DeviceNet is a registered trademark of Open DeviceNet Vendor Association, Inc.
Modbus is a registered trademark of Schneider Electric.
The name of each programmable controller (PLC) means the products of each manufacturer.
Company names and product names used in this manual are the trademarks or registered trademarks of the respective companies.
This product has been self-tested by RKC at DeviceNet Protocol Conformance Test Software Version A-17.
Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

**SYMBOLS**

**WARNING**: This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

**CAUTION**: This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

⚠️ : This mark indicates that all precautions should be taken for safe usage.

📖 : This mark indicates important information on installation, handling and operating procedures.

📖 : This mark indicates supplemental information on installation, handling and operating procedures.

📚 : This mark indicates where additional information may be located.

---

**WARNING**

- 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 product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)

This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.

This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.

Be sure to provide an appropriate surge control circuit respectively for the following:
- If input/output or signal lines within the building are longer than 30 meters.
- If input/output or signal lines leave the building, regardless the length.

This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.

All precautions described in this manual should be taken to avoid damage to the instrument or equipment.

All wiring must be in accordance with local codes and regulations.

All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.

To prevent instrument damage 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.

When high alarm with hold action/re-hold action is used for Alarm function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.

The figures, diagrams and numeric values used in this manual are only for purpose of illustration.

RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.

RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.

Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.

Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.

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# CONTENTS

1. OUTLINE ......................................................................................... 1

2. SPECIFICATIONS .............................................................................. 3

3. SETTING PROCEDURE TO OPERATION ........................................ 4

4. COMMUNICATION SETTING ......................................................... 6
   4.1 DeviceNet Communication Setting .................................................. 6
       4.1.1 Node address setting ................................................................... 6
       4.1.2 DeviceNet communication speed setting ....................................... 7
       4.1.3 DIP switch 1 setting ................................................................... 8
   4.2 Module Address Setting ................................................................. 9
   4.3 Communication Environment Setting by Rotary Switch ......................... 12

5. WIRING ............................................................................................ 15
   5.1 Connection Outline of DeviceNet .................................................... 15
   5.2 Connection to DeviceNet ................................................................. 16
   5.3 Module Connection ....................................................................... 18
   5.4 Host Communication Connection .................................................... 25

6. DeviceNet COMMUNICATIONS ..................................................... 26
   6.1 Features and Functionality ............................................................. 26
   6.2 Communication Method ................................................................. 27
       6.2.1 Polling I/O communication .......................................................... 27
       6.2.2 Explicit message communication ................................................ 37
   6.3 Communication Items List .............................................................. 42

7. COMMUNICATION DATA DESCRIPTION ..................................... 49
   7.1 Communication Data of TIO Module ................................................ 50
       7.1.1 Normal setting data items ............................................................ 50
       7.1.2 Initial setting data items ............................................................... 76
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. USAGE EXAMPLE</td>
<td>79</td>
</tr>
<tr>
<td>8.1 Handling Procedures</td>
<td>86</td>
</tr>
<tr>
<td>8.2 System Configuration</td>
<td>87</td>
</tr>
<tr>
<td>8.3 Hardware Setting</td>
<td>88</td>
</tr>
<tr>
<td>8.4 Sample Programs</td>
<td>89</td>
</tr>
<tr>
<td>8.4.1 Polling I/O communication (When the SYSMAC CJ)</td>
<td>89</td>
</tr>
<tr>
<td>8.4.2 Explicit message communication (When the SYSMAC CJ)</td>
<td>92</td>
</tr>
<tr>
<td>9. TROUBLESHOOTING</td>
<td>98</td>
</tr>
<tr>
<td>APPENDIX A. DEVICE PROFILES</td>
<td>101</td>
</tr>
<tr>
<td>A.1 Basic Data</td>
<td>101</td>
</tr>
<tr>
<td>A.2 Object Mounting</td>
<td>102</td>
</tr>
<tr>
<td>APPENDIX B. HOST COMMUNICATION</td>
<td>112</td>
</tr>
<tr>
<td>B.1 Host Communication Specifications (DeviceNet Board)</td>
<td>112</td>
</tr>
<tr>
<td>B.2 Communication Setting</td>
<td>114</td>
</tr>
<tr>
<td>B.3 Communication Items List</td>
<td>116</td>
</tr>
<tr>
<td>APPENDIX C. HARDWARE</td>
<td>119</td>
</tr>
<tr>
<td>C.1 Terminal Configuration</td>
<td>119</td>
</tr>
<tr>
<td>C.2 Indication Lamp</td>
<td>120</td>
</tr>
<tr>
<td>C.3 Product Specifications</td>
<td>122</td>
</tr>
</tbody>
</table>
1. OUTLINE

This manual describes DeviceNet specification, wiring, setting, and data instructions for the module type controller SRV.

The temperature control module for DeviceNet V-TIO-J/K (hereafter called the “V-TIO-J/K module”) can send and receive data to/from DeviceNet compatible programmable controller (hereafter called PLC) and personal computers by the DeviceNet that is a multivendor compatible open field network.

- On DeviceNet, a computer or a PLC is a master device, and the V-TIO-J/K module is a slave device.
- The V-TIO-J/K module has two communication ports to conduct host communication with DeviceNet. DeviceNet uses a DeviceNet connector. There are two connector types: open-style connector and micro-style connector.

For DeviceNet, refer to the web site of ODVA (Open DeviceNet Vender Association). http://www.odva.org

For host communication using host communication terminals, refer to the 5.4 Host Communication Connection (P. 25), the APPENDIX B. HOST COMMUNICATION (P. 105) and the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E).


System configuration example
1. OUTLINE

- **EDS file**

  The EDS file for the V-TIO-J/K module can be downloaded from the official RKC website: http://www.rkcinst.com/english/download/field_network.htm. Use the EDS file when recognizing the V-TIO-J/K module on the DeviceNet by using a configurator (tool used to set a master or slave environment on the DeviceNet) of each manufacturer.

  For details, refer to Configuration Tool Instruction Manual of each company or Instruction Manual of the master product.
2. SPECIFICATIONS

- DeviceNet communication

**Protocol:** DeviceNet

**Supported connection:** Polling I/O, Explicit message

**Connection method:** Multi-drop connection, T-branch connection  
   (Terminating resistor is necessary)

**Communication speed:** 125 kbps, 250 kbps, 500 kbps  
   (Communication speed can be selected with switch)  
   Factory set value: 125 kbps

**Communication length:**

<table>
<thead>
<tr>
<th>Communication speed</th>
<th>Maximum network length *</th>
<th>Maximum drop length</th>
<th>Cumulative drop length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thick trunk length</td>
<td>Thin trunk length</td>
<td></td>
</tr>
<tr>
<td>125 kbps</td>
<td>500 m</td>
<td>100 m</td>
<td>6 m</td>
</tr>
<tr>
<td>250 kbps</td>
<td>250 m</td>
<td></td>
<td>6 m</td>
</tr>
<tr>
<td>500 kbps</td>
<td>100 m</td>
<td></td>
<td>6 m</td>
</tr>
</tbody>
</table>

* The maximum of length between nodes

**Maximum number of connection nodes:**  
   64 (including master)

**Error control:** CRC error, Node address (MAC ID) duplication check

**Conforms to DeviceNet specification:**  
   Volume I –Release2.0  
   Volume II –Release2.0

**Device profile name:** Generic Device

**Connection cable:** Use the special cable

**Connector type:** Open-style connector or Micro-style connector

**Termination resistor:** 121 Ω, 1/4 W (externally connected)

For details of device profile, refer to the APPENDIX A. DEVICE PROFILES (P. 94).
3. SETTING PROCEDURE TO OPERATION

Conduct necessary setting before operation according to the procedure described below.

- **Module setting**
  - The DIP switch sets the number of communication data items when conducting DeviceNet polling I/O communication. In addition, set a module address of SRV with the module address setting switch.
  - Refer to 4.1.3 DIP switch 1 setting (P. 8), and 4.2 Module Address Setting (P. 9).
  - The number of communication data items can also be set via DeviceNet Explicit message communication or by the configuration tool. In this case, set it at the stage of the “Device parameter setting” procedure (P. 5).

- **Wiring of SRV**
  - Wire a power supply and input/output of SRV
  - For the V-TIO-J/K module, refer to APPENDIX C.1 Terminal Configuration (P. 113). For other modules, refer to the Instruction Manual of each module.

- **DeviceNet communication setting**
  - Set the node address and the communication speed of DeviceNet to SRV.
  - Refer to 4.1.1 Node address setting (P. 6) and 4.1.2 DeviceNet communication speed setting (P. 7).

- **Connection of communication line**
  - Connect the SRV on DeviceNet.
  - Refer to 5. WIRING (P. 15).
To prevent malfunctioning, turn the power on in order of DeviceNet communication, slave and master.

When turn on the power supply of DeviceNet communication, slave including SRV, and master (PLC etc.), the SRV performs as follows.

1. The V-TIO-J/K module starts collecting data on each module connected from the time when the power is turned on.
2. The RUN lamp corresponding to indication lamp 2 flashed at very short intervals.
3. After data collection is finished and DeviceNet communication becomes enabled *, the RUN lamp keeps lighting.

* Time required for enabling DeviceNet communication is about 15 seconds.

Install the EDS file of SRV in a configuration tool of DeviceNet.

The EDS file for the V-TIO-J/K module can be downloaded from the official RKC website:

Refer to the Instruction Manual of Configuration Tool.

Set SRV communication parameters relating to polling I/O communication by using the DeviceNet configuration tool.

Refer to 6.2.1 Polling I/O communication (P. 27) and the Instruction Manual of Configuration Tool.

Download each device parameter created by the DeviceNet configuration tool to device on the actual network.

Refer to the Instruction Manual of Configuration Tool.

Create the sequence program.

Refer to 8.4 Sample Programs (P. 82).
4. COMMUNICATION SETTING

**WARNING**

- To prevent electric shock or instrument failure, always turn off the power before setting the switch.
- To prevent electric shock or instrument failure, never touch any section other than those instructed in this manual.

**CAUTION**

Do not separate the module mainframe from the terminal base with the power turned on. If so, instrument failure may result.

Set the following communication setting before operation.

### 4.1 DeviceNet Communication Setting

#### 4.1.1 Node address setting

To identify each device connected to the network, it is necessary to set a different address to each device (node).

For the DeviceNet, as it is possible to connect up to 64 devices including a master to the network, node address (MAC ID) from 0 to 63 can be set.

For this setting, use a small slotted screwdriver.

![Node address setting switch](image)

- **MSD**: High-order digit setting (set value × 10)
- **LSD**: Low-order digit setting (set value × 1)

Setting range: 0 to 63 (Factory set value: 63)

The above figure is open-style connector type. The figure of micro-style connector type is the same as an open-style connector type.

When any number exceeding 64 is set, the node address number becomes “63.”
4.1.2 DeviceNet communication speed setting

Set the communication speed of DeviceNet.
For this setting, use a small slotted screwdriver.

DeviceNet communication speed setting switch (DR or RATE *)

Setting range: 0: 125 kbps
1: 250 kbps
2: 500 kbps
(Factory set value: 0)

* Open-style connector type: DR
  Micro-style connector type: RATE

The above figure is open-style connector type. The figure of micro-style connector type is the same as an open-style connector type.

When any number between 3 and 9 is set, the communication speed becomes “500 kbps.”
4.1.3 DIP switch 1 setting

With the DIP switch 1 which is on the left side of the module, set the number of communication data items when conducting DeviceNet polling I/O communication.

Switch No. 3: OFF fixed (Do not change this one)
Switch No. 8: OFF fixed (Do not change this one)

Switch No. 1, 2, 6, and 7 are used for the setting related to host communication on the DeviceNet side. When used only for DeviceNet communication, do not change the factory set values.

For the host communication setting, refer to APPENDIX B.2 Communication Setting (P. 107).

The number of communication data items when conducting polling I/O communication can also be set via Explicit message communication, or by the configuration tool or rotary switch. However, when the number of communication data items is set via Explicit message communication, or by the configuration tool or rotary switch, the value set by the DIP switch may be ignored.

For the number of communication data items when conducting polling I/O communication, refer to 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31), Communication parameter setting by Explicit message communication (P. 39) or 7. COMMUNICATION DATA DESCRIPTION “Number of communication measured (or set) data items” (P. 75).
4.2 Module Address Setting

When using two or more modules, set the desired address to each module.
(PLC communication/host communication is common)
Module address setting differs depending on operation mode selection address settings.

Refer to Address settings (P. 10).

Set the module address by module address setting switch of front of module. For this setting, use a small slotted screwdriver.

Do not set address “99*.” Otherwise, malfunction may result.

* The DeviceNet board and the temperature control board are incorporated in the V-TIO-J/K module, and each board is assigned with the module address. The DeviceNet board address is fixed to “99.” Any address set by the module address setting switch corresponds to the temperature control board address.

Set the module address such that it is different to the other addresses on the same line. Otherwise, problems or malfunction may result.

The above figure is open-style connector type. The figure of micro-style connector type is the same as an open-style connector type.
Address settings

Addresses are set by either of free and continuous settings.

• Free setting
When in the free setting, any numbers from 0 to 98 can be freely set. In addition, to each module address, the relevant temperature control channel is assigned. Each temperature control channel number can be calculated from the following equation.

Temperature control channel number of communication
= (Module address × 2) + Temperature control channel number of module

[Setting example]

• Continuous setting
When in the continuous setting, set the V-TIO-J/K module address to 0 and also set other module addresses to consecutive numbers starting from 1. In addition, each temperature control channel number is automatically assigned in order of smaller module address number.

[Setting example]

Continued on the next page.
The number of temperature control channels which can be used in DeviceNet polling I/O communication is in accordance with the setting of “the number of communication channels.” If “the number of communication channels” is set to 5 in the system configuration of the previous page, no data in CH6 to CH14 is accessible via polling I/O communication.

For the number of communication channels, refer to 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31), Communication parameter setting by Explicit message communication (P. 39) or APPENDIX B. HOST COMMUNICATION (P. 105).

For Heat/Cool control, data in the second channel of each module becomes invalid.

[Example] If module addresses of one V-TIO-K module and four V-TIO-D modules which are Heat/Cool temperature control modules are set as follows by the free setting, data in odd channels is used because data in even channels is invalid.

Valid channel number: 1, 3, 5, 7, 9
Invalid channel number: 2, 4, 6, 8, 10

Prior to factory shipment, the module is set to “free setting” which is one of operation mode selection address settings.

When in the free setting, regardless of the number of modules connected when the power is turned on, much time is required until module recognition operation comes to an end compared to the continuous setting as this operation is performed to addresses from 0 to 98.

For operation mode selection address settings, refer to 4.3 Communication Environment Setting by Rotary Switch (P. 12).
4.3 Communication Environment Setting by Rotary Switch

Set communication environment of polling I/O communication of DeviceNet and host communication by using the “Node address setting switch” and the “DeviceNet communication speed setting switch” which are the rotary switch of the V-TIO-J/K module.

Setting procedure

1. Turn off the power supply.

2. Before setting module, record the switch positions of node address setting switch and DeviceNet communication speed setting switch. (When this module is used for the first time, no recording is required.)

3. Set all the values of a node address setting switch and a DeviceNet communication speed setting switch to “9.”

4. Turning on the power sets the module to the communication environment setting mode. If set to the communication environment setting mode, the RUN lamp goes off and the FAIL lamp flashes.

5. Select a setting item number with MSD of the node address setting switch, and set data with LSD of the node address setting switch.

Refer to List of communication environment setting items (P. 14).

6. Set the DeviceNet communication speed setting switch in the order of “9,” “0” and “1.” The RUN lamp turns on and then it turns off after registration of the set data is complete (after a lapse about 3 seconds).

Continued on the next page.
4. COMMUNICATION SETTING

Continued from the previous page.

7. Repeat the steps from 5. to 6. of previous page, and set other setting items.
   [Example] When set the number of polling I/O communication channel to a 18 channel
   • Set “2” * by MSD of the node address setting switch.
   • Set “3” * (3 × 6 = 18) by LSD of the node address setting switch.
   • Turn the DeviceNet communication speed setting switch to “1” from “0.”
   The RUN lamp turns on and then it turns off after registration of the set data is complete (after
   a lapse about 3 seconds).
   * Refer to List of communication environment setting items (P. 14).

8. First check that the RUN lamp goes off, and then turn off the power.

9. Return the switch positions of node address setting switch and DeviceNet communication speed
setting switch to the positions already recorded.

10. Turn on the power again.
    The set data valid if the power is turned on again.
### List of communication environment setting items

<table>
<thead>
<tr>
<th>No.</th>
<th>Setting item</th>
<th>Node address setting switch MSD</th>
<th>Data range</th>
<th>Node address setting switch LSD</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Internal communication speed</td>
<td>0: 2400bps</td>
<td>1: 9600bps</td>
<td>2: 19200bps</td>
<td>38400 bps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3: 38400bps</td>
<td>4 to 9: Unused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Action mode selection</td>
<td>Address setting</td>
<td>0: Continuous setting</td>
<td></td>
<td>Free setting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Free setting</td>
<td>2 to 9: Unused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Number of polling I/O communication channel</td>
<td>0: 2 channels</td>
<td>1 to 8: 6 to 48 channels</td>
<td>(= set value × 6)</td>
<td>10 channels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9: 62 channels</td>
<td>Set the number of temperature control channel of SRV communicating by polling I/O communication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Host communication transmission transfer time</td>
<td>0 to 8: 0 to 80 ms (= set value × 10)</td>
<td>9: 255 ms</td>
<td>Set the standby time until the V-TIO-J/K module starts sending data after receiving data from the host computer.</td>
<td>255 ms</td>
</tr>
<tr>
<td>4</td>
<td>Modbus data interval extension time</td>
<td>0 to 8: 0 to 80 ms (= set value × 10)</td>
<td>9: 255 ms</td>
<td>Extend data time interval in Modbus.</td>
<td>255 ms</td>
</tr>
<tr>
<td>5</td>
<td>Polling I/O communication Number of communication measured data items (IN)</td>
<td>0 to 9: 0 to 90 words (= set value × 10)</td>
<td>Set the number of measured data items (IN) (number of words) communicating via polling I/O communication.</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Polling I/O communication Number of communication set data items (OUT)</td>
<td>0 to 9: 0 to 90 words (= set value × 10)</td>
<td>Set the number of set data items (OUT) (number of words) communicating via polling I/O communication.</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Unused</td>
<td>Do not set this one</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Unused</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Set value initialization</td>
<td>0 to 8: Unused</td>
<td>9: Communication environment setting initialization execution</td>
<td>Initialize each communication environment setting data item which can be set by the rotary switch.</td>
<td></td>
</tr>
</tbody>
</table>
5. WIRING

5.1 Connection Outline of DeviceNet

The following diagram shows the configuration of a DeviceNet network.

- **Nodes**
  There are two kinds of nodes of master and slave in DeviceNet. The master and slaves can be connected at any location in the network.

- **Trunk/Drop lines**
  The trunk line refers to the cable that has Terminating Resistors on both ends. Cables branching from the trunk line are known as drop lines.
  Use the DeviceNet communication cable (thick or thin cable) for Trunk/Drop lines.

- **Connection methods**
  Two methods can be used to connect DeviceNet nodes: The T-branch method and the multi-drop method. With the T-branch method, the node is connected to a drop line created with a T-branch Tap. With the multi-drop method, the node is directly connected to the trunk line or the drop line.

- **Terminating resistors**
  Install terminating resistors to both ends of a trunk line in DeviceNet.
  Specification of terminating resistor: 121 $\Omega$, ±1 %, 1/4 W (Metal film resistance)

- **Communications power supplies**
  To use DeviceNet, connect a communications power supply (24 V DC) to the communications connector of each node with a cable.

**WARNING**

To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment. Make sure that the wiring is correct before applying power to the instrument.
5. WIRING

- Communication length

<table>
<thead>
<tr>
<th>Communication speed</th>
<th>Maximum network length *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thick trunk length</td>
</tr>
<tr>
<td>125 kbps</td>
<td>500 m</td>
</tr>
<tr>
<td>250 kbps</td>
<td>250 m</td>
</tr>
<tr>
<td>500 kbps</td>
<td>100 m</td>
</tr>
</tbody>
</table>

* The maximum of length between nodes


5.2 Connection to DeviceNet

- Open-style connector

![DeviceNet connector open-style connector (COM. PORT)]

Communication terminal number and signal details

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Symbol</th>
<th>Cable color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply, minus (−)</td>
<td>V−</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>Communication data, low</td>
<td>CAN_L</td>
<td>Blue</td>
</tr>
<tr>
<td>3</td>
<td>Shield</td>
<td>Drain</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>Communication data, high</td>
<td>CAN_H</td>
<td>White</td>
</tr>
<tr>
<td>5</td>
<td>Power supply, plus (+)</td>
<td>V+</td>
<td>Red</td>
</tr>
</tbody>
</table>

- Connection plugs (recommended models)

SRXDN-01 (Sold separately)
MSTB2.5/5-STF-5.08AUM (PHOENIX CONTACT, Inc.) or equal

Multi-drop type (recommended models):
TMSTBP2.5/5-STF-5.08AUM (PHOENIX CONTACT, Inc.)
5. WIRING

■ Micro-style connector

![DeviceNet connector micro-style connector (COM. PORT)](image)

Communication terminal number and signal details

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Symbol</th>
<th>Cable color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shield</td>
<td>Drain</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>Power supply, plus (+)</td>
<td>V+</td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>Power supply, minus (−)</td>
<td>V−</td>
<td>Black</td>
</tr>
<tr>
<td>4</td>
<td>Communication data, high</td>
<td>CAN_H</td>
<td>White</td>
</tr>
<tr>
<td>5</td>
<td>Communication data, low</td>
<td>CAN_L</td>
<td>Blue</td>
</tr>
</tbody>
</table>

■ Connection socket (recommended model)

SACC-M12FS-5CON-PG 9-M (PHOENIX CONTACT, Inc.)

This socket is a type to use thin cable.

■ Cable

Use the specified DeviceNet communication cable (either thick cable or thin cable).

By thickness of a cable to use and connection method, usable connection connector type is different.

For cable specifications, connection method and vendor, refer to website of ODVA (Open DeviceNet Vender Association).
http://www.odva.org
5.3 Module Connection

**SRV usable modules**

The modules which can be connected with the module (V-TIO-J or V-TIO-K) is shown in the below.

- Temperature control module [basic type]: V-TIO-A, V-TIO-C
- Temperature control module [extension type]: V-TIO-B, V-TIO-D

_up to 30 modules (V-TIO-A, V-TIO-B, V-TIO-C or V-TIO-D) can be connected to one module (V-TIO-J or V-TIO-K)._  

Be careful of the following when connected to the module (V-TIO-A or V-TIO-C).

- Supply a power supply to either the V-TIO-J/K or V-TIO-A/C module.
- When conducting communication (RKC communication or Modbus) using communication terminals, use them on either the V-TIO-J/K or V-TIO-A/C module.

_for host communication (RKC communication or Modbus) using communication terminals, refer to Module Type Controller SRV Communication Instruction Manual (IMS01P01-E)._
Connection in the module division

If there are restrictions on the number of modules in one unit due to environments at installing locations, it is possible to divide these modules in one unit into some groups for their installation.

When connecting the modules divided into some groups, use communication terminals (internal communication) on the terminal board for communication between each module. Therefore, one module (V-TIO-A or V-TIO-C) with the communication terminals is required for those modules divided into each group.

When connecting the modules divided into some groups, first turn on the power on the V-TIO-A/C module side and then turn on the power on the V-TIO-J/K module side.

Even if the modules are divided into some groups, one V-TIO-J/K module and one or more temperature control modules connected to the V-TIO-A/C module is counted as one unit.
5. WIRING

• Connection terminals

![Diagram of Connection Terminals]

- T/R(A)
- T/R(B)
- SG
- V-TIO-J/K module
- V-TIO-A/C module

• Communication terminal number and signal details (V-TIO-J/K, V-TIO-A/C)

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Send/receive data</td>
<td>T/R (B)</td>
</tr>
<tr>
<td>16</td>
<td>Send/receive data</td>
<td>T/R (A)</td>
</tr>
<tr>
<td>17</td>
<td>Signal ground</td>
<td>SG</td>
</tr>
</tbody>
</table>

• Diagram of RS-485 wiring

![Diagram of RS-485 Wiring]

- V-TIO-J/K module
- V-TIO-A/C module
- Pair wire
- Shielded twisted pare wire
- Communication terminal

Customer is requested to prepare a communication cable.
- **Installation of termination resistor**

  When a termination resistor is connected to the RS-485 communication line, a procedure for connecting the termination resistor on the SRV side is described.

  - If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors to the SRV and the other party unit.

- **Installation of termination resistor when connected V-TIO-J/K module alone**

  Install termination resistor in terminal directly.

  Termination resistor
  (Example: 120 Ω 1/2 W)

  Recommended tightening torque:
  0.4 N·m (4 kgf·cm)

  - The termination resistor must be provided by the customer.

- **Installation of termination resistor when two or more TIO module [extension type] are connected to one module (V-TIO-J or V-TIO-K)**

  When the extension module is connected to the module (V-TIO-J or V-TIO-K), connect a termination resistor to the termination of the communication line in the extension module at the extreme end.

  As a termination resistor is not externally connected to the TIO module [extension type], a termination resistor built in the module is switch-selected. (Refer to P. 23)
5. WIRING

- **Installation of termination resistor when the modules divided into some groups**

  Even when connecting the modules divided into some groups, connect a termination resistor to the termination of the communication line in module at the extreme end.

  The module (V-TIO-A or V-TIO-C) install termination resistor in terminal directly. (Refer to P. 21)

  As a termination resistor is not externally connected to the TIO module [extension type], a termination resistor built in the module is switch-selected. (Refer to P. 23)
Transfer procedure of termination resistor built-in the terminal base

1. Turn off the power supply of the module.
   - Do not separate the module mainframe from the terminal base with the power turned on. If separated, adjusted data may be destroyed; control be stopped, and no return can be made.

2. Pull out the module mainframe itself toward you while pushing the locks at its top and bottom, and then separate it from the terminal base.

3. Turn on the termination resistor transfer switch in the terminal base.

A terminal base of the state which removed module mainframe
4. Push the module mainframe thus separated in the terminal base until firmly locked.

5. Connect the module whose termination resistor transfer switch is turned to the ON position to the right end. Connect each module using joint connector while sliding the module. And, lift each of the joint tabs located at the top and bottom of the module and then insert it in the slot of the adjacent module to fix these two modules.
5.4 Host Communication Connection

The V-TIO-J/K module is possible to connect to the host computer by using communication terminals for maintenance. The communication interface is RS-485. However in this case, switch No. 7 of the DIP switch 1 need to be set to the “ON: host communication (internal communication invalidity mode: Modbus)”.

For details of the DIP switch 1 setting, refer to APPENDIX B.2 Communication Setting (P. 107).

For host communication (RKC communication or Modbus) using communication terminals, refer to Module Type Controller SRV Communication Instruction Manual (IMS01P01-E†).
6. DeviceNet COMMUNICATIONS

6.1 Features and Functionality

- One DeviceNet Network can have a maximum of 64 Media Access Control Identifiers (MAC ID: Node address).

- Network length changes with communication speed.

<table>
<thead>
<tr>
<th>Communication speed</th>
<th>Maximum network length</th>
<th>Maximum drop length</th>
<th>Cumulative drop length</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 kbps</td>
<td>500 m</td>
<td>100 m</td>
<td>156 m or less</td>
</tr>
<tr>
<td>250 kbps</td>
<td>250 m</td>
<td></td>
<td>78 m or less</td>
</tr>
<tr>
<td>500 kbps</td>
<td>100 m</td>
<td></td>
<td>39 m or less</td>
</tr>
</tbody>
</table>

* Maximum distance between nodes

- Install terminating resistors to both ends of a trunk line in DeviceNet. Specification of terminating resistor: 121 Ω, ±1 %, 1/4 W (Metal film resistance)

- A DeviceNet node is modeled as a collection of objects. The object model provides a template for organizing and implementing the Attributes (data), Services and Behaviors of the components of a DeviceNet product. This model has represented the construction of address designation to consist of four levels of Node address (MAC ID), Object class ID, Instance ID and Attribute ID. An address of this 4 level is used as an identification factor of data in Explicit message communication.

<table>
<thead>
<tr>
<th>Address</th>
<th>Lowest</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node</td>
<td>0</td>
<td>63</td>
</tr>
<tr>
<td>Object class</td>
<td>1</td>
<td>65535</td>
</tr>
<tr>
<td>Instance</td>
<td>0</td>
<td>65535</td>
</tr>
<tr>
<td>Attribute</td>
<td>1</td>
<td>255</td>
</tr>
</tbody>
</table>

- DeviceNet incorporates CAN (Controller Area Network). CAN defines the syntax or form of the data movement. Data on DeviceNet is transmitted using CAN data frame.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Control</th>
<th>Data (0 to 8 bytes)</th>
<th>CRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of Frame</td>
<td>RTR Bit</td>
<td>CAN data frame</td>
<td>End of Frame</td>
</tr>
</tbody>
</table>

6.2 Communication Method

SRV has supported “Polling I/O communication” and “Explicit message communication” as a communication method of DeviceNet.

6.2.1 Polling I/O communication

Polling I/O communication is the communication that master and slave always execute transmission and reception of data. Used always when checking data items such as measured values, etc.

Set the following items before communication start.

- Communication data items (set data items and measured data items)
- Number of communication channels (temperature control channel)
- Number of communication data items

Polling made once enables the following data items to be read or written via polling I/O communication.

<table>
<thead>
<tr>
<th>Request: set data items (OUT)</th>
<th>Response: measured data items (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting state selection</td>
<td>Alarm state</td>
</tr>
<tr>
<td>Control RUN/STOP selection</td>
<td>Control RUN/STOP state</td>
</tr>
<tr>
<td>Selected set data items</td>
<td>Selected measured data items</td>
</tr>
</tbody>
</table>

Outline of polling I/O communication

For data processed in actual communication, its decimal point is ignored. In addition, data with a minus sign is expressed as 2’s complement data.

[Example 1]
For a set value of “120.0,” set “1200.”

[Example 2]
For a set value of “−1,” set “65535.”

(10000H − 1 = FFFFH = 65535)
Data to send from a master [Request: set data items (OUT)]

A master transmits data of the following for slave (SRV).

Communication data (set data items) contents

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting state selection (channel 1 to 16)</td>
<td>Bit data</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Setting state selection (channel 17 to 32)</td>
<td>The following channels correspond to Bit 0 to Bit 15 of communication data No. 1 to 4.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Setting state selection (channel 33 to 48)</td>
<td>No. 1: Bit 0 to Bit 15 • • • channel 1 to 16 No. 2: Bit 0 to Bit 15 • • • channel 17 to 32 No. 3: Bit 0 to Bit 15 • • • channel 33 to 48 No. 4: Bit 0 to Bit 15 • • • channel 49 to 62 Data 0: Setting disabled 1: Setting enabled</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Setting state selection (channel 49 to 62)</td>
<td>[Decimal number: 0 to 65535]</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Control RUN/STOP selection (module 1 to 16) [Data of each module]</td>
<td>Bit data</td>
<td>Same as control RUN/STOP state of SRV</td>
</tr>
<tr>
<td>6</td>
<td>Control RUN/STOP selection (module 17 to 31) [Data of each module]</td>
<td>The following modules correspond to Bit 0 to Bit 15 of communication data No. 5 and 6. No. 5: Bit 0 to Bit 15 • • • module 1 to 16 No. 6: Bit 0 to Bit 14 • • • module 17 to 31</td>
<td></td>
</tr>
<tr>
<td>On and after 7</td>
<td>Selected set data items Set data items are set by the configuration tool or via Explicit message communication are assigned by the number of channels similarly set.</td>
<td>Same as the range of set data items selected</td>
<td>Same as the factory set value of set data items selected</td>
</tr>
</tbody>
</table>

Communication data No. 1 to 6 (corresponding to 6 words) are fixed communication data items.

In order to validate data items on and after communication data No. 7, it is necessary to set the relevant channel for setting state selection of communication data No. 1 to 4 to “1: Setting enabled.” However, this is applied only to TIO module communication data items.

For the setting method of the number of communication data items, refer to 4.1.3 DIP switch 1 setting (P. 8), 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31) or Communication parameter setting by Explicit message communication (P. 39).

For the communication data items setting by configuration tool, refer to Communication parameter setting by configuration tool (P. 31). In addition, for the communication data items setting by Explicit message communication, refer to Communication parameter setting by Explicit message communication (P. 39).

For contents of set data items, refer to 6.3 Communication Items List (P. 42).
Data which a master receives [Response: measured items (IN)]

A master transmits data of the following for slave (SRV).

**Communication data (measured items) contents**

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Data range</th>
</tr>
</thead>
</table>
| 1   | Alarm state (channel 1 to 16) | Bit data  
No. 1: Bit 0 to Bit 15 of communication data No. 1 to 4.  
No. 2: Bit 0 to Bit 15 of channel 1 to 16  
No. 3: Bit 0 to Bit 15 of channel 17 to 32  
No. 4: Bit 0 to Bit 15 of channel 33 to 48  
No. 5: Bit 0 to Bit 15 of channel 49 to 62  
Data 0: Alarm OFF  
1: Alarm ON  
Set to “1” if any one of burnout, event 1, event 2, heater break alarm (HBA) and control loop break alarm (LBA) is turned on in each channel.  
[Decimal number: 0 to 65535] |
| 2   | Alarm state (channel 17 to 32) | Bit data  
No. 1: Bit 0 to Bit 15 of channel 17 to 32  
No. 2: Bit 0 to Bit 15 of channel 33 to 48  
No. 3: Bit 0 to Bit 15 of channel 49 to 62  
No. 4: Bit 0 to Bit 13 of channel 49 to 62  
Data 0: Alarm OFF  
1: Alarm ON  
Set to “1” if any one of burnout, event 1, event 2, heater break alarm (HBA) and control loop break alarm (LBA) is turned on in each channel.  
[Decimal number: 0 to 65535] |
| 3   | Alarm state (channel 33 to 48) | Bit data  
No. 1: Bit 0 to Bit 15 of channel 17 to 32  
No. 2: Bit 0 to Bit 15 of channel 33 to 48  
No. 3: Bit 0 to Bit 15 of channel 49 to 62  
No. 4: Bit 0 to Bit 13 of channel 49 to 62  
Data 0: Alarm OFF  
1: Alarm ON  
Set to “1” if any one of burnout, event 1, event 2, heater break alarm (HBA) and control loop break alarm (LBA) is turned on in each channel.  
[Decimal number: 0 to 65535] |
| 4   | Alarm state (channel 49 to 62) | Bit data  
No. 1: Bit 0 to Bit 15 of channel 17 to 32  
No. 2: Bit 0 to Bit 15 of channel 33 to 48  
No. 3: Bit 0 to Bit 15 of channel 49 to 62  
No. 4: Bit 0 to Bit 13 of channel 49 to 62  
Data 0: Alarm OFF  
1: Alarm ON  
Set to “1” if any one of burnout, event 1, event 2, heater break alarm (HBA) and control loop break alarm (LBA) is turned on in each channel.  
[Decimal number: 0 to 65535] |
| 5   | Control RUN/STOP state (module 1 to 16) | Bit data  
No. 1: Bit 0 to Bit 15 of communication data No. 1 to 4.  
No. 5: Bit 0 to Bit 15 of module 1 to 16  
No. 6: Bit 0 to Bit 14 of module 17 to 31  
Data 0: RUN  
1: STOP  
[Decimal number: 0 to 65535] |
| 6   | Control RUN/STOP state (module 17 to 31) | Bit data  
No. 5: Bit 0 to Bit 15 of module 1 to 16  
No. 6: Bit 0 to Bit 14 of module 17 to 31  
Data 0: RUN  
1: STOP  
[Decimal number: 0 to 65535] |
| On and after 7 | Selected measured data items | Same as the range of measured data items selected |

Communication data No. 1 to 6 (corresponding to 6 words) are fixed communication data items.

- For the setting method of the number of communication data items, refer to 4.1.3 DIP switch 1 setting (P. 8), 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31) or Communication parameter setting by Explicit message communication (P. 39).

- For the communication data items setting by configuration tool, refer to Communication parameter setting by configuration tool (P. 31). In addition, for the communication data items setting by Explicit message communication, refer to Communication parameter setting by Explicit message communication (P. 39).

- For contents of measured data items, refer to 6.3 Communication Items List (P. 42).
Number of communication data items setting by DIP switch

Use the switch No. 4 and 5 of the DIP switch 1 which there is on the left side of V-TIO-J/K module, set the number of polling I/O communication data of DeviceNet.

<table>
<thead>
<tr>
<th>4</th>
<th>5</th>
<th>Number of communication data items when conducting polling I/O communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>8 words</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>26 words</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>46 words</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>100 words</td>
</tr>
</tbody>
</table>

Switch No. 3: OFF fixed (Do not change this one)
Switch No. 8: OFF fixed (Do not change this one)

The number of communication data items can also be set via Explicit message communication, or by the configuration tool or rotary switch. However, when the number of communication data items is set via Explicit message communication, or by the configuration tool or rotary switch, the value set by the DIP switch may be ignored.

For the number of communication data items, refer to 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31), Communication parameter setting by Explicit message communication (P. 39) or 7. COMMUNICATION DATA DESCRIPTION “Number of communication measured (or set) data items” (P. 75).

For switch No. 1, 2, 6, and 7, refer to APPENDIX B.2 Communication Setting (P. 107).
6. DeviceNet COMMUNICATIONS

- Communication parameter setting by configuration tool

Set the following items with the configuration tool.

- Communication data items (set data items and measured data items)
- Number of communication channels (temperature control channel)
- Number of communication data items

Time-out may occur if trying to read any SRV parameter from the configuration tool while in polling I/O communication between the master station and SRV. When reading or setting the parameters by the configuration tool, stop I/O polling at the master station.

For operation of the configuration tool, refer to each configuration tool instruction manual.

It is also possible to set communication data items, the number of communication channels and the number of communication data items using Explicit message communication. For details, refer to Communication parameter setting by Explicit message communication (P. 39).

- Setting procedure

1. Connect a personal computer installed with the configuration tool to the SRV via DeviceNet.

2. Install the EDS file attached to SRV in the configuration tool.

3. Open a parameter setting screen of SRV after having added SRV to network configuration by using a configuration tool.

< Reference screen 1: Configuration tool made by OMRON >

Set attribute ID of the communication item, the number of communication channel and the number of communication data.
4. Set attribute ID of the communication data items, the number of communication channel and the number of communication data items with a parameter setting screen.

“The number of communication channels” corresponds to number of temperature control channels of the SRV communicating via polling I/O communication.

For attribute ID of the communication item, refer to 6.3 Communication Items List (P. 42).
Parameter setting example of polling I/O communication
An example of how to set each parameter for polling of the following data is shown.

- **Measured data items:** Alarm state, Control RUN/STOP state, Measured value (PV), Heat-side manipulated output value
- **Set data items:** Setting state transfer, Control RUN/STOP transfer, Set value (SV), Event 1 set value
- **Number of communication channels:** 10 channels
- **Number of communication data items:** 26 words (IN), 26 words (OUT)

Fixed six communication data words are assigned to the measured data items of “Alarm state” and “Control RUN/STOP state.” In addition, fixed six communication data words are assigned to the set data items of “Setting state selection” and “Control RUN/STOP selection.”

When the number of communication data items is set via Explicit message communication, or by the configuration tool or rotary switch, the value set by the DIP switch may be ignored. For details, refer to 7. COMMUNICATION DATA DESCRIPTION “Number of communication measured (or set) data items” (P. 75).

Conduct parameter set according to the procedure described below.

1. Set measured data items (IN) with a parameter setting screen of SRV.
   - Set attribute ID “1” of “Measured value (PV)” in “IN ch1 (Parameter 1).”
   - Set attribute ID “3” of “Heat-side manipulated output value” in “IN ch2 (Parameter 2).”
   - “0” is set to unused IN ch (Parameter 3 to 10).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IN ch1</td>
</tr>
<tr>
<td>2</td>
<td>IN ch2</td>
</tr>
<tr>
<td>3</td>
<td>IN ch3</td>
</tr>
<tr>
<td>4</td>
<td>IN ch4</td>
</tr>
<tr>
<td>5</td>
<td>IN ch5</td>
</tr>
<tr>
<td>6</td>
<td>IN ch6</td>
</tr>
<tr>
<td>7</td>
<td>IN ch7</td>
</tr>
<tr>
<td>8</td>
<td>IN ch8</td>
</tr>
<tr>
<td>9</td>
<td>IN ch9</td>
</tr>
<tr>
<td>10</td>
<td>IN ch10</td>
</tr>
</tbody>
</table>

In addition to “Alarm state” and “Control RUN/STOP state” assigned as fixed, up to ten types of measured data items can be selected.
Set measured data items in order starting from IN ch1 (Parameter 1). If any of the following values is set, all items from that item to IN ch10 (Parameter 10) are the same as those when set at “0.”
- If at “0”
- If set to attribute ID to which no communication data items are assigned
- If at 51, 52, 53 or 54 as attribute ID

For attribute ID of the communication data items, refer to 6.3 Communication Items List (P. 42).

2. Set the setting data item (OUT) on the same SRV parameter setting screen.
- Set attribute ID “8” of “Set value (SV)” in “OUT ch1 (Parameter 11).”
- Set attribute ID “13” of “Event 1 set value” in “OUT ch2 (Parameter 12).”
- “0” is set to unused OUT ch (Parameter 13 to 20).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 OUT ch1</td>
<td>8</td>
</tr>
<tr>
<td>12 OUT ch2</td>
<td>13</td>
</tr>
<tr>
<td>13 OUT ch3</td>
<td>0</td>
</tr>
<tr>
<td>14 OUT ch4</td>
<td>0</td>
</tr>
<tr>
<td>15 OUT ch5</td>
<td>0</td>
</tr>
<tr>
<td>16 OUT ch6</td>
<td>0</td>
</tr>
<tr>
<td>17 OUT ch7</td>
<td>0</td>
</tr>
<tr>
<td>18 OUT ch8</td>
<td>0</td>
</tr>
<tr>
<td>19 OUT ch9</td>
<td>0</td>
</tr>
<tr>
<td>20 OUT ch10</td>
<td>0</td>
</tr>
</tbody>
</table>

- Attribute ID of Set value (SV): 8
- Attribute ID of Event 1 set value: 13
- Set “0” in unused items

In addition to “Setting state selection” and “Control RUN/STOP selection” assigned as fixed, up to ten types of set data items can be selected.

Set the set data items in order starting from OUT ch1 (Parameter 11). If any of the following values is set, all items from that item to OUT ch10 (Parameter 20) are the same as those when set at “0.”
- If at “0”
- If set to attribute ID to which readable communication data items are assigned
- If set to attribute ID to which no communication data items are assigned
- If at 22, 51, 52, 53 or 54 as attribute ID

For attribute ID of the communication data items, refer to 6.3 Communications Item List (P. 42).

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

3. Set the number of communication channels (TIO CH) on the same SRV parameter setting screen. Set “10” which is the number of SRV temperature control channels communicating via polling I/O communication to TIO CH (Parameter 21).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IN ch1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>20 OUT ch10</td>
<td>0</td>
</tr>
<tr>
<td>21 TIO CH</td>
<td>10</td>
</tr>
<tr>
<td>22 I/O IN WORDS</td>
<td>0</td>
</tr>
<tr>
<td>23 I/O OUT WORDS</td>
<td>0</td>
</tr>
</tbody>
</table>

Number of communication channel: 10

4. Set the number of communication data items on the same SRV parameter setting screen.
   - Set “26 words” which is the number of communication measured data items communicating via polling I/O communication to I/O IN WORDS (Parameter 22).
   - Set “26 words” which is the number of communication set data items communicating via polling I/O communication to I/O OUT WORDS (Parameter 23).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IN ch1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>20 OUT ch10</td>
<td>0</td>
</tr>
<tr>
<td>21 TIO CH</td>
<td>10</td>
</tr>
<tr>
<td>22 I/O IN WORDS</td>
<td>26</td>
</tr>
<tr>
<td>23 I/O OUT WORDS</td>
<td>26</td>
</tr>
</tbody>
</table>

Number of communication measured data items: 26 words
Number of communication set data items: 26 words
### Example of communication data list

This is a list of communication data items in the previous parameter setting example (P. 33).

(Communication data items IN and OUT corresponding to 26 words, respectively.)

- Measured and set data items from No. 1 to 6 (corresponding to 6 words) are those assign as fixed.
  (section)
- Communication data items set on and after No. 7 are assigned by the specified number of communication channels.
- Data of unused items become “0.”

<table>
<thead>
<tr>
<th>Measured items (IN)</th>
<th>Setting items (OUT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>1 Alarm state (channel 1 to 16)</td>
<td>1 Setting state selection (channel 1 to 16)</td>
</tr>
<tr>
<td>2 Alarm state (channel 17 to 32)</td>
<td>2 Setting state selection (channel 17 to 32)</td>
</tr>
<tr>
<td>3 Alarm state (channel 33 to 48)</td>
<td>3 Setting state selection (channel 33 to 48)</td>
</tr>
<tr>
<td>4 Alarm state (channel 49 to 62)</td>
<td>4 Setting state selection (channel 49 to 62)</td>
</tr>
<tr>
<td>5 Control RUN/STOP state (module 1 to 16)</td>
<td>5 Control RUN/STOP selection (module 1 to 16)</td>
</tr>
<tr>
<td>6 Control RUN/STOP state (module 17 to 31)</td>
<td>6 Control RUN/STOP selection (module 17 to 31)</td>
</tr>
<tr>
<td>7 Channel 1 Measured value (PV)</td>
<td>7 Channel 1 Set value (SV)</td>
</tr>
<tr>
<td>8 Channel 2 Measured value (PV)</td>
<td>8 Channel 2 Set value (SV)</td>
</tr>
<tr>
<td>9 Channel 3 Measured value (PV)</td>
<td>9 Channel 3 Set value (SV)</td>
</tr>
<tr>
<td>10 Channel 4 Measured value (PV)</td>
<td>10 Channel 4 Set value (SV)</td>
</tr>
<tr>
<td>11 Channel 5 Measured value (PV)</td>
<td>11 Channel 5 Set value (SV)</td>
</tr>
<tr>
<td>12 Channel 6 Measured value (PV)</td>
<td>12 Channel 6 Set value (SV)</td>
</tr>
<tr>
<td>13 Channel 7 Measured value (PV)</td>
<td>13 Channel 7 Set value (SV)</td>
</tr>
<tr>
<td>14 Channel 8 Measured value (PV)</td>
<td>14 Channel 8 Set value (SV)</td>
</tr>
<tr>
<td>15 Channel 9 Measured value (PV)</td>
<td>15 Channel 9 Set value (SV)</td>
</tr>
<tr>
<td>16 Channel 10 Measured value (PV)</td>
<td>16 Channel 10 Set value (SV)</td>
</tr>
<tr>
<td>17 Channel 1 Heat-side manipulated output value</td>
<td>17 Channel 1 Event 1 set value</td>
</tr>
<tr>
<td>18 Channel 2 Heat-side manipulated output value</td>
<td>18 Channel 2 Event 1 set value</td>
</tr>
<tr>
<td>19 Channel 3 Heat-side manipulated output value</td>
<td>19 Channel 3 Event 1 set value</td>
</tr>
<tr>
<td>20 Channel 4 Heat-side manipulated output value</td>
<td>20 Channel 4 Event 1 set value</td>
</tr>
<tr>
<td>21 Channel 5 Heat-side manipulated output value</td>
<td>21 Channel 5 Event 1 set value</td>
</tr>
<tr>
<td>22 Channel 6 Heat-side manipulated output value</td>
<td>22 Channel 6 Event 1 set value</td>
</tr>
<tr>
<td>23 Channel 7 Heat-side manipulated output value</td>
<td>23 Channel 7 Event 1 set value</td>
</tr>
<tr>
<td>24 Channel 8 Heat-side manipulated output value</td>
<td>24 Channel 8 Event 1 set value</td>
</tr>
<tr>
<td>25 Channel 9 Heat-side manipulated output value</td>
<td>25 Channel 9 Event 1 set value</td>
</tr>
<tr>
<td>26 Channel 10 Heat-side manipulated output value</td>
<td>26 Channel 10 Event 1 set value</td>
</tr>
</tbody>
</table>

For details of communication data items, refer to 6.3 Communication Items List (P. 42).
6.2.2 Explicit message communication

Explicit message communication uses an Explicit message defined with DeviceNet, and be communication to execute transmission and reception of data between nodes when it is necessary. Explicit message communication is executed like the following, when SRV (slave) is connected to a master instrument with DeviceNet.

In Explicit message communication, not only data relating to the SRV but also all of the attributes (data) described in APPENDIX A. DEVICE PROFILES (P. 94) are subject to being sent or received.

- **When read data**

If the node address (MAC ID), service code (0EH: Get_Attribute_Single), object class ID, instance ID and attribute ID are sent from the master, the node address (MAC ID) thus sent and service code (0EH + 80H *) as well as the data requested are sent from the slave.

* 80H represents a response message.

![Outline of Explicit message communication (data read)](image)

- **Service code 14H of [Error response] has shown that it is error response.**
- **For Error code of [Error response], refer to DeviceNet specifications.**
When write data

If the node address (MAC ID), service code (10H: Set_Attribute_Single), object class ID, instance ID attribute ID and write data are sent from the master, the node address (MAC ID) thus sent and service code (10H + 80H *) are sent from the slave.

* 80H represents a response message.

---

Outline of Explicit message communication (data write)

For data processed in actual communication, its decimal point is ignored. In addition, data with a minus sign is expressed as 2’s complement data.

[Example 1] For a set value of “120.0,” set “1200.”

[Example 2] For a set value of “−1,” set “65535.”

(10000H − 1 = FFFFH = 65535)

Service code 14H of [Error response] has shown that it is error response.

For Error code of [Error response], refer to DeviceNet specifications.

For Explicit message communication specification of data relating to SRV, refer to **Controller object (0x64) (P. 101) of APPENDIX A.DEVICE PROFILES.**
Communication parameter setting by Explicit message communication

“Communication data item setting” and “Setting the number of communication channels” necessary when conducting polling I/O communication are described by referring to the same settings made via Explicit message communication.

- Communication item setting

Each communication data item when conducting polling I/O communication is set by object instance (instance ID) 1 in “Controller communication item setting object (0xC7: C7H).”

### Controller communication item setting object (0xC7: C7H): Object instance 1

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>Contents</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measured data item (IN) 1</td>
<td>Select the necessary measured data item from among controller objects (0x64: 64H) and set the relevant attribute ID.</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Measured data item (IN) 2</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Measured data item (IN) 3</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Measured data item (IN) 4</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Measured data item (IN) 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Measured data item (IN) 6</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Measured data item (IN) 7</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Measured data item (IN) 8</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Measured data item (IN) 9</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Measured data item (IN) 10</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>Set data item (OUT) 1</td>
<td>Select the necessary set data item from among controller objects (0x64: 64H) and set the relevant attribute ID.</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>Set data item (OUT) 2</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Set data item (OUT) 3</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Set data item (OUT) 4</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>Set data item (OUT) 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Set data item (OUT) 6</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Set data item (OUT) 7</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>Set data item (OUT) 8</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>Set data item (OUT) 9</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>Set data item (OUT) 10</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

*Set measured data items in order starting from “Measured data item (IN) 1.” If any of the following values is set, all items from that item to “Measured data item (IN) 10” are the same as those when set at “0.”
- If at “0”
- If set to attribute ID to which no communication data items are assigned
- If at 51, 52, 53 or 54 as attribute ID

*Set the set data items in order starting from “Set data item (OUT) 1.” If any of the following values is set, all items from that item to “Set data item (OUT) 10” are the same as those when set at “0.”
- If at “0”
- If set to attribute ID to which readable communication data items are assigned
- If set to attribute ID to which no communication data items are assigned
- If at 22, 51, 52, 53 or 54 as attribute ID

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

For contents of attribute ID of controller object (0x64: 64H), refer to 6.3 Communication Items List (P. 42).

- **Number of communication channel setting**
  The number of communication channels when conducting polling I/O communication is set by the attribute ID 51 of object instance (instance ID) 1 in “Controller object (0x64: 64H).”

  Corresponding object:  Controller object (0x64)
  - Object class ID: 64
  - Instance ID: 1
  - Attribute ID: 51 (number of communication channels)
  - Write data: 1 to 62 channels

- **Number of communication data setting**
  The number of communication data items when conducting polling I/O communication is set by the attribute IDs, 53 and 54 of object instance (instance ID) 1 in “Controller object (0x64: 64H).”

  Attribute ID 53: Number of communication measured data items (IN)
  - Attribute ID 54: Number of communication set data items (OUT)

  Corresponding object:  Controller object (0x64)
  - Object class ID: 64
  - Instance ID: 1
  - Attribute ID: 53 (number of communication measured data items)
    - 54 (number of communication set data items)
  - Write data: 0 to 100 words
Data setting example

Corresponding object: Controller object (0x64)
Object class ID: 64
Instance ID: 1 to 62
Attribute ID: 1 to 120

[Example]

- **When set in “100” in Set value (SV) of temperature control channel 5**
  (Node address of SRV: 1)
  Node address (MAC ID): 1
  Service code: 10H (Set_Attribute_Single)
  Object class ID: 64
  Instance ID: 5
  Attribute ID: 8 (Set value (SV))
  Write data: 100

- **When set in “50” in heat-side proportional band of temperature control channel 2**
  (Node address of SRV: 1)
  Node address (MAC ID): 1
  Service code: 10H (Set_Attribute_Single)
  Object class ID: 64
  Instance ID: 2
  Attribute ID: 9 (Heat-side proportional band)
  Write data: 50
6.3 Communication Items List

Attribute contents of the controller object (0x64: 64H) are described to the communication item list.

- **ID:** Number (attribute ID) which identifies SRV data. Attribute ID is written using both of decimal and hexadecimal (in parentheses) numbers.

- **Attribute:**
  - RO (Read only):
    - Correspond to Service code: 0EH (Get_Attribute_Single) of DeviceNet.
    - For data request of a master, data is read from slave.
  - R/W (Read and Write):
    - Correspond to Service code: 0EH (Get_Attribute_Single)/Service code: 10H (Set_Attribute_Single) of DeviceNet.
    - In Get_Attribute_Single, data is read for data request of a master from Slave.
    - In Set_Attribute_Single, write in data for Slave from a master.

- **Structure:**
  - C: Data of each channel (Instance ID range: 1 to 62)
  - M: Data of each module (Instance ID range: 1 to 31)
  - U: Data of each unit (Instance ID range: 1)

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0x0001)</td>
<td>Measured value (PV)</td>
<td>RO</td>
<td>C</td>
<td>TC/RTD input:</td>
<td>—</td>
<td>P. 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Within input range</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage (V)/Current (I) input:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Input scale low to high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (0x0002)</td>
<td>Set value monitor</td>
<td>RO</td>
<td>C</td>
<td>TC/RTD input:</td>
<td>—</td>
<td>P. 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Within input range</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage (V)/Current (I) input:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Input scale low to high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (0x0003)</td>
<td>Heat-side manipulated</td>
<td>RO</td>
<td>C</td>
<td>−5.0 to +105.0 %</td>
<td>—</td>
<td>P. 50</td>
</tr>
<tr>
<td>output value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (0x0004)</td>
<td>Cool-side manipulated output value</td>
<td>RO</td>
<td>C</td>
<td>−5.0 to +105.0 %</td>
<td>—</td>
<td>P. 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 (0x0005)</td>
<td>Current transformer input measured</td>
<td>RO</td>
<td>C</td>
<td>0.0 to 30.0 A or 0.0 to 100.0 A</td>
<td>—</td>
<td>P. 51</td>
</tr>
<tr>
<td></td>
<td>value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>TIO state</td>
<td>RO</td>
<td>C</td>
<td>Bit data&lt;sup&gt;1&lt;/sup&gt;&lt;br&gt;Bit 0: Burnout&lt;br&gt;Bit 1: Event 1 state&lt;br&gt;Bit 2: Event 2 state&lt;br&gt;Bit 3: Heater break alarm (HBA) state&lt;br&gt;Bit 4: Control loop break alarm (LBA) state&lt;br&gt;Bit 5 to Bit 7: Unused&lt;br&gt;Bit 8: Digital input (DI) state&lt;br&gt;Bit 9: Digital output (DO) 1 state&lt;br&gt;Bit 10: Digital output (DO) 2 state&lt;br&gt;Bit 11: Temperature rise completion state&lt;br&gt;Bit 12: Control RUN/STOP state&lt;br&gt;Bit 13: Module error (DeviceNet board side)&lt;br&gt;Bit 14: Unused&lt;br&gt;Bit 15: Error code state (temperature control board side)&lt;br&gt;Data 0: OFF 1: ON [Decimal number: 0 to 65535]</td>
<td>—</td>
<td>P. 51</td>
</tr>
<tr>
<td>7</td>
<td>Operation mode</td>
<td>R/W</td>
<td>C</td>
<td>0: Unused&lt;br&gt;1: Monitor 1&lt;br&gt;2: Monitor 2&lt;br&gt;3: Control</td>
<td>1</td>
<td>P. 52</td>
</tr>
<tr>
<td>8</td>
<td>Set value (SV)</td>
<td>R/W</td>
<td>C</td>
<td>TC/RTD input:&lt;br&gt;Within input range&lt;br&gt;Voltage (V)/Current (I) input:&lt;br&gt;Input scale low to Input scale high</td>
<td>0 (0.0)</td>
<td>P. 53</td>
</tr>
<tr>
<td>9</td>
<td>Heat-side proportional band</td>
<td>R/W</td>
<td>C</td>
<td>TC/RTD input:&lt;br&gt;0 (0.0) to Input span (°C or °F)&lt;br&gt;Voltage (V)/Current (I) input:&lt;br&gt;0.0 to 100.0 % of input span&lt;br&gt;0 (0.0): ON/OFF action</td>
<td>30 (30.0)</td>
<td>P. 53</td>
</tr>
<tr>
<td>10</td>
<td>Integral time</td>
<td>R/W</td>
<td>C</td>
<td>1 to 3600 seconds</td>
<td>240</td>
<td>P. 53</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
</table>
| 11 (0x000B) | Derivative time | R/W       | C         | 0 to 3600 seconds
0: Derivative action OFF
(PI action) | 60                  | P. 54       |
| 12 (0x000C) | PV bias                    | R/W       | C         | −Input span to +Input span | 0 (0.0)             | P. 54       |
| 13 (0x000D) | Event 1 set value          | R/W       | C         | Deviation high/Deviation low:
−Input span to +Input span
Deviation high/low, Band:
0 (0.0) to Input span
Process high/Process low: | 0 | P. 54       |
| 14 (0x000E) | Event 2 set value          | R/W       | C         | TC/RTD input:
Within input range
Voltage (V)/Current (I) input:
Input scale low to
Input scale high | 0 | P. 54       |
| 15 (0x000F) | Cool-side proportional band | R/W       | C         | TC/RTD input:
1 (0.1) to Input span (°C or °F)
Voltage (V)/Current (I) input:
0.1 to 100.0 % of input span | 30 (30.0) | P. 53       |
| 16 (0x0010) | Overlap/Deadband           | R/W       | C         | −Input span to +Input span | 0 (0.0)             | P. 55       |
| 17 (0x0011) | Setting change rate limiter | R/W       | C         | 0 (0.0) to Input span/minute
0 (0.0): Setting change rate limiter OFF | 0 (0.0) | P. 55       |
| 18 (0x0012) | PID/AT transfer            | R/W       | C         | 0: PID control operation
1: AT (Autotuning) operation | 0 | P. 56       |
| 19 (0x0013) | Auto/Manual transfer       | R/W       | C         | 0: Auto mode
1: Manual mode | 0 | P. 57       |
| 20 (0x0014) | Manual output value        | R/W       | C         | −5.0 to +105.0 % | 0.0 | P. 57       |
| 21 (0x0015) | Heater break alarm (HBA) set value | R/W | C | 0.0 to 30.0 A or
0.0 to 100.0 A | 0.0 | P. 57       |
| 22 (0x0016) | Control RUN/STOP transfer | R/W       | M         | 0: Control STOP
1: Control RUN | 0 | P. 59       |

Continued on the next page.
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<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
</table>
| 23    | DI setting       | R/W       | M         | 1: Control RUN/STOP  
2: Event interlock release  
Except the above (within 0 to 20): Unused | V-TIO-J/ K: 0  
V-TIO-A/ B/C/D: Specify when ordering | P. 60 |
| 24    | DO1 setting      | R/W       | M         | 1: CH1 Event 1 state  
2: CH2 Event 1 state  
3: CH1 Event 2 state  
4: CH2 Event 2 state  
5: CH1 Heater break alarm (HBA) state  
6: CH2 Heater break alarm (HBA) state  
7: CH1 Control loop break alarm (LBA) state | V-TIO-J/ K: 0  
V-TIO-A/ B/C/D: Specify when ordering | P. 61 |
| 25    | DO2 setting      | R/W       | M         | 1: CH1 Event 1 state  
2: CH2 Event 1 state  
3: CH1 Event 2 state  
4: CH2 Event 2 state  
5: CH1 Heater break alarm (HBA) state  
6: CH2 Heater break alarm (HBA) state  
7: CH1 Control loop break alarm (LBA) state  
8: CH2 Control loop break alarm (LBA) state  
9: CH1 Burnout state  
10: CH2 Burnout state  
11: CH1 Temperature rise completion  
12: CH2 Temperature rise completion  
Except the above (within 0 to 20): Unused | V-TIO-J/ K: 0  
V-TIO-A/ B/C/D: Specify when ordering | P. 61 |
| 26    | Control response parameters | R/W | C | 0: Slow  
1: Medium  
2: Fast | 0 | P. 62 |
| 27    | Output limiter high | R/W | C | Output limiter low to 105.0 % | 100.0 | P. 63 |
| 28    | Output limiter low | R/W | C | -5.0 % to Output limiter high | 0.0 | P. 63 |

Continued on the next page.
### 6. DeviceNet COMMUNICATIONS

Continued from the previous page.

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Heat-side proportional cycle time</td>
<td>R/W</td>
<td>C</td>
<td>1 to 100 seconds</td>
<td>Relay contact output: 20 Voltage pulse output: 2</td>
<td>P. 63</td>
</tr>
<tr>
<td>30</td>
<td>Cool-side proportional cycle time</td>
<td>R/W</td>
<td>C</td>
<td>0 to 100 seconds 0: Digital filter OFF</td>
<td>0</td>
<td>P. 63</td>
</tr>
<tr>
<td>31</td>
<td>Digital filter</td>
<td>R/W</td>
<td>C</td>
<td>0 to 100 seconds</td>
<td>0</td>
<td>P. 64</td>
</tr>
<tr>
<td>32</td>
<td>Number of heater break alarm (HBA) delay times</td>
<td>R/W</td>
<td>C</td>
<td>1 to 255 times</td>
<td>5</td>
<td>P. 64</td>
</tr>
<tr>
<td>33</td>
<td>Input error determination point (high)</td>
<td>R/W</td>
<td>C</td>
<td>TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high</td>
<td>TC/RTD: Input range high V/I: Input scale high</td>
<td>P. 65</td>
</tr>
<tr>
<td>34</td>
<td>Input error determination point (low)</td>
<td>R/W</td>
<td>C</td>
<td>TC/RTD: Input range low V/I: Input scale low</td>
<td></td>
<td>P. 65</td>
</tr>
<tr>
<td>35</td>
<td>Action at input error (high)</td>
<td>R/W</td>
<td>C</td>
<td>0: Normal control 1: Manipulated output value at input error</td>
<td>0</td>
<td>P. 66</td>
</tr>
<tr>
<td>36</td>
<td>Action at input error (low)</td>
<td>R/W</td>
<td>C</td>
<td></td>
<td>0</td>
<td>P. 66</td>
</tr>
<tr>
<td>37</td>
<td>Manipulated output value at input error</td>
<td>R/W</td>
<td>C</td>
<td>−105.0 to +105.0 %</td>
<td>0.0</td>
<td>P. 66</td>
</tr>
<tr>
<td>38</td>
<td>AT differential gap time</td>
<td>R/W</td>
<td>C</td>
<td>0 to 100 seconds</td>
<td>1</td>
<td>P. 67</td>
</tr>
<tr>
<td>39</td>
<td>AT bias</td>
<td>R/W</td>
<td>C</td>
<td>−Input span to +Input span</td>
<td>0 (0.0)</td>
<td>P. 68</td>
</tr>
</tbody>
</table>
Continued from the previous page.

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
</table>
| 40 (0x0028) | Event LED mode setting                     | R/W       | M         | 1: Mode 1  
2: Mode 2  
3: Mode 3  
Except the above (within 0 to 255): Unused | 0 (Unused)         | P. 69          |
| 41 (0x0029) | DI state                                   | RO        | M         | 0: Contact open (OFF)  
1: Contact closed (ON) | —        | P. 69          |
| 42 (0x002A) | DO state                                   | R/W       | M         | 0: DO1: Contact open (OFF)  
DO2: Contact open (OFF)  
1: DO1: Contact closed (ON)  
DO2: Contact open (OFF)  
2: DO1: Contact open (OFF)  
DO2: Contact closed (ON)  
3: DO1: Contact closed (ON)  
DO2: Contact closed (ON)  
Data write is possible only when the DO1 and DO2 setting values are “0.” | 0        | P. 70          |
| 43 (0x002B) | Event interlock release                    | R/W       | M         | 0: Normal state  
1: Event interlock release execution | 0        | P. 71          |
| 44 (0x002C) | Temperature rise completion zone           | R/W       | C         | 0 (0.0) to Input span  
0 (0.0): Unused | 0 (0.0)    | P. 72          |
| 45 (0x002D) | Temperature rise completion soak time      | R/W       | C         | 0 to 360 minutes | 0        | P. 73          |
| 46 (0x002E) ; 50 (0x0032) | Unused                                   | —         | —         | —                                             | —        | —             |
| 51 (0x0033) | Number of communication channels           | R/W       | U         | 1 to 62 channels | 10       | P. 74          |
| 52 (0x0034) | Number of connected TIO channels           | R/W       | U         | 0 to 62 channels | —        | P. 74          |

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

<table>
<thead>
<tr>
<th>ID</th>
<th>Items</th>
<th>Attribute</th>
<th>Structure</th>
<th>Data range</th>
<th>Factory set value</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Number of communication measured data items (IN) (Available only with Explicit message communication)</td>
<td>R/W</td>
<td>U</td>
<td>0 to 100 words</td>
<td>0</td>
<td>P. 75</td>
</tr>
<tr>
<td>54</td>
<td>Number of communication set data items (OUT) (Available only with Explicit message communication)</td>
<td>R/W</td>
<td>U</td>
<td>0 to 100 words</td>
<td>0</td>
<td>P. 75</td>
</tr>
<tr>
<td>55</td>
<td>Unused</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>60</td>
<td>Unused</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>61</td>
<td>Initial setting mode</td>
<td>R/W</td>
<td>M</td>
<td>0: Normal setting mode</td>
<td>0</td>
<td>P. 75</td>
</tr>
<tr>
<td>62</td>
<td>Control loop break alarm (LBA) use selection</td>
<td>R/W</td>
<td>C</td>
<td>0: Unused</td>
<td>0</td>
<td>P. 76</td>
</tr>
<tr>
<td>63</td>
<td>Control loop break alarm (LBA) time</td>
<td>R/W</td>
<td>C</td>
<td>1 to 7200 seconds</td>
<td>480</td>
<td>P. 77</td>
</tr>
<tr>
<td>64</td>
<td>LBA deadband (LBD)</td>
<td>R/W</td>
<td>C</td>
<td>0 (0.0) to Input span</td>
<td>0 (0.0)</td>
<td>P. 78</td>
</tr>
<tr>
<td>65</td>
<td>Unused</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

(0x0035) Number of communication measured data items (IN) (Available only with Explicit message communication)

(0x0036) Number of communication set data items (OUT) (Available only with Explicit message communication)

(0x0037) : (0x003C) Unused

(0x003D) Initial setting mode

(0x003E) Control loop break alarm (LBA) use selection

(0x003F) Control loop break alarm (LBA) time

(0x0040) LBA deadband (LBD)

(0x0041) : (0x0078) Unused
7. COMMUNICATION DATA DESCRIPTION

- Referance to communication data contents

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current transformer input measured value</strong></td>
<td><strong>Attribute ID</strong></td>
</tr>
</tbody>
</table>

- This item is current transformer input value to use by a heater break alarm (HBA) function.

<table>
<thead>
<tr>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attribute:</strong> RO (Read only)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of data:</strong> 62 (Data of each channel)</td>
<td><strong>Data range:</strong> 0.0 to 30.0 A (CT type: CTL-6-P-N) 0.0 to 100.0 A (CT type: CTL-12-S56-10L-N)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Related parameters:</strong> TIO state (P. 51), Heater break alarm (HBA) set value (P. 57), Number of heater break alarm (HBA) delay times (P. 64)</td>
<td></td>
</tr>
</tbody>
</table>

| **Factory set value:** — |

---

(1) **Name:** Communication data name is written.

(2) **Attribute ID:** Attribute ID of controller object (0x64: 64H) is written. These Attribute ID are written using both of hexadecimal and decimal (in parentheses) numbers.

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

(4) **Attribute:** A method of how communication data items are read or written when viewed from the master (PLC) is described.

- **RO:** Only reading data is possible.

  ![Data direction diagram]

- **R/W:** Reading and writing data is possible.

(5) **Number of data:** The number of maximum communication data points is written.

  - Communication data of each channel: 62 (Instance ID range: 1 to 62)
  - Communication data of each module: 31 (Instance ID range: 1 to 31)
  - Communication data of each unit: 1 (Instance ID range: 1)

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

(7) **Related parameters:** A name and a page of relational items are written.

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

There is item including the functional description.
7.1 Communication Data of TIO Module

7.1.1 Normal setting data items

<table>
<thead>
<tr>
<th>Measured value (PV)</th>
<th>Attribute ID</th>
<th>1 (0x0001)</th>
</tr>
</thead>
</table>

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

- **Attribute:** RO (Read only)
- **Number of data:** 62 (Data of each channel)
- **Data range:**
  - TC/RTD input: Within input range
  - Voltage (V)/Current (I) input: Input scale low to Input scale high
- **Factory set value:** —

<table>
<thead>
<tr>
<th>Set value monitor</th>
<th>Attribute ID</th>
<th>2 (0x0002)</th>
</tr>
</thead>
</table>

This item is monitor of the set value (SV) which is the desired value for control.

- **Attribute:** RO (Read only)
- **Number of data:** 62 (Data of each channel)
- **Data range:**
  - TC/RTD input: Within input range
  - Voltage (V)/Current (I) input: Input scale low to Input scale high
- **Factory set value:** —

<table>
<thead>
<tr>
<th>Heat-side manipulated output value</th>
<th>Attribute ID</th>
<th>3 (0x0003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool-side manipulated output value</td>
<td>Attribute ID</td>
<td>4 (0x0004)</td>
</tr>
</tbody>
</table>

Heat-side manipulated output value and cool-side manipulated output value are the output value of SRV.

- **Attribute:** RO (Read only)
- **Number of data:** 62 (Data of each channel)
- **Data range:** −5.0 to +105.0 %
- **Related parameters:** Manual output value (P. 57), Output limiter high/low (P. 63), Event LED mode setting (P. 69)
- **Factory set value:** —

The manipulated output value on the cool-side is valid only during Heat/Cool control.
7. COMMUNICATION DATA DESCRIPTION

### Current transformer input measured value

<table>
<thead>
<tr>
<th>Current transformer input measured value</th>
<th>Attribute ID</th>
<th>5 (0x0005)</th>
</tr>
</thead>
</table>

This item is current transformer input value to use by a heater break alarm (HBA) function.

**Attribute:** RO (Read only)

**Number of data:** 62 (Data of each channel)

**Data range:**
- 0.0 to 30.0 A (CT type: CTL-6-P-N)
- 0.0 to 100.0 A (CT type: CTL-12-S56-10L-N)

**Related parameters:** TIO state (P. 51), Heater break alarm (HBA) set value (P. 57), Number of heater break alarm (HBA) delay times (P. 64)

**Factory set value:** —

### TIO state

<table>
<thead>
<tr>
<th>TIO state</th>
<th>Attribute ID</th>
<th>6 (0x0006)</th>
</tr>
</thead>
</table>

Each event state such as burnout, event 1, event 2, heater break alarm (HBA), control loop break alarm (LBA), digital input (DI) contact state, digital output (DO) 1 contact state, digital output (DO) 2 contact state, temperature rise completion state, control RUN/STOP state, module error or error code is expressed in bit data items.

**Attribute:** RO (Read only)

**Number of data:** 62 (Data of each channel)

**Data range:**
- 0 to 65535 (bit data)

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

- **Bit image:** 0000000000000000
  - Bit 15: ................. Bit 0

- **Bit data:** 0: OFF 1: ON

- **Bit 0:** Burnout
  - Become ON in input break.

- **Bit 1, Bit 2:** Event 1 state, Event 2 state
  - Event type: Deviation high, Deviation low, Deviation high/low, Band, Process high, Process low
  - Can change an event type by host communication.

- **Bit 3:** Heater break alarm (HBA) state
  - This is valid only when heater break alarm (HBA) function is used. However, heater break alarm function cannot be used when control output is Voltage/Current output.

- **Bit 4:** Control loop break alarm (LBA) state
  - This is valid only when control loop break alarm (LBA) function is used.
  - The Use/Unused of the control loop break alarm (LBA) is selected and control loop break alarm (LBA) related settings are made via host communication.

- **Bit 5 to Bit 7:** Unused

Continued on the next page.
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Bit 8: Digital input (DI) state
Become ON in the optional digital input contact closed, and become OFF in the optional digital input contact open. However, this bit is valid only during a module other than the V-TIO-J/K module.

Bit 9, Bit 10: Digital output (DO) 1 state, Digital output (DO) 2 state
Become ON in the optional digital output contact closed, and become OFF in the optional digital output contact open. However, this bit is valid only during a module other than the V-TIO-J/K module.

Bit 11: Temperature rise completion state
Become ON in temperature rise completion.

Bit 12: Control RUN/STOP state
Become ON in the control RUN, and become OFF in the control STOP.

Bit 13: Module error (DeviceNet board side)
To be turned on when the DeviceNet board can conduct (no response) no communication with the relevant module (channel).

Bit 14: Unused

Bit 15: Error code state (temperature control board side)
To be turned on when the value becomes more than 1 as any error occurs in the host communication error code (temperature control board side).

For host communication, refer to the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E).  

Related parameters: Event set value (P. 54), Heater break alarm (HBA) set value (P. 57), Control RUN/STOP transfer (P. 59), Number of heater break alarm (HBA) delay times (P. 64), DI state (P. 69), DO state (P. 70), Control loop break alarm (LBA) use selection (P. 76), Control loop break alarm (LBA) time (P. 77), LBA deadband (LBD) (P. 78)

Factory set value: —

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Attribute ID</th>
<th>7 (0x0007)</th>
</tr>
</thead>
</table>

Use to selects Unused, Monitor or Control for each channel.

Attribute: R/W (Read and Write)
Number of data: 62 (Data of each channel)
Data range:
0: Unused: Execute neither monitor nor the control
1: Monitor 1: Execute only data monitor
2: Monitor 2: Execute data monitor and an event action
   (include HBA and LBA)
3: Control: Execute the control

Related parameters: Event LED mode setting (P. 69)
Factory set value: Heat control  CH1 3: Control
                  CH2 3: Control
                  Heat/Cool control CH1 3: Control
                  CH2 0: Unused
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Set value (SV)</th>
<th>Attribute ID</th>
<th>8 (0x0008)</th>
</tr>
</thead>
</table>

Set value (SV) is desired value of the control.

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:**  
- TC/RTD input: Within input range  
- Voltage (V)/Current (I) input: Input scale low to Input scale high  
**Factory set value:** 0

<table>
<thead>
<tr>
<th>Heat-side proportional band</th>
<th>Attribute ID</th>
<th>9 (0x0009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool-side proportional band</td>
<td>Attribute ID</td>
<td>15 (0x000F)</td>
</tr>
</tbody>
</table>

Use to set the proportional band of the PI and PID control.

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:**  
- Heat-side proportional band  
  - TC/RTD input: 0 (0.0) to Input span (°C or °F)  
  - Voltage (V)/Current (I) input: 0.0 to 100.0 % of input span  
  - 0 (0.0): ON/OFF action  
- Cool-side proportional band  
  - TC/RTD input: 1 (0.1) to Input span (°C or °F)  
  - Voltage (V)/Current (I) input: 0.1 to 100.0 % of input span  
  - Input span: Input scale low to Input scale high  
**Related parameters:** Overlap/Deadband (P. 55)  
**Factory set value:** 30 (30.0)

<table>
<thead>
<tr>
<th>Integral time</th>
<th>Attribute ID</th>
<th>10 (0x000A)</th>
</tr>
</thead>
</table>

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

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:** 1 to 3600 seconds  
**Factory set value:** 240
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Derivative time</th>
<th>Attribute ID</th>
<th>11 (0x000B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derivative action is to prevent rippling and make control stable by monitoring output change. The degree of Derivative action is set by time in seconds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute:</td>
<td>R/W (Read and Write)</td>
<td></td>
</tr>
<tr>
<td>Number of data:</td>
<td>62 (Data of each channel)</td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td>0 to 3600 seconds</td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PV bias</th>
<th>Attribute ID</th>
<th>12 (0x000C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV bias adds bias to the Measured value (PV). The PV bias is used to compensate the individual variations of the sensors or correct the difference between the Measured value (PV) of other instruments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute:</td>
<td>R/W (Read and Write)</td>
<td></td>
</tr>
<tr>
<td>Number of data:</td>
<td>62 (Data of each channel)</td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td>−Input span to +Input span</td>
<td></td>
</tr>
<tr>
<td>(Input span: Input scale low limit to Input scale high limit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>0 (0.0)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 1 set value</th>
<th>Attribute ID</th>
<th>13 (0x000D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 2 set value</td>
<td>Attribute ID</td>
<td>14 (0x000E)</td>
</tr>
<tr>
<td>This item is setting value of an event action.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute:</td>
<td>R/W (Read and Write)</td>
<td></td>
</tr>
<tr>
<td>Number of data:</td>
<td>62 (Data of each channel)</td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td>Deviation high/Deviation low: −Input span to +Input span</td>
<td></td>
</tr>
<tr>
<td>Deviation high/low, Band:</td>
<td>0 to Input span</td>
<td></td>
</tr>
<tr>
<td>Process high/Process low:</td>
<td>TC/RTD input: Within input range</td>
<td></td>
</tr>
<tr>
<td>Voltage (V)/Current (I) input: Input scale low to Input scale high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Input span: Input scale low limit to Input scale high)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>0 (0.0)</td>
<td></td>
</tr>
</tbody>
</table>

An event type sets with a host communication. For host communication, refer to the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E†).
## Overlap/Deadband

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>16 (0x0010)</th>
</tr>
</thead>
</table>

Deadband: Control deadband between heat-side and cool-side proportional bands. Minus (−) setting results in overlap.

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:**  
- Input span to +Input span  
  (Input span: Input scale low to Input scale high)  
**Factory set value:**  
- TC/RTD input: 10.0 °C (10.0 °F)  
- Voltage (V)/Current (I) input: 10.0 %

## Setting change rate limiter

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>17 (0x0011)</th>
</tr>
</thead>
</table>

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

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:**  
- 0 (0.0) to Input span/minute  
  (Input span: Input scale low to Input scale high)  
**Factory set value:** 0 (0.0)  
**Function:** Application examples of setting change rate limiter:

- **Increasing the SV to a higher value**
  ![Increasing SV Diagram](image)

- **Decreasing the SV to a lower value**
  ![Decreasing SV Diagram](image)

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

<table>
<thead>
<tr>
<th>PID/AT transfer</th>
<th>Attribute ID</th>
<th>18 (0x0012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use to transfers PID control and autotuning (AT).</td>
<td>Attribute:</td>
<td>R/W (Read and Write)</td>
</tr>
<tr>
<td>Number of data:</td>
<td>62 (Data of each channel)</td>
<td>Data range:</td>
</tr>
<tr>
<td>Related parameters:</td>
<td>AT differential gap time (P. 67), AT bias (P. 68)</td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>0: PID control operation</td>
<td>Function:</td>
</tr>
<tr>
<td><strong>Requirements for AT start</strong></td>
<td>Start the autotuning when all following conditions are satisfied:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Auto/Manual transfer → Auto mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Control RUN/STOP transfer → Control RUN mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The output limiter high limit is 0.1 % higher and the output limiter low limit is 99.9 % or less.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>When the autotuning is finished, the controller will automatically returns to “0: PID control operation.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The autotuning is canceled if any of the following conditions exist:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When the PV bias value is changed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When the Auto/Manual mode is changed to the Manual mode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When the power is turned off.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When the PID/AT transfer is changed to the PID control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>− When executed a step action during program operation.</td>
<td></td>
</tr>
<tr>
<td><strong>If the AT is canceled, the controller immediately changes to PID control. The PID values will be the same as before AT was activated.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Caution for using the Autotuning (AT)</strong></td>
<td>When a temperature change (UP and/or Down) is 1 ºC (1 ºF) or less per minute during Autotuning, Autotuning may be cancelled before calculating PID values. In that case, adjust the PID values manually. It is possible to happen when the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.</td>
<td></td>
</tr>
</tbody>
</table>
### Auto/Manual transfer

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>19 (0x0013)</th>
</tr>
</thead>
</table>
Use to transfers the automatic (AUTO) control and the manual (MAN) control.

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

**Number of data:** 62 (Data of each channel)

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

**Factory set value:**
- 0: Auto mode

*No manual mode can be set for Heat/Cool control.*

### Manual output value

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>20 (0x0014)</th>
</tr>
</thead>
</table>
Use to set the output value in the manual control.

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

**Number of data:** 62 (Data of each channel)

**Data range:**
- \(-5.0\) to \(+105.0\) %
(However, the actual output value is within output limiter range.)

**Related parameters:** Output limiter high/low (P. 63)

**Factory set value:**
- 0.0

*Manual output value cannot be output in Heat/Cool control.*

### Heater break alarm (HBA) set value

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>21 (0x0015)</th>
</tr>
</thead>
</table>
This item is setting value of heater break alarm (HBA). HBA set value is set by referring to CT input measured value.

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

**Number of data:** 62 (Data of each channel)

**Data range:**
- \(0.0\) to \(30.0\) A (CT type: CTL-6-P-N)
- \(0.0\) to \(100.0\) A (CT type: CTL-12-S56-10L-N)

Set HBA set value to a value about 85 % of current transformer input measured value (CT). However, when power supply variations are large, set the HBA to a slightly smaller value. In addition, when two or more heaters are connected in parallel, set the HBA to a slightly larger value so that it is activated even with only one heater is broken (However, within the value of CT).

**Related parameters:** Current transformer input measured value (P. 51), Number of heater break alarm (HBA) delay times (P. 64)

**Factory set value:**
- 0.0

Continued on the next page.
Heater break alarm function cannot be used when control output is Voltage/Current output.

**Function:**

The heater break alarm (HBA) function detects a fault in the heating or cooling circuit and displays actual amperage on the display by monitoring the current draw of the load by the current transformer.

- **When no heater current flows:** Heater break or faulty operating unit, etc.

  When the control output is on and the current transformer (CT) input measured value is equal to or less than the HBA set value, an alarm status is produced. However, heater break alarm does not action when control output ON time is 0.1 second or less.

- **When the heater current can not be turned off:** Welded reay contact, etc.

  When the control output is off and the current transformer (CT) input value is equal to greater than the HBA set value, an alarm status is produced. However, heater break alarm does not action when control output OFF time is 0.1 second or less.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Control RUN/STOP transfer</th>
<th>Attribute ID</th>
<th>22 (0x0016)</th>
</tr>
</thead>
</table>

Use to transfers RUN and STOP of the control.

Attribute: R/W (Read and Write)
Number of data: 31 (Data of each module)
Data range:
- 0: Control STOP
- 1: Control RUN
Factory set value: 0

When the optional digital input is “Control RUN/STOP,” the instrument cannot be changed to the RUN by communication, if the instrument is STOP state by the contact input. (The “STOP” has priority.) However, excepting for the V-TIO-J/K module.

<table>
<thead>
<tr>
<th>RUN/STOP state by DI</th>
<th>RUN/STOP transfer by communication</th>
<th>Instrument state</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN (Contact close)</td>
<td>RUN</td>
<td>RUN</td>
</tr>
<tr>
<td></td>
<td>STOP</td>
<td>STOP</td>
</tr>
<tr>
<td>STOP (Contact open)</td>
<td>RUN</td>
<td>STOP</td>
</tr>
<tr>
<td></td>
<td>STOP</td>
<td>STOP</td>
</tr>
</tbody>
</table>

If “Control RUN/STOP” is set as the setting data item (OUT) by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.” If set as the measured data item (IN), it can be used as is.

When used together with RKC panel mounted controllers (HA400/900/401/901, CB100/400/700/900, etc.), be careful that the numbers of indicating “Control RUN/STOP” of this instrument are opposite from those of the above controllers (0: Control RUN and 1: Control STOP).
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>DI setting</th>
<th>Attribute ID</th>
<th>23 (0x0017)</th>
</tr>
</thead>
</table>

Sets the content of optional digital input.

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

**Number of data:**
- 31 (Data of each module)

**Data range:**
- 0: Unused
- 1: Control RUN/STOP
- 2: Event interlock release

Except the above (within 0 to 20): Unused

**Related parameters:**
- Control RUN/STOP transfer (P. 59), DI state (P. 69),
- Event interlock release (P. 71)

**Factory set value:**
- V-TIO-J/K module: 0
- V-TIO-A/B/C/D module:
  - Factory set value is as the event input (DI: optional) specified when ordering.
    - When “N: None” is selected: 0
    - When “1: Control RUN/STOP” is selected: 1
    - When “2: Event interlock release” is selected: 2

**Function:**
- Control RUN/STOP
  - Contact open: Control STOP
  - Contact closed: Control RUN
- Event interlock release
  - Contact closed: Event interlock release

**This item setting is ignored for the V-TIO-J/K module.**

**When the DI setting is “Control RUN/STOP,” the instrument cannot be changed to the**
**RUN by communication, if the instrument is STOP state by the contact input. (The**
**“STOP” has priority.) However, excepting for the V-TIO-J/K module.**

<table>
<thead>
<tr>
<th>RUN/STOP state by DI</th>
<th>RUN/STOP transfer by communication</th>
<th>Instrument state</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN (Contact closed)</td>
<td>RUN</td>
<td>RUN</td>
</tr>
<tr>
<td>STOP (Contact open)</td>
<td>STOP</td>
<td>STOP</td>
</tr>
<tr>
<td>RUN</td>
<td>RUN</td>
<td>RUN</td>
</tr>
<tr>
<td>STOP</td>
<td>STOP</td>
<td>STOP</td>
</tr>
</tbody>
</table>

**In order to make contact activation valid, it is necessary to maintain the same contact state for more than 125 ms. Otherwise, that contact state is ignored.**

**In order to validate the event interlock function, it is necessary to set Bit 2 to “1” in item “Event action selection” with a host communication. For host communication, refer to the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E).**
### DOSW setting

<table>
<thead>
<tr>
<th>DO1 setting</th>
<th>Attribute ID</th>
<th>24 (0x0018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO2 setting</td>
<td>Attribute ID</td>
<td>25 (0x0019)</td>
</tr>
</tbody>
</table>

Sets the content of optional digital output.

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

**Number of data:** 31 (Data of each module)

**Data range:**
- 0: Unused
- 1: CH1 Event 1 state
- 2: CH2 Event 1 state
- 3: CH1 Event 2 state
- 4: CH2 Event 2 state
- 5: CH1 Heater break alarm (HBA) state
- 6: CH2 Heater break alarm (HBA) state
- 7: CH1 Control loop break alarm (LBA) state
- 8: CH2 Control loop break alarm (LBA) state
- 9: CH1 Burnout state
- 10: CH2 Burnout state
- 11: CH1 Temperature rise completion
- 12: CH2 Temperature rise completion

Except the above (within 0 to 20): Unused

**Related parameters:** TIO state (P. 51)

**Factory set value:**
- V-TIO-J/K module: 0
- V-TIO-A/B/C/D module: Specify when ordering

This item setting is ignored for the V-TIO-J/K module.

For details of the content of the event, refer to the **Module Type Controller SRV Communication Instruction Instruction Manual (IMS01P01-E)***.
The control response for the Set value (SV) change can be selected among Slow, Medium, and Fast.

Attribute: R/W (Read and Write)
Number of data: 62 (Data of each channel)
Data range:
0: Slow
1: Medium
2: Fast
Factory set value: 0: Slow
Function: The control response for the Set value (SV) change can be selected among Slow, Medium, and Fast. If a fast response is required, Fast is chosen. Fast may cause overshoot. If overshoot is critical, Slow is chosen.
7. COMMUNICATION DATA DESCRIPTION

### Output limiter high

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>27 (0x001B)</th>
</tr>
</thead>
</table>

Use to set the high limit value (or low limit value) of manipulated output.

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

**Number of data:** 62 (Data of each channel)

**Data range:**
- [Heat control]: Output limiter high: Output limiter low to 105.0 %
  
- [Heat/Cool control]:
  - Output limiter low: −5.0 % to Output limiter high
  - Heat-side output limiter (high): −5.0 to +105.0 %
  - Cool-side output limiter (high): −5.0 to +105.0 %
  - Output limiter low (For both control heat and cool): −5.0 % (fixed)

**Related parameters:** Manipulated output value (P. 57)

**Factory set value:**
- Output limiter high: 100.0
- Output limiter low: 0.0

For the Heat/Cool control, the cool-side output limiter (high) is set by using the output limiter low.

### Output limiter low

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>28 (0x001C)</th>
</tr>
</thead>
</table>

### Heat-side proportional cycle time

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>29 (0x001D)</th>
</tr>
</thead>
</table>

Proportional cycle time is to set control cycle time for time based control output such as voltage pulse output and relay contact output.

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

**Number of data:** 62 (Data of each channel)

**Data range:** 1 to 100 seconds

**Factory set value:**
- Relay contact output: 20
- Voltage pulse output: 2

The invalidity in case of the Voltage/Current outputs.

The cool-side proportional cycle time is valid only during Heat/Cool control.
### Digital filter

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>31 (0x001F)</th>
</tr>
</thead>
</table>

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

- **Attribute:** R/W (Read and Write)
- **Number of data:** 62 (Data of each channel)
- **Data range:** 0 to 100 seconds
  - 0: Digital filter OFF
- **Factory set value:** 0

### Number of heater break alarm (HBA) delay times

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>32 (0x0020)</th>
</tr>
</thead>
</table>

It the number of heater break alarm (HBA) times continues its preset times (the number of sampling times), the heater break alarm is turned on.

- **Attribute:** R/W (Read and Write)
- **Number of data:** 62 (Data of each channel)
- **Data range:** 1 to 255 times
- **Related parameters:** Current transformer input measured value (P. 51), Heater break alarm (HBA) set value (P.57)
- **Factory set value:** 5
- **Function:** Heater break alarm (HBA) delay time = Number of delay times × Sampling time (Sampling time: 500 ms)
  
  **[Example]** Number of delay times: 5 times (factory set value)

  \[HBA \text{ delay time} = 5 \times 500 \text{ ms} = 2500 \text{ ms} = 2.5 \text{ seconds}\]

Heater break alarm function can not be used when control output is Voltage/Current output.
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Input error determination point (high)</th>
<th>Attribute ID</th>
<th>33 (0x0021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input error determination point (low)</td>
<td>Attribute ID</td>
<td>34 (0x0022)</td>
</tr>
</tbody>
</table>

Use to set input error determination point (high or low). Input error determination function is activated when a measured value reaches the limit, and control output value selected by action at input error will be output.

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

**Number of data:** 62 (Data of each channel)

**Data range:**
- TC/RTD input: Within input range
- Voltage (V)/Current (I) input: Input scale low to Input scale high

**Related parameters:**
- Action at input error (high/low) (P. 66),
- Manipulated output value at input error (P. 66)

**Factory set value:**
- [Input error determination point (high)]
  - TC/RTD input: Input range high
  - Voltage (V)/Current (I) input: Input scale high
- [Input error determination point (low)]
  - TC/RTD input: Input range low
  - Voltage (V)/Current (I) input: Input scale low
### 7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Action at input error (high)</th>
<th>Attribute ID</th>
<th>35 (0x0023)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action at input error (low)</td>
<td>Attribute ID</td>
<td>36 (0x0024)</td>
</tr>
</tbody>
</table>

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

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

**Number of data:** 62 (Data of each channel)

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

**Related parameters:** Input error determination point (high/low) (P. 65), Manipulated output value at input error (P. 66)

**Factory set value:** 0: Normal control (The present output)

**Function:** 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): 300 °C
- Input error determination point (low): 50 °C

![Diagram of input error determination and action]

<table>
<thead>
<tr>
<th>Manipulated output value at input error</th>
<th>Attribute ID</th>
<th>37 (0x0025)</th>
</tr>
</thead>
</table>

When the input measured value reaches input error determination point and action at input error is set to “1,” this manipulated value is output.

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

**Number of data:** 62 (Data of each channel)

**Data range:**
- −105.0 to +105.0 %
  
  (However, the actual output value is within output limiter range.)

**Related parameters:** Input error determination point (high/low) (P. 65), Action at input error (high/low) (P. 66)

**Factory set value:** 0.0
Use to set an ON/OFF action differential gap time for autotuning. This function prevents the AT function from malfunctioning caused by noise.

**Attribute:** R/W (Read and Write)  
**Number of data:** 62 (Data of each channel)  
**Data range:** 0 to 100 seconds  
**Related parameters:** PID/AT transfer (P. 56)  
**Factory set value:** 1  
**Function:** In order to prevent the output from chattering due to the fluctuation of a Measured value (PV) caused by noise during autotuning, the output on or off state is held until “AT differential gap time” has passed after the output on/off state is changed to the other. Set “AT differential gap time” to “1/100 × Time required for temperature rise.”

**[Example]**  
A: AT cycle time when the AT differential gap time is set to 0 second  
The output chatters due to the fluctuation of the Measured value (PV) caused by noise, and autotuning function is not able to monitor appropriate cycles to calculate suitable PID values.  
B: AT cycle time when the AT differential gap time is set to “Time corresponding to 0.25 cycles”  
The fluctuation of a Measured value (PV) caused by noise is ignored and as a result autotuning function is able to monitor appropriate cycles to calculate suitable PID values.

---

The AT cycle of SRV is 2 cycles.
Use to set a bias to move the set value only when autotuning is activated.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>R/W (Read and Write)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of data:</td>
<td>62 (Data of each channel)</td>
</tr>
<tr>
<td>Data range:</td>
<td>−Input span to +Input span (Input span: Input scale low to Input scale high)</td>
</tr>
<tr>
<td>Related parameters:</td>
<td>PID/AT transfer (P. 56)</td>
</tr>
<tr>
<td>Factory set value:</td>
<td>0</td>
</tr>
</tbody>
</table>

Function:
The AT bias is used to prevent overshoot during autotuning in the application which does not allow overshoot even during autotuning. RKC autotuning method uses ON/OFF control at the set value to calculate the PID values. However, if overshoot is a concern during autotuning, the desired AT bias should be set to lower the set point during autotuning so that overshoot is prevented.

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

![Diagram showing AT bias effect](image-url)
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Event LED mode setting</th>
<th>Attribute ID</th>
<th>40 (0x0028)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This item is for selecting the indicating details of 4 EVENT lamps located at the front of the module.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute: R/W (Read and Write)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of data: 31 (Data of each module)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0: Unused (No display)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Mode 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Mode 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Mode 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Except the above (within 0 to 255): Unused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory set value: 0 (No display)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function: Relationship between the content of each mode and each EVENT lamp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode</th>
<th>EVENT 1 lamp</th>
<th>EVENT 2 lamp</th>
<th>EVENT 3 lamp</th>
<th>EVENT 4 lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ch1 Event 1</td>
<td>ch1 Event 2</td>
<td>ch2 Event 1</td>
<td>ch2 Event 2</td>
</tr>
<tr>
<td>2</td>
<td>ch1 Comprehensive event 1</td>
<td>ch2 Comprehensive event 1</td>
<td>ch1 Output state 2</td>
<td>ch2 Output state 2</td>
</tr>
<tr>
<td>3</td>
<td>ch1 Comprehensive event 1</td>
<td>ch2 Comprehensive event 1</td>
<td>ch1 Control state 3</td>
<td>ch2 Control state 3</td>
</tr>
</tbody>
</table>

1 If any one of burnout, event 1, event 2, heater break alarm and control loop break alarm is turned on, the comprehensive event is turned on (lit).
2 For Voltage output/Current output, it is always turned off (extinguished).
3 When “Control RUN/STOP” is set to “Control RUN” and the operation mode is set to “Control,” it is turned on (lit).

<table>
<thead>
<tr>
<th>DI state</th>
<th>Attribute ID</th>
<th>41 (0x0029)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitors the optional digital input contact state.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute: R/W (Read and Write)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of data: 31 (Data of each module)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0: Contact open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Contact closed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Related parameters: DI setting (P. 60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory set value: —</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Except for the V-TIO-J/K module.
Monitors the optional digital input contact state.

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

**Number of data:** 31 (Data of each module)

**Data range:**
- 0: DO1: Contact open (OFF), DO2: Contact open (OFF)
- 1: DO1: Contact closed (ON), DO2: Contact open (OFF)
- 2: DO1: Contact open (OFF), DO2: Contact closed (ON)
- 3: DO1: Contact closed (ON), DO2: Contact closed (ON)

**Related parameters:** DO setting (P. 61)

**Factory set value:** 0

*This item setting is ignored for the V-TIO-J/K module.*

Data write is possible only when the DO1 and DO2 setting values are “0.”
### Event interlock release

<table>
<thead>
<tr>
<th>Attribute ID</th>
<th>43 (0x002B)</th>
</tr>
</thead>
</table>

Monitors the optional digital input contact state.

- **Attribute:** R/W (Read and Write)
- **Number of data:** 31 (Data of each module)
- **Data range:**
  - 0: Normal state
  - 1: Event interlock release execution
- **Related parameters:** DI setting (P. 60)
- **Factory set value:** 0
- **Function:** The following example shows how the event interlock is released.

![Example diagram](image)

<table>
<thead>
<tr>
<th>Event set value</th>
<th>Measured value (PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event state</td>
<td>OFF</td>
</tr>
<tr>
<td>Event interlock release input</td>
<td>OFF</td>
</tr>
</tbody>
</table>

- Invalid when the Measured value (PV) is in the event ON zone.
- Turned OFF as the event interlock is released.
- Not turned OFF as the event interlock continues.

In order to validate the event interlock function, it is necessary to set Bit 2 to “1” in item “Event action selection” with a host communication. For host communication, refer to the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E).
### Temperature rise completion zone

| Zone where the Measured value (PV) complete its temperature rise. |
|-------------------|-----------------|-----------------|
| Attribute:        | R/W (Read and Write) |
| Number of data:   | 62 (Data of each channel) |
| Data range:       | 0 (0.0) to Input span |
|                   | 0 (0.0): Unused |
|                   | (Input span: Input scale low to Input scale high) |
| Related parameters: | TIO state (P. 51), Temperature rise completion soak time (P. 73) |
| Factory set value: | 0 (0.0) |
| Function:         | Equal zone widths are set above and below the Set value (SV) and the temperature rise is complete if the Measured value (PV) enters any of these zone widths. Each of these zone widths corresponds to the temperature rise completion zone. |
|                   | During the sampling of temperature input, when the Measured value (PV) comes within the temperature rise completion zone, the temperature rise completion will occur. Further in considering the case that where the temperature rise completion zone has been set in a narrow zone, etc., even if the Measured value (PV) passes through the temperature rise completion zone in the time between the sampling periods (Previous sampling period − This time sampling period), it is also judged as the temperature rise completion. |

A temperature rise is complete just when the temperature rise completion soak time elapses after the Measured value (PV) enters the temperature rise completion zone.

Any channel which does not use temperature rise completion completes its temperature rise just when started.
Temperature rise completion soak time | Attribute ID | 45 (0x002D)

The time until the temperature rise is complete after the Measured value (PV) enters the temperature rise completion zone.

Attribute: R/W (Read and Write)
Number of data: 62 (Data of each channel)
Data range: 0 to 360 minutes
Related parameters: TIO state (P. 51), Temperature rise completion zone (P. 72)
Factory set value: 0

Function: The time until the temperature rise is complete after the Measured value (PV) enters the temperature rise completion zone corresponds to the temperature rise completion soak time.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Number of communication channels</th>
<th>Attribute ID</th>
<th>51 (0x0033)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This item corresponds to number of temperature control channels of the SRV communicating via polling I/O communication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute:</td>
<td>R/W (Read and Write)</td>
<td></td>
</tr>
<tr>
<td>Number of data:</td>
<td>1 (Data of each unit)</td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td>1 to 62 channels</td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

The number of communication channels can also be set via Explicit message communication, or by the configuration tool or rotary switch. If “Number of communication channels” is set by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.”

<table>
<thead>
<tr>
<th>Number of connected TIO channels</th>
<th>Attribute ID</th>
<th>52 (0x0034)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is the number of TIO channels of the SRV actually connected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute:</td>
<td>RO (Read only)</td>
<td></td>
</tr>
<tr>
<td>Number of data:</td>
<td>1 (Data of each unit)</td>
<td></td>
</tr>
<tr>
<td>Data range:</td>
<td>0 to 62 channels</td>
<td></td>
</tr>
<tr>
<td>Factory set value:</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

It is possible to read data items only via Explicit message communication. If “Number of connected TIO channels” is set by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.”

The V-TIO-J/K module starts collecting data on connected modules just after the power is turned on, and communication is validated after data collection is finished. If “the number of connected TIO channels” is read during data collection, “0” is returned. Therefore, the communication enable state after the power is turned on can be checked as far as “the number of connected TIO channels” is monitored.
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>Number of communication measured data items (IN)</th>
<th>Attribute ID</th>
<th>53 (0x0035)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of communication set data items (OUT)</td>
<td>Attribute ID</td>
<td>54 (0x0036)</td>
</tr>
</tbody>
</table>

This is the number of measured (IN) or set (OUT) data items (No. of words) communicating via polling I/O communication.

- **Attribute:** R/W (Read and Write)
- **Number of data:** 1 (Data of each unit)
- **Data range:** 0 to 100 words
- **Factory set value:** 0

The number of communication channels can also be set via Explicit message communication, or by the configuration tool or rotary switch. If “Number of measured (set) data items” is set by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.”

The number of communication data items can also be set by DIP switch 1 on the left side of the V-TIO-J/K module.

The number of data items which can actually communicate differs depending on the set data value.
- If value set via communication is “0”: Value set by DIP switch
- If value set via communication is any value from “1 to 6”: Fixed at 6
- If value set via communication is any value from “7 to 100”: Value set by communication
  - Value set by communication:
    - Value set by Explicit message communication, or by the configuration tool or rotary switch.

<table>
<thead>
<tr>
<th>Initial setting mode</th>
<th>Attribute ID</th>
<th>61 (0x003D)</th>
</tr>
</thead>
</table>

It is necessary to transfer the initial setting mode when read and write the initial setting data.

- **Attribute:** R/W (Read and Write)
- **Digits:** 1 digit
- **Number of data:** 31 (Data of each module)
- **Data range:** 0: Normal setting mode
  - 1: Initial setting mode
- **Factory set value:** 0: Normal setting mode

When “Control RUN/STOP” is set to “Control RUN,” no initial set mode can be set.

For initial setting data, refer to **7.1.2 Initial setting data items (P. 76).**
7. COMMUNICATION DATA DESCRIPTION

7.1.2 Initial setting data items

⚠️ WARNING ⚠️

The Initial setting data should be set according to the application before setting any parameter related to operation. Once the Initial setting data is set correctly, no further changes need to be made to data for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Initial setting.

### Setting procedure of initial setting data items

The initial setting data items can be set by changing to the initial setting mode. Transfer to initial setting mode sets in “1” with attribute ID “61” (normally setting mode).

📖 The instrument cannot be changed to the initial setting mode state at control start (during control). If it needs to be changed to the above state, first stop the control by “Control RUN/STOP transfer.”

📖 No control can be started during initial setting mode. If the control needs to be re-started, first change the instrument the normal setting mode state (set attribute ID “61” by 0).

<table>
<thead>
<tr>
<th>Control loop break alarm (LBA) use selection</th>
<th>Attribute ID</th>
<th>62 (0x003E)</th>
</tr>
</thead>
</table>

This item is for selecting the use/unused of control loop break alarm.

- **Attribute:** R/W (Read and Write)
- **Number of data:** 62 (Data of each channel)
- **Data range:**
  - 0: Unused
  - 1: Used
- **Related parameters:** TIO state (P. 51), Control loop break alarm (LBA) time (P. 77), LBA deadband (LBD) (P. 78)
- **Factory set value:** 0: Unused
- **Function:**
  - The control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break.
  - The LBA function is activated when control output reaches 0% (low limit with output limit function) or 100% (high limit with output limit function). LBA monitors variation of the Measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

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

[Alarm action]

LBA determination range: Temperature input: $2 \degree C$ [$2 \degree F$] (fixed)
Voltage (V)/Current (I) input: 0.2% of input span (fixed)

- **Heat control**

<table>
<thead>
<tr>
<th></th>
<th>When the output reaches 0 % (low limit with output limit function)</th>
<th>When the output exceeds 100 % (high limit with output limit function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For reverse action</td>
<td>When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.</td>
<td>When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.</td>
</tr>
<tr>
<td>For direct action</td>
<td>When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.</td>
<td>When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.</td>
</tr>
</tbody>
</table>

- **Heat/Cool control**

<table>
<thead>
<tr>
<th></th>
<th>When the heat-side output reaches 0 % and the cool-side output exceeds 100 % (high limit with cool-side output limit function)</th>
<th>When the heat-side output exceeds 100 % and the cool-side output reaches 0 % (high limit with heat-side output limit function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.</td>
<td>When the LBA time has passed and the PV has not fallen below the alarm determination range.</td>
<td>When the LBA time has passed and the PV has not risen beyond the alarm determination range.</td>
</tr>
</tbody>
</table>

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

---

Control loop break alarm (LBA) time

<table>
<thead>
<tr>
<th>Control loop break alarm (LBA) time</th>
<th>Attribute ID</th>
<th>63 (0x003F)</th>
</tr>
</thead>
</table>

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

Attribute: R/W (Read and Write)
Number of data: 62 (Data of each channel)
Data range: 1 to 7200 seconds
Related parameters: TIO state (P. 51), Control loop break alarm (LBA) use selection (P. 76), LBA deadband (LBD) (P.78)
Factory set value: 480
7. COMMUNICATION DATA DESCRIPTION

<table>
<thead>
<tr>
<th>LBA deadband (LBD)</th>
<th>Attribute ID</th>
<th>64 (0x0040)</th>
</tr>
</thead>
</table>

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

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

**Number of data:**
62 (Data of each channel)

**Data range:**
0 (0.0) to Input span
(Input span: Input scale low to Input scale high)

**Related parameters:**
TIO state (P. 51), Control loop break alarm (LBA) use selection (P. 76), Control loop break alarm (LBA) time (P. 77)

**Factory set value:**
0 (0.0)

**Function:**
The LBA may malfunction due to external disturbance from outside even when the control does not have any problem. To prevent malfunctioning due to external disturbance, LBA deadband (LBD) sets a neutral zone in which LBA is not activated.

When the Measured value (PV) is within the LBD area, LBA will not be activated. If the LBD setting is not correct, the LBA will not work correctly.

![LBD differential gap diagram]

If the LBA function detects an error occurring in the control loop, but cannot specify the location, a check of the control loop in order. The LBA function does not detect a location which causes alarm status. If LBA alarm is ON, check each device or wiring of the control loop.

When AT function is activated or the controller is in STOP mode, the LBA function is not activated.

If the LBA setting time match the controlled object requirements, the LBA setting time should be adjusted. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate time or not turning on at all.

While the LBA is ON (under alarm status), the following conditions cancel the alarm status and LBA will be OFF.
- The Measured value (PV) rises beyond (or falls below) the LBA determination range within the LBA time.
- The Measured value (PV) enters within the LBA deadband.
8. USAGE EXAMPLE

In this Chapter, an example of using DeviceNet communication is explained when the SRV is connected to a PLC as a master.

8.1 Handling Procedures

- Preparations of configuration instrument
  - Refer to 8.2 System Configuration (P. 80).

- SRV hardware setting
  - Refer to 4.1.3 DIP switch 1 setting (P. 8) and 4.2 Module Address Setting (P. 9).

- SRV wiring
  - For the V-TIO-J/K module, refer to APPENDIX C.1 Terminal Configuration (P. 113). For other modules, refer to the Instruction Manual of each module.

- PLC setting
  - Refer to 8.3 Hardware Setting (P. 81) and PLC Instruction Manual.

- DeviceNet wiring
  - For wiring of SRV, refer to 5. WIRING (P. 15).
  - For wiring of PLC, refer to PLC Instruction Manual.
  - For network laying requirement of DeviceNet/method, refer to Instruction Manual of master product or website of ODVA (Open DeviceNet Vendor Association).
    http://www.odva.org

- Communication items setting
  - Refer to 6. DeviceNet COMMUNICATIONS (P. 26) and the Instruction Manual of Configuration Tool.

- Programming
  - Refer to 8.4 Sample Programs (P. 82) and PLC Instruction Manual.
8.2 System Configuration

- **Use instruments**
  - **Module type controller SRV**
    - Temperature control module for DeviceNet: V-TIO-J
  - **PLC**
    - SYSMAC CJ (OMRON product)
      - CPU unit: CJ1M, DeviceNet master unit: CJ1W-DRM21
      or
    - Control Logix 5550 [Rockwell Inc. (Allen-Bradley)]
      - CPU module: 1756-L1, LINK module (DeviceNet): 1756-DNB
  - **Personal computer**
    The configuration tool must be installed in a personal computer.
8.3 Hardware Setting

Set each hardware’s as the following.

**PLC setting**

Set PLC in requirement of the following.

[DeviceNet communication requirement]

- Node address: 0
- DeviceNet communication speed: 125 kbps
- Unit Number: 0

For setting method, refer to Instruction Manual for PLC.

**SRV setting**

Set V-TIO-J module in requirement of the following.

[DeviceNet communication requirement]

- Node address: 1
- DeviceNet communication speed: 125 kbps
- Number of communication data: 8 words

For setting method, refer to 4.1 DeviceNet Communication Setting (P. 6).

The number of communication data items when conducting polling I/O communication can also be set via Explicit message communication, or by the configuration tool or rotary switch. For details, refer to 4.3 Communication Environment Setting by Rotary Switch (P. 12), Communication parameter setting by configuration tool (P. 31), or Communication parameter setting by Explicit message communication (P. 39).
8.4 Sample Programs

8.4.1 Polling I/O communication (When the SYSMAC CJ)

Polling I/O communication is called “Remote I/O communication” in OMRON PLC related instruction manuals.

- **Communication requirement**
  - **Contents of communication parameter setting**
    
    Communication data items:  
    - Measured data item (IN): Measured value (PV) [Attribute ID: 1]  
    - Set data item (OUT): Set value (SV) [Attribute ID: 8]

    Number of communication channels: 2 channels
    Number of communication data items: 8 words

- **Memory allocation**
  
  Allocate the memory by using the configuration tool.
  Allocation method: Manual allocation
  Data area:  
  - Measured data item (IN) area: D00000 to D00007 (8 words)
  - Set data item (OUT) area: D10000 to D10007 (8 words)

- **Data which a master receives [Response: measured items (IN)]**

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Storage location of read data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm state (channel 1 to 16)</td>
<td>D00000</td>
</tr>
<tr>
<td>2</td>
<td>Alarm state (channel 17 to 32)</td>
<td>D00001</td>
</tr>
<tr>
<td>3</td>
<td>Alarm state (channel 33 to 48)</td>
<td>D00002</td>
</tr>
<tr>
<td>4</td>
<td>Alarm state (channel 49 to 62)</td>
<td>D00003</td>
</tr>
<tr>
<td>5</td>
<td>Control RUN/STOP state (module 1 to 16)</td>
<td>D00004</td>
</tr>
<tr>
<td></td>
<td>[Data of each module]</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Control RUN/STOP state (module 17 to 31)</td>
<td>D00005</td>
</tr>
<tr>
<td></td>
<td>[Data of each module]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Measured value (PV) channel 1</td>
<td>D00006</td>
</tr>
<tr>
<td>8</td>
<td>Measured value (PV) channel 2</td>
<td>D00007</td>
</tr>
</tbody>
</table>

Communication data No. 1 to 6 (corresponding to 6 words) are fixed communication data items.
### Data to send from a master [Request: setting items (OUT)]

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Data contents</th>
<th>Storage location of write data</th>
</tr>
</thead>
</table>
| 1   | Setting state selection (channel 1 to 16) | As there are two communication channels, only Bit 0 (channel 1) and Bit 1 (channel 2) corresponding to communication data No.1 can be used.  
0000000000000000  
Bit 1 Bit 0  
Data 0: Setting disabled  
1: Setting enabled  
[Decimal number: 0 to 3] | D10000 |
| 2   | Setting state selection (channel 17 to 32) | 0 | D10001 |
| 3   | Setting state selection (channel 33 to 48) | 0 | D10002 |
| 4   | Setting state selection (channel 49 to 62) | 0 | D10003 |
| 5   | Control RUN/STOP selection (module 1 to 16)  
[Data of each module] | As one module is used, only Bit 0 (module 1) corresponding to data No. 5 can be used.  
0000000000000000  
Bit 0  
Data 0: STOP  
1: RUN  
[Decimal number: 0 to 1] | D10004 |
| 6   | Control RUN/STOP selection (module 17 to 31)  
[Data of each module] | 0 | D10005 |
| 7   | Set value (SV) channel 1 | 100 | D10006 |
| 8   | Set value (SV) channel 2 | 200 | D10007 |

Communication data No. 1 to 6 (corresponding to 6 words) are fixed communication data items.
Sample program (ladder)

Measured data items (IN)

Data corresponding to the measured data item (IN) can be checked only by reading the data storage register assigned by the configuration tool.

Set data items (OUT)

The following procedure is required for setting data to the SRV:

1. Sets 100 to “Set value (SV): D10006” of temperature control channel 1.
2. Sets 200 to “Set value (SV): D10007” of temperature control channel 2.
3. Set Bit 0 (TIO channel 1) and Bit 1 (TIO channel 2) for “Setting state selection: D10000” to “1: Setting enabled.”
4. Set Bit 0 (TIO channel 1) and Bit 1 (TIO channel 2) for “Setting state selection: D10000” to “0: Setting disabled” after a lapse of preset time (Ex.: 200 ms).
5. Sets 0 (reset) to “Set value (SV): D10006” of temperature control channel 1.
6. Sets 0 (reset) to “Set value (SV): D10007” of temperature control channel 2.

- Sets 100 to D10006 when relay 1.00 is turned ON.
- Sets 200 to D10007 when relay 1.00 is turned ON.
- Activate timer T0000 by setting to 200 ms when relay 1.00 is turned ON.
- Sets 0003H (Bit 0: 1, Bit 1: 1) to D10000 when relay 1.00 is turned ON.
- Differentiating the fall signal of the relay 1.00 activates the relay 1.01.
- Sets 0000H (Bit 0: 0, Bit 1: 0) to D10000 when relay 1.01 is turned ON.
- Sets 0 (data reset) to D10006 when relay 1.01 is turned ON.
- Sets 0 (data reset) to D10007 when relay 1.01 is turned ON.
### 8.4.2 Explicit message communication (When the SYSMAM CJ)

In order to conduct Explicit message communication using the OMRON SYSMAC CJ PLC, the FINS command for FINS communication (communication protocol developed by OMRON) is used.

For the FINS command and the CMND instruction, refer to the Instruction Manual of OMRON SYSMAC CJ PLC.

**Communication requirement**

The vendor code is read from the SRV (slave). (RKC vendor code: 394 = 018AH)

- Using the “Explicit message send” command (2801) of FINS command.
- The “CMND instruction” is used to send FINS commands.
- Write location of request data from the PLC (master): On and after D01000
- Storage location of response data from the SRV (slave): On and after D02000
- The completion code is stored in D00006 when execution of CMND has been completed and then the command is executed again.
- When an Explicit message is sent by the SYSMAC CJ, the send location of the FINS command is assigned to the DeviceNet master unit of its own node instead of the actual send location (SRV). The SRV node address is specified within Explicit message send command data.
8. USAGE EXAMPLE

- Command data format

Command data format at communicating by an Explicit message with SYSMAC CJ is shown with the following.

[Request data format from the PLC (master)]

<table>
<thead>
<tr>
<th>Command code</th>
<th>Object class ID</th>
<th>Instance ID</th>
<th>Service data</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Destination node address

[Response data format]

- Normal response

<table>
<thead>
<tr>
<th>Command code</th>
<th>Response code</th>
<th>No. of bytes received</th>
<th>Service data</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 01 00 00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source node address

- Error response

<table>
<thead>
<tr>
<th>Command code</th>
<th>Response code</th>
<th>No. of bytes received</th>
<th>Error code</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 01 00 00</td>
<td></td>
<td></td>
<td>94</td>
</tr>
</tbody>
</table>

Service code (94H): 14H + 80H = 94H
14H: Error response
80H: Response data

- Cannot be sent/Timeout

As this response (Cannot be sent/Timeout) is an error response sent to the CPU unit from the DeviceNet master unit of the SYSMAC CJ, this is not an error in DeviceNet communication.
8. USAGE EXAMPLE

● Description of CMND

[CMND S D C]

- **CMND**
- **S**: First command word
- **D**: First response word
- **C**: First control data word

Command data is set in order starting with the word specified for the CMND operand S (first command word) and continuing with words with higher addresses in I/O memory in the command block format.

- **C+0**
  - Number of command bytes to send: 0000H to 02E1H (0 to 542 bytes)

- **C+1**
  - Number of response data bytes to receive: 0000H to 02E1H (0 to 542 bytes)

- **C+2**
  - Destination network address
  - 00H: Local network
  - 01H to 7FH: 1 to 127

- **C+3**
  - Destination node address
  - 00 to 3FH: 0 to 63

- **C+4**
  - Number of retries: 0H to FH (0 to 15 times)
  - Transmission port number: 0 to 7
  - 0: Response returned
  - 1: No response.

- **C+5**
  - Response monitoring time
  - 0000H: 2 seconds
  - 0001H to FFFFH: 0.1 to 6553.5 seconds
8. USAGE EXAMPLE

[Sample program]
S  D01000+ 0 2801H Command code (2801H)
   + 1 0B0EH Slave node address: 11 (0BH), Service code (0EH)
   + 2 0001H Object class ID (0001H)
   + 3 0001H Instance ID (0001H)
   + 4 0100H Attribute ID (01H)
D  D02000   First response word at local node
C  D00000+ 0 0009H Number of command bytes (9 bytes)
   + 1 000AH Number of response bytes (10 bytes)
   + 2 0001H Destination network address (1)
   + 3 05FEH Destination node address (5), Destination unit address: FEH (or 10H)
   + 4 0000H Response (0), Transmission port No.0 (0), No retries (0H)
   + 5 0064H Response monitoring time: 10.0 seconds (64H)

*** Response
D02000+ 0 2801H Command code (2801H)
   + 1 0000H Response code (0000H)
   + 2 0004H Number of bytes received (0004H)
   + 3 0B8EH Response source node address: 11 (0BH), Normal completion (8EH)
   + 4 8A01H Vendor code stored from high to low byte
     (RKC vendor code: 394 = 018AH)
Sets 0000 in order to initialize D00000 to D02999.

A20011: First cycle flag

Places 0009 into D00000.
Number of command bytes: 9 bytes

Places 000A into D00001.
Number of response bytes: 10 bytes

Places 0001 into D00002.
Destination network address: 01H

Places 05FE into D00003.
Destination node address: 05H
Destination unit FINS address: FEH

Places 0000 into D00004.
Response (0), Transmission port No.0, No retries (0)

Places 0064 into D00005.
Response monitoring time:
10.0 seconds

Places 2801 into D01000.
Explicit message send command

Places 0B0E into D01001.
Slave node address: 11 (0BH)
Service code: 0EH

Places 0001 into D01002.
Object class ID: 0001H

Places 0001 into D01003.
Instance ID: 0001H

Places 0100 into D01008.
Attribute ID: 01H

Places 0001 in CIO 0000.

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

Sends 9 bytes of command data to node 05 (unit FE) on network 01 and receives 10 bytes of response data and stores it in D02000.

Shifts the contents of CIO 0000 one bit to the left (CIO 000001 ON).

Stores the completion code in A203 to D00006.

Shifts the contents of CIO 0000 one bit to the right and retry at next cycle (CIO 000000 ON).
9. TROUBLESHOOTING

This section explains probable causes and solutions if any abnormality occurs in the instrument. For any inquiries or to confirm the specifications of the product, please contact RKC sales office or the agent.

If it is necessary to replace a device, always strictly observe the warnings below.

⚠️ WARNING ⚠️

- To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.
- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

⚠️ CAUTION ⚠️

- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.
- The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- Do not separate the module mainframe from the terminal base with the power turned on. If separated, adjusted data may be destroyed; control be stopped, and no return can be made.

📚 When replacing the module with a new one, always use the module with the same model code. If the module is replaced, it is necessary to re-set each data item.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response (DeviceNet)</td>
<td>Wrong connection, no connection or disconnection of the DeviceNet 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 DeviceNet communication cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication speed setting of master (PLC) and the slave (SRV) is mismatch</td>
<td>Confirm the communication speed setting and set that correctly</td>
<td></td>
</tr>
<tr>
<td>Wrong node address setting</td>
<td>Confirm the address setting and set that correctly</td>
<td></td>
</tr>
<tr>
<td><strong>NS (or NET) lamp OFF</strong> <strong>MS (or MOD) lamp ON (Green)</strong></td>
<td>Wait for completion of node address duplication check with a master</td>
<td>If only the SRV is in this state though both of the NS/MS (NET/MOD) lamps are lit in green, re-start after checking that each communication speed is the same</td>
</tr>
<tr>
<td><strong>MS (or MOD) lamp flashes (Green)</strong></td>
<td>Module configuration error</td>
<td>Check an error occurring in any module other than the V-TIO-J/K module and then initialize the module</td>
</tr>
<tr>
<td><strong>MS (or MOD) lamp ON (Green)</strong></td>
<td>Memory backup error</td>
<td>Replace V-TIO-J/K module</td>
</tr>
<tr>
<td><strong>NS (or NET) lamp ON (Red)</strong> <strong>MS (or MOD) lamp ON (Green)</strong></td>
<td>Node address duplication</td>
<td>Re-start after the re-setting is made so that no node address is duplicated</td>
</tr>
<tr>
<td>Bus off status (communication stop by data abnormality frequent occurrence)</td>
<td>Re-start after checking the following items.</td>
<td></td>
</tr>
<tr>
<td>• Does the speed coincide with the master communication speed ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is not the DeviceNet communication cable connected yet, incorrectly connected or removed ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is the length of the DeviceNet communication cable appropriate ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Are termination resistors (121 Ω) connected only to both ends of the trunk line ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Does much noise exist ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakdown of communication device</td>
<td>Replace V-TIO-J/K module</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NS (or NET) lamp flashes (Red)</td>
<td>DeviceNet communication I/O connection time-out state</td>
<td>• Set the I/O connection Expected packet rate (class: 0x05, instance: 2, attribute: 9) to 0 (No time-out) or set it to a sufficiently large value.</td>
</tr>
<tr>
<td>• MS (or MOD) lamp ON (Green)</td>
<td></td>
<td>• Lengthen the master I/O message communication cycle time.</td>
</tr>
<tr>
<td>• NS (or NET) lamp flashes (Green)</td>
<td>DeviceNet communication Communication have not yet been established</td>
<td>It is checked whether or not the V-TIO-J/K module is registered to the master as a slave. Re-start after checking the following items.</td>
</tr>
<tr>
<td>• MS (or MOD) lamp ON (Green)</td>
<td></td>
<td>• Does the speed coincide with the master communication speed ?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Is not the DeviceNet communication cable connected yet, incorrectly connected or removed ?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Is the length of the DeviceNet communication cable appropriate ?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Are termination resistors (121 Ω) connected only to both ends of the trunk line ?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does much noise exist ?</td>
</tr>
</tbody>
</table>
APPENDIX A. DEVICE PROFILES

A device profile is the specification that defined each necessary parameter with DeviceNet. Use it after understanding contents of a device profile of SRV fully when connected to a master.

A.1 Basic Data

- **General device data**

  | Conforms to DeviceNet specification | Volume I - Release 2.0 | Volume II - Release 2.0 |
  | Vender name | RKC INSTRUMENT INC. (Vender ID = 394) |
  | Device profile name | Generic Device |
  | Product catalog number | Instruction manual number: IMS01P11-E (English) IMS01P11-J (Japanese) |
  | Product revision | 1.0 |

- **Physical conformance data**

  | Network power consumption | 2 mA @ 11 V DC | 4 mA @ 24 V DC |
  | Connector type | Open-style connector or Micro-style connector |
  | Insulated physical layer | Provided |
  | LEDs supported | Module, Network |
  | MAC ID setting | Rotary switch (Node address setting) |
  | Default MAC ID | 63 |
  | Communication speed setting | Rotary switch (DeviceNet communication speed setting) |
  | Communication speed supported | 125 kbps, 250 kbps, 500 kbps |

- **Communication data**

  | Predefined master/slave connection set | Group 2 Only server |
  | Dynamic connection supported (UCMM) | Not supported |
  | Fragmented Explicit Messaging | None |
A.2 Object Mounting

- **Identity Object (0x01: 01H)**

- **Object class**

  Attributes | Not supported
  Services | Not supported

- **Object instance**

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>1 Vender</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>394</td>
</tr>
<tr>
<td></td>
<td>2 Product type</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3 Product code</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>4 Revision</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Major revision</td>
<td></td>
<td></td>
<td>USINT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minor revision</td>
<td></td>
<td></td>
<td>USINT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 Status (bits supported)</td>
<td>Yes</td>
<td>No</td>
<td>WORD</td>
<td>Note</td>
</tr>
<tr>
<td></td>
<td>6 Serial number</td>
<td>Yes</td>
<td>No</td>
<td>UDINT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 Product name</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td></td>
<td></td>
<td>STRING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td></td>
<td></td>
<td></td>
<td>SRV</td>
</tr>
</tbody>
</table>

- **DeviceNet service**

<table>
<thead>
<tr>
<th>Parameter option</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x05 Reset</td>
</tr>
<tr>
<td>0x0E Get_Attribute_Single</td>
</tr>
</tbody>
</table>

Note: A bit layout of “Status”

- Bit 0: Owned
- Bit 7: Become 1 when controller state of SRV become abnormal
  
  (It includes the case when an error code of the connected TIO module becomes other than “0.”)

- Bit 1 to 6 and Bit 8 to 15: Unused
Message Router Object (0x02: 02H)

- Object class

  Attributes  Not supported
  Services    Not supported

- Object instance

  Attributes  Not supported
  Services    Not supported
# DeviceNet Object (0x03: 03H)

## Object class

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>1 Revision</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>2</td>
</tr>
</tbody>
</table>

### DeviceNet service

<table>
<thead>
<tr>
<th>Services</th>
<th>Parameter option</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x0E</td>
<td>Get_Attribute_Single</td>
</tr>
</tbody>
</table>

## Object instance

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>1 MAC ID</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0 to 63</td>
</tr>
<tr>
<td></td>
<td>2 Baud rate</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td>3 BOI</td>
<td>Yes</td>
<td>No</td>
<td>BOOL</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4 Bus-off counter</td>
<td>Yes</td>
<td>Yes</td>
<td>USINT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 Allocation information</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allocation choice byte</td>
<td></td>
<td></td>
<td>BYTE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Master’s MAC ID</td>
<td></td>
<td></td>
<td>USINT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 MAC ID switch changed</td>
<td>Yes</td>
<td>No</td>
<td>BOOL</td>
<td>0, 1</td>
</tr>
<tr>
<td></td>
<td>7 Baud rate switch changed</td>
<td>Yes</td>
<td>No</td>
<td>BOOL</td>
<td>0, 1</td>
</tr>
<tr>
<td></td>
<td>8 MAC ID switch value</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0 to 63</td>
</tr>
<tr>
<td></td>
<td>9 Baud rate switch value</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0 to 2</td>
</tr>
</tbody>
</table>

### DeviceNet service

<table>
<thead>
<tr>
<th>Services</th>
<th>Parameter option</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x0E</td>
<td>Get_Attribute_Single</td>
</tr>
<tr>
<td>0x10</td>
<td>Set_Attribute_Single</td>
</tr>
<tr>
<td>0x4B</td>
<td>Allocate_Master/Slave_Connection_Set</td>
</tr>
<tr>
<td>0x4C</td>
<td>Release_Group_2_Identifire_Set</td>
</tr>
</tbody>
</table>
## Assembly Object (0x04: 04H)

### Object class

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>1 Revision</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>2</td>
</tr>
</tbody>
</table>

**DeviceNet service**

<table>
<thead>
<tr>
<th>Services</th>
<th>0x0E Get_Attribute_Single</th>
<th>Parameter option</th>
</tr>
</thead>
</table>

### Object instance 100

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>3 Data</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

**DeviceNet service**

<table>
<thead>
<tr>
<th>Services</th>
<th>0x0E Get_Attribute_Single</th>
<th>Parameter option</th>
</tr>
</thead>
</table>

### Object instance 101

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td>3 Data</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**DeviceNet service**

<table>
<thead>
<tr>
<th>Services</th>
<th>0x0E Get_Attribute_Single</th>
<th>Parameter option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0x10 Set_Attribute_Single</td>
<td>None</td>
</tr>
</tbody>
</table>
## Connection Object (0x05: 05H)

### Object class

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not supported</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

Number of maximum possible active connection

### Object instance 1

<table>
<thead>
<tr>
<th>Section</th>
<th>Information</th>
<th>Number of maximum instance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance type</td>
<td>Explicit Message</td>
<td>1</td>
</tr>
<tr>
<td>Production trigger</td>
<td>Cyclic</td>
<td></td>
</tr>
<tr>
<td>Transport type</td>
<td>Server</td>
<td></td>
</tr>
<tr>
<td>Transport class</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>State</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Instance type</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0x00</td>
</tr>
<tr>
<td>3</td>
<td>Transport class trigger</td>
<td>Yes</td>
<td>No</td>
<td>BYTE</td>
<td>0x83</td>
</tr>
<tr>
<td>4</td>
<td>Produced connection ID</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Consumed connection ID</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Initial comm. Characteristics</td>
<td>Yes</td>
<td>No</td>
<td>BYTE</td>
<td>0x21</td>
</tr>
<tr>
<td>7</td>
<td>Produced connection size</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Consumed connection size</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>Expected packet rate</td>
<td>Yes</td>
<td>Yes</td>
<td>UINT</td>
<td>Default: 2500</td>
</tr>
<tr>
<td>12</td>
<td>Watchdog time-out action</td>
<td>Yes</td>
<td>Yes</td>
<td>USINT</td>
<td>1, 3</td>
</tr>
<tr>
<td>13</td>
<td>Produced connection path length</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Produced connection path</td>
<td>Yes</td>
<td>No</td>
<td>(null)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Consumed connection path length</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Consumed connection path</td>
<td>Yes</td>
<td>No</td>
<td>(null)</td>
<td></td>
</tr>
</tbody>
</table>

### DeviceNet service

<table>
<thead>
<tr>
<th>Services</th>
<th>Parameter option</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x05</td>
<td>Reset</td>
</tr>
<tr>
<td>0x0E</td>
<td>Get_Attribute_Single</td>
</tr>
<tr>
<td>0x10</td>
<td>Set_Attribute_Single</td>
</tr>
</tbody>
</table>

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

- **Object instance 2**

<table>
<thead>
<tr>
<th>Section</th>
<th>Information</th>
<th>Number of maximum instance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance type</td>
<td>Polled I/O</td>
<td>1</td>
</tr>
<tr>
<td>Production trigger</td>
<td>Cyclic</td>
<td></td>
</tr>
<tr>
<td>Transport type</td>
<td>Server</td>
<td></td>
</tr>
<tr>
<td>Transport class</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Get</th>
<th>Set</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>State</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Instance type</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0x01</td>
</tr>
<tr>
<td>3</td>
<td>Transport class trigger</td>
<td>Yes</td>
<td>No</td>
<td>BYTE</td>
<td>0x82</td>
</tr>
<tr>
<td>4</td>
<td>Produced connection ID</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Consumed connection ID</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Initial comm. Characteristics</td>
<td>Yes</td>
<td>No</td>
<td>BYTE</td>
<td>0x01</td>
</tr>
<tr>
<td>7</td>
<td>Produced connection size</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Consumed connection size</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>Note</td>
</tr>
<tr>
<td>9</td>
<td>Expected packet rate</td>
<td>Yes</td>
<td>Yes</td>
<td>UINT</td>
<td>Default: 0</td>
</tr>
<tr>
<td>12</td>
<td>Watchdog time-out action</td>
<td>Yes</td>
<td>No</td>
<td>USINT</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Produced connection path length</td>
<td>Yes</td>
<td>No</td>
<td>UINT</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>Produced connection path</td>
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Note: Make the setting by any of the following methods. (The value is validated with the power turned on)

- Select with the DIP switch 1. [16 (8 words), 52 (26 words), 92 (46 words) or 200 (100 words)]
- Set with number setting (attribute ID: 53 and 54) of communication data of controller object (0x64).
### Controller Object (0x64: 64H)

#### Object class

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#### Object instance [□] (□: 1 to 62)

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* If “Control RUN/STOP” is set as the setting data item (OUT) by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.” If set as the measured data item (IN), it can be used as is.

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Continued from the previous page.

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¹ If this data item is set as a measured data item (IN) or set data item (OUT) by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.” In addition, any data item set hereafter is invalidated.

² It is validated only via Explicit message communication. If this data item is set as a measured data item (IN) or set data item (OUT) by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.” In addition, any data item set hereafter is invalidated.

³ The V-TIO-J/K module starts collecting data on connected modules just after the power is turned on, and communication is validated after data collection is finished. If “the number of connected TIO channels” is read during data collection, “0” is returned. Therefore, the communication enable state after the power is turned on can be checked as far as “the number of connected TIO channels” is monitored.

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

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<td>Control loop break alarm (LBA) use selection</td>
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<td>LBA deadband (LBD)</td>
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DeviceNet service

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1 To set the control loop break alarm (LBA) use selection, the control loop break alarm (LBA) time, or the LBA deadband (LBD) must be set to “1” on the initial setting mode. After completing those parameter settings, always return to “0” on the initial setting mode.

2 If this data item is set as a measured data item (IN) or set data item (OUT) by the “Controller communication item setting object (0xC7: C7H)” which sets communication data items via polling I/O communication, it becomes the same as that when set at “0.” In addition, any data item set hereafter is invalidated.

Any object instance from 1 to 62 corresponds to any TIO channel from 1 to 62. However if a unit of communication is for each module, any object instance from 1 to 31 corresponds to any module No. from 1 to 31. In addition, if a unit of communication is for a group of these modules, only object instance 1 is validated.
Controller Communication Item Setting Object (0xC7: C7H)

- **Object class**
  - Attributes: Not supported
  - Services: Not supported

- **Object instance 1**

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DeviceNet service Parameter option

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<td>0x0E</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>0x10</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

Measured data items (IN) and set data items (OUT) communicating via polling I/O communication are set by the attribute ID in “Controller object (0x64: 64H).”

If not used, 0 is set. Any measured data item (IN) or set data item (OUT) after the item to which 0 is set is invalidated.
APPENDIX B. HOST COMMUNICATION

The V-TIO-J/K module is for DeviceNet communication but it is also possible to communicate using the host communication terminal. RKC communication and Modbus are possible to communicate using the host communication terminal.

The DeviceNet board and temperature control board are incorporated in the V-TIO-J/K module, and each of them is handled as one set.

In this chapter, host communication data on the DeviceNet board is mainly described.

For communication protocol and communication data for a temperature control board, refer to the Module Type Controller SRV Communication Instruction Manual (IMS01P01-E).  

B.1 Host Communication Specifications (DeviceNet Board)

- **RKC communication**
  
  **Interface:** Based on RS-485, EIA standard
  
  **Connection method:** 2-wire system, half-duplex multi-drop connection
  
  **Synchronous method:** Start/Stop synchronous type
  
  **Communication speed:** 2400 bps, 9600 bps, 19200 bps, 38400 bps
  Communication speed can be selected with switch
  
  **Data bit configuration:**
  - Start bit: 1
  - Data bit: 8
  - Parity bit: Without
  - Stop bit: 1
  
  **Protocol:** Based on ANSI X3.28-1976 subcategories 2.5 and A4
  Polling/selecting type
  
  **Error control:** Horizontal parity (BCC check)
  
  **Data types:** ASCII 7-bit code
  
  **Termination resistor:** Externally terminal connected: 120 Ω, 1/2 W
  
  **Maximum connections:** 32 modules maximum including a host computer
  (As each of the DeviceNet board and temperature control board incorporated in the V-TIO-J/K module is handled as one unit, one V-TIO-J/K module corresponds two modules.)
  
  **Signal logic:** 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.
Modbus

**Interface:** Based on RS-485, EIA standard

**Connection method:** 2-wire system, half-duplex multi-drop connection

**Synchronous method:** Start/Stop synchronous type

**Communication speed:** 2400 bps, 9600 bps, 19200 bps, 38400 bps
Communication speed can be selected with switch

**Data bit configuration:**
- Start bit: 1
- Data bit: 8
- Parity bit: Without
- Stop bit: 1

**Protocol:** Modbus

**Signal transmission mode:** Remote Terminal Unit (RTU) mode

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

**Error check method:** CRC-16

**Error codes:**
1: Function code error  
(An unsupported function code was specified)
2: When the mismatched address is specified.
3: • When the data written exceeds the setting range.
   • When the specified number of data items in the query message exceeds the maximum number (1 to 125) of data items available

**Termination resistor:** Externally terminal connected: 120 Ω, 1/2 W

**Maximum connections:** 32 modules maximum including a host computer
(As each of the DeviceNet board and temperature control board incorporated in the V-TIO-J/K module is handled as one unit, one V-TIO-J/K module corresponds two modules.)

**Signal logic:** 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.

RKC communication or Modbus protocol can be selected with switch.
B.2 Communication Setting

- A module address of a DeviceNet board is “99” (fixed).
  
  For module address setting of temperature control board, refer to 4.2 Module Address Setting (P. 9).

- With the DIP switch 1 which there is on the left side of V-TIO-J/K module, set the host communication speed and the communication protocol of DeviceNet board.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>Host communication speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>2400 bps</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>9600 bps</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>19200 bps</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>38400 bps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th>Communication protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>RKC communication</td>
</tr>
<tr>
<td>ON</td>
<td>Modbus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7</th>
<th>Internal communication mode selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>DeviceNet communication mode</td>
</tr>
<tr>
<td>ON</td>
<td>Host communication (RS-485) mode</td>
</tr>
</tbody>
</table>

Switch No. 3: OFF fixed (Do not change this one)
Switch No. 8: OFF fixed (Do not change this one)

Switch No. 4 and 5 are used for setting the number of communication data items when conducting DeviceNet polling I/O communication.

For the number of communication data items when conducting DeviceNet polling I/O communication, refer to 4.1.3 DIP switch 1 setting (P. 8).
Communication setting of temperature control board
With the DIP switch 2 which there is on the right side of module, set the communication speed, data bit configuration, protocol, and termination resistor of internal data bus for host communication of temperature control board.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>Communication speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>2400 bps</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>9600 bps</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>19200 bps</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>38400 bps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Data bit configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>Data 8-bit, Without parity, Stop 1-bit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th>Communication protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>RKC communication</td>
</tr>
<tr>
<td>ON</td>
<td>Modbus</td>
</tr>
</tbody>
</table>

- Switch No. 7: OFF fixed (Do not change this one)
- Switch No. 8: OFF fixed (Do not change this one)
- Always set “Data 8-bit, Without parity, Stop 1-bit” in data bit configuration. (Switch No. 3: ON, No. 4: OFF, No. 5: OFF)
- Set communication speed, data bit configuration and communication protocol to the same contents as those of the DeviceNet board and host computer.
- When connecting two or more modules (TIO module [Extension type] etc.) to the V-TIO-J/K module, for switch No. 1 to 6 set the DIP switch 2 in all of the V-TIO-J/K modules to the same positions.
### B.3 Communication Items List

This is a list of data items which can communicate with the DeviceNet board via host communication.

- “Identifier” is used for RKC communication.
- “Register address” is used for Modbus.
- RO: Read only  R/W: Read and Write

<table>
<thead>
<tr>
<th>Name</th>
<th>Identifier</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polling I/O communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measured items (IN) ID setting</td>
<td>R8</td>
<td>CH1: 1520</td>
<td>HEX</td>
<td>DOC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH2: 1521</td>
<td></td>
<td>CH1: 5408</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH3: 1522</td>
<td></td>
<td>CH2: 5409</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH4: 1523</td>
<td></td>
<td>CH3: 5410</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH5: 1524</td>
<td></td>
<td>CH4: 5411</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH6: 1525</td>
<td></td>
<td>CH5: 5412</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH7: 1526</td>
<td></td>
<td>CH6: 5413</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH8: 1527</td>
<td></td>
<td>CH7: 5414</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH9: 1528</td>
<td></td>
<td>CH8: 5415</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH10:1529</td>
<td></td>
<td>CH9: 5416</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R/W</td>
<td></td>
<td>Data: 0 to 120</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0: No communication item</td>
<td>CH1: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This is the measured data item (IN) communicating via polling I/O communication.</td>
<td>CH2 to 10: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select any measured data item from among “Controller object (0x64: 64H)” and set the relevant attribute ID.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Any CH from 1 to 10 corresponds to any attribute ID from 1 to 10 of object instance 1 in “Controller communication data item setting object (0xC7: C7H).”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For contents of setting items, refer to 6.3 Communication Items List (P. 42).</td>
<td></td>
</tr>
<tr>
<td>Polling I/O communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting items (OUT) ID setting</td>
<td>R9</td>
<td>CH1: 1540</td>
<td>HEX</td>
<td>DOC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH2: 1541</td>
<td></td>
<td>CH1: 5440</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH3: 1542</td>
<td></td>
<td>CH2: 5441</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH4: 1543</td>
<td></td>
<td>CH3: 5442</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH5: 1544</td>
<td></td>
<td>CH4: 5443</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH6: 1545</td>
<td></td>
<td>CH5: 5444</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH7: 1546</td>
<td></td>
<td>CH6: 5445</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH8: 1547</td>
<td></td>
<td>CH7: 5446</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH9: 1548</td>
<td></td>
<td>CH8: 5447</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH10:1549</td>
<td></td>
<td>CH9: 5448</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R/W</td>
<td></td>
<td>Data: 0 to 120</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0: No communication item</td>
<td>CH1: 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This is the set data item (OUT) communicating via polling I/O communication.</td>
<td>CH2 to 10: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select any set data item from among “Controller object (0x64: 64H)” and set the relevant attribute ID.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Any CH from 1 to 10 corresponds to any attribute ID from 11 to 20 of object instance 1 in “Controller communication data item setting object (0xC7: C7H).”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For contents of setting items, refer to 6.3 Communication Items List (P. 42).</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Identifier</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polling I/O communication Number of communication channel</td>
<td>QY</td>
<td>7D03 32003</td>
<td>R/W</td>
<td>1 to 62 channels This is the number of temperature control channels of the SRV communicating via polling I/O communication. After the data is set, turn off the power once and turn it on again to validate the data. The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td>10</td>
</tr>
<tr>
<td>V-TIO-J/K module Error code</td>
<td>ES</td>
<td>7D08 32008</td>
<td>RO</td>
<td>Bit data Bit 0: Memory backup error (DeviceNet board side) Bit 1 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 1]</td>
<td>—</td>
</tr>
<tr>
<td>Action mode selection</td>
<td>RZ</td>
<td>7D0C 32012</td>
<td>R/W</td>
<td>Bit data Bit 0: Address setting Data 0: Continuous setting 1: Free setting Bit 1 to Bit 15: Unused [Decimal number: 0 to 1] The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td>1</td>
</tr>
<tr>
<td>Polling I/O communication Measured items (IN) Number of communication data setting</td>
<td>RX</td>
<td>7D0D 32013</td>
<td>R/W</td>
<td>0 to 100 words This is the number of measured data items (IN) (No. of words) communicating via polling I/O communication. After the data is set, turn off the power once and turn it on again to validate the data. The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td>0</td>
</tr>
</tbody>
</table>

Continued on the next page.
### APPENDIX B. HOST COMMUNICATION

<table>
<thead>
<tr>
<th>Name</th>
<th>Identifier</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polling I/O communication Setting items (OUT) Number of communication data setting</td>
<td>RY</td>
<td>7D0E 32014</td>
<td>R/W</td>
<td>0 to 100 words</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This is the number of set data items (OUT) (No. of words) communicating via polling I/O communication. After the data is set, turn off the power once and turn it on again to validate the data. The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td></td>
</tr>
<tr>
<td>Initial setting mode</td>
<td>IN</td>
<td>7D20 32032</td>
<td>R/W</td>
<td>0: Normal setting mode 1: Initial setting mode</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The instrument cannot be changed to the initial setting mode state at control start (during control).</td>
<td></td>
</tr>
<tr>
<td>Host communication Transmission transfer time setting</td>
<td>ZX</td>
<td>7D21 32033</td>
<td>R/W</td>
<td>0 to 255 ms</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Set the wait time until the V-TIO-J/K module starts sending data after that data is received from the host computer. As this item corresponds to the initial set data, it is readable and writable only in the initial set mode. The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td></td>
</tr>
<tr>
<td>Internal communication speed</td>
<td>QQ</td>
<td>7D24 32036</td>
<td>R/W</td>
<td>0: 2400bps 1: 9600bps 2: 19200bps 3: 38400bps 4 to 9: Unused</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As this item corresponds to the initial set data, it is readable and writable only in the initial set mode. After the data is set, turn off the power once and turn it on again to validate the data. The communication environment can also be set (refer to P. 12) by the rotary switch.</td>
<td></td>
</tr>
</tbody>
</table>

Continued from the previous page.

Continued on the next page.
Modbus Data interval extension time

<table>
<thead>
<tr>
<th>Name</th>
<th>Identifier</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ZY</td>
<td>7D27</td>
<td>R/W</td>
<td>0 to 255 ms</td>
<td>255</td>
</tr>
</tbody>
</table>

Data time intervals during Modbus communication are extended. As this item corresponds to the initial set data, it is readable and writable only in the initial set mode. After the data is set, turn off the power once and turn it on again to validate the data.
C.1 Terminal Configuration

Wiring cautions
- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
- Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
- Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
- Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).

V-TIO-J/V-TIO-K

- Terminal No. 11 is not used.
- Use the solderless terminals appropriate to the screw size (M3).
- Make sure that the any wiring such as solderless terminal is not in contact with the adjoining terminals.

5.9 mm or less
3.2 mm or more

Recommended tightening torque: 0.4 Nm (4 kgf-cm)

For Heat/Cool PID control (V-TIO-K), input channel 2 becomes unused.
For Heat/Cool PID control (V-TIO-K), Control output 1 corresponds to the heating output and Control output 2 corresponds to the cooling output.
Heater break alarm (HBA) function cannot be used when control output is Voltage/Current output.
C.2 Indication Lamp

[Indication Lamp 1]
- **FAIL/RUN**
  During normal operation: Green lamp: ON (RUN)
  During error: Red lamp: ON (FAIL)
- **RX/TX (for host communication using host communication terminals)**
  During data send or receive: Green lamp: ON
- **EVENT 1 to 4**
  Display various states by setting.
  ON state: Green lamp: ON
  Display contents: Event 1 state, Event 2 state, Comprehensive event state, Output state, Control state, Execution segment state, Time signal state

[Indication Lamp 2]
- **FAIL (for DeviceNet communication)**
  During error: Red lamp: ON
  Communication environment setting mode by the switch:
  Red lamp: flashing
- **RUN (for DeviceNet communication)**
  During normal operation: Green lamp: ON
  During memory backup error: Green lamp: slow flashing
  During module configuration error: Green lamp: slow flashing
  During communication error: Green lamp: slow flashing
  During data collection after power ON: Green lamp: rapid flashing

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- **NS or NET (Network status)**
  
  Network is operating normally, but communications have not yet been established:
  
  Green lamp: flashing
  
  Network is operating normally (communications established):
  
  Green lamp: ON
  
  I/O connection is timeout: Red lamp: flashing
  
  A fatal communications error has occurred or Network communications are not possible:
  
  Red lamp: ON

- **MS or MOD (Module status)**
  
  During normal operation: Green lamp: ON
  
  During module configuration error: Green lamp: flashing
  
  During memory backup error: Red lamp: ON
C.3 Product Specifications

There are data items settable only via host communication in set data items.

For settable items in DeviceNet, refer to the controller object (0x64: 64H) (P. 101).

Input

Measured input:

Number of inputs: 2 points (For Heat/Cool PID control, input channel 2 becomes unused.)

Isolated between each input channel:
- Thermocouple input, Voltage (low)

Not isolated between each input channel:
- RTD input, Voltage (high) input, Current input

Input type:
  W5Re/W26Re (ASTM-E988-96)
- Resistance temperature detector (RTD) input (3-wire system):
  Pt100 (JIS-C1604-1997)
  JPt100 (JIS-C1604-1989, Pt100 of JIS-C1604-1981)
- Voltage (low): 0 to 100 mV
- Voltage (high): 0 to 5 V, 1 to 5 V, 0 to 10 V
- Current: 0 to 20 mA, 4 to 20 mA (Input impedance: 250 Ω)

The type of input needs to be specified when ordering and then fixed.

Input range:

<table>
<thead>
<tr>
<th>Input type</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>0 to 400 °C, 0 to 800 °C, −200 to +1372 °C, 0.0 to 400.0 °C, −200.0 to +400.0 °C, 32 to 752 °F, 32 to 1472 °F, −328.0 to +752.0 °F, 32.0 to 752.0 °F, −328.0 to +752.0 °F</td>
</tr>
<tr>
<td>J</td>
<td>0 to 400 °C, 0 to 800 °C, −200 to +1200 °C, 0.0 to 400.0 °C, −200.0 to +400.0 °C, 32 to 752 °F, 32 to 1472 °F, −328.0 to +752.0 °F, 32.0 to 752.0 °F, −328.0 to +752.0 °F</td>
</tr>
<tr>
<td>R</td>
<td>0 to 200 °C, 0 to 400 °C, −200 to +400.0 °C, 0.0 to 400.0 °C, −200.0 to +400.0 °C, 32 to 392 °F, 32 to 752 °F, −328.0 to +752.0 °F, 32.0 to 752.0 °F, −328.0 to +752.0 °F</td>
</tr>
<tr>
<td>S</td>
<td>0 to 1768 °C, 32 to 3214 °F</td>
</tr>
<tr>
<td>B</td>
<td>0 to 1768 °C, 32 to 3214 °F</td>
</tr>
<tr>
<td>E</td>
<td>0 to 1390 °C, 32 to 2534 °F</td>
</tr>
<tr>
<td>N</td>
<td>0 to 1300 °C, 32 to 2372 °F</td>
</tr>
<tr>
<td>T</td>
<td>0 to 2300 °C, 32 to 4172 °F</td>
</tr>
<tr>
<td>W5Re/W26Re</td>
<td>0 to 800 °C, 0 to 1000 °C, 32 to 1472 °F, 32 to 1832 °F</td>
</tr>
<tr>
<td>PLII</td>
<td>0 to 1800 °C, 32 to 3272 °F</td>
</tr>
<tr>
<td>Pt100</td>
<td>0 to 400 °C, 0 to 850 °C, 0.0 to 400.0 °C, −200.0 to +400.0 °C, 32 to 752 °F, 32 to 1562 °F, 32.0 to 752.0 °F, −328.0 to +752.0 °F</td>
</tr>
<tr>
<td>JPt100</td>
<td>0 to 400 °C, 0 to 600 °C, 0.0 to 400.0 °C, −200.0 to +400.0 °C, 32 to 752 °F, 32 to 1112 °F, 32.0 to 752.0 °F, −328.0 to +752.0 °F</td>
</tr>
</tbody>
</table>

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

- Voltage/Current input
  Programmable range
  Input scale high: Input scale low to 10000
  Input scale low: −2000 to Input scale high
  However, a input scale span is 12000 or less.

**Accuracy (At the ambient temperature 23 °C ±2 °C):**

- Thermocouple input (K, J, T, PLII, E)
  Less than −100 °C: ±2.0 °C
  −100 °C to less than +334 °C: ±1.0 °C
  334 °C or more: ± (0.3 % of reading + 1digit)

- Thermocouple input (R, S, N, W5Re/W26Re)
  −50 °C to less than +667 °C: ±2.0 °C
  667 °C or more: ± (0.3 % of reading + 1digit)

- Thermocouple input (B)
  Less than 400 °C: ±70.0 °C
  400 °C to less than 667 °C: ±2.0 °C
  667 °C or more: ± (0.3 % of reading + 1digit)

- RTD input
  Less than 267 °C: ±0.8 °C
  267 °C or more: ± (0.3 % of reading + 1digit)

- Voltage/Current input
  ± 0.3 % of input span

- Cold junction temperature compensation accuracy
  ±1.0 °C (Ambient temperature 23 °C ±2 °C)
  Within ±1.5 °C between −10 to +50 °C of ambient temperature

**Sampling cycle:** 500 ms

**Input resolution:**
- Thermocouple input: 1 °C or 0.1 °C
- RTD input: 1 °C or 0.1 °C
- Voltage/Current input: 1 to 0.0001 (programmable)

**RTD sensor current:** 0.25 mA

**Action at input break:**
- Thermocouple input: Upscale
- RTD input: Upscale
- Voltage input
  - 0 to 10 mV, 0 to 100 mV: Upscale
  - 0 to 1 V, 0 to 5 V, 1 to 5 V, 0 to 10 V:
    Indicate value near 0 V
- Current input
  0 to 20 mA, 4 to 20 mA: Indicate value near 0 mA

**Signal source resistance effect:**
0.15 μV/Ω (Only for thermocouple input)
Allowable influence of input lead:
10 Ω or less per wire (Only for RTD input)

Input digital filter:
First order lag digital filter
Time constant: 1 to 100 seconds (Setting 0: Filter OFF)

PV bias:
±Input span

Normal mode rejection ratio (NMRR):
60 dB or more

CT input:
Number of inputs: 2 points
Sampling cycle: 1 seconds (Data update cycle)
Resolution of A/D transfer: 10-bit or more
Input current:
- 0.0 to 30.0 A (CTL-6-P-N)
- 0.0 to 100.0 A (CTL-12-S56-10L-N)
Current measuring accuracy:
±5 % of input value or ±2 A
(The value whichever is greater)

### Output

**Number of outputs:**
2 points
Isolated between input and output and between output and power supply. Not isolated between each output channel.

**Output type:**
The type of output needs to be specified when ordering and then fixed. (The type of output can be selected independently for each channel.)
- Relay contact output
  Contact type: 1a contact
  250 V AC 3 A (Resistive load)
  Electrical life: 300,000 times or more (Rated load)
- Voltage pulse output
  Output voltage: 0/12 V DC
  Allowable load resistance: 600 Ω or more
- Current output
  Output type: 0 to 20 mA DC, 4 to 20 mA DC
  Allowable load resistance: 600 Ω or less
  Output resolution: 11-bit or more
- Voltage output
  Output voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
  Allowable load resistance: 1 kΩ or more
  Output resolution: 11-bit or more
### Indication lamp

**Number of indicates:** 10 points

**Indication contents:**

**Temperature control side**
- Operation state indication [RUN/FAIL] (1 point)
  - During normal operation: Green lamp: ON (RUN)
  - During error: Red lamp: ON (FAIL)
- Communication state indication [RX/TX] (1 point)
  - During data send or receive: Green lamp: ON
- Event display [EVENT1 to 4] (4 points)
  - Various states are displayed depending on setting.
  - Display contents: Event 1 state, Event 2 state, Comprehensive event state, Output state, Control state, Execution segment state, Time signal state

**DeviceNet communication side**
- Operation state indication [RUN, FAIL] (2 points)
  - During normal operation: Green lamp: ON (RUN)
  - During error: Red lamp: ON (FAIL)
  - During data collection after power ON: Green lamp: rapid flashing (RUN)
  - During self-diagnostic error: Green lamp: slow flashing (RUN)
  - During communication environment setting mode: Red lamp: slow flashing (FAIL)
- NS or NET (Network status)
  - Network is operating normally, but communications have not yet been established: Green lamp: flashing
  - Network is operating normally (communications established): Green lamp: ON
  - I/O connection is timeout: Red lamp: flashing
  - A fatal communications error has occurred or Network communications are not possible: Red lamp: ON
- MS or MOD (Module status)
  - During normal operation: Green lamp: ON
  - During module configuration error: Green lamp: flashing
  - During memory backup error: Red lamp: ON

### Setting

**Setting method:** Setting by communication

**Setting range:** Same as input range

**Setting resolution:** Same as input resolution
Control

Number of controls: 2 points

Control method: Brilliant PID control
Correspond to the heat control direct action, the heat control reverse action, and the Heat/Cool control.

Additional functions: Autotuning function
With output limiter function

Setting range:
- Proportional band (heat-side/cool-side):
  - Temperature input: 0 (0.0) to Input span
  - Voltage/Current input: 0.0 to 100.0 % of Input span (0 or 0.0: ON/OFF action)

  Integral time: 1 to 3600 seconds

  Derivative time: 0 to 3600 seconds (0: PI action)

Control response parameter: Slow, Medium, Fast

Output limiter high:
- Heat control: Output limiter low to +105.0 %
- Heat/Cool control: −5.0 to +105.0 % (For both control heat and cool)

Output limiter low:
- Heat control: −5.0 % to Output limiter high
- Heat/Cool control: −5.0 % (fixed) (For both control heat and cool)

For the Heat/Cool control, the cool-side output limiter (high) is set by using the identifier or register address of the output limiter low.

Overlap/Deadband:
- −Input span to +Input span
- Minus (−) setting results in overlap.

Setting change rate limiter:
- 0 (0.0) to Input span/minute
- 0 (0.0): Setting change rate limiter OFF

Proportioning cycle time:
- 1 to 100 seconds (Heat-side/Cool-side)

Direct/Reverse action selection:
- Direct action, Reverse action

AUTO/MAN selection:
- Auto mode (AUTO), Manual mode (MAN)

Manual output setting:
- −5.0 to +105.0 %
  However, the actual output value is within output limiter range.

PID/AT transfer:
- PID control, Autotuning (AT)

AT bias:
- ±Input span
- **Event function**
  - **Number of events:** 2 points/channel
  - **Event type:** Deviation high, Deviation low, Deviation high/low, Band, Process high, Process low
  - **Additional function:** Hold action, Re-hold action
    - **Number of event delay times:** 0 to 255 times
  - **Setting range:** Deviation high, Deviation low: \(-\)Input span to \(+\)Input span
    - Deviation high/low, Band: 0 to Input span
    - Process high, Process low: Same as input range
  - **Differential gap:** 0 to Input span
  - **Event state:** Output the event state as communication data.

- **Heater break alarm (HBA) function**
  - **Number of HBA:** 2 points
  - **Setting range:**
    - 0.0 to 30.0 A (Current transformer: CTL-6-P-N)
    - 0.0 to 100.0 A (Current transformer: CTL-12-S56-10L-N)
    - (0.0 A: HBA OFF)
  - **Additional function:** Number of event delay times: 1 to 255 times
  - **HBA state:** Output the HBA state as communication data.

- **Control loop break alarm (LBA) function**
  - **Number of LBA:** 2 points
  - **LBA time:** 1 to 7200 seconds
  - **LBA deadband (LBD) setting:** 0 to Input span
  - **LBA state:** Output the LBA state as communication data.

- **Comprehensive event state**
  - **Event state:** Bit data items are expressed in decimal number from 0 to 31.
    - Burnout: Bit 0
    - Event 1 state: Bit 1
    - Event 2 state: Bit 2
    - Heater break alarm (HBA) state: Bit 3
    - Control loop break alarm (LBA) state: Bit 4
Control action selection function at input error

Function:
This function is used to change to the manual mode when the input is abnormal [Input error determination point (low) ≥ PV or PV ≥ Input error determination point (high)] in the control state.

Action selection:
It is selected whether or not the manual output is changed independently of the high limit and low limit.

Setting range:
Input error determination point (high): Within input range
Input error determination point (low): Within input range
Manipulated output value at input error: −5.0 to +105.0 %
(However, the actual output value is within output limiter range.)

Control RUN/STOP function

Function:
RUN/STOP action is taken simultaneously for two channels.
The function and output in the control stop state are the same as those when the power supply is turned off.
Control STOP: 0
Control RUN: 1

Self-diagnostic function

Check item (error code):
Memory backup error (DeviceNet board side),
Module configuration error (temperature control board side)
If any error occurs, bit 7 of attribute ID: 5 in Identity object (0x01) is set to 1.

General specifications

Power supply:
Power supply voltage: 24 V DC
Power supply voltage range: 21.6 to 26.4 V DC
Current consumption: 170 mA or less/module

Insulation resistance:
20 MΩ or more at 500 V DC (Between each insulation block)

Withstand voltage:
600 V AC for 1 minute (Between each insulation block)

Power failure effect:
No influence even under power failure of 20 ms or less.

Data backup:
Data backed up by EEPROM.
Number of write times: 1 million times or more
Data storage period: Approx. 10 years
Working environment conditions:

Allowable ambient temperature:

−10 to +50 °C

Allowable ambient humidity: 5 to 95 %RH (Non condensing)

Absolute humidity:

MAX.W.C 29 g/m³ dry air at 101.3 kPa

Installation environment conditions:

Indoor use

Altitude up to 2000 m

■ Mounting and structure

Mounting procedure:  DIN rail mounting

Case color:

Terminal base:  Black

Module mainframe:  Bluish white

Dimensions:

40.5 (W) ×125.0 (H) ×110.0 (D) mm

Weight:

Open-style connector type:  Approx. 250 g

Micro-style connector type:  Approx. 270 g

■ Standard

Safety standard:

UL:  UL61010A-1

CSA:  CAN/CSA-C22.2 No1010.1

CE marking:

LVD:  EN61010-1

OVERVOLTAGE CATEGORY II,

POLLUTION DEGREE 2,

Class II (Reinforced insulation)

EMC:  EN61326-1

C-Tick:  EN55011