate limiter (up)</td>
</tr>
<tr>
<td>LBA2 deadband</td>
<td>Input 1_output change rate limiter (down)</td>
</tr>
<tr>
<td>Input 1_setting change rate limiter (up)</td>
<td>Input 1_output limiter (high limit)</td>
</tr>
<tr>
<td>Input 1_setting change rate limiter (down)</td>
<td>Input 1_output limiter (low limit)</td>
</tr>
<tr>
<td>Input 2_setting change rate limiter (up)</td>
<td>Input 2_derivative gain</td>
</tr>
<tr>
<td>Input 2_setting change rate limiter (down)</td>
<td>Input 2_manipulated output value at input error</td>
</tr>
<tr>
<td>Heater break alarm 1 (HBA1) set value</td>
<td>Input 2_output change rate limiter (up)</td>
</tr>
<tr>
<td>Heater break alarm 2 (HBA2) set value</td>
<td>Input 2_output change rate limiter (down)</td>
</tr>
<tr>
<td>Input 1_proportional cycle time</td>
<td>Input 2_output limiter (high limit)</td>
</tr>
<tr>
<td>Input 1_manipulated output value</td>
<td>Input 2_output limiter (low limit)</td>
</tr>
<tr>
<td>Input 2_proportional cycle time</td>
<td>Open/Close output neutral zone</td>
</tr>
<tr>
<td>Input 2_manipulated output value</td>
<td>Open/Close output differential gap</td>
</tr>
<tr>
<td>Output 1 timer setting</td>
<td>Holding peak value ambient temperature display</td>
</tr>
<tr>
<td>Output 2 timer setting</td>
<td>Power feed transformer input value</td>
</tr>
</tbody>
</table>

Example: When Input 1_manipulated output value (MV1) is 5.0 %, 5.0 is processed as 50, 50 = 0032H
● **Data with 2 digit below decimal point**
  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

<table>
<thead>
<tr>
<th>Input 1_PV digital filter</th>
<th>High</th>
<th>00H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>37H</td>
</tr>
</tbody>
</table>

● **Data with 3 digit below decimal point**
  Input 1_PV ratio
  Input 2_PV ratio
  Cascade ratio

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

<table>
<thead>
<tr>
<th>Input 1_PV ratio</th>
<th>High</th>
<th>02H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>2BH</td>
</tr>
</tbody>
</table>

● **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 digit below decimal point, 1 digit below decimal point, 2 digit below decimal point

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

Example: When Input 1_integral time is 240.00 seconds, 240.00 is processed as 24000, 24000 = 5DC0H

<table>
<thead>
<tr>
<th>Input 1_integral time</th>
<th>High</th>
<th>5DH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>C0H</td>
</tr>
</tbody>
</table>
• 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 digit below decimal point, 1 digit below decimal point, 2 digit below decimal point

Voltage/current input: No digit below decimal point, 1 digit below decimal point, 2 digit below decimal point, 3 digit below decimal point, 4 digit below decimal point

For details, see Input range table (P. 134).

Example: When Input 1_set value (SV1) is −20.0 °C, −20.0 is processed as −200, −200 = 0000H − 00C8H = FF38H

<table>
<thead>
<tr>
<th>Input 1_set value (SV1)</th>
<th>High</th>
<th>FFH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>38H</td>
</tr>
</tbody>
</table>

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Data without decimal points

Model codes
Input 1_burnout state
Input 2_burnout state
Feedback resistance input burnout state
Event 1 state
Event 2 state
Event 3 state
Event 4 state
Heater break alarm 1 (HBA1) state
Heater break alarm 2 (HBA2) state
Error codes
Event input state
Operation mode state
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
Link area number
Set lock level
EEPROM storage state
EEPROM storage mode
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
CT1 ratio
CT1 assignment
CT2 ratio
CT2 assignment
Hot/Cold start selection
Input 2_use selection
SV tracking
Input 1_control action type selection
Input 1_integral/derivative time decimal position selection
Input 1_action at input error (high limit)
Input 1_action at input error (low limit)
Input 1_power feed forward
Input 2_control action type selection
Input 2_integral/derivative time decimal position selection
Input 2_action at input error (high limit)
Input 2_action at input error (low limit)
Input 2_power feed forward
Input 1_AT cycle
Input 2_AT cycle
Action at feedback resistance input (FBR) error
Feedback adjustment
Setting change rate limiter unit time
Soak time unit selection
ROM version display
Integrated operating time display

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

<table>
<thead>
<tr>
<th>Integrated operating time display</th>
<th>High</th>
<th>00H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>48H</td>
<td></td>
</tr>
</tbody>
</table>
6. MODBUS

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).

- Turn of high order word and low order word is handled as Motorola Semiconductor type approval (high order sequence of low 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 “20H” in low order word.
  
  The controller interprets high order word as “00H.”

  Example 2: When did a writing only of “FFH (−1)” in low order word.
  
  The controller interprets high order word as “FFH.”

- Addresses in which data (holding register) is accessible are from 0000H to 0093H, from 0200H to 02E9H, and from 0500H to 0535H. If any address other than 0000H to 0093H, 0200H to 02E9H, 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 which 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. 72).

- 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).
- Turn of high order word and low order word is handled as Motorola Semiconductor type approval (high order sequence of low order).
- Register address 0500 H to 0535 H handles it when I do confirmation and change of set value belonging to memory area except control area. (see P. 96)

<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Data range</th>
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<tr>
<td>Input 1_measured value (PV1) monitor</td>
<td>0000 0001 0 1</td>
<td>Input 1_input scale low to high</td>
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<tr>
<td>Input 2_measured value (PV2) monitor</td>
<td>0002 0003 2 3</td>
<td>Input 2_input scale low to high</td>
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<tr>
<td>Feedback resistance input value monitor</td>
<td>0004 0005 4 5</td>
<td>0.0 to 100.0 %</td>
<td>—</td>
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<tr>
<td>Current transformer input value 1 (CT1) monitor</td>
<td>0006 0007 6 7</td>
<td>0.0 to 30.0 A or 0.0 to 100.0 A</td>
<td>—</td>
<td>P. 101</td>
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<tr>
<td>Current transformer input value 2 (CT2) monitor</td>
<td>0008 0009 8 9</td>
<td>0.0 to 30.0 A or 0.0 to 100.0 A</td>
<td>—</td>
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<tr>
<td>Input 1_set value (SV1) monitor</td>
<td>000A 000B 10 11</td>
<td>Input 1_setting limiter (low limit) to high limit</td>
<td>—</td>
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<tr>
<td>Input 2_set value (SV2) monitor</td>
<td>000C 000D 12 13</td>
<td>Input 2_setting limiter (low limit) to high limit</td>
<td>—</td>
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<tr>
<td>Remote input value monitor</td>
<td>000E 000F 14 15</td>
<td>Input 1_setting limiter (low limit) to high limit</td>
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<tr>
<td>Cascade monitor</td>
<td>0010 0011 16 17</td>
<td>Input 2_setting limiter (low limit) to high limit</td>
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<td>Input 1_burnout state</td>
<td>0012 0013 18 19</td>
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<td>0: OFF</td>
<td>1: ON</td>
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<td>Input 2_burnout state</td>
<td>0014 0015 20 21</td>
<td>RO</td>
<td>0: OFF</td>
<td>1: ON</td>
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<td>Feedback resistance input burnout state</td>
<td>0016 0017 22 23</td>
<td>RO</td>
<td>0: OFF</td>
<td>1: ON</td>
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<td>0: OFF</td>
<td>1: ON</td>
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<td>Event 2 state</td>
<td>001A 001B 26 27</td>
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<td>1: ON</td>
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<td>Event 3 state</td>
<td>001C 001D 28 29</td>
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<td>1: ON</td>
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<td>Event 4 state</td>
<td>001E 001F 30 31</td>
<td>RO</td>
<td>0: OFF</td>
<td>1: ON</td>
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<tr>
<td>Heater break alarm 1 (HBA1) state</td>
<td>0020 0021 32 33</td>
<td>RO</td>
<td>0: OFF</td>
<td>1: ON</td>
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<td>Heater break alarm 2 (HBA2) state</td>
<td>0022 0023 34 35</td>
<td>RO</td>
<td>0: OFF</td>
<td>1: ON</td>
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<tr>
<td>Input 1_manipulated output value (MV1) monitor</td>
<td>0024 0025 36 37</td>
<td>RO</td>
<td>−5.0 to</td>
<td>+105.0 %</td>
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<tr>
<td>Input 2_manipulated output value (MV2) monitor</td>
<td>0026 0027 38 39</td>
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<td>+105.0 %</td>
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<tr>
<td>Error codes</td>
<td>0028 0029 40 41</td>
<td>RO</td>
<td>0 to 4095 (Bit data)</td>
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<td>b6: Unused</td>
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<td>b7: 1: Watchdog timer error</td>
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<td>b8∼b10: Unused</td>
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<td>b12∼b31: Unused</td>
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<td>Event input state</td>
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<td>0 to 127 (Bit data)</td>
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<td>b0: DI 1 state</td>
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<td>0: Open, 1: Close</td>
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<td>b1: DI 2 state</td>
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<td>0: Open, 1: Close</td>
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<td>b2: DI 3 state</td>
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<td>0: Open, 1: Close</td>
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<td>b3: DI 4 state</td>
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<td>b4: DI 5 state</td>
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<td>b5: DI 6 state</td>
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<td>b6: DI 7 state</td>
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<td>b7 to b31: Unused</td>
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<tr>
<td>Operation mode state</td>
<td>002C 002D</td>
<td>RO</td>
<td>0 to 31 (Bit data)</td>
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<td>b0: 1: Control STOP</td>
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<td>b1: 1: Control RUN</td>
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<td>b2: 1: Input 1_Manual mode (Including Input 1_Remote mode)</td>
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<td>b3: 1: Input 2_Manual mode (Including Input 2_Remote mode)</td>
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<td>b4: 1: Remote mode or Cascade control</td>
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<td>b5 to b31: Unused</td>
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<tr>
<td>Memory area soak time monitor</td>
<td>002E 002F</td>
<td>RO</td>
<td>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</td>
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<td>— P. 108</td>
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<tr>
<td>Input 1_PID/AT transfer</td>
<td>0030 0031</td>
<td>R/W</td>
<td>0: PID control 1: Autotuning (AT)</td>
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<td>Input 2_PID/AT transfer</td>
<td>0032 0033</td>
<td>50 51</td>
<td>R/W</td>
<td>0: PID control 1: Autotuning (AT)</td>
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<tr>
<td>Input 1_Auto/Manual transfer</td>
<td>0034 0035</td>
<td>52 53</td>
<td>R/W</td>
<td>0: Input 1_Auto mode 1: Input 1_Manual mode</td>
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<td>Input 2_Auto/Manual transfer</td>
<td>0036 0037</td>
<td>54 55</td>
<td>R/W</td>
<td>0: Input 2_Auto mode 1: Input 2_Manual mode</td>
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<td>Remote/Local transfer</td>
<td>0038 0039</td>
<td>56 57</td>
<td>R/W</td>
<td>0: Local mode 1: Remote mode or Cascade control</td>
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<tr>
<td>RUN/STOP transfer</td>
<td>003A 003B</td>
<td>58 59</td>
<td>R/W</td>
<td>0: Control RUN 1: Control STOP</td>
<td>0</td>
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<td>Memory area selection</td>
<td>003C 003D</td>
<td>60 61</td>
<td>R/W</td>
<td>1 to 16</td>
<td>1</td>
<td>P. 111</td>
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<td>Event 1 set value</td>
<td>003E 003F</td>
<td>62 63</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
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<tr>
<td>Event 2 set value</td>
<td>0040 0041</td>
<td>64 65</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
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<td>Event 3 set value</td>
<td>0042 0043</td>
<td>66 67</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
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<tr>
<td>Control loop break alarm 1 (LBA1)</td>
<td>0044 0045</td>
<td>68 69</td>
<td>R/W</td>
<td>0: OFF (Not provided) 1 to 7200 seconds</td>
<td>480</td>
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<tr>
<td>LBA1 deadband</td>
<td>0046 0047</td>
<td>70 71</td>
<td>R/W</td>
<td>0.0 to input span</td>
<td>0.0</td>
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<tr>
<td>Event 4 set value</td>
<td>0048 0049</td>
<td>72 73</td>
<td>R/W</td>
<td>Deviation: −Input span to +input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 112</td>
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<td>Control loop break alarm 2 (LBA2)</td>
<td>004A 004B 74 75</td>
<td>004D 76 77</td>
<td>R/W</td>
<td>0: OFF (Not provided) 1 to 7200 seconds</td>
<td>480</td>
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<td>LBA2 deadband</td>
<td>004C 004D 76 77</td>
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<td>R/W</td>
<td>0.0 to input span</td>
<td>0.0</td>
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<td>Input 1_set value (SV1)</td>
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<td>R/W</td>
<td>Input 1_setting limiter (low limit) to input 1_setting limiter (high limit)</td>
<td>0.0</td>
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<tr>
<td>Input 1_proportional band</td>
<td>0050 0051 80 81</td>
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<td>R/W</td>
<td>TC/RTD input: 0 to input span Voltage/current input: 0.0 to 1000.0% of input span</td>
<td>30.0</td>
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<tr>
<td>Input 1_integral time</td>
<td>0052 0053 82 83</td>
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<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PD action)</td>
<td>240.00</td>
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<td>Input 1_derivative time</td>
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<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PI action)</td>
<td>60.00</td>
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<td>Input 1_control response parameter</td>
<td>0056 0057 86 87</td>
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<td>R/W</td>
<td>0: Slow 1: Medium 2: Fast</td>
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<td>Unused</td>
<td>0058 0059 88 89</td>
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<td>Input 2_set value (SV2)</td>
<td>005A 005B 90 91</td>
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<td>Input 2_setting limiter (low limit) to input 2_setting limiter (high limit)</td>
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<tr>
<td>Input 2_proportional band</td>
<td>005C 005D 92 93</td>
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<td>R/W</td>
<td>TC/RTD input: 0 to input span Voltage/current input: 0.0 to 1000.0% of input span</td>
<td>30.0</td>
<td>P. 116</td>
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<tr>
<td>Input 2_integral time</td>
<td>005E 005F 94 95</td>
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<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PD action)</td>
<td>240.00</td>
<td>P. 117</td>
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<tr>
<td>Input 2_derivative time</td>
<td>0060 0061 96 97</td>
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<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PI action)</td>
<td>60.00</td>
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<tr>
<td>Input 2_control response parameter</td>
<td>0062 0063 98 99</td>
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<td>R/W</td>
<td>0: Slow 1: Medium 2: Fast</td>
<td>0.0</td>
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<td>Unused</td>
<td>0064 0065 100 101</td>
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<td>Input 1_setting change rate limiter (up)</td>
<td>0066 0067</td>
<td>102 103</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
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<tr>
<td>Input 1_setting change rate limiter (down)</td>
<td>0068 0069</td>
<td>104 105</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
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<tr>
<td>Input 2_setting change rate limiter (up)</td>
<td>006A 006B</td>
<td>106 107</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
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<tr>
<td>Input 2_setting change rate limiter (down)</td>
<td>006C 006D</td>
<td>108 109</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 119</td>
</tr>
<tr>
<td>Area soak time</td>
<td>006E 006F</td>
<td>110 111</td>
<td>R/W</td>
<td>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</td>
<td>0.00.00</td>
<td>P. 121</td>
</tr>
<tr>
<td>Link area number</td>
<td>0070 0071</td>
<td>112 1113</td>
<td>R/W</td>
<td>0: OFF (No link) 1 to 16</td>
<td>0</td>
<td>P. 122</td>
</tr>
<tr>
<td>Heater break alarm 1 (HBA1) set value</td>
<td>0072 0073</td>
<td>114 115</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to 30.0 A or 0.1 to 100.0 A</td>
<td>0.0</td>
<td>P. 123</td>
</tr>
<tr>
<td>Heater break alarm 2 (HBA2) set value</td>
<td>0074 0075</td>
<td>116 117</td>
<td>R/W</td>
<td>0.0: OFF (Not provided) 0.1 to 30.0 A or 0.1 to 100.0 A</td>
<td>0.0</td>
<td>P. 123</td>
</tr>
<tr>
<td>Input 1_PV bias</td>
<td>0076 0077</td>
<td>118 119</td>
<td>R/W</td>
<td>–Input span to +input span</td>
<td>0</td>
<td>P. 124</td>
</tr>
<tr>
<td>Input 1_PV digital filter</td>
<td>0078 0079</td>
<td>120 121</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.01 to 10.00 seconds</td>
<td>Note1</td>
<td>P. 124</td>
</tr>
<tr>
<td>Input 1_PV ratio</td>
<td>007A 007B</td>
<td>122 123</td>
<td>R/W</td>
<td>0.500 to 1.500</td>
<td>1.000</td>
<td>P. 125</td>
</tr>
<tr>
<td>Input 1_PV low input cut-off</td>
<td>007C 007D</td>
<td>124 125</td>
<td>R/W</td>
<td>0.00 to 25.00 % of input span</td>
<td>0.00</td>
<td>P. 126</td>
</tr>
<tr>
<td>Input 1_proportional cycle time</td>
<td>007E 007F</td>
<td>126 127</td>
<td>R/W</td>
<td>0.1 to 100.0 seconds Other outputs: Voltage pulse output and triac output</td>
<td>Note2</td>
<td>P. 127</td>
</tr>
</tbody>
</table>

Note1  HA400/HA900: 0.00  HA401/HA901: 1.00
Note2  Relay contact output: 20.0 sec  Other outputs: 2.0 sec

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<thead>
<tr>
<th>Name</th>
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<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
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<tbody>
<tr>
<td>Input 1_manipulated output value</td>
<td>0080 0081</td>
<td>R/W</td>
<td>Input 1_output limiter (low limit) to Input 1_output limiter (high limit)</td>
<td>0.0</td>
<td>P. 127</td>
</tr>
<tr>
<td>Input 2_PV bias</td>
<td>0082 0083</td>
<td>R/W</td>
<td>~Input span to +input span</td>
<td>0</td>
<td>P. 124</td>
</tr>
<tr>
<td>Input 2_PV digital filter</td>
<td>0084 0085</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.01 to 10.00 seconds</td>
<td>Note1</td>
<td>P. 124</td>
</tr>
<tr>
<td>Input 2_PV ratio</td>
<td>0086 0087</td>
<td>R/W</td>
<td>0.500 to 1.500</td>
<td>1.00</td>
<td>P. 125</td>
</tr>
<tr>
<td>Input 2_PV low input cut-off</td>
<td>0088 0089</td>
<td>R/W</td>
<td>0.00 to 25.00 % of input span</td>
<td>0.00</td>
<td>P. 126</td>
</tr>
<tr>
<td>Input 2_proportional cycle time</td>
<td>008A 008B</td>
<td>R/W</td>
<td>0.1 to 100.0 seconds Other outputs: Voltage pulse output and triac output</td>
<td>Note2</td>
<td>P. 127</td>
</tr>
<tr>
<td>Input 2_manipulated output value</td>
<td>008C 008D</td>
<td>R/W</td>
<td>Input 2_output limiter (low limit) to Input 2_output limiter (high limit)</td>
<td>0.0</td>
<td>P. 127</td>
</tr>
</tbody>
</table>
| Set lock level              | 008E 008F        | R/W       | 0 to 15 (Bit data)  
|                             |                  |          | b0: Lock only setting items other than SV and events (EV1 to EV4).  
|                             |                  |          | 0: Settable, 1: Not settable (Lock)  
|                             |                  |          | b1: Lock only events (EV1 to EV4).  
|                             |                  |          | 0: Settable, 1: Not settable (Lock)  
|                             |                  |          | b2: Lock only set value (SV).  
|                             |                  |          | 0: Settable, 1: Not settable (Lock)  
|                             |                  |          | b3～b31: Unused          | 0                | P. 128         |

Note1 HA400/HA900: 0.00   HA401/HA901: 1.00
Note2 Relay contact output: 20.0 sec Other outputs: 2.0 sec

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<tr>
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<th>Register address</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
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</thead>
<tbody>
<tr>
<td>EEPROM storage state</td>
<td>0090 0091</td>
<td>144 145</td>
<td>RO</td>
<td>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.</td>
<td>— P. 129</td>
</tr>
<tr>
<td>EEPROM storage mode</td>
<td>0092 0093</td>
<td>146 147</td>
<td>R/W</td>
<td>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.</td>
<td>0 P. 129</td>
</tr>
<tr>
<td>Unused</td>
<td>0094 0095</td>
<td>148 149</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>STOP display selection</td>
<td>0200 0201</td>
<td>512 513</td>
<td>R/W</td>
<td>0: Displays on the measured value (PV1/PV2) unit 1: Displays on the set value (SV) unit</td>
<td>0 P. 130</td>
</tr>
<tr>
<td>Bar graph display selection</td>
<td>0202 0203</td>
<td>514 515</td>
<td>R/W</td>
<td>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: Feedback resistance input value (POS) 6: Input 2 manipulated output value (MV) 7: Input 2 measured value (PV) 8: Input 2 set value (SV) 9: Input 2 deviation value</td>
<td>0 P. 131</td>
</tr>
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## 6. MODBUS

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<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar graph resolution setting</td>
<td>0204 0205</td>
<td>516 517</td>
<td>R/W 1 to 100 digit/dot</td>
<td>100</td>
<td>P. 132</td>
</tr>
<tr>
<td>Unused</td>
<td>0206 0207</td>
<td>518 519</td>
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<tr>
<td>Auto/Manual transfer key operation selection (A/M)</td>
<td>0208 0209</td>
<td>520 521</td>
<td>R/W 0: No direct key operation</td>
<td>3</td>
<td>P. 132</td>
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<tr>
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<td>1: Auto/Manual transfer for input 1</td>
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<td>2: Auto/Manual transfer for input 2</td>
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<td>3: Auto/Manual transfer for input 1 and input 2</td>
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<tr>
<td>Remote/Local transfer key operation selection (R/L)</td>
<td>020A 020B</td>
<td>522 523</td>
<td>R/W 0: No direct key operation</td>
<td>1</td>
<td>P. 133</td>
</tr>
<tr>
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<td>1: Remote/Local transfer</td>
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<td></td>
</tr>
<tr>
<td>RUN/STOP transfer key operation selection (R/S)</td>
<td>020C 020D</td>
<td>524 525</td>
<td>R/W 0: No direct key operation</td>
<td>1</td>
<td>P. 133</td>
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<tr>
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<td>1: RUN/STOP transfer</td>
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<table>
<thead>
<tr>
<th>Name</th>
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<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
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<tbody>
<tr>
<td>Input 1_input type selection</td>
<td>020E 020F</td>
<td>526 527</td>
<td>R/W TC input</td>
<td>Depend on model code</td>
<td>P. 134</td>
</tr>
</tbody>
</table>
|                                           |                  |           | 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                                  |                  |           |                                              | Type K            |                |
|                                           |                  |           |  -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             |                  |           |                                              |                   |                |
| 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                          |                  |           |                                              |                   |                |
| RTD input (4-wire system)                  |                  |           |                                              |                   |                |
| 22: Pt100                                  |                  |           |                                              |                   |                |
|                                           |                  |           |  -200 to +850 °C  
-328.0 to 1562.0 °F  |
| 23: JPt100                                 |                  |           |                                              |                   |                |
|                                           |                  |           |  -200 to +600 °C  
-328.0 to 1112.0 °F  |

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<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Hexadecimal</th>
<th>Decimal</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
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<tbody>
<tr>
<td>Input 1_display unit selection</td>
<td>0210</td>
<td>0211</td>
<td>528</td>
<td>529</td>
<td>R/W</td>
<td>0: °C</td>
<td>0 P. 135</td>
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<td>1: °F</td>
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<td>Input 1_decimal point position</td>
<td>0212</td>
<td>0213</td>
<td>530</td>
<td>531</td>
<td>R/W</td>
<td>0: No digit below</td>
<td>1 P. 136</td>
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<td>1: 1 digit below</td>
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<td>2: 2 digits below</td>
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<td>3: 3 digits below</td>
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<td>4: 4 digits below</td>
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<tr>
<td>Input 1_input scale high</td>
<td>0214</td>
<td>0215</td>
<td>532</td>
<td>533</td>
<td>R/W</td>
<td>TC/RTD input:</td>
<td>Note1</td>
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<td>Input scale low to</td>
<td>P. 137</td>
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<td>Voltage (V)/current (I) input:</td>
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<td>−19999 to +99999</td>
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<td>(Varies depending on the position of the decimal point setting)</td>
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<td>0217</td>
<td>534</td>
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<td>R/W</td>
<td>TC/RTD input:</td>
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<td>Minimum value of</td>
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<td>Voltage (V)/current (I) input:</td>
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<td>−19999 to +99999</td>
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<td>(Varies depending on the position of the decimal point setting)</td>
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<tr>
<td>Input 1_input error determination point</td>
<td>0218</td>
<td>0219</td>
<td>536</td>
<td>537</td>
<td>R/W</td>
<td>Input scale low −</td>
<td>Note3</td>
</tr>
<tr>
<td>(high limit)</td>
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<td></td>
<td>(5 % of input span) to input scale high + (5 % of input span)</td>
<td>P. 139</td>
</tr>
<tr>
<td>Input 1_input error determination point</td>
<td>021A</td>
<td>021B</td>
<td>538</td>
<td>539</td>
<td>R/W</td>
<td>Input scale low −</td>
<td>Note4</td>
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<td>(low limit)</td>
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<td>(5 % of input span) to input scale high + (5 % of input span)</td>
<td>P. 140</td>
</tr>
</tbody>
</table>

Note1 TC/RTD: Maximum value of input range  V/I: 100.0
Note2 TC/RTD: Minimum value of input range  V/I: 0.0
Note3 TC/RTD: Input scale high + (5 % of input span)  V/I: 105.0
Note4 TC/RTD: Input scale low − (5 % of input span)  V/I: −5.0

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<th>Factory set value</th>
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</thead>
<tbody>
<tr>
<td>Input 1 _ burnout direction</td>
<td>021C 021D</td>
<td>R/W</td>
<td>0: Upscale</td>
<td>Note1 P. 140</td>
</tr>
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<td>540 541</td>
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<td>1: Downscale</td>
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<td>Note1 P. 140</td>
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<tr>
<td>Input 1 _ square root extraction selection</td>
<td>021E 021F</td>
<td>R/W</td>
<td>0: Not provided</td>
<td>0 P. 141</td>
</tr>
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<td>542 543</td>
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<td>1: Provided</td>
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<tr>
<td>Power supply frequency selection</td>
<td>0220 0221</td>
<td>R/W</td>
<td>0: 50 Hz</td>
<td>0 P. 141</td>
</tr>
<tr>
<td></td>
<td>544 545</td>
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<td>1: 60 Hz</td>
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</table>

Note1 TC/RTD: 0 V/I: 1

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<tr>
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<th>Register address</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
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<tbody>
<tr>
<td>Input 2 input type selection</td>
<td>0222 0223 546 547</td>
<td>R/W</td>
<td>TC input</td>
<td>Depend on model code</td>
<td>When not specifying: Type K</td>
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<tr>
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<td></td>
<td>0: K −200 to +1372 °C −328.0 to 2501.6 °F</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>1: J −200 to +1200 °C −328.0 to 2192.0 °F</td>
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<td>2: R −50 to +1768 °C −58.0 to 3214.4 °F</td>
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<td>4: B 0 to 1800 °C 32.0 to 3272.0 °F</td>
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<td>5: E −200 to +1000 °C −328.0 to 1832.0 °F</td>
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<td>6: N 0 to 1300 °C 32.0 to 2372.0 °F</td>
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<td>8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F</td>
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<td>9: PLII 0 to 1390 °C 32.0 to 2534.0 °F</td>
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<td>12: Pt100</td>
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<td>−200 to +850 °C −328.0 to 1562.0 °F</td>
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<td>−200 to +600 °C −328.0 to 1112.0 °F</td>
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<td>15: 4 to 20 mA DC</td>
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<td>16: 0 to 10 V DC</td>
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<td>17: 0 to 5 V DC</td>
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<td>18: 1 to 5 V DC</td>
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<td>19: 0 to 1 V DC</td>
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<td>20: 0 to 100 mV DC</td>
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<td>21: 0 to 10 mV DC</td>
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<td>23: JPt100</td>
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<td>0: °C</td>
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<td>Input 2 _decimal point position</td>
<td>0226 0227</td>
<td>550</td>
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<td>R/W</td>
<td>0: No digit below decimal point 1: 1 digit below decimal point 2: 2 digits below decimal point 3: 3 digits below decimal point 4: 4 digits below decimal point</td>
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<td>Input 2 _input scale high</td>
<td>0228 0229</td>
<td>552</td>
<td>553</td>
<td>R/W</td>
<td>TC/RTD input: Input scale low to maximum value of input range Voltage (V)/current (I) input: −19999 to +99999 (Varies depending on the position of the decimal point setting)</td>
<td>Note1</td>
<td>P. 137</td>
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<td>Input 2 _input scale low</td>
<td>022A 022B</td>
<td>554</td>
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<td>R/W</td>
<td>TC/RTD input: Minimum value of input range to input scale high Voltage (V)/current (I) input: −19999 to +99999 (Varies depending on the position of the decimal point setting)</td>
<td>Note2</td>
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<td>Input 2 _input error determination point (high limit)</td>
<td>022C 022D</td>
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<td>R/W</td>
<td>Input scale low − (5 % of input span) to input scale high + (5 % of input span)</td>
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<td>Input 2 _input error determination point (low limit)</td>
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<td>R/W</td>
<td>Input scale low − (5 % of input span) to input scale high + (5 % of input span)</td>
<td>Note4</td>
<td>P. 140</td>
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Note1 TC/RTD: Maximum value of input range V/I: 100.0
Note2 TC/RTD: Minimum value of input range V/I: 0.0
Note3 TC/RTD: Input scale high + (5 % of input span) V/I: 105.0
Note4 TC/RTD: Input scale low − (5 % of input span) V/I: −5.0

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<td>0231</td>
<td>560 561</td>
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<td>0233</td>
<td>562 563</td>
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<td>0 to 6</td>
<td>1 P. 142</td>
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<td>566 567</td>
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<td>Output 1 timer setting</td>
<td>0238 0239</td>
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<td>0239</td>
<td>568 569</td>
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<td>0.0 to 600.0 seconds</td>
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<td>023A</td>
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<td>023D</td>
<td>572 573</td>
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<td>0.0 to 600.0 seconds</td>
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<td>Output 4 timer setting</td>
<td>023E 023F</td>
<td>023E</td>
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<td>574 575</td>
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<td>0.0 to 600.0 seconds</td>
<td>0.0 P. 146</td>
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<td>Output 5 timer setting</td>
<td>0240 0241</td>
<td>0240</td>
<td>0241</td>
<td>576 577</td>
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<td>0243</td>
<td>578 579</td>
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<td>4: Input 1_manipulated output value (MV)</td>
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<td>5: Input 2_measured value (PV)</td>
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<td>7: Input 2_deviation</td>
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<td>0245</td>
<td>580 581</td>
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<td>Input scale low to input scale high</td>
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<td>−5.0 to +105.0 %</td>
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<td>−Input span to +Input span</td>
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Note1 TC/RTD: 0 V/I: 1
Note2 1 input: 1 2 input: 5
Note3 PV/SV: Input scale high MV: 100.0 Deviation: +Input span

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<td>Deviation: −Input span to +Input span</td>
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Note1 PV/SV: Input scale low MV: 0.0 Deviation: −Input span
Note2 PV/SV: Input scale high MV: 100.0 Deviation: +Input span

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<td>- Input scale low to input scale high</td>
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<td>- Manipulated output value (MV): −5.0 to +105.0 %</td>
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<td>- Deviation: −Input span to +Input span</td>
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Note1 PV/SV: Input scale low MV: 0.0 Deviation: −Input span
Note2 PV/SV: Input scale high MV: 100.0 Deviation: +Input span

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<td>0252 0253 594 595</td>
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<td>Event 1 type selection</td>
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<td>Event 1 hold action</td>
<td>0256 0257 598 599</td>
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<td>0: Not provided 1: Provided 2: Re-hold action</td>
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<td>Event 1 differential gap</td>
<td>0258 0259 600 601</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note2</td>
<td>P. 156</td>
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<tr>
<td>Event 1 action at input error</td>
<td>025A 025B 602 603</td>
<td>R/W</td>
<td>0: Normal processing 1: Forcibly turned on</td>
<td>0</td>
<td>P. 158</td>
</tr>
<tr>
<td>Event 1 assignment</td>
<td>025C 025D 604 605</td>
<td>R/W</td>
<td>1: For input 1 2: For input 2</td>
<td>0</td>
<td>P. 160</td>
</tr>
<tr>
<td>Event 2 type selection</td>
<td>025E 025F 606 607</td>
<td>R/W</td>
<td>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</td>
<td>0</td>
<td>P. 151</td>
</tr>
<tr>
<td>Event 2 hold action</td>
<td>0260 0261 608 609</td>
<td>R/W</td>
<td>0: Not provided 1: Provided 2: Re-hold action</td>
<td>0</td>
<td>P. 154</td>
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</table>

Note1 PV/SV: Input scale low MV: 0.0 Deviation: −Input span
Note2 TC/RTD: 2.0 °C V/I: 0.2 % of input span

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<td>0262</td>
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<td>610</td>
<td>611</td>
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<td>0264</td>
<td>0265</td>
<td>612</td>
<td>613</td>
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<td>0266</td>
<td>0267</td>
<td>614</td>
<td>615</td>
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<td>0269</td>
<td>616</td>
<td>617</td>
<td>R/W</td>
<td>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</td>
<td>0 P. 151</td>
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<td>Event 3 hold action</td>
<td>026A</td>
<td>026B</td>
<td>618</td>
<td>619</td>
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<td>0: Not provided 1: Provided 2: Re-hold action</td>
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<td>026C</td>
<td>026D</td>
<td>620</td>
<td>621</td>
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<td>Note1 P. 156</td>
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<td>026F</td>
<td>622</td>
<td>623</td>
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<td>0270</td>
<td>0271</td>
<td>624</td>
<td>625</td>
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<td>1: For input 1 2: For input 2</td>
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<td>Event 4 type selection</td>
<td>0272</td>
<td>0273</td>
<td>626</td>
<td>627</td>
<td>R/W</td>
<td>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</td>
<td>0 P. 151</td>
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<td>Event 4 hold action</td>
<td>0274</td>
<td>0275</td>
<td>628</td>
<td>629</td>
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<td>0 P. 154</td>
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<td>Event 4 differential gap</td>
<td>0276</td>
<td>0277</td>
<td>630</td>
<td>631</td>
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<td>Note1 P. 156</td>
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<td>Event 4 action at input error</td>
<td>0278</td>
<td>0279</td>
<td>632</td>
<td>633</td>
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<td>0: Normal processing 1: Forcibly turned on</td>
<td>0 P. 158</td>
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<td>Event 4 assignment</td>
<td>027A</td>
<td>027B</td>
<td>634</td>
<td>635</td>
<td>R/W</td>
<td>1: For input 1 2: For input 2</td>
<td>0 P. 160</td>
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Note1 TC/RTD: 2.0 °C  V/I: 0.2 % of input span

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<tr>
<td>CT1 ratio</td>
<td>027C 027D</td>
<td>R/W</td>
<td>0 to 9999</td>
<td>Depend on model code</td>
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</tr>
<tr>
<td>CT1 assignment</td>
<td>027E 027F</td>
<td>R/W</td>
<td>0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4 5: OUT5</td>
<td>Note1</td>
<td>P. 162</td>
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<tr>
<td>CT2 ratio</td>
<td>0280 0281</td>
<td>R/W</td>
<td>0 to 9999</td>
<td>Depend on model code</td>
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<tr>
<td>CT2 assignment</td>
<td>0282 0283</td>
<td>R/W</td>
<td>0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4 5: OUT5</td>
<td>Note2</td>
<td>P. 162</td>
</tr>
<tr>
<td>Hot/Cold start selection</td>
<td>0284 0285</td>
<td>R/W</td>
<td>Power failure of 3 seconds or less 0: Hot 1 1: Hot 2 2: Cold 3: Hot 2 4: Hot 2 5: Cold Power failure of 3 seconds or more 0: Hot 1 1: Hot 2 2: Cold 4: Cold 5: Cold</td>
<td>0</td>
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<tr>
<td>Input 2_use selection</td>
<td>0286 0287</td>
<td>R/W</td>
<td>0: Single loop control 1: Remote input 2: Cascade control (Slave)</td>
<td>0</td>
<td>P. 164</td>
</tr>
<tr>
<td>Cascade ratio</td>
<td>0288 0289</td>
<td>R/W</td>
<td>0.000 to 1.500</td>
<td>1.000</td>
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<tr>
<td>Cascade bias</td>
<td>028A 028B</td>
<td>R/W</td>
<td>0.000 to 1.500</td>
<td>0.000</td>
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<tr>
<td>SV tracking</td>
<td>028C 028D</td>
<td>R/W</td>
<td>0: Not provided 1: Provided</td>
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<tr>
<td>Input 1_control action type selection</td>
<td>028E 028F</td>
<td>R/W</td>
<td>0: Direct action 1: Reverse action</td>
<td>1</td>
<td>P. 168</td>
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Note1  CT1 provided: 1  CT1 not provided: 0
Note2  CT2 provided: 1  CT2 not provided: 0

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<tr>
<td><strong>Input 1</strong> integral/derivative time decimal point position selection**</td>
<td></td>
<td>0290 0291</td>
<td>656 657</td>
<td>R/W</td>
<td>0: No digit below decimal point 1: 1 digit below decimal point 2: 2 digits below decimal point</td>
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<tr>
<td><strong>Input 1</strong> derivative gain</td>
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<td>0292 0293</td>
<td>658 659</td>
<td>R/W</td>
<td>0.1 to 10.0</td>
<td>6.0</td>
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<tr>
<td><strong>Input 1</strong> ON/OFF action differential gap (upper)</td>
<td></td>
<td>0294 0295</td>
<td>660 661</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note1</td>
<td>P. 170</td>
</tr>
<tr>
<td><strong>Input 1</strong> ON/OFF action differential gap (lower)</td>
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<td>0296 0297</td>
<td>662 663</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note1</td>
<td>P. 171</td>
</tr>
<tr>
<td><strong>Input 1</strong> action at input error (high limit)</td>
<td></td>
<td>0298 0299</td>
<td>664 665</td>
<td>R/W</td>
<td>0: Normal control (present output) 1: Manipulated output value at input error</td>
<td>0</td>
<td>P. 172</td>
</tr>
<tr>
<td><strong>Input 1</strong> action at input error (low limit)</td>
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<td>029A 029B</td>
<td>666 667</td>
<td>R/W</td>
<td>0: Normal control (present output) 1: Manipulated output value at input error</td>
<td>0</td>
<td>P. 173</td>
</tr>
<tr>
<td><strong>Input 1</strong> manipulated output value at input error</td>
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<td>029C 029D</td>
<td>668 669</td>
<td>R/W</td>
<td>−5.0 to +105.0 %</td>
<td>−5.0</td>
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</tr>
<tr>
<td><strong>Input 1</strong> output change rate limiter (up)</td>
<td></td>
<td>029E 029F</td>
<td>670 671</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
<tr>
<td><strong>Input 1</strong> output change rate limiter (down)</td>
<td></td>
<td>02A0 02A1</td>
<td>672 673</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
<td>P. 174</td>
</tr>
<tr>
<td><strong>Input 1</strong> output limiter (high limit)</td>
<td></td>
<td>02A2 02A3</td>
<td>674 675</td>
<td>R/W</td>
<td></td>
<td>105.0</td>
<td>P. 176</td>
</tr>
<tr>
<td><strong>Input 1</strong> output limiter (low limit)</td>
<td></td>
<td>02A4 02A5</td>
<td>676 677</td>
<td>R/W</td>
<td>−5.0 % to input 1_output limiter (high limit)</td>
<td>−5.0</td>
<td>P. 176</td>
</tr>
<tr>
<td><strong>Input 1</strong> power feed forward</td>
<td></td>
<td>02A6 02A7</td>
<td>678 679</td>
<td>R/W</td>
<td>0: Not provided 1: Provided</td>
<td>Note2</td>
<td>P. 177</td>
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<tr>
<td><strong>Input 2</strong> control action type selection</td>
<td></td>
<td>02A8 02A9</td>
<td>680 681</td>
<td>R/W</td>
<td>0: Direct action 1: Reverse action</td>
<td>1</td>
<td>P. 168</td>
</tr>
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</table>

**Note1** TC/RTD: 1.0 °C  
V/I: 0.1 % of input span

**Note2** Not provided: 0  
Provided: 1

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<table>
<thead>
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<th>Decimal</th>
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<th>Factory set value</th>
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<tbody>
<tr>
<td>Input 2_integr/derivative time decimal point position selection</td>
<td>02AA 02AB</td>
<td>682 683</td>
<td>R/W</td>
<td>0: No digit below decimal point 1: 1 digit below decimal point 2: 2 digits below decimal point</td>
<td>2</td>
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<tr>
<td>Input 2_derivative gain</td>
<td>02AC 02AD</td>
<td>684 685</td>
<td>R/W</td>
<td>0.1 to 10.0</td>
<td>6.0</td>
<td>P. 170</td>
<td></td>
</tr>
<tr>
<td>Input 2_ON/OFF action differential gap (upper)</td>
<td>02AE 02AF</td>
<td>686 687</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note1</td>
<td>P. 170</td>
<td></td>
</tr>
<tr>
<td>Input 2_ON/OFF action differential gap (lower)</td>
<td>02B0 02B1</td>
<td>688 689</td>
<td>R/W</td>
<td>0 to input span</td>
<td>Note1</td>
<td>P. 171</td>
<td></td>
</tr>
<tr>
<td>Input 2_action at input error (high limit)</td>
<td>02B2 02B3</td>
<td>690 691</td>
<td>R/W</td>
<td>0: Normal control (present output) 1: Manipulated output value at input error</td>
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<td></td>
</tr>
<tr>
<td>Input 2_action at input error (low limit)</td>
<td>02B4 02B5</td>
<td>692 693</td>
<td>R/W</td>
<td>0: Normal control (present output) 1: Manipulated output value at input error</td>
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<tr>
<td>Input 2_manipulated output value at input error</td>
<td>02B6 02B7</td>
<td>694 695</td>
<td>R/W</td>
<td>−5.0 to +105.0 %</td>
<td>−5.0</td>
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<td>Input 2_output change rate limiter (up)</td>
<td>02B8 02B9</td>
<td>696 697</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
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<tr>
<td>Input 2_output change rate limiter (down)</td>
<td>02BA 02BB</td>
<td>698 699</td>
<td>R/W</td>
<td>0.0 to 1000.0 %/seconds</td>
<td>0.0</td>
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<td>Input 2_output limiter (high limit)</td>
<td>02BC 02BD</td>
<td>700 701</td>
<td>R/W</td>
<td>Input 2_output limiter (low limit) to 105.0 %</td>
<td>105.0</td>
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<tr>
<td>Input 2_output limiter (low limit)</td>
<td>02BE 02BF</td>
<td>702 703</td>
<td>R/W</td>
<td>−5.0 % to input 2_output limiter (high limit)</td>
<td>−5.0</td>
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<tr>
<td>Input 2_power feed forward</td>
<td>02C0 02C1</td>
<td>704 705</td>
<td>R/W</td>
<td>0: Not provided 1: Provided</td>
<td>Note2</td>
<td>P. 177</td>
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<tr>
<td>Input 1_AT bias</td>
<td>02C2 02C3</td>
<td>706 707</td>
<td>R/W</td>
<td>−Input span to +input span</td>
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<tr>
<td>Input 1_AT cycle</td>
<td>02C4 02C5</td>
<td>708 709</td>
<td>R/W</td>
<td>0: 1.5 cycle 1: 2.0 cycle 2: 2.5 cycle 3: 3.0 cycle</td>
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Note1 TC/RTD: 1.0 °C V/I: 0.1 % of input span
Note2 Not provided: 0 Provided: 1

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<td>710 711</td>
<td>R/W</td>
<td>0.00 to 50.00 seconds</td>
<td>Note1 P. 180</td>
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<tr>
<td>Input 2_AT bias</td>
<td>02C8 02C9</td>
<td>712 713</td>
<td>R/W</td>
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<td>0 P. 178</td>
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<tr>
<td>Input 2_AT cycle</td>
<td>02CA 02CB</td>
<td>714 715</td>
<td>R/W</td>
<td>0: 1.5 cycle 1: 2.0 cycle 2: 2.5 cycle 3: 3.0 cycle</td>
<td>1 P. 179</td>
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<tr>
<td>Input 2_AT differential gap time</td>
<td>02CC 02CD</td>
<td>716 717</td>
<td>R/W</td>
<td>0.00 to 50.00 seconds</td>
<td>Note1 P. 180</td>
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<tr>
<td>Open/Close output neutral zone</td>
<td>02CE 02CF</td>
<td>718 719</td>
<td>R/W</td>
<td>0.1 to 10.0 %</td>
<td>10.0 P. 182</td>
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<tr>
<td>Open/Close output differential gap</td>
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<td>720 721</td>
<td>R/W</td>
<td>0.1 to 5.0 %</td>
<td>0.2 P. 183</td>
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<tr>
<td>Action at feedback resistance input (FBR) error</td>
<td>02D2 02D3</td>
<td>722 723</td>
<td>R/W</td>
<td>0: Close-side output ON, Open-side output OFF 1: Close-side output OFF, Open-side output OFF 2: Close-side output OFF, Open-side output ON</td>
<td>0 P. 184</td>
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<tr>
<td>Feedback adjustment</td>
<td>02D4 02D5</td>
<td>724 725</td>
<td>R/W</td>
<td>0: Adjustment end 1: During the Open-side adjusting 2: During the Close-side adjusting</td>
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<td>Setting change rate limiter unit time</td>
<td>02D6 02D7</td>
<td>726 727</td>
<td>R/W</td>
<td>1 to 3600 seconds</td>
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<td>Soak time unit selection</td>
<td>02D8 02D9</td>
<td>728 729</td>
<td>R/W</td>
<td>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</td>
<td>2 P. 186</td>
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<tr>
<td>Input 1_setting limiter (high limit)</td>
<td>02DA 02DB</td>
<td>730 731</td>
<td>R/W</td>
<td>Input 1_setting limiter (low limit) to input 1_input scale high</td>
<td>Input 1_input scale high P. 187</td>
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**Note1** HA400/HA900: 0.10 HA401/HA901: 10.00

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<td>02DC 02DD</td>
<td>R/W</td>
<td>Input 1_input scale low to input 1_setting limiter (high limit)</td>
<td>Input 1_input scale low</td>
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<td>Input 1_input scale high</td>
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<td>Input 2_setting limiter (high limit)</td>
<td>02DE 02DF</td>
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<td>Input 2_setting limiter (low limit) to input 2_input scale high</td>
<td>Input 2_input scale high</td>
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<tr>
<td>Input 2_input scale high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input 2_setting limiter (low limit)</td>
<td>02E0 02E1</td>
<td>R/W</td>
<td>Input 2_input scale low to input 2_setting limiter (high limit)</td>
<td>Input 2_input scale low</td>
<td>P. 188</td>
</tr>
<tr>
<td>ROM version display</td>
<td>02E2 02E3</td>
<td>RO</td>
<td>Display the version of loading software.</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>Integrated operating time display</td>
<td>02E4 02E5</td>
<td>RO</td>
<td>0 to 99999 hours</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>Holding peak value ambient temperature display</td>
<td>02E6 02E7</td>
<td>RO</td>
<td>−10.0 to +100.0 °C</td>
<td>—</td>
<td>P. 189</td>
</tr>
<tr>
<td>Power feed transformer input value monitor</td>
<td>02E8 02E9</td>
<td>RO</td>
<td>0.0 to 160.0 %</td>
<td>—</td>
<td>P. 190</td>
</tr>
<tr>
<td>Unused</td>
<td>02EA 02EB</td>
<td>—</td>
<td></td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>04FE 04FF</td>
<td>—</td>
<td></td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Items relating to the memory area other than the control area

<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Hex/Dec Address</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory area selection</td>
<td>0500 0501</td>
<td>1280 1281</td>
<td>R/W 1 to 16</td>
<td>1</td>
<td>P. 191</td>
</tr>
<tr>
<td>Event 1 set value</td>
<td>0502 0503</td>
<td>1282 1283</td>
<td>R/W Deviation: −Input span to + input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 192</td>
</tr>
<tr>
<td>Event 2 set value</td>
<td>0504 0505</td>
<td>1284 1285</td>
<td>R/W Deviation: −Input span to + input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 192</td>
</tr>
<tr>
<td>Event 3 set value</td>
<td>0506 0507</td>
<td>1286 1287</td>
<td>R/W Deviation: −Input span to + input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 192</td>
</tr>
<tr>
<td>Control loop break alarm 1 (LBA1)</td>
<td>0508 0509</td>
<td>1288 1289</td>
<td>R/W 0: OFF (Not provided) 1 to 7200 seconds</td>
<td>480</td>
<td>P. 193</td>
</tr>
<tr>
<td>LBA1 deadband</td>
<td>050A 050B</td>
<td>1290 1291</td>
<td>R/W 0.0 to input span</td>
<td>0.0</td>
<td>P. 193</td>
</tr>
<tr>
<td>Event 4 set value</td>
<td>050C 050D</td>
<td>1292 1293</td>
<td>R/W Deviation: −Input span to + input span Process/SV: Input scale low to input scale high</td>
<td>50.0</td>
<td>P. 192</td>
</tr>
<tr>
<td>Control loop break alarm 2 (LBA2)</td>
<td>050E 050F</td>
<td>1294 1295</td>
<td>R/W 0: OFF (Not provided) 1 to 7200 seconds</td>
<td>480</td>
<td>P. 193</td>
</tr>
<tr>
<td>LBA2 deadband</td>
<td>0510 0511</td>
<td>1296 1297</td>
<td>R/W 0.0 to input span</td>
<td>0.0</td>
<td>P. 193</td>
</tr>
<tr>
<td>Input 1_set value (SV1)</td>
<td>0512 0513</td>
<td>1298 1299</td>
<td>R/W Input 1_setting limiter (low limit) to input 1_setting limiter (high limit)</td>
<td>0.0</td>
<td>P. 194</td>
</tr>
<tr>
<td>Input 1_proportional band</td>
<td>0514 0515</td>
<td>1300 1301</td>
<td>R/W TC/RTD input: 0 to input span Voltage/current input: 0.0 to 1000.0 % of input span</td>
<td>30.0</td>
<td>P. 194</td>
</tr>
</tbody>
</table>

Continued on the next page.
Continued from the previous page.

<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Hexadecimal</th>
<th>Decimal</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input 1_integral time</td>
<td>0516 0517</td>
<td>0516 0517</td>
<td>1302 1303</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PD action)</td>
<td>240.00</td>
<td>P. 195</td>
</tr>
<tr>
<td>Input 1_derivative time</td>
<td>0518 0519</td>
<td>0518 0519</td>
<td>1304 1305</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PI action)</td>
<td>60.00</td>
<td>P. 195</td>
</tr>
<tr>
<td>Input 1_control response parameter</td>
<td>051A 051B</td>
<td>051A 051B</td>
<td>1306 1307</td>
<td>R/W</td>
<td>0: Slow 1: Medium 2: Fast</td>
<td>0</td>
<td>P. 196</td>
</tr>
<tr>
<td>Unused</td>
<td>051C 051D</td>
<td>051C 051D</td>
<td>1308 1309</td>
<td></td>
<td>Input 2_setting limiter (low limit) to input 2_setting limiter (high limit)</td>
<td>0.0</td>
<td>P. 194</td>
</tr>
<tr>
<td>Input 2_set value (SV2)</td>
<td>0520 0521</td>
<td>0520 0521</td>
<td>1312 1313</td>
<td>R/W</td>
<td>TC/RTD input: 0 to input span Voltage/current input: 0.0 to 1000.0 % of input span</td>
<td>30.0</td>
<td>P. 194</td>
</tr>
<tr>
<td>Input 2_proportional band</td>
<td>0522 0523</td>
<td>0522 0523</td>
<td>1314 1315</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PD action)</td>
<td>240.00</td>
<td>P. 195</td>
</tr>
<tr>
<td>Input 2_integer time</td>
<td>0524 0525</td>
<td>0524 0525</td>
<td>1316 1317</td>
<td>R/W</td>
<td>0.0 to 3600.0 seconds or 0.00 to 360.00 seconds (0.0 or 0.00: PI action)</td>
<td>60.00</td>
<td>P. 195</td>
</tr>
<tr>
<td>Input 2_control response parameter</td>
<td>0526 0527</td>
<td>0526 0527</td>
<td>1318 1319</td>
<td>R/W</td>
<td>0: Slow 1: Medium 2: Fast</td>
<td>0</td>
<td>P. 196</td>
</tr>
<tr>
<td>Unused</td>
<td>0528 0529</td>
<td>0528 0529</td>
<td>1320 1321</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input 1_setting change rate limiter (up)</td>
<td>052A 052B</td>
<td>052A 052B</td>
<td>1322 1323</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 196</td>
</tr>
<tr>
<td>Input 1_setting change rate limiter (down)</td>
<td>052C 052D</td>
<td>052C 052D</td>
<td>1324 1325</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 197</td>
</tr>
<tr>
<td>Input 2_setting change rate limiter (up)</td>
<td>052E 052F</td>
<td>052E 052F</td>
<td>1326 1327</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 196</td>
</tr>
<tr>
<td>Input 2_setting change rate limiter (down)</td>
<td>0530 0531</td>
<td>0530 0531</td>
<td>1328 1329</td>
<td>R/W</td>
<td>0: OFF (Not provided) 0.1 to input span/one minute</td>
<td>0.0</td>
<td>P. 197</td>
</tr>
</tbody>
</table>

Continued on the next page.
<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area soak time</td>
<td>0532 0533 1330 1331</td>
<td>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</td>
<td>0.00.00</td>
<td>P. 197</td>
</tr>
<tr>
<td>Link area number</td>
<td>0534 0535 1332 1333</td>
<td>0: OFF (No link) 1 to 16</td>
<td>0</td>
<td>P. 198</td>
</tr>
</tbody>
</table>
7. COMMUNICATION DATA DESCRIPTION

- **Referance to communication data contents**

<table>
<thead>
<tr>
<th>(1)</th>
<th>RKC communication identifier</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0000H (0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0001H (1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2)</th>
<th>RKC communication identifier</th>
<th>M0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0002H (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0003H (3)</td>
<td></td>
</tr>
</tbody>
</table>

| (3) | Input 1_ measured value (PV1) monitor |
|     | Input 2_ measured value (PV2) monitor |

(4) Measured value (PV) is the input value of the controller. There are thermocouple input, resistance temperature detector input, voltage input and current input.

(5) Attribute: RO (Read only)

(6) Digits: 7 digits

(7) Data range: Input scale low limit to Input scale high limit

(8) Factory set value: —

(9) Relational items: Decimal point position (P. 136)

(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 parantheses) numbers.

(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 from the controller is possible.

R/W: Reading and writing data from the controller 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) Relational items: A name and a page of relational items are written.

There is item including the functional description.
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:** —

<table>
<thead>
<tr>
<th>Input 1_ measured value (PV1) monitor</th>
<th>RKC communication identifier</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0000H (0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0001H (1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_ measured value (PV2) monitor</th>
<th>RKC communication identifier</th>
<th>M0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0002H (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0003H (3)</td>
<td></td>
</tr>
</tbody>
</table>

Measured value (PV) is an input value of the controller. There are 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 limit to Input scale high limit

See **Input range table (P. 134)**

**Factory set value:** —
**Relational items:** Decimal point position (P. 136)

<table>
<thead>
<tr>
<th>Feedback resistance input value monitor</th>
<th>RKC communication identifier</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0004H (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0005H (5)</td>
<td></td>
</tr>
</tbody>
</table>

This value is a feedback resistance input value of the controller.

**Attribute:** RO (Read only)
**Digits:** 7 digits
**Data range:** 0.0 to 100.0 
**Factory set value:** —
**Relational items:** Open/Close output neutral zone (P. 182),
Open/Close output differential gap (P. 183)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Current transformer input value 1 (CT1) monitor</th>
<th>RKC communication identifier</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0006H (6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0007H (7)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current transformer input value 2 (CT2) monitor</th>
<th>RKC communication identifier</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0008H (8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0009H (9)</td>
<td></td>
</tr>
</tbody>
</table>

This value is a current transformer input value that is used for heater break alarm function.

Attribute: RO (Read only)
Digits: 7 digits
Data range: When the CT type is CTL-6-P-N: 0.0 to 30.0 A
When the CT type is CTL-12-S56-10L-N: 0.0 to 100.0 A
Factory set value: —
Relational items: Heater break alarm (HBA) state (P. 104), Heater break alarm (HBA) set value (P. 123), CT ratio (P. 161), CT assignment (P. 162)

<table>
<thead>
<tr>
<th>Input 1_set value (SV1) monitor</th>
<th>RKC communication identifier</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 000AH (10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 000BH (11)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_set value (SV2) monitor</th>
<th>RKC communication identifier</th>
<th>MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 000CH (12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 000DH (13)</td>
<td></td>
</tr>
</tbody>
</table>

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 limit) to Setting limiter (high limit)

See Input range table (P. 134)
Factory set value: —
Relational items: Decimal point position (P. 136)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Remote input value monitor</th>
<th>RKC communication identifier</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 000EH (14)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 000FH (15)</td>
<td></td>
</tr>
</tbody>
</table>

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 limit) to Input 1_setting limiter (high limit)

See **Input range table (P. 134)**

Factory set value: —

<table>
<thead>
<tr>
<th>Cascade monitor</th>
<th>RKC communication identifier</th>
<th>KH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0010H (16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0011H (17)</td>
<td></td>
</tr>
</tbody>
</table>

This value is an input value (a commanding value from the master) that is used for cascade control function.

- **Attribute:** RO (Read only)
- **Digits:** 7 digits
- **Data range:** Input 2_setting limiter (low limit) to Input 2_setting limiter (high limit)

See **Input range table (P. 134)**

Factory set value: —

Relational items: Input 2_use selection (P. 164)

<table>
<thead>
<tr>
<th>Input 1_burnout state</th>
<th>RKC communication identifier</th>
<th>B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0012H (18)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0013H (19)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_burnout state</th>
<th>RKC communication identifier</th>
<th>B0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0014H (20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0015H (21)</td>
<td></td>
</tr>
</tbody>
</table>

This value expresses a state in input break.

- **Attribute:** RO (Read only)
- **Digits:** 7 digits
- **Data range:**
  - 0: OFF
  - 1: ON

Factory set value: —

Relational items: Burnout direction (P. 140)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Feedback resistance input burnout state</th>
<th>RKC communication identifier</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0016H (22)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0017H (23)</td>
<td></td>
</tr>
</tbody>
</table>

This value expresses a state in feedback resistance input break.

- **Attribute:** RO (Read only)
- **Digits:** 7 digits
- **Data range:**
  - 0: OFF
  - 1: ON
- **Factory set value:** —
- **Relational items:** Action at feedback resistance input (FBR) error (P. 184)

<table>
<thead>
<tr>
<th>Event 1 state</th>
<th>RKC communication identifier</th>
<th>AA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0018H (24)</td>
<td>Low order: 0019H (25)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 2 state</th>
<th>RKC communication identifier</th>
<th>AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 001AH (26)</td>
<td>Low order: 001BH (27)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 3 state</th>
<th>RKC communication identifier</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 001CH (28)</td>
<td>Low order: 001DH (29)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 state</th>
<th>RKC communication identifier</th>
<th>AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 001EH (30)</td>
<td>Low order: 001FH (31)</td>
</tr>
</tbody>
</table>

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:** —
- **Relational items:**
  - Event set value (P. 112), Output logic selection (P. 144),
  - Event type selection (P. 151), Event hold action (P. 154),
  - Event differential gap (P. 156), Event action at input error (P. 158),
  - Event assignment (P. 160)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Description</th>
<th>RKC communication identifier</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater break alarm 1 (HBA1) state</td>
<td>MODBUS register address</td>
<td>High order: 0020H (32)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0021H (33)</td>
</tr>
<tr>
<td>Heater break alarm 2 (HBA2) state</td>
<td>MODBUS register address</td>
<td>High order: 0022H (34)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0023H (35)</td>
</tr>
</tbody>
</table>

This value expresses a state of the heater break alarm ON/OFF.

**Attribute:** RO (Read only)

**Digits:** 7 digits

**Data range:**
- 0: OFF
- 1: ON

**Factory set value:** undefined

**Relational items:**
- Current transformer input value (CT) monitor (P. 101),
- Heater break alarm (HBA) set value (P. 123),
- CT ratio (P. 161), CT assignment (P. 162)

<table>
<thead>
<tr>
<th>Description</th>
<th>RKC communication identifier</th>
<th>O1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input 1 manipulated output value (MV1) monitor</td>
<td>MODBUS register address</td>
<td>High order: 0024H (36)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0025H (37)</td>
</tr>
<tr>
<td>Input 2 manipulated output value (MV2) monitor</td>
<td>MODBUS register address</td>
<td>High order: 0026H (38)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0027H (39)</td>
</tr>
</tbody>
</table>

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:** undefined

**Relational items:**
- Manipulated output value (P. 127), Output logic selection (P. 144),
- Output change rate limiter (up/down) (P. 174),
- Output limiter (high limit/low limit) (P. 176)
<table>
<thead>
<tr>
<th>Error codes</th>
<th>RKC communication identifier</th>
<th>ER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS</td>
<td>High order: 0028H (40)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0029H (41)</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Bit image:</th>
<th>000000000000</th>
<th>bit 0: Adjustment data error</th>
</tr>
</thead>
<tbody>
<tr>
<td>bit 11</td>
<td>⋮</td>
<td>bit 1: EEPROM error</td>
</tr>
<tr>
<td>bit 0</td>
<td></td>
<td>bit 2: A/D conversion error</td>
</tr>
<tr>
<td>bit 3</td>
<td></td>
<td>bit 3: RAM check error</td>
</tr>
<tr>
<td>bit 4</td>
<td></td>
<td>bit 4: Hard configuration error</td>
</tr>
<tr>
<td>bit 5</td>
<td></td>
<td>bit 5: Soft configuration error</td>
</tr>
<tr>
<td>bit 6</td>
<td></td>
<td>bit 6: Unused</td>
</tr>
<tr>
<td>bit 7</td>
<td></td>
<td>bit 7: Watchdog timer error</td>
</tr>
<tr>
<td>bit 8 to bit 10:</td>
<td>Unused</td>
<td></td>
</tr>
<tr>
<td>bit 11: Program busy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bit 12 to bit 31:</td>
<td>Unused</td>
<td></td>
</tr>
</tbody>
</table>

**Factory set value:** —
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: Open  1: Close  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:  The state of DI 6
Most significant digit: The state of DI 7

MODBUS: 0 to 127 (bit data)
The event input state is assigned as a bit image in binary numbers.

Bit image: 0000000
bit 6 ・・・・・・ bit 0

Bit data: 0: Open  1: Close
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:  The state of DI 6
bit 6:  The state of DI 7
bit 7 to bit 31: Unused

Factory set value: —
Relational items: Event input logic selection (P. 142)
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

Least significant digit: 1: Control STOP
2nd digit: 1: Control RUN
3rd digit: 1: Input 1_Manual mode (Including Input 1_Remote mode)
4th digit: 1: Input 2_Manual mode (Including Input 2_Remote mode)
5th digit: 1: Remote mode or Cascade control
6th digit to 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: 0000

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

Factory set value: —
Relational items: Auto/Manual transfer (P. 110), Remote/Local transfer (P. 111), RUN/STOP transfer (P. 111), Input 2_use selection (P. 164)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Memory area soak time monitor</th>
<th>RKC communication identifier</th>
<th>TR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 002EH (46)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 002FH (47)</td>
<td></td>
</tr>
</tbody>
</table>

This value expresses memory area soak time to use in case of simple program operation (see P. 109) that used memory area.

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 35999 seconds
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds: 0 to 59999 seconds

Factory set value: —

Relational items: Area soak time (P. 121), Soak time unit selection (P. 186)

<table>
<thead>
<tr>
<th>Input 1_PID/AT transfer</th>
<th>RKC communication identifier</th>
<th>G1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0030H (48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0031H (49)</td>
<td></td>
</tr>
</tbody>
</table>

This item transfers PID control and autotuning (AT).

Attribute: R/W (Read and Write)

Input 2_PID/AT transfer (G0) becomes RO (Read only) for one input specification.

Digits: 7 digits

Data range: 0: PID control
1: Autotuning (AT)

Factory set value: 0

Relational items: AT bias (P. 178), AT cycle (P. 179), AT differential gap time (P. 180)

Functional description:

Autotuning (AT) is the function which automatically measures, calculates and sets the optimum PID constants according to the set temperature. The following is the conditions necessary to carry out autotuning and the conditions which will cause the autotuning to stop.

Continued on the next page.
Continued from the previous page.

The autotuning start:
Start the autotuning when all following conditions are satisfied:
• Operation mode conditions:
  – Auto/Manual transfer → Auto mode
  – Remote/Local transfer → Local mode
  – PID/AT transfer → PID control
  – RUN/STOP transfer → Control RUN
• The measured value (PV1) should not be an underscale or overscale displayed.
• The output limiter high limit should be 0.1 % or more and the output limiter low limit should be 99.9 % or less.

When the autotuning is finished, the control will automatically returns to PID control.

The autotuning cancellation:
• 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 transfer is changed to the Manual mode.
• When the Remote/Local transfer is changed to the Remote mode.
• When the measured value (PV1) becomes an underscale or overscale display.
• When the power failure occurs.
• When FAIL occurs in the controller.
• When the PID/AT transfer is changed to the PID control.
• When the RUN/STOP transfer is changed to the Control STOP.

When the above-mentioned conditions to stop the autotuning occurs, the autotuning is immediately stopped and switch over to the PID control mode. The PID constants return to the values at the start of the autotuning.
### Input 1_Auto/Manual transfer

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>J1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td>High order: 0034H (52)</td>
<td></td>
</tr>
<tr>
<td>Low order: 0035H (53)</td>
<td></td>
</tr>
</tbody>
</table>

### Input 2_Auto/Manual transfer

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>J0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td>High order: 0036H (54)</td>
<td></td>
</tr>
<tr>
<td>Low order: 0037H (55)</td>
<td></td>
</tr>
</tbody>
</table>

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 one input specification.**

**Digits:** 7 digits

**Data range:**
- 0: Auto mode
- 1: Manual mode

**Factory set value:** 0

**Relational items:** Operation mode state (P. 107)
### Remote/Local transfer

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>High order: 0038H (56)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0039H (57)</td>
</tr>
</tbody>
</table>

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 or the cascade control specification.**

**Digits:** 7 digits

**Data range:**
- 0: Local mode
- 1: Remote mode or Cascade control

**Factory set value:** 0

**Relational items:** Operation mode state (P. 107)

### RUN/STOP transfer

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>High order: 003AH (58)</td>
</tr>
<tr>
<td></td>
<td>Low order: 003BH (59)</td>
</tr>
</tbody>
</table>

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

**Relational items:** Operation mode state (P. 107)

### Memory area selection

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZA</td>
<td>High order: 003CH (60)</td>
</tr>
<tr>
<td></td>
<td>Low order: 003DH (61)</td>
</tr>
</tbody>
</table>

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
This value expresses a set value of the event action.

<table>
<thead>
<tr>
<th>Event 1 set value</th>
<th>RKC communication identifier</th>
<th>A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 003EH (62) Low order: 003FH (63)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 2 set value</th>
<th>RKC communication identifier</th>
<th>A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0040H (64) Low order: 0041H (65)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 3 set value</th>
<th>RKC communication identifier</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0042H (66) Low order: 0043H (67)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 set value</th>
<th>RKC communication identifier</th>
<th>A4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0048H (72) Low order: 0049H (73)</td>
<td></td>
</tr>
</tbody>
</table>

**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

**Relational items:**
- Event state (P. 103), Event type selection (P. 151), Event hold action (P. 154), Event differential gap (P. 156), Event action at input error (P. 158), Event assignment (P. 160)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Control loop break alarm 1 (LBA1) time</th>
<th>RKC communication identifier</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 0044H (68) Low order: 0045H (69)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control loop break alarm 2 (LBA2) time</th>
<th>RKC communication identifier</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 004AH (74) Low order: 004BH (75)</td>
</tr>
</tbody>
</table>

The variation of measured value (PV) is monitored for each control loop break alarm (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: Not provided)  
**Factory set value:** 480  
**Relational items:** Event state (P. 103), Event assignment (P. 160), LBA deadband (P. 113)

<table>
<thead>
<tr>
<th>LBA1 deadband</th>
<th>RKC communication identifier</th>
<th>N1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 0046H (70) Low order: 0047H (71)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LBA2 deadband</th>
<th>RKC communication identifier</th>
<th>N2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 004CH (76) Low order: 004DH (77)</td>
</tr>
</tbody>
</table>

The LBA deadband is a 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  
**Relational items:** Event state (P. 103), Event assignment (P. 160), Control loop break alarm (LBA) time (P. 113)
## Functional description

**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.

This function monitors the measured value (PV) variation at LBA time intervals from the time the output exceeds 100 % (or output limiter: high limit) or falls below 0 % (or output limiter: low limit), then detects a heater or input break.

### [Alarm action]

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

- **LBA triggering width:**
  - Temperature input: 2 °C [2 °F] fixed
  - Voltage/current input: 0.2% fixed

- **When the output falls below 0 % (or output limiter: low limit):**
  - For direct action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA time.
  - For reverse action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA time.

- **When the output exceeds 100 % (or output limiter: high limit):**
  - For direct action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA time.
  - For reverse action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA time.

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

### Control loop break alarm (LBA) deadband:

The LBA may be produced by disturbances (other heat sources) even if the control system is not abnormal. In such a case, an area in which no alarm is produced can be set by setting the desired LBA deadband (LBD).

When the measured value (PV) is within the LBD area, no alarm is produced even if all of the conditions to produce the alarm are satisfied. Therefore, carefully set the LBD.

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

The LBA function detects an error occurring in the control loop, but cannot specify the erroneous location. Therefore, check the control loop in order.

Continued on the next page.
Continued from the previous page.

The LBA function is not activated when any of the following cases occurs.
- When the autotuning function is being executed.
- When operation mode is not in Control mode.

When the LBA setting time is extremely short or does not meet the controlled object, the LBA may be turned on and off, or may not be turned on. In such a case, change the LBA time depending on the situation.

The LBA output is turned off when any of the following cases occurs with the LBA output turned on.
- When the measured value (PV) rises beyond (or falls below) the LBA triggering width within the LBA time.
- When the measured value (PV) is within the LBA deadband.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_set value (SV1)</th>
<th>RKC communication identifier</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 004EH (78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 004FH (79)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_set value (SV2)</th>
<th>RKC communication identifier</th>
<th>S0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 005AH (90)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 005BH (91)</td>
<td></td>
</tr>
</tbody>
</table>

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 one input specification.

Digits: 7 digits

Data range: Setting limiter (low limit) to setting limiter (high limit)

Factory set value: 0

Relational items: Setting limiter high limit/low limit (P. 188)

<table>
<thead>
<tr>
<th>Input 1_proportional band</th>
<th>RKC communication identifier</th>
<th>P1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0050H (80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0051H (81)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_proportional band</th>
<th>RKC communication identifier</th>
<th>P0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 005CH (92)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 005DH (93)</td>
<td></td>
</tr>
</tbody>
</table>

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 one input specification.

Digits: 7 digits

Data range:
- 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: 30.0

Relational items: ON/OFF action differential gap upper (P. 170),
ON/OFF action differential gap lower (P. 171)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_integrat time</th>
<th>RKC communication identifier</th>
<th>I1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0052H (82) Low order: 0053H (83)</td>
<td></td>
</tr>
</tbody>
</table>

This value expresses a time of the integral action that eliminates the offset occurring in proportional control.

Attribute: R/W (Read and Write)

The Input 2_integral time (I0) becomes RO (Read only) for the one input specification.

Digits: 7 digits
Data range: 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds
(0.0 or 0.00: PD action)
Factory set value: 240.00
Relational items: Integral/derivative time decimal point position selection (P. 169)

<table>
<thead>
<tr>
<th>Input 1_derivative time</th>
<th>RKC communication identifier</th>
<th>D1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0054H (84) Low order: 0055H (85)</td>
<td></td>
</tr>
</tbody>
</table>

This value expresses a time of the derivative action that prevents ripples by predicting output changes and thus improves control stability.

Attribute: R/W (Read and Write)

The Input 2_derivative time (D0) becomes RO (Read only) for the one input specification.

Digits: 7 digits
Data range: 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds
(0.0 or 0.00: PI action)
Factory set value: 60.00
Relational items: Integral/derivative time decimal point position selection (P. 169)
The Input 2_control response parameter (C9) becomes RO (Read only) for the one input specification.

Digits: 7 digits
Data range:
0: Slow
1: Medium
2: Fast
Factory set value: 0
Functional description:
This is the function of enabling the setting of response to set value (SV) change in select any one of 3 steps (Slow, Medium, Fast) in PID control.
In order to achieve faster controlled object response to set value (SV) change, select Fast. However, slight overshoot is unavoidable when selecting Fast. Depending on the controlled object, specify Slow if overshoot should be avoided.
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_ setting change rate limiter (up)</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HH</td>
<td>High order: 0066H (102) Low order: 0067H (103)</td>
</tr>
</tbody>
</table>

**Input 2_ setting change rate limiter (up)**

| MODBUS register address | High order: 006AH (106) Low order: 006BH (107) |

This value expresses a set value of the setting change rate limiter up.

Attribute: **R/W (Read and Write)**

📖 **The Input 2 setting change rate limiter up (HX) becomes RO (Read only) for the one input specification.**

- **Digits:** 7 digits
- **Data range:** 0.1 to input span/one minute
  - 0.0: OFF (Not provided)
- **Factory set value:** 0.0
- **Relational items:** Setting change rate limiter unit time (P. 186)

<table>
<thead>
<tr>
<th>Input 1_ setting change rate limiter (down)</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HL</td>
<td>High order: 0068H (104) Low order: 0069H (105)</td>
</tr>
</tbody>
</table>

**Input 2_ setting change rate limiter (down)**

| MODBUS register address | High order: 006CH (108) Low order: 006DH (109) |

This value expresses a set value of the setting change rate limiter down.

Attribute: **R/W (Read and Write)**

📖 **The Input 2 setting change rate limiter down (HY) becomes RO (Read only) for the one input specification.**

- **Digits:** 7 digits
- **Data range:** 0.1 to input span/one minute
  - 0.0: OFF (Not provided)
- **Factory set value:** 0.0
- **Relational items:** Setting change rate limiter unit time (P. 186)
## Functional description

The setting change rate limiter is the function of setting amount of set value (SV) change per unit time when the set value (SV) is changed.

**Application example of setting change rate limiter:**

- Example of increasing set value to higher value
- Example of decreasing set value to lower value

![Diagram of setting change rate limiter](image)

When the power is turned on or operation is changed from STOP to RUN, the setting change rate limiter functions toward the set value (SV) from the measured value (PV) when started.

If the autotuning (AT) function is activated while the setting change rate limiter functions, PID control continues until the limiter completes its functioning, and the autotuning (AT) function is activated after the limiter completes its functioning.

When it changed the setting change rate limiter during executing the control area, the gradient is change than the internal computation after being changed. In this case, it does not change when the gradient arrives at set value (SV).
### Communication Data Description

<table>
<thead>
<tr>
<th>Area soak time</th>
<th>RKC communication identifier</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 006EH (110)</td>
<td>Low order: 006FH (111)</td>
</tr>
</tbody>
</table>

This item uses the combination of the setting change rate limiter up/down and the link area number in case of simple program operation. (see P. 122)

- **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)
- **Relational items:** Soak time unit selection (P. 186)

![Diagram showing the area soak time change](image)

- When the setting of the area soak time is changed while the control area is being performed, the area soak time is changed the value changed. However, it is not added with the value before changing the setting of the area soak time.

For example, when the area soak time is changed 10 minutes after the control area that is setted the area soak time with 5 minutes operated for three minutes, the time of remaining operating hour becomes 7 minutes.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Link area number</th>
<th>RKC communication identifier</th>
<th>LP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 0070H (112)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0071H (113)</td>
</tr>
</tbody>
</table>

This item uses the combination of the setting change rate limiter up/down and the area soak time in case of simple program operation.

Attribute: R/W (Read and Write)

Digits: 7 digits

Data range: 0 to 16

0: OFF (No link)

Factory set value: 0

Functional description:

Simple program operation can perform to combine with the setting change rate limiter up/down, the area soak time and the link area number.

[Usage example]
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Heater break alarm 1 (HBA1) set value</th>
<th>RKC communication identifier</th>
<th>A7</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High order: 0072H (114)</td>
<td>Low order: 0073H (115)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heater break alarm 2 (HBA2) set value</th>
<th>RKC communication identifier</th>
<th>A8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High order: 0074H (116)</td>
<td>Low order: 0075H (117)</td>
<td></td>
</tr>
</tbody>
</table>

HBA set value sets by referring to CT input measured value of current transformer.

Attribute: R/W (Read and Write)

- **Heater break alarm 1 (HBA1) set value (A7) becomes RO (Read only) for no current transformer input 1 (CT1) specification.**
- **Heater break alarm 2 (HBA2) set value (A8) becomes RO (Read only) for no current transformer input 2 (CT2) specification.**

Digits: 7 digits

Data range:
- When the CT type is CTL-6-P-N: 0.0 to 30.0 A
- When the CT type is CTL-12-S56-10L-N: 0.0 to 100.0 A
- 0.0: OFF (Not provided)

Factory set value: 0.0

Functional description:

The heater break alarm (HBA) function is used to detect the current flowing through the load (heater) by using a current transformer (CT), to compare the current thus detected to the heater break alarm set value, and thus to produce a heater break alarm when any of the following causes occurs.

- **When the heater current does not flow:** Heater break or abnormality in the operating unit, etc.

  When the control output is on and the current transformer (CT) input value is the HBA set value or less, the alarm is set up.

- **When the heater current does not stop:** The melting of relay, etc.

  When the control output is off and the current transformer (CT) input value is the HBA set value or more, the alarm is set up.

Heater current data items are updated using data items captured when the control output is turned on. However when the relay is welded, they are updated using data items captured when the control output is turned off.

![Diagram](https://via.placeholder.com/150)

**HBA: Heater break alarm**

**CT: Current transformer**
This item is the PV bias to add to measured value for sensor correction, etc. The PV bias uses when you need to correct the individual variations in the sensors or 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 one input specification.

**Digits:** 7 digits

**Data range:** −Input span to +input span

**Factory set value:** 0

---

This item is the time of the first-order lag filter that rejects any noise contained in the measured input.

**Attribute:** R/W (Read and Write)

The Input 2 PV digital filter (F0) becomes RO (Read only) for the one input specification.

**Digits:** 7 digits

**Data range:** 0: OFF (Not provided)
0.01 to 10.00 seconds

**Factory set value:** HA400/HA900: 0.00
HA400/HA901: 1.00
### Input 1_PV ratio

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 007AH (122)</td>
</tr>
<tr>
<td></td>
<td>Low order: 007BH (123)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_PV ratio</th>
<th>PQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>RKC communication identifier</td>
<td>High order: 0086H (134)</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>Low order: 0087H (135)</td>
</tr>
</tbody>
</table>

This item is the PV ratio (magnification) to add to measured value for sensor correction, etc. The PV bias is used to correct the individual variations in the sensors or when there is 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 one input specification.*

**Digits:** 7 digits

**Data range:** 0.500 to 1.500

**Factory set value:** 1.000
### Input 1_PV low input cut-off

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP</td>
<td>High order: 007CH (124)</td>
</tr>
<tr>
<td></td>
<td>Low order: 007DH (125)</td>
</tr>
</tbody>
</table>

### Input 2_PV low input cut-off

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO</td>
<td>High order: 0088H (136)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0089H (137)</td>
</tr>
</tbody>
</table>

As a result of square root extraction, low input value with large variation is cut.

**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:** 0.00

**Functional description:**

When input signal square root extraction is used, such as in flow control, the square root extraction result varies widely in the selection with low input value. In order to eliminate control inconvenience caused by input variations at low input value, input of less than the value set is cut (0 input) and processed.

![Graph showing output vs input for low input cut-off](image)

- **Output**
  - 100 %
  - 70.7 %
  - 50 %

- **Input**
  - 0 %
  - 25 %
  - 50 %
  - 100 %

- **When set value of the PV low input cut-off is 0 %:**
  - Output: 0 %

- **When set value of the PV low input cut-off is 15 %:**
  - Input: 25 %
### Input 1_proportional cycle time

<table>
<thead>
<tr>
<th></th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>High order: 007EH (126)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 007FH (127)</td>
</tr>
</tbody>
</table>

**MODBUS register address**
- High order: 007EH (126)
- Low order: 007FH (127)

This item is proportional cycle time of control 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:**
- Relay contact output: 20.0 seconds
- Voltage pulse output and triac output: 2.0 seconds

- The proportional cycle time becomes invalid for the voltage/current output specification.

### Input 2_proportional cycle time

<table>
<thead>
<tr>
<th></th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T2</td>
<td>High order: 008AH (138)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 008BH (139)</td>
</tr>
</tbody>
</table>

**MODBUS register address**
- High order: 008AH (138)
- Low order: 008BH (139)

### Input 1_manipulated output value

<table>
<thead>
<tr>
<th></th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON</td>
<td>High order: 0080H (128)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0081H (129)</td>
</tr>
</tbody>
</table>

**MODBUS register address**
- High order: 0080H (128)
- Low order: 0081H (129)

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:** Output limiter (low limit) to output limiter (high limit)

**Factory set value:** 0.0

**Relational items:** Output limiter high limit/low limit (P. 176)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Set lock level</th>
<th>RKC communication identifier</th>
<th>LK</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 008EH (142)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 008FH (143)</td>
<td></td>
</tr>
</tbody>
</table>

Use this item when you need to restrict a setting change of the parameter to the operator, or to prevent the operator from doing misoperation during operation. (Data lock function)

**Attribute:** R/W (Read and Write)

**Digits:** 7 digits

**Data range:**
- **RKC communication:** ASCII code data of 7 digits
- **MODBUS:** 0 to 15 (bit data)

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

**ASCII code data of 7 digits:**

```plaintext
Most significant digit · · · · · · Least significant digit
```

- **Least significant digit:** Lock only setting items other than SV and events (EV1 to EV4).
  - 0: Settable, 1: Not settable (Lock)
- **2nd digit:** Lock only events (EV1 to EV4).
  - 0: Settable, 1: Not settable (Lock)
- **3rd digit:** Lock only set value (SV).
  - 0: Settable, 1: Not settable (Lock)
- **4th digit to Most significant digit:** Unused

**MODBUS:** 0 to 15 (bit data)

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

**Bit image:**

```plaintext
0000
```

- **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: Settable
- 1: Not settable (Lock)

**Factory set value:** 0
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>EEPROM storage state</th>
<th>RKC communication identifier</th>
<th>EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS</td>
<td>High order: 0090H (144)</td>
<td>Low order: 0091H (145)</td>
</tr>
</tbody>
</table>

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: —

<table>
<thead>
<tr>
<th>EEPROM storage mode</th>
<th>RKC communication identifier</th>
<th>EB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS</td>
<td>High order: 0092H (146)</td>
<td>Low order: 0093H (147)</td>
</tr>
</tbody>
</table>

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.”

📝 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.

Continued on the next page.
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.

<table>
<thead>
<tr>
<th>STOP display selection</th>
<th>RKC communication identifier</th>
<th>DX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0200H (512)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0201H (513)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects the display position of the STOP characters at control stop.

- **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

 Displays in the STOP mode become as follows.

**TYPE1:**

- (KSTP): 
  \[\text{ESRP} \quad 1 \quad 2000\]
- (dSTP): 
  \[\text{dESRP} \quad 1 \quad 2000\]
- (SToP): 
  \[\text{SToP}\]

**TYPE2:**

- (KSTP): 
  \[\text{28.0}\]
- (dSTP): 
  \[\text{28.0}\]
- (SToP): 
  \[\text{28.0}\]
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Bar graph display selection</th>
<th>RKC communication identifier</th>
<th>DA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0202H (514)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0203H (515)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects 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: Feedback resistance input value (POS)
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

Relational items: Bar graph resolution setting (P. 132)

Each bar graph display becomes as follows.

<table>
<thead>
<tr>
<th>Manipulated output value (MV) display</th>
<th>Displays the manipulated output value (MV) in a span of from 0 to 100 %. The dot of bar graph left end blinks when the MV is less than 0 %. In addition, the dot of bar graph right end blinks when the MV is more than 100 %.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Display example] 0 50 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measured value (PV) display</th>
<th>Displays the measured value (PV). Scaling in the scale range.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Display example] 0 50 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set value (SV) display</th>
<th>Displays the set value (SV). Scaling in the scale range.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Display example] 0 50 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deviation value display</th>
<th>Displays the deviation of measured value (PV) corresponding to the set value (SV). The dots at both ends of bar graph light to indicate deviation display. One dot is variable in a range of from 1 to 100 digit.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Display example] - 0 +</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback resistance input value (POS) display</th>
<th>The bar graph displays the feedback resistance input value (POS). (Only in case of the position proportioning PID control)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Display example] 0 50 100</td>
</tr>
</tbody>
</table>

* The number of dot points: 10 dots (for HA400/HA401) 20 dots (for HA900/HA901)
### Bar Graph Resolution Setting

<table>
<thead>
<tr>
<th>RKC Communication Identifier</th>
<th>Modbus Register Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>High order: 0204H (516)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0205H (517)</td>
</tr>
</tbody>
</table>

This item is 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

**Relational Items:** Bar graph display selection (P. 131)

---

### Auto/Manual Transfer Key Operation Selection (A/M)

<table>
<thead>
<tr>
<th>RKC Communication Identifier</th>
<th>Modbus Register Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK</td>
<td>High order: 0208H (520)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0209H (521)</td>
</tr>
</tbody>
</table>

This item selects the Auto/Manual transfer key (A/M) Used/Unused.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits
**Data Range:**
- 0: No direct key operation
- 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

<table>
<thead>
<tr>
<th>MODBUS register address</th>
<th>High order: 020AH (522)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low order: 020BH (523)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects the Remote/Local transfer key (R/L) Used/Unused.

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range:
0: No direct key operation
1: Remote/Local transfer

Factory set value: 1

RUN/STOP transfer key operation selection (R/S)  RKC communication identifier  DM

<table>
<thead>
<tr>
<th>MODBUS register address</th>
<th>High order: 020CH (524)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low order: 020DH (525)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects the RUN/STOP transfer key (R/S) Used/Unused.

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range:
0: No direct key operation
1: RUN/STOP transfer

Factory set value: 1
### Input 1 _input type selection

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>XI</td>
<td>High order: 020EH (526)</td>
</tr>
<tr>
<td></td>
<td>Low order: 020FH (527)</td>
</tr>
</tbody>
</table>

### Input 2 _ input type selection

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>XJ</td>
<td>High order: 0222H (546)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0223H (547)</td>
</tr>
</tbody>
</table>

This value indicates input type and input range.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:** 0 to 23 (see the following table)

**[Input Range Table]**

<table>
<thead>
<tr>
<th>Set value</th>
<th>Input type</th>
<th>Input range</th>
<th>Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>K</td>
<td>−200 to +1372 °C or −328.0 to +2501.6 °F</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>J</td>
<td>−200 to +1200 °C or −328.0 to +2192.0 °F</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R</td>
<td>−50 to +1768 °C or −58.0 to +3214.4 °F</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S</td>
<td>−50 to +1768 °C or −58.0 to +3214.4 °F</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>0 to 1800 °C or 32.0 to 3272.0 °F</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>−200 to +1000 °C or −328.0 to +1832.0 °F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>N</td>
<td>0 to 1300 °C or 32.0 to 2372.0 °F</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>T</td>
<td>−200 to +400 °C or −328.0 to +752.0 °F</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>W5Re/W26Re</td>
<td>0 to 2300 °C or 32.0 to 4172.0 °F</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>PLII</td>
<td>0 to 1390 °C or 32.0 to 2534.0 °F</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Voltage (Low)</td>
<td>Programmable range (−19999 to +99999)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>RTD input</td>
<td>3-wire system Pt100</td>
<td>−200 to +850 °C or −328.0 to +1562.0 °F</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>3-wire system JPt100</td>
<td>−200 to +600 °C or −328.0 to +1112.0 °F</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>4-wire system Pt100</td>
<td>−200 to +850 °C or −328.0 to +1562.0 °F</td>
</tr>
<tr>
<td>14</td>
<td>Current input</td>
<td>0~20 mA</td>
<td>Programmable range (-19999 to +99999)</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>4~20 mA</td>
<td>Programmable range (-19999 to +99999)</td>
</tr>
<tr>
<td>16</td>
<td>Voltage (High)</td>
<td>0~10 V</td>
<td>Programmable range (-19999 to +99999)</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0~5 V</td>
<td>Programmable range (-19999 to +99999)</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>1~5 V</td>
<td>Programmable range (-19999 to +99999)</td>
</tr>
</tbody>
</table>

If the hardware is the same, this item enables to change the input type. Not change the different hardware group interval.

Do not set to any number (10 or 11) which is not described in the above input range table. This may cause malfunction.

The Input 2 _input type selection (2. InP) can not select 22 and 23 for the two input specification.

Continued on the next page.
Continued from the previous page.

See the above input range table also when you select input type of the remote input. However, the remote input specification can not select 0 to 13, 22, and 23.

**Factory set value:** Depend on model code. (when not specifying: Type K)

**Relational items:** Display unit selection (P. 135), Decimal point position (P. 136), Input scale high (P. 137), Input scale low (P. 138)

<table>
<thead>
<tr>
<th>Input 1 display unit selection</th>
<th>RKC communication identifier</th>
<th>PU</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0210H (528)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0211H (529)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2 display unit selection</th>
<th>RKC communication identifier</th>
<th>PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0224H (548)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0225H (549)</td>
<td></td>
</tr>
</tbody>
</table>

This value indicates temperature unit for thermocouple (TC) and RTD inputs.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**
- 0: °C
- 1: °F

**Factory set value:** 0
This value indicates decimal point position of the input range.

<table>
<thead>
<tr>
<th>Input 1_decimal point position</th>
<th>RKC communication identifier</th>
<th>XU</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0212H (530)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0213H (531)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_decimal point position</th>
<th>RKC communication identifier</th>
<th>XT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0226H (550)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0227H (551)</td>
<td></td>
</tr>
</tbody>
</table>

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**

- Thermocouple (TC) inputs:
  - 0: No digit below decimal point
  - 1: 1 digit below decimal point

- RTD inputs:
  - 0: No digit below decimal point
  - 1: 1 digit below decimal point
  - 2: 2 digits below decimal point

- Voltage (V) /current (I) inputs:
  - 0: No digit below decimal point
  - 1: 1 digit below decimal point
  - 2: 2 digits below decimal point
  - 3: 3 digits below decimal point
  - 4: 4 digits below decimal point

**Factory set value:** 1

**Relational items:** Input type selection (P. 134), Input scale high (P. 137), Input scale low (P. 138)
<table>
<thead>
<tr>
<th>Input 1_input scale high</th>
<th>RKC communication identifier</th>
<th>XV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 0214H (532)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0215H (533)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_input scale high</th>
<th>RKC communication identifier</th>
<th>XX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td>High order: 0228H (552)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0229H (553)</td>
</tr>
</tbody>
</table>

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: Thermocouple (TC) /RTD inputs:
Input scale low to maximum value of input range
Voltage (V)/current (I) inputs:
−19999 to +99999
Varies depending on the position of the decimal point setting

Factory set value: Thermocouple (TC) /RTD inputs: Maximum value of input range
Voltage (V)/current (I) inputs: 100.0

Relational items: Input type selection (P. 134), Decimal point position (P. 136), Input scale low (P. 138)

Functional description:
For this product, an input range provided for each input type is only one type of maximum input range. Therefore, the input scale range can be freely set by setting the input scale high limit/low limit.

This item enables to set the input scale high limit smaller than the input scale low limit for voltage (V)/current (I) inputs. (Input scale high limit < Input scale low limit)
### Input 1_input scale low

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>XY</th>
</tr>
</thead>
</table>
| MODBUS register address      | High order: 0216H (534)  
                                | Low order: 0217H (535) |

This value is 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:**
- Thermocouple (TC) /RTD inputs:
  - Minimum value of input range to input scale high
- Voltage (V)/current (I) inputs:
  - −19999 to +99999
  - Varies depending on the position of the decimal point setting

**Factory set value:**
- Thermocouple (TC) /RTD inputs: Minimum value of input range
- Voltage (V)/current (I) inputs: 0.0

**Relational items:**
- Input type selection (P. 134), Decimal point position (P. 136), Input scale high (P. 137)

**Functional description:**
See the input scale high.

### Input 2_input scale low

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>XY</th>
</tr>
</thead>
</table>
| MODBUS register address      | High order: 022AH (554)  
                                | Low order: 022BH (555) |

This value is low limit of the input scale range.

**Attribute:** R/W (Read and Write)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_input error determination point (high limit)</th>
<th>RKC communication identifier</th>
<th>AV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0218H (536)</td>
<td>Low order: 0219H (537)</td>
</tr>
<tr>
<td>Input 2_input error determination point (high limit)</td>
<td>RKC communication identifier</td>
<td>AX</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 022CH (556)</td>
<td>Low order: 022DH (557)</td>
</tr>
</tbody>
</table>

An action at input error is activated when input measured value (PV) becomes input error determination point (high limit) or more.

**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:**

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

**Relational items:**

Input error determination point low limit (P. 140),
Action at input error high limit (P. 172), Action at input error low limit (P. 173),
Manipulated output value at input error (P. 173)

**Example**

When the input scale is from −200.0 to +1200.0:

- Input span: 1400.0
- 5 % of input span: 70.0
- Setting range: −270.0 to +1270.0
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_input error determination point (low limit)</th>
<th>RKC communication identifier</th>
<th>AW</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 021AH (538)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 021BH (539)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_input error determination point (low limit)</th>
<th>RKC communication identifier</th>
<th>AY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 022EH (558)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 022FH (559)</td>
<td></td>
</tr>
</tbody>
</table>

An action at input error is activated when input measured value (PV) becomes input error determination point (low limit) or less.

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: Thermocouple (TC)/RTD inputs: Input scale low – (5 % of input span)
Voltage (V)/current (I) inputs: 5.0

Relational items: Input error determination point high limit (P. 139), Action at input error high limit (P. 172), Action at input error low limit (P. 173), Manipulated output value at input error (P. 173)

<table>
<thead>
<tr>
<th>Input 1_burnout direction</th>
<th>RKC communication identifier</th>
<th>BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 021CH (540)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 021DH (541)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_burnout direction</th>
<th>RKC communication identifier</th>
<th>BR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0230H (560)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0231H (561)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects a burnout direction in the input breaks.

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range: 0: Upscale
1: Downscale

Factory set value: 0

The action in the input breaks fix regardless of setting a burnout direction about the following input.
- RTD inputs: Upscale
- Voltage (High) inputs: Downscale
- Current (I) inputs: Downscale

Value in the neighborhood of a 0 input (0 V) displayed.
Value in the neighborhood of a 0 input (0 mA) displayed.
This item selects the presence or absence of the square root extraction for measured value.

Attribute: R/W (Read and Write)

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

Digits: 7 digits
Data range: 0: Not provided
1: Provided
Factory set value: 0
Functional description:
This is the function of square root extracting measured value (PV). Generally, a differential pressure type flow transmitter is used in combination with a square root extractor, but the use of this function enables flow control with transmitter output connected directly to this instrument.

This item selects power supply frequency of the controller.

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
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Event input logic selection</th>
<th>RKC communication identifier</th>
<th>H2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0234H (564)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0235H (565)</td>
<td></td>
</tr>
</tbody>
</table>

This item is an item that assigns the function (memory area, operation mode) for the event input (DI 1 to DI 7).

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range: 0 to 6 (see the following table)

### [Function Assignment Table]

<table>
<thead>
<tr>
<th>Set value</th>
<th>DI 1</th>
<th>DI 2</th>
<th>DI 3</th>
<th>DI 4</th>
<th>DI 5</th>
<th>DI 6</th>
<th>DI 7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Terminal No. 30-31</td>
<td>Terminal No. 30-32</td>
<td>Terminal No. 30-33</td>
<td>Terminal No. 35-36</td>
<td>Terminal No. 13-14</td>
<td>Terminal No. 13-15</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Memory area number set (1 to 16)</td>
<td>Memory area set</td>
<td>RUN/STOP transfer</td>
<td>Auto/Manual transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Memory area number selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Memory area number selection (1 to 16)</td>
<td>Memory area set</td>
<td>RUN/STOP transfer</td>
<td>Remote/Local transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Memory area number selection (1 to 16)</td>
<td>Memory area set</td>
<td>Remote/Local transfer</td>
<td>Auto/Manual transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Memory area number selection (1 to 8)</td>
<td>Memory area set</td>
<td>RUN/STOP transfer</td>
<td>Remote/Local transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Memory area number selection (1 to 8)</td>
<td>Memory area set</td>
<td>Remote/Local transfer</td>
<td>Unused</td>
<td>Unused</td>
<td>Unused</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Memory area number selection (1 to 8)</td>
<td>Memory area set</td>
<td>Auto/Manual transfer</td>
<td>Unused</td>
<td>Unused</td>
<td>Unused</td>
<td></td>
</tr>
</tbody>
</table>

DI 6 and DI 7 can not use for types with the communication 1 function.

Factory set value: 1

Functional description:
Refer to the following.

- **Contact status of memory area number selection**

```
<table>
<thead>
<tr>
<th>Event input</th>
<th>Memory area number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI 1</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16</td>
</tr>
<tr>
<td>DI 2</td>
<td>x x x x x x x x x x x x x x x x x x x x</td>
</tr>
<tr>
<td>DI 3</td>
<td>x x x x x x x x x x x x x x x x x x x x</td>
</tr>
<tr>
<td>DI 4</td>
<td>x x x x x x x x x x x x x x x x x x x x</td>
</tr>
</tbody>
</table>
```

|x: Contact open  | —: Contact closed |

The selected memory area number is captured after the controller inputs a close signal of the memory area set.

Continued on the next page.
Continued from the previous page.

- **Relationship between contact status of operation mode and mode status**

<table>
<thead>
<tr>
<th></th>
<th>Contact closed</th>
<th>Contact open</th>
<th>No event input or not selected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RUN/STOP transfer</strong></td>
<td>RUN (Control RUN)</td>
<td>STOP (Control STOP)</td>
<td>RUN (Control RUN)</td>
</tr>
<tr>
<td><strong>Auto/Manual transfer</strong></td>
<td>Auto</td>
<td>Manual</td>
<td>Auto</td>
</tr>
<tr>
<td><strong>Remote/Local transfer</strong></td>
<td>Remote or cascade control</td>
<td>Local</td>
<td>Local</td>
</tr>
</tbody>
</table>

- **RUN/STOP transfer**

<table>
<thead>
<tr>
<th>Mode select with front key or communication</th>
<th>Status of event input (DI)</th>
<th>Actual operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN (Control RUN)</td>
<td>Contact closed</td>
<td>RUN (Control RUN)</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td>STOP (Control STOP)</td>
</tr>
<tr>
<td>STOP (Control STOP)</td>
<td>Contact closed</td>
<td>STOP (Control STOP)</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td></td>
</tr>
</tbody>
</table>

- **Auto/Manual transfer**

<table>
<thead>
<tr>
<th>Mode select with front key or communication</th>
<th>Status of event input (DI)</th>
<th>Actual operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>Contact closed</td>
<td>Auto</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td>Manual</td>
</tr>
<tr>
<td>Manual</td>
<td>Contact closed</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td></td>
</tr>
</tbody>
</table>

- **Remote/Local transfer**

<table>
<thead>
<tr>
<th>Mode select with front key or communication</th>
<th>Status of event input (DI)</th>
<th>Actual operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote</td>
<td>Contact closed</td>
<td>Remote</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>Contact closed</td>
<td>Local</td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td></td>
</tr>
</tbody>
</table>
### Output logic selection

**RKC communication identifier**

- E0

**MODBUS register address**

- High order: 0236H (566)
- Low order: 0237H (567)

This item is an item that assigns 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:**

- 1 to 10 (see the following table)

<table>
<thead>
<tr>
<th>Set value</th>
<th>OUT1 (M/ V / R / E / T)</th>
<th>OUT2 (M/ V / R / E / T)</th>
<th>OUT3 (M/ V / R / E / T)</th>
<th>OUT4 (M)</th>
<th>OUT5 (M)</th>
<th>备考</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MV 1</td>
<td>HBA 1 (Energized) or HBA 2 (Energized)</td>
<td>EV 3 (Energized) or EV 4 (Energized)</td>
<td>EV 2 (Energized)</td>
<td>EV 1 (Energized)</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>MV 1</td>
<td>HBA 1 (De-energized) or HBA 2 (De-energized)</td>
<td>EV 3 (De-energized) or EV 4 (De-energized)</td>
<td>EV 2 (De-energized)</td>
<td>EV 1 (De-energized)</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>MV 1</td>
<td>EV 3 (Energized), EV 4 (Energized), HBA 1 (Energized) or HBA 2 (Energized)</td>
<td>EV 2 (Energized)</td>
<td>EV 1 (Energized)</td>
<td>FAIL (De-energized)</td>
<td>Energized alarm corresponding to FAIL output</td>
</tr>
<tr>
<td>4</td>
<td>MV 1</td>
<td>EV 3 (De-energized), EV 4 (De-energized), HBA 1 (De-energized) or HBA 2 (De-energized)</td>
<td>EV 2 (De-energized)</td>
<td>EV 1 (De-energized)</td>
<td>FAIL (De-energized)</td>
<td>De-energized alarm corresponding to FAIL output</td>
</tr>
<tr>
<td>5</td>
<td>MV 1</td>
<td>MV 2</td>
<td>EV 4 (Energized) or HBA 2 (Energized)</td>
<td>EV 3 (Energized) or HBA 1 (Energized)</td>
<td>EV 1 (Energized)</td>
<td>Energized alarm corresponding to two loops control</td>
</tr>
<tr>
<td>6</td>
<td>MV 1</td>
<td>MV 2</td>
<td>EV 4 (De-energized) or HBA 2 (De-energized)</td>
<td>EV 3 (De-energized) or HBA 1 (De-energized)</td>
<td>EV 1 (De-energized)</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>MV 1</td>
<td>MV 2</td>
<td>EV 3 (Energized), EV 4 (Energized), HBA 1 (Energized) or HBA 2 (Energized)</td>
<td>EV 2 (Energized)</td>
<td>EV 1 (Energized)</td>
<td>Energized alarm corresponding to two loops control</td>
</tr>
<tr>
<td>8</td>
<td>MV 1</td>
<td>MV 2</td>
<td>EV 3 (De-energized), EV 4 (De-energized), HBA 1 (De-energized) or HBA 2 (De-energized)</td>
<td>EV 2 (De-energized)</td>
<td>EV 1 (De-energized)</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>MV 1 (OPEN)</td>
<td>MV 1 (CLOSE)</td>
<td>EV 3 (Energized), EV 4 (Energized), HBA 1 (Energized) or HBA 2 (Energized)</td>
<td>EV 2 (Energized)</td>
<td>EV 1 (Energized)</td>
<td>Energized alarm corresponding to position proportioning PID control</td>
</tr>
<tr>
<td>10</td>
<td>MV 1 (OPEN)</td>
<td>MV 1 (CLOSE)</td>
<td>EV 3 (De-energized), EV 4 (De-energized), HBA 1 (De-energized) or HBA 2 (De-energized)</td>
<td>EV 2 (De-energized)</td>
<td>EV 1 (De-energized)</td>
<td>De-energized alarm corresponding to position proportioning PID control</td>
</tr>
</tbody>
</table>

**Notes:**

- MV 1 = Manipulated output value of Input 1, MV 2 = Manipulated output value of Input 2.
- HBA 1 = Output of Heater break alarm 1, HBA 2 = Output of Heater break alarm 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.

Continued on the next page.
An output point becomes OR output when two or more output function is assigned to it.

When the output function can use the transmission output (3 points), the transmission output is automatically assigned from out 1 to out 3 (see the following table). As the transmission output is given priority over the output function that is assigned the output logic selection, the manipulated output value (MV) that is assigned the output logic selection cannot output. In such a case, it is necessary that the transmission output type selection selects “4: Input 1_manipulated output value (MV)” or “8: Input 2_manipulated output value (MV)”.

<table>
<thead>
<tr>
<th>Transmission output type</th>
<th>Assign location of output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission output 1</td>
<td>Output 1 (OUT1)</td>
</tr>
<tr>
<td>Transmission output 2</td>
<td>Output 2 (OUT2)</td>
</tr>
<tr>
<td>Transmission output 3</td>
<td>Output 3 (OUT3)</td>
</tr>
</tbody>
</table>

Factory set value: For one input specification: 1
For two input specification: 5

Relational items: Transmission output type selection (P. 148),
Event input logic selection (P. 142), CT assignment (P. 162)
### Output 1 timer setting
<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD</td>
<td>High order: 0238H (568)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0239H (569)</td>
</tr>
</tbody>
</table>

### Output 2 timer setting
<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>TG</td>
<td>High order: 023AH (570)</td>
</tr>
<tr>
<td></td>
<td>Low order: 023BH (571)</td>
</tr>
</tbody>
</table>

### Output 3 timer setting
<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH</td>
<td>High order: 023CH (572)</td>
</tr>
<tr>
<td></td>
<td>Low order: 023DH (573)</td>
</tr>
</tbody>
</table>

### Output 4 timer setting
<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI</td>
<td>High order: 023EH (574)</td>
</tr>
<tr>
<td></td>
<td>Low order: 023FH (575)</td>
</tr>
</tbody>
</table>

### Output 5 timer setting
<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>TJ</td>
<td>High order: 0240H (576)</td>
</tr>
<tr>
<td></td>
<td>Low order: 0241H (577)</td>
</tr>
</tbody>
</table>

This item is a time until the event output is actually output after the event that is assigned for from output 1 (OUT1) to output 5 (OUT5) became the event state.

**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

**Relational items:**

Output logic selection (P. 144), Event type selection (P. 151)

**Functional description:**

The event timer function regards the period until the event timer is set after measured value (PV) or deviation exceeds the event set value as a non-event state and outputs an event after the event timer setting time elapses.

The event timer starts being activated if the event is turned on. In addition, if the event state is released while the event timer is being activated, no event is output.
Example: When set the event timer for 100.0 seconds.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Transmission output 1_ type selection</th>
<th>RKC communication identifier</th>
<th>LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0242H (578)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0243H (579)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmission output 2_ type selection</th>
<th>RKC communication identifier</th>
<th>LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0248H (584)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0249H (585)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmission output 3_ type selection</th>
<th>RKC communication identifier</th>
<th>LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 024EH (590)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 024FH (591)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects output contents of the transmission output.

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
4: Input 1 manipulated output value (MV)
5: Input 2 measured value (PV)
6: Input 2 set value (SV)
7: Input 2 deviation
8: Input 2 manipulated output value (MV)

Factory set value: 0

Relational items: Transmission output scale high (P. 149),
Transmission output scale low (P. 150)

The output type of the transmission output specify when ordering.

The transmission output corresponds for output 3 from output 1 as follows when this item is selected other than “0: None.”

- When using transmission output 1: Corresponding to output 1 (OUT1)
- When using transmission output 2: Corresponding to output 2 (OUT2)
- When using transmission output 3: Corresponding to output 3 (OUT3)

The transmission output is output priority to the output function that is assigned to the output logic selection.
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Transmission output 1_scale high</th>
<th>RKC communication identifier</th>
<th>HV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0244H (580)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0245H (581)</td>
<td></td>
</tr>
<tr>
<td>Transmission output 2_scale high</td>
<td>RKC communication identifier</td>
<td>CV</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 024AH (586)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 024BH (587)</td>
<td></td>
</tr>
<tr>
<td>Transmission output 3_scale high</td>
<td>RKC communication identifier</td>
<td>EV</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 0250H (592)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0251H (593)</td>
<td></td>
</tr>
</tbody>
</table>

This value is 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: $-\text{Input span}$ to $+\text{Input span}$

**Factory set value:**

Measured value (PV) and set value (SV): Input scale high
Manipulated output value (MV): $100.0$
Deviation: $+\text{Input span}$

**Relational items:**

Transmission output type selection (P. 151),
Transmission output scale low (P. 150)
This value is 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

**Relational items:**
Transmission output type selection (P. 151),
Transmission output scale high (P. 149)
<table>
<thead>
<tr>
<th>Event 1 type selection</th>
<th>RKC communication identifier</th>
<th>XA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0254H (596)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0255H (597)</td>
<td></td>
</tr>
<tr>
<td>Event 2 type selection</td>
<td>RKC communication identifier</td>
<td>XB</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 025EH (606)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 025FH (607)</td>
<td></td>
</tr>
<tr>
<td>Event 3 type selection</td>
<td>RKC communication identifier</td>
<td>XC</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 0268H (616)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0269H (617)</td>
<td></td>
</tr>
<tr>
<td>Event 4 type selection</td>
<td>RKC communication identifier</td>
<td>XD</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 0272H (626)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0273H (627)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects a type 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: 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)

1 These type can select the event hold action.
2 The “9: Control loop break alarm (LBA)” can select only event 3 and event 4.

Factory set value: 0

Relational items: Event set value (P. 112), Control loop break alarm (LBA) time (P. 113), LBA deadband (P. 113), Output logic selection (P. 144), Event hold action (P. 154), Event differential gap (P. 156), Event action at input error (P. 158), Event assignment (P. 160)

Functional description:
See the next page.

Continued on the next page.
Continued from the previous page.

### Event action type

**Deviation high:** (Event state where the event set value is set to plus)

- Low: OFF
- ON
- High

**Deviation low:** (Event state where the event set value is set to plus)

- Low: ON
- OFF
- High

**Deviation high/low:**

- Low: ON
- OFF
- ON
- High

**Process high:**

- Low: OFF
- ON
- High

**SV high:**

- Low: OFF
- ON
- High

(▲: Set value (SV) △: Event set value)

### 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. This function monitors the measured value (PV) variation at LBA time intervals from the time the output exceeds 100 % (or output limiter: high limit) or falls below 0 % (or output limiter: low limit), then detects a heater or input break.

**[Alarm action]**

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

- **LBA triggering width:**
  - Temperature input: 2 °C [2 °F] fixed
  - Voltage/current input: 0.2% fixed

- **When the output falls below 0 % (or output limiter: low limit)**
  - For direct action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA time.
  - For reverse action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA time.

- **When the output exceeds 100 % (or output limiter: high limit)**
  - For direct action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA time.
  - For reverse action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA time.

- **If the autotuning function is used,** the LBA time twice as large as the integral time is automatically set. The LBA setting time does not change even if the integral time is changed.

- **The LBA function is not activated when any of the following cases occurs.**
  - When the autotuning function is being executed.
  - When the control stops.

Continued on the next page.
Continued from the previous page.

The LBA function detects an error occurring in the control loop, but cannot specify the erroneous location. Therefore, check the control loop in order.

The LBA output is turned off when any of the following cases occurs with the LBA output turned on.

- When the measured value (PV) rises beyond (or falls below) the LBA triggering width within the LBA setting time.
- When the measured value (PV) is within the LBA deadband.
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Event 1 hold action</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WA</td>
<td>High order: 0256H (598)</td>
<td>Low order: 0257H (599)</td>
</tr>
<tr>
<td>Event 2 hold action</td>
<td>RKC communication identifier</td>
<td>MODBUS register address</td>
<td>High order: 0260H (608)</td>
</tr>
<tr>
<td></td>
<td>WB</td>
<td>Low order: 0261H (609)</td>
<td></td>
</tr>
<tr>
<td>Event 3 hold action</td>
<td>RKC communication identifier</td>
<td>MODBUS register address</td>
<td>High order: 026AH (618)</td>
</tr>
<tr>
<td></td>
<td>WC</td>
<td>Low order: 026BH (619)</td>
<td></td>
</tr>
<tr>
<td>Event 4 hold action</td>
<td>RKC communication identifier</td>
<td>MODBUS register address</td>
<td>High order: 0274H (628)</td>
</tr>
<tr>
<td></td>
<td>WD</td>
<td>Low order: 0275H (629)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects a hold action 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: Not provided
- 1: Provided
- 2: Re-hold action

**Factory set value:** 0

**Relational items:**
- Event set value (P. 112)
- Event type selection (P. 151)
- Event differential gap (P. 156)
- Event action at input error (P. 158)
- Event assignment (P. 160)

**Functional description:**

See the next page.

Continued on the next page.
Continued from the previous page.

**Hold action**

In the event hold action, the event action is kept invalid even if the measured value (PV) is in the event range when the power is on or the operation mode is switched to RUN from STOP. The event action is held until the measured value (PV) goes out of the event state once.

Example: The difference between events with “hold action” and without “hold action” are described by referring to the deviation low as an example.

[With hold action]  
[Without hold action]

**Re-hold action**

In the event hold action, the holding is effective if the input value is in the event range at the power on and is cancelled if the input value will go out of the event range. While, in the event re-hold action the hold action becomes effective when the temperature set value is changed again. This action can be only selected for deviation.

Example: When the measured value (PV) is in the position as shown in the below figure before the change of set value and then the set value is changed as shown in the figure, the measured value goes into the event area and the event is set up. To hold this event, the event re-hold action can be used effectively.
This item sets 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:**
- Thermocouple (TC) /RTD inputs: 2.0 °C
- Voltage (V)/current (I) inputs: 0.2 % of input span
**Relational items:**
- Event set value (P. 112), Event type selection (P. 151),
- Event hold action (P. 154), Event action at input error (P. 158),
- Event assignment (P. 160)

**Functional description:**
If measured value (PV) is close to the event set value, the event relay contact may repeatedly turn on and off due to input fluctuations. If the event differential gap is set, repeated turning on and off of the relay contact can be prevented.

Continued on the next page.
Continued from the previous page.

[Event high]

Measured value (PV)

Event set value

Differential gap

Time

Event status

OFF ON OFF

[Event low]

Measured value (PV)

Event set value

Differential gap

Time

Event status

OFF ON OFF
<table>
<thead>
<tr>
<th>Event 1 action at input error</th>
<th>RKC communication identifier</th>
<th>OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 025AH (602)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 025BH (603)</td>
<td></td>
</tr>
<tr>
<td>Event 2 action at input error</td>
<td>RKC communication identifier</td>
<td>OB</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 0264H (612)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0265H (613)</td>
<td></td>
</tr>
<tr>
<td>Event 3 action at input error</td>
<td>RKC communication identifier</td>
<td>OC</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 026EH (622)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 026FH (623)</td>
<td></td>
</tr>
<tr>
<td>Event 4 action at input error</td>
<td>RKC communication identifier</td>
<td>OD</td>
</tr>
<tr>
<td>MODBUS register address</td>
<td>High order: 0278H (632)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0279H (633)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects the action when measured value (PV) of the event exceeds 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: Forcibly turned on

Factory set value: 0
Relational items:
Input error determination point high limit (P. 139),
Input error determination point low limit (P. 140)

Continued on the next page.
Continued from the previous page.

**Functional description:**

An example of the following explains input error determination point and action at input error.

**Example:** Input range: 0 to 400 °C

- Input error determination point (high limit): 300 °C
- Input error determination point (low limit): 50 °C

---

1. The event is forcibly turned on regardless of the event action selected by the event type selection when the input is abnormal.

2. The event action selected by the event type selection is taken even if the input is abnormal.
This item selects an input that a decision of the event intends for.

Attribute: R/W (Read and Write)

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

Digits: 7 digits
Data range: 0: For input 1
           1: For input 2
Factory set value: 0
Relational items: Event set value (P. 112), Event type selection (P. 151),
                  Event hold action (P. 154), Event differential gap (P. 156),
                  Event action at input error (P. 158)
CT1 ratio

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>XR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
</tbody>
</table>

- High order: 027CH (636)
- Low order: 027DH (637)

CT2 ratio

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>XS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
</tbody>
</table>

- High order: 0280H (640)
- Low order: 0281H (641)

This item sets the number of turns (ratio) of the current transformer that is used with the heater break alarm (HBA).

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range: 0 to 9999

Factory set value:
- When the CT type is CTL-6-P-N: 800
- When the CT type is CTL-12-S56-10L-N: 1000

Relational items:
- Heater break alarm (HBA) set value (P. 123), CT assignment (P. 162)
This item assigns an output that a decision of the heater break alarm (HBA) intends for.

Attribute: R/W (Read and Write)

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

Digits: 7 digits
Data range:
- 0: None
- 1: Output 1 (OUT 1)
- 2: Output 2 (OUT 2)
- 3: Output 3 (OUT 3)
- 4: Output 4 (OUT 4)
- 5: Output 5 (OUT 5)

Factory set value:
- **Heater break alarm 1 (HBA1):**
  - Current transformer 1 (CT1) not provided: 0
  - Current transformer 1 (CT1) provided: 1
- **Heater break alarm 2 (HBA2):**
  - Current transformer 2 (CT2) not provided: 0
  - Current transformer 2 (CT2) provided: 2

Relational items: Heater break alarm (HBA) set value (P. 123), Output logic selection (P. 144), CT ratio (P. 161)

The current transformer 1 (CT1) assignment corresponds to the heater break alarm 1 (HBA 1). The current transformer 2 (CT2) assignment corresponds to the heater break alarm 2 (HBA 2). Match the output assigned at the CT assignment with the output assigned to a control output at the output logic selection.
Hot/Cold start selection  |  RKC communication identifier  |  XN
---|---|---
MODBUS register address  |  High order: 0284H (644)  |  Low order: 0285H (645)

This item selects 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)

<table>
<thead>
<tr>
<th>Set value</th>
<th>When the time of power failure is less than 3 seconds</th>
<th>When the time of power failure is not less than 3 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Hot start 1</td>
<td>Hot start 1</td>
</tr>
<tr>
<td>1</td>
<td>Hot start 1</td>
<td>Hot start 2</td>
</tr>
<tr>
<td>2</td>
<td>Hot start 1</td>
<td>Cold start</td>
</tr>
<tr>
<td>3</td>
<td>Hot start 2</td>
<td>Hot start 2</td>
</tr>
<tr>
<td>4</td>
<td>Hot start 2</td>
<td>Cold start</td>
</tr>
<tr>
<td>5</td>
<td>Cold start</td>
<td>Cold start</td>
</tr>
</tbody>
</table>

**Factory set value:**  0

**Functional description:**

Each start state is shown below.

Hot start 1:  Operation is started in the operation mode and output value before power failure.

Hot start 2:  Operation is started in the operation mode before power failure.

- In the manual mode, operation is started from the low output limit value.
- In the auto mode, operation is started from the output value calculated using control response designation parameters. Therefore, the initial output value does not become uniform.

Cold start:  In the manual mode, operation is started from the low output limit value.
Among the single loop control, remote setting input, cascade control (slave), this item selects which application the input 2 is used by.

**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
- 2: Cascade control (Slave)

**Factory set value:**
- 0
This value is the ratio when the manipulated output (%) in the cascade master is converted to the relevant cascade signal (°C).

Attribute: R/W (Read and Write)

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

Digits: 7 digits
Data range: 0.000 to 1.500
Factory set value: 1.000
Relational items: Cascade bias (P. 165)

The cascade bias is a bias added to the input value on the slave side in the cascade control.

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: 0

The functional description of relative items to the cascade control is shown in the following.

**Cascade control**

Cascade control monitors the controlled object temperature in the master unit and then corrects the set value in the slave unit depending on the deviation between the target value (set value) and actual temperature. The slave unit controls the non-controlled object. As a result, this control matches the controlled object temperature to the target value. This cascaded control is suitable when there is a large time lag between the heat source (heater) and section whose temperature is necessary to be stabilized.

- **Cascade ratio**
  The conversion rate when the manipulated output (%) in the cascade master is converted to the relevant cascade signal (°C) can by changed from 0.0 to 1.500 by the cascade ratio.

- **Cascade bias**
  The cascade bias is a bias added to the input value on the slave side.

Continued on the next page.
Example: Relationship between the manipulated output (%) in the cascade master and relevant cascade signal (°C)

Output scale in the input 1 (master): 0 to 100 %
Input scale in the input 2: −100 to +400 °C

Manipulated output in the input 1 (master) = 100 %
Cascade ratio = 1.000
Cascade bias = 0 °C

Manipulated output in the input 1 (master) = 100 %
Cascade ratio = 0.500
Cascade bias = 50 °C

Manipulated output in the input 1 (master) = 0 %
Cascade ratio = 0.500
Cascade bias = 50 °C

Manipulated output in the input 1 (master) = 0 %
Cascade ratio = 1.000
Cascade bias = 0 °C

Relevant cascade signal (input 2: set value on the slave side) = 400 °C
Relevant cascade signal (input 2: set value on the slave side) = 250 °C
Relevant cascade signal (input 2: set value on the slave side) = 0 °C
Relevant cascade signal (input 2: set value on the slave side) = −100 °C

Relevant cascade signal [°C]: set value (SV) in the input 2 (slave)
Manipulated output value [%]: manipulated output value in the input 1 (master)

50 % (Scaling coverted value: 400 °C)
100 % (Scaling coverted value: −100 °C)
SV tracking | RKC communication identifier | XL
---|---|---
MODBUS register address | High order: 028CH (652) | Low order: 028DH (653)

This item is a function that can select whether a local setting value is followed or not in a remote setting value just before the operation mode is transferred to when the operation mode is transferred to the local setting mode from the remote setting mode.

Attribute: R/W (Read and Write)

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

Digits: 7 digits
Data range: 0: Not provided
1: Provided
Factory set value: 1

Functional description:

The SV tracking is a function that a local setting value is followed in a remote setting value just before the operation mode is transferred to when the operation mode is transferred to the local setting mode from the remote setting mode. As a result, this function can prevent rapid set value changes when the operation mode is transferred to the local setting mode from the remote setting mode.

[About the variation of set value]

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Local</th>
<th>Remote</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set value used</td>
<td>Set value (SV) = Local set value</td>
<td>Set value (SV) = Remote set value</td>
<td>Set value (SV) = Local set value</td>
</tr>
<tr>
<td>SV tracking provided</td>
<td>Local set value ≠ Remote set value</td>
<td>Local set value = Remote set value</td>
<td>Local set value = Remote set value</td>
</tr>
<tr>
<td>SV tracking not provided</td>
<td>Local set value ≠ Remote set value</td>
<td>Local set value ≠ Remote set value</td>
<td>Local set value ≠ Remote set value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (t)</th>
<th>Set value (SV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local set value</td>
<td>Remote set value</td>
</tr>
<tr>
<td>Remote/Local transferred point (SV tracking provided)</td>
<td>Time (t)</td>
</tr>
<tr>
<td>Remote set value</td>
<td>Local set value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (t)</th>
<th>Set value (SV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local set value</td>
<td>Remote set value</td>
</tr>
<tr>
<td>Remote/Local transferred point (SV tracking not provided)</td>
<td>Time (t)</td>
</tr>
<tr>
<td>Remote set value</td>
<td>Local set value</td>
</tr>
</tbody>
</table>
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_control action type selection</th>
<th>RKC communication identifier</th>
<th>XE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 028EH (654)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 028FH (655)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_control action type selection</th>
<th>RKC communication identifier</th>
<th>XF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02A8H (680)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02A9H (681)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects 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:** 1

**Functional description:**

- **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

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>PK</td>
<td>High order: 0290H (656) Low order: 0291H (657)</td>
</tr>
</tbody>
</table>

### Input 2_integral/derivative time
decimal point position selection

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>PJ</td>
<td>High order: 02AAH (682) Low order: 02ABH (683)</td>
</tr>
</tbody>
</table>

This item selects 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 digit below decimal point
- 1: 1 digit below decimal point
- 2: 2 digits below decimal point

**Factory set value:** 2

**Relational items:** Integral time (P. 117), Derivative time (P. 117)
### Input 1_derivative gain

**RKC communication identifier:** DG

**MODBUS register address:**
- High order: 0292H (658)
- Low order: 0293H (659)

**Input 2_derivative gain**

**RKC communication identifier:** DJ

**MODBUS register address:**
- High order: 02ACH (684)
- Low order: 02ADH (685)

This item is a gain used for derivative action in PID control. It adjusts a worked condition by derivative action.

**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:** 6.0

*Under ordinary operation, it is not necessary to change the factory set value.*

### Input 1_ON/OFF action differential gap (upper)

**RKC communication identifier:** IV

**MODBUS register address:**
- High order: 0294H (660)
- Low order: 0295H (661)

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

**RKC communication identifier:** IX

**MODBUS register address:**
- High order: 02AEH (686)
- Low order: 02AFH (687)

This item sets 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:**
- Thermocouple (TC) /RTD inputs: 1 °C
- Voltage (V)/current (I) inputs: 0.1 % of input span

**Relational items:** ON/OFF action differential gap lower (P. 171)

**Functional description:** See the ON/OFF action differential gap lower.
This item sets 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: Thermocouple (TC) /RTD inputs: 1 °C
Voltage (V)/current (I) inputs: 0.1 % of input span
Relational items: ON/OFF action differential gap upper (P. 170)
Functional description:

It is ON/OFF control when it sets proportional band in “0” or “0.0.”

In ON/OFF control, the manipulated output (MV) is turned on and off depending on whether measured value (PV) is larger or smaller than set value (SV). Differential gap setting can prevent relay contact from on or off repetition around set value (SV).
This item selects the action when input measured value becomes the input error determination point (high limit) or more.

Attribute: R/W (Read and Write)

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

Digits: 7 digits

Data range:
0: Normal control (present output)
1: Manipulated output value at input error

Factory set value: 0

Relational items:
Input error determination point high limit (P. 139),
Manipulated output value at input error (P. 173)

Functional description:
An example of the following explains input error determination point and action at input error.

Example:
Input range: 0 to 400 °C
Input error determination point (high limit): 300 °C
Input error determination point (low limit): 50 °C
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1 _action at input error (low limit)</th>
<th>RKC communication identifier</th>
<th>WL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 029AH (666)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 029BH (667)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2 _action at input error (low limit)</th>
<th>RKC communication identifier</th>
<th>WY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02B4H (692)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02B5H (693)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects the action when input measured value becomes the input error determination point (low limit) or less.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**
- 0: Normal control (present output)
- 1: Manipulated output value at input error

**Factory set value:** 0

**Relational items:**
- Input error determination point low limit (P. 140)
- Manipulated output value at input error (P. 173)

**Functional description:**
- See the action at input error (high limit).

<table>
<thead>
<tr>
<th>Input 1 _manipulated output value at input error</th>
<th>RKC communication identifier</th>
<th>OE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 029CH (668)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 029DH (669)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2 _manipulated output value at input error</th>
<th>RKC communication identifier</th>
<th>OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02B6H (694)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02B7H (695)</td>
<td></td>
</tr>
</tbody>
</table>

This item is a manipulated output value output when an input measured value goes up or down from the high or low limit of the input error discriminating point with the selection of operation at the time of input error occurrence set to “1.”

**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:** −5.0

**Relational items:**
- Input error determination point high limit (P. 139)
- Input error determination point low limit (P. 140)
- Action at input error high limit (P. 172)
- Action at input error low limit (P. 173)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1 output change rate limiter (up)</th>
<th>RKC communication identifier</th>
<th>PH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 029EH (670)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 029FH (671)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2 output change rate limiter (up)</th>
<th>RKC communication identifier</th>
<th>PX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 02B8H (696)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02B9H (697)</td>
<td></td>
</tr>
</tbody>
</table>

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 %/seconds
0.0: OFF (Not provided)

**Factory set value:** 0.0

**Relational items:** Output change rate limiter down (P. 174), Output limiter high limit (P. 176), Output limiter low limit (P. 176)

**Functional description:** See the next page.

<table>
<thead>
<tr>
<th>Input 1 output change rate limiter (down)</th>
<th>RKC communication identifier</th>
<th>PL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 02A0H (672)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02A1H (673)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2 output change rate limiter (down)</th>
<th>RKC communication identifier</th>
<th>PY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 02BAH (698)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02BBH (699)</td>
<td></td>
</tr>
</tbody>
</table>

The output change rate limiter (downward 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 %/seconds
0.0: OFF (Not provided)

**Factory set value:** 0.0

**Relational items:** Output change rate limiter up (P. 174), Output limiter high limit (P. 176), Output limiter low limit (P. 176)

**Functional description:** See the next page.

Continued on the next page.
Functional description:
The output change rate limiter limits the variation of manipulated output (MV) for a time unit. You can set an output variation, and control the output, when your object requires to avoid sudden variation.

**[The output change rate limiter is effective in the following cases]**

- If the output starts from 100 % when putting power on (if a sudden change of 100 % causes a problem with variation of flow, etc.)
- If the output changes suddenly when changing the set value.

As it is described in the figure above, the output does not make a sudden change, but it changes based on the set inclination, when giving power (outside of the proportional band), or changing the set value (large change). The figure above is an example of upward output variation. For the downward variation, downward variation (inclination) has to be set.

- Response to the control becomes slow, and the effect of differentiation is lost, when the output change rate limiter is set too small (small inclination).
- When the output change rate limiter is used, you may not be able to obtain appropriate PID constants during autotuning.
- The output variation limiter is particularly effective when a sudden variation may cause the controller to crash, or when it may cause a large current. Also, it is very effective when you are dealing with current output or voltage output.
### 7. COMMUNICATION DATA DESCRIPTION

#### Input 1_output limiter (high limit)

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>OH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02A2H (674)</td>
</tr>
<tr>
<td></td>
<td>Low order: 02A3H (675)</td>
</tr>
</tbody>
</table>

#### Input 2_output limiter (high limit)

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>OX</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02BCH (700)</td>
</tr>
<tr>
<td></td>
<td>Low order: 02BDH (701)</td>
</tr>
</tbody>
</table>

This item is 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 limit) to 105.0 %

**Factory set value:** 105.0

**Relational items:** Output change rate limiter up (P. 174), Output change rate limiter down (P. 174), Output limiter low limit (P. 176)

#### Input 1_output limiter (low limit)

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02A4H (676)</td>
</tr>
<tr>
<td></td>
<td>Low order: 02A5H (677)</td>
</tr>
</tbody>
</table>

#### Input 2_output limiter (low limit)

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>OY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02BEH (702)</td>
</tr>
<tr>
<td></td>
<td>Low order: 02BFH (703)</td>
</tr>
</tbody>
</table>

This item is 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 limit)

**Factory set value:** −5.0

**Relational items:** Output change rate limiter up (P. 174), Output change rate limiter down (P. 174), Output limiter high limit (P. 176)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1</th>
<th>Power feed forward</th>
<th>RKC communication identifier</th>
<th>PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02A6H (678) Low order: 02A7H (679)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2</th>
<th>Power feed forward</th>
<th>RKC communication identifier</th>
<th>PG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02C0H (704) Low order: 02C1H (705)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This item selects the provided or not provided of power feed forward function.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**
- 0: Not provided
- 1: Provided

**Factory set value:** 0

**Functional description:**

The power feed forward function is used to stabilize the control point by monitoring the load voltage by the power feed transformer. If the power feed input voltage becomes less than approx. −30 % of the rated value, control automatically stops.

![Diagram of control system](image)

When a type of the controller specified the power feed forward function (option) is used with unconnected the power feed transformer, the control output is turned off.

This item becomes valid only type of the controller specified the power feed forward function (option) when ordering.

When the power feed forward function is used with a type of the controller specified the two loops control function, the power supply circuit of each loops is required to be the same.

Always use the power feed transformer attached to product.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_AT bias</th>
<th>RKC communication identifier</th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02C2H (706)</td>
<td>Low order: 02C3H (707)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_AT bias</th>
<th>RKC communication identifier</th>
<th>GA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02C8H (712)</td>
<td>Low order: 02C9H (713)</td>
</tr>
</tbody>
</table>

This item is for setting the desired bias to move the AT point when the autotuning (AT) function 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: 0
Relational items: PID/AT transfer (P. 108)

Functional description:

The AT bias is set when the autotuning function in which the measured value (PV) does not exceed the set value (SV) is activated. Our autotuning method performs ON/OFF control centering around the set value (SV), then calculates and sets each of the PID constants by hunting the measured value (PV). However, overshooting caused by this hunting may not be preferable depending on the controlled object. In such a case, the desired AT bias is set.

If it is set, another set value (SV) to activate the autotuning function [AT point] can be set.

Example: When AT bias is set to the minus (−) side

![Diagram showing measured value (PV), set value (SV), AT point, and AT bias over time.](image-url)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_AT cycle</th>
<th>RKC communication identifier</th>
<th>G3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02C4H (708)</td>
<td>Low order: 02C5H (709)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_AT cycle</th>
<th>RKC communication identifier</th>
<th>G2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02CAH (714)</td>
<td>Low order: 02CBH (715)</td>
</tr>
</tbody>
</table>

This value is the number of ON/OFF cycle when the autotuning (AT) function is activated.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**
- 0: 1.5 cycle
- 1: 2.0 cycle
- 2: 2.5 cycle
- 3: 3.0 cycle

**Factory set value:** 1

**Relational items:** PID/AT transfer (P. 108)

**Functional description:**

The AT cycle is the number of ON/OFF cycle when the autotuning (AT) function is activated.

**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.

---

**Diagram:**

- Measured value (PV)
- Set value (SV)
- Start the PID computation in accordance with PID parameters calculated by AT.

---

---
This item is for setting the desired ON/OFF action differential gap time when the autotuning (AT) function is activated. This 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: HA400/HA900: 0.10
                    HA401/HA901: 10.00

Relational items: PID/AT transfer (P. 108)

Functional description:

In order to prevent the output from chattering due to the fluctuation of a measured value (PV) caused by noise when the autotuning (AT) function is activated, the output on or off state is held until “AT differential gap time” passes after the output on/off state is selected. Set “AT differential gap time” to “1/100 × Time required for temperature rise.”

Continued on the next page.
Continued from the previous page.

Example:
A: AT cycle time at an AT differential gap time of 0.00 second
   If the output chatters due to the fluctuation of a measured value (PV) caused by noise, the AT function is likely to be terminated halfway.
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 the normal AT function is activated.

The AT cycle of this instrument is 2 cycles (factory set value).
This item is an area where the output between open-side and close-side outputs is turned off used in the position proportioning PID control.

**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:** 10.0
**Relational items:** Open/Close output differential gap (P. 183), Action at feedback resistance (FBR) input error (P. 184), Feedback adjustment (P. 185)

**Functional description:**

The neutral zone is an area where the output between open-side and close-side outputs is turned off. This zone is used to prevent the output signal from being frequently output to the control motor. The output addition value within the neutral zone is temporarily held and when it is out of the neutral zone, the output to the control motor starts.

The opening output is not turned on until the control computation result (ΔMV) becomes the neutral zone value or more.
This item is a differential gap of Open/Close output used in the position proportioning PID control.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:** 0.1 to 5.0 %

**Factory set value:** 0.2

**Relational items:**
- Open/Close output neutral zone (P. 182),
- Action at feedback resistance (FBR) input error (P. 184),
- Feedback adjustment (P. 185)

**Functional description:**

Setting the Open/Close output differential gap can prevent a state where the manipulated output relay contacts on the open and close sides repeat turning ON and OFF by feedback resistance input fluctuation.

<table>
<thead>
<tr>
<th>Open/Close output differential gap</th>
<th>RKC communication identifier</th>
<th>VH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02D0H (720)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02D1H (721)</td>
<td></td>
</tr>
</tbody>
</table>

This item becomes RO (Read only) during control RUN.
### Action at feedback resistance (FBR) input error

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
<th>SY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High order: 02D2H (722)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 02D3H (723)</td>
<td></td>
</tr>
</tbody>
</table>

This item selects an action at the feedback resistance (FBR) input break.

**Attribute:** R/W (Read and Write)

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

**Digits:** 7 digits

**Data range:**
- 0: Close-side output ON, Open-side output OFF
- 1: Close-side output OFF, Open-side output OFF
- 2: Close-side output OFF, Open-side output ON

**Factory set value:** 1

**Relational items:**
- Open/Close output neutral zone (P. 182),
- Open/Close output differential gap (P. 183), Feedback adjustment (P. 185)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Feedback adjustment</th>
<th>RKC communication identifier</th>
<th>FV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 02D4H (724)</td>
<td>Low order: 02D5H (725)</td>
</tr>
</tbody>
</table>

This item conducts an automatic adjustment of the control motor that is used for the position proportioning PID control.

This adjustment matches a valve opening signal (feedback resistance input: total closing to full admission) from the control motor with the manipulated variable range (0 to 100 %) of the PID computation result. Always conducts the feedback adjustment prior to starting operation. Prior to conducting adjustment, check that the wiring has been finished, and that the load (control motor, etc.) have been operated.

**Attribute:**  
R/W (Read and Write)  

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

**Digits:**  
7 digits

**Data range:**  
0: Adjustment end  
1: During the Open-side adjusting  
2: During the Close-side adjusting

**Factory set value:**  
—

**Functional description:**  
The position proportioning PID control is performed by feeding back both the valve opening (feedback resistance input) from the control motor and measured value (PV) from the controlled object in the flow control.
This item sets a unit time used with the 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
Relational items: Setting change rate limiter up/down (P. 119)

This item selects a time range (span) used with the 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
Relational items: Area soak time (P. 121)
This value is a high limit of the setting range.

Attribute: 

\[\text{This item becomes RO (Read only) during control RUN.}\]

Digits: 7 digits

Data range: Setting limiter (low limit) to input scale high

Factory set value: Input 1_setting limiter (high limit): Input 1_input scale high

Input 2_setting limiter (high limit): Input 2_input scale high

Relational items: Decimal point position (P. 136), Input scale high (P. 137), Setting limiter low limit (P. 188)

Functional description:

The setting limiter is the function of limiting the set value (SV) setting range.

Example: When the input range (input scale range) is from 0 to 400 °C, and the setting limiter (high limit) is 200 °C, and the setting limiter (low limit) is 20 °C.
This value is a low limit of the setting range.

**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 limit)

**Factory set value:**
- Input 1_setting limiter (low limit): Input 1_input scale low
- Input 2_setting limiter (low limit): Input 2_input scale low

**Relational items:**
- Decimal point position (P. 136), Input scale low (P. 138), Setting limiter high limit (P. 187)

**Functional description:**
See the setting limiter (high limit).
### ROM version display

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td>High order: 02E2H (738)</td>
<td></td>
</tr>
<tr>
<td>Low order: 02E3H (739)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>UT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td>High order: 02E4H (740)</td>
<td></td>
</tr>
<tr>
<td>Low order: 02E5H (741)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>RKC communication identifier</th>
<th>Hp</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td>High order: 02E6H (742)</td>
<td></td>
</tr>
<tr>
<td>Low order: 02E7H (743)</td>
<td></td>
</tr>
</tbody>
</table>

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:** —
This value is a monitored value of the power feed forward (PEF) input.

<table>
<thead>
<tr>
<th>Attribute:</th>
<th></th>
<th>RO (Read only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digits:</td>
<td></td>
<td>7 digits</td>
</tr>
<tr>
<td>Data range:</td>
<td></td>
<td>0.0 to 160.0 %</td>
</tr>
</tbody>
</table>

Display in the engineering unit of % corresponding to the rated value.

Factory set value: —
**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.

<table>
<thead>
<tr>
<th>Memory area selection</th>
<th>RKC communication identifier</th>
<th>ZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS</td>
<td>High order: 0500H (1280)</td>
<td>Low order: 0501H (1281)</td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Event set value</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 1 set value</td>
<td>A1</td>
<td>High order: 0502H (1282) Low order: 0503H (1283)</td>
</tr>
<tr>
<td>Event 2 set value</td>
<td>A2</td>
<td>High order: 0504H (1284) Low order: 0505H (1285)</td>
</tr>
<tr>
<td>Event 3 set value</td>
<td>A3</td>
<td>High order: 0506H (1286) Low order: 0507H (1287)</td>
</tr>
<tr>
<td>Event 4 set value</td>
<td>A4</td>
<td>High order: 050CH (1292) Low order: 050DH (1293)</td>
</tr>
</tbody>
</table>

This value expresses a set value 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: $-\text{Input span to } +\text{input span}$  
Process: Input scale low to input scale high  
SV: Input scale low to input scale high

**Factory set value:** 50.0

**Relational items:**  
Event state (P. 103), Event type selection (P. 151), Event hold action (P. 154), Event differential gap (P. 156), Event action at input error (P. 158), Event assignment (P. 160)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Control loop break alarm 1 (LBA1) time</th>
<th>RKC communication identifier</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0508H (1288)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0509H (1289)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control loop break alarm 2 (LBA2) time</th>
<th>RKC communication identifier</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 050EH (1294)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 050FH (1295)</td>
<td></td>
</tr>
</tbody>
</table>

The variation of measured value (PV) is monitored for each control loop break alarm (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: Not provided)

Factory set value: 480

Relational items: Event state (P. 103), Event assignment (P. 160), LBA deadband (P. 113)

<table>
<thead>
<tr>
<th>LBA1 deadband</th>
<th>RKC communication identifier</th>
<th>N1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 050AH (1290)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 050BH (1291)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LBA2 deadband</th>
<th>RKC communication identifier</th>
<th>N2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODBUS register address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High order: 0510H (1296)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0511H (1297)</td>
<td></td>
</tr>
</tbody>
</table>

The LBA deadband is a 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

Relational items: Event state (P. 103), Event assignment (P. 160), Control loop break alarm (LBA) time (P. 113)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_set value (SV1)</th>
<th>RKC communication identifier</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0512H (1298)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0513H (1299)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_set value (SV2)</th>
<th>RKC communication identifier</th>
<th>S0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 051EH (1310)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 051FH (1311)</td>
<td></td>
</tr>
</tbody>
</table>

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 one input specification.

Digits: 7 digits
Data range: Setting limiter (low limit) to setting limiter (high limit)

See Input range table (P. 119)

Factory set value: 0
Relational items: Setting limiter high limit/ low limit (P. 188)

<table>
<thead>
<tr>
<th>Input 1_proportional band</th>
<th>RKC communication identifier</th>
<th>P1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0514H (1300)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0515H (1301)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_proportional band</th>
<th>RKC communication identifier</th>
<th>P0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0520H (1312)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low order: 0521H (1313)</td>
<td></td>
</tr>
</tbody>
</table>

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 one input specification.

Digits: 7 digits
Data range: 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: 30.0
Relational items: ON/OFF action differential gap upper (P. 170), ON/OFF action differential gap lower (P. 171)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_integral time</th>
<th>RKC communication identifier</th>
<th>I1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0516H (1302)</td>
<td>Low order: 0517H (1303)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_integral time</th>
<th>RKC communication identifier</th>
<th>I0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0522H (1314)</td>
<td>Low order: 0523H (1315)</td>
</tr>
</tbody>
</table>

This value expresses a time of the integral action that eliminates the offset occurring in proportional control.

Attribute: R/W (Read and Write)

The Input 2_integral time (I0) becomes RO (Read only) for the one input specification.

Digits: 7 digits

Data range: 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds
(0.0 or 0.00: PD action)

Factory set value: 240.00

Relational items: Integral/derivative time decimal point position selection (P. 169)

<table>
<thead>
<tr>
<th>Input 1_derivative time</th>
<th>RKC communication identifier</th>
<th>D1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0518H (1304)</td>
<td>Low order: 0519H (1305)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input 2_derivative time</th>
<th>RKC communication identifier</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODBUS register address</td>
<td>High order: 0524H (1316)</td>
<td>Low order: 0525H (1317)</td>
</tr>
</tbody>
</table>

This value expresses a time of the derivative action that prevents ripples by predicting output changes and thus improves control stability.

Attribute: R/W (Read and Write)

The Input 2_derivative time (D0) becomes RO (Read only) for the one input specification.

Digits: 7 digits

Data range: 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds
(0.0 or 0.00: PI action)

Factory set value: 60.00

Relational items: Integral/derivative time decimal point position selection (P. 169)
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input 1_control response parameter</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CA</td>
<td>High order: 051AH (1306) Low order: 051BH (1307)</td>
</tr>
<tr>
<td>Input 2_control response parameter</td>
<td>RKC communication identifier</td>
<td>MODBUS register address</td>
</tr>
<tr>
<td></td>
<td>C9</td>
<td>High order: 0526H (1318) Low order: 0527H (1319)</td>
</tr>
</tbody>
</table>

This item is a response resulting from a set value (SV) change in PID control.

**Attribute:** R/W (Read and Write)

The Input 2_control response parameter (C9) becomes RO (Read only) for the one input specification.

**Digits:** 7 digits

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

**Factory set value:** 0

<table>
<thead>
<tr>
<th>Input 1_setting change rate limiter (up)</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HH</td>
<td>High order: 052AH (1322) Low order: 052BH (1323)</td>
</tr>
<tr>
<td>Input 2_setting change rate limiter (up)</td>
<td>RKC communication identifier</td>
<td>MODBUS register address</td>
</tr>
<tr>
<td></td>
<td>HX</td>
<td>High order: 052EH (1326) Low order: 052FH (1327)</td>
</tr>
</tbody>
</table>

This value expresses a set value of the setting change rate limiter up.

**Attribute:** R/W (Read and Write)

The Input 2_setting change rate limiter up (HX) becomes RO (Read only) for the one input specification.

**Digits:** 7 digits

**Data range:**
- 0.1 to input span/one minute
- 0.0: OFF (Not provided)

**Factory set value:** 0.0

**Relational items:** Setting change rate limiter unit time (P. 186)
This value expresses a set value of the setting change rate limiter down.

Attribute: R/W (Read and Write)

The Input 2 setting change rate limiter down (HY) becomes RO (Read only) for the one input specification.

Digits: 7 digits
Data range: 0.1 to input span/one minute
0.0: OFF (Not provided)
Factory set value: 0.0
Relational items: Setting change rate limiter unit time (P. 186)

This item uses the combination of the setting change rate limiter up/down and the link area number in case of simple program operation. (see P. 109)

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: 00.00 (0 minute 00.00 second to 9 minute 59.99 seconds)
Relational items: Soak time unit selection (P. 186)
This item uses the combination of the setting change rate limiter up/down and the area soak time in case of simple program operation. (see P. 109)

<table>
<thead>
<tr>
<th>Link area number</th>
<th>RKC communication identifier</th>
<th>MODBUS register address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
<td>High order: 0534H (1332)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low order: 0535H (1333)</td>
</tr>
</tbody>
</table>

Attribute: R/W (Read and Write)

Digits: 7 digits

Data range:
- 0 to 16
- 0: OFF (No link)

Factory set value: 0
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 can not solve a problem, please contact RKC sales office or the agent, on confirming the type name and specifications of the product.

**RKC communication**

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

Continued on the next page.
Continued from the previous page.

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

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response</td>
<td>Wrong connection, no connection or disconnection of the communication cable</td>
<td>Confirm the connection method or condition and connect correctly</td>
</tr>
<tr>
<td>Breakage, wrong wiring, or imperfect contact of the communication cable</td>
<td>Confirm the wiring or connector and repair or replace the wrong one</td>
<td></td>
</tr>
<tr>
<td>Mismatch of the setting data of communication speed and data bit configuration with those of the host</td>
<td>Confirm the settings and set them correctly</td>
<td></td>
</tr>
<tr>
<td>Wrong address setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message</td>
<td>Re-transmit after time-out occurs or verify communication program</td>
<td></td>
</tr>
<tr>
<td>The time interval between adjacent data in the query message is too long, exceeding 24 bit’s time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error code 1</td>
<td>Function cod error (Specifying nonexistent function code)</td>
<td>Confirm the function code</td>
</tr>
<tr>
<td>Error code 2</td>
<td>When any address other than 0000H to 0093H, 0200H to 02E9H, and 0500H to 0535H are specified</td>
<td>Confirm the address of holding register</td>
</tr>
<tr>
<td>Error code 3</td>
<td>When the specified number of data items in the query message exceeds the maximum number of data items available</td>
<td>Confirm the setting data</td>
</tr>
<tr>
<td>Error code 4</td>
<td>Self-diagnostic error</td>
<td>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.</td>
</tr>
</tbody>
</table>
9. ASCII 7-BIT CODE TABLE

This table is only for use with RKC communication.

<table>
<thead>
<tr>
<th>b5</th>
<th>b4</th>
<th>b3</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
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</tr>
</tbody>
</table>
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| 1  | 1  | 1  | 0  | E  | SO  | RS  | > | N | ^ | n | ~ |
| 1  | 1  | 1  | 1  | F  | SI  | US  | / | O | _ | o | DEL |