Module Type Controller

SRX

PLC/Host Communication Instruction Manual

RKC INSTRUMENT INC.

IMS01N13-E2

- 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.

Thank you for purchasing this RKC instrument. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place this manual in a convenient location for easy reference.

SYMBOLS

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

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

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

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

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

 : This mark indicates where additional information may be located.

⚠ WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

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

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
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CONTENTS

MEMO

1. OUTLINE

This manual describes communication with the programmable controller (hereafter called the PLC) and host computer when the temperature control module for PLC communication X-TIO-R for the module type controller SRX is used.

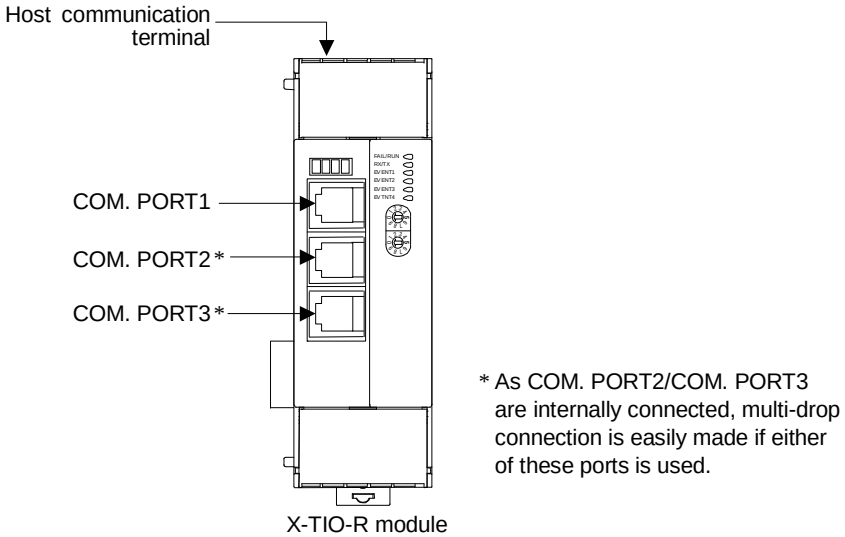
- Three communication ports (COM. PORT1 to 3) of the X-TIO-R module can be selected from among the following four assignments. (The communication specification of COM. PORT2 is the same as that of COM. PORT3.)

	Assignment 1	Assignment 2	Assignment 3	Assignment 4
COM. PORT1	Host communication 1	PLC communication	Host communication 1	Host communication 2
COM. PORT2/ COM. PORT3	PLC communication	Host communication 1	Host communication 2	Host communication 1

For host communication 1 or 2, its data bit configuration, communication speed and communication protocol can be independently set.

- In addition to the three communication ports (COM. PORT1 to 3) of the X-TIO-R module, it is also possible to conduct host communication using the host communication terminal.
- Up to 29 modules that is the temperature control module (X-TIO-A/B), the digital input (DI) module and the digital output (DO) module, can be connected to one X-TIO-R module.
- For PLC communication, up to four X-TIO-R modules can be multi-drop connected to one PLC communication port. Therefore, temperature control of up to 240 channels per one PLC communication port can be performed. (For using the COM. PORT2 and COM. PORT3)
- For host communication, up to 16 X-TIO-R modules can be multi-drop connected to one host communication port. Therefore, temperature control of up to 960 channels per one host communication port can be performed. (For using the COM. PORT2 and COM. PORT3)

For specification, parts description and wiring of the X-TIO-R module, see **Temperature Control Module for PLC Communication X-TIO-R Instruction Manual (IMS01N12-E□)**. In addition, for host communication using host communication terminals, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.



Communication port of X-TIO-R module

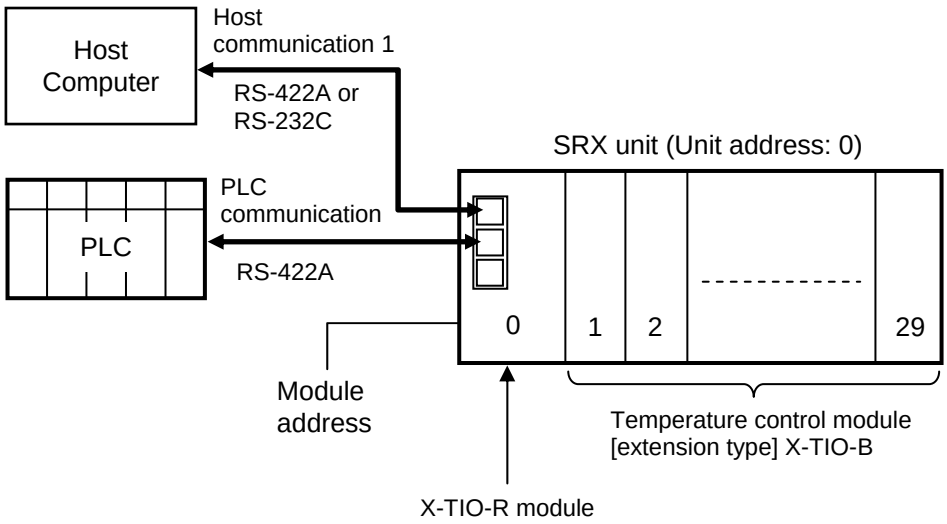
1.1 SRX Unit Configuration

One SRX unit consists of one X-TIO-R module and several other temperature control modules.

1.1.1 When one SRX unit is connected

- Up to 29 modules that is the temperature control module (X-TIO-A/B), the digital input (DI) module and the digital output (DO) module, can be connected to one X-TIO-R module with the SRX unit. (Common to PLC communication and host communication)
- As the number of temperature control channels per module is 2, the maximum number of temperature control channels per unit becomes 60 when the SRX unit is configured with only a temperature control module. (Including the temperature control channels of the X-TIO-R module.)

[Example] When each communication port of the X-TIO-R module is assigned as follows.
COM.PORT1: Host communication 1 (RS-422A or RS-232C)
COM.PORT2/3: PLC communication (RS-422A)



Up to 29 temperature control modules can be connected to one X-TIO-R module

Number of temperature control channel: 60 CH max.

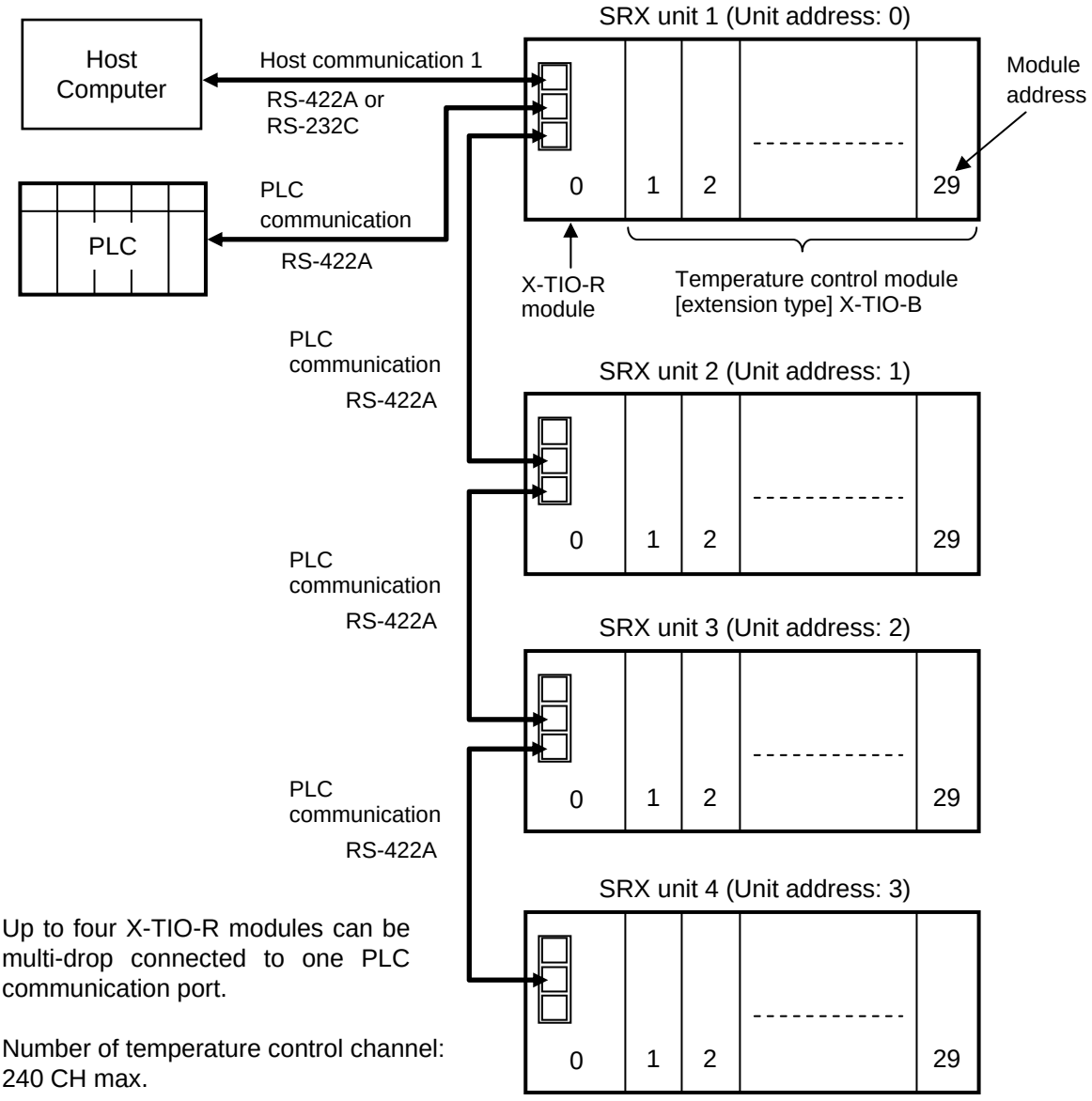
For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

1.1.2 When two or more SRX units are connected

■ Multi-drop connection by PLC communication

For PLC communication, up to four X-TIO-R modules (i.e. four SRX units) can be multi-drop connected to one PLC communication port.
In addition, as up to 29 temperature control modules can be connected to one X-TIO-R module, it is possible to perform temperature control of up to 240 channels (60 channels × 4 SRX units) if the SRX unit is configured by using temperature control modules only. (Including the temperature control channels of the X-TIO-R module.)

[Example] When each communication port of the X-TIO-R module is assigned as follows.
COM.PORT1: Host communication 1 (RS-422A or RS-232C)
COM.PORT2/3: PLC communication (RS-422A) [Multi-drop connection]

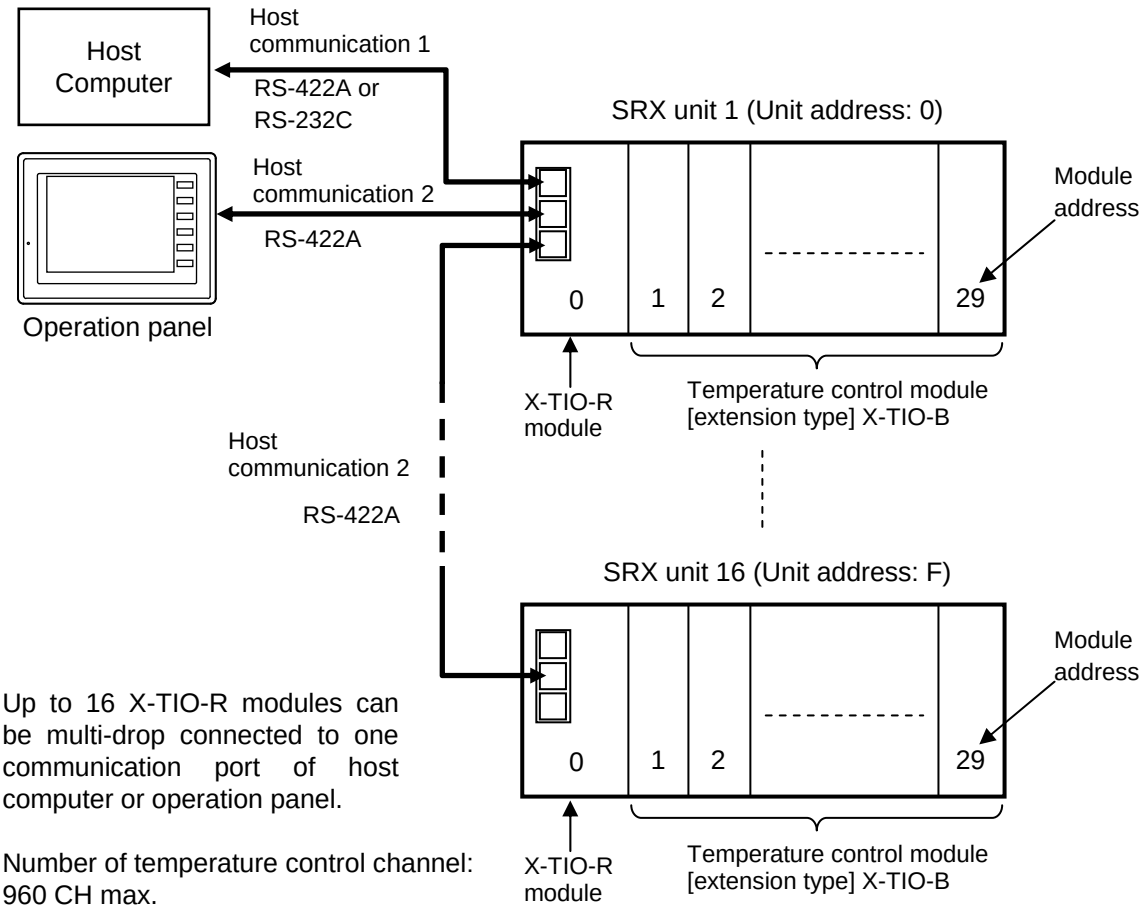


☞ For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

■ Multi-drop connection by host communication

For host communication, up to 16 X-TIO-R modules (i.e. 16 SRX units) can be multi-drop connected to one communication port of host computer or operation panel.
In addition, as up to 29 temperature control modules can be connected to one X-TIO-R module, it is possible to perform temperature control of up to 960 channels (60 channels × 16 SRX units) if the SRX unit is configured by using temperature control modules only. (Including the temperature control channels of the X-TIO-R module.)

[Example] When each communication port of the X-TIO-R module is assigned as follows.
COM.PORT1: Host communication 1 (RS-422A or RS-232C)
COM.PORT2/3: Host communication 2 (RS-422A) [Multi-drop connection]



📖 When in the above figure, the host computer connected to COM. PORT1 can communicate only with SRX unit 1.

📖 When connecting the operation panel to the SRX unit, please contact RKC sales office or the agent.

☞ For multi-drop connection using COM. PORT1, see **5.1.2 Wiring (P. 36)** [MITSUBISHI PLC], or **6.2 Wiring (P. 96)** [host communication].

☞ For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

2. COMMUNICATION SPECIFICATIONS

■ PLC communication

Interface:
Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
COM. PORT1: Specify when ordering
COM. PORT2/COM. PORT3: RS-422A (fixed)

Connection method:
RS-422A: 4-wire system, full-duplex multi-drop connection
RS-232C: Point-to-point connection

Synchronous method:
Start/stop synchronous type

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

Data bit configuration:
Start bit: 1
Data bit: 7 or 8
Parity bit: Without, Odd or Even
Without for 8 data bits
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol:
MITSUBISHI MELSEC series special protocol
–ACPU common command (A series, FX2N, FX2NCseries)
–AnA/AnUCPU common command (AnA/QnA series, Q series)
The protocol can be selected with switch

Maximum connections:
Four modules (X-TIO-R) per communication port of PLC
[Temperature control channel: 240 CH max.]

■ Host communication (modular connector side)

Interface:
Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
COM. PORT1: Specify when ordering
COM. PORT2/COM. PORT3: RS-422A (fixed)

Connection method:
RS-422A: 4-wire system, full-duplex multi-drop connection
RS-232C: Point-to-point 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: 7 or 8 (RKC communication)
8 (Modbus)
Parity bit: Without, Odd or Even
Without for 8 data bits
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol:

- RKC communication
  Based on ANSI X3.28 subcategory 2.5 B1
  Polling/selecting type
  Error control: Vertical parity (with parity bit selected)
  Horizontal parity (BCC check)
  Data types: ASCII 7-bit code
- 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

RKC communication or Modbus protocol can be selected with switch

Maximum connections:
RS-422A: 16 modules (X-TIO-R) per communication port of host computer [Temperature control channel: 960 CH max.]
RS-232C: One module (X-TIO-R) per communication port of host computer [Temperature control channel: 60 CH max.]

■ Host communication (host communication terminal side)

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: 7 or 8 (RKC communication)
8 (Modbus)
Parity bit: Without, Odd or Even
Without for 8 data bits
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol:

- RKC communication
  Based on ANSI X3.28 subcategory 2.5 B1
  Polling/selecting type
  Error control: Vertical parity (with parity bit selected)
  Horizontal parity (BCC check)
  Data types: ASCII 7-bit code
- 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

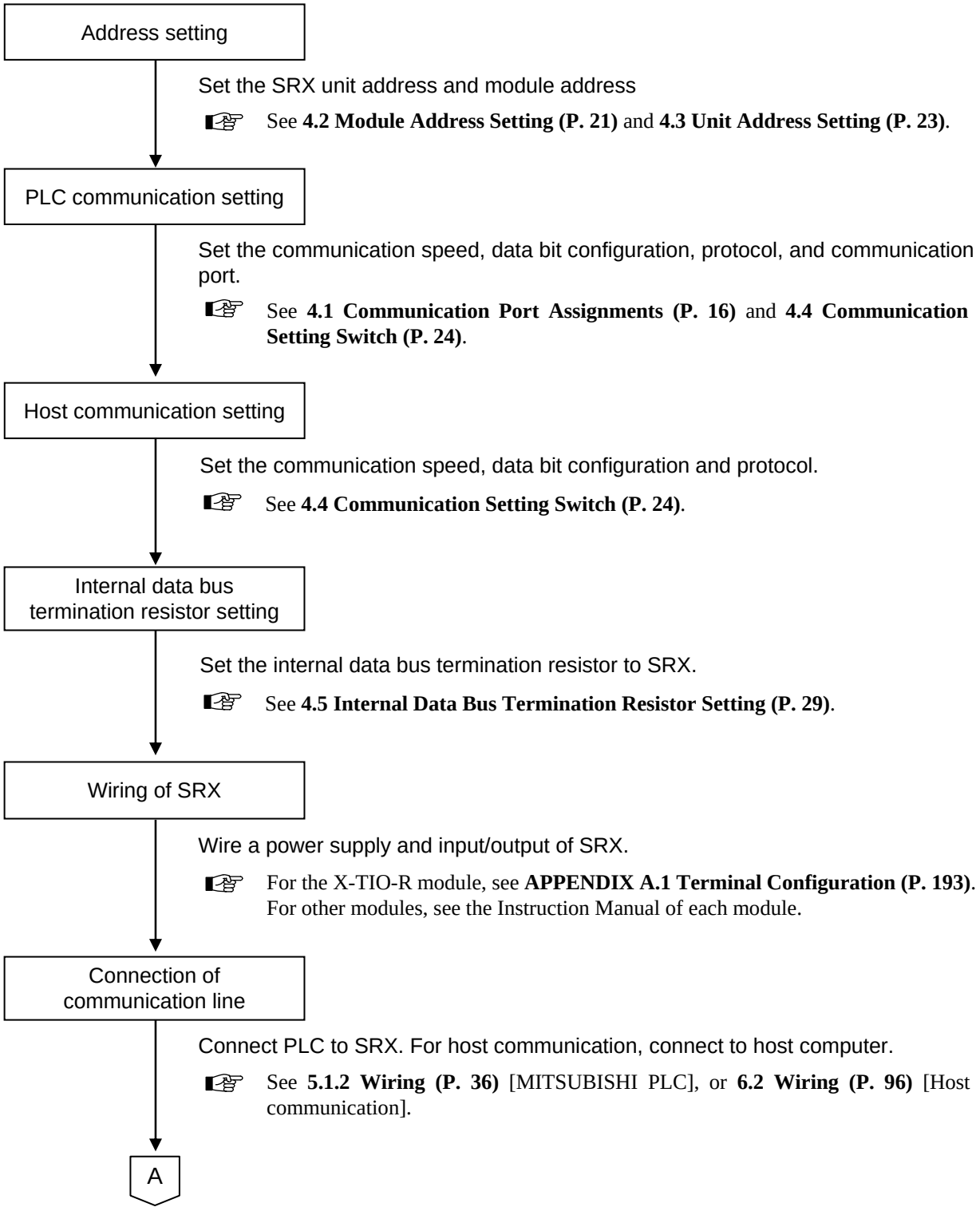
RKC communication or Modbus protocol can be selected with switch

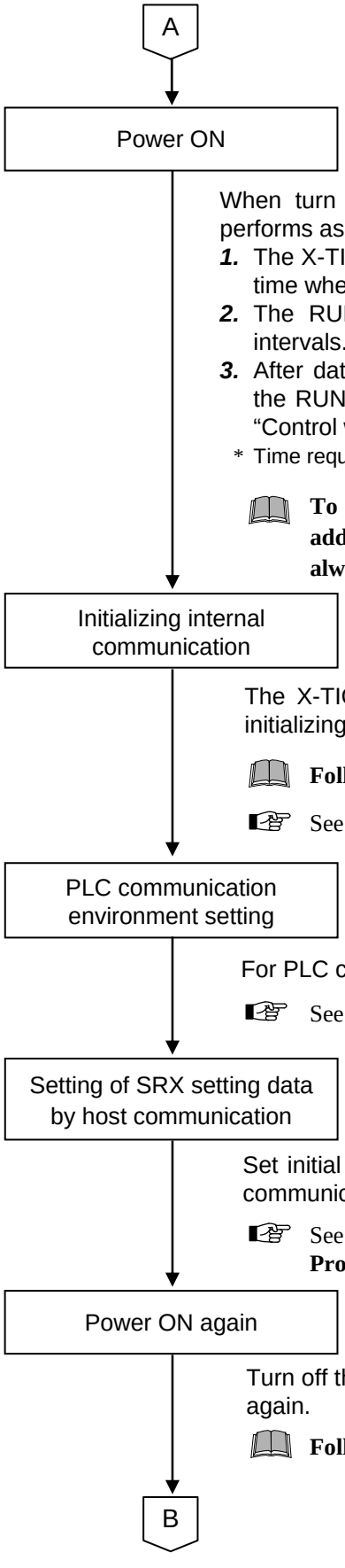
Maximum connections: 31 modules maximum including a host computer
(Up to 29 modules can be connected to one X-TIO-R module)

3. SETTING PROCEDURE TO OPERATION

3.1 When Use PLC Communication and Host Communication

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





When turn on the power supply of SRX, PLC and host computer, the SRX performs as follows.

1. The X-TIO-R 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 PLC communication becomes enabled *, the RUN lamp keeps lighting and as a result "SRX communication state" and "Control word 2" is set to 1.

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

To prevent malfunction, always turn on the power of the SRX last. In addition, if there are two or more SRX units in PLC communication, always turn on the power of the master unit last.

The X-TIO-R module recognizes modules connected within the same unit by initializing internal communication.

Follow the caution of "Power ON."

See **4.6 Initializing Internal Communication (P. 31)**.

For PLC communication, set a necessary item.

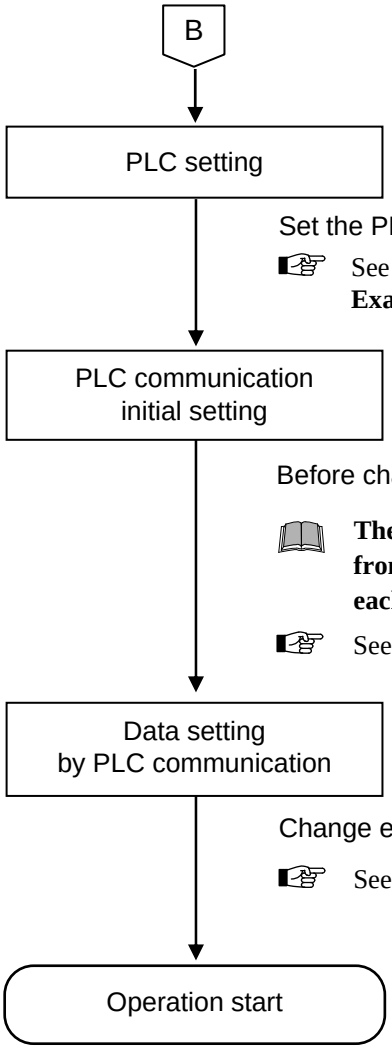
See **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

Set initial setting data and the operation data that setting is impossible in PLC communication.

See **6.4 RKC Communication Protocol (P. 103)** or **6.5 Modbus Communication Protocol (P. 136)**.

Turn off the power of the SRX, PLC and host computer once, and then turn it on again.

Follow the caution of "Power ON."



Set the PLC side.

☞ See **5.1.4 Setting on the PLC (Computer link module) (P. 52)** or **5.4 Usage Example (P. 74)**.

Before changing the SRX data from PLC, always read it into the PLC once.

The initial setting must always conduct. If each set value of SRX is changed from the PLC without setting the initial values, it is re-written to 0 with each set value of the PLC at that time set to 0.

☞ See **5.2 Data Transfer (P. 53)** or **5.4 Usage Example (P. 74)**.

Change each SRX set value data from the PLC.

☞ See **5.3. PLC Communication Data Map (P. 62)** or **5.4 Usage Example (P. 74)**.

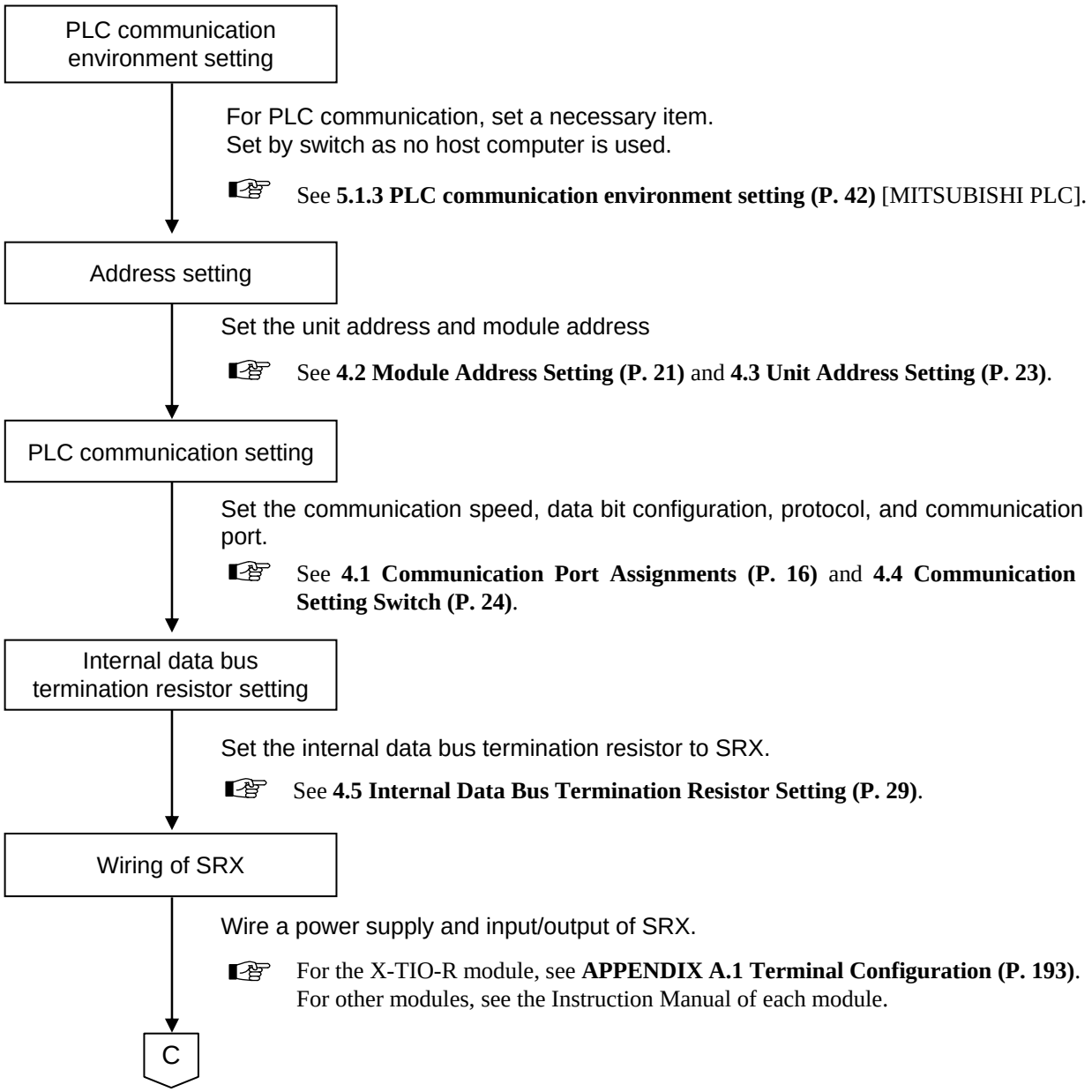
3.2 Only When Use PLC Communication

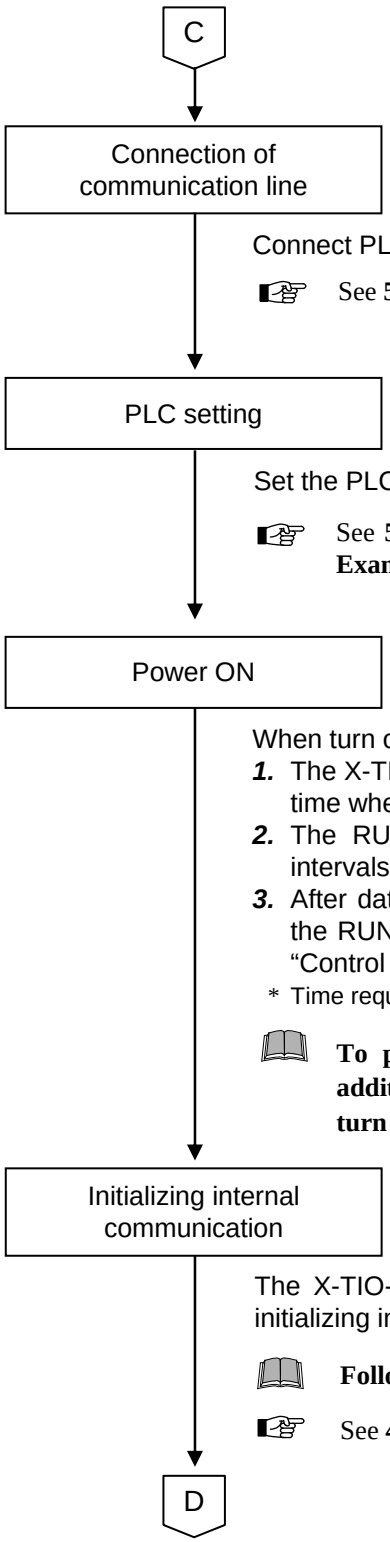
Conduct necessary setting before operation according to the procedure described below.

As some items can be set only via host communication, carefully check them and then conduct host communication, if necessary.

For details of items which can be set only via host communication, see as follows.

- **6.4.4 Communication identifier list of TIO module (P. 116)**
- **6.4.5 Communication identifier list of DI module (P. 128)**
- **6.4.6 Communication identifier list of DO module (P. 131)**
- **6.5.8 Data map of TIO module (P. 151)**
- **6.5.9 Data map of DI module (P. 180)**
- **6.5.10 Data map of DO module (P. 183)**





Connect PLC to SRX.

☞ See **5.1.2 Wiring (P. 36)** [MITSUBISHI PLC].

Set the PLC side.

☞ See **5.1.4 Setting on the PLC (Computer link module) (P. 52)**, or **5.4 Usage Example (P. 74)**.

When turn on the power supply of SRX and PLC, the SRX performs as follows.

1. The X-TIO-R 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 PLC communication becomes enabled *, the RUN lamp keeps lighting and as a result “SRX communication state” and “Control word 2” is set to 1.

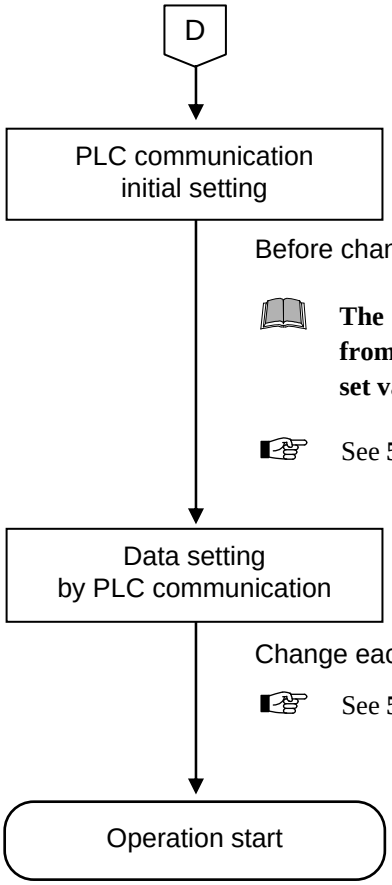
* Time required for enabling PLC communication is about 15 seconds.

📖 **To prevent malfunction, always turn on the power of the SRX last. In addition, if there are two or more SRX units in PLC communication, always turn on the power of the master unit last.**

The X-TIO-R module recognizes modules connected within the same unit by initializing internal communication.

📖 **Follow the caution of “Power ON.”**

☞ See **4.6 Initializing Internal Communication (P. 31)**.



Before changing the SRX data from PLC, always read it into the PLC once.

The initial setting must always conduct. If each set value of SRX is changed from the PLC without setting the initial values, it is re-written to 0 with each set value of the PLC at that time set to 0.

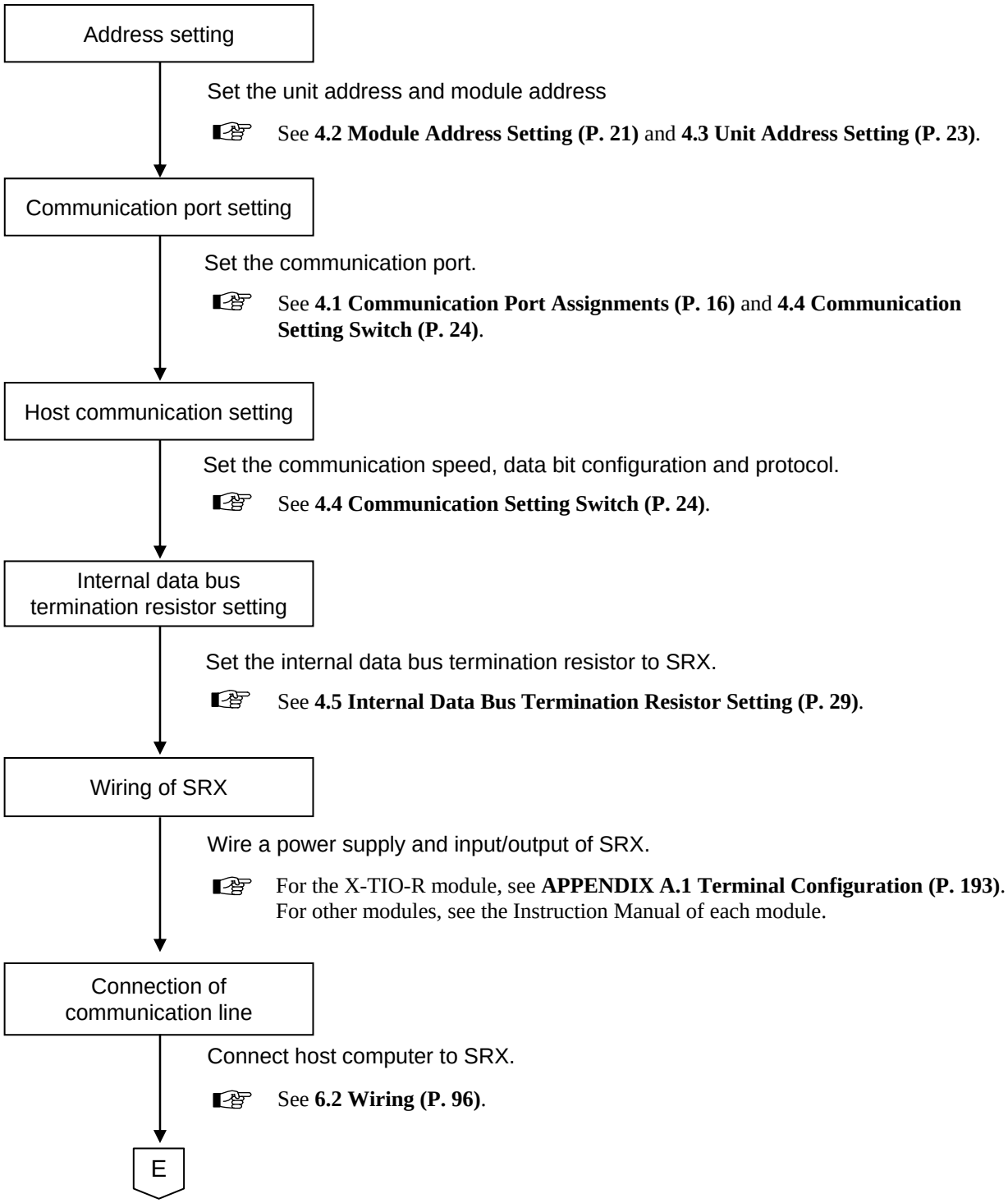
☞ See **5.2 Data Transfer (P. 53)** or **5.4 Usage Example (P. 74)**.

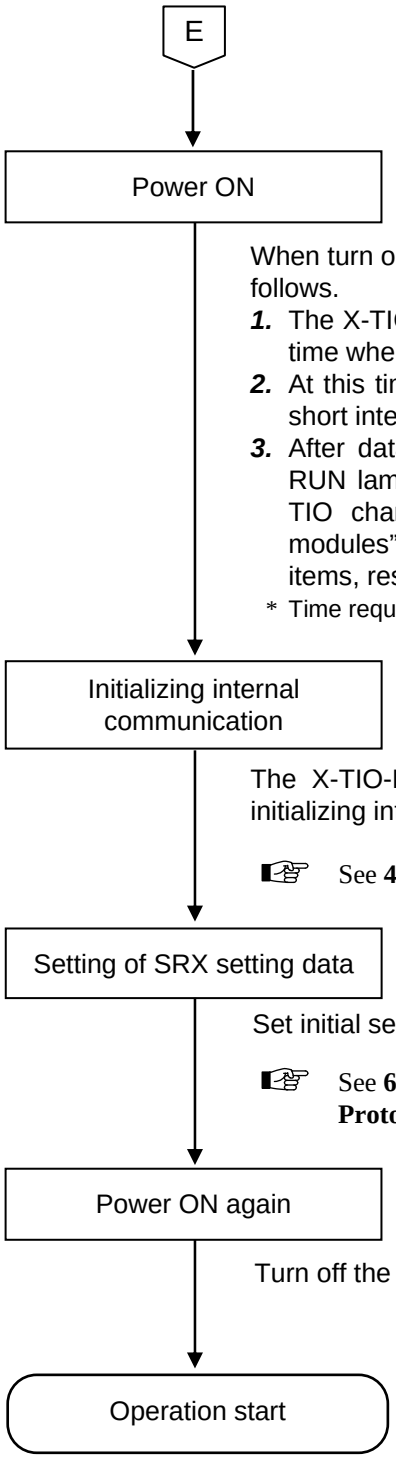
Change each SRX set value data from the PLC.

☞ See **5.3. PLC Communication Data Map (P. 62)** or **5.4 Usage Example (P. 74)**.

3.3 Only When Use Host Communication

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





When turn on the power supply of SRX and host computer, the SRX performs as follows.

1. The X-TIO-R module starts collecting data on each module connected from the time when the power is turned on.

2. At this time, the RUN lamp corresponding to indication lamp 2 flashed at very short intervals.

3. After data collection is finished and communication becomes enabled *, the RUN lamp lights. In addition, the number of TIO modules and the number of TIO channels connected are entered in the “Number of connecting TIO modules” and the “Number of connecting TIO channels” in communication items, respectively.

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

The X-TIO-R module recognizes modules connected within the same unit by initializing internal communication.

☞ See **4.6 Initializing Internal Communication (P. 31)**.

Set initial setting data and the operation data.

☞ See **6.4 RKC Communication Protocol (P. 103)** or **6.5 Modbus Communication Protocol (P. 136)**.

Turn off the power of the SRX and host computer once, and then turn it on again.

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.

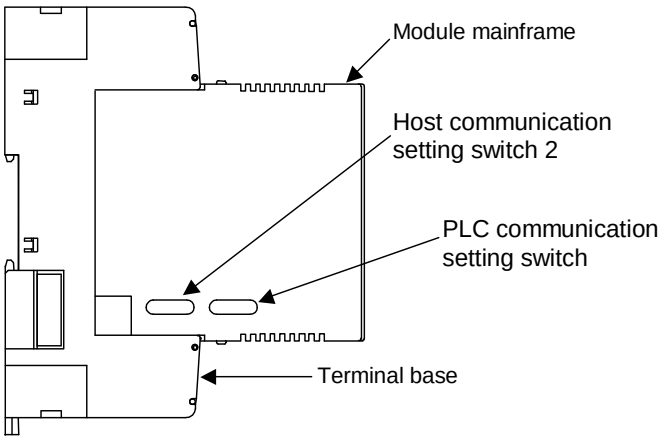
4.1 Communication Port Assignments

Three communication ports (COM. PORT1 to 3) of the X-TIO-R module can be selected from among the following four assignments. (The communication specification of COM. PORT2 is the same as that of COM. PORT3.)
In order to assign each communication port, PLC communication setting switches at the left side of the X-TIO-R module are used.

- The PLC communication setting switches are used to set the data bit configuration, communication speed and communication protocol of each of "PLC communication" and "Host communication 2." They are also used to select the assigned contents of COM. PORT1 and COM. PORT2/COM. PORT3.
- The host communication setting switch 2 are used to set the data bit configuration, communication speed and communication protocol of "Host communication 1."

COM. PORT Assignment Table

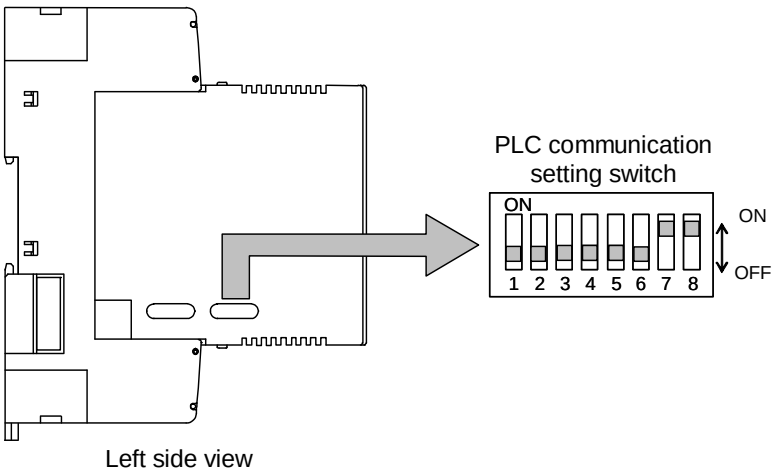
	Assignment 1	Assignment 2	Assignment 3	Assignment 4
COM. PORT1	Host communication 1	PLC communication	Host communication 1	Host communication 2
COM. PORT2/ COM. PORT3	PLC communication	Host communication 1	Host communication 2	Host communication 1



Left side view of X-TIO-R module

■ Assignment 1 (COM. PORT1: Host communication 1, COM. PORT2/COM. PORT3: PLC communication)

In order to set assignment 1 (COM. PORT1: Host communication 1, COM. PORT2/COM. PORT3: PLC communication), set the PLC communication setting switches as follows.



- No. 5, No. 6, No. 7: Communication protocol

The PLC communication can be selected from the following three types.

5	6	7	Communication protocol
OFF	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol ACPU common command (WR/WW) (A series, FX2N, FX2NC series)
ON	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol AnA/AnUCPU common command (QR/QW) (AnA/QnA series, Q series)

- No. 8: Communication port assignment

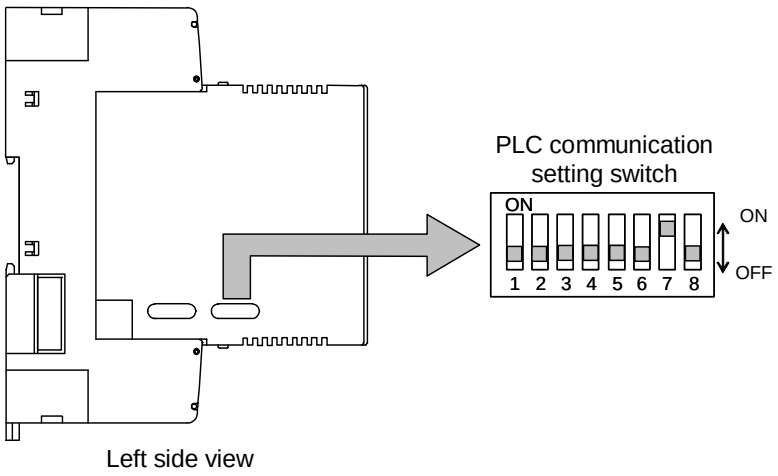
8	Communication port assignment
ON	COM. PORT1: Host communication 1 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: PLC communication [RS-422A]

Switch Nos. 1 to 4 are used to set the data bit configuration and communication speed of PLC communication. Set them to the same values as the PLC connected.

For details of the PLC communication setting switch, see **4.4 Communication Setting Switch (P. 24)**.

■ Assignment 2 (COM. PORT1: PLC communication, COM. PORT2/COM. PORT3: Host communication 1)

In order to set assignment 2 (COM. PORT1: PLC communication, COM. PORT2/COM. PORT3: Host communication 1), set the PLC communication setting switches as follows.



- No. 5, No. 6, No. 7: Communication protocol

The PLC communication can be selected from the following three types.

5	6	7	Communication protocol
OFF	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol ACPU common command (WR/WW) (A series, FX2N, FX2NC series)
ON	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol AnA/AnUCPU common command (QR/QW) (AnA/QnA series, Q series)

- No. 8: Communication port assignment

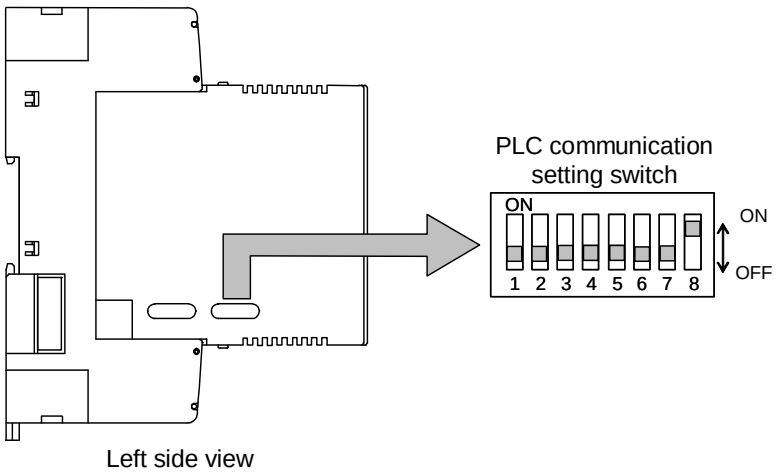
8	Communication port assignment
OFF	COM. PORT1: PLC communication [RS-232C/RS-422A] COM. PORT2/COM. PORT3: Host communication 1 [RS-422A]

Switch Nos. 1 to 4 are used to set the data bit configuration and communication speed of PLC communication. Set them to the same values as the PLC connected.

For details of the PLC communication setting switch, see **4.4 Communication Setting Switch (P. 24)**.

■ Assignment 3 (COM. PORT1: Host communication 1, COM. PORT2/COM. PORT3: Host communication 2)

In order to set assignment 3 (COM. PORT1: Host communication 1, COM. PORT2/COM. PORT3: Host communication 2), set the PLC communication setting switches as follows.



- No. 5, No. 6, No. 7: Communication protocol

The host communication can be selected from the following two types.

5	6	7	Communication protocol
OFF	OFF	OFF	Host communication 2 (RKC communication)
ON	OFF	OFF	Host communication 2 (Modbus)

- No. 8: Communication port assignment

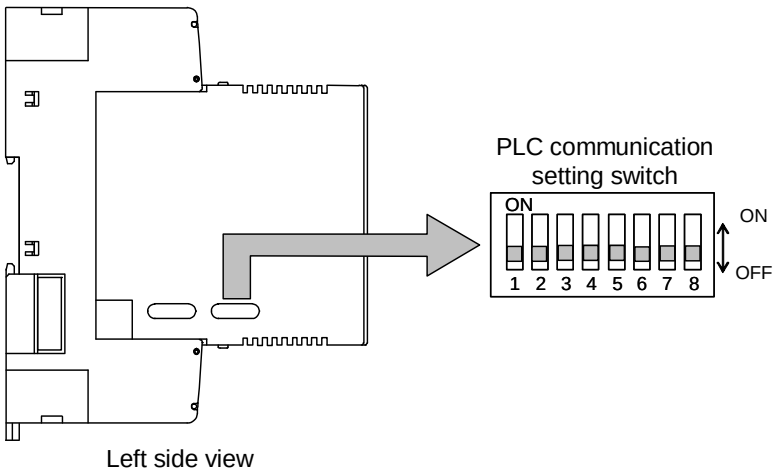
8	Communication port assignment
ON	COM. PORT1: Host communication 1 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: Host communication 2 [RS-422A]

Switch Nos. 1 to 4 are used to set the data bit configuration and communication speed of host communication 2. Set them to the same values as the host computer (or operation panel etc.) connected.

For details of the PLC communication setting switch, see **4.4 Communication Setting Switch (P. 24)**.

■ Assignment 4 (COM. PORT1: Host communication 2, COM. PORT2/COM. PORT3: Host communication 1)

In order to set assignment 4 (COM. PORT1: Host communication 2, COM. PORT2/COM. PORT3: Host communication 1), set the PLC communication setting switches as follows.



- No. 5, No. 6, No. 7: Communication protocol

The host communication can be selected from the following two types.

5	6	7	Communication protocol
OFF	OFF	OFF	Host communication 2 (RKC communication)
ON	OFF	OFF	Host communication 2 (Modbus)

- No. 8: Communication port assignment

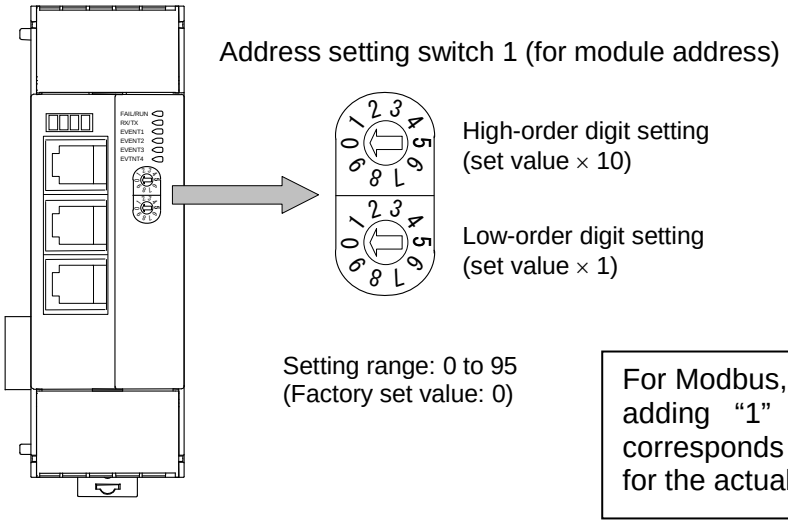
8	Communication port assignment
OFF	COM. PORT1: Host communication 2 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: Host communication 1 [RS-422A]

Switch Nos. 1 to 4 are used to set the data bit configuration and communication speed of host communication 2. Set them to the same values as the host computer (or operation panel etc.) connected.

For details of the PLC communication setting switch, see **4.4 Communication Setting Switch (P. 24)**.

4.2 Module Address Setting

When using two or more modules, set the desired address to each module.
(PLC communication / host communication is common)
Set the module address by address setting switch 1 of front of module. For this setting, use a small blade screwdriver.



For Modbus, the value obtained by adding “1” to the set address corresponds to the address used for the actual program.

Do not set address 96 to 99. Otherwise, malfunction may result.

Set the module address such that it is different to the other addresses on the same line. Otherwise, problems or malfunction may result.
However, when a unit address is different, can set the same module address.

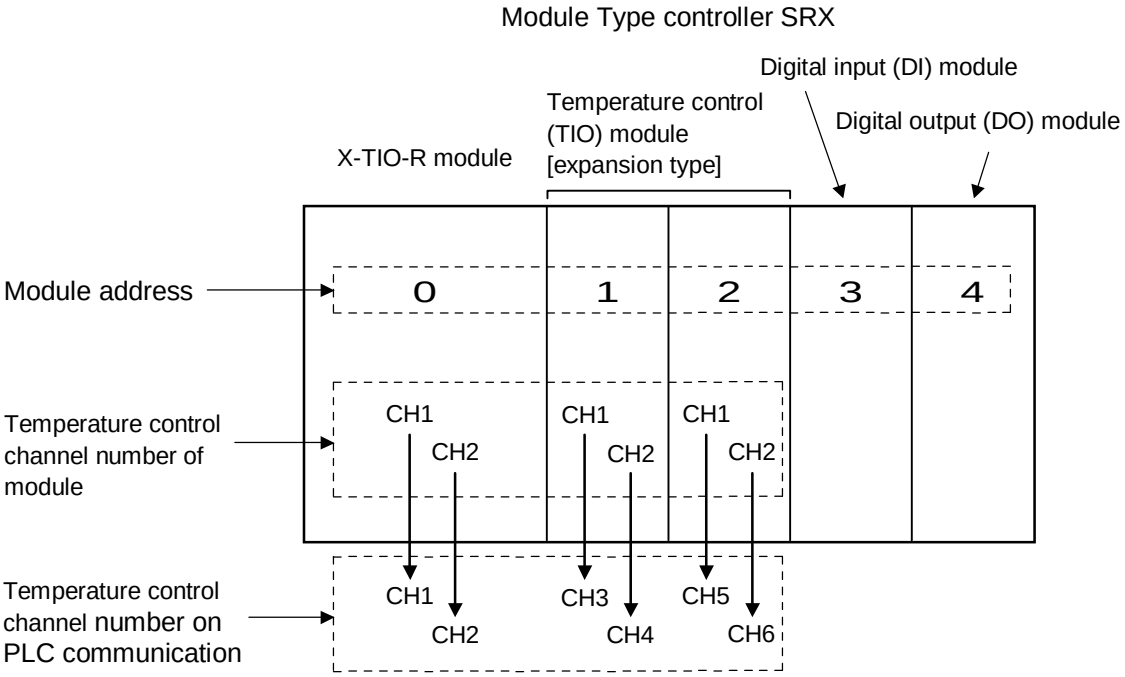
The above figure is X-TIO-R module. The figure of other module is the same as a X-TIO-R module.

■ Assignment of channels

In PLC communication, temperature control channel numbers are automatically determined in order starting from a smaller module address.

Example: The assignment of channel numbers in the following system configuration is shown.

X-TIO-R module 1
Temperature control (TIO) module [expansion type].....2
Digital input (DI) module 1
Digital output (DO) module.....1



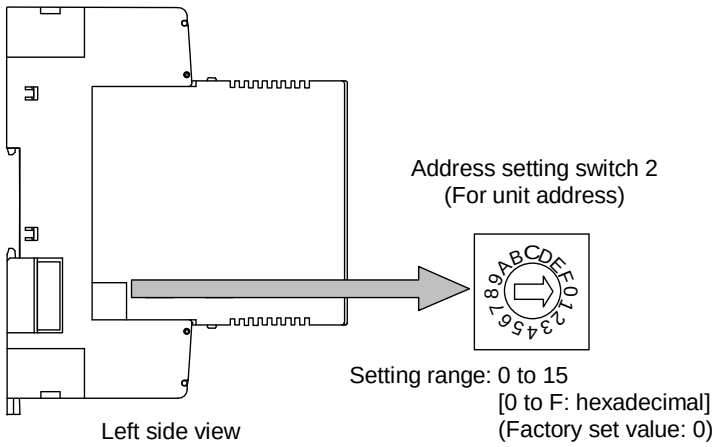
The number of temperature control channels which can be used in PLC communication is in accordance with the setting of the “maximum number of PLC communication channels” in PLC communication environment settings. If “the maximum number of PLC communication channels” is set to 5 in the above system configuration, no PLC communication can be conducted since CH6 data items are not assigned to register addresses.

For maximum channel number of PLC communication, see the **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

4.3 Unit Address Setting

When two or more X-TIO-R modules are multi-drop connected, set an address to each X-TIO-R module. This becomes the unit address of the SRX unit.

Set the unit address by address setting switch 2 of left side of module. For this setting, use a small blade screwdriver.



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

■ PLC communication

Up to four X-TIO-R modules can be connected to a PLC communication port. Therefore the unit address uses the four X-TIO-R modules as a group. Use consecutive numbers in any one of four groups in the following table as unit address.

Always set the unit address of each group including 0, 4, 8 or C. 0, 4, 8 or C becomes the master for communication transfer.

Group	Address setting switch 2
Group 1	0
	1
	2
	3
Group 2	4
	5
	6
	7

Group	Address setting switch 2
Group 3	8
	9
	A
	B
Group 4	C
	D
	E
	F

■ Host communication

Differently from PLC communication, there are no group restrictions. Free settings can be made in the range of 0 to F.

For Modbus, the value obtained by adding "1" to the set address corresponds to the address used for the actual program.

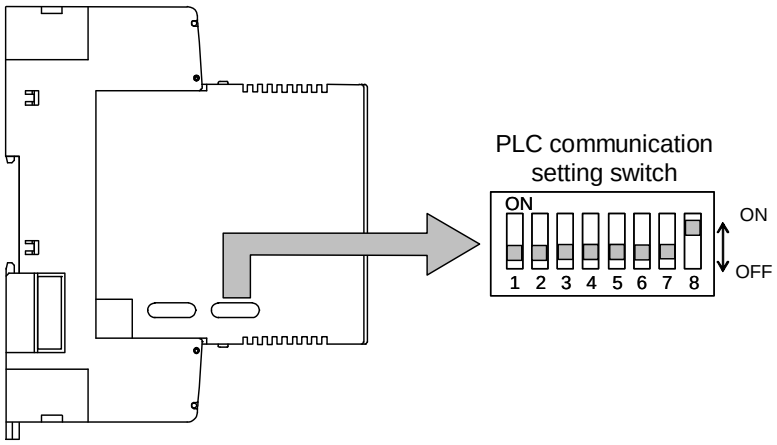
4.4 Communication Setting Switch

■ PLC communication setting switch

The PLC communication setting switches are used to set the data bit configuration, communication speed and communication protocol of each of "PLC communication" and "Host communication 2." They are also used to select the assigned contents of COM. PORT1 and COM. PORT2/COM. PORT3.

Set the same contents as communication speed, data bit configuration and communication protocol of PLC or host computer (operation panel).

When two or more X-TIO-R modules are multi-drop connected, set the PLC communication setting switches in all of the X-TIO-R modules to the same positions.



Left side view

1	2	Data bit configuration
OFF	OFF	Data 8-bit, Without parity, Stop 1-bit
ON	OFF	Data 7-bit *, Odd parity, Stop 1-bit
OFF	ON	Data 7-bit *, Even parity, Stop 1-bit
ON	ON	Data 7-bit *, Even parity, Stop 2-bit

← Factory set value

* To be changed to data 8-bit only when "Host communication 2 (Modbus)" is selected.

3	4	Communication speed
OFF	OFF	9600 bps
ON	OFF	19200 bps
OFF	ON	38400 bps
ON	ON	Do not set this one

← Factory set value

Continued on the next page.

Continued from the previous page.

5	6	7	Communication protocol
OFF	OFF	OFF	Host communication 2 (RKC communication) ← Factory set value
ON	OFF	OFF	Host communication 2 (Modbus)
OFF	ON	OFF	Do not set this one
ON	ON	OFF	Do not set this one
OFF	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol ACPU common command (WR/WW) (A series, FX2N, FX2NC series)
ON	OFF	ON	PLC communication MITSUBISHI MELSEC series special protocol AnA/AnUCPU common command (QR/QW) (AnA/QnA series, Q series)
OFF	ON	ON	Do not set this one
ON	ON	ON	Do not set this one

8	Communication port assignment
OFF	COM. PORT1: PLC communication or Host communication 2 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: Host communication 1 [RS-422A]
ON	COM. PORT1: Host communication 1 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: PLC communication or Host communication 2 [RS-422A] ← Factory set value

COM. PORT2 and COM. PORT3 become the same communication specification.

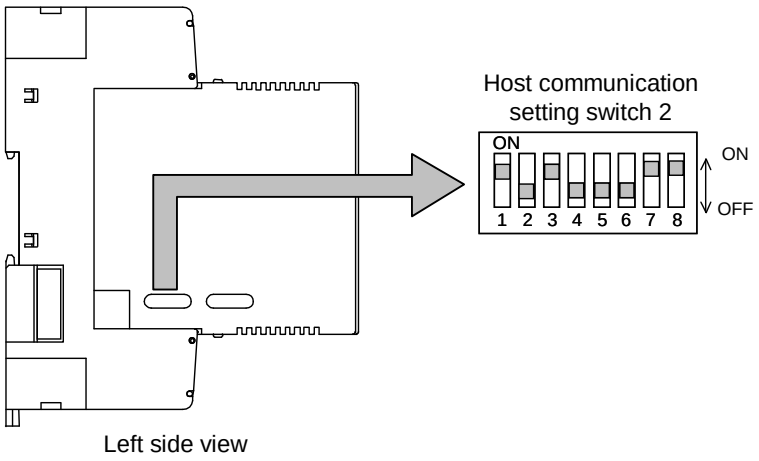
■ Host communication setting switch 2

The host communication setting switch 2 are used to set the data bit configuration, communication speed and communication protocol of "Host communication 1."

Switch No. 7: ON fixed (Do not change this one)

Set the same contents as communication speed, data bit configuration and communication protocol of host computer.

When two or more X-TIO-R modules are multi-drop connected, for switch Nos.1 to 6 set the host communication setting switches in all of the X-TIO-R modules to the same positions.



1	2	Communication speed	
OFF	OFF	2400 bps	
ON	OFF	9600 bps	← Factory set value
OFF	ON	19200 bps	
ON	ON	38400 bps	

3	4	5	Data bit configuration	
OFF	OFF	OFF	Data 7-bit, Without parity, Stop 1-bit *	
OFF	OFF	ON	Data 7-bit, Even parity, Stop 1-bit *	
OFF	ON	ON	Data 7-bit, Odd parity, Stop 1-bit *	
ON	OFF	OFF	Data 8-bit, Without parity, Stop 1-bit	← Factory set value
ON	OFF	ON	Data 8-bit, Even parity, Stop 1-bit	
ON	ON	ON	Data 8-bit, Odd parity, Stop 1-bit	

* When the Modbus communication protocol is selected, do not set this one.

Continued on the next page.

Continued from the previous page.

6	Communication protocol	
OFF	Host communication 1 (RKC communication)	← Factory set value
ON	Host communication 1 (Modbus)	

8	Internal data bus termination resistor setting	
OFF	Termination resistor OFF	
ON	Termination resistor ON	← Factory set value

■ Host communication setting switch 1

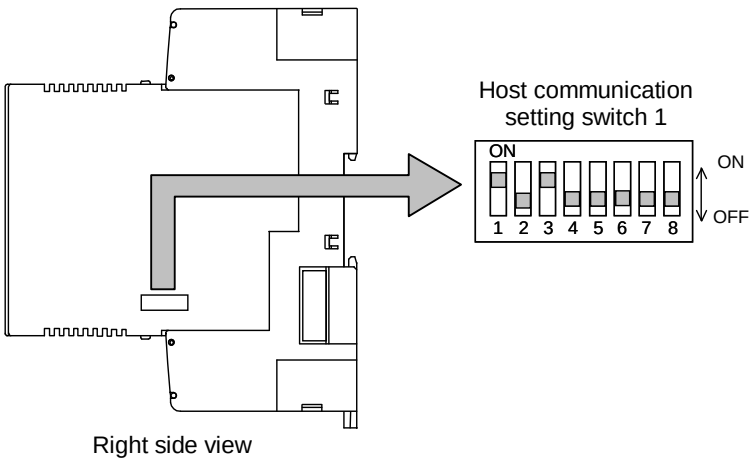
The host communication setting switch 1 is used to set the communication speed, data bit configuration and communication protocol of "Host communication using host communication terminals."

Switch No. 7: OFF fixed (Do not change this one)

Set the same contents as communication speed, data bit configuration and communication protocol of host computer.

When two or more X-TIO-R modules are multi-drop connected, for switch Nos.1 to 6 set the host communication setting switches in all of the X-TIO-R modules to the same positions.

For host communication using host communication terminals, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.



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1	2	Communication speed
OFF	OFF	2400 bps
ON	OFF	9600 bps
OFF	ON	19200 bps
ON	ON	38400 bps

← Factory set value

3	4	5	Data bit configuration
OFF	OFF	OFF	Data 7-bit, Without parity, Stop 1-bit *
OFF	OFF	ON	Data 7-bit, Even parity, Stop 1-bit *
OFF	ON	ON	Data 7-bit, Odd parity, Stop 1-bit *
ON	OFF	OFF	Data 8-bit, Without parity, Stop 1-bit
ON	OFF	ON	Data 8-bit, Even parity, Stop 1-bit
ON	ON	ON	Data 8-bit, Odd parity, Stop 1-bit

← Factory set value

* When the Modbus communication protocol is selected, do not set this one.

6	Communication protocol
OFF	Host communication using host communication terminals: RKC communication
ON	Host communication using host communication terminals: Modbus

8	Internal data bus termination resistor setting
OFF	Termination resistor OFF
ON	Termination resistor ON

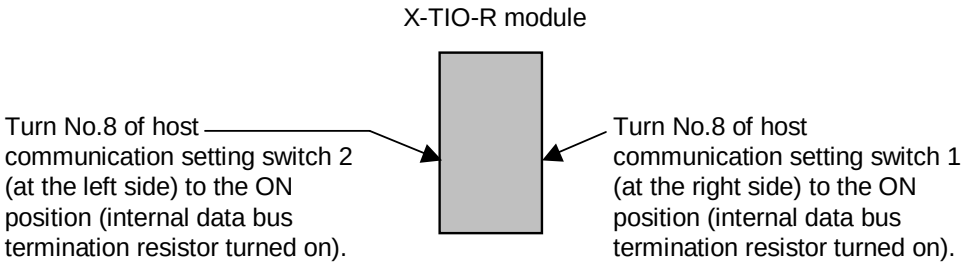
← Factory set value

4.5 Internal Data Bus Termination Resistor Setting

It is necessary to set the internal data bus termination resistor to the SRX unit.

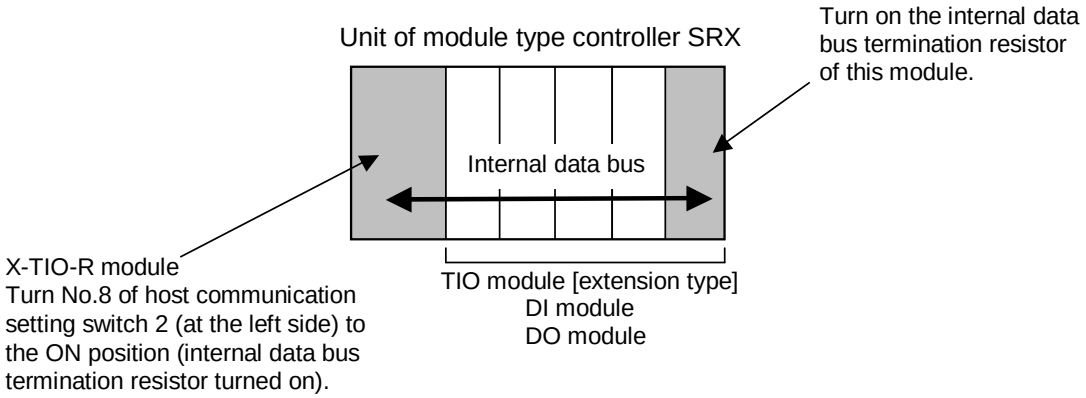
■ When connected X-TIO-R module alone

Turn on the internal data bus termination resistor in module of both sides.



■ When the SRX unit is one

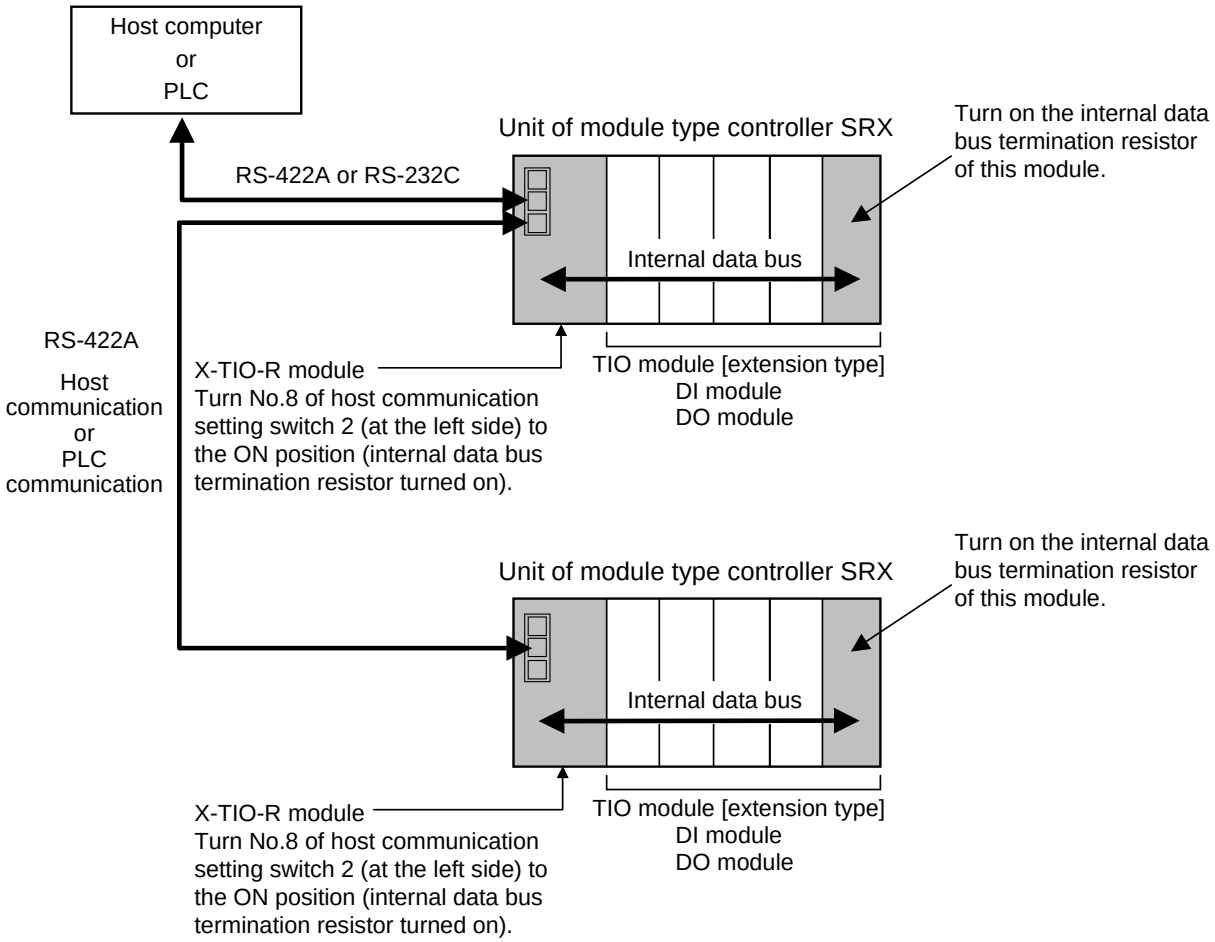
Turn on the internal data bus termination resistor in module of both ends.



For above figure, turn No.8 of host communication setting switch 1 (at the right side) of X-TIO-R module to the OFF position (internal data bus termination resistor turned off).

■ When two or more SRX units are connected

Turn on the internal data bus termination resistor in module of both ends for each unit.



For above figure, turn No.8 of host communication setting switch 1 (at the right side) of X-TIO-R module to the OFF position (internal data bus termination resistor turned off).

If the host communication terminal is used, it is necessary to set the termination resistor for internal communication (RS-485), in addition to setting the internal data bus termination resistor. For details, see the **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

4.6 Initializing Internal Communication

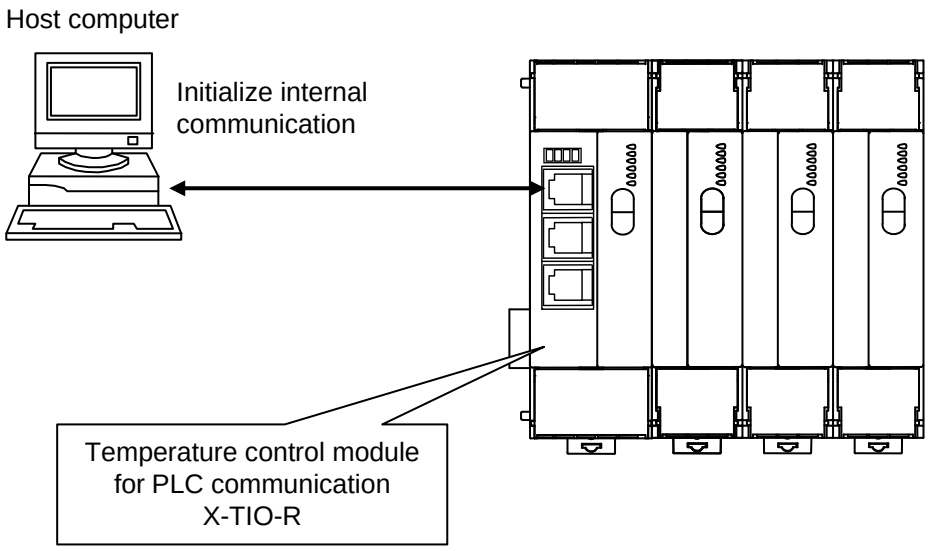
The X-TIO-R module recognizes modules connected within the same unit by initializing internal communication. Conduct this initialization when the power is turned on for the first time or the module configuration is changed.
Internal communication is initialized by any one of the two methods: the use of host communication or the use of switch.

■ Initializing internal communication via host communication

Internal communication is initialized via host communication using the communication port (COM. PORT1 or COM. PORT2) on the X-TIO-R module.

☞ Only initializing internal communication is described here.
- For connection with host computer, see **6.2 Wiring (P. 96)**.
- For setting about host communication, see **4. COMMUNICATION SETTING (P. 16)**.
- For communication protocol of host communication, see **6.4 RKC Communication Protocol (P. 103)** or **6.5 Modbus Communication Protocol (P. 136)**.

☞ For the communication port assignment of the X-TIO-R module, see **4.1 Communication Port Assignments (P. 16)**.



● Setting procedure

1. Set the SRX to initialize set mode.
For RKC communication, the SRX is set to the initialize set mode with the identifier **IN** set to "1." For Modbus, the SRX is set to the initialize set mode with the register address 7D20H (32032) set to "1."

2. Initialize internal communication
For RKC communication, internal communication starts being initialized with the identifier **CL** set to "1." For Modbus, internal communication starts being initialized with the register address 7D23H (32035) set to "1."

[Setting data]

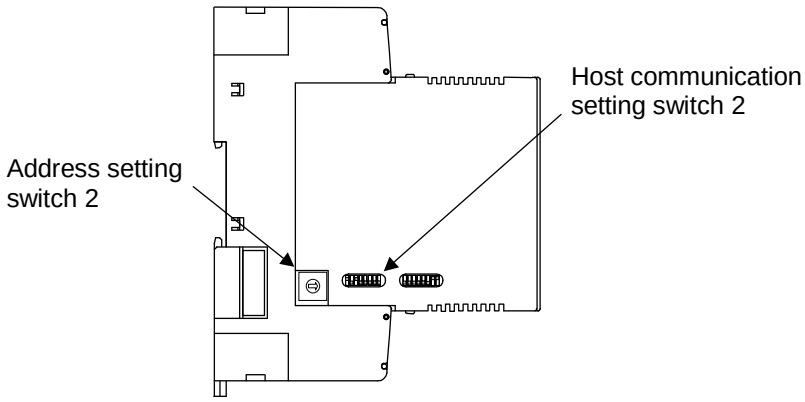
Name:	Initializing internal communication
Identifier:	CL [For RKC communication]
Digits:	7 digits [For RKC communication]
Register address:	7D23H (hexadecimal), 32035 (decimal) [For Modbus]
Data range:	0: Normal state (Initialization is not execute) 1: Initialize internal communication Automatically returns to "0" if initialization is complete after "1" is set.
Factory set value:	0

The RUN lamp flashes quickly while internal communication is being initialized and it goes on if terminated. It takes about 15 seconds for initialization.

3. Return the SRX to normal state.
For RKC communication, it returns to normal with the identifier **IN** set to "0."
For Modbus, it returns to normal with the register address 7D20H (32032) set to "0."

■ Initializing internal communication by switch

Initialize internal communication by using the address setting switch 2 and the host communication setting switch 2 on the X-TIO-R module.



X-TIO-R module left side view

● Setting procedure

1. Turn off the power supply.

2. Before initializing internal communication, record the switch positions of address setting switch 2 and host communication setting switch 2.

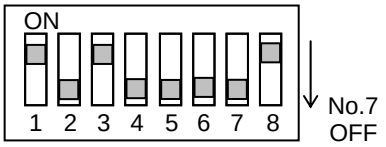
3. Set address setting switch 2 to “F.”

Address setting switch 2

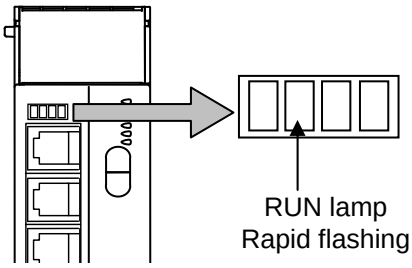
Set “F”

4. Set No. 7 of the host communication setting switch 2 to OFF. Nos. 1 to 6 and No. 8 of the same switch can take any positions.

Host communication setting switch 2



5. Internal communication starts being initialized with the power turned on. The RUN lamp flashes quickly while internal communication is being initialized.
It takes about 15 seconds for initialization.



6. The RUN lamp is turned on if initializing internal communication is completed.

7. Turn off the power supply, and return the switch positions of address setting switch 2 and the host communication setting switch 2 to the positions already recorded.

8. Turn on the power again.

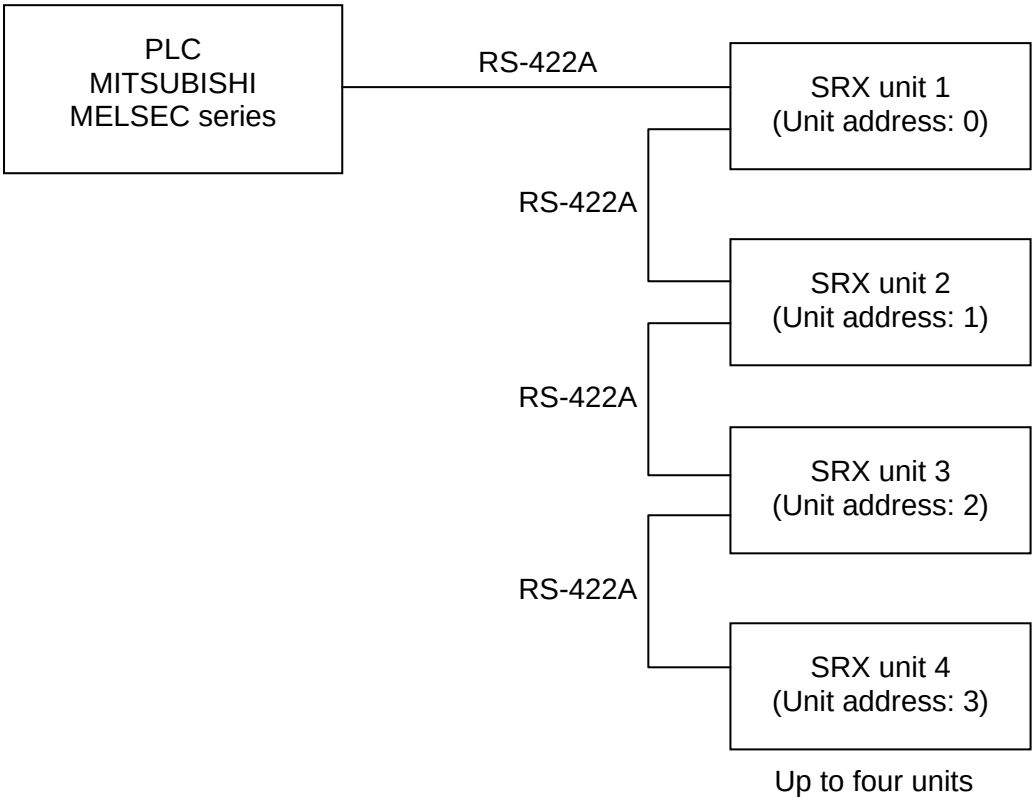
5. PLC COMMUNICATION

5.1 MITSUBISHI MELSEC series

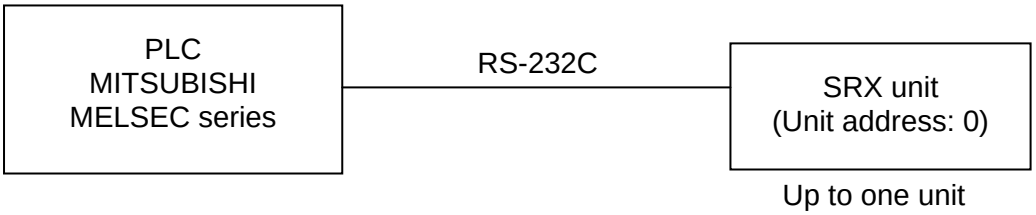
5.1.1 Outline

The SRX (X-TIO-R) can be connected to the MITSUBISHI MELSEC series computer link module without using any program.

- **RS-422A**



- **RS-232C**



■ Usable PLC modules (MITSUBISHI MELSEC series)

Name	Type
Computer link module	AJ71UC24 A1SJ71UC24-R2 A1SJ71UC24-R4 A1SJ71UC24-PRF A1SJ71C24-R2 A1SJ71C24-R4 A1SJ71C24-PRF A1SCPUC24-R2 A2CCPUC24 (PRF) The module which A series common command (type 4) can use.
Serial communication modules	AJ71QC24N A1SJ71QC24N QJ71C24 The module which A series common command (type 4) can use.
Adapter	FX0N-232ADP FX0N-485ADP
Expanded function board	FX2N-232BD FX2N-485BD

■ Usable SRX modules

Name	Type
Temperature control (TIO) module	X-TIO-R (PLC communication type) X-TIO-A (basic type), X-TIO-B (extension type)
Digital input (DI) module	X-DI-A (input 12 points), X-DI-B (input 28 points)
Digital output (DO) module	X-DO-A (output 12 points), X-DO-B (output 28 points)

One temperature control module for PLC communication (X-TIO-R) is required.
Up to four X-TIO-R modules can be multi-drop connected to one PLC communication port.
In addition, Up to 29 modules that is the temperature control module (X-TIO-A/B), the digital input (DI) module and the digital output (DO) module, can be connected to one X-TIO-R module.

☞ For each module, see Instruction Manual of the following.

- **Temperature Control Module for PLC Communication X-TIO-R Instruction Manual (IMS01N12-E□)**
- **Temperature Control Module [Basic type] X-TIO-A Instruction Manual (IMS01N02-E□)**
- **Temperature Control Module [Extension type] X-TIO-B Instruction Manual (IMS01N03-E□)**
- **Digital Input Module X-DI-A/X-DI-B Instruction Manual (IMS01N04-E□)**
- **Digital Output Module X-DO-A/X-DO-B Instruction Manual (IMS01N05-E□)**

5.1.2 Wiring

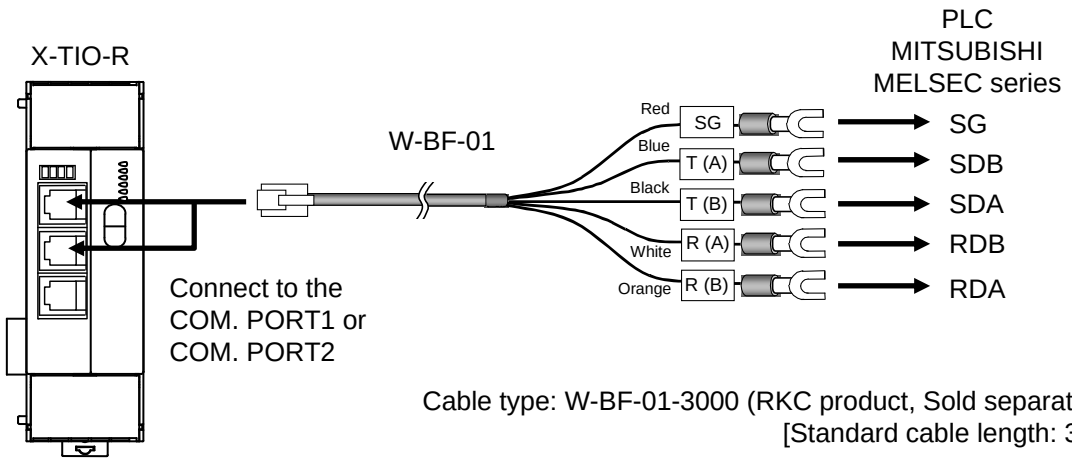
⚠ WARNING

To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

CAUTION

- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- When connecting or disconnecting the connectors, do not force it too far to right and left or up and down, but move it on the straight. Otherwise, the connector pins may be bent, causing instrument failure.
- When disconnecting a connector, hold it by the connector itself. Disconnecting connectors by yanking on their cables can cause breakdowns.
- To prevent malfunction, never touch the contact section of a connector with bare hands or with hands soiled with oil or the like.
- To prevent malfunction, connect cable connectors securely, then firmly tighten the connector fastening screws.
- To prevent damage to cables, do not bend cables over with excessive force.
- If the instrument is easily affected by noise, use the ferrite core in the both ends of the communication cable (nearest the connector).

■ RS-422A



Cable type: W-BF-01-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

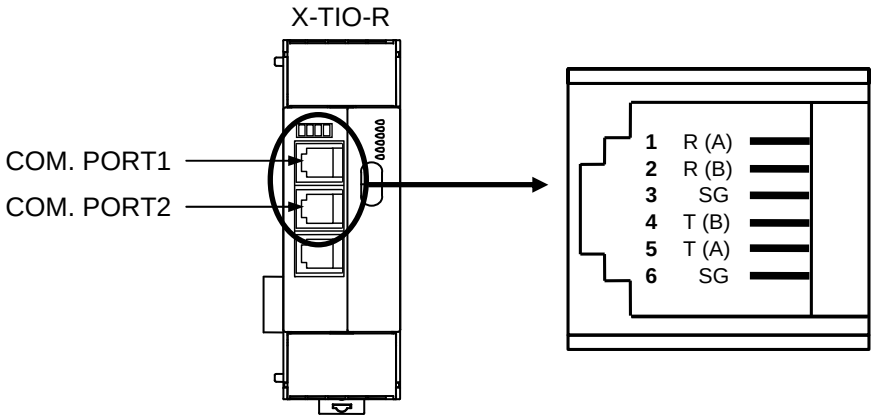
Connection cable W-BF-01 * (RKC product) can use to connect the PLC.

* Shields of the cable are connected to SG (No. 6 pin) of the X-TIO-R connector.

For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

The details of the connectable connector for the PLC, see the instruction manual for the used PLC.

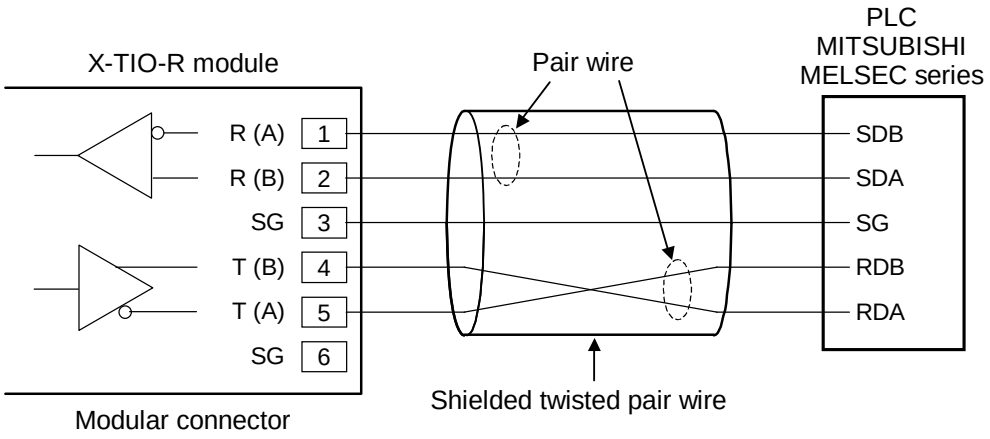
● Pin layout of modular connector



● Connector pin number and signal details

Pin No.	Signal name	Symbol
1	Receive data	R (A)
2	Receive data	R (B)
3	Signal ground	SG
4	Send data	T (B)
5	Send data	T (A)
6	Signal ground	SG

- **Diagram of RS-422A wiring**



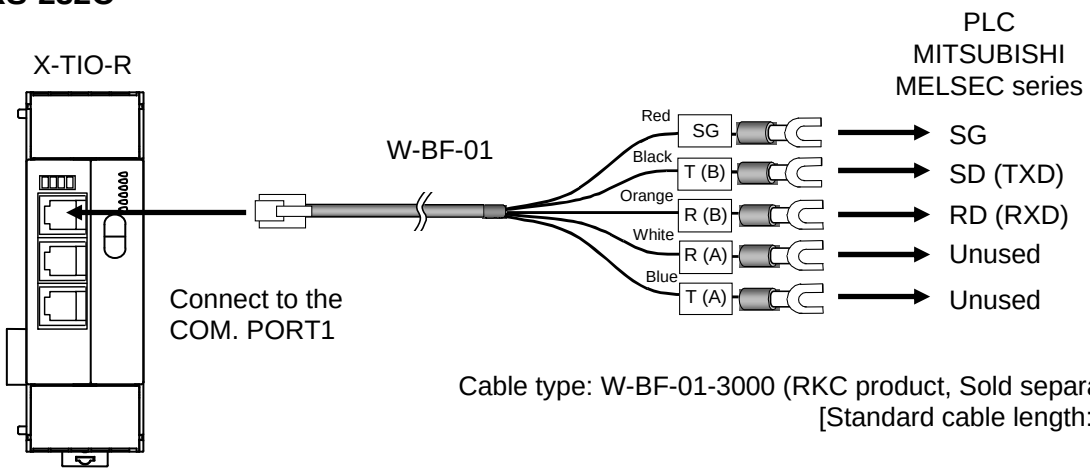
When preparing a cable of connecting the computer link module belonging to the MITSUBISHI MELSEC series to our X-TIO-R module, cross each pair of wires the A and B terminal positions on their terminal boards are not symmetrical.

Example: Connect the X-TIO-R module T (A) send data terminal to the RDB receive data terminal on the computer link module belonging to the MITSUBISHI MELSEC series.

The 6-pin type modular connector should be used for the connection to the X-TIO-R module.
Recommended model: TM4P-66P (Manufactured by HIROSE ELECTRIC CO., LTD.,)

Customer is requested to prepare a communication cable fit for the control unit to be connected by the PLC.

■ RS-232C



Cable type: W-BF-01-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

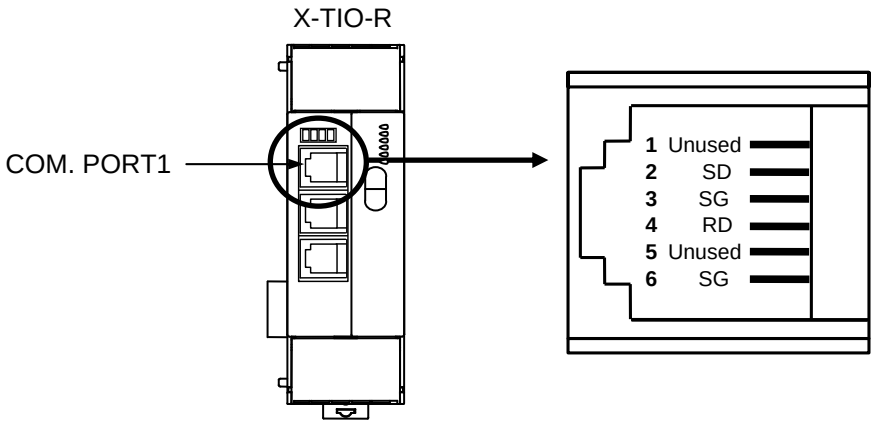
Be sure to insulate the wires that are not used by covering them with insulating tape.

Connection cable W-BF-01 * (RKC product) can use to connect the PLC.
* Shields of the cable are connected to SG (No. 6 pin) of the X-TIO-R connector.

For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

The details of the connectable connector for the PLC, see the instruction manual for the used PLC.

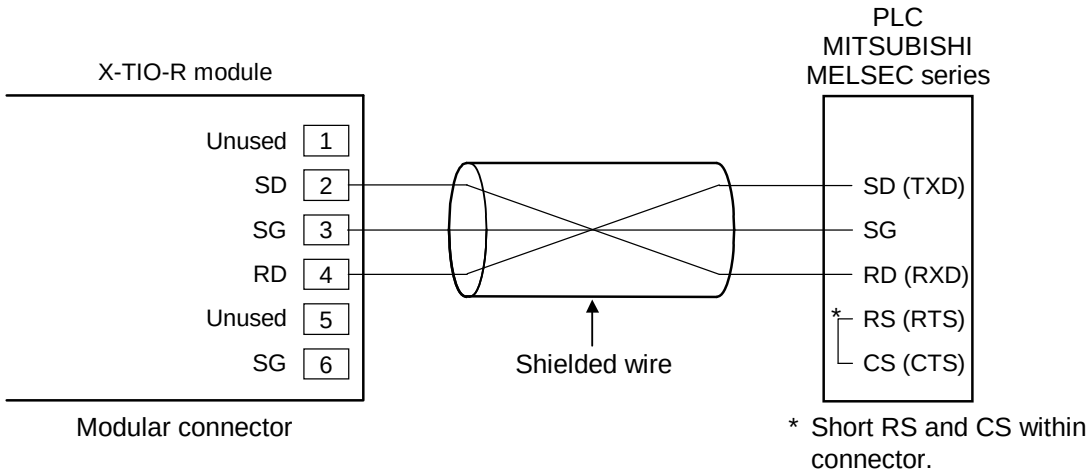
- **Pin layout of modular connector**



- **Connector pin number and signal details**

Pin No.	Signal name	Symbol
1	Unused	—
2	Send data	SD (TXD)
3	Signal ground	SG
4	Receive data	RD (RXD)
5	Unused	—
6	Signal ground	SG

- **Diagram of RS-232C wiring**



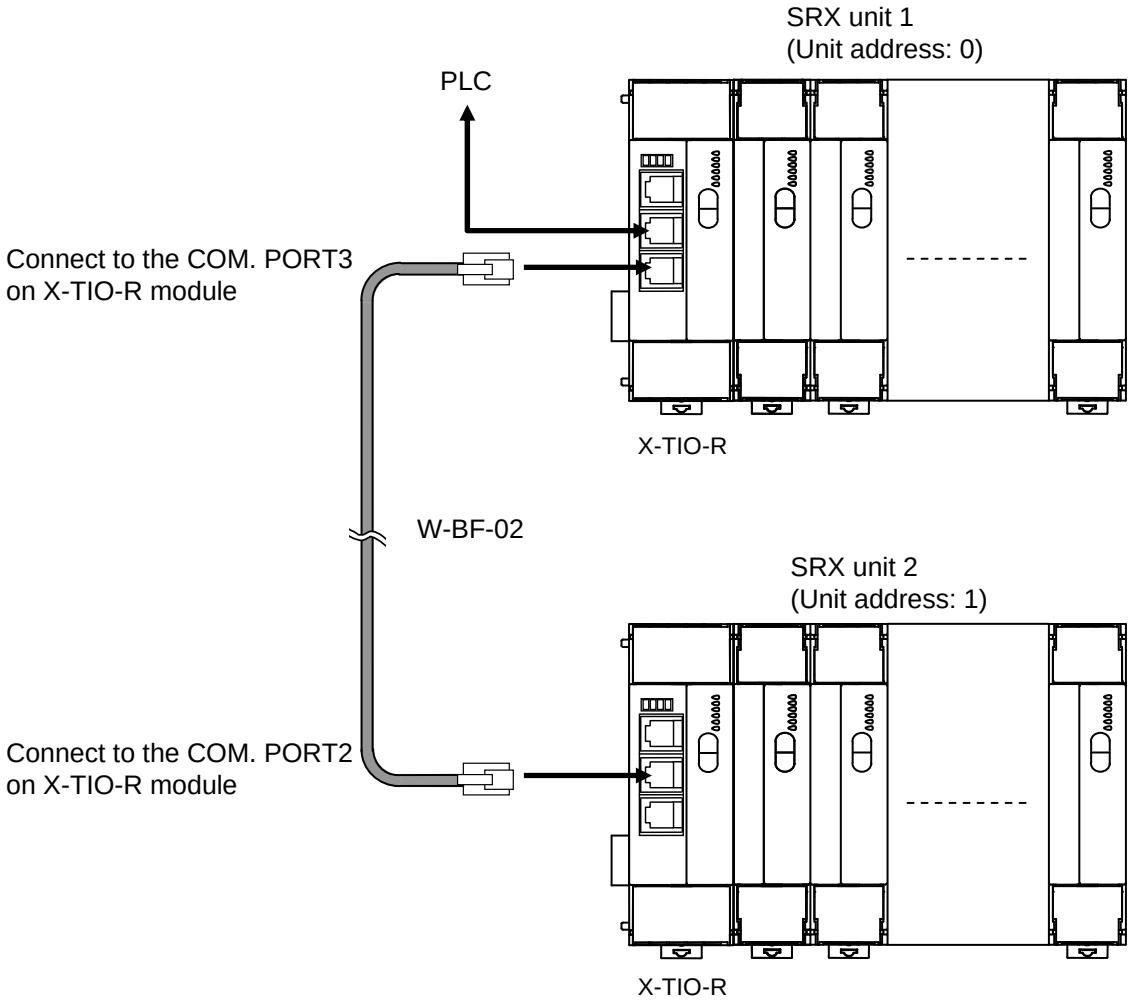
The 6-pin type modular connector should be used for the connection to the X-TIO-R module. Recommended model: TM4P-66P (Manufactured by HIROSE ELECTRIC CO., LTD.,)

Customer is requested to prepare a communication cable fit for the control unit to be connected by the PLC.

■ Multiple SRX unit connections

● When using COM. PORT2 and COM. PORT3

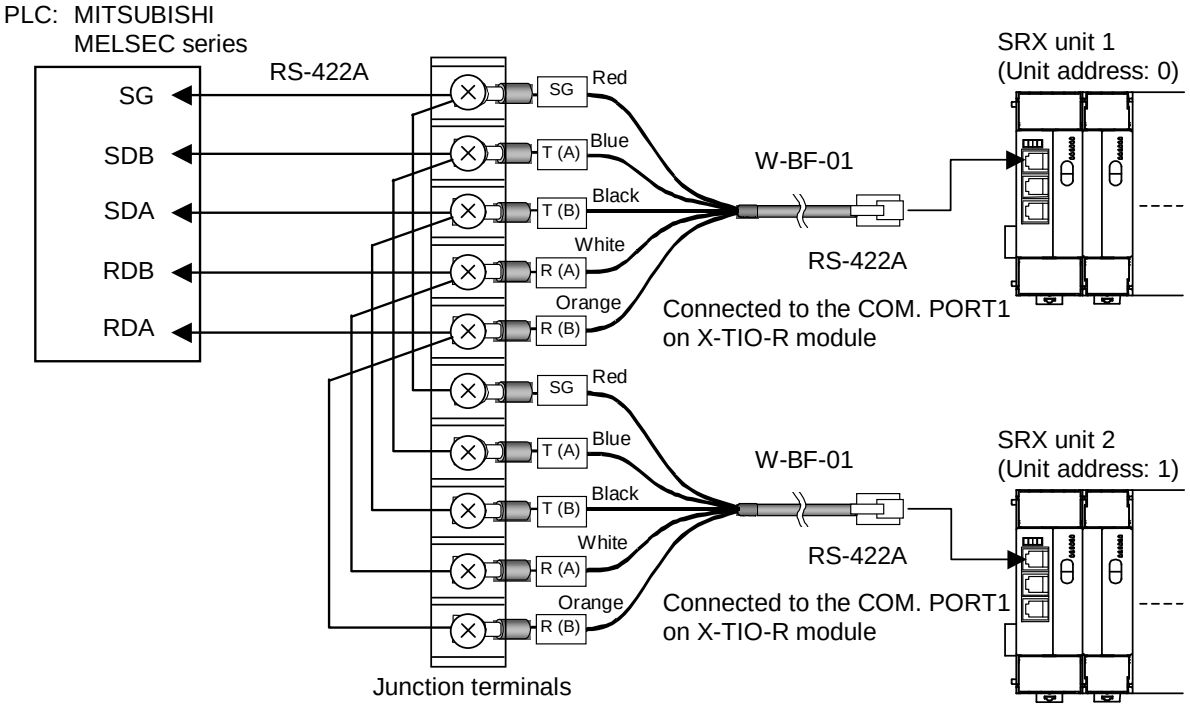
COM. PORT2/COM. PORT3 are connectors for multi-drop connection of the SRX unit.
For SRX unit extension, connect COM. PORT3 to COM. PORT2 of the SRX unit for extension using our cable (Sold separately: W-BF-02).



Cable type: W-BF-02-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

● When using COM. PORT1

When multi-drop connection is made by using COM. PORT1, it is necessary to conduct wiring by using junction terminals and our cables (Sold separately: W-BF-01).



Cable type: W-BF-01-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

5.1.3 PLC communication environment setting

There are two types of PLC communication environment settings: via host communication and by switch.

📖 "PLC communication start time" can be set only when in host communication.

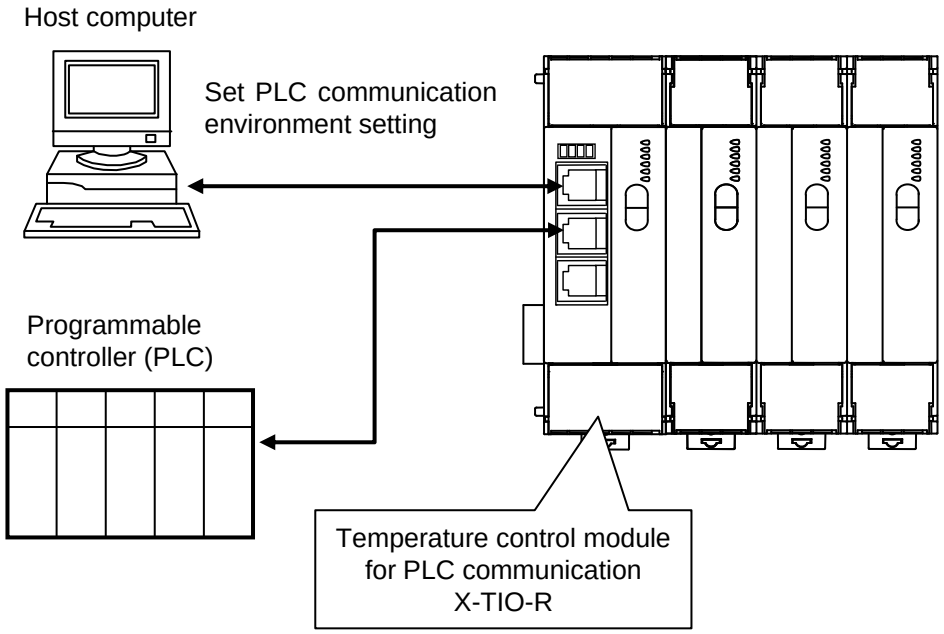
■ Setting by host communication

Set the PLC communication environment via host communication in which the X-TIO-R module communication port (COM. PORT1 or COM. PORT2) is used.
The X-TIO-R module is an object of communication.

📖 **For setting the PLC communication environment via host communication, each data becomes valid just when the power is turned off once after the data is set, and then it is turned on again.**

☞ The only PLC communication environment setting data is described here.
- For connection with host computer, see **6.2 Wiring (P. 96)**.
- For setting about host communication, see **4. COMMUNICATION SETTING (P. 16)**.
- For communication protocol of host communication, see **6.4 RKC Communication Protocol (P. 103)** or **6.5 Modbus Communication Protocol (P. 136)**.

☞ For the communication port assignment of the X-TIO-R module, see **4.1 Communication Port Assignments (P. 16)**.



● Setting items list

The following items are set to the X-TIO-R module.

The following items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

All of the following items can be read and written (R/W). In addition, no channel designation is required.

"Identifier" and "Digits" are used for RKC communication and "Register address" is used for Modbus.

Name	Iden-tifier	Digits	Register address		Data range	Factory set value
			HEX	DEC		
Station number	**QV**	7	7D00	32000	0 to 31 Set the PLC station number. Set it to the same number as the PLC.	0
PC number	**QW**	7	7D01	32001	0 to 255 Set the PLC PC number. Set it to the same number as the PLC.	255
Register start number	**QX**	7	7D02	32002	0 to 9994: ACPU common command (WR/WW) 0 to 32767: AnA/AnUCPU common command (QR/QW) Set the start number of the register used in PLC communication.	1000
Maximum number of PLC communication channels	**QY**	7	7D03	32003	1 to 60 CH/unit Set the maximum number of temperature control channels used in PLC communication.	20
Register type (D, R, W)	**QZ**	7	7D04	32004	0: D register (data register) 1: R register (file register) 2: W register (link register) Set the register types used in PLC communication.	0

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Name	Iden-tifier	Digits	Register address		Data range	Factory set value
			HEX	DEC		
X-TIO-R module monitor item selection *	**QS**	7	7D06	32006	Bit data b0: Measured value (PV) b1: Set value monitor b2: Control output value b3: CT input measured value b4: TIO state 1 b5: TIO state 2 b6: Execution pattern b7: Execution segment b8: Segment remaining time b9: Time signal output state 1 b10: Time signal output state 2 Data 0: Invalid 1: Valid [Decimal number: 0 to 2047] The data updating period is shortened by selecting the only necessary data from among the above monitored data.	bit 0: 1 bit 1: 1 bit 2: 1 bit 3: 1 bit 4: 1 bit 5: 1 bit 6: 1 bit 7: 1 bit 8: 1 bit 9: 1 bit 10: 1 [Decimal number: 2047]

* This is the setting of shortening the data updating period by not sending unnecessary monitored items from among all items which are sent to the PLC. The only items selected by this setting are written to the PLC.

Monitor item selection is assigned as a bit image in binary numbers.

Bit image: 00000000000

bit 10 ····· bit 0

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Name	Iden-tifier	Digits	Register address		Data range	Factory set value
			HEX	DEC		
X-TIO-R module link recognition time *	**QT**	7	7D07	32007	0 to 255 seconds When connecting two or more X-TIO-R modules, set the time required until a module after the second module is recognized. Set this item to the master unit.	10
PLC scanning time setting	**ST**	7	7D09	32009	0 to 3000 ms Set the time of waiting for a response from the PLC. Usually, no factory set values are necessary to be changed.	255

* When two or more X-TIO-R modules which are multi-drop connected communicate with the PLC, the master unit with the unit address of "0," "4," "8" or "C" in order to recognize the existence of slave units (unit address: 1 to 3, 5 to 7, 9 to B and D to F), checks whether these slaves exist or not during the time period set by "X-TIO-R module Link recognition time." Any slave with the address which did not respond at all is judged not to be in existence, and hereafter the only the remaining units start communicating with the master unit.

Set this item to the X-TIO-R module (master unit) with the unit address of "0," "4," "8" or "C."

The slave units are necessary to be ready for communicating with the PLC during the time period set by "X-TIO-R module Link recognition time." Therefore, if the power of all of the modules cannot be simultaneously turned on, turn on the power of the master unit last. Data send to the PLC starts within about 5 sec after the power of the master unit is turned on to start processing slave unit recognition.

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Name	Iden-tifier	Digits	Register address		Data range	Factory set value
			HEX	DEC		
Action mode selection *	**RZ**	7	7D0C	32012	Bit data b0: Unused (1 fixed) b1: PLC register read/write error elimination 0: Manual elimination 1: Automatic elimination b2 to b7:Unused [Decimal number: 0 to 255] Sets an action taken when the address is specified and an error occurs in PLC communication.	bit 0: 1 bit 1: 0 bit 2 to 7: 0 [Decimal number: 1]
PLC communication start time	**RU**	7	7D0D	32015	1 to 255 seconds Time until communication with the PLC starts is set after the power is turned on.	5

* **[PLC register read/write error release]**
Specifies the procedure for eliminating a PLC register read/write error. The PLC register read/write error is assigned to the PLC communication error code, bit 0.

- When manually eliminated, the request command, "2: Set value monitor" is executed and then the error is eliminated after all of the set values are written in the register.
- When automatically eliminated, the error is automatically eliminated after PLC communication returns to normal and the error is retained for more than one second (or monitor processing time).

☞ For PLC communication error code and request command, see **5.3 PLC Communication Data Map (P. 62)**.

📖 Action mode selection is assigned as a bit image in binary numbers.

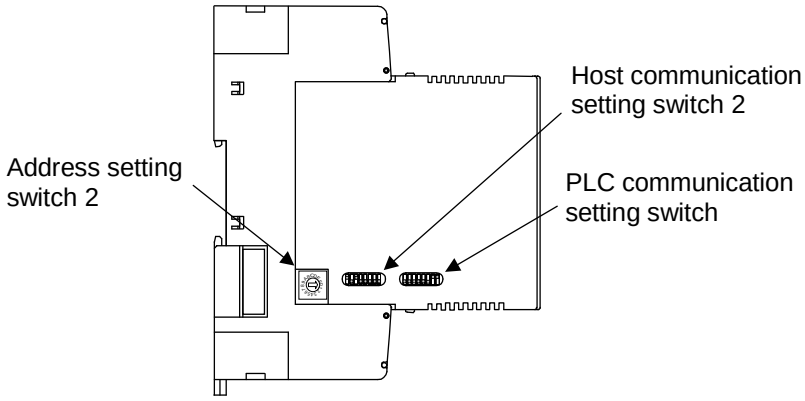
Bit image: 00000000

bit 7 ····· bit 0

■ Setting by the switch

The PLC communication environment is set by using the switch in the X-TIO-R module without conducting host communication. The switch to use for setting is Address setting switch 2, Host communication setting switch 2 and PLC communication setting switch.

When the PLC communication environment is set by switch, the setting details cannot be check afterwards. When checking the details thus set, check them via host communication. In addition, as each switch position is moved during the setting, record the switch ON/OFF position before making the setting.



X-TIO-R module left side view

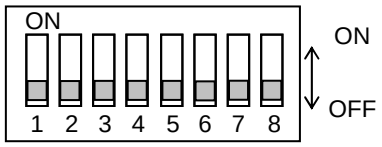
■ Setting procedure

1. Turn off the power supply.

2. Before setting the PLC communication environment, record the ON/OFF positions of address setting switch 2, host communication setting switch 2 and PLC communication setting switch.

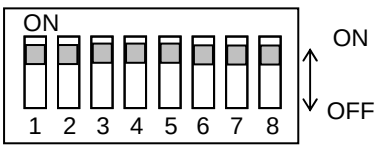
3. Turn off all of the sub switches in the host communication setting switch 2. In addition, turn on all of the sub switches in the PLC communication setting switch.

Host communication setting switch 2



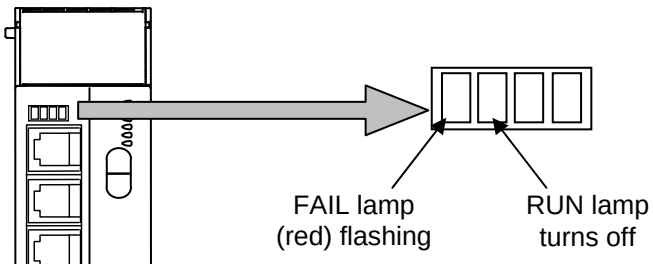
All switches: OFF

PLC communication setting switch



All switches: ON

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



5. Select a setting item with a host communication setting switch 2 or a PLC communication setting switch.

- For the host communication setting switch 2, change its position from OFF to ON.
  See **Setting items list of host communication setting switch 2 (P. 49)**.
- For the PLC communication setting switch, change its position from ON to OFF.
  See **Setting items list of PLC communication setting switch (P. 50)**.

6. Set data with address setting switch 2.

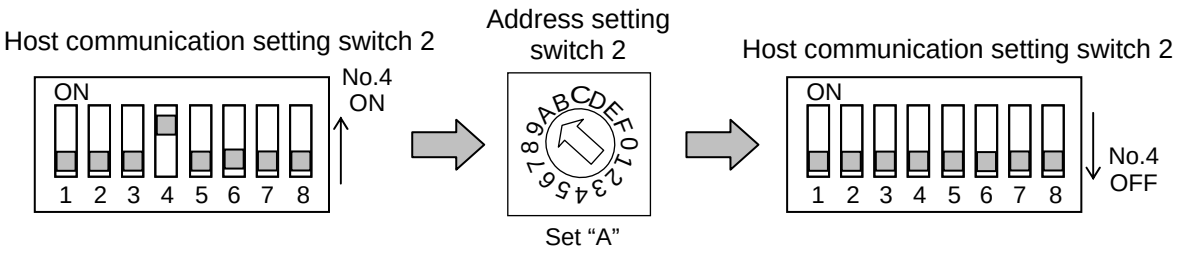
☞ See **Setting items list of host communication setting switch 2 (P. 49)** or **Setting items list of PLC communication setting switch (P. 50)**.

7. After the setting is finished, for the host communication setting switch 2 return its position to OFF from ON (for the PLC communication setting switch, to ON from OFF).
The RUN lamp goes on and it goes off after the set data has been registered (about 3 sec. later).

8. Repeat the above steps from ***5.*** to ***7.*** to set other setting items.

[Example] When setting maximum number of PLC communication channels to 40 CH/unit.

- Change the No. 4 position of the host communication setting switch 2 to ON from OFF.
- Set address setting switch 2 to "A" ($10 \times 4 = 40$).
- Return the No. 4 positions of the host communication setting switch 2 to OFF from ON.
  The RUN lamp goes on and it goes off after the set data has been registered (about 3 sec. later).



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

10. Return the ON/OFF positions of address setting switch 2, the host communication setting switch 2 and PLC communication setting switch to the positions already recorded.

11. Turn on the power again.
The set data valid if the power is turned on again.

● **Setting items list of host communication setting switch 2**

Switch No.	Setting item	Data range (Address setting switch 2)	Factory set value
1	Station number	0 to F: 0 to 15 Set the PLC station number. Set it to the same number as the PLC.	0
2	PC number	0 to E: 0 to 14 F: 255 Set the PLC PC number. Set it to the same number as the PLC.	255
3	Register start number	0 to F: 0 to 15000 (Set value × 1000) Set the start number of the register used in PLC communication.	1000
4	Maximum number of PLC communication channels	0: 2 CH/unit 1 to E: 4 to 56 CH/unit (Set value × 4) F: 60 CH/unit Set the maximum number of temperature control channels used in PLC communication.	10 CH
5	Register type (D, R, W)	0: D register (data register) 1: R register (file register) 2: W register (link register) (3 to F: D register) Set the register types used in PLC communication.	D register
6	PLC scanning time setting	0 to E: 0 to 140 ms (Set value × 10) F: 255 ms Set the response wait time from the PLC. Usually, no factory set values are necessary to be changed.	255 ms
7	X-TIO-R module link recognition time *	0: No slave unit 1 to E: 10 to 140 seconds (Set value × 10) F: 255 seconds When connecting two or more X-TIO-R modules, set the time required until a module after the second module is recognized.	10 seconds
8	Unused (Do not set this one)	—	—

* For details, see ● **Setting items list (P. 43)** of ■ **Setting by host communication**.

- **Setting items list of PLC communication setting switch**

Switch No.	Setting item	Data range (Address setting switch 2)	Factory set value
1	X-TIO-R module monitor item selection *	0: Measured value (PV) 1: CT input measured value 2: Measured value (PV), CT input measured value 3: Measured value (PV), Control output value 4: Measured value (PV), Control output value, CT input measured value 5: Measured value (PV), TIO state 1, TIO state 2 6: Measured value (PV), Control output value, TIO state 1, TIO state 2 7: Measured value (PV), CT input measured value, TIO state 1, TIO state 2 8: Measured value (PV), Control output value, CT input measured value, TIO state 1, TIO state 2 9: Measured value (PV), Set value monitor, Control output value, TIO state 1, TIO state 2 A: Measured value (PV), Set value monitor, CT input measured value, TIO state 1, TIO state 2 B: Measured value (PV), Set value monitor, Control output value, CT input measured value, TIO state 1, TIO state 2 C: Measured value (PV), Set value monitor, Control output value, TIO state 1, TIO state 2, Execution pattern D: Measured value (PV), Set value monitor, Control output value, TIO state 1, TIO state 2, Execution pattern, Execution segment E: Measured value (PV), Set value monitor, Control output value, TIO state 1, TIO state 2, Execution pattern, Execution segment, Segment remaining time F: Measured value (PV), Set value monitor, Control output value, TIO state 1, TIO state 2, Execution pattern, Execution segment, Segment remaining time, Time signal output state 1, Time signal output state 2 Form among combinations of the above monitored data, select a combination of the only necessary data to shorten the data updating period.	Select all items ・Measured value (PV) ・Set value monitor ・Control output value ・CT input measured value ・TIO state 1 ・TIO state 2 ・Execution pattern ・Execution segment ・Segment remaining time ・Time signal output state 1 ・Time signal output state 2

* This is the setting of shortening the data updating period by not sending unnecessary monitored items from among all items which are sent to the PLC. The only items selected by this setting are written to the PLC.

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Switch No.	Setting item	Data range (Address setting switch 2)	Factory set value
2 to 5	Cannot be used for setting the PLC communication environment. (Do not set this one)	—	—
6	Action mode selection *	PLC register read/write error elimination: 0 or 1: Manual elimination 2 or 3: Automatic elimination 4 to F: Unused (Do not set this one) Sets an action taken when the address is specified and an error occurs in PLC communication.	Manual elimination
7, 8	Cannot be used for setting the PLC communication environment. (Do not set this one)	—	—

* **[PLC register read/write error release]**

Specifies the procedure for eliminating a PLC register read/write error. The PLC register read/write error is assigned to the PLC communication error code, bit 0.

- When manually eliminated, the request command, "2: Set value monitor" is executed and then the error is eliminated after all of the set values are written in the register.
- When automatically eliminated, the error is automatically eliminated after PLC communication returns to normal and the error is retained for more than one second (or monitor processing time).

☞ For PLC communication error code and request command, see **5.3 PLC Communication Data Map (P. 62)**.

5.1.4 Setting on the PLC (Computer link module)

Set the PLC as follows. (Recommend setting example)

Item	Description
Protocol	Type 4 protocol mode
Station number	00
Computer link/multi-drop selection	Computer link
Communication rate	Set the same as SRX (X-TIO-R module)
Operation setting	Independent
Data bit	8
Parity bit	Without
Stop bit	1
Sum check code	Provided
Writing during RUN	Allowed
Setting modification	Allowed
Termination resistor	Connect the termination resistor attached to the PLC

☞ The setting item varies depending on the PLC. The details of the setting procedure for the PLC, see the instruction manual for the PLC being used.

5.2 Data Transfer

For data transfer between the PLC and SRX, both “fixed data transfer type” and “specified data transfer type” are available.

5.2.1 Fixed data transfer type

The PLC communication data map data already assigned is transferred. The type of data is fixed but register address and the number of data transfer channels can be changed.

📖 These register address and the number of data transfer channels are changed by the communication environment setting.

☞ For details of data contents, see **5.3 PLC Communication Data Map (P. 62)**.

■ Request command

Data transfer between PLC and SRX are executed by request command.

- **Request command “0: Monitor (PLC ← SRX)”**
  Command which requests the SRX to write data such as temperature measured values, etc. (attribute: RO) to the PLC side.
  The SRX always repeats data writing until “1: Setting” or “2: Set value monitor” is set to the request command.
  The SRX communication state is set to “1: Writing on monitor data” during data transfer.
  Relevant data: Data whose register addresses are from “Measured value (PV)” to “Time signal output state 2” on the PLC communication data map

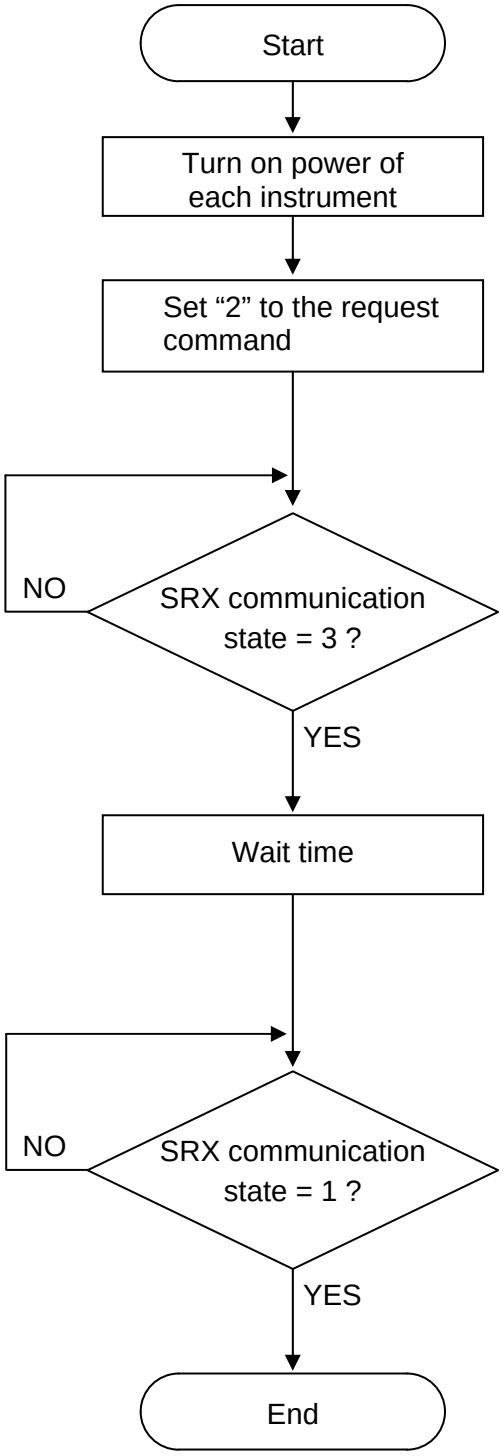
- **Request command “1: Setting (PLC → SRX)”**
  Command which requests the SRX to read data such as temperature set values, etc. (attribute: RW) from the PLC side. Just when “1: Setting” is set to the request command, the SRX starts reading the data from the PLC side.
  The SRX communication state is set to “2: Reading out setting data” during data transfer.
  After the data is transferred, the request command and SRX communication state returns to “0: Monitor” and “1: Writing on monitor data,” respectively.
  Relevant data: Data whose register addresses are from “Program operation mode” to “Program operation start mode” on the PLC communication data map

- **Request command “2: Set value monitor (PLC ← SRX)”**
  Command which requests the SRX to write data such as temperature set values, etc. (attribute: RW) to the PLC side. Just when “2: Set value monitor” is set to the request command, the SRX starts writing the data to the PLC side.
  The SRX communication state is set to “3: Writing on setting data” during data transfer.
  After the data is transferred, the request command and SRX communication state returns to “0: Monitor” and “1: Writing on monitor data,” respectively.
  Relevant data: Data whose register addresses are from “Program operation mode” to “Program operation start mode” on the PLC communication data map

■ Data transfer procedures

Change each set value of SRX from the PLC after the initial settings are made.
If each set value of SRX is changed from the PLC without setting the initial values, it is re-written to 0 with each set value of the PLC at that time set to 0.

● Initial Setting (When transmit data of temperature setting values from SRX to PLC)



When 2 (Set value monitor) is set to request command in PLC register, the SRX starts writing the data items to the PLC side.

Relevant data: Data whose register addresses are from “Program operation mode” to “Program operation start mode” on the PLC communication data map

If 3 (Set data write) is set to SRX communication state in the PLC register, this indicates that SRX data items are being written into the PLC.

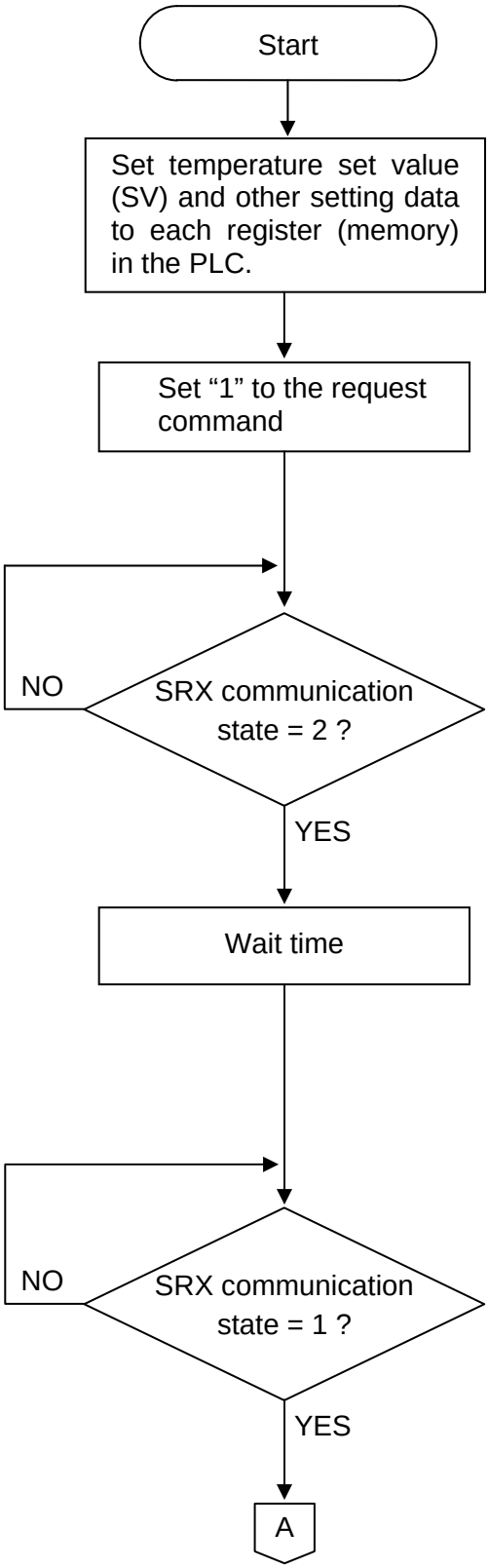
Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

Waiting time [for 38400 bps]: 2 to 4 seconds

Changes depending on the maximum number of PLC communication channels and PLC response time.

If the SRX communication state in the PLC register is set to 1 (Data write into monitor), this indicates that data write to the PLC terminates to return to the monitored state (Request command: 0).

- **Data setting (When transmit data of temperature setting values from PLC to SRX)**



[Data setting]
When 1 (Setting) is set to request command in PLC register, the SRX starts reading the data set to the register (memory) on the PLC side.

Relevant data: Data whose register addresses are from "Program operation mode" to "Program operation start mode" on the PLC communication data map

If 2 (Set data read) is set to SRX communication state in the PLC register, this indicates that SRX data items are being read from the PLC side.

Reserve data read time as wait time. In addition, process data in each item as indefinite during this period.

Readout time [for 38400 bps]: 3 to 7 seconds

Changes depending on the maximum number of PLC communication channels and PLC response time.

If the SRX communication state in the PLC register is set to 1 (Data write into monitor), this indicates that data write to the PLC terminates to return to the monitored state (Request command: 0).

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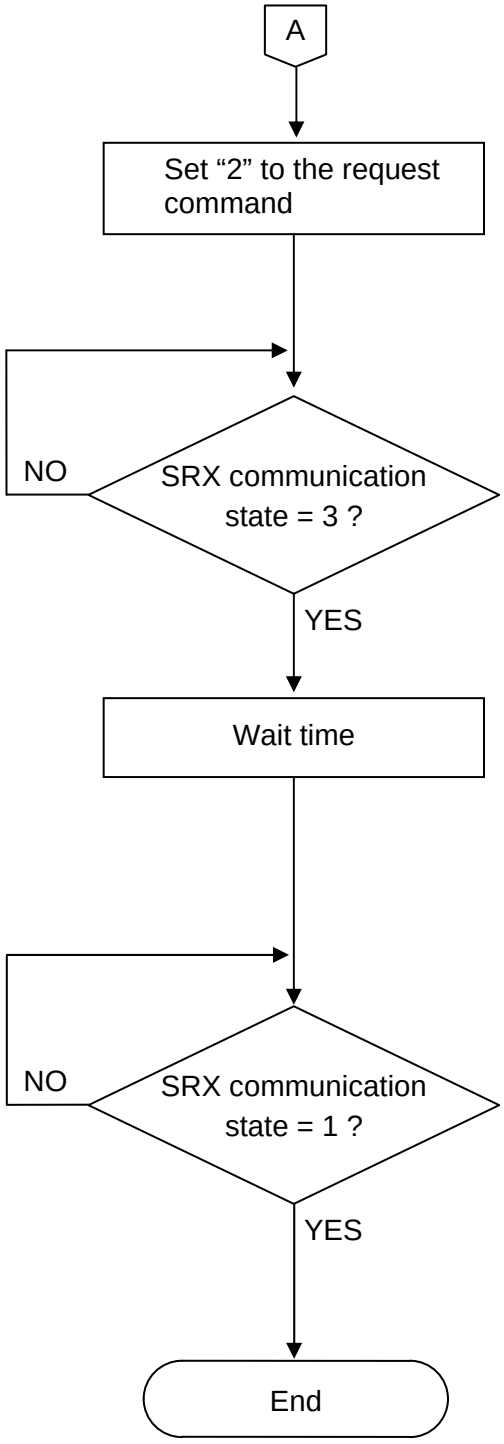


[Confirmation of setting data]

When 2 (Set value monitor) is set to request command in PLC register, the SRX starts writing the data set to the PLC side.

Relevant data: Data whose register addresses are from “Program operation mode” to “Program operation start mode” on the PLC communication data map.

If 3 (Set data write) is set to SRX communication state in the PLC register, this indicates that SRX data items are being written into the PLC.

Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

Waiting time [for 38400 bps]: 2 to 4 seconds

Changes depending on the maximum number of PLC communication channels and PLC response time.

If the SRX communication state in the PLC register is set to 1 (Data write into monitor), this indicates that data write to the PLC terminates to return to the monitored state (Request command: 0).

■ Data processing precautions

- The data type is treated as binary data with a sign and without a decimal point. For this reason, carefully express and set the data. (excluding the TIO state, time signal output state, integral time and derivative time)

  [Example] Setting of proportional band
  Initial value of internal data: 3.0
  Communication data: 30

- If the data range error occurs during data setting, “Setting error” (bit 7 in the TIO state 1) is set to ON in the channel where the error occurs. The SRX continues operation at the present set value without updating the data.

   Any attempt to write to an unused channel is not processed as an error.

- The autotuning (AT) function starts its execution with PID/AT transfer and the request command set to “1: AT operation” and “1: Setting,” respectively. After the autotuning function finishes its execution, PID/AT transfer returns to “0: PID control operation” and thus the PID constants are updated.

- Some communication data may become invalid depending on the module selection or the module configuration of the SRX. If any one of the conditions listed below occurs and data items written are within the setting range.

5.2.2 Specified data transfer type

This is the transfer type of specifying data address and the number of data points to be transferred. It is possible to transfer all of the data exchangeable via host communication (Modbus). Data corresponding to up to 16 words can be transferred.

As data addresses specified by "Start address," host communication (Modbus) register addresses are used.

For register address of host communication (Modbus), see as follows.
- **6.5.8 Data map of TIO module (P. 151)**
- **6.5.9 Data map of DI module (P. 180)**
- **6.5.10 Data map of DO module (P. 183)**

■ Control word 1 (request command)

Data transfer between the PLC and SRX when of the specified data transfer type is made by "Control word 1 (request command)." Only when "Control word 1 (request command)" is set to "1: Setting" or "2: Monitor," data transfer is made.

Relevant data: Start address, Number of transfer words, Control word 2 (SRX communication state) and Transfer data

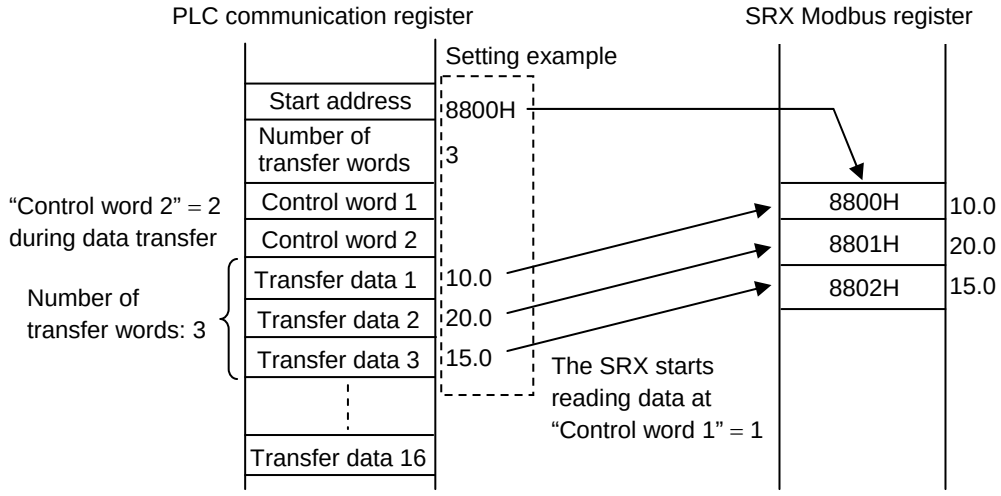
- **Control word 1 (request command) "1: Setting (PLC → SRX)"**

  Command requesting PLC data to be read to the SRX.

  1. Specifying the address of data to be transferred to "Start address" and sets the number of data words to "the number of transfer words." In addition, the data value is set to "Transfer data" in advance.

  2. If "Control word 1 (request command)" in the PLC register is set to "1: Setting," the SRX starts reading "Transfer data" set to the register (memory) on the PLC side by "the number of transfer words" specified to "Start address" on the SRX Modbus register addresses.
  The Control word 2 (SRX communication state) is set to "2: Set data read (PLC → SRX)" during data transfer.

  3. After data transfer is finished, "Control word 2 (SRX communication state)" returned to "1: No transfer operation." "Control word 1 (request command)" also returned to "0: No transfer operation."



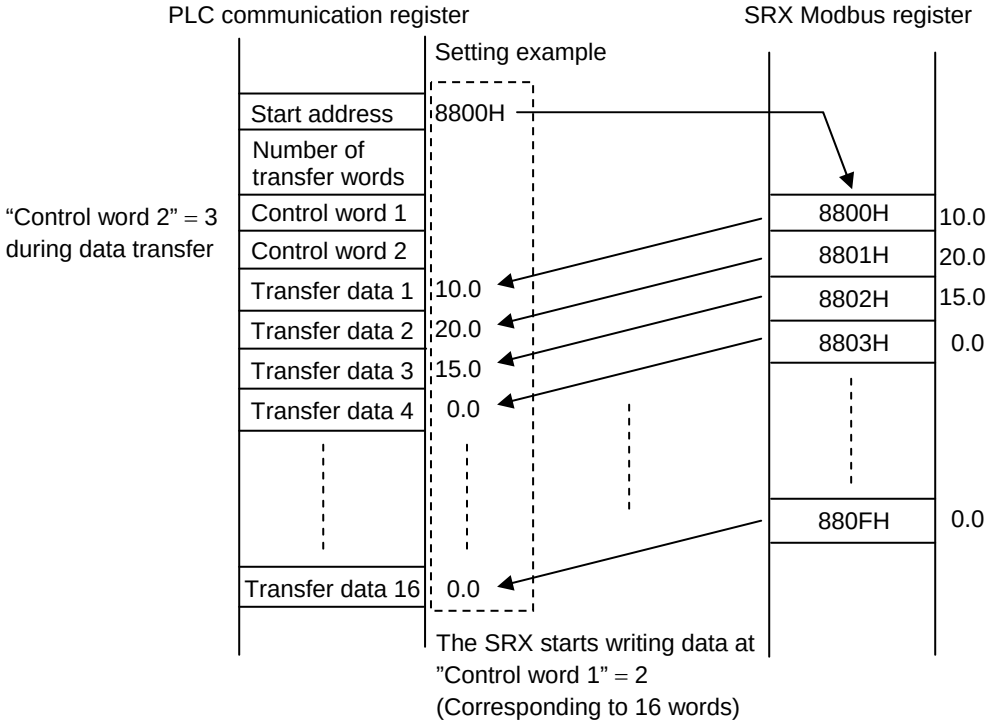
Conceptual diagram of setting (PLC → SRX)

- **Control word 1 (request command) "2: Monitor (PLC ← SRX)"**
  Command requesting the SRX data to be written to the PLC.

  1. Specifying the address of data to be transferred to "Start address."

  2. If "Control word 1 (request command)" in the PLC register is set to "2: Monitor," the SRX starts writing data corresponding to 16 words (corresponding to 16 register address) from "Start address" on Modbus register addresses to "Transfer data" in the register (memory) on the PLC side.
  The Control word 2 (SRX communication state) is set to "3: Set data write (PLC ← SRX)" during data transfer.

  3. After data transfer is finished, "Control word 2 (SRX communication state)" returned to "1: No transfer operation." "Control word 1 (request command)" also returned to "0: No transfer operation."



Conceptual diagram of monitor (PLC ← SRX)

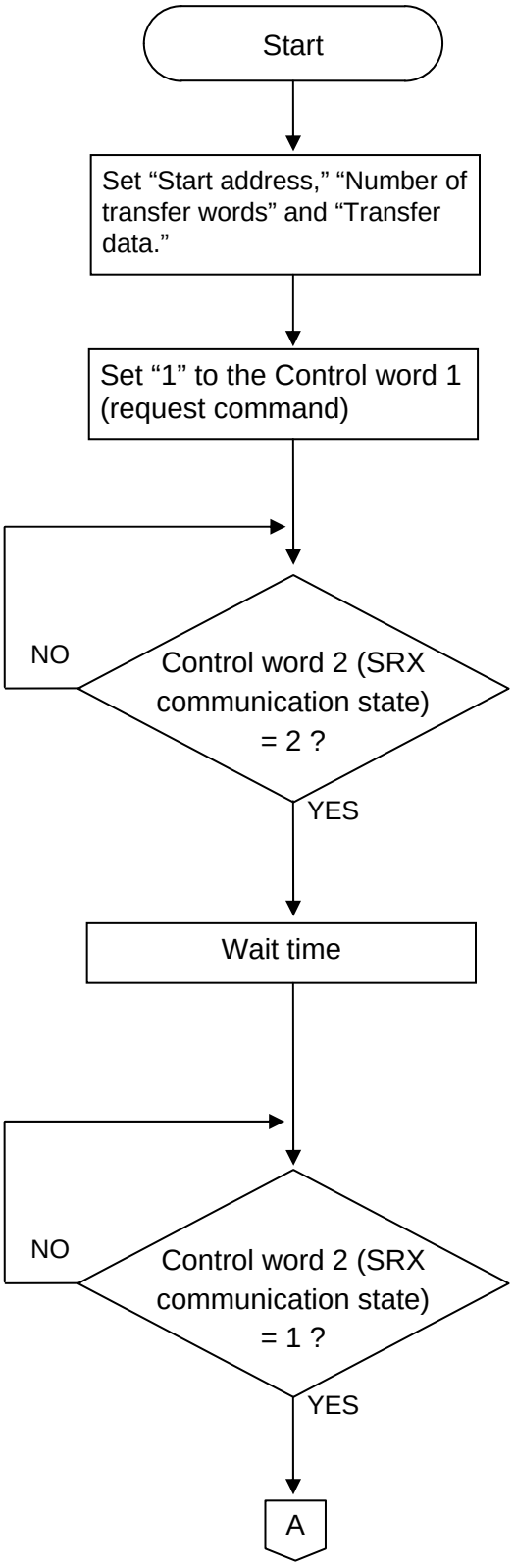
The setting of "Number of transfer words" is valid only when "Control word 1 (request command)" is set to "1: Setting." If "Control word 1 (request command)" is set to "2: Monitor," data corresponding to 16 words is always transferred.

Data in unused or inexistent registers may be transferred depending on the value in "Start address." Transfer data in that case becomes "0."

If data for each unit is set by using "Control word 1 (request command)," that data is not stored. However in this case, turning off the power once and then turning it on again can return to the value before its change. Set data for each unit via host communication.

■ Data transfer procedures

● Data setting (When transmit data from PLC to SRX)



[Data setting]
If “Control word 1 (request command)” in the PLC register is set to 1 (Setting), the SRX starts reading “Transfer data” set to the register (memory) on the PLC side by “the number of transfer words” specified to “Start address” on the SRX Modbus register addresses.

If “Control word 2 (SRX communication state)” in the PLC register is set to 2 (Setting read), this indicates that the SRX is reading “Transfer data” on the PLC side.

Reserve data read time as wait time. In addition, process data in each item as indefinite during this period.
Waiting time [for 38400 bps]: About 3 seconds

If “Control word 2 (SRX communication state)” in the PLC register is set to 1 (No transfer operation), this indicates that “Transfer data” read is finished.

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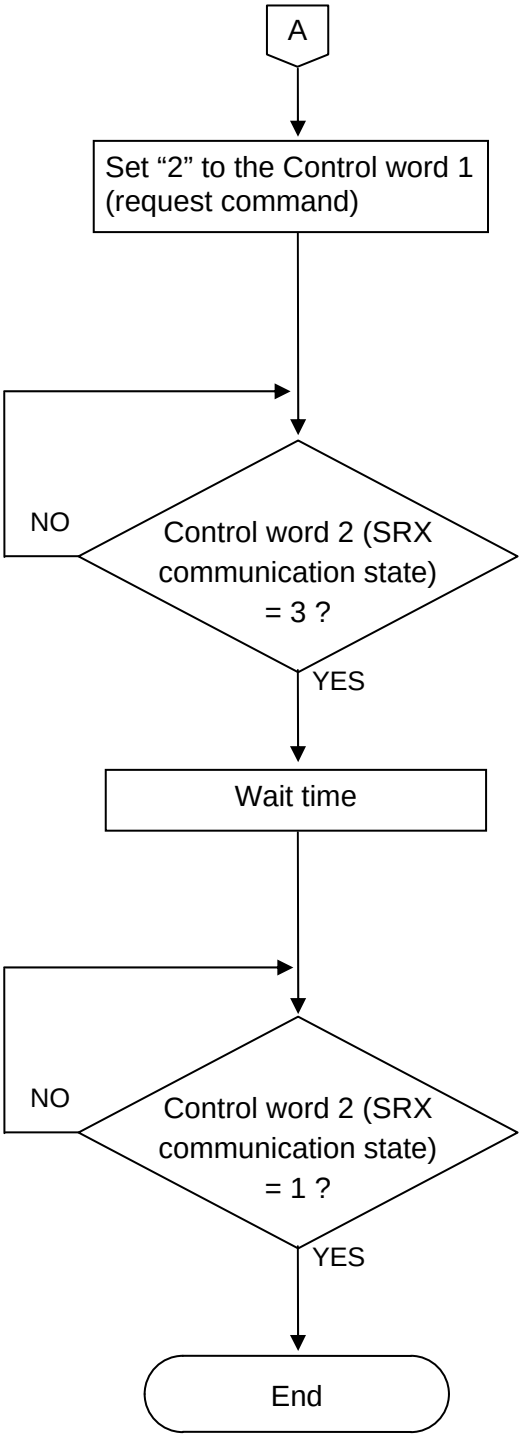

[Confirmation of setting data]
In order for the SRX to check “Transfer data” read from the PLC, if “Control word 1 (request command)” in the PLC register is set to “2: Monitor,” the SRX starts writing data corresponding to 16 words (corresponding to 16 register address) from “Start address” on Modbus register addresses to “Transfer data” in the register (memory) on the PLC side.

If “Control word 2 (SRX communication state)” in the PLC register is set to 3 (setting write), this indicates that data corresponding to 16 words (corresponding to 16 register address) is being written to “Transfer data” of the PLC from “Start address” of the SRX.

Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

Waiting time [for 38400 bps]: About 2 seconds

If “Control word 2 (SRX communication state)” in the PLC register is set to 1 (No transfer operation), this indicates that data write to “Transfer data” of the PLC is finished.

5.3 PLC Communication Data Map

The PLC communication data map summarizes data addresses, channels and names which enable PLC communication.

■ Reference to data map

(1) (2) (3) (4) (5) (6)

Name	Register address	Structure	Attribute	Data range	Factory set value
Request command	D01000	U	R/W	0: Monitor 1: Setting 2: Set value monitor	—
SRX communication state	D01001	U	RO	0: Unused 1: Data write into monitor 2: Set data read 3: Set data write	—

(1) Name: Name of communication data

(2) Register address: A register address of communication data in PLC communication

Register addresses in this manual are those assigned when the PLC communication environment is set as follows.

- Maximum number of PLC communication channels: 10
- Register start number: 1000
- Register type (D, R, W): 0 (D register)
  Set only when the PLC is MITSUBISHI MELSEC series

📖 Setting of "Maximum number of PLC communication channels" and "Register start number" changes an assignment of a register address.

Name	Register address	
Request command	D01000	← Register start number
SRX communication state	D01001	
⋮	⋮	
Measured value (PV)	D01030 to D01039	← Measured value (PV) CH1 to CH10
Set value monitor	D01040 to D01049	← Set value monitor CH1 to CH10
Heat-side manipulated output value	D01050 to D01059	← Heat-side manipulated output value CH1 to CH10

☞ For the PLC communication environment setting, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

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(3) Structure: C: Data for each channel
M: Data for each module
U: Data for each unit

(4) Attribute: RO: Only reading data is possible.
(SRX → PLC)
R/W: Reading and writing data is possible.
(SRX ↔ PLC)

(5) Data range: Read or write range of communication data

(6) Factory set value: Factory set value of communication data

■ Data map list

Name	Register address	Structure	Attribute	Data range	Factory set value
Request command [1]	D01000	U	R/W	0: Monitor (PLC ← SRX) 1: Setting (PLC → SRX) 2: Set value monitor (PLC ← SRX)	0
SRX communication state	D01001	U	RO	0: Unused 1: Data write into monitor During monitor data of attribute RO is written to PLC 2: Set data read During setting data of attribute R/W is read from PLC 3: Set data write During setting data of attribute R/W is written to PLC	—
SRX normal communication flag [2]	D01002	U	RO	0/1 transfer (For communication checking) "0" and "1" are repeated for each communication period.	—
—	D01003	—	—	Do not use this register address as it is used for the internal processing.	—
—	D01004	—	—		—

[1] 0: Monitor (PLC ← SRX)
Command which requests the SRX to write data to the PLC side. The SRX always repeats data writing until "1: Setting" or "2: Set value monitor" is set to the Request command. The SRX communication state 1 is set to "1: Data write into monitor" during data transfer.

1: Setting (PLC → SRX)
Command which requests the SRX to read data from the PLC side. Just when "1: Setting" is set to the Request command, the SRX starts reading the data from the PLC side. The SRX communication state 1 is set to "2: Set data read" during data transfer. After the data is transferred, the Request command and SRX communication state 1 returns to "0: Monitor" and "1: Writing on monitor data," respectively.

2: Set value monitor (PLC ← SRX)
Command which requests the SRX to write data to the PLC side. Just when "2: Set value monitor" is set to the Request command, the SRX starts writing the data to the PLC side. The SRX communication state 1 is set to "3: Set data write" during data transfer. After the data is transferred, the Request command and SRX communication state 1 returns to "0: Monitor" and "1: Writing on monitor data," respectively.

☞ For details, see **5.2.1 Fixed data transfer type (P. 53)**.

[2] The SRX re-writes this area alternately in order of 0→1→0 for each communication period. It is possible to judge that the SRX does not communicate any more by periodically monitoring this area using the PLC program.

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Name	Register address	Structure	Attribute	Data range	Factory set value
PLC communication error code [1]	D01005	U	RO	Bit data b0: PLC register read/write error b1: Slave communication timeout Data 0: OFF 1: ON [Decimal number: 0 to 3]	—
Unit recognition flag [2]	D01006	U	RO	Bit data b0: SRX unit 1 b1: SRX unit 2 b2: SRX unit 3 b3: SRX unit 4 Data 0: No unit exists 1: Unit exists [Decimal number: 0 to 15]	—

[1] b0: PLC register read/write error

To be turned on when data read and write cannot be made to/from the PLC register.
The PLC communication environment setting enables the PLC register read/write error to be eliminated.

☞ For the PLC communication environment setting, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

b1: Slave communication timeout

If communication with slave units during communication with the PLC is timed up with SRX units multi-drop connected, this register bit of the master unit is turned on.
(Cannot be checked by the PLC as communication with slave units is cut off.)

[Slave unit operation]

Stops data send to the PLC and set to the standby state. In addition, re-starts communication if data send from the master unit starts again.

[Master unit operation]

Send data to the slave unit again

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

Bit image: 00

bit 1 bit 0

[2] The master unit (unit address: 0, 4, 8 or C) can recognize all of the units but the slave unit can only recognize its own unit.

📖 Unit recognition state is assigned as a bit image in binary numbers.

Bit image: 0000

bit 3 ····· bit 0

☞ For unit address, see **4.3 Unit Address Setting (P. 23)**.

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Name	Register address	Structure	Attribute	Data range	Factory set value
Maximum number of PLC communication channels [1]	D01007	U	RO	1 to 60 CH/unit	—
Number of connected TIO modules	D01008	U	RO	1 to 30 modules Number of TIO module constituting a SRX unit	—
Number of connected TIO channels	D01009	U	RO	1 to 60 CH Number of temperature control channel of a SRX unit	—
Start address [2]	D01010	U	R/W	Register address range of host communication (Modbus) Transfer data start address of specified data transfer type	0
Number of transfer words [2]	D01011	U	R/W	1 to 16 words 0: No transfer operation Number of transfer data words of specified data transfer type	0

[1] Set it by PLC communication environment setting.

☞ For the PLC communication environment setting, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

[2] Used for specified data transfer type.

☞ For register address of host communication (Modbus), see as follows.
- **6.5.8 Data map of TIO module (P. 151)**
- **6.5.9 Data map of DI module (P. 180)**
- **6.5.10 Data map of DO module (P. 183)**

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Name	Register address	Structure	Attribute	Data range	Factory set value
Control word 1 (request command) [1, 2]	D01012	U	R/W	0: No transfer operation 1: Setting (PLC → SRX) 2: Monitor (PLC ← SRX) Request command of specified data transfer type	0
Control word 2 (SRX communication state) [1]	D01013	U	RO	0: Unused 1: No transfer operation 2: Reading out setting data During data is read from PLC 3: Writing on setting data During data is written to PLC SRX communication state of specified data transfer type	—
Transfer data [1]	D01014 to D01029	U	R/W	Data range specified by start address Data written or read by specified data transfer type	0
Measured value (PV)	D01030 to D01039	C	RO	Input scale low limit to Input scale high limit	—
Set value monitor	D01040 to D01049	C	RO	Input scale low limit to Input scale high limit	—
Manipulated output value	D01050 to D01059	C	RO	–5.0 to +105.0 %	—
CT input measured value	D01060 to D01069	C	RO	CT type and data range CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A This item is current transformer (CT) input value to use by a heater break alarm (HBA) function.	—

[1] Used for specified data transfer type.

[2] 1: Setting (PLC → SRX)
Command requesting PLC data to be read to the SRX.

If data for each unit is set, that data is not stored. However in this case, turning off the power once and then turning it on again can return to the value before its change.

For details, see **5.2.2 Specified data transfer type (P. 58)**.

2: Monitor (PLC ← SRX)
Command requesting the SRX data to be written to the PLC.

For details, see **5.2.2 Specified data transfer type (P. 58)**.

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Name	Register address	Structure	Attribute	Data range	Factory set value
TIO state 1 *	D01070 to D01079	C	RO	Bit data b0: Burnout b1: Event 1 state b2: Event 2 state b3: Heater break alarm (HBA) state b4: Control loop break alarm (LBA) state b5: Unused b6: Unused b7: Setting error b8: Module error b9: Error code Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

* A Module error and Error code are data of every module. Only channel 1 of each module is valid.

b0: Burnout
Become ON in input break.

b1, b2: 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.

b3: 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.

b4: 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.

b5 to b6: Unused

b7: Setting error
To be turned on when the setting of the relevant channel exceeds the data range.

b8: Module error
To be turned on when no communication with the relevant module (channel) can be conducted (no response).

b9: Error code
To be turned on when the value becomes more than 1 as any error occurs in the host communication error code (see P. 116 or P. 151).

TIO state 1 is assigned as a bit image in binary numbers.

Bit image: 0000000000

bit 9 ····· bit 0

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Name	Register address	Struc-ture	Attri-bute	Data range	Factory set value
TIO state 2 *	D01080 to D01089	C	RO	Bit data b0: End state b1: Pattern end output state b2: Wait state b3: PID/AT state 0: PID control 1: AT state b4 to b6: Level number (level PID) Level 1: b4: 0, b5: 0, b6: 0 Level 2: b4: 1, b5: 0, b6: 0 Level 3: b4: 0, b5: 1, b6: 0 Level 4: b4: 1, b5: 1, b6: 0 Level 5: b4: 0, b5: 0, b6: 1 Level 6: b4: 1, b5: 0, b6: 1 Level 7: b4: 0, b5: 1, b6: 1 Level 8: b4: 1, b5: 1, b6: 1 b7: Hold state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

* b0: End state
The state at the end of program operation is monitored.
It is turned on at the end of program operation. The state of being turned on is kept until the program is executed again.

b1: Pattern end output state
The pattern end output state output at the end of program operation is monitored.
It is turned on at the end of program operation. Time to be turned on can be set by setting the pattern end output time.

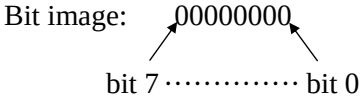
b2: Wait state
Program operation is turned on in the wait state.

b3: PID/AT state
Monitor a control state.
Set to 0 during PID control or 1 during autotuning (AT) execution.

b4 to b6: Level number (level PID)
The level PID function enables monitoring the present set value (SV) level. The bit ON/OFF status now set represents the corresponding level number (from 1 to 8).

b7: Hold state
The hold state of program operation is monitored.
Turned on when program operation is in the temporary stop state (hold state).

TIO state 2 is assigned as a bit image in binary numbers.



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Name	Register address	Structure	Attribute	Data range	Factory set value
Execution pattern (monitor)	D01090 to D01099	C	RO	1 to 16 The pattern number during program operation	—
Execution segment	D01100 to D01109	C	RO	1 to 16 The segment number during program operation	—
Segment remaining time [1]	D01110 to D01119	C	RO	0.00 to 300.00 seconds The segment remaining time of now under program execution	—
Time signal output state 1 [a]	D01120 to D01129	C	RO	Bit data b0: Time signal No. 1 b1: Time signal No. 2 b2: Time signal No. 3 b3: Time signal No. 4 b4: Time signal No. 5 b5: Time signal No. 6 b6: Time signal No. 7 b7: Time signal No. 8 Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
Time signal output state 2 [a]	D01130 to D01139	C	RO	Bit data b0: Time signal No. 9 b1: Time signal No. 10 b2: Time signal No. 11 b3: Time signal No. 12 b4: Time signal No. 13 b5: Time signal No. 14 b6: Time signal No. 15 b7: Time signal No. 16 Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

[1] Can also be changed to the following time unit via host communication.
0.0 to 3000.0 seconds
0 to 30000 seconds
0 to 30000 minutes
(Data range of shipment: 0.00 to 300.00 seconds)

[a] The time signal output state is expressed in bit data.

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

Bit image: 00000000

bit 7 ····· bit 0

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Name	Register address	Structure	Attribute	Data range	Factory set value
Program operation mode	D01140 to D01149	C	R/W	0: RESET (Reset mode) Stop program operation and return the segment number to No. 1. Turn off the time signal output and the end output. An event becomes OFF. A set value becomes 0. 1: RUN (Program control mode) Execute program control. 2: FIX (Fixed set point control mode) Execute fixed set point. 3: MAN (Manual control mode) Manual control can be performed.	2
Set value (SV)	D01150 to D01159	C	R/W	Input scale low limit to Input scale high limit	0
Proportional band	D01160 to D01169	C	R/W	TC/RTD input: 0 to Input span Voltage (V)/current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time [1]	D01170 to D01179	C	R/W	0.1 to 3600.0 seconds 0.01 to 360.00seconds	40.00
Derivative time [1]	D01180 to D01189	C	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
PV bias	D01190 to D01199	C	R/W	–Input span to +Input span	0
Event 1 set value [2]	D01200 to D01209	C	R/W	Deviation high/Deviation low: –Input span to +Input span Deviation high/low, Band: 0 to Input span Process high/Process low: Within input range	0
Event 2 set value [2]	D01210 to D01219	C	R/W		0

[1] The decimal point position can be changed via host communication.

[2] The event type can be changed via host communication.

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Name	Register address	Structure	Attribute	Data range	Factory set value
PID/AT transfer	D01220 to D01229	C	R/W	0: PID control 1: Autotuning (AT) When the autotuning is finished, the controller will automatically returns to "0: PID control operation."	0
Manual output value	D01230 to D01239	C	R/W	–5.0 to +105.0 % Output value at the manual control	0.0
Heater break alarm (HBA) set value [1]	D01240 to D01249	C	R/W	CT type and data range CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	0.0
Control RUN/STOP [2]	D01250 to D01259	M	R/W	0: STOP 1: RUN	0
Execution pattern [3]	D01260 to D01269	C	R/W	1 to 16 The pattern number setting of program operation	1
Hold state [4]	D01270 to D01279	C	R/W	0: Hold state OFF 1: Hold state ON The program stops its progress temporarily.	0

[1]
- Set the HBA set value to approximately 85% of the maximum reading of the CT input.
- Set the HBA set value to a slightly smaller value to prevent a false alarm if the power supply may become unstable.
- When more than one heater is connected in parallel, it may be necessary to increase the HBA setting value to detect a single heater failure.


Heater break alarm function cannot be used with voltage/current output.

[2] Control RUN/STOP is data of every module. Only channel 1 of each module is valid.
In this table, 10 channels are used. If there are two temperature control channels per module, then the Control RUN/STOP is valid only for the following register address (5 pcs.).
- Control RUN/STOP: D01250, D01252, D01254, D01256, D01258

[3] Only when the program operation mode is set to RESET, the pattern number needing to be executed is set.

[4] The hold state is not released if set to any of other program operation modes (FIX or MAN).

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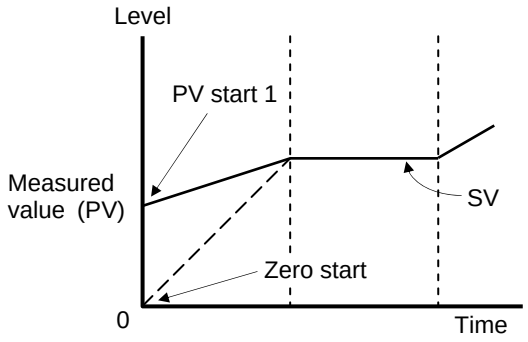
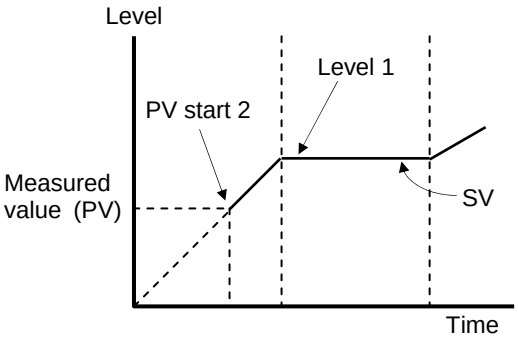
Name	Register address	Struc-ture	Attri-bute	Data range	Factory set value
Step action [1]	D01280 to D01289	C	R/W	0: Not step action 1: Step action execution The program progresses by one segment. One segment progresses by the setting per once.	0
Program operation start mode [2]	D01290 to D01299	C	R/W	0: Zero start 1: PV start 1 (Fixed time type) 2: PV start 2 (Time shortening type) This is a method of starting set value (SV) when the program starts.	0

[1] The step action cannot be used in the hold state.

[2] Started form the input range low limit for the voltage/current input.



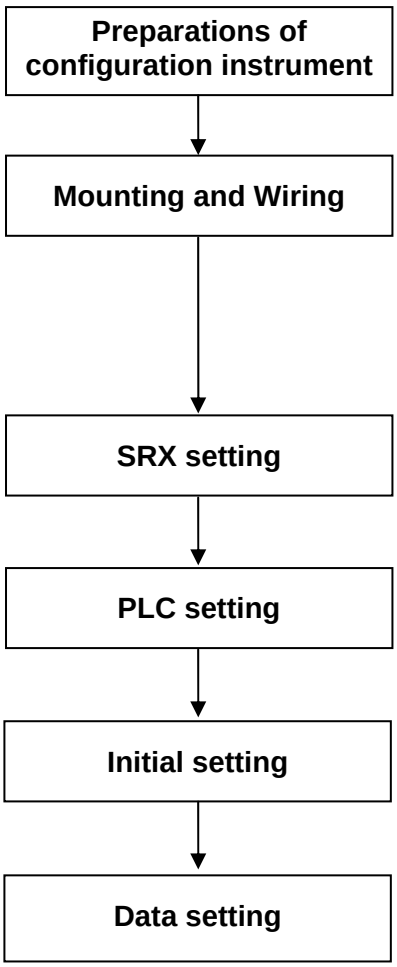


- At PV ≤ 0 °C:
  SV is started from 0 °C.
- At PV ≥ Level 1:
  SV is started from level 1.

5.4 Usage Example

In this Chapter, an example of data setting procedure is explained when the SRX is connected to a PLC of MITSUBISHI MELSEC series.

5.4.1 Handling procedures



☞ See **5.4.2 System configuration (P. 75)**.

☞
- See **5.4.3 Connection with PLC (P. 76)**.
- For mounting of SRX, see the instruction manual of each module.
- For mounting and wiring of PLC, see the instruction manual for the used PLC.

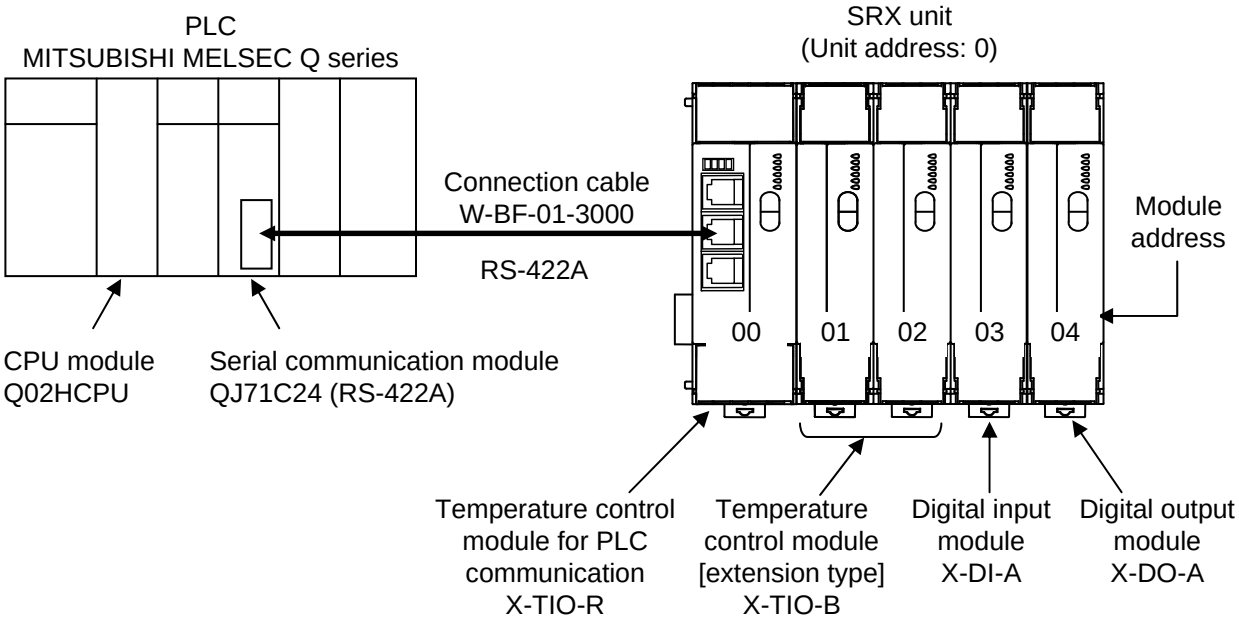
☞ See **5.4.4 SRX setting (P. 77)**.

☞ See **5.4.5 PLC setting (P. 85)**.

☞ See **5.4.6 Initial setting (P. 87)**.

☞ See **5.4.7 Data setting (P. 88)**.

5.4.2 System configuration



■ Use instruments

- **MITSUBISHI MELSEC Q series**

  CPU module Q02HCPU 1
  Serial communication module QJ71C24 (RS-422A).....1
  Power supply, I/O module, etc.

- **SRX unit**

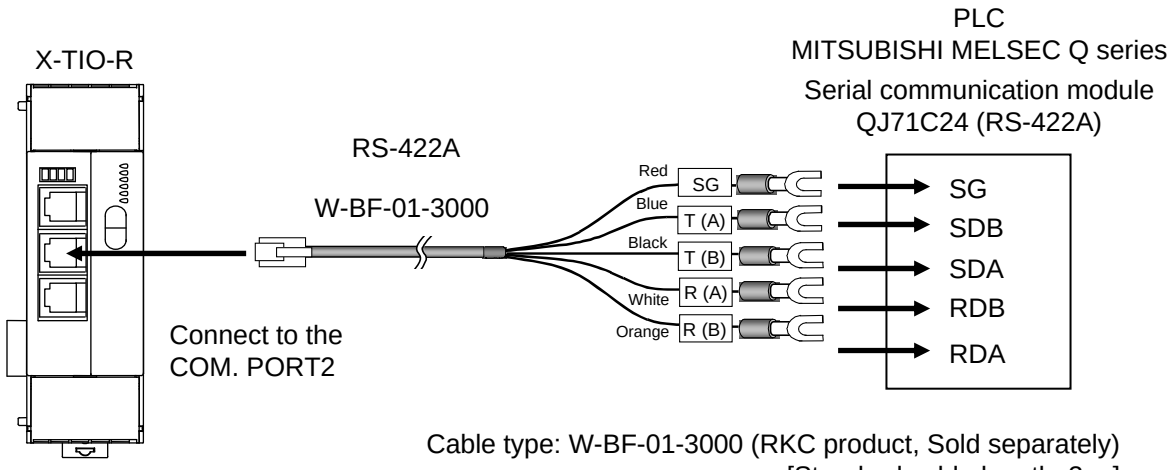
  Temperature control module for PLC communication X-TIO-R ...1
  Temperature control module [extension type] X-TIO-B 2
  Digital input module X-DI-A.....1
  Digital output module X-DO-A 1

- **Connection cable for connecting SRX unit and PLC**

  W-BF-01-3000 (RKC product, Sold separately) [Standard cable length: 3 m] 1

5.4.3 Connection with PLC

Connect X-TIO-R module and PLC (Serial communication module).
An assignment of a communication port is “COM. PORT1: Host communication 1, COM. PORT2/3: PLC communication.”
For the connection cable, use the W-BF-01-3000 (RKC product).



Cable type: W-BF-01-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

Shields of the connection cable (W-BF-01-3000) are connected to SG (No. 6 pin) of the COM. PORT2 connector of the X-TIO-R module.

For the communication port assignment, see ■ **PLC communication setting (P. 78)**.

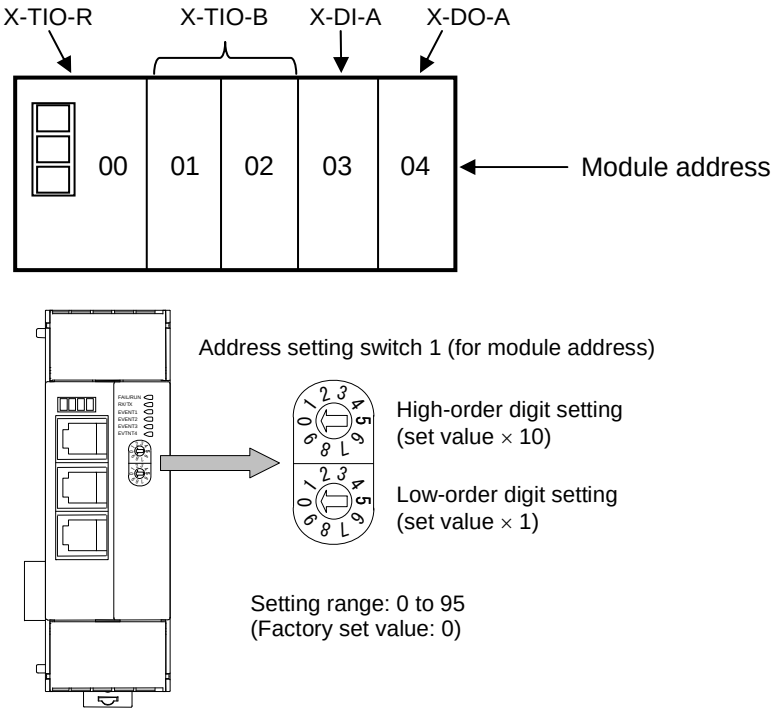
The details of the connectable connector for the PLC, see the instruction manual for the PLC being used.

When be prepared cable with a customer, see **5.1.2 Wiring (P. 36)**.

5.4.4 SRX setting

■ Module address setting

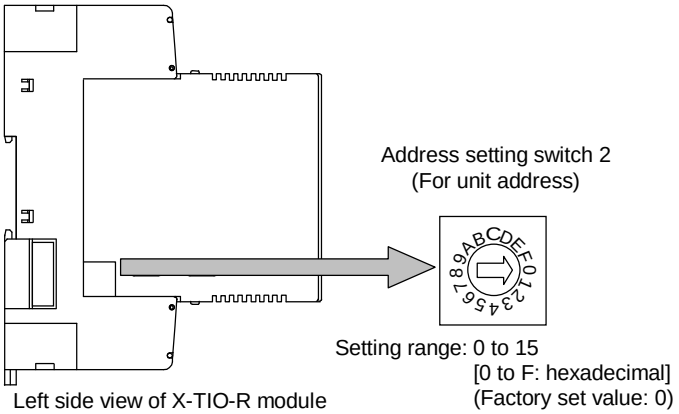
Set the module address by address setting switch 1 of front of module. For this setting, use a small blade screwdriver.
In this application, make the setting as follows.



The above figure is X-TIO-R module. The figure of other module is the same as a X-TIO-R module.

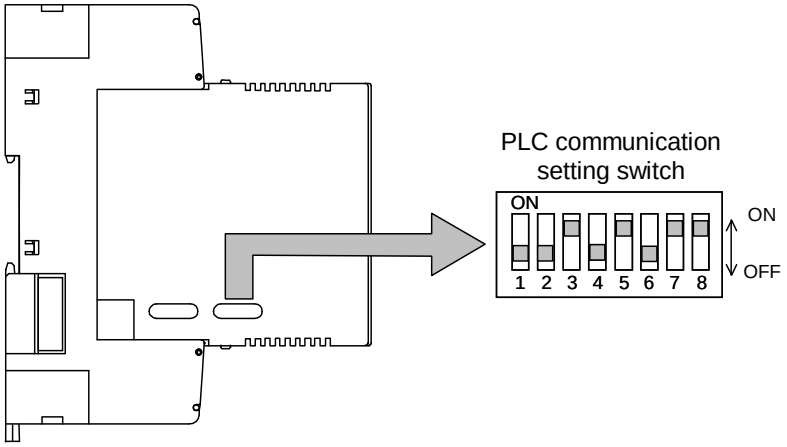
■ Unit address setting

Set the unit address by address setting switch 2 of left side of X-TIO-R module. For this setting, use a small blade screwdriver.
In this application, the unit address is assumed to be “0.”



■ PLC communication setting

The PLC communication setting switch on the left side of the X-TIO-R module enables the setting of communication speed, data bit configuration and protocol, and assign the communication port to the front of the X-TIO-R module.
In the usage example, set it as follows.



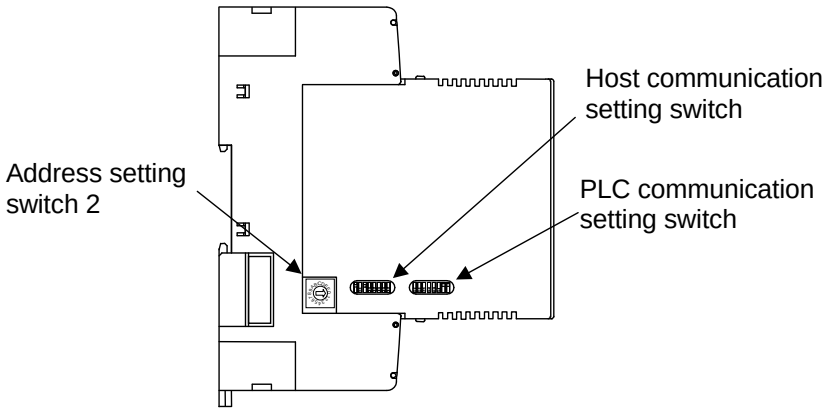
Left side view of X-TIO-R module

PLC communication setting switch		Setting contents
1	OFF	Data bit configuration
2	OFF	Data 8-bit, Without parity, Stop 1-bit
3	ON	Communication speed
4	OFF	19200 bps
5	ON	Protocol
6	OFF	MITSUBISHI MELSEC series special protocol
7	ON	AnA/AnUCPU common command (QR/QW)
8	ON	Communication port COM. PORT1: Host communication 1 [RS-232C/RS-422A] COM. PORT2/COM. PORT3: PLC communication [RS-422A]

☞ For details of setting, see **4.4 Communication Setting Switch (P. 24)**.

■ PLC communication environment setting

In this application, the PLC communication environment is set as follows by switch.
Address setting switch 2 and the host communication setting and PLC communication setting switches at the left side of the X-TIO-R module are used.



Left side view of X-TIO-R module

☞ For setting procedure, see ■ **Setting by the switch (P. 47)** of **5.1.3 PLC communication environment setting**.

● Setting items with the host communication setting switch

Switch No.	Setting items	Set value
1	Station number	0
2	PC number (CPU number)	255
3	Register start number	1000
4	Maximum number of PLC communication channels	10 CH
5	Register type (D, R, W)	D register
6	PLC scanning time setting	255 ms
7	X-TIO-R module Link recognition time	10 seconds
8	Unused (Do not set this one)	—

● Setting items with the PLC communication setting switch

Switch No.	Setting items	Set value
1	X-TIO-R module monitor item selection	B: Measured value (PV), Set value monitor, Control output value, CT input measured value, TIO state 1, TIO state 2
2 to 5	Unused (Do not set this one)	—
6	Action mode selection	1: Manual elimination
7, 8	Unused (Do not set this one)	—

■ PLC communication register address

The register address of each data in PLC communication becomes as follows with the register start number set to “1000,” the maximum number of PLC communication channels set to “10 CH” and the register type set to “D register” in PLC communication environment setting items.

Register address	Communication items	
D01000	Request command	
D01001	SRX communication state	
D01002	SRX normal communication flag	
D01003	Do not use this register address as it is used for the internal processing.	
D01004		
D01005	PLC communication error code	
D01006	Unit recognition flag	
D01007	Maximum number of PLC communication channels	
D01008	Number of connected TIO modules	
D01009	Number of connected TIO channels	
D01010	Top address	
D01011	Number of transfer words	
D01012	Control word 1 (request command)	
D01013	Control word 2 (SRX communication state)	
D01014 to D01029	Transfer data	
D01030 to D01039	Measured value (PV)	CH1 to CH10
D01040 to D01049	Set value monitor	CH1 to CH10
D01050 to D01059	Manipulated output value	CH1 to CH10
D01060 to D01069	CT input measured value	CH1 to CH10
D01070 to D01079	TIO state 1	CH1 to CH10
D01080 to D01089	TIO state 2	CH1 to CH10
D01090 to D01099	Execution pattern (monitor)	CH1 to CH10
D01100 to D01109	Execution segment	CH1 to CH10
D01110 to D01119	Segment remaining time	CH1 to CH10
D01120 to D01129	Time signal output state 1	CH1 to CH10
D01130 to D01139	Time signal output state 2	CH1 to CH10
D01140 to D01149	Program operation mode	CH1 to CH10
D01150 to D01159	Set value (SV)	CH1 to CH10
D01160 to D01169	Proportional band	CH1 to CH10
D01170 to D01179	Integral time	CH1 to CH10
D01180 to D01189	Derivative time	CH1 to CH10
D01190 to D01199	PV bias	CH1 to CH10
D01200 to D01209	Event 1 set value	CH1 to CH10
D01210 to D01219	Event 2 set value	CH1 to CH10
D01220 to D01229	PID/AT transfer	CH1 to CH10
D01230 to D01239	Manual output value	CH1 to CH10

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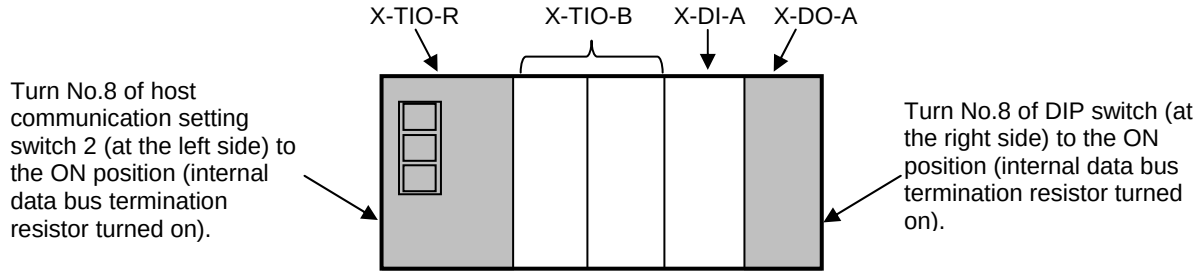
Register address	Communication items	
D01240 to D01249	Heater break alarm (HBA) set value	CH1 to CH10
D01250 to D01259	Control RUN/STOP	CH1 to CH10
D01260 to D01269	Execution pattern	CH1 to CH10
D01270 to D01279	Hold state	CH1 to CH10
D01280 to D01289	Step action	CH1 to CH10
D01290 to D01299	Program operation start mode	CH1 to CH10

■ Internal data bus termination resistor setting

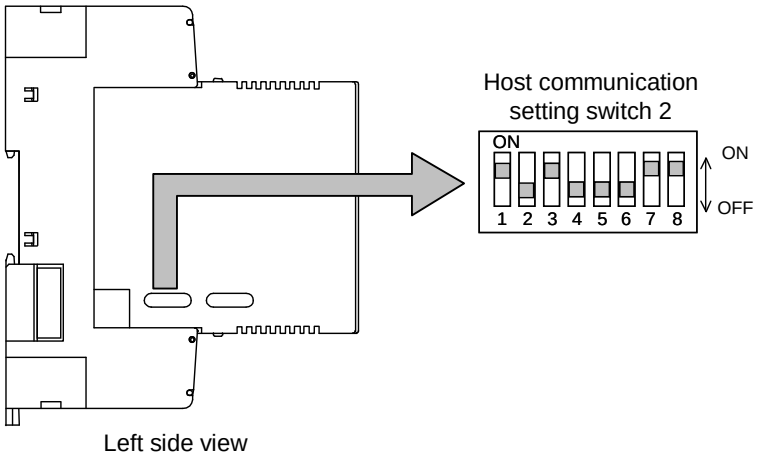
Set the internal data bus termination resistor in module of both ends of a SRX unit.
When in the following unit configuration, turn on each of the internal data bus termination resistors in the X-TIO-R and X-DO-A modules.



● X-TIO-R module setting

Turn on No. 8 of the Host communication setting switch 2 (the left side) and also turn on the internal data bus termination resistor.

Nos. 1 to 7 of the Host communication setting switch 2 are used to set the communication speed data bit configuration, and communication protocol of “Host communication 1” using the modular connector. However, as no host communication is used in this example, their factory set values remain unchanged.

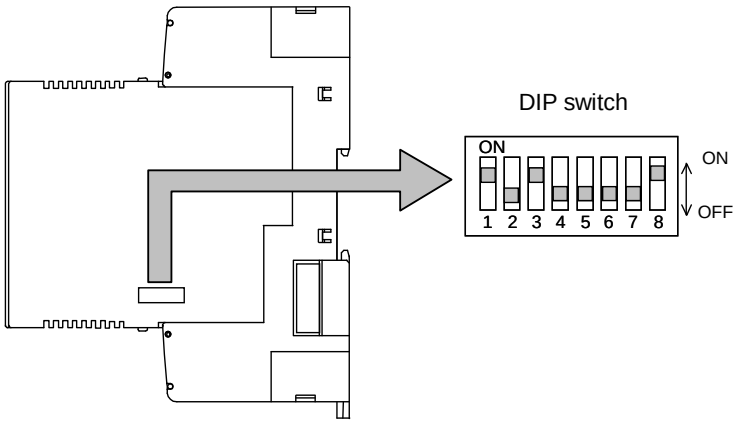


Host communication setting switch 2		Setting contents
1	ON	Communication speed: 9600 bps
2	OFF	
3	ON	Data bit configuration: Data 8-bit
4	OFF	Without parity
5	OFF	Stop 1-bit
6	OFF	Protocol: RKC communication
7	ON	ON fixed (Do not change this one)
8	ON	Internal data bus termination resistor setting: Termination resistor ON

- **X-DO-A module setting**

Turn on No. 8 of the DIP switch (the right side) and also turn on the internal data bus termination resistor.

DIP switch Nos. 1 to 7 set prior to factory set value remain unchanged.



Right side view

DIP switch		Setting contents
1	ON	Communication speed: 9600 bps
2	OFF	
3	ON	Data bit configuration: Data 8-bit
4	OFF	Without parity
5	OFF	Stop 1-bit
6	OFF	Protocol: RKC communication
7	OFF	OFF fixed (Do not change this one)
8	ON	Internal data bus termination resistor setting: Termination resistor ON

- **Other setting**

[Host communication setting switch 1 of X-TIO-R module]

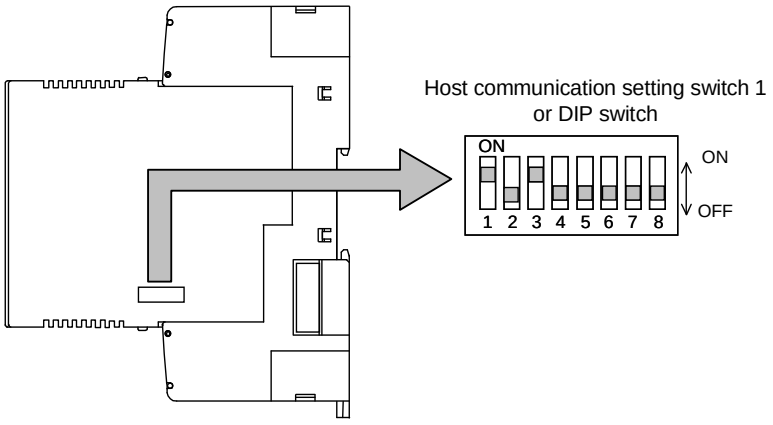
Turn off No. 8 of the Host communication setting switch 1 (the right side) and also turn off the internal data bus termination resistor.

Nos. 1 to 7 of the Host communication setting switch 1 are used to set the communication speed data bit configuration, and communication protocol of "Host communication using host communication terminals." However, as no host communication is used in this example, their factory set values remain unchanged.

[DIP switch of X-TIO-B module and X-DI-A module]

Turn on No. 8 of the DIP switch (the right side) and also turn on the internal data bus termination resistor.

DIP switch Nos. 1 to 7 set prior to factory set value remain unchanged.

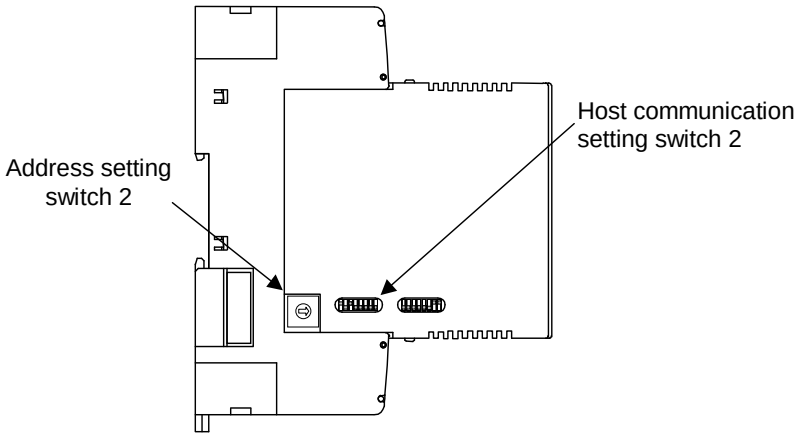


X-TIO-R/X-TIO-B/X-DI-A module
Right side view

DIP switch		Setting contents
1	ON	Communication speed: 9600 bps
2	OFF	
3	ON	Data bit configuration: Data 8-bit
4	OFF	Without parity
5	OFF	Stop 1-bit
6	OFF	Protocol: RKC communication
7	OFF	OFF fixed (Do not change this one)
8	OFF	Internal data bus termination resistor setting: Termination resistor OFF

■ Initializing internal communication

In this application, initialize internal communication by switch.
The X-TIO-R module recognizes each of the X-TIO-B, X-DI-A and X-DO-A modules connected by initializing internal communication.
Address setting switch 2 and the host communication setting switch 2 at the left side of the X-TIO-R module are used.



Left side view of X-TIO-R module

☞ For setting procedure, see **4.6 Initializing internal communication (P. 31)**.

5.4.5 PLC setting

Set the Serial communication module of MITSUBISHI MELSEC Q series as follows.

Setting item	Description
Operation setting	Independent
Data bit	8
Parity bit	NO
Even/odd parity	Odd
Stop bit	1
Sum check code	YES

Setting item	Description
Writing during RUN	Allowed
Setting modification	Allowed
Communication rate	19200 bps
Communication protocol	MC protocol, Format 4
Station number	0

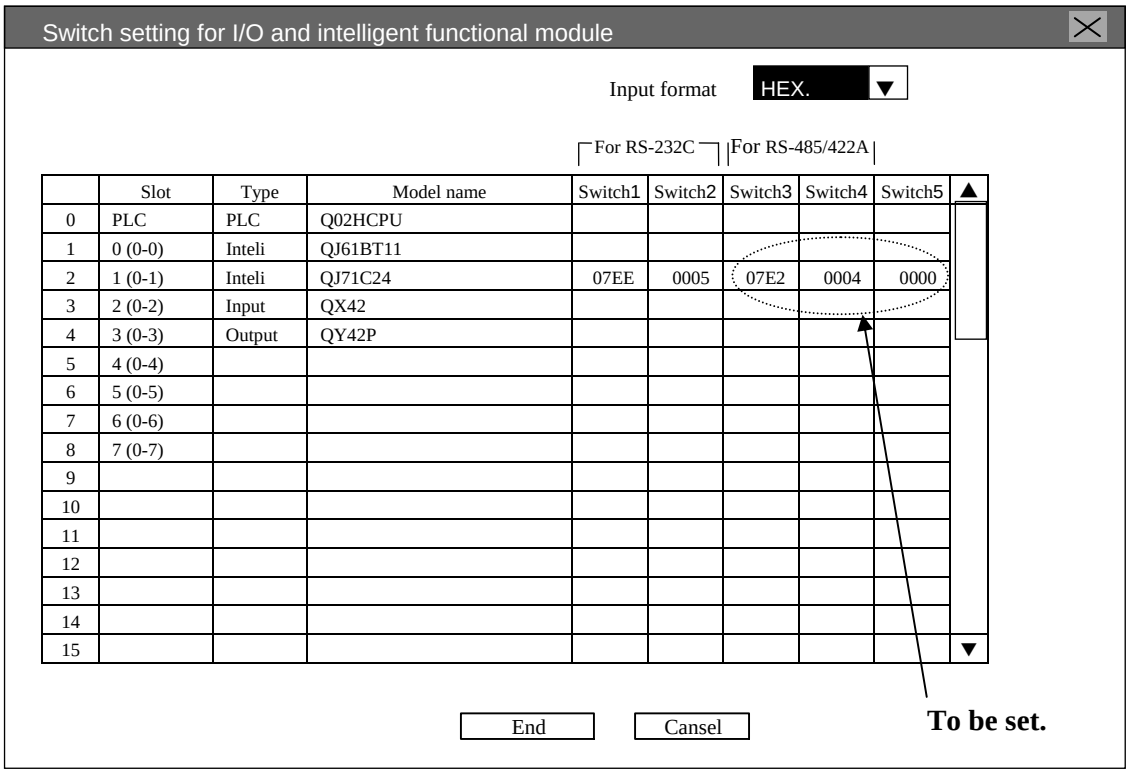
Setting in the serial communication module (QJ71C24) belonging to the MITSUBISHI MELSEC Q series do with the GX Developer of the MITSUBISHI MELSEC PLC programming software (SW□D5C-GPPW-E).
Setting set the following set value with switch setting for I/O and intelligent functional module.

Switch 3: **07E2** * Switch 4: **0004** * Switch 5: **0000** * * Hexadecimal

[Setting procedure]

[GX Developer] → [PLC parameters] → [I/O assignment setting] → **Switch setting**

[Setting screen]



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- **Description Switches 1 to 5**

Switch number	Description	
Switch 1	b15 to b8	b7 to b0
	CH1 Communication rate setting	CH1 Transmission setting
Switch 2	CH1 Communication protocol setting	
Switch 3	b15 to b8	b7 to b0
	CH2 Communication rate setting	CH2 Transmission setting
Switch 4	CH2 Communication protocol setting	
Switch 5	Station number setting	

Set the transmission specifications and communication protocol of each interface using the combinations of setting values for each switch with 16-bit binary data.

- **Setting on switch 3 (CH2 Transmission setting)**

Bit	Description	OFF (0)	ON (1)	Setting	Set value
b0	Operation setting *	Independent	Link	0	2
b1	Data bit	7	8	1	
b2	Parity bit	No	Yes	0	
b3	Even/Odd parity	Odd	Even	0	
b4	Stop bit	1	2	0	E
b5	Sum check code	No	Yes	1	
b6	Write during RUN	Prohibited	Allowed	1	
b7	Setting modifications	Prohibited	Allowed	1	

* Must be set to OFF (0) on CH1

- **Setting on switch 3 (CH2 Communication rate setting)**

Communication rate (Unit: bps)	Bit position b15 to b8	Communication rate (Unit: bps)	Bit position b15 to b8
300	00H	14400	06H
600	01H	19200	07H
1200	02H	28800	08H
2400	03H	38400	09H
4800	04H	57600	0AH
9600	05H	115200	0BH

Set 19200 bps on communication rate. (Set value: 07H)

- **Setting on switch 4 (CH2 Communication protocol setting)**

Set number	Description	
0H	GX Developer connection	
1H	MC protocol	Format 1
2H		Format 2
3H		Format 3
4H		Format 4
5H		Format 5

Set number	Description
6H	Non procedure protocol
7H	Bidirectional protocol
8H	For linked operation setting
9 to DH	Setting prohibited
EH	ROM/RAM/switch test
FH	Individual station loopback test

Set MC protocol Format 4 on communication protocol setting. (Set value: 4H)

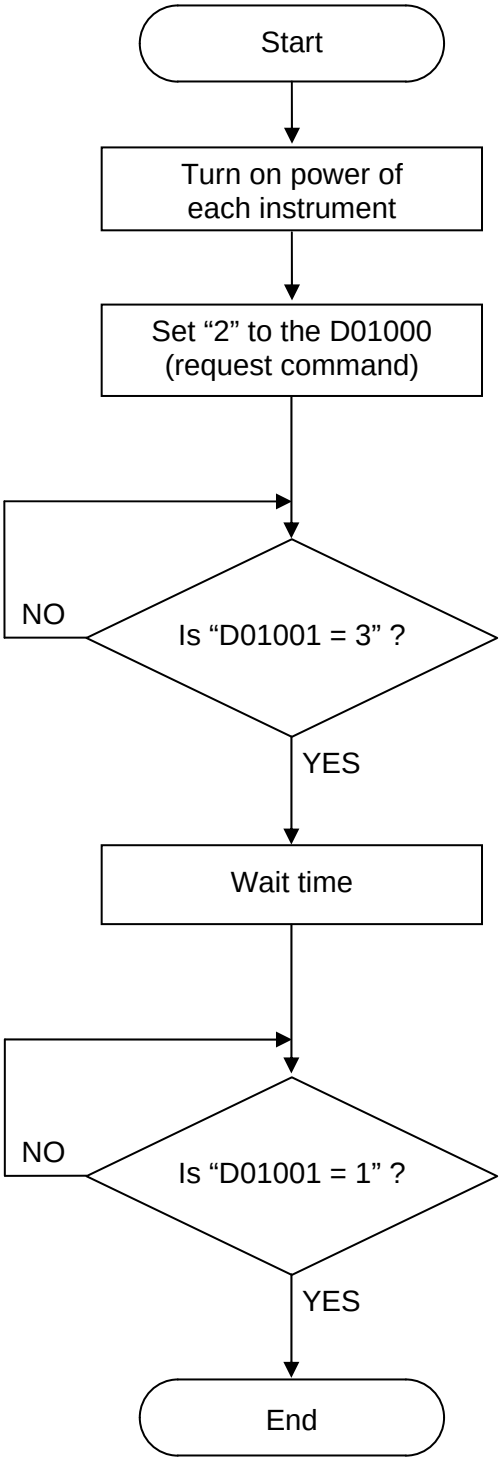
- **Setting on switch 5 (Station number setting)**

This setting is common for both CH1 and CH2 sides.
Set the station number to 0.

☞ The details of the switch setting for the PLC, see the instruction manual for the PLC being used.

5.4.6 Initial setting

Change each set value of SRX from the PLC after the initial settings are made.



When 2 (Set value monitor) is set to **D01000** (Request command), the SRX starts writing the data items such as temperature set value, etc. (attribute: R/W) to the PLC side.

If 3 (Set data write) is set to **D01001** (SRX communication state) in the PLC, this indicates that SRX data items such as temperature set value, etc. (attribute: R/W) are being written into the PLC.

Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

Writing time [for 38400 bps]: 2 to 4 seconds

If 1 (Data write into monitor) is set to **D01001** (SRX communication state) in the PLC, this indicates that SRX data items such as temperature set value, etc. (attribute: R/W) have been written to start writing SRX data items such as temperature measured values (PV), etc. (attribute: RO) into the PLC.

5.4.7 Data setting

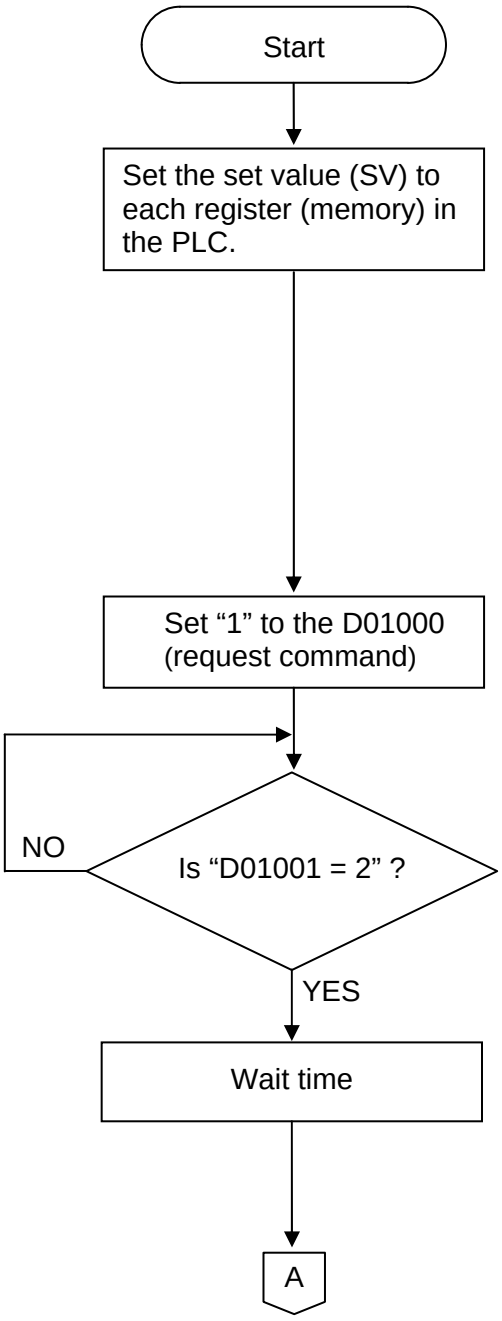
It is assumed that initial setting is finished.

If each set value of SRX is changed from the PLC without setting the initial values, it is re-written to 0 with each set value of the PLC at that time set to 0.

■ Setting example (fixed data transfer type)

When set the set value (SV) of SRX as follows:

Set value (SV) CH1=100 CH2=100 CH3=110 CH4=110 CH5=120
CH6=120 CH7=130 CH8=130 CH9=50 CH10=50



Register address of set value (SV) (see P. 89)

Register address	Communication item	Set value
D01030	Set value (SV) CH1	100
D01031	Set value (SV) CH2	100
D01032	Set value (SV) CH3	110
D01033	Set value (SV) CH4	110
D01034	Set value (SV) CH5	120
D01035	Set value (SV) CH6	120
D01036	Set value (SV) CH7	130
D01037	Set value (SV) CH8	130
D01038	Set value (SV) CH9	50
D01039	Set value (SV) CH10	50

[Data setting]
When 1 (Setting) is set to **D01000** (Request command), the SRX starts reading the set value (SV) data set to the register (memory) on the PLC side

If 2 (Set data read) is set to **D01001** (SRX communication state) in the PLC, this indicates that set values (SV) data are being read from the PLC.

Reserve data read time as wait time. In addition, process data in each item as indefinite during this period.
Readout time [for 38400 bps]: 3 to 7 seconds

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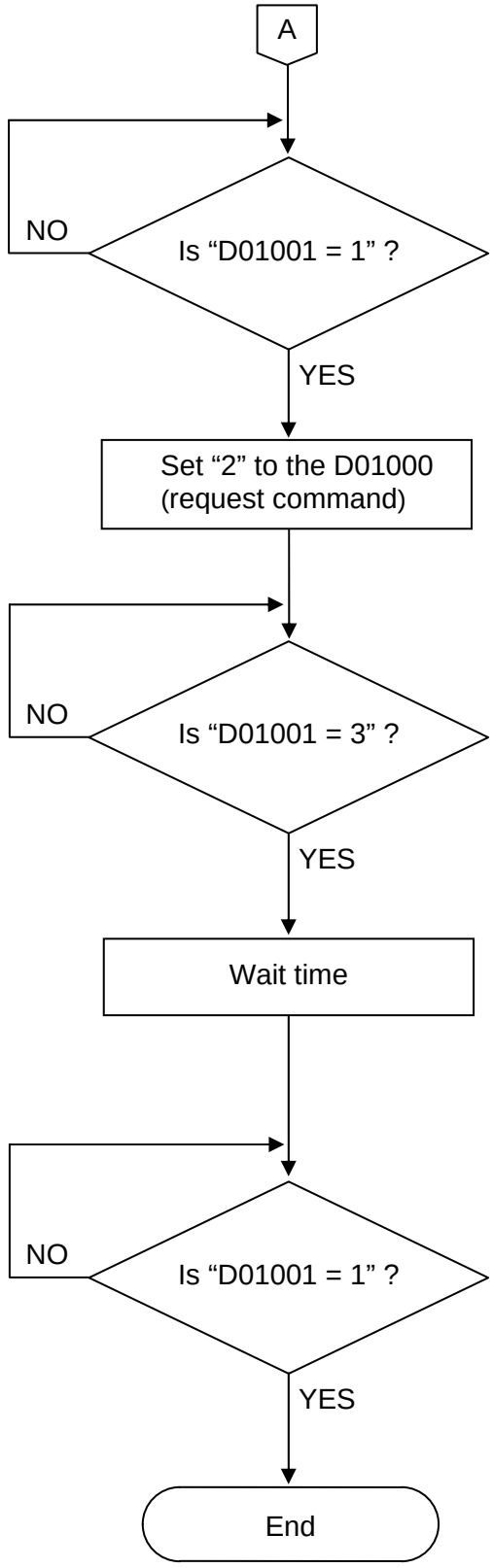


If 1 (Data write into monitor) is set to **D01001** (SRX communication state) in the PLC, this indicates that set value (SV) data have been read to start writing SRX data items such as measured values (PV) etc. (attribute: RO) into the PLC.

[Confirmation of setting data]

When 2 (Set value monitor) is set to **D01000** (Request command), the SRX starts writing the set value (SV) data set to the PLC side.

If 3 (Set data write) is set to **D01001** (SRX communication state) in the PLC, this indicates that SRX set value (SV) data are being written into the PLC.

Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

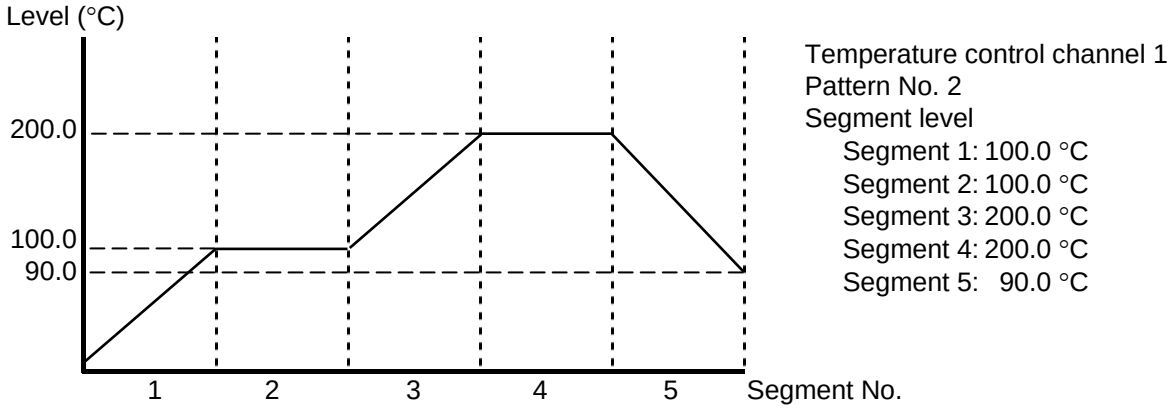
Writing time [for 38400 bps]: 2 to 4 seconds

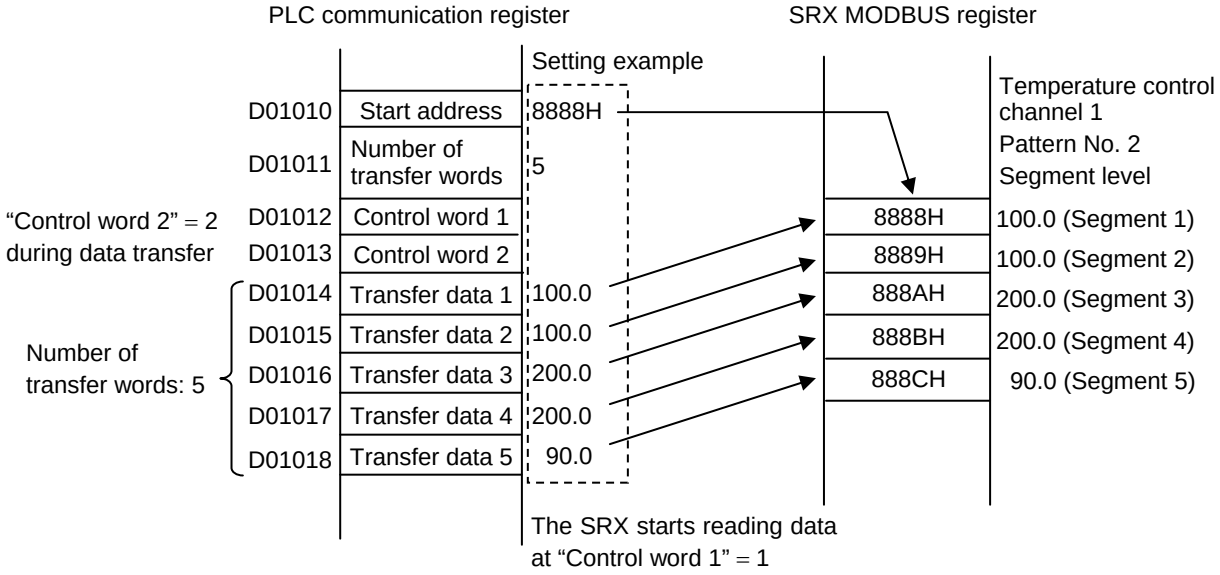
If 1 (Data write into monitor) is set to **D01001** (SRX communication state) in the PLC, this indicates that set values (SV) have been written to start writing SRX data items such as measured values (PV), etc. (attribute: RO) into the PLC.

■ Setting example (specified data transfer type)

● When setting the segment level of pattern No. 2 in the temperature control channel 1 (PLC → SRX)

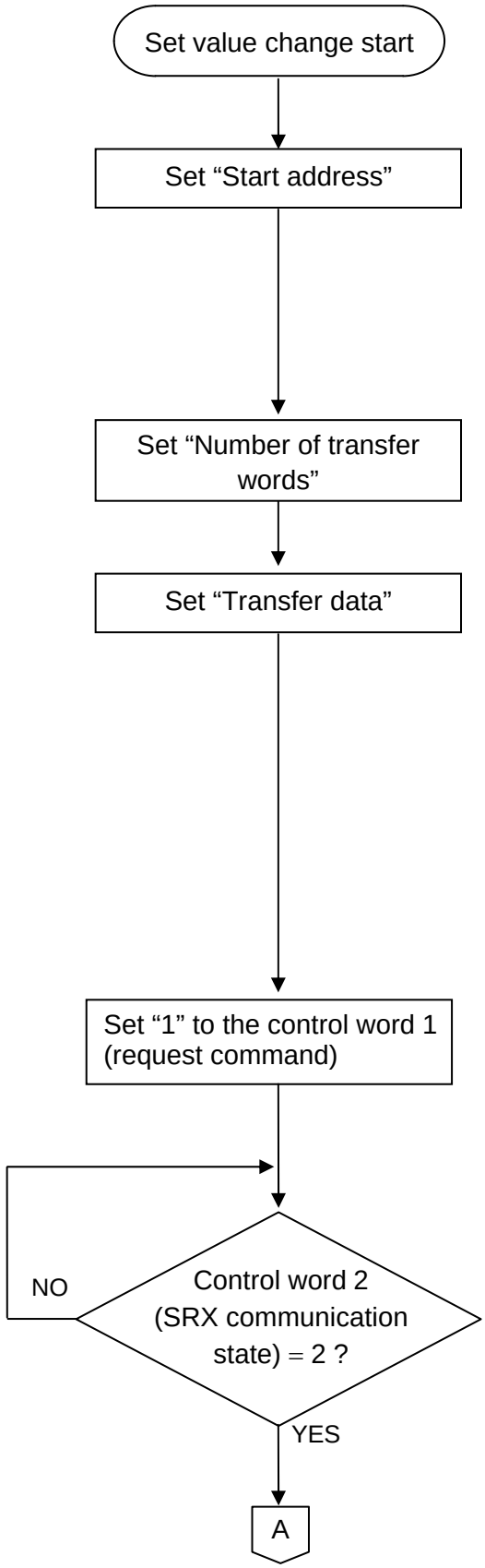
The following pattern is set as "Pattern No. 2 in the Temperature control channel 1."





The PLC communication register address in this example is in allocation when set as follows by the PLC communication environment setting.

- Register start number: 1000
- Register type: 0 (D register)



Set **D01010** (Start address) of the PLC to the Modbus register address **8888H (34952)** of “Temperature control channel 1 and Pattern No. 2 segment level 1.”

☞ See **6.5.8 Data map of TIO module ■Level PID and program control data ●Channel 1 data (P. 160)**

Set 5 to the **D01011** (Number of transfer words) in the PLC. As “Number of transfer words” is set to **5**, it is possible to transfer five “Transfer data” (five words).

Set **D01014 to D01018** (Transfer data) of the PLC to the desired segment level of each of segments 1 to 5.

Register address	Communication item	Set value
D01014	Segment level: Segment 1	100.0
D01015	Segment level: Segment 2	100.0
D01016	Segment level: Segment 3	200.0
D01017	Segment level: Segment 4	200.0
D01018	Segment level: Segment 5	90.0

If **D01012** (Control word 1) of the PLC is set to **1** (Setting), the SRX reads “Transfer data” set to **D01014 to D01018** of the PLC onto the SRX Modbus register addresses, **8888H (34952) to 888CH (34956)**.

If 2 (Reading out setting data) is set to **D01013** (Control word 2) in the PLC, this indicates that transfer data are being read from the PLC.

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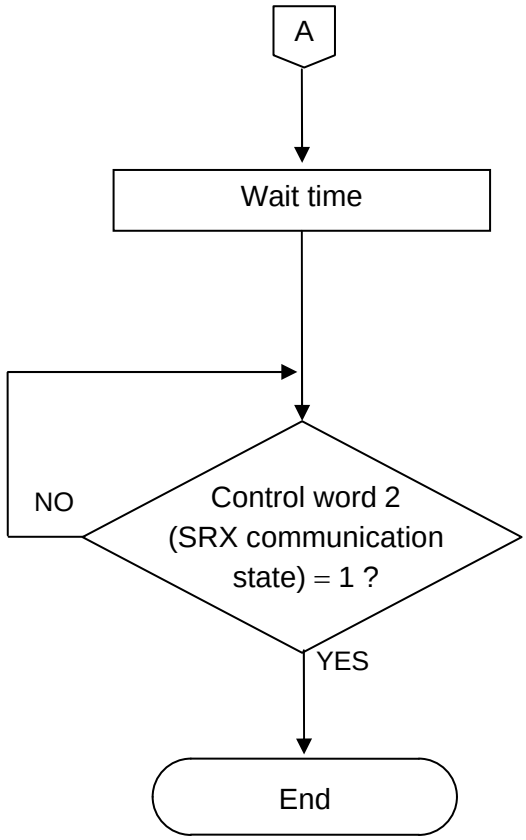
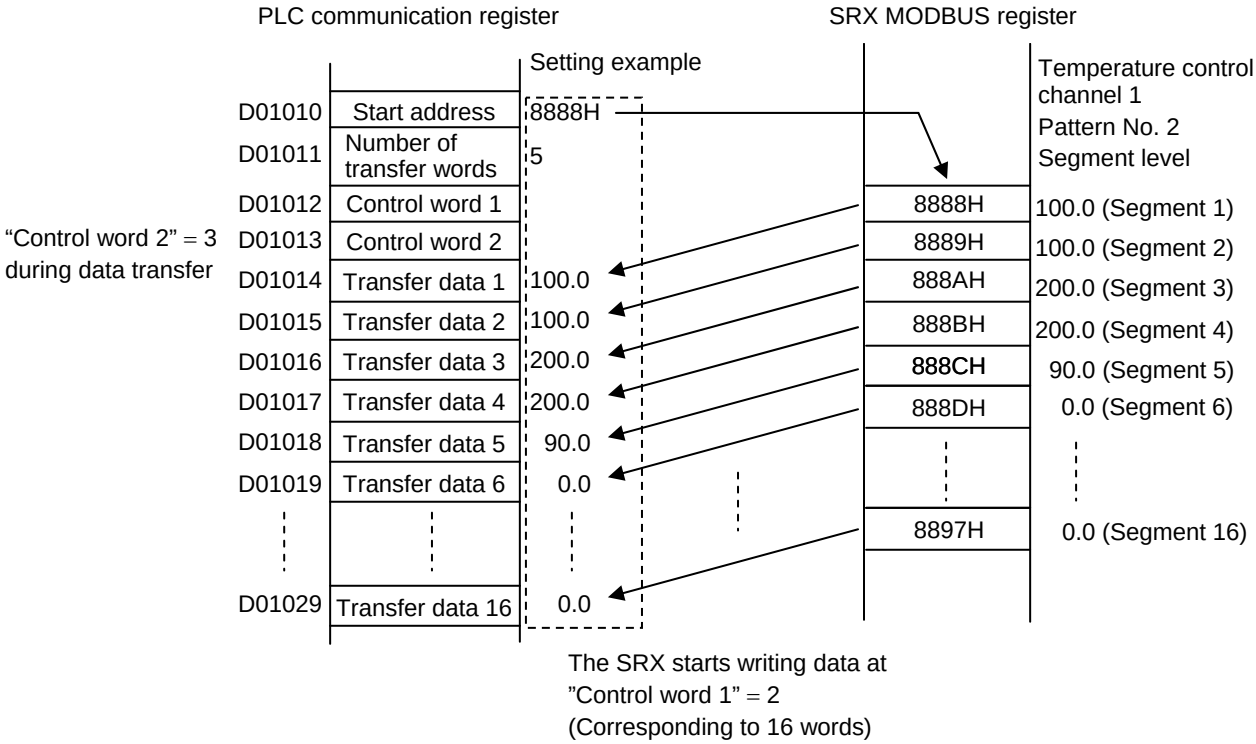


Reserve data read time as wait time. In addition, process data in each item as indefinite during this period.

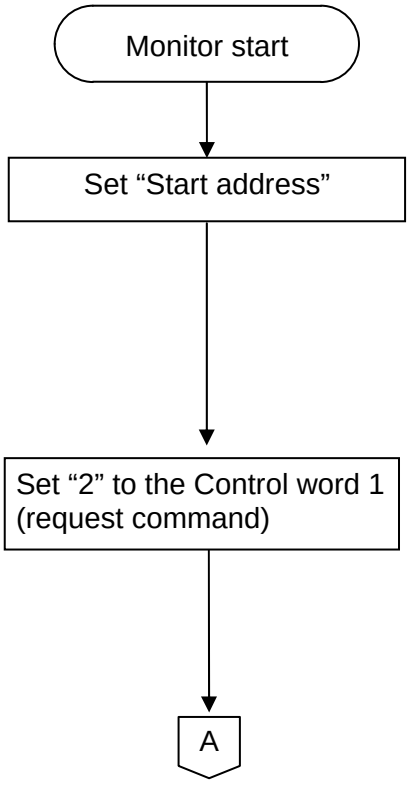
Readout time [for 38400 bps]: About 3 seconds

If **D01013** (Control word 2) in the PLC is set to 1 (No transfer operation), this indicates that "Transfer data" read is finished.
D01012 (control word 1) in the PLC also returned to "0: No transfer operation."

- **When monitoring the segment level of pattern No. 2 in the temperature control channel 1 (PLC ← SRX) (Data used is the same as that for "Setting")**



As segments from 6 to 16 are not used, a factory set value of "0.0" remains unchanged.



Set **D01010** (Start address) of the PLC to the Modbus register address **8888H (34952)** of "Temperature control channel 1 and Pattern No. 2 segment level 1."

☞ See **6.5.8 Data map of TIO module ■Level PID and program control data ●Channel 1 data (P. 160)**

If **D01012** (Control word 1) of the PLC is set to 2 (Monitor), the SRX starts writing "Transfer data" set on the Modbus register addresses, **8888H (34952) to 8897H (34967)** [16 words] to **D01014 to D01029** of the PLC.

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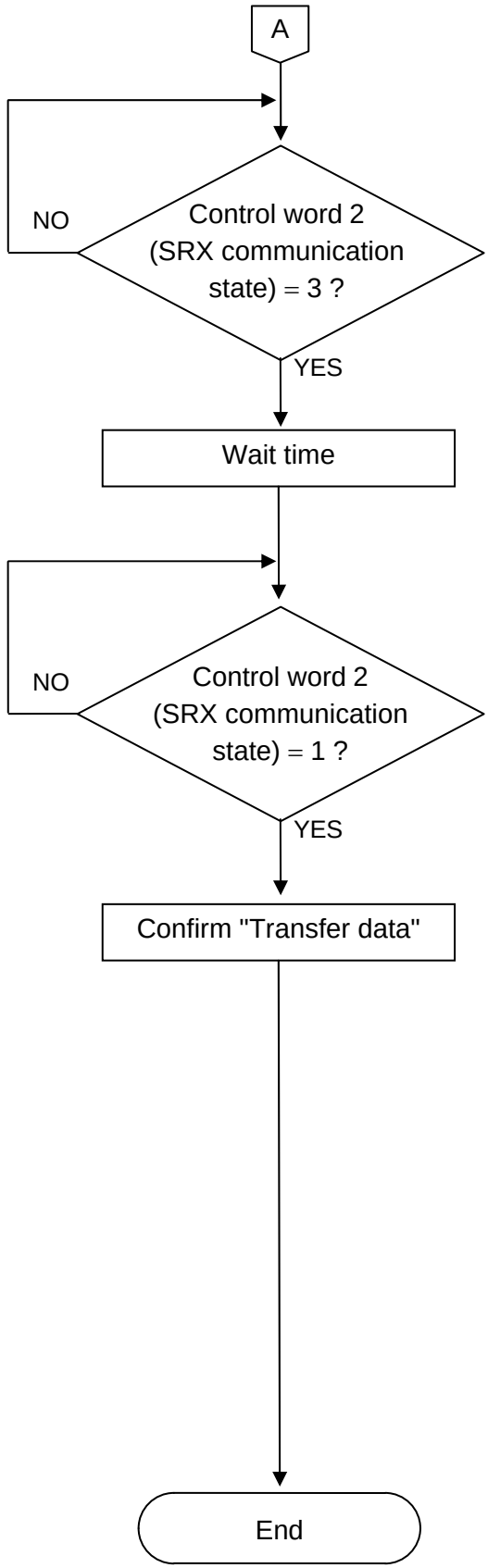


If **D01013** (Control word 2) in the PLC is set to 3 (Setting write), this indicates that data corresponding to 16 words (corresponding to 16 register address) is being written to "Transfer data" of the PLC from "Start address" of the SRX.

Reserve data write time as wait time. In addition, process data in each item as indefinite during this period.

Waiting time [for 38400 bps]: About 2 seconds

If **D01013** (Control word 2) in the PLC is set to 1 (No transfer operation), this indicates that "Transfer data" read is finished.
D01012 (Control word 1) in the PLC also returned to "0: No transfer operation."

Check the segment level of each of segments from 1 to 16 set to **D01014 to D01029** (Transfer data) of the PLC.
As segments from 6 to 16 are not used, a factory set value of "0.0" remains unchanged.

Register address	Communication item	Monitor value
D01014	Segment level: Segment 1	100.0
D01015	Segment level: Segment 2	100.0
D01016	Segment level: Segment 3	200.0
D01017	Segment level: Segment 4	200.0
D01018	Segment level: Segment 5	90.0
D01019	Segment level: Segment 6	0.0
⋮	⋮	⋮
D01029	Segment level: Segment 16	0.0

6. HOST COMMUNICATION

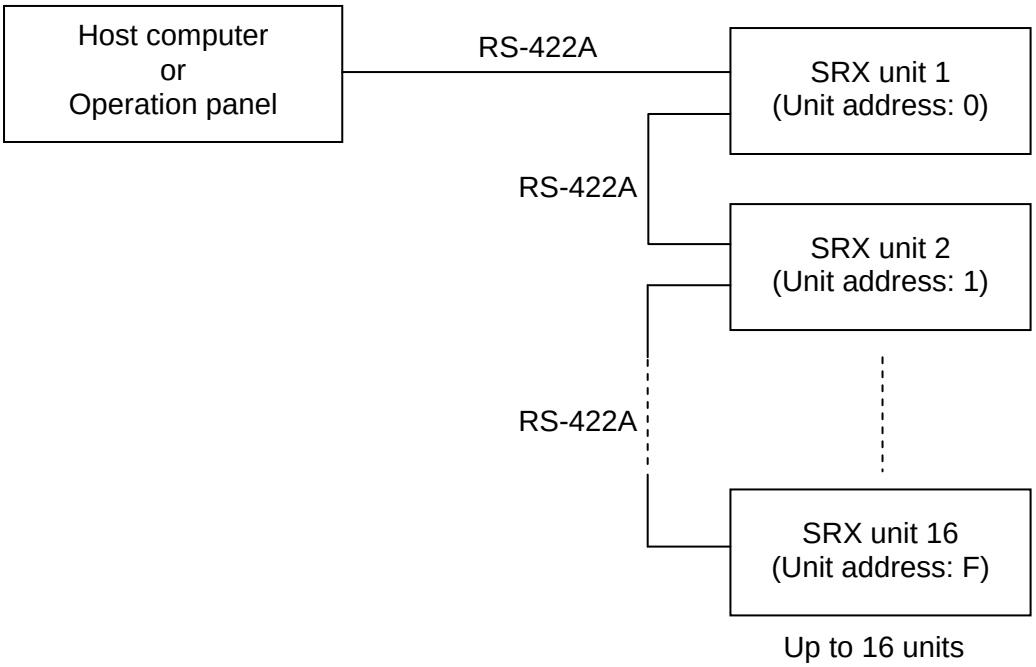
6.1 Outline

Three communication ports (COM. PORT1 to 3) of the X-TIO-R module can be selected from among the following four assignments. (The communication specification of COM. PORT2 is the same as that of COM. PORT3.)

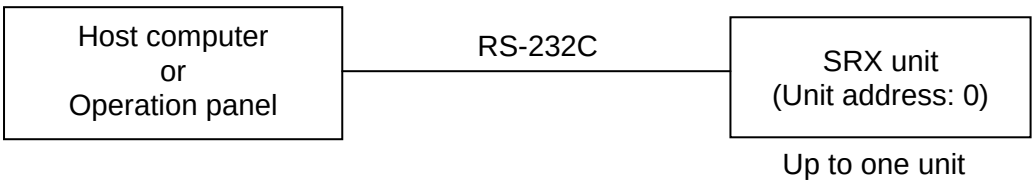
	Assignment 1	Assignment 2	Assignment 3	Assignment 4
COM. PORT1	Host communication 1	PLC communication	Host communication 1	Host communication 2
COM. PORT2/ COM. PORT3	PLC communication	Host communication 1	Host communication 2	Host communication 1

- Host communication 1 can be used in any communication port assignment. In addition, it is possible to use two host communication line.
- For COM. PORT1, either RS-422A or RS-232C can be selected when ordering. In addition, for COM. PORT2/COM. PORT3, only RS-422A is available.
- When COM. PORT2/COM. PORT3 is used, up to 16 SRX units can be multi-drop connected.

- **RS-422A**



- **RS-232C**



6.2 Wiring

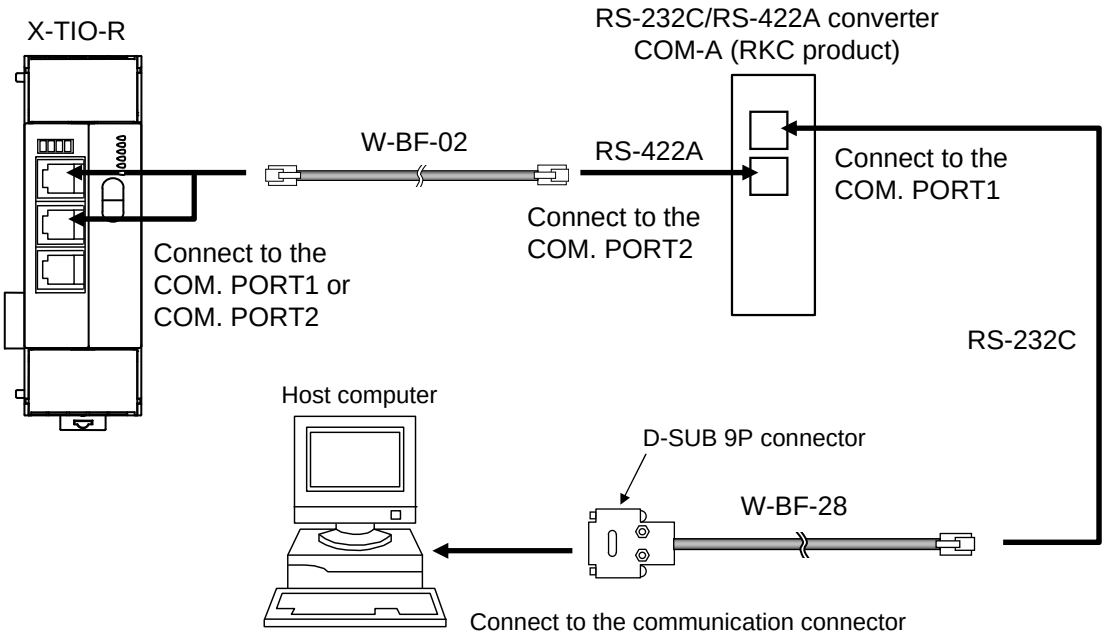
⚠ WARNING

To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

CAUTION

- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- When connecting or disconnecting the connectors, do not force it too far to right and left or up and down, but move it on the straight. Otherwise, the connector pins may be bent, causing instrument failure.
- When disconnecting a connector, hold it by the connector itself. Disconnecting connectors by yanking on their cables can cause breakdowns.
- To prevent malfunction, never touch the contact section of a connector with bare hands or with hands soiled with oil or the like.
- To prevent malfunction, connect cable connectors securely, then firmly tighten the connector fastening screws.
- To prevent damage to cables, do not bend cables over with excessive force.
- If the instrument is easily affected by noise, use the ferrite core in the both ends of the communication cable (nearest the connector).

■ RS-422A



Cable type: W-BF-02-3000 (RKC product, Sold separately) [Standard cable length: 3 m]
W-BF-28-3000 (RKC product, Sold separately) [Standard cable length: 3 m]

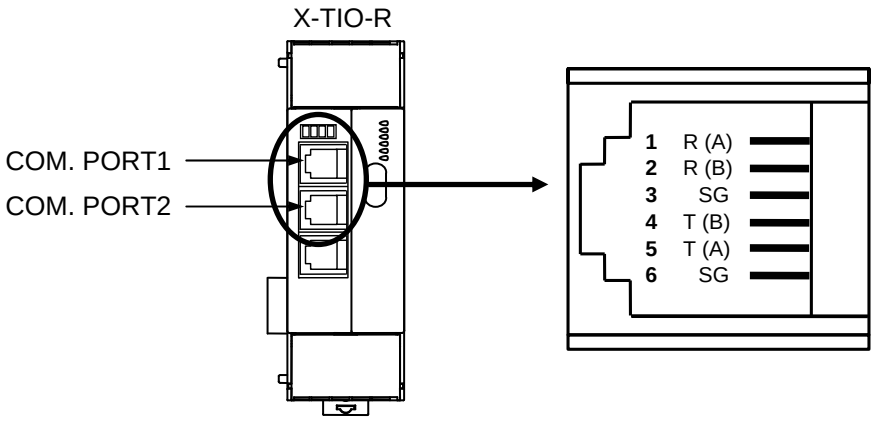
Connection cable W-BF-02 * and W-BF-28 (RKC product) can use to connect the host computer.

* Shields of the cable are connected to SG (No. 6 pin) of the X-TIO-R connector.

Recommended RS-232C/RS-422A converter: **COM-A** (RKC product)
For the COM-A, see **COM-A/COM-B Instruction Manual (IMSRM33-E□)**.

For the communication port assignment of the X-TIO-R module, see **4.1 Communication Port Assignments (P. 16)**.

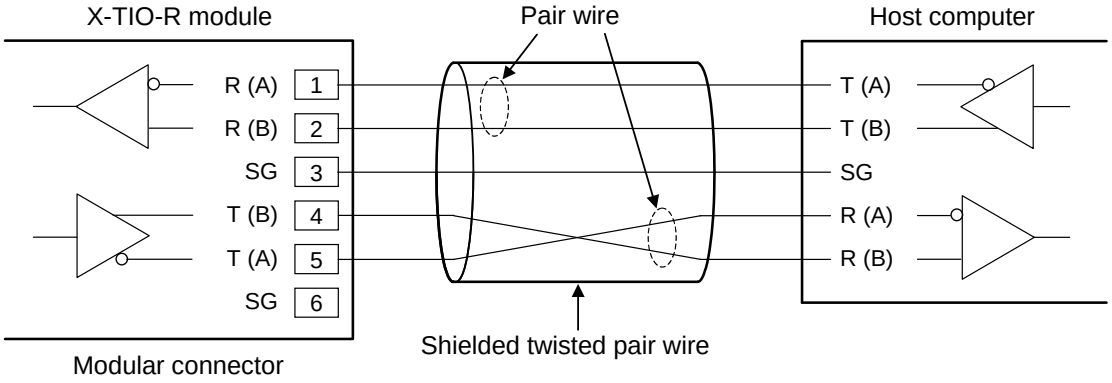
● Pin layout of modular connector



- **Connector pin number and signal details**

Pin No.	Signal name	Symbol
1	Receive data	R (A)
2	Receive data	R (B)
3	Signal ground	SG
4	Send data	T (B)
5	Send data	T (A)
6	Signal ground	SG

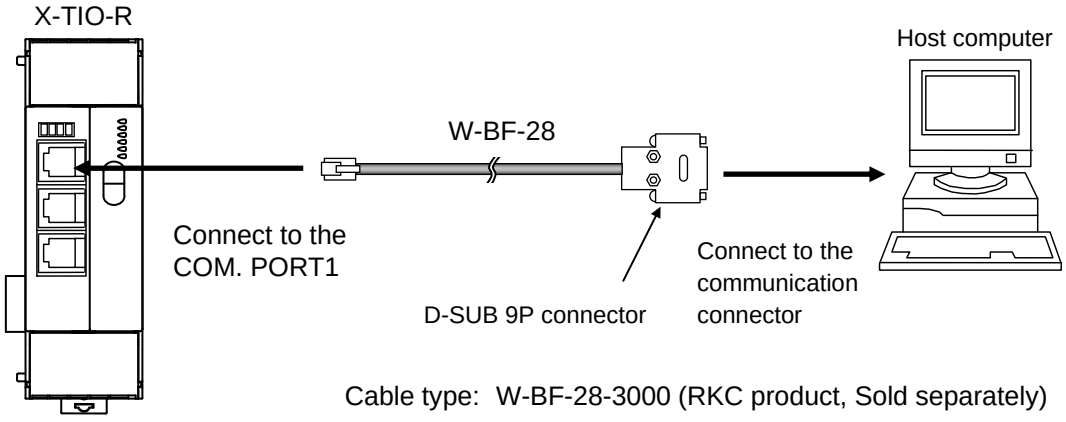
- **Diagram of RS-422A wiring**



The 6-pin type modular connector should be used for the connection to the X-TIO-R module. Recommended model: TM4P-66P (Manufactured by HIROSE ELECTRIC CO., LTD.,)

Customer is requested to prepare a communication cable fit for the control unit to be connected by the host computer.

■ RS-232C

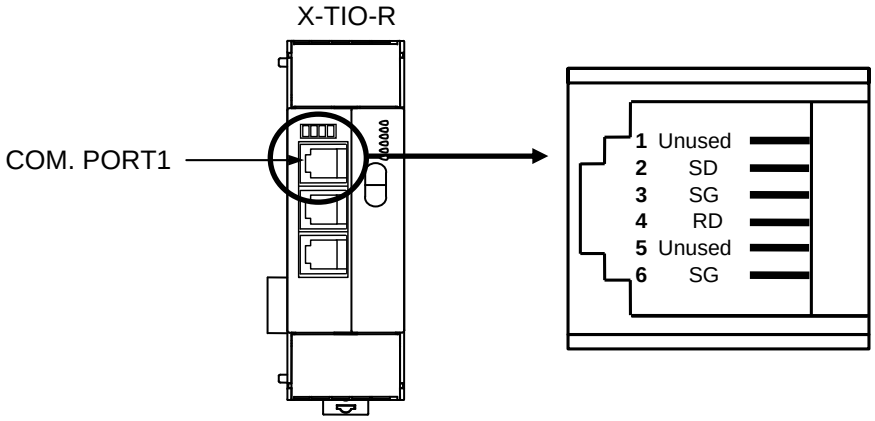


Cable type: W-BF-28-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

Connection cable W-BF-28 * (RKC product) can use to connect the host computer.
* Shields of the cable are connected to SG (No. 6 pin) of the X-TIO-R connector.

For the communication port assignment, see **4.1 Communication Port Assignments (P. 16)**.

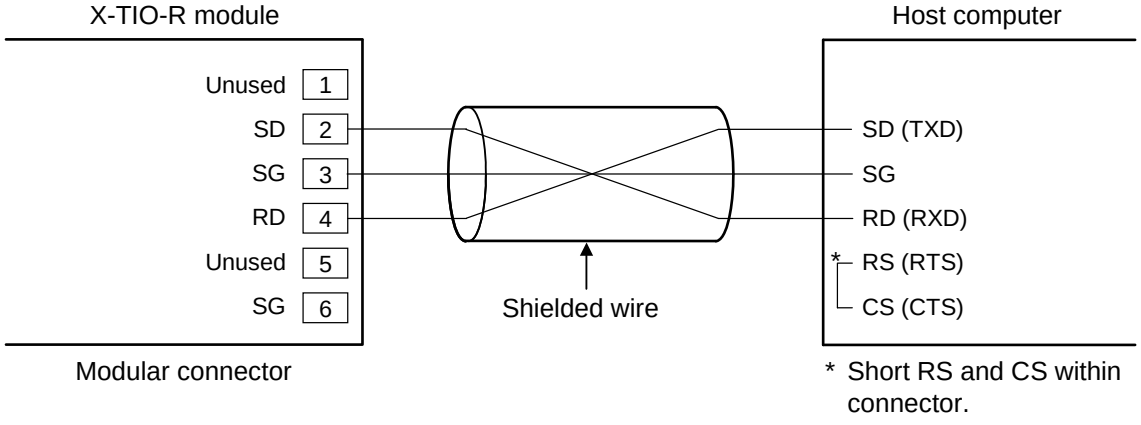
- **Pin layout of modular connector**



- **Connector pin number and signal details**

Pin No.	Signal name	Symbol
1	Unused	—
2	Send data	SD (TXD)
3	Signal ground	SG
4	Receive data	RD (RXD)
5	Unused	—
6	Signal ground	SG

- **Diagram of RS-232C wiring**



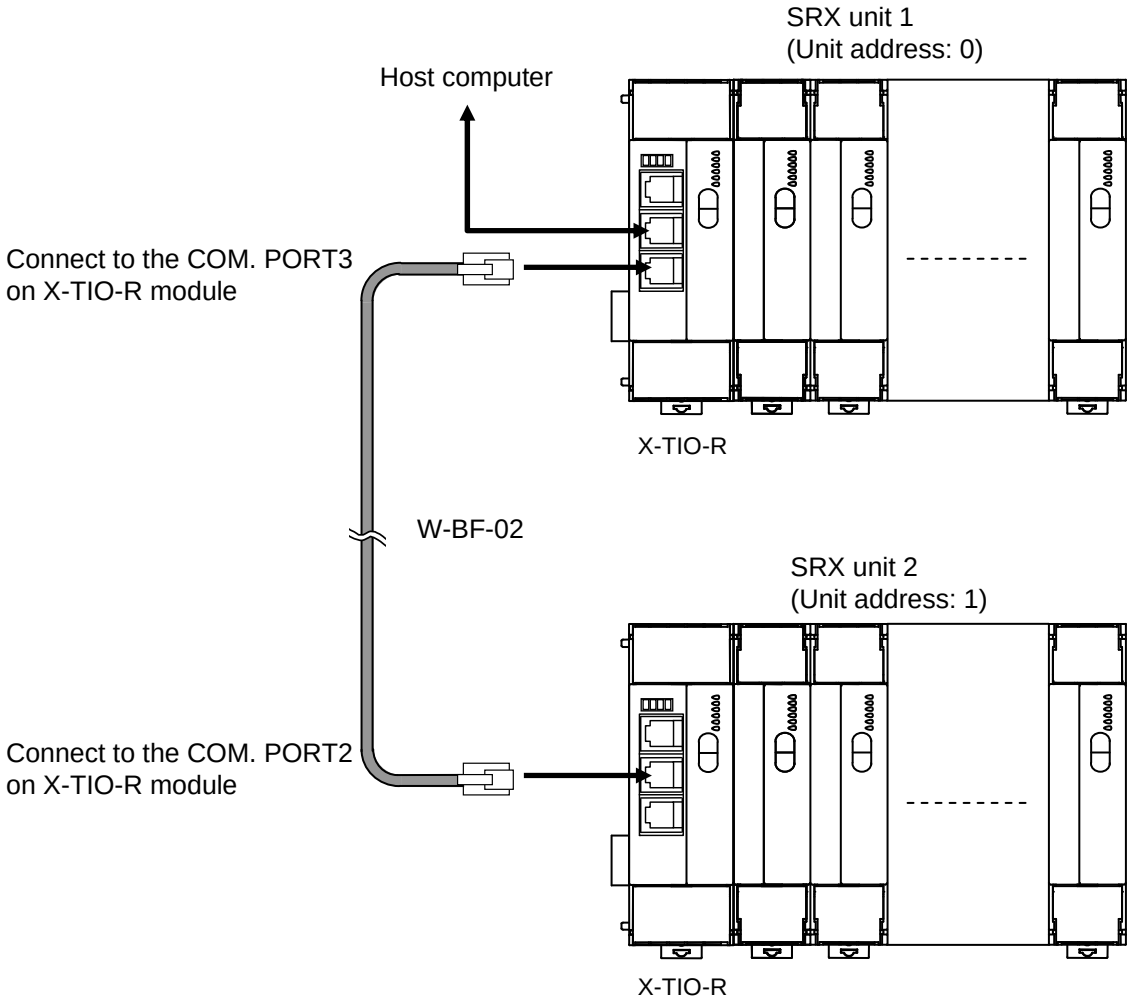
The 6-pin type modular connector should be used for the connection to the X-TIO-R module. Recommended model: TM4P-66P (Manufactured by HIROSE ELECTRIC CO., LTD.,)

Customer is requested to prepare a communication cable fit for the control unit to be connected by the host computer.

■ Multiple SRX unit connections

● When using COM. PORT2 and COM. PORT3

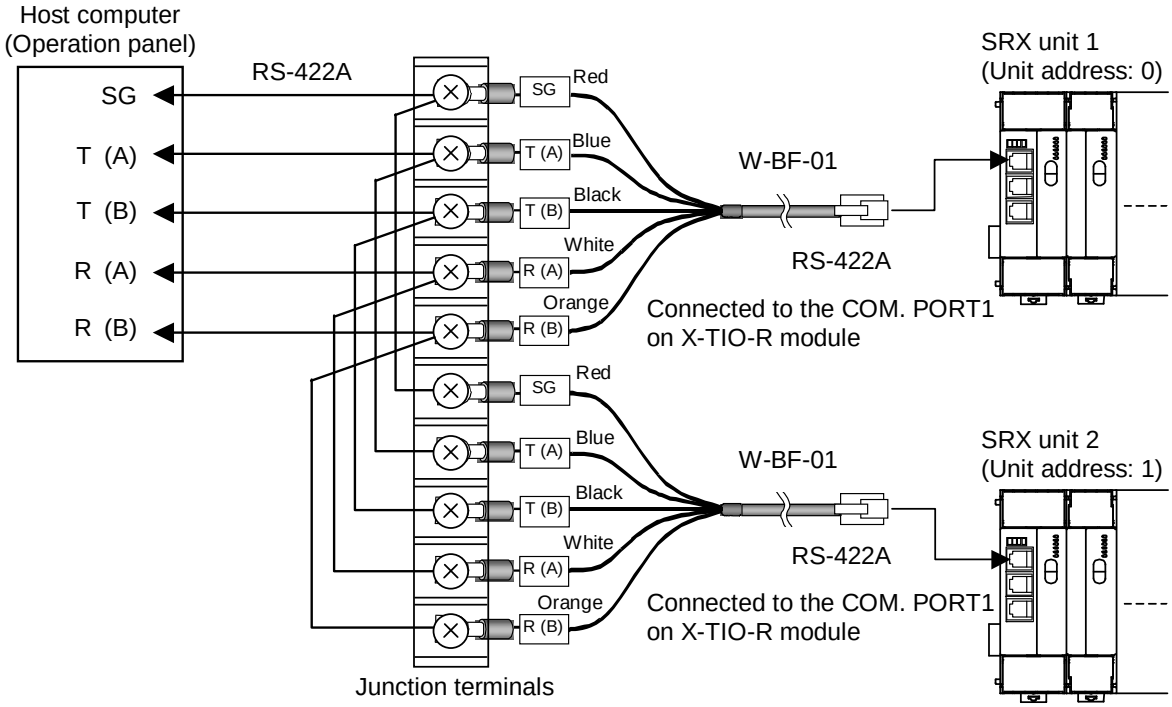
COM. PORT2/COM. PORT3 are connectors for multi-drop connection of the SRX unit.
For SRX unit extension, connect COM. PORT3 to COM. PORT2 of the SRX unit for extension using our cable (Sold separately: W-BF-02).



Cable type: W-BF-02-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

● When using COM. PORT1

When multi-drop connection is made by using COM. PORT1, it is necessary to conduct wiring by using junction terminals and our cables (Sold separately: W-BF-01).



Cable type: W-BF-01-3000 (RKC product, Sold separately)
[Standard cable length: 3 m]

6.3 Communication Requirements

■ Processing times during data send/receive

The SRX requires the following processing times during data send/receive.
Whether the host computer is using either the polling or selecting procedure for communication, the following processing times are required for SRX to send data:

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

RKC communication (Polling procedure)

Procedure details	Time
Response send time after SRX receives ENQ	15 ms max.
Response send time after SRX receives ACK	15 ms max.
Response send time after SRX receives NAK	15 ms max.
Response wait time after SRX sends BCC	1 ms max.

RKC communication (Selecting procedure)

Procedure details	Time
Response send time after SRX receives BCC	15 ms max.
Response wait time after SRX sends ACK	1 ms max.
Response wait time after SRX sends NAK	1 ms max.

Modbus

Procedure details	Time
Read holding registers [03H] Response send time after the slave receives the query message	15 ms max.
Preset single register [06H] Response send time after the slave receives the query message	15 ms max.
Diagnostics (loopback test) [08H] Response send time after the slave receives the query message	15 ms max.
Preset multiple register [10H] Response send time after the slave receives the query message	15 ms max.

Only one port uses communication port, and response send time is time at having set transmission transfer time in 0 ms.

■ Fail-safe

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

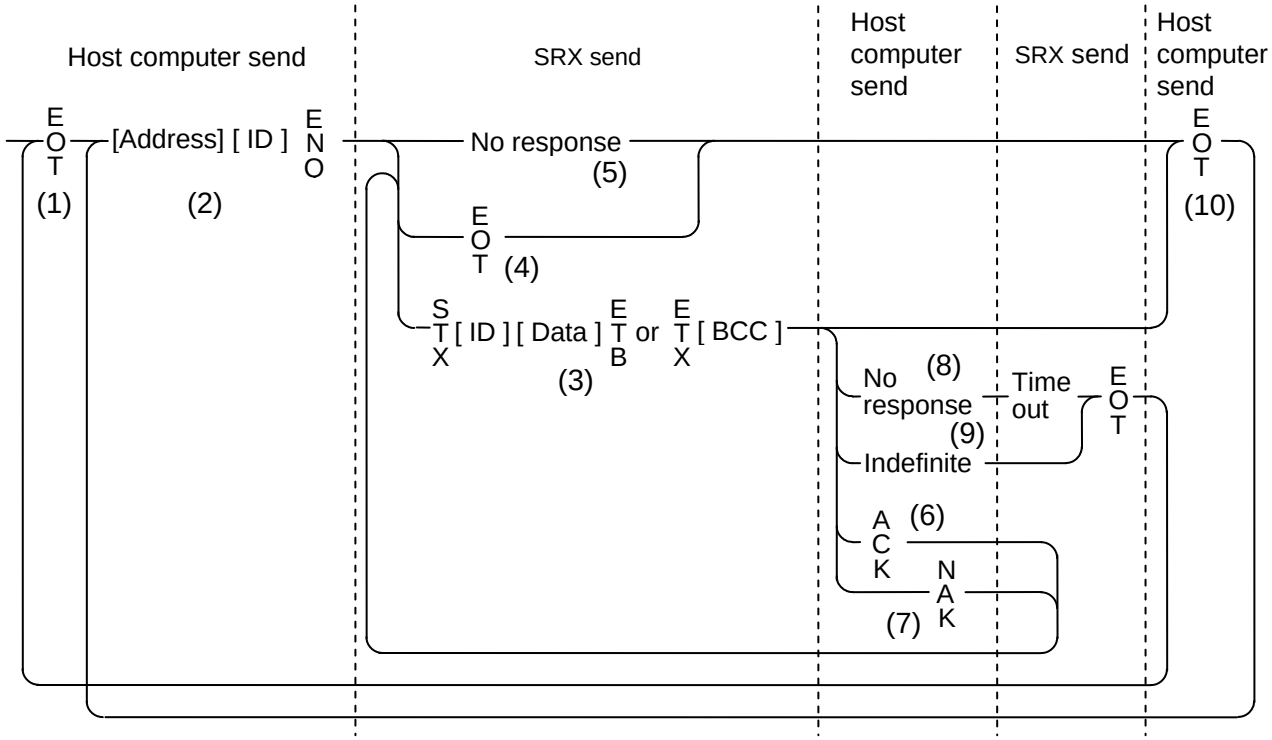
6.4 RKC Communication Protocol

RKC communication uses the polling/selecting method to establish a data link. The basic procedure is followed ANSI X3.28 subcategory 2.5, B1 basic mode data transmission control procedure (Fast selecting is the selecting method used in SRX).

- The polling/selecting procedures are a centralized control method where the host computer controls the entire process. The host computer initiates all communication so the controller responds according to queries and commands from the host.
- The code use in communication is 7-bit ASCII code including transmission control characters.
  Transmission control characters used in SRX:
  EOT (04H), ENQ (05H), ACK (06H), NAK (15H), STX (02H), ETB (17H), ETX (03H)
  ( ): Hexadecimal

6.4.1 Polling

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



ID: Identifier

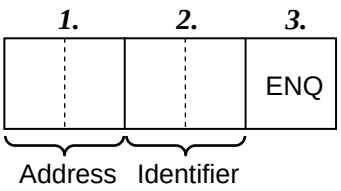
■ Polling procedures

(1) Data link initialization

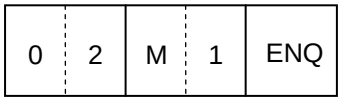
Host computer sends EOT to the controllers to initiate data link before polling sequence.

(2) Data sent from host computer - Polling sequence

Host computer sends polling sequence with the format shown below:



Example:



1. Address (2 digits)
This data is a unit address of the SRX for polled and must be the same as the unit address set value in item ■ **Unit address setting (P. 104)**.

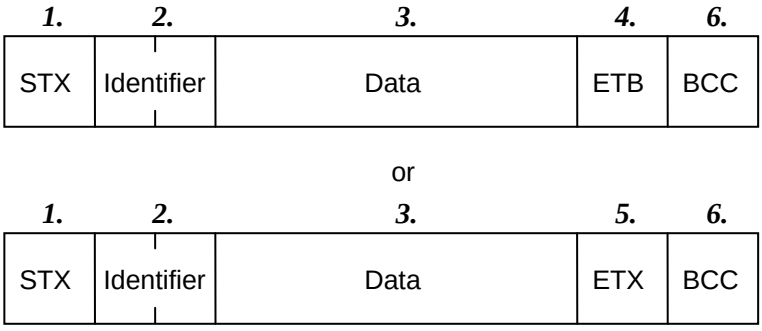
2. Identifier (2 digits)
The identifier specifies the type of data that is requested from the SRX. Always attach the ENQ code to the end of the identifier.

☞ See **6.4.4 Communication identifier list of TIO module (P. 116)**, **6.4.5 Communication identifier list of DI module (P. 128)** and **6.4.6 Communication identifier list of DI module (P. 131)**.

3. ENQ
The ENQ is the transmission control character that indicates the end of the polling sequence. The host computer then must wait for a response from the SRX.

(3) Data sent from the SRX

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



🕮 If the length of send data (from STX to BCC) exceeds 255 bytes *, it is divided into blocks by ETB. In this case, the succeeding divided data is sent after STX.

* Communication data block length can be changed with "Communication data block length" (identifier Z3) of the initial setting mode.

1. STX

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

2. Identifier (2 digits)

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

☞ See **6.4.4 Communication identifier list of TIO module (P. 116)**, **6.4.5 Communication identifier list of DI module (P. 128)** and **6.4.6 Communication identifier list of DI module (P. 131)**.

3. Data

Data which is indicated by an identifier of SRX, consisting of channel numbers (or module address), data, etc. Each channel number (or module address) and data are delimited by a space (20H). The data and the next channel number (or module address) are delimited by a comma.

- Channel number (Used for data corresponding to each channel):
  2-digit ASCII code, not zero-suppressed. Channels without channel numbers may exist depending on the type of identifier.
- Module address (Used for data corresponding to each module):
  2-digit ASCII code, not zero-suppressed.
  Specify the number obtained by adding “1” to the module address set at the front of each module.
  Set the same set value as that of the module address in **4.2 Module Address Setting (P. 21)**.
- Data: ASCII code, zero-suppressed with spaces (20H). The number of digits varies depending on the type of identifier.

☞ See **6.4.3 Communication data structure (P. 113)**.

4. ETB

Transmission control character indicating the end of the block.

5. ETX

Transmission control character indicating the end of the text.

6. BCC

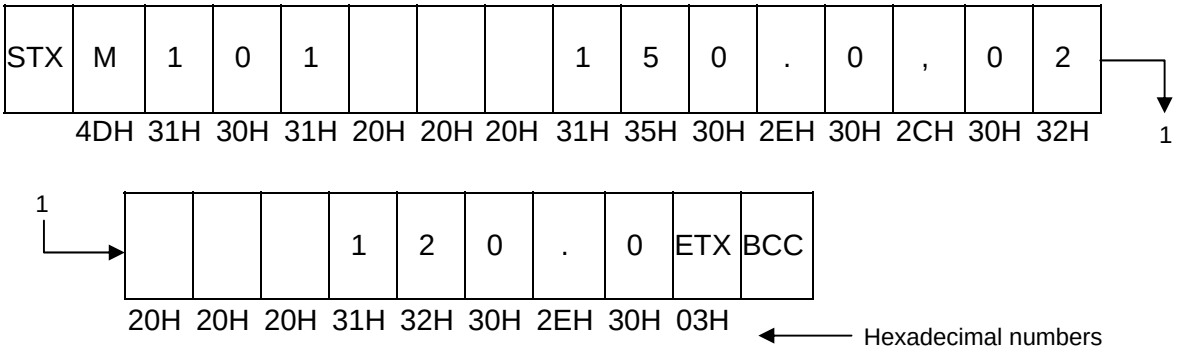
BCC (Block Check Character) detects error by using horizontal parity (even number).

Continued on the next page.

Continued from the previous page.

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

<Example>



BCC = 4DH ⊕ 31H ⊕ 30H ⊕ 31H ⊕ 20H ⊕ 20H ⊕ 20H ⊕ 31H ⊕ 35H ⊕ 30H ⊕ 2EH ⊕ 30H ⊕ 2CH ⊕ 30H ⊕ 32H ⊕ 20H ⊕ 20H ⊕ 20H ⊕ 31H ⊕ 32H ⊕ 30H ⊕ 2EH ⊕ 30H ⊕ 03H = 57H
(⊕: *Exclusive OR*)
Value of BCC becomes 57H.

(4) EOT send (Ending data transmission from the SRX)

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

- When the specified identifier is invalid
- When there is an error in the data format
- When all the data has been sent

(5) No response from the SRX

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

(6) ACK (Acknowledgment)

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

If ACK is sent in succession, data is sent in order as shown in the following list of communication identifiers.

Communication identifier list	Communication identifiers responding in succession		
	No.	Name	Identifier
Communication identifier list of TIO module (P. 116)	1 ⋮ 54	Measured value (PV) ⋮ Integral/derivative time decimal point position	**M1** ⋮ **PK**
If ACK is sent for data with the identifier **PK**, data with the identifier **RL** is sent next.			
Communication identifier list of DI module (P. 128)	1 ⋮ 4	Input state of digital input (terminal) ⋮ Error code	**RL** ⋮ **EU**
If ACK is sent for data with the identifier **EU**, data with the identifier **RQ** is sent next.			
Communication identifier list of DO module (P. 131)	1 ⋮ 7	Output state of digital output (terminal) ⋮ Error code	**RQ** ⋮ **EW**

No identifier data on disconnected modules is sent.

(7) NAK (Negative acknowledge)

If the host computer does not receive correct data from the SRX, it sends a negative acknowledgment NAK to the SRX. The SRX will re-send the same data when NAK is received. This cycle will go on continuously until either recovery is achieved or the data link is corrected at the host computer.

(8) No response from host computer

When the host computer does not respond within approximately three seconds after the SRX sends data, the SRX sends EOT to terminate the data link (time-out time: about 3 seconds).

(9) Indefinite response from host computer

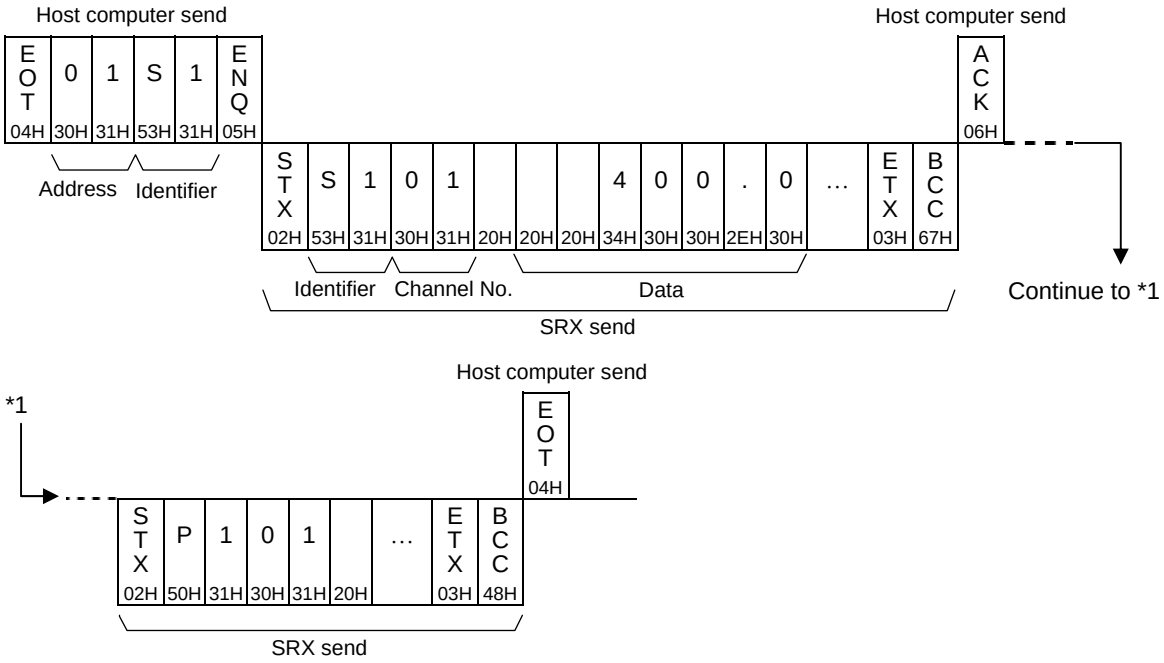
The SRX sends EOT to terminate the data link when the host computer response is indefinite.

(10) EOT (Data link termination)

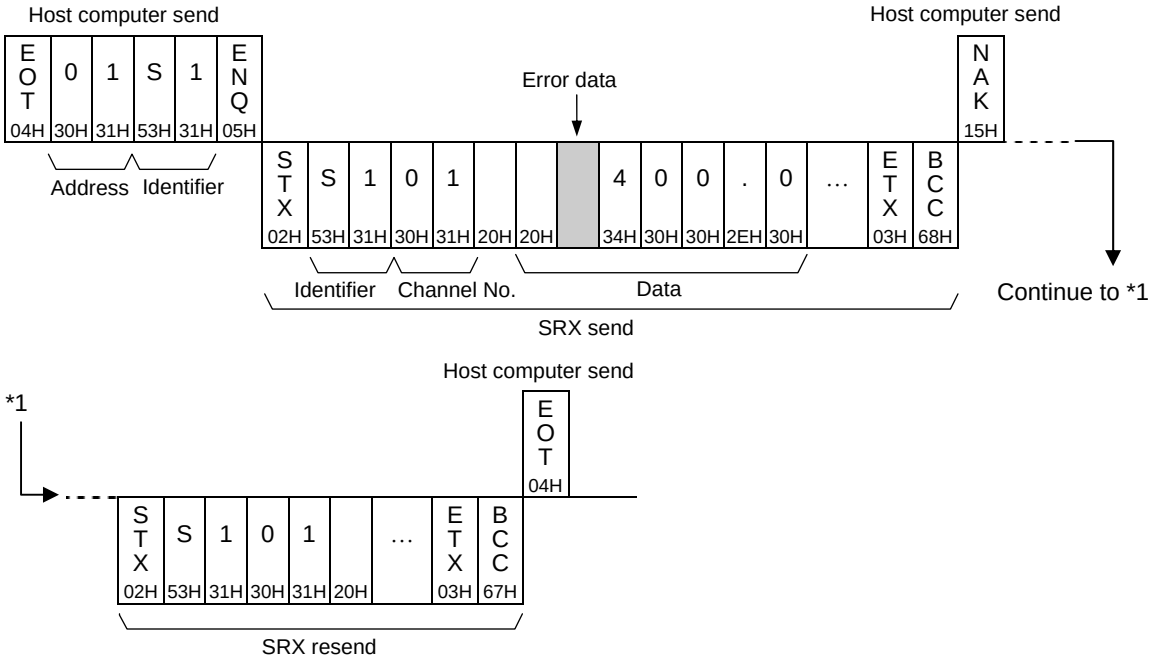
The host computer sends EOT message when it is necessary to suspend communication with the SRX or to terminate the data link due lack of response from the SRX.

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

● Normal transmission

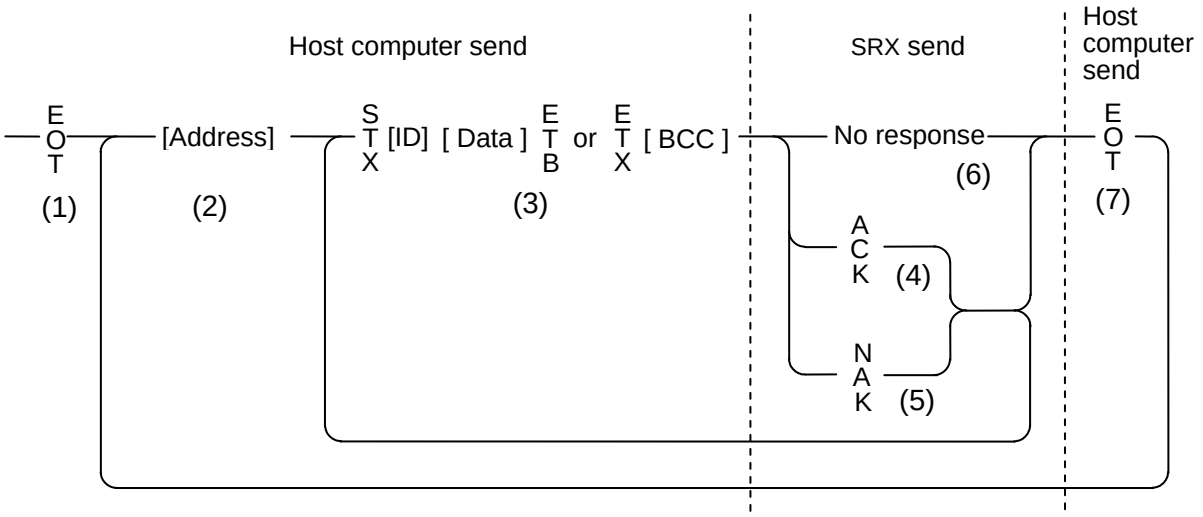


● Error transmission



6.4.2 Selecting

Selecting is the action where the host computer requests one of the connected SRX to receive data. An example of the selecting procedure is shown below:



ID: Identifier

■ Selecting procedures

(1) Data link initialization

Host computer sends EOT to the SRX to initiate data link before selecting sequence.

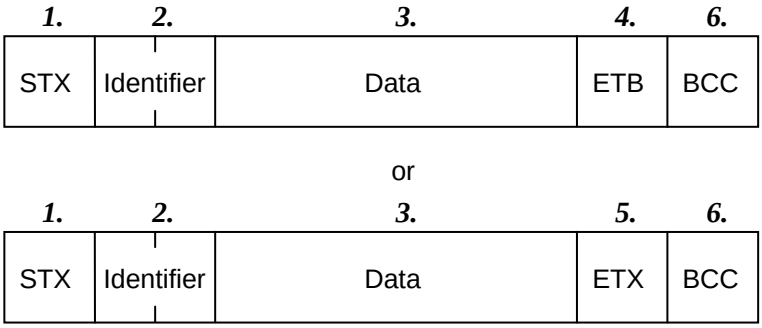
(2) Sending selecting address from the host computer

Host computer sends selecting address for the selecting sequence.

Address (2 digits):
This data is a unit address of the SRX to be selected and must be the same as the unit address set value in item **4.3 Unit address setting (P. 23)**.

(3) Data sent from the host computer

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



Send data (from STX to BCC) can be divided into some groups by ETB. In this case, the succeeding divided data is sent after STX.

Details for ***1*** to ***6***, see **6.4.1 Polling (P. 103)**.

- **About numerical data**

The data that receipt of letter is possible

- Zero-suppressed data can be received with the SRX. (Number of digits: Within 7 digits)

  <Example> When data send –001.5, –01.5, or –1.5 at the time of "–1.5," the SRX can receive a data.
  However, when data send with –1.50, or –1.500, the SRX sends NAK so that after the decimal point number of digits is different.

- The SRX receives value in accordance with decided place after the decimal point. The value below the decided place after the decimal point is cut off.

  <Example> When setting range is –10.00 to +10.00, the SRX receives as a following.

Send data	–.5	.05	–0
Receive data	–0.50	0.05	0.00

The data that receipt of letter is impossible

The SRX sends NAK when received a following data.

+	Plus sign and the data that gained plus sing
–	Only minus sign (there is no figure)
.	Only decimal point (period)
–.	Only minus sign and decimal point (period)

(4) ACK (Acknowledgment)

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

For the temperature control related set value, ACK is sent even if the set data exceeds the setting range. In this case, the value returns to the original value if the fixed time (500 ms max.) elapses after sending ACK.
However, regarding PLC communication environment setting items, NAK is sent when the set data items exceed the setting range.

(5) NAK (Negative acknowledge)

In the following cases, the SRX sends NAK. Then the appropriate recovery processing steps should be taken, such as resending the data on the host computer side.

- When an error occurs on the line (parity error, framing error, etc.)
- When a BCC check error occurs
- When the specified identifier is invalid
- When there is an error in the data format
- When receive data exceeds the setting range

(6) No response from SRX

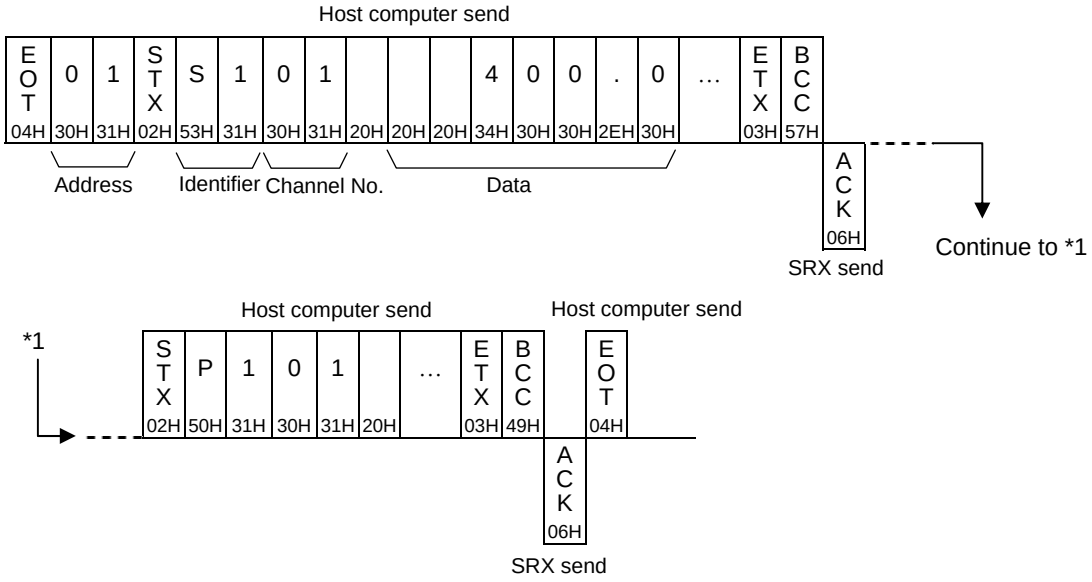
The SRX does not respond when it cannot receive the selecting address, STX, ETB, ETX or BCC.

(7) EOT (Data link termination)

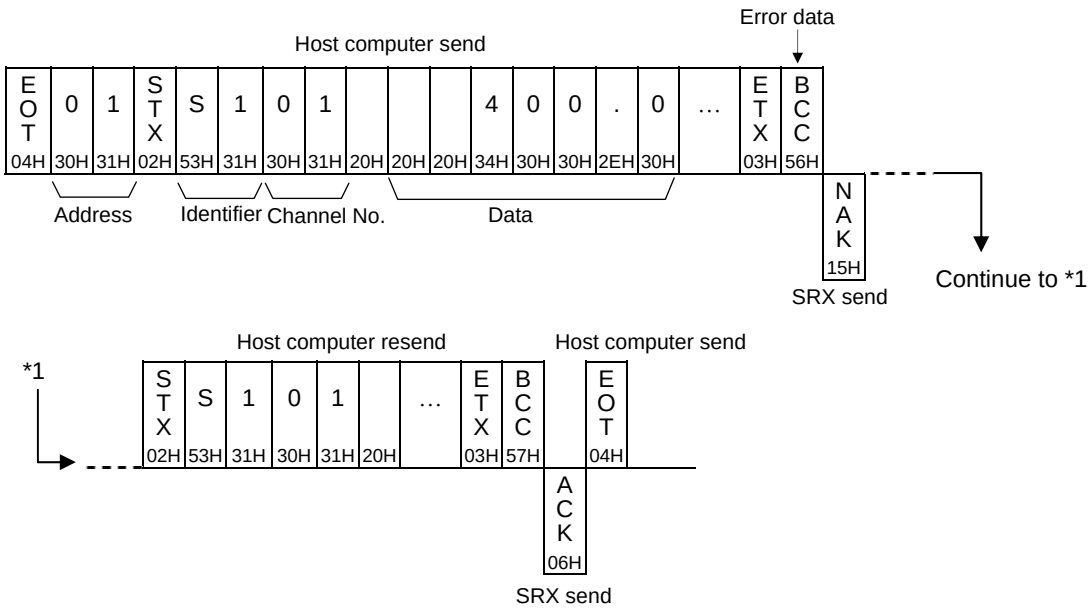
The host computer sends EOT when there is no more data to be sent from the host computer or there is no response from the SRX.

■ Selecting procedure example (when the host computer sends data)

● Normal transmission

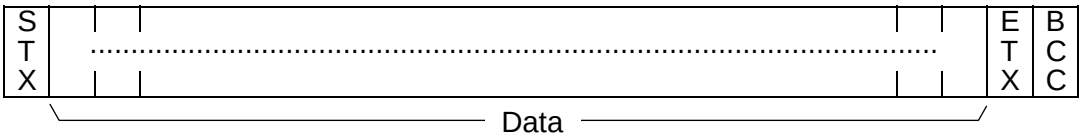


● Error transmission



6.4.3 Communication data structure

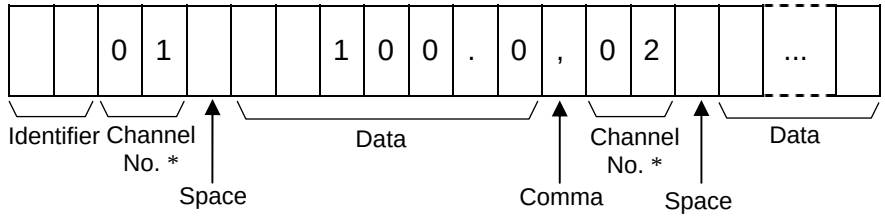
■ Data description (Transmission/receive data structure)



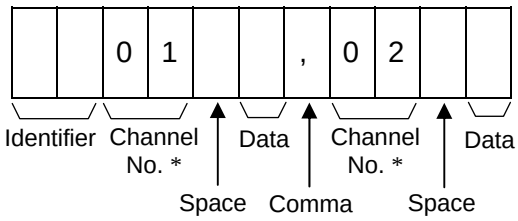
Part of the data above is shown below.

■ Data for each channel (Data for each module)

Data length 7 digits



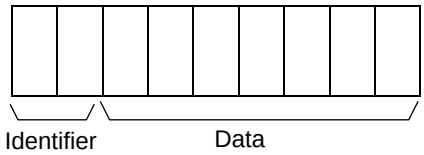
Data length 1 digit



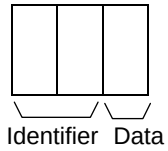
* For data corresponding to each module, it becomes the number obtained by adding “1” to the module address.

■ Data for each unit (Without channel)

Data length 7 digits

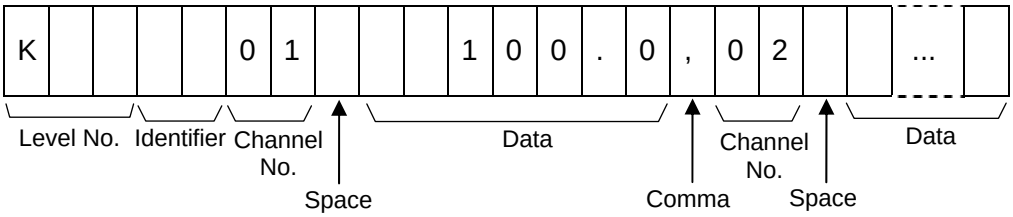


Data length 1 digit

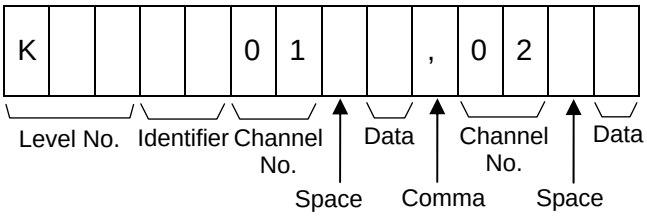


■ Data for level PID

Data length 7 digits



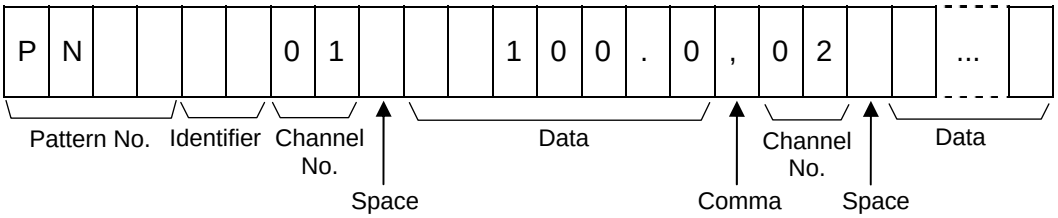
Data length 1 digit



■ Data for program control

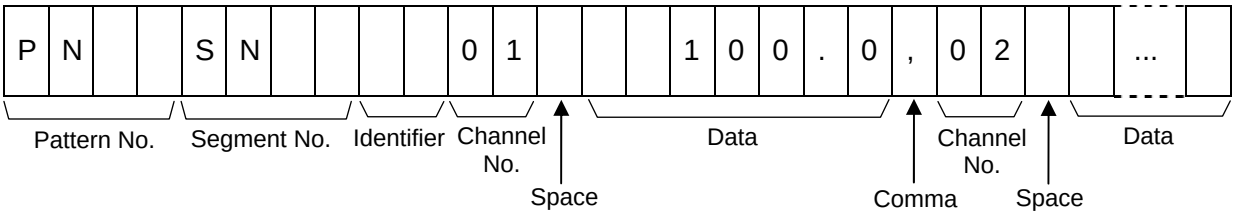
● Pattern group

Data length 7 digits



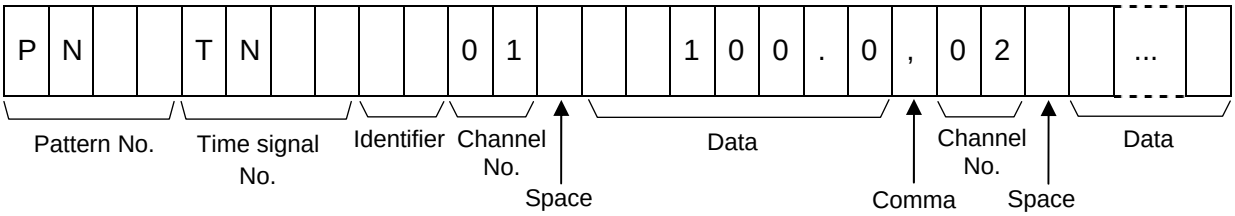
● Segment group

Data length 7 digits



● Time signal group

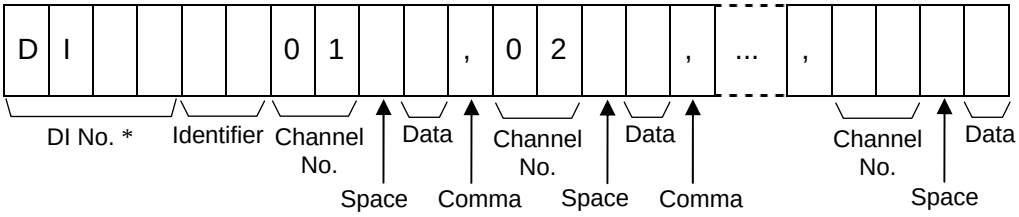
Data length 7 digits



■ Data for digital input (DI)

● Event LED selection (Terminal input: identifier LI, Connector input: identifier LJ)

Data length 1 digit

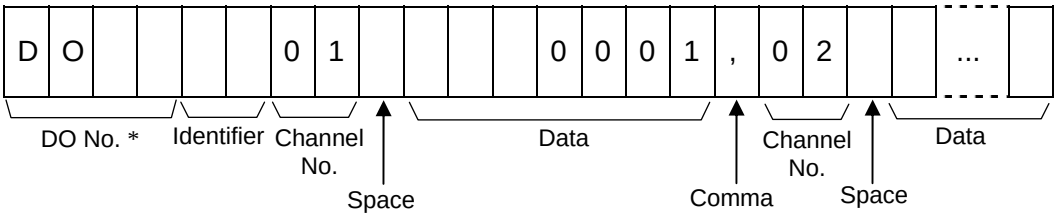


* DI numbers are assigned to DI modules in the SRX unit in the ascending order of module address number starting from "1."

■ Data for digital output (DO)

● Function selection of DO channel (Terminal: identifier RA, Connector: identifier RB)

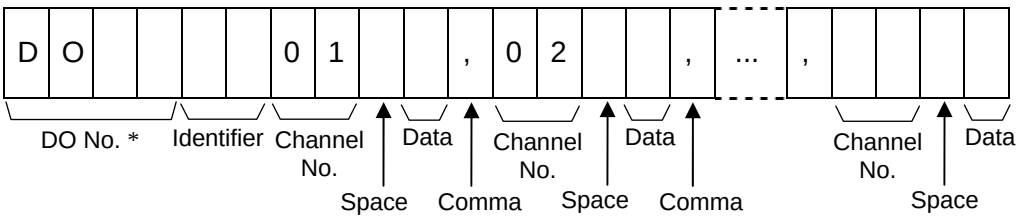
Data length 7 digits



* DO numbers are assigned to DO modules in the SRX unit in the ascending order of module address number starting from "1."

● Event LED selection (Terminal output: identifier QI, Connector output: identifier QJ)

Data length 1 digit



* DO numbers are assigned to DO modules in the SRX unit in the ascending order of module address number starting from "1."

6.4.4 Communication identifier list of TIO module

☞ For details of each item, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC], **5.3 PLC Communication Data Map (P. 62)**, or **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Data items for normal setting mode

RO: Read only R/W: Read and Write

: PLC communication environment setting item

No.	Name	Identifier	Attribute	Data range	Factory set value
1	Measured value (PV)	**M1**	RO	Input scale low limit to Input scale high limit	—
2	Comprehensive event state	**AJ**	RO	Bit data b0: Burnout b1: Event 1 state b2: Event 2 state b3: Heater break alarm state b4: Control loop break alarm (LBA) state Data 0: OFF 1: ON [Decimal number: 0 to 31]	—
3	Manipulated output value	**O1**	RO	–5.0 to +105.0 %	—
4	Set value monitor	**MS**	RO	Input scale low limit to Input scale high limit	—
5	Error code (Data of each module)	**ER**	RO	Bit data b0: Memory backup error b1: Unused b2: Internal communication error b3: Adjustment data error b4: Input A/D error b5: Current transformer input A/D error b6: Temperature compensation A/D error b7: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
6	Current transformer input measured value	**M3**	RO	0.0 to 30.0 A or 0.0 to 100.0 A	—
7	Burnout state	**B1**	RO	0: OFF 1: ON	—
8	Event 1 state	**AA**	RO	0: OFF 1: ON	—
9	Event 2 state	**AB**	RO	0: OFF 1: ON	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
10	Heater break alarm (HBA) state	**AC**	RO	0: OFF 1: Heater break 2: Relay welding	—
11	Control loop break alarm (LBA) state	**AP**	RO	0: OFF 1: ON	—
12	Operation mode	**EI**	R/W	0: Unused 1: Monitor 1 2: Monitor 2 3: Control	3
13	Set value (SV)	**S1**	R/W	Input scale low limit to Input scale high limit	0
14	Proportional band	**P1**	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
15	Integral time	**I1**	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
16	Derivative time	**D1**	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
17	Control response parameters	**CA**	R/W	0: Slow 1: Medium 2: Fast	0
18	PV bias	**PB**	R/W	–Input span to +Input span	0
19	Event 1 set value	**A1**	R/W	Deviation high/Deviation low: –Input span to +Input span Deviation high/low, Band: 0 to Input span	0
20	Event 2 set value	**A2**	R/W	Process high/Process low: Input scale low limit to Input scale high limit	0
21	PID/AT transfer *	**G1**	R/W	0: PID control operation 1: AT (Autotuning) operation	0
22	Auto/Manual transfer	**J1**	R/W	0: Auto mode 1: Manual mode	0

* Caution for using the Autotuning (AT)
When control loop break alarm (LBA) is used, control loop break alarm (LBA) time is automatically calculated by AT. However, the calculated data becomes valid by changing to the initial setting mode once after AT is executed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
23	Manual output value	**ON**	R/W	–5.0 to +105.0 %	0.0
24	Output limiter (high)	**OH**	R/W	Output limiter (low) to 105.0 %	100.0
25	Output limiter (low)	**OL**	R/W	–5.0 % to Output limiter (high)	0.0
26	Proportional cycle time	**T0**	R/W	0.2 to 50.0 seconds	Relay contact output: 20.0 Voltage pulse output: 2.0
27	Digital filter	**F1**	R/W	0.00 to 10.00 seconds 0.00: OFF (Not provided)	0.00
28	Heater break alarm (HBA) set value	**A3**	R/W	0.0 to 30.0 A or 0.0 to 100.0 A	0.0
29	Number of heater break alarm (HBA) delay times	**DH**	R/W	1 to 255 times	5
30	Hot/cold start selection	**XN**	R/W	0: Hot start 1 1: Hot start 2 2: Cold start 1 3: Cold start 2	0
31	Start determination point	**SX**	R/W	0 to input span	0.0
32	Control RUN/STOP transfer (Data of each module)	**SR**	R/W	0: Control STOP 1: Control RUN	0
33	Input error determination point (high)	**AV**	R/W	Input scale low limit to Input scale high limit	Input scale high limit
34	Input error determination point (low)	**AW**	R/W	Input scale low limit to Input scale high limit	Input scale low limit
35	Action at input error (high)	**WH**	R/W	0: Normal control 1: Manipulated output value at input error	0
36	Action at input error (low)	**WL**	R/W		0
37	Manipulated output value at input error	**OE**	R/W	–5.0 to +105.0 %	0.0
38	AT differential gap time	**GH**	R/W	0.00 to 50.00 seconds	0.10
39	AT bias	**GB**	R/W	–Input span to +Input span	0
40	Remote/Local transfer (Data of each module)	**C1**	R/W	0: Local mode 1: Remote mode	0

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
41	Event LED mode setting (Data of each module)	**XH**	R/W	1: Mode 1 11: Mode 11 2: Mode 2 12: Mode 12 3: Mode 3 13: Mode 13 10: Mode 10 Except the above: Unused	0 (Unused)
42	Digital input setting 1 (RESET)	**E1**	R/W	0000 to 9999 Upper two digits (Thousands and hundreds digits): Address of DI module Lower two digits (Tens and units digits): Channel number of DI module 00: No function	0000
43	Digital input setting 2 (RUN)	**E2**	R/W		0000
44	Digital input setting 3 (FIX)	**E3**	R/W		0000
45	Digital input setting 4 (MAN)	**E4**	R/W		0000
46	Digital input setting 5 (HOLD)	**E5**	R/W		0000
47	Digital input setting 6 (STEP)	**E6**	R/W		0000
48	Digital input setting 7 (Program pattern selection)	**E7**	R/W		0000
49	Digital input setting 8 (AT/PID)	**E8**	R/W		0000
50	Comprehensive alarm state (Data of each unit)	**AM**	RO	Bit data b0: OR operation of burnout states in all channels b1: OR operation of event 1 states in all channels b2: OR operation of event 2 states in all channels b3: OR operation of heater break alarm states in all channels b4: OR operation of control loop break alarm states in all channels b5 to b6: Unused b7: OR operation of setting error states in all channels Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
51	Control loop break alarm (LBA) use selection	**HP**	R/W	0: Unused 1: Used	0
52	Control loop break alarm (LBA) time	**C6**	R/W	1 to 7200 seconds	80
53	Control loop break alarm (LBA) deadband	**V2**	R/W	0 to Input span	0
54	Integral/derivative time decimal point position	**PK**	R/W	0: Two decimal places 1: One decimal places	0

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
55	Program operation mode selection	**XM**	R/W	0: RESET 1: RUN (Program control) 2: FIX (Fixed set point control) 3: MAN (Manual control)	2
56	Execution pattern	**PS**	R/W	1 to 16	1
57	Execution segment	**SN**	RO	1 to 16	—
58	Segment remaining time	**TR**	RO	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	—
59	Number of program execution times	**RT**	RO	0 to 9999 times	—
60	Time signal output state 1	**T8**	RO	Bit data b0: Time signal 1 output state b1: Time signal 2 output state b2: Time signal 3 output state b3: Time signal 4 output state b4: Time signal 5 output state b5: Time signal 6 output state b6: Time signal 7 output state b7: Time signal 8 output state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
61	Time signal output state 2	**T9**	RO	Bit data b0: Time signal 9 output state b1: Time signal 10 output state b2: Time signal 11 output state b3: Time signal 12 output state b4: Time signal 13 output state b5: Time signal 14 output state b6: Time signal 15 output state b7: Time signal 16 output state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
62	Pattern end output state	**EO**	RO	0: Pattern end output OFF 1: Pattern end output ON	—
63	End state	**EN**	RO	0: End state OFF 1: End state ON	—
64	Wait state	**WT**	RO	0: Wait state OFF 1: Wait state ON	—
65	Hold state	**HO**	R/W	0: Hold state OFF 1: Hold state ON	0

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
66	Step action	**SK**	R/W	0: Not step action 1: Step action execution	0
67	Program operation start mode	**SS**	R/W	0: Zero start 1: PV start 1 2: PV start 2	0
68	Level PID high limit set value	**PW**	R/W	Input scale low limit to Input scale high limit	Input scale high limit
69	Setting of the number of program execution times (Pattern group)	**RR**	R/W	1 to 1000 times 1000: Number of infinite times	1
70	End segment (Pattern group)	**PE**	R/W	1 to 16	16
71	Link pattern (Pattern group)	**LP**	R/W	0 to 16 0: No link pattern	0
72	Pattern end output time (Pattern group)	**ET**	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
73	Wait zone (Pattern group)	**ZW**	R/W	0 to Input span	0.0
74	Segment level (Segment group)	**LE**	R/W	Input scale low limit to Input scale high limit	0
75	Segment time (Segment group)	**TM**	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
76	Time signal output number (Time signal group)	**RE**	R/W	0 to 16 0: No time signal output	0
77	Time signal ON segment (Time signal group)	**SO**	R/W	1 to 16	1
78	Time signal ON time (Time signal group)	**TO**	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
79	Time signal OFF segment (Time signal group)	**SF**	R/W	1 to 16	1
80	Time signal OFF time (Time signal group)	**TF**	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
81	Station number * (Data of each unit)	**QV**	R/W	0 to 31	0
82	PC number * (Data of each unit)	**QW**	R/W	0 to 255	255
83	Register start number * (Data of each unit)	**QX**	R/W	0 to 32767 or 0 to 9944	1000
84	Maximum number of PLC communication channels * (Data of each unit)	**QY**	R/W	1 to 60 CH	10
85	Register type (D, R, W) * (Data of each unit)	**QZ**	R/W	0: D register (data register) 1: R register (file register) 2: W register (link register)	0
86	X-TIO-R module monitor item selection * (Data of each unit)	**QS**	R/W	Bit data b0: Measured value (PV) b1: Set value monitor b2: Control output value b3: CT input measured value b4: TIO state 1 b5: TIO state 2 b6: Execution pattern b7: Execution segment b8: Segment remaining time b9: Time signal output state 1 b10: Time signal output state 2 Data 0: Invalid 1: Valid [Decimal number: 0 to 2047]	bit 0: 1 bit 1: 1 bit 2: 1 bit 3: 1 bit 4: 1 bit 5: 1 bit 6: 1 bit 7: 1 bit 8: 1 bit 9: 1 bit 10: 1 [Decimal number: 2047]
87	X-TIO-R module Link recognition time * (Data of each unit)	**QT**	R/W	0 to 255 seconds	10
88	X-TIO-R module error code (Data of each unit)	**ES**	RO	Bit data b0: Memory backup error b1: Unused b2: Module configuration error b3: Unused b4: Unused b5: Unused b6: Unused b7: PLC communication error Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
89	PLC scanning time setting * (Data of each unit)	**ST**	R/W	0 to 3000 ms	255

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
90	Number of connected TIO modules (Data of each unit)	**QN**	RO	0 to 30	—
91	Number of connected TIO channels (Data of each unit)	**QP**	RO	0 to 60 CH	—
92	Action mode selection * (Data of each unit)	**RZ**	R/W	Bit data b0: Unused (1 fixed) b1: PLC register read/write error elimination 0: Manual elimination 1: Automatic elimination b2 to b7:Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	bit 0: 1 bit 1: 0 bit 2 to 7: 0 [Decimal number: 1]
93	PLC communication start time * (Data of each unit)	**RU**	R/W	1 to 255 seconds	5
94	Program data display: start channel setting (Data of each unit)	**RV**	R/W	1 to 51 CH	1
95	Initial setting mode (Data of each unit)	**IN**	R/W	0: Normal setting mode 1: Initial setting mode	0

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

■ Data items for initial setting mode

⚠ 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, those data is not necessary to be changed 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.

● Transfer to initial setting mode.

Transfer to initial setting mode sets in "1" with identifier IN (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 identifier "IN" by 0).

No.	Name	Identifier	Attribute	Data range	Factory set value
1	Input range number *	**XI**	R/W	TC input: 0: K −200 to +1372 °C or −328 to +2501 °F 1: J −200 to +1200 °C or −328 to +2192 °F 2: R −50 to +1768 °C or −58 to +3000 °F 3: S −50 to +1768 °C or −58 to +3000 °F 4: B 0 to 1800 °C or 32 to 3000 °F 5: E −200 to +1000 °C or −328 to +1832 °F 6: N 0 to 1300 °C or 32 to 2372 °F 7: T −200 to +400 °C or −328 to +752 °F 8: W5Re/W26Re 0 to 2300 °C or 32 to 3000 °F 9: PLII 0 to 1390 °C or 32 to 2534 °F	Specify when ordering

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
1	Input range number *	**XI**	R/W	RTD input: 12: Pt100 –200 to +850 °C or –328 to +1562 °F 13: JPt100 –200 to +600 °C or –328 to +1112 °F Voltage/Current input: 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100mV DC 21: 0 to 10 mV DC	Specify when ordering
2	Input scale high limit *	**XV**	R/W	Input scale low limit to 20000	Depend on input range
3	Input scale low limit *	**XW**	R/W	–20000 to Input scale high limit	Depend on input range
4	Input range decimal point position *	**XU**	R/W	TC/RTD input: 0 to 1 Voltage/Current input: 0 to 4 0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1
5	Temperature unit selection *	**PU**	R/W	0: °C 1: °F	0
6	Control type selection	**XE**	R/W	0: Direct action 1: Reverse action	1
7	ON/OFF control differential gap (upper)	**IV**	R/W	0 to Input span	TC/RTD: 1.0 °C or 1.0 °F V/I: 0.1 % of input span
8	ON/OFF control differential gap (lower)	**IW**	R/W		
9	Event 1 differential gap	**HA**	R/W	0 to Input span	TC/RTD: 2.0 °C or 2.0 °F V/I: 0.2 % of input span
10	Event 2 differential gap	**HB**	R/W		

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
11	Event 1 type selection *	**XA**	R/W	0: Not provided 1: Process high 2: Process low 3: Deviation high 4: Deviation low 5: Deviation high/low 6: Band	0
12	Event 2 type selection *	**XB**	R/W		0
13	Event 1 hold action	**WA**	R/W	0: Not provided 1: Hold action (2: Do not set this one) 3: Re-hold action	3
14	Event 2 hold action	**WB**	R/W		3
15	Number of event delay times	**DF**	R/W	0 to 255 times	0
16	TIO module internal communication transmission transfer time setting (Data of each module)	**ZR**	R/W	0 to 100 ms	6
17	Segment time unit setting	**XP**	R/W	0: 0.01 second 1: 0.1 second 2: 1 second 3: 1 minute	0
18	Operation mode holding setting (Data of each module)	**X2**	R/W	0: Not hold 1: Hold	1
19	Output change rate limiter (up)	**PH**	R/W	0.0 to 100.0 %/second 0.0: Limiter OFF	0.0
20	Output change rate limiter (down)	**PL**	R/W	0.0 to 100.0 %/second 0.0: Limiter OFF	0.0
21	Installing module type monitor (Data of each module)	**CN**	RO	1: TIO module 2: Unused 3: Digital input (DI) module 4: Digital output (DO) module	—
22	TIO state 1	**AK**	RO	Bit data b0: Burnout b1: Event 1 state b2: Event 2 state b3: Heater break alarm (HBA) state b4: Control loop break alarm (LBA) state b5: Unused b6: Unused b7: Setting error b8: Module error b9: Error code Data 0: OFF 1: ON [Decimal number: 0 to 1023]	—

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
23	TIO state 2	**AQ**	RO	Bit data b0: End state b1: Pattern end output state b2: Wait state b3: PID/AT state 0: PID control 1: AT state b4 to b6: Level number (level PID) Level 1: b4: 0, b5: 0, b6: 0 Level 2: b4: 1, b5: 0, b6: 0 Level 3: b4: 0, b5: 1, b6: 0 Level 4: b4: 1, b5: 1, b6: 0 Level 5: b4: 0, b5: 0, b6: 1 Level 6: b4: 1, b5: 0, b6: 1 Level 7: b4: 0, b5: 1, b6: 1 Level 8: b4: 1, b5: 1, b6: 1 b7: Hold state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
24	Host communication 1 Transmission transfer time setting (Data of each unit)	**ZX**	R/W	0 to 255 ms	6
25	PLC communication/ Host communication 2 Transmission transfer time setting (Data of each unit)	**QU**	R/W	0 to 255 ms	1
26	Initializing internal communication (Data of each unit)	**CL**	R/W	0: Normal state (Initialization is not execute) 1: Initialize internal communication	0
27	Communication data block length (RKC communication) (Data of each unit)	**Z3**	R/W	20 to 255 byte (Valid only when communication method is polling)	255
28	Modbus data interval extension time * (Data of each unit)	**ZY**	R/W	0 to 255 ms	0

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

6.4.5 Communication identifier list of DI module

☞ For details of each item, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Data items for normal setting mode

RO: Read only R/W: Read and Write

No.	Name	Identifier	Attribute	Data range	Factory set value
1	Input state of digital input (terminal) (Data of each module)	**RL**	RO	Bit data b0: DI channel 1 b1: DI channel 2 b2: DI channel 3 b3: DI channel 4 b4: DI channel 5 b5: DI channel 6 b6: DI channel 7 b7: DI channel 8 b8: DI channel 9 b9: DI channel 10 b10: DI channel 11 b11: DI channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095]	—
2	Input state of digital input (connector) 1 (Data of each module)	**L2**	RO	Bit data b0: DI channel 13 b1: DI channel 14 b2: DI channel 15 b3: DI channel 16 b4: DI channel 17 b5: DI channel 18 b6: DI channel 19 b7: DI channel 20 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
3	Input state of digital input (connector) 2 (Data of each module)	**L3**	RO	Bit data b0: DI channel 21 b1: DI channel 22 b2: DI channel 23 b3: DI channel 24 b4: DI channel 25 b5: DI channel 26 b6: DI channel 27 b7: DI channel 28 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
4	Error code (Data of each module)	**EU**	RO	Bit data b0: Backup error b1 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 1]	—
5	Event LED selection: terminal input (DI channel 1 to 12)	**LI**	R/W	0: Unused 1: EVENT1 lamp 2: EVENT2 lamp 3: EVENT3 lamp 4: EVENT4 lamp	0
6	Event LED selection: connector input (DI channel 13 to 28)	**LJ**	R/W		0
7	Initial setting mode (Data of each module)	**IN**	R/W	0: Normal setting mode 1: Initial setting mode	0

■ Data items for initial setting mode

⚠ 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, those data is not necessary to be changed 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.

[Transfer to initial setting mode]

Transfer to initial setting mode sets in "1" with identifier IN (normally setting mode).

[Data items for initial setting mode]

No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
1	Transmission transfer time setting (Data of each module)	**ZS**	R/W	0 to 100 ms	6

6.4.6 Communication identifier list of DO module

☞ For details of each item, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Data items for normal setting mode

RO: Read only R/W: Read and Write

No.	Name	Identifier	Attribute	Data range	Factory set value
1	Output state of digital output (terminal) (Data of each module)	**RQ**	RO	Bit data b0: DO channel 1 b1: DO channel 2 b2: DO channel 3 b3: DO channel 4 b4: DO channel 5 b5: DO channel 6 b6: DO channel 7 b7: DO channel 8 b8: DO channel 9 b9: DO channel 10 b10: DO channel 11 b11: DO channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095]	—
2	Output state of digital output (connector) 1 (Data of each module)	**Q2**	RO	Bit data b0: DO channel 13 b1: DO channel 14 b2: DO channel 15 b3: DO channel 16 b4: DO channel 17 b5: DO channel 18 b6: DO channel 19 b7: DO channel 20 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
3	Output state of digital output (connector) 2 (Data of each module)	**Q3**	RO	Bit data b0: DO channel 21 b1: DO channel 22 b2: DO channel 23 b3: DO channel 24 b4: DO channel 25 b5: DO channel 26 b6: DO channel 27 b7: DO channel 28 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
4	Manual output setting of digital output (terminal) * (Data of each module)	**Q4**	R/W	Bit data b0: DO channel 1 b1: DO channel 2 b2: DO channel 3 b3: DO channel 4 b4: DO channel 5 b5: DO channel 6 b6: DO channel 7 b7: DO channel 8 b8: DO channel 9 b9: DO channel 10 b10: DO channel 11 b11: DO channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095]	bit 0 to 15: 0 [Decimal number: 0]
5	Manual output setting 1 of digital output (connector) * (Data of each module)	**Q5**	R/W	Bit data b0: DO channel 13 b1: DO channel 14 b2: DO channel 15 b3: DO channel 16 b4: DO channel 17 b5: DO channel 18 b6: DO channel 19 b7: DO channel 20 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	bit 0 to 15: 0 [Decimal number: 0]
6	Manual output setting 2 of digital output (connector) * (Data of each module)	**Q6**	R/W	Bit data b0: DO channel 21 b1: DO channel 22 b2: DO channel 23 b3: DO channel 24 b4: DO channel 25 b5: DO channel 26 b6: DO channel 27 b7: DO channel 28 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	bit 0 to 15: 0 [Decimal number: 0]

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
7	Error code (Data of each module)	**EW**	RO	Bit data b0: Backup error b1 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 1]	—
8	Function selection of DO channel 1 to 12 (terminal)	**RA**	R/W	0000 to 9999 Upper two digits (Thousands and hundreds digits): Address of TIO module or DI module Lower two digits (Tens and units digits): Function number of output signal ☞ See **Function Number Table (P. 134)**. Upper two digits are ignored with lower two digits set to "00."	0
9	Function selection of DO channel 13 to 28 (connector) (DO channel 13 to 28 is used as DO channel 1 to 16 on communication.)	**RB**	R/W	0000 to 9999 Upper two digits (Thousands and hundreds digits): Address of TIO module or DI module Lower two digits (Tens and units digits): Function number of output signal ☞ See **Function Number Table (P. 134)**. Upper two digits are ignored with lower two digits set to "00."	0
10	Event LED selection: terminal output (DO channel 1 to 12)	**QI**	R/W	0: Unused 1: EVENT1 lamp 2: EVENT2 lamp 3: EVENT3 lamp 4: EVENT4 lamp	0
11	Event LED selection: connector output (DO channel 13 to 28)	**QJ**	R/W		0
12	Initial setting mode (Data of each module)	**IN**	R/W	0: Normal setting mode 1: Initial setting mode	0

Function Number Table (TIO module)

Function No.	Contents
00	DO manual output
01	CH1 Burnout output
02	CH1 Event 1 output
03	CH1 Event 2 output
04	CH1 Heater break alarm (HBA) output
05	CH1 Control loop break alarm (LBA) output
06 to 08	Unused
09	CH1 Program end state output
10	CH1 Pattern end output
11	CH1 Wait state output
12 to 16	Unused
17	CH2 Burnout output
18	CH2 Event 1 output
19	CH2 Event 2 output
20	CH2 Heater break alarm (HBA) output
21	CH2 Control loop break alarm (LBA) output
22 to 24	Unused
25	CH2 Program end state output
26	CH2 Pattern end output
27	CH2 Wait state output
28 to 32	Unused
33	CH1 Time signal 1 output
34	CH1 Time signal 2 output
35	CH1 Time signal 3 output
36	CH1 Time signal 4 output
37	CH1 Time signal 5 output
38	CH1 Time signal 6 output

Function No.	Contents
39	CH1 Time signal 7 output
40	CH1 Time signal 8 output
41	CH1 Time signal 9 output
42	CH1 Time signal 10 output
43	CH1 Time signal 11 output
44	CH1 Time signal 12 output
45	CH1 Time signal 13 output
46	CH1 Time signal 14 output
47	CH1 Time signal 15 output
48	CH1 Time signal 16 output
49	CH2 Time signal 1 output
50	CH2 Time signal 2 output
51	CH2 Time signal 3 output
52	CH2 Time signal 4 output
53	CH2 Time signal 5 output
54	CH2 Time signal 6 output
55	CH2 Time signal 7 output
56	CH2 Time signal 8 output
57	CH2 Time signal 9 output
58	CH2 Time signal 10 output
59	CH2 Time signal 11 output
60	CH2 Time signal 12 output
61	CH2 Time signal 13 output
62	CH2 Time signal 14 output
63	CH2 Time signal 15 output
64	CH2 Time signal 16 output
65 to 99	Unused

Function Number Table (DI module)

Function No.	Contents
00	DO manual output
01	DI module CH1 Input state
02	DI module CH2 Input state
03	DI module CH3 Input state
04	DI module CH4 Input state
05	DI module CH5 Input state
06	DI module CH6 Input state
07	DI module CH7 Input state
08	DI module CH8 Input state
09	DI module CH9 Input state
10	DI module CH10 Input state
11	DI module CH11 Input state
12	DI module CH12 Input state
13 to 16	Unused
17	DI module CH13 Input state
18	DI module CH14 Input state

Function No.	Contents
19	DI module CH15 Input state
20	DI module CH16 Input state
21	DI module CH17 Input state
22	DI module CH18 Input state
23	DI module CH19 Input state
24	DI module CH20 Input state
25	DI module CH21 Input state
26	DI module CH22 Input state
27	DI module CH23 Input state
28	DI module CH24 Input state
29	DI module CH25 Input state
30	DI module CH26 Input state
31	DI module CH27 Input state
32	DI module CH28 Input state
33 to 99	Unused

■ Data items for initial setting mode

⚠ 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, those data is not necessary to be changed 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.

[Transfer to initial setting mode]

Transfer to initial setting mode sets in "1" with identifier IN (normally setting mode).

[Data items for initial setting mode]

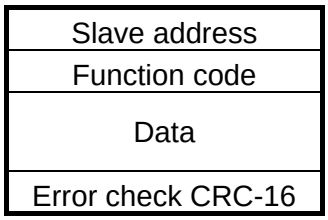
No.	Name	Iden-tifier	Attri-bute	Data range	Factory set value
1	Transmission transfer time setting (Data of each module)	**ZT**	R/W	0 to 100 ms	6

6.5 Modbus Communication Protocol

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

6.5.1 Message format

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



Message format

■ Slave address

The slave address is a number from 0 to 99 manually set at the module address setting switch located at the front of the SRX module. Although all connected slave units receive the query message sent from the master, only the slave with the slave address coinciding with the query message will accept the message.

■ Function code

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

☞ For details, see **6.5.2 Function code (P. 137)**.

■ Data

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

☞ For details, see as follows.
- **6.5.6 Message format (P. 142)**
- **6.5.7 Data configuration (P. 146)**
- **6.5.8 Data map of TIO module (P. 151)**
- **6.5.9 Data map of DI module (P. 180)**
- **6.5.10 Data map of DO module (P. 183)**

■ Error check

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

☞ For details, see **6.5.5 Calculating CRC-16 (P. 139)**.

6.5.2 Function code

- **Function code contents**

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

- **Message length of each function (Unit: byte)**

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

6.5.3 Communication mode

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

RTU mode

Items	Contents
Data bit length	8-bit (Binary)
Start mark of message	Unused
End mark of message	Unused
Message length	See **6.5.2 Function code**
Data time interval	Less than 24 bits' time *
Error check	CRC-16 (Cyclic Redundancy Check)

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

A data time interval may become more than 24 bits depending on the type of master used. In that case, the data time interval can be extended in the range of 1 to 255 ms.
The extension time of the data interval can be set with **Initial setting data items (P. 175)**.

6.5.4 Slave response

(1) Normal response

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

(2) Defective message response

- If the query message from the master is defective, except for transmission error, the slave returns the error response message without any action.
- If the self-diagnostic function of the slave detects an error, the slave will return an error response message to all query messages.
- The function code of each error response message is obtained by adding 80H to the function code of the query message.

Slave address
Function code
Error code
Error check CRC-16

Error response message

Error code	Contents
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

(3) No response

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

- The slave address in the query message does not coincide with any slave address settings.
- The transmission parameter of the master does not coincide with that of the slave.
- Transmission error such as overrun, framing, parity and etc., is found in the query message.
- There is length of query message exceeds set range.
- The number of data points is not twice the specified number of data points at the time of data write.
- If data time interval in the query message from the master is following
  24 bits' time or more
  24 bits' time plus a few milliseconds or more

6.5.5 Calculating CRC-16

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

The CRC code is formed in the following sequence:

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

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

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

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

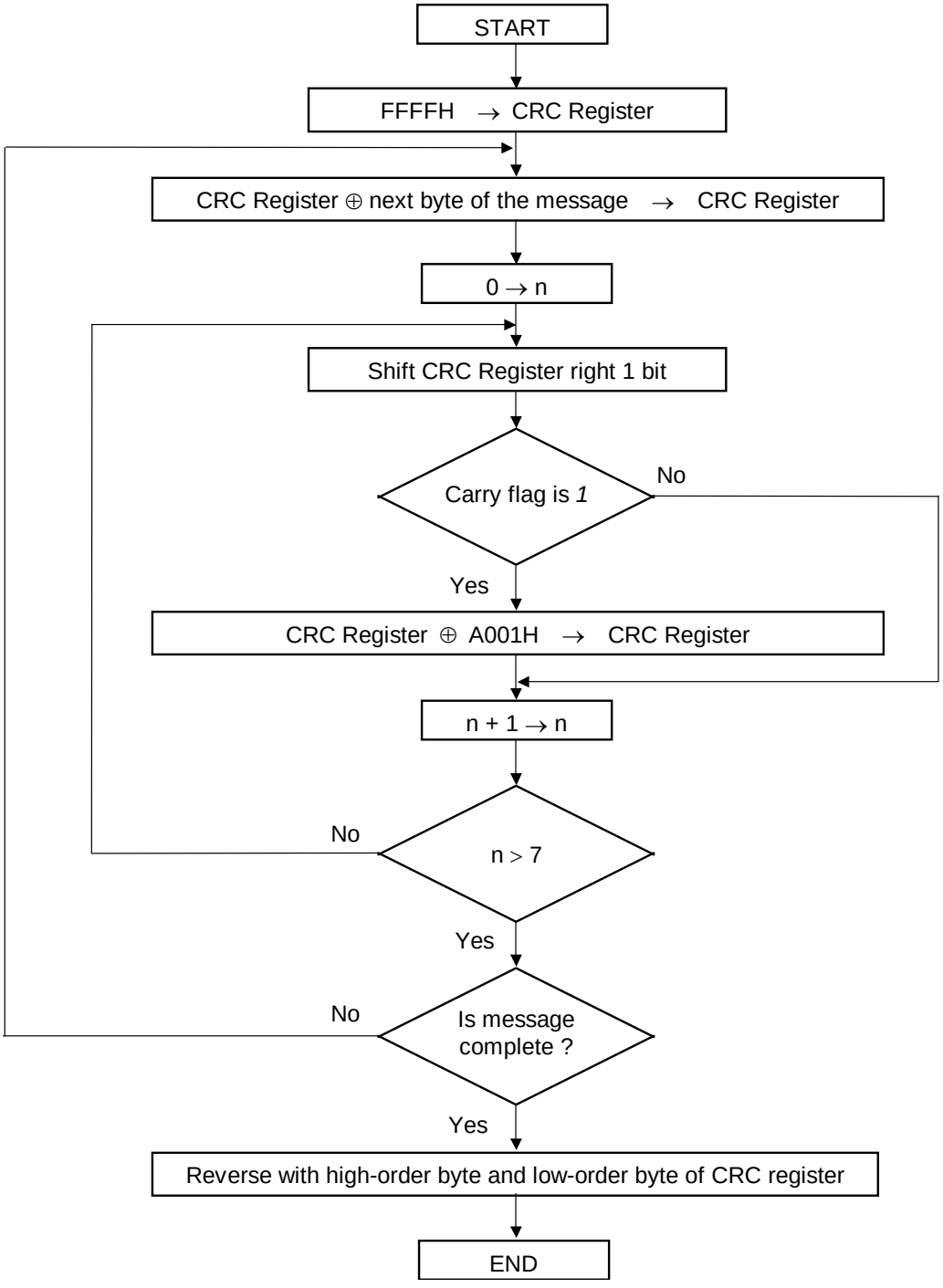
5. Repeat step ***3*** and ***4*** until there have been 8 shifts.

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

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

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

■ The flow chart of CRC-16



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

■ Example of a CRC calculation in the ‘C’ language

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

uint16 calculate_crc（byte *z_p, unit16 z_message_length）

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

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

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

6.5.6 Message format

■ Read holding registers [03H]

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

Example: The contents of the three holding registers from 0000H to 0002H are the read out from slave address 2.

Query message

Slave address		02H	
Function code		03H	
Starting No.	High	00H	First holding register address
	Low	00H	
Quantity	High	00H	The setting must be between 1 (0001H) and 125 (007DH).
	Low	03H	
CRC-16	High	05H	
	Low	F8H	

Normal response message

Slave address		02H	
Function code		03H	
Number of data		06H	→ Number of holding registers × 2
First holding register contents	High	00H	
	Low	78H	
Next holding register contents	High	00H	
	Low	00H	
Next holding register contents	High	00H	
	Low	14H	
CRC-16	High	95H	
	Low	80H	

Error response message

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

■ Preset single register [06H]

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

Example: Data is written into the holding register 0400H of slave address 1.

Query message

Slave address		01H
Function code		06H
Holding register number	High	04H
	Low	00H
Write data	High	00H
	Low	64H
CRC-16	High	89H
	Low	11H

} Any data within the range

Normal response message

Slave address		01H
Function code		06H
Holding register number	High	04H
	Low	00H
Write data	High	00H
	Low	64H
CRC-16	High	89H
	Low	11H

} Contents will be the same as query message data

Error response message

Slave address		01H
80H + Function code		86H
Error code		03H
CRC-16	High	02H
	Low	61H

■ Diagnostics (Loopback test) [08H]

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

Example: Loopback test for slave address 1

Query message

Slave address		01H
Function code		08H
Test code	High	00H
	Low	00H
Data	High	1FH
	Low	34H
CRC-16	High	E9H
	Low	ECH

Test code must be set to *00*

Any pertinent data

Normal response message

Slave address		01H
Function code		08H
Test code	High	00H
	Low	00H
Data	High	1FH
	Low	34H
CRC-16	High	E9H
	Low	ECH

Contents will be the same as query message data

Error response message

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

■ Preset multiple registers [10H]

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

Example: Data is written into the two holding registers from 0400H to 0401H of slave address 1.

Query message

Slave address		01H	
Function code		10H	
Starting number	High	04H	First holding register address
	Low	00H	
Quantity	High	00H	The setting must be between 1 (0001H) and 123 (007BH).
	Low	02H	
Number of data		04H	→ Number of holding registers × 2
Data to first register	High	00H	
	Low	64H	
Data to next register	High	00H	
	Low	1EH	
CRC-16	High	00H	
	Low	B8H	

Normal response message

Slave address		01H
Function code		10H
Starting number	High	04H
	Low	00H
Quantity	High	00H
	Low	02H
CRC-16	High	40H
	Low	F8H

Error response message

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

6.5.7 Data configuration

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

FFFFH represents −1.

■ Data processing with decimal points

(1) Data without decimal points

● Data of TIO module

Comprehensive event state
Error code
Burnout state
Event 1 state
Event 2 state
Heater break alarm state
Control loop break alarm (LBA) state
Operation mode
Control response parameters
PID/AT transfer
Auto/Manual transfer
Number of heater break alarm delay times
Hot/cold start selection
Control RUN/STOP transfer
Input error determination point (high)
Input error determination point (low)
Remote/Local transfer
Event LED mode setting
Digital input setting 1 (RESET)
Digital input setting 2 (RUN)
Digital input setting 3 (FIX)
Digital input setting 4 (MAN)
Digital input setting 5 (HOLD)
Digital input setting 6 (STEP)
Digital input setting 7 (Program pattern selection)
Digital input setting 8 (AT/PID)
Comprehensive alarm state
Control loop break alarm (LBA) use selection
Control loop break alarm (LBA) time
Integral/derivative time decimal point position
Program operation mode selection
Execution pattern
Execution segment
Number of program execution times
Time signal output state 1
Time signal output state 2
Pattern end output state
End state
Wait state
Hold state
Step action
Program operation start mode
Setting of the number of program execution times
End segment
Link pattern
Time signal output number
Time signal ON segment
Time signal OFF segment
Station number
PC number
Register start number
Maximum number of PLC communication channels
Register type (D, R, W)
X-TIO-R module monitor item selection
X-TIO-R module Link recognition time
X-TIO-R module error code
PLC scanning time setting
Number of connected TIO modules
Number of connected TIO channels
Action mode selection
PLC communication start time
Program data display: start channel setting
Initial setting mode
Input rang number
Input range decimal point position
Temperature unit selection
Control type selection
Event 1 type selection

Continued on the next page.

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Event 2 type selection
Event 1 hold action
Event 2 hold action
Number of event delay times
TIO module internal communication:
Transmission transfer time setting
Segment time unit setting
Operation mode holding setting
Installing module type monitor
Host communication 1:
Transmission transfer time setting
PLC communication or Host communication 2:
Transmission transfer time setting
Initializing internal communication
Communication data block length
(RKC communication)
Modbus data interval extension time

- **Data of DI module**

Input state of digital input
Error code
Event LED selection (terminal input)
Event LED selection (connector input)
Initial setting mode
Transmission transfer time setting

- **Data of DO module**

Output state of digital output
Manual output setting of digital output
Error code
Function selection of DO channel 1 to 12 (terminal)
Function selection of DO channel 13 to 28 (connector)
Event LED selection (terminal output)
Event LED selection (connector output)
Initial setting mode
Transmission transfer time setting

Example: When input range number is 18, 18 = 12H

Input range number	High	00H
	Low	12H

(2) Data with decimal points

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

- **Data with one decimal place**

Manipulated output value
Manual output value
Current transformer input measured value
Output limiter (high)
Output limiter (low)
Proportional cycle time
Heater break alarm set value
Manipulated output value at input error
Output change rate limiter (up)
Output change rate limiter (down)

Example: When heater break alarm set value 1 is 20.0 A, 20.0 is processed as 200, 200 = C8H

Heater break alarm set value	High	00H
	Low	C8H

- **Data with two decimal places**

Digital filter
AT differential gap time

(3) Data whose decimal point's presence and/or position depends on input range

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

Type of decimal points position:
Temperature input: No decimal place or one decimal place
Voltage/current input: No decimal place, one decimal place, two decimal places, three decimal places or four decimal places

Measured value (PV)
Set value monitor
Set value (SV)
Proportional band
PV bias
Event 1 set value
Event 2 set value
Start determination point
Input error determination point (high)
Input error determination point (low)
AT bias
Control loop break alarm (LBA) deadband
Level PID high limit set value
Wait zone
Segment level
Input scale high limit
Input scale low limit
ON/OFF control differential gap (upper)
ON/OFF control differential gap (lower)
Event 1 differential gap
Event 2 differential gap

Example: When the set value is –20.0 °C, –20.00 is processed as –200,
–200 = 0000H – 00C8H = FF38H

Set value	High	FFH
	Low	38H

(4) Data whose decimal point's presence and/or position depends on segment time unit setting

The position of the decimal point changes depending on the segment time unit setting because the Modbus protocol does not recognize data with decimal points during communication.

Type of decimal points position: No decimal place, one decimal place, two decimal places

Segment remaining time
Pattern end output time
Segment time
Time signal ON time
Time signal OFF time

(5) Data whose decimal point's position depends on Integral/ derivative time decimal point position

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

Type of decimal points position: One decimal place, two decimal places

Integral time
Derivative time

■ Data processing precautions

Do not write data to any address which is not described in a list of data maps.

- With Modbus protocol, the maximum number of channels per slave address is 60.
- If data range or address error occurs during data writing, the data written before error is in effect.
- Some communication data may become invalid depending on the module selection or the configuration of the SRX.
  Under conditions listed below, no error response message will occur.
  - – When ON/OFF control, proportional band, integral time and derivative time are invalid.
  - – When current/voltage output, proportioning cycle time are invalid.
  - – When only the heater break alarm function is provided, current transformer input measured value, heater break alarm status, heater break alarm set value and number of heater break alarm delay times are valid.
  - – When only the control loop break alarm (LBA) function is provided, control loop break alarm (LBA) status, use selection, time and deadband are valid.
- Send the next command message at time intervals of 30 bits after the master receives the response message.
- For level PID data and program control data, there may be a few data points in one item for each channel.
  For X-TIO-R Modbus, these data points (17 items) are collected for each channel and data points corresponding to 10 channels are assigned to range address. However as there are 60 temperature control channels maximum, the desired channel is selected by specifying the start channel using “Program data display: start channel setting” (register address: 7D10H).

Level PID data and progran control data corresponding to one channel

	Name	Number of data	Data type
1	Proportional band	8	Level PID data
2	Integral time	8	Level PID data
3	Derivative time	8	Level PID data
4	Control response parameters	8	Level PID data
5	Level PID high limit set value	8	Level PID data
6	Setting of the number of program execution times	16	Pattern data
7	End segment	16	Pattern data
8	Link pattern	16	Pattern data
9	Pattern end output time	16	Pattern data
10	Wait zone	16	Pattern data
11	Segment level	256	Segment data
12	Segment time	256	Segment data
13	Time signal output number	256	Time signal data
14	Time signal ON segment	256	Time signal data
15	Time signal ON time	256	Time signal data
16	Time signal OFF segment	256	Time signal data
17	Time signal OFF time	256	Time signal data

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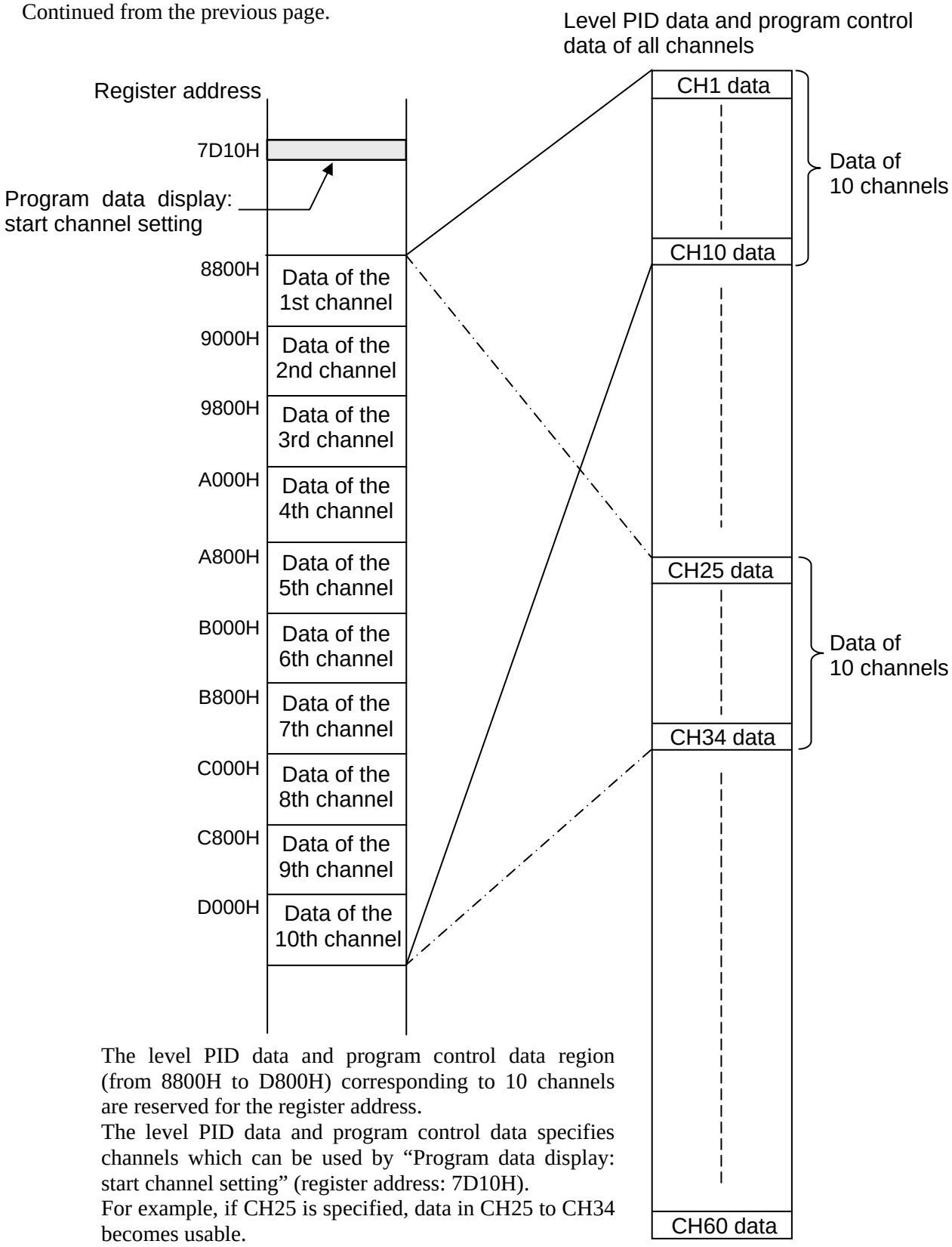

The level PID data and program control data region (from 8800H to D800H) corresponding to 10 channels are reserved for the register address.
The level PID data and program control data specifies channels which can be used by “Program data display: start channel setting” (register address: 7D10H).
For example, if CH25 is specified, data in CH25 to CH34 becomes usable.

Conceptual diagram of level PID data and program control data

6.5.8 Data map of TIO module

Register address numbers which are not described are those unused.

For details of each item, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC], **5.3 PLC Communication Data Map (P. 62)**, or **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Normal setting data items

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write
: PLC communication environment setting item

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Measured value (PV)	0000 ⋮ 003B	0 ⋮ 59	60	RO	Input scale low limit to Input scale high limit	—
Comprehensive event state	0040 ⋮ 007B	64 ⋮ 123	60	RO	Bit data b0: Burnout b1: Event 1 state b2: Event 2 state b3: Heater break alarm state b4: Control loop break alarm (LBA) state Data 0: OFF 1: ON [Decimal number: 0 to 31]	—
Manipulated output value	0080 ⋮ 00BB	128 ⋮ 187	60	RO	–5.0 to +105.0 %	—
Set value monitor	00C0 ⋮ 00FB	192 ⋮ 251	60	RO	Input scale low limit to Input scale high limit	—
Error code (Data of each module)	0100 ⋮ 011D	256 ⋮ 285	30	RO	Bit data b0: Memory backup error b1: Unused b2: Internal communication error b3: Adjustment data error b4: Input A/D error b5: Current transformer input A/D error b6: Temperature compensation A/D error b7: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Current transformer input measured value	0180 : 01BB	384 : 443	60	RO	0.0 to 30.0 A or 0.0 to 100.0 A	—
Burnout state	0200 : 023B	512 : 571	60	RO	0: OFF 1: ON	—
Event 1 state	0240 : 027B	576 : 635	60	RO	0: OFF 1: ON	—
Event 2 state	0280 : 02BB	640 : 699	60	RO	0: OFF 1: ON	—
Heater break alarm (HBA) state	02C0 : 02FB	704 : 763	60	RO	0: OFF 1: Heater break 2: Relay welding	—
Control loop break alarm (LBA) state	0300 : 033B	768 : 827	60	RO	0: OFF 1: ON	—
Operation mode	03C0 : 03FB	960 : 1019	60	R/W	0: Unused 1: Monitor 1 2: Monitor 2 3: Control	3
Set value (SV)	0400 : 043B	1024 : 1083	60	R/W	Input scale low limit to Input scale high limit	0
Proportional band	0440 : 047B	1088 : 1147	60	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time	0480 : 04BB	1152 : 1211	60	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time	04C0 : 04FB	1216 : 1275	60	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters	0500 : 053B	1280 : 1339	60	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
PV bias	0540 ⋮ 057B	1344 ⋮ 1403	60	R/W	–Input span to +Input span	0
Event 1 set value	0580 ⋮ 05BB	1408 ⋮ 1467	60	R/W	Deviation high/Deviation low: –Input span to +Input span Deviation high/low, Band: 0 to Input span Process high/Process low: Input scale low limit to Input scale high limit	0
Event 2 set value	05C0 ⋮ 05FB	1472 ⋮ 1531	60	R/W		0
PID/AT transfer *	0800 ⋮ 083B	2048 ⋮ 2107	60	R/W	0: PID control operation 1: AT (Autotuning) operation	0
Auto/Manual transfer	0840 ⋮ 087B	2112 ⋮ 2171	60	R/W	0: Auto mode 1: Manual mode	0
Manual output value	0880 ⋮ 08BB	2176 ⋮ 2235	60	R/W	–5.0 to +105.0 %	0.0
Output limiter (high)	08C0 ⋮ 08FB	2240 ⋮ 2299	60	R/W	Output limiter (low) to 105.0 %	100.0
Output limiter (low)	0900 ⋮ 093B	2304 ⋮ 2363	60	R/W	–5.0 % to Output limiter (high)	0.0
Proportional cycle time	0940 ⋮ 097B	2368 ⋮ 2427	60	R/W	0.2 to 50.0 seconds	Relay contact output: 20.0 Voltage pulse output: 2.0
Digital filter	09C0 ⋮ 09FB	2496 ⋮ 2555	60	R/W	0.00 to 10.00 seconds 0.00: Digital filter OFF	0.00
Heater break alarm (HBA) set value	0A00 ⋮ 0A3B	2560 ⋮ 2619	60	R/W	0.0 to 30.0 A or 0.0 to 100.0 A	0.0

* Caution for using the Autotuning (AT)

When control loop break alarm (LBA) is used, control loop break alarm (LBA) time is automatically calculated by AT. However, the calculated data becomes valid by changing to the initial setting mode once after AT is executed.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Number of heater break alarm (HBA) delay times	0A40 : 0A7B	2624 : 2683	60	R/W	1 to 255 times	5
Hot/cold start selection	0A80 : 0ABB	2688 : 2747	60	R/W	0: Hot start 1 1: Hot start 2 2: Cold start 1 3: Cold start 2	0
Start determination point	0AC0 : 0AFB	2752 : 2811	60	R/W	0 to input span	0.0
Control RUN/STOP transfer (Data of each module)	0C00 : 0C1D	3072 : 3101	30	R/W	0: Control STOP 1: Control RUN	0
Input error determination point (high)	0C40 : 0C7B	3136 : 3195	60	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Input error determination point (low)	0C80 : 0CBB	3200 : 3259	60	R/W	Input scale low limit to Input scale high limit	Input scale low limit
Action at input error (high)	0CC0 : 0CFB	3264 : 3323	60	R/W	0: Normal control 1: Manipulated output value at input error	0
Action at input error (low)	0D00 : 0D3B	3328 : 3387	60	R/W	0: Normal control 1: Manipulated output value at input error	0
Manipulated output value at input error	0D40 : 0D7B	3392 : 3451	60	R/W	–5.0 to +105.0 %	0.0
AT differential gap time	0D80 : 0DBB	3456 : 3515	60	R/W	0.00 to 50.00 seconds	0.10
AT bias	0E00 : 0E3B	3584 : 3643	60	R/W	–Input span to +Input span	0
Remote/Local transfer (Data of each module)	0EC0 : 0EDD	3776 : 3805	30	R/W	0: Local mode 1: Remote mode	0
Event LED mode setting (Data of each module)	0F00 : 0F1D	3840 : 3869	30	R/W	1: Mode 1 11: Mode 11 2: Mode 2 12: Mode 12 3: Mode 3 13: Mode 13 10:Mode 10 Except the above: Unused	0 (Unused)

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Digital input setting 1 (RESET)	0F40 : 0F7B	3904 : 3963	60	R/W	0000 to 9999 Upper two digits (Thousands and hundreds digits): Address of DI module Lower two digits (Tens and units digits): Channel number of DI module 00: No function	0000
Digital input setting 2 (RUN)	1240 : 127B	4672 : 4731	60	R/W		0000
Digital input setting 3 (FIX)	1280 : 12BB	4736 : 4795	60	R/W		0000
Digital input setting 4 (MAN)	12C0 : 12FB	4800 : 4859	60	R/W		0000
Digital input setting 5 (HOLD)	1300 : 133B	4864 : 4923	60	R/W		0000
Digital input setting 6 (STEP)	1340 : 137B	4928 : 4987	60	R/W		0000
Digital input setting 7 (Program pattern selection)	1380 : 13BB	4992 : 5051	60	R/W		0000
Digital input setting 8 (AT/PID)	13C0 : 13FB	5056 : 5115	60	R/W		0000
Comprehensive alarm state (Data of each unit)	1500	5376	1	RO	Bit data b0: OR operation of burnout states in all channels b1: OR operation of event 1 states in all channels b2: OR operation of event 2 states in all channels b3: OR operation of heater break alarm states in all channels b4: OR operation of control loop break alarm states in all channels b5 to b6: Unused b7: OR operation of setting error states in all channels Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
Control loop break alarm (LBA) use selection	6A40 : 6A7B	27200 : 27259	60	R/W	0: Unused 1: Used	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Control loop break alarm (LBA) time	6A80 ⋮ 6ABB	27264 ⋮ 27323	60	R/W	1 to 7200 seconds	80
Control loop break alarm (LBA) deadband	6AC0 ⋮ 6AFB	27328 ⋮ 27387	60	R/W	0 to Input span	0
Integral/derivative time decimal point position	6B00 ⋮ 6B3B	27392 ⋮ 27451	60	R/W	0: Two decimal places 1: One decimal places	0
Station number * (Data of each unit)	7D00	32000	1	R/W	0 to 31	0
PC number * (Data of each unit)	7D01	32001	1	R/W	0 to 255	255
Register start number * (Data of each unit)	7D02	32002	1	R/W	0 to 32767 or 0 to 9944	1000
Maximum number of PLC communication channels * (Data of each unit)	7D03	32003	1	R/W	1 to 60 CH	10
Register type (D, R, W) * (Data of each unit)	7D04	32004	1	R/W	0: D register (data register) 1: R register (file register) 2: W register (link register)	0
X-TIO-R module monitor item selection * (Data of each unit)	7D06	32006	1	R/W	Bit data b0: Measured value (PV) b1: Set value monitor b2: Control output value b3: CT input measured value b4: TIO state 1 b5: TIO state 2 b6: Execution pattern b7: Execution segment b8: Segment remaining time b9: Time signal output state 1 b10: Time signal output state 2 Data 0: Invalid 1: Valid [Decimal number: 0 to 2047]	bit 0: 1 bit 1: 1 bit 2: 1 bit 3: 1 bit 4: 1 bit 5: 1 bit 6: 1 bit 7: 1 bit 8: 1 bit 9: 1 bit 10: 1 [Decimal number: 2047]
X-TIO-R module Link recognition time * (Data of each unit)	7D07	32007	1	R/W	0 to 255 seconds	10

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
X-TIO-R module error code (Data of each unit)	7D08	32008	1	RO	Bit data b0: Memory backup error b1: Unused b2: Module configuration error b3: Unused b4: Unused b5: Unused b6: Unused b7: PLC communication error Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
PLC scanning time setting * (Data of each unit)	7D09	32009	1	R/W	0 to 3000 ms	255
Number of connected TIO modules (Data of each unit)	7D0A	32010	1	RO	0 to 31	—
Number of connected TIO channels (Data of each unit)	7D0B	32011	1	RO	0 to 60 CH	—
Action mode selection * (Data of each unit)	7D0C	32012	1	R/W	Bit data b0: Unused (1 fixed) b1: PLC register read/write error elimination 0: Manual elimination 1: Automatic elimination b2 to b7: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	bit 0: 1 bit 1: 0 bit 2 to 7: 0 [Decimal number: 1]
PLC communication start time * (Data of each unit)	7D0F	32015	1	R/W	1 to 255 seconds	5
Program data display: start channel setting (Data of each unit)	7D10	32016	1	R/W	1 to 51 CH	1
Initial setting mode (Data of each unit)	7D20	32032	1	R/W	0: Normal setting mode 1: Initial setting mode	0

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

■ Level PID/program control data

For level PID data and program control data, there may be a few data points in one item for each channel. (The number of data points differ depending on the data type.)
For example, for level PID data, there are level data points corresponding to eight levels for each channel. In addition, for program control data, there are pattern data points corresponding to 16 patterns for each channel.
For X-TIO-R Modbus, these data points (17 items) are collected for each channel and data points corresponding to 10 channels are assigned to range address. However as there are 60 temperature control channels maximum, the desired channel is selected by specifying the start channel using "Program data display: start channel setting" (register address: 7D10H).
In addition, if there is only one data point in one channel, a register address is allocated for each item in addition to the above data.

☞ For Level PID/program control data, see ■ **Data processing precautions (P. 149)**.

● Items of 1 channel/data

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Program operation mode selection	8000 ⋮ 803B	32768 ⋮ 32827	60	R/W	0: RESET 1: RUN (Program control) 2: FIX (Fixed set point control) 3: MAN (Manual control)	2
Execution pattern	8040 ⋮ 807B	32832 ⋮ 32891	60	R/W	1 to 16	1
Execution segment	8080 ⋮ 80BB	32896 ⋮ 32955	60	RO	1 to 16	—
Segment remaining time	80C0 ⋮ 80FB	32960 ⋮ 33019	60	RO	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	—
Number of program execution times	8100 ⋮ 813B	33024 ⋮ 33083	60	RO	0 to 9999 times	—

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output state 1	8140 : 817B	33088 : 33147	60	RO	Bit data b0: Time signal 1 output state b1: Time signal 2 output state b2: Time signal 3 output state b3: Time signal 4 output state b4: Time signal 5 output state b5: Time signal 6 output state b6: Time signal 7 output state b7: Time signal 8 output state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
Time signal output state 2	8180 : 81BB	33152 : 33211	60	RO	Bit data b0: Time signal 9 output state b1: Time signal 10 output state b2: Time signal 11 output state b3: Time signal 12 output state b4: Time signal 13 output state b5: Time signal 14 output state b6: Time signal 15 output state b7: Time signal 16 output state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
Pattern end output state	81C0 : 81FB	33216 : 33275	60	RO	0: Pattern end output OFF 1: Pattern end output ON	—
End state	8200 : 821D	33280 : 33339	60	RO	0: End state OFF 1: End state ON	—
Wait state	8240 : 827B	33344 : 33403	60	RO	0: Wait state OFF 1: Wait state ON	—
Hold state	8280 : 82BB	33408 : 33467	60	R/W	0: Hold state OFF 1: Hold state ON	0
Step action	82C0 : 82FB	33472 : 33561	60	R/W	0: Not step action 1: Step action execution	0
Program operation start mode	8300 : 833B	33536 : 33595	60	R/W	0: Zero start 1: PV start 1 2: PV start 2	0

- **Channel 1 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	8800 : 8807	34816 : 34823	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	8808 : 880F	34824 : 34831	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	8810 : 8817	34832 : 34839	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	8818 : 881F	34840 : 34847	8	R/W	0: Slow 1: Medium 2: Fast	0
Level PID high limit set value (Level PID data)	8820 : 8827	34848 : 34855	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	8828 : 8837	34856 : 34871	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	8838 : 8847	34872 : 34887	16	R/W	1 to 16	16
Link pattern (Pattern data)	8848 : 8857	34888 : 34903	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	8858 : 8867	34904 : 34919	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	8868 : 8877	34920 : 34935	16	R/W	0 to Input span	0.0
Segment level (Segment data)	8878 : 8977	34936 : 35191	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	8978 : 8A77	35192 : 35447	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output number (Time signal data)	8A78 : 8B77	35448 : 35703	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	8B78 : 8C77	35704 : 35959	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	8C78 : 8D77	35960 : 36215	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	8D78 : 8E77	36216 : 36471	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	8E78 : 8F77	36472 : 36727	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 2 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	9000 : 9007	36864 : 36871	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	9008 : 900F	36872 : 36879	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	9010 : 9017	36880 : 36887	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	9018 : 901F	36888 : 36895	8	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Level PID high limit set value (Level PID data)	9020 : 9027	36896 : 36903	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	9028 : 9037	36904 : 36919	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	9038 : 9047	36920 : 36935	16	R/W	1 to 16	16
Link pattern (Pattern data)	9048 : 9057	36936 : 36951	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	9058 : 9067	36952 : 36967	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	9068 : 9077	36968 : 36983	16	R/W	0 to Input span	0.0
Segment level (Segment data)	9078 : 9177	36984 : 37239	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	9178 : 9277	37240 : 37495	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal output number (Time signal data)	9278 : 9377	37496 : 37751	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	9378 : 9477	37752 : 38007	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	9478 : 9577	38008 : 38263	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	9578 : 9677	38264 : 38519	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	9678 : 9777	38520 : 38775	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 3 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	9800 : 9807	38912 : 38919	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	9808 : 980F	38920 : 38927	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	9810 : 9817	38928 : 38935	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	9818 : 981F	38936 : 38943	8	R/W	0: Slow 1: Medium 2: Fast	0
Level PID high limit set value (Level PID data)	9820 : 9827	38944 : 38951	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	9828 : 9837	38952 : 38967	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	9838 : 9847	38968 : 38983	16	R/W	1 to 16	16
Link pattern (Pattern data)	9848 : 9857	38964 : 38999	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	9858 : 9867	39000 : 39015	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	9868 : 9877	39016 : 39031	16	R/W	0 to Input span	0.0
Segment level (Segment data)	9878 : 9977	39032 : 39287	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	9978 : 9A77	39288 : 39543	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output number (Time signal data)	9A78 : 9B77	39544 : 39799	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	9B78 : 9C77	39800 : 40055	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	9C78 : 9D77	40056 : 40311	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	9D78 : 9E77	40312 : 40567	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	9E78 : 9F77	40568 : 40823	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 4 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	A000 : A007	40960 : 40967	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	A008 : A00F	40968 : 40975	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	A010 : A9017	40976 : 40983	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	A018 : A01F	40984 : 40991	8	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Level PID high limit set value (Level PID data)	A020 : A027	40992 : 40999	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	A028 : A037	41000 : 41015	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	A038 : A047	41016 : 41031	16	R/W	1 to 16	16
Link pattern (Pattern data)	A048 : A057	41032 : 41047	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	A058 : A067	41048 : 41063	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	A068 : A077	41064 : 41079	16	R/W	0 to Input span	0.0
Segment level (Segment data)	A078 : A177	41080 : 41335	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	A178 : A277	41336 : 41591	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal output number (Time signal data)	A278 : A377	41592 : 41847	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	A378 : A477	41848 : 42103	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	A478 : A577	42104 : 42359	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	A578 : A677	42360 : 42615	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	A678 : A777	42616 : 42871	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 5 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	A800 : A807	43008 : 43015	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	A808 : A80F	43016 : 43023	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	A810 : A817	43024 : 43031	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	A818 : A81F	43032 : 43039	8	R/W	0: Slow 1: Medium 2: Fast	0
Level PID high limit set value (Level PID data)	A820 : A827	43040 : 43047	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	A828 : A837	43048 : 43063	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	A838 : A847	43064 : 43079	16	R/W	1 to 16	16
Link pattern (Pattern data)	A848 : A857	43080 : 43095	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	A858 : A867	43096 : 43111	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	A868 : A877	43112 : 43127	16	R/W	0 to Input span	0.0
Segment level (Segment data)	A878 : A977	43128 : 43383	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	A978 : AA77	43384 : 43639	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output number (Time signal data)	AA78 : AB77	43640 : 43895	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	AB78 : AC77	43896 : 44151	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	AC78 : AD77	44152 : 44407	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	AD78 : AE77	44408 : 44663	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	AE78 : AF77	44664 : 44919	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 6 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	B000 : B007	45056 : 45063	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	B008 : B00F	45064 : 45071	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	B010 : B017	45072 : 45079	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	B018 : B01F	45080 : 45087	8	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Level PID high limit set value (Level PID data)	B020 : B027	45088 : 45095	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	B028 : B037	45096 : 45111	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	B038 : B047	45112 : 45127	16	R/W	1 to 16	16
Link pattern (Pattern data)	B048 : B057	45128 : 45143	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	B058 : B067	45144 : 45159	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	B068 : B077	45160 : 45175	16	R/W	0 to Input span	0.0
Segment level (Segment data)	B078 : B177	45176 : 45431	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	B178 : B277	45432 : 45687	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal output number (Time signal data)	B278 : B377	45688 : 45943	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	B378 : B477	45944 : 46199	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	B478 : B577	46200 : 46455	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	B578 : B677	46456 : 46711	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	B678 : B777	46712 : 46967	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 7 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	B800 : B807	47104 : 47111	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	B808 : B80F	47112 : 47119	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	B810 : B817	47120 : 47127	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	B818 : B81F	47128 : 47135	8	R/W	0: Slow 1: Medium 2: Fast	0
Level PID high limit set value (Level PID data)	B820 : B827	47136 : 47143	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	B828 : B837	47144 : 47159	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	B838 : B847	47160 : 47175	16	R/W	1 to 16	16
Link pattern (Pattern data)	B848 : B857	47176 : 47191	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	B858 : B867	47192 : 47207	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	B868 : B877	47208 : 47223	16	R/W	0 to Input span	0.0
Segment level (Segment data)	B878 : B977	47224 : 47479	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	B978 : BA77	47480 : 47735	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output number (Time signal data)	BA78 : BB77	47736 : 47991	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	BB78 : BC77	47992 : 48247	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	BC78 : BD77	48248 : 48503	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	BD78 : BE77	48504 : 48759	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	BE78 : BF77	48760 : 49015	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 8 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	C000 : C007	49152 : 49159	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	C008 : C00F	49160 : 49167	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	C010 : C017	49168 : 49175	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	C018 : C01F	49176 : 49183	8	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Level PID high limit set value (Level PID data)	C020 : C027	49184 : 49191	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	C028 : C037	49192 : 49207	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	C038 : C047	49208 : 49223	16	R/W	1 to 16	16
Link pattern (Pattern data)	C048 : C057	49224 : 49239	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	C058 : C067	49240 : 49255	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	C068 : C077	49256 : 49271	16	R/W	0 to Input span	0.0
Segment level (Segment data)	C078 : C177	49272 : 49527	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	C178 : C277	49528 : 49783	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal output number (Time signal data)	C278 : C377	49784 : 50039	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	C378 : C477	50040 : 50295	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	C478 : C577	50296 : 50551	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	C578 : C677	50552 : 50807	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	C678 : C777	50808 : 51063	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 9 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	C800 : C807	51200 : 51207	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	C808 : C80F	51208 : 51215	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	C810 : C817	51216 : 51223	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	C818 : C81F	51224 : 51231	8	R/W	0: Slow 1: Medium 2: Fast	0
Level PID high limit set value (Level PID data)	C820 : C827	51232 : 51239	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	C828 : C837	51240 : 51255	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	C838 : C847	51256 : 51271	16	R/W	1 to 16	16
Link pattern (Pattern data)	C848 : C857	51272 : 51287	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	C858 : C867	51288 : 51303	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	C868 : C877	51304 : 51319	16	R/W	0 to Input span	0.0
Segment level (Segment data)	C878 : C977	51320 : 51575	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	C978 : CA77	51576 : 51831	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Time signal output number (Time signal data)	CA78 : CB77	51832 : 52087	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	CB78 : CC77	52088 : 52343	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	CC78 : CD77	52344 : 52599	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	CD78 : CE77	52600 : 52855	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	CE78 : CF77	52856 : 53111	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

- **Channel 10 data**

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Proportional band (Level PID data)	D000 : D007	53248 : 53255	8	R/W	TC/RTD input: 0 (0.0) to Input span Voltage (V)/Current (I) input: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action	TC/RTD: 10.0 °C or 10.0 °F V/I: 10.0 % of input span
Integral time (Level PID data)	D008 : D00F	53256 : 53263	8	R/W	0.1 to 3600.0 seconds 0.01 to 360.00 seconds	40.00
Derivative time (Level PID data)	D010 : D017	53264 : 53271	8	R/W	0.0 to 3600.0 seconds 0.00 to 360.00 seconds 0.0 (0.00): Derivative action OFF (PI action)	10.00
Control response parameters (Level PID data)	D018 : D01F	53272 : 53279	8	R/W	0: Slow 1: Medium 2: Fast	0

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Level PID high limit set value (Level PID data)	D020 : D027	53280 : 53287	8	R/W	Input scale low limit to Input scale high limit	Input scale high limit
Setting of the number of program execution times (Pattern data)	D028 : D037	53288 : 53303	16	R/W	1 to 1000 times 1000: Number of infinite times	1
End segment (Pattern data)	D038 : D047	53304 : 53319	16	R/W	1 to 16	16
Link pattern (Pattern data)	D048 : D057	53320 : 53335	16	R/W	0 to 16 0: No link pattern	0
Pattern end output time (Pattern data)	D058 : D067	53336 : 53351	16	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Wait zone (Pattern data)	D068 : D077	53352 : 53367	16	R/W	0 to Input span	0.0
Segment level (Segment data)	D078 : D177	53368 : 53623	256	R/W	Input scale low limit to Input scale high limit	0
Segment time (Segment data)	D178 : D277	53624 : 53879	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal output number (Time signal data)	D278 : D377	53880 : 54135	256	R/W	0 to 16 0: No time signal output	0
Time signal ON segment (Time signal data)	D378 : D477	54136 : 54391	256	R/W	1 to 16	1
Time signal ON time (Time signal data)	D478 : D577	54392 : 54647	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00
Time signal OFF segment (Time signal data)	D578 : D677	54648 : 54903	256	R/W	1 to 16	1
Time signal OFF time (Time signal data)	D678 : D777	54904 : 55159	256	R/W	0.00 to 300.00 seconds 0.0 to 3000.0 seconds 0 to 30000 seconds 0 to 30000 minutes	0.00

■ 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, those data is not necessary to be changed 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.

● Transfer to initial setting mode.

Transfer to initial setting mode sets in "1" with register address 7D20H (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 register address 7D20H by 0).

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Input range number *	7000 ⋮ 703B	28672 ⋮ 28731	60	R/W	TC input: 0: K –200 to +1372 °C or –328 to +2501 °F 1: J –200 to +1200 °C or –328 to +2192 °F 2: R –50 to +1768 °C or –58 to +3000 °F 3: S –50 to +1768 °C or –58 to +3000 °F 4: B 0 to 1800 °C or 32 to 3000 °F 5: E –200 to +1000 °C or –328 to +1832 °F 6: N 0 to 1300 °C or 32 to 2372 °F 7: T –200 to +400 °C or –328 to +752 °F 8: W5Re/W26Re 0 to 2300 °C or 32 to 3000 °F 9: PLII 0 to 1390 °C or 32 to 2534 °F	Specify when ordering

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Input range number *	7000 ⋮ 703B	28672 ⋮ 28731	60	R/W	RTD input: 12: Pt100 –200 to +850 °C or –328 to +1562 °F 13: JPt100 –200 to +600 °C or –328 to +1112 °F Voltage/Current input: 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100mV DC 21: 0 to 10 mV DC	Specify when ordering
Input scale high limit *	7040 ⋮ 707B	28736 ⋮ 28795	60	R/W	Input scale low limit to 20000	Depend on input range
Input scale low limit *	7080 ⋮ 70BB	28800 ⋮ 28859	60	R/W	–2000 to Input scale high limit	Depend on input range
Input range decimal point position *	70C0 ⋮ 70FB	28864 ⋮ 28923	60	R/W	TC/RTD input: 0 to 1 Voltage/Current input: 0 to 4 0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1
Temperature unit selection *	7100 ⋮ 713B	28928 ⋮ 28987	60	R/W	0: °C 1: °F	0
Control type selection	7140 ⋮ 717B	28992 ⋮ 29051	60	R/W	0: Direct action 1: Reverse action	1
ON/OFF control differential gap (upper)	7180 ⋮ 71BB	29056 ⋮ 29115	60	R/W	0 to Input span	TC/RTD: 1.0 °C or 1.0 °F
ON/OFF control differential gap (lower)	71C0 ⋮ 71FB	29120 ⋮ 29179	60	R/W		V/I: 0.1 % of input span

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Event 1 differential gap	7200 : 723B	29184 : 29243	60	R/W	0 to Input span	TC/RTD: 2.0 °C or 2.0 °F V/I: 0.2 % of input span
Event 2 differential gap	7240 : 727B	29248 : 29307	60	R/W		
Event 1 type selection *	7280 : 72BB	29312 : 29371	60	R/W	0: None 1: Process high 2: Process low 3: Deviation high 4: Deviation low 5: Deviation high/low 6: Band	0
Event 2 type selection *	72C0 : 72FB	29376 : 29435	60	R/W		0
Event 1 hold action	7300 : 733B	29440 : 29499	60	R/W	0: Not provided 1: Hold action (2: Do not set this one) 3: Re-hold action	3
Event 2 hold action	7340 : 737B	29504 : 29563	60	R/W		3
Number of event delay times	7380 : 73BB	29568 : 29627	60	R/W	0 to 255 times	0
TIO module internal communication: Transmission transfer time setting (Data of each module)	73C0 : 73DD	29632 : 29661	30	R/W	0 to 100 ms	6
Segment time unit setting	7400 : 741D	29696 : 29725	30	R/W	0: 0.01 second 1: 0.1 second 2: 1 second 3: 1 minute	0
Operation mode holding setting (Data of each module)	7440 : 745D	29760 : 29789	30	R/W	0: Not hold 1: Hold	1
Output change rate limiter (up)	7480 : 74BB	29824 : 29883	60	R/W	0.0 to 100.0 %/second 0.0: Limiter OFF	0.0
Output change rate limiter (down)	74C0 : 74FB	29888 : 29947	60	R/W	0.0 to 100.0 %/second 0.0: Limiter OFF	0.0

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Installing module type monitor (Data of each module)	7580 ⋮ 759D	30080 ⋮ 30109	30	RO	1: TIO module 2: Unused 3: Digital input (DI) module 4: Digital output (DO) module	—
TIO state 1	7600 ⋮ 763B	30208 ⋮ 30267	60	RO	Bit data b0: Burnout b1: Event 1 state b2: Event 2 state b3: Heater break alarm (HBA) state b4: Control loop break alarm (LBA) state b5: Unused b6: Unused b7: Setting error b8: Module error b9: Error code Data 0: OFF 1: ON [Decimal number: 0 to 1023]	—
TIO state 2	7640 ⋮ 767B	30272 ⋮ 30331	60	RO	Bit data b0: End state b1: Pattern end output state b2: Wait state b3: PID/AT state 0: PID control 1: AT state b4 to b6: Level number (level PID) Level 1: b4: 0, b5: 0, b6: 0 Level 2: b4: 1, b5: 0, b6: 0 Level 3: b4: 0, b5: 1, b6: 0 Level 4: b4: 1, b5: 1, b6: 0 Level 5: b4: 0, b5: 0, b6: 1 Level 6: b4: 1, b5: 0, b6: 1 Level 7: b4: 0, b5: 1, b6: 1 Level 8: b4: 1, b5: 1, b6: 1 b7: Hold state Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
Host communication 1: Transmission transfer time setting (Data of each unit)	7D21	32033	1	R/W	0 to 255 ms	6

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
PLC communication or Host communication 2: Transmission transfer time setting (Data of each unit)	7D22	32034	1	R/W	0 to 255 ms	1
Initializing internal communication (Data of each unit)	7D24	32036	1	R/W	0: Normal state (Initialization is not execute) 1: Initialize internal communication	0
Communication data block length (RKC communication) (Data of each unit)	7D26	32038	1	R/W	20 to 255 byte	255
Modbus data interval extension time * (Data of each unit)	7D27	32039	1	R/W	0 to 255 ms	0

* These items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.

6.5.9 Data map of DI module

Register address numbers which are not described are those unused.

For details of each item, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Normal setting data items

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Input state of digital input *	2000 ⋮ 2039	8192 ⋮ 8249	58	RO	Bit data •First word (terminal input) b0: DI channel 1 b1: DI channel 2 b2: DI channel 3 b3: DI channel 4 b4: DI channel 5 b5: DI channel 6 b6: DI channel 7 b7: DI channel 8 b8: DI channel 9 b9: DI channel 10 b10: DI channel 11 b11: DI channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095] •Second word (connector input) b0: DI channel 13 b1: DI channel 14 b2: DI channel 15 b3: DI channel 16 b4: DI channel 17 b5: DI channel 18 b6: DI channel 19 b7: DI channel 20 b8: DI channel 21 b9: DI channel 22 b10: DI channel 23 b11: DI channel 24 b12: DI channel 25 b13: DI channel 26 b14: DI channel 27 b15: DI channel 28 Data 0: OFF 1: ON [Decimal number: 0 to 65535] Successive two words correspond to one module. Data is arranged in the ascending order of module address number.	—

* For the X-DI-A module, as there is no connector input, data in the second word becomes zero.

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Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Error code (Data of each module)	2100 ⋮ 211C	8448 ⋮ 8476	29	RO	Bit data b0: Backup error b1 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 1]	—
Event LED selection: terminal input (DI channel 1 to 12)	2200 ⋮ 235B	8704 ⋮ 9051	348	R/W	0: Unused 1: EVENT1 lamp 2: EVENT2 lamp 3: EVENT3 lamp 4: EVENT4 lamp	0
Event LED selection: connector input (DI channel 13 to 28)	2400 ⋮ 25CF	9216 ⋮ 9679	464	R/W		0
Initial setting mode (Data of each module)	7D20	32032	1	R/W	0: Normal setting mode 1: Initial setting mode	0

■ 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, those data is not necessary to be changed 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.

[Transfer to initial setting mode]

Transfer to initial setting mode sets in "1" with register address 7D20H (normally setting mode).

[Initial setting data]

Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Transmission transfer time setting (Data of each module)	2600 : 261C	972 : 9756	29	R/W	0 to 100 ms	6

6.5.10 Data map of DO module

Register address numbers which are not described are those unused.

For details of each item, see **Module Type Controller SRX Communication Instruction Manual (IMS01N01-E□)**.

■ Normal setting data items

HEX: Hexadecimal DEC: Decimal
RO: Read only R/W: Read and Write

Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Output state of digital output *	3000 ⋮ 3039	12288 ⋮ 12345	58	RO	Bit data •First word (terminal input) b0: DO channel 1 b1: DO channel 2 b2: DO channel 3 b3: DO channel 4 b4: DO channel 5 b5: DO channel 6 b6: DO channel 7 b7: DO channel 8 b8: DO channel 9 b9: DO channel 10 b10: DO channel 11 b11: DO channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095] •Second word (connector input) b0: DO channel 13 b1: DO channel 14 b2: DO channel 15 b3: DO channel 16 b4: DO channel 17 b5: DO channel 18 b6: DO channel 19 b7: DO channel 20 b8: DO channel 21 b9: DO channel 22 b10: DO channel 23 b11: DO channel 24 b12: DO channel 25 b13: DO channel 26 b14: DO channel 27 b15: DO channel 28 Data 0: OFF 1: ON [Decimal number: 0 to 65535] Successive two words correspond to one module. Data is arranged in the ascending order of module address number.	—

* For the X-DO-A module, as there is no connector output, data in the second word becomes zero.

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Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Manual output setting of digital output *	3100 : 3139	12544 : 12601	58	R/W	Bit data •First word (terminal input) b0: DO channel 1 b1: DO channel 2 b2: DO channel 3 b3: DO channel 4 b4: DO channel 5 b5: DO channel 6 b6: DO channel 7 b7: DO channel 8 b8: DO channel 9 b9: DO channel 10 b10: DO channel 11 b11: DO channel 12 b12 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 4095] •Second word (connector input) b0: DO channel 13 b1: DO channel 14 b2: DO channel 15 b3: DO channel 16 b4: DO channel 17 b5: DO channel 18 b6: DO channel 19 b7: DO channel 20 b8: DO channel 21 b9: DO channel 22 b10: DO channel 23 b11: DO channel 24 b12: DO channel 25 b13: DO channel 26 b14: DO channel 27 b15: DO channel 28 Data 0: OFF 1: ON [Decimal number: 0 to 65535] Successive two words correspond to one module. Data is arranged in the ascending order of module address number.	bit 0 to 15: 0 [Decimal number: 0]

* For the X-DO-A module, as there is no connector output, data in the second word becomes zero.
In order to make the “Manual output setting of digital output” valid, set the lower digits to “00” by selecting the DO channel function.

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Name	Register address		No. of data	Attribute	Data range	Factory set value
	HEX	DEC				
Error code (Data of each module)	3220 ⋮ 323C	12832 ⋮ 12860	29	RO	Bit data b0: Backup error b1 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 1]	—
Function selection of DO channel 1 to 12 (terminal)	3300 ⋮ 345B	13056 ⋮ 13403	348	R/W	0000 to 9999 Upper two digits (Thousands and hundreds digits): Address of TIO module or DI module Lower two digits (Tens and units digits): Function number of output signal ☞ See **Function Number Table (P. 134)**. Upper two digits are ignored with lower two digits set to "00."	0
Function selection of DO channel 13 to 28 (connector)	3500 ⋮ 36CF	13568 ⋮ 14031	464	R/W		0
Event LED selection: terminal input (DO channel 1 to 12)	3700 ⋮ 385B	14080 ⋮ 14427	348	R/W	0: Unused 1: EVENT1 lamp 2: EVENT2 lamp 3: EVENT3 lamp 4: EVENT4 lamp	0
Event LED selection: connector input (DO channel 13 to 28)	3900 ⋮ 3ACF	14592 ⋮ 15055	464	R/W		0
Initial setting mode (Data of each module)	7D20	32032	1	R/W	0: Normal setting mode 1: Initial setting mode	0

■ 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, those data is not necessary to be changed 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.

[Transfer to initial setting mode]

Transfer to initial setting mode sets in "1" with register address 7D20H (normally setting mode).

[Initial setting data]

Name	Register address		No. of data	Attri-bute	Data range	Factory set value
	HEX	DEC				
Transmission transfer time setting (Data of each module)	3B00 : 3B1C	15104 : 15132	29	R/W	0 to 100 ms	6

7. TROUBLESHOOTING

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

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 the wiring is completed.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

CAUTION

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

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.

■ X-TIO-R module

Problem	Probable cause	Solution
FAIL/RUN lamp does not light up (temperature control side) RUN lamp does not light up (PLC/host communication side)	Power not being supplied	Check external breaker etc.
	Appropriate power supply voltage not being supplied	Check the power supply
	Power supply terminal contact defect	Retighten the terminals
	Power supply section defect	Replace X-TIO-R module
RUN lamp flashes rapidly (PLC/host communication side)	Data collection just after the power is turned on	After data collection, the lamp goes on, if normal
RUN lamp flashes slowly (PLC/host communication side)	Memory backup error	Replace X-TIO-R module
	Module configuration error Disconnection of the module connection or disconnection of the module mainframe from terminal base	Confirm the module connection condition and connect correctly
	PLC communication error No connection or disconnection or imperfect contact of the communication cable	Confirm the cable connection condition and connect correctly
	PLC register read/write error Reset with the PLC side	PLC register read/write error elimination: Manual elimination The request command, “2: Set value monitor” is executed and then the error is eliminated after all of the set values are written in the register. PLC register read/write error elimination: Automatic elimination The error is automatically eliminated after PLC communication returns to normal and the error is retained for more than one second (or monitor processing time).
RX/TX lamp does not flash (temperature control side)	Disconnection of the module connection or imperfect contact of the junction connector	Confirm the connection condition or connector and connect correctly
	CPU section defect	Replace X-TIO-R module
FAIL/RUN lamp is lit (red): FAIL status (temperature control side)	CPU section or power section defect	Replace X-TIO-R module

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Problem	Probable cause	Solution
FAIL lamp is lit (PLC/host communication side)	CPU section defect	Replace X-TIO-R module
FAIL lamp flashes (PLC/host communication side)	PLC communication environment setting mode by the switch	Return the switch to its original position

☞ For the PLC communication environment setting mode by the switch, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

■ PLC communication

Problem	Probable cause	Solution
• Even if "1: Setting" or "2: Set value monitor" is set in request command, transfer is not finished. Request command does not return to "0: Monitor" • COM. PORT1 lamp or COM. PORT2/ COM. PORT3 lamp is lit, and it can be seen to communicate normally, but monitor value is not transferred to PLC	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed, data bit configuration and protocol with those of the PLC	Confirm the X-TIO-R module settings and set them correctly
	Wrong setting of PLC communication data	Confirm the PLC communication settings and set them correctly
		Setting of termination resistor in accordance with PLC or the insertion is done
	Setting of PLC becomes write inhibit	Setting of PLC is turned into write enable (Write enable in RUN, shift to monitor mode, etc.)
	Accesses outside the range of memory address of PLC (wrong setting of address)	Confirm the PLC communication environment setting and set them correctly
If two or more units are connected, no units after the second unit are recognized	X-TIO-R module Link recognition time is short	Lengthen X-TIO-R module link recognition time
When request command is set in "1: Setting," setting error (bit 7 of TIO state 1, ON) is become	Data rang error	Confirm the setting range of set value and set them correctly
Details of each setting of the PLC communication environment by switch are known	There is no record of setting details	• Initialize the set state by switch, and then re-set each value • Set it by host communication

☞ For "PLC communication environment setting," and "X-TIO-R module link recognition time," see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

☞ For the initialization method of PLC communication environment setting by the switch, see **APPENDIX A.2 Various Setting Change by the Switch (P. 194)**.

■ Host communication

● RKC communication

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host	Confirm the settings and set them correctly
	Wrong address setting	
	Error in the data format	Reexamine the communication program
	Transmission line is not set to the receive state after data send	
	Transmission transfer time is short	Lengthen transmission transfer time
EOT return	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it
	Error in the data format	Reexamine the communication program
NAK return	Error occurs on the line (parity bit error, framing error, etc.	Confirm the cause of error, and solve the problem appropriately. (Confirm the transmitting data, and resend data)
	BCC error	
	The data exceeds the setting range	Confirm the setting range and transmit correct data
	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it

☞ For the initialization method of PLC communication environment setting by the switch, see **APPENDIX A.2 Various Setting Change by the Switch (P. 194)**.

- **Modbus**

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host	Confirm the settings and set them correctly
	Wrong address setting	
	There is length of query message exceeds set range	
	The number of data points is not twice the specified number of data points at the time of data write	
	A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message	Re-transmit after time-out occurs or verify communication program
	The time interval between adjacent data in the query message is too long, 24-bit time (or 24-bit time + a few ms) or more	• Re-transmit after time-out occurs • Verify communication program • Set Modbus data interval extension time
	Transmission transfer time is short	Lengthen transmission transfer time
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When the mismatched address is specified	Confirm the address of holding register
Error code 3	When the data written exceeds the setting range	Confirm the setting data
	When the specified number of data items in the query message exceeds the maximum number of data items available	

☞ For the setting method of host communication transmission transfer time and Modbus data interval extension time by the switch, see **APPENDIX A.2 Various Setting Change by the Switch (P. 194)**.

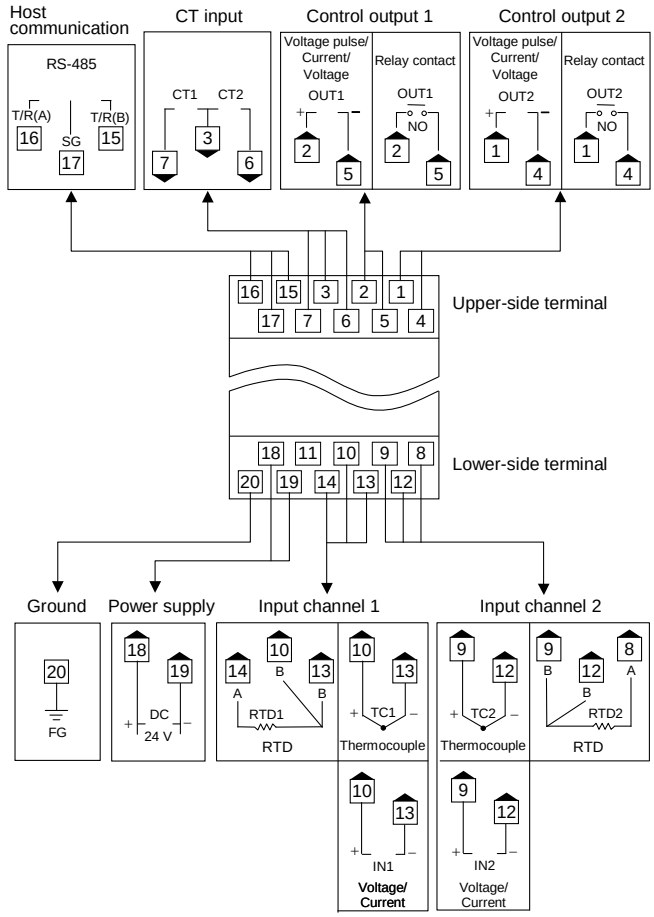
APPENDIX A. HARDWARE

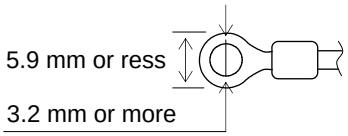
A.1 Terminal Configuration

■ 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.

■ X-TIO-R





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

- Terminal No. 11 is not used.
- Input channel 2 can be used as remote setting input (only for voltage/current input). In this case, control output 2 and CT input 2 become unused.
- Use the solderless terminals appropriate to the screw size (M3).

A.2 Various Setting Change by the Switch

Items which are not necessary to be frequently changed are set by the DIP switch in the X-TIO-R module. When changing the setting, set the module to the PLC communication environment setting mode in the same way as setting the PLC communication environment by switch. Switches used are the PLC communication setting switch and address setting switch 2.

📖 **Change the following items only when normal communication can be conducted as far as the factory set values are used.**

📖 **The following items become valid by turning off the power of the X-TIO-R module once, and then turning it on again after the settings are changed.**

☞ For changing method, see **5.1.3 PLC communication environment setting (P. 42)** [MITSUBISHI PLC].

● PLC communication setting switch

Switch No.	Setting items	Data range (Address setting switch 2)	Factory set value
1	X-TIO-R module monitor item selection	This item is the item of PLC communication environment setting.	—
2	Unused (Do not set this one)	—	—
3	Host communication 1 transmission transfer time setting [1]	0 to E: 0 to 140 ms (set value × 10) F: 255 ms Set the standby time until the X-TIO-R module starts sending data after receiving data from the host computer.	6 ms
4	Modbus data interval extension time [1, 2]	0 to E: 0 to 140 ms (set value × 10) F: 255 ms Extend data time interval in Modbus.	0 ms
5	PLC communication/ Host communication 2 transmission transfer time setting [1]	0 to E: 0 to 140 ms (set value × 10) F: 255 ms Set the standby time until the X-TIO-R module starts sending data after receiving data from the PLC.	1 ms

[1] The setting can also be made in the host communication initial set mode.

☞ For initial setting mode, see **6.4.4 Communication identifier list of TIO module (P. 116)** or **6.5.8 Data map of TIO module (P. 151)**.

[2] For Modbus, a data time interval is set to less than 24 bits' time. However, it may become more than 24 bits' time depending on the type of master. In that case, extend the data time interval in this setting.

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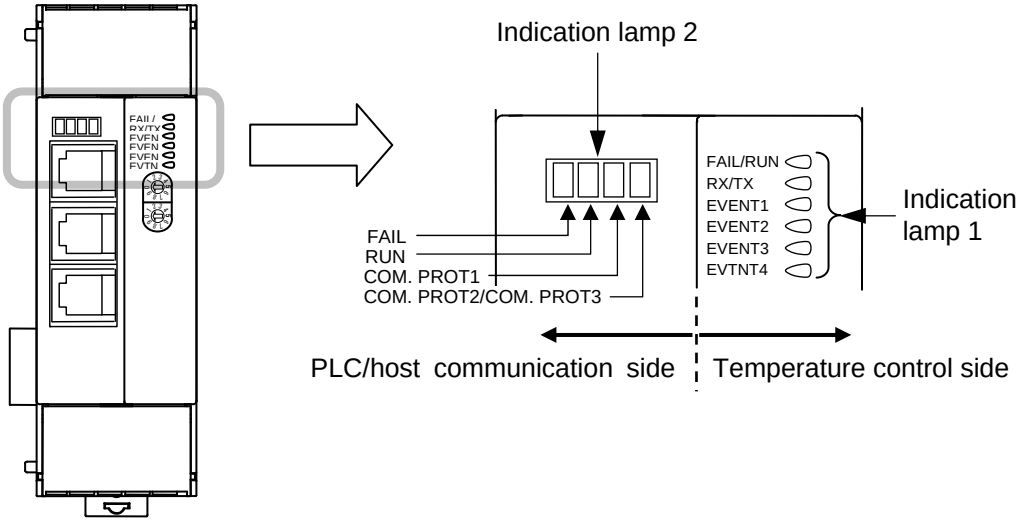
Switch No.	Setting items	Data range (Address setting switch 2)	Factory set value
6	Action mode selection	PLC register read/write error elimination: 0 or 1: Manual elimination 2 or3: Automatic elimination 4 to F: Unused (Do not set this one) Sets an action taken when the address is specified and an error occurs in PLC communication.	Manual elimination
7	Unused (Do not set this one)	—	—
8	Set value initialize	0 to E: Do not initialize F: Initialize data Initialize all of the items (including items in this table) which can be set in the PLC communication environment setting mode to return to the state prior to factory shipment.	Do not initialize

A.3 Indication Lamp



X-TIO-R module

[Indication lamp 1]

- **FAIL/RUN**
  During normal operation: Green lamp: ON (RUN)
  During error: Red lamp: ON (FAIL)
  During self-diagnostic error: Green lamp: flashing
- **RX/TX**
  During data send or receive: Green lamp: ON
- **EVENT 1 to 4**
  Display various states by setting.
  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**
  During normal operation: Red lamp: OFF
  During error: Red lamp: ON
  Communication environment setting mode by the switch: Red lamp: slow flashing
- **RUN**
  During normal operation: Green lamp: ON
  During error: Green lamp: OFF
  During memory backup error: Green lamp: slow flashing
  During module configuration error: Green lamp: slow flashing
  During PLC communication error: Green lamp: slow flashing
  During data collection after power ON: Green lamp: rapid flashing
- **COM. PORT1**
  During data send or receive: Yellow lamp: ON
- **COM. PORT2/COM. PORT3**
  During data send or receive: Yellow lamp: ON

A.4 Product Specifications

■ Input

Measuring input:

Number of inputs: 2 points (Isolated between each input channel)
Channel 2 can be used as remote input.

Input type:

- Voltage (low) input group
  Thermocouple: K, J, T, S, R, E, B, N (JIS-C1602-1995)
  PLII (NBS)
  W5Re/W26Re (ASTM-E988-96)
  Voltage (low): 0 to 10 mV, 0 to 100 mV, 0 to 1 V
- Resistance temperature detector (RTD) input group (3-wire system)
  Pt100 (JIS-C1604-1997)
  JPt100 (JIS-C1604-1989, Pt100 of JIS-C1604-1981)
- Voltage (high)/Current input group
  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.
-The type of input can be selected independently for each channel.

Input range:

- Temperature input (Thermocouple/RTD input)

Input type	Input range
K	–200 to +1372 °C or –328 to +2502 °F
J	–200 to +1200 °C or –328 to +2192 °F
R	–50 to +1768 °C or –58 to +3000 °F
S	–50 to +1768 °C or –58 to +3000 °F
B	0 to 1800 °C or 32 to 3000 °F
E	–200 to +1000 °C or –328 to +1832 °F
N	0 to 1300 °C or 32 to 2372 °F
T	–200 to +400 °C or –328 to +752 °F
W5Re/W26Re	0 to 2300 °C or 32 to 3000 °F
PLII	0 to 1390 °C or 32 to 2534 °F
Pt100	–200 to +850 °C or –328 to +1562 °F
JPt100	–200 to +600 °C or –328 to +1112 °F

However, within “Input scale low limit to Input scale high limit.”

- Voltage/Current input
  Programmable range
  Input scale high limit: Input scale low limit to 20000
  Input scale low limit: –20000 to Input scale high limit
  However, a span is 20000 or less.

Accuracy (in ambient temperature 23 °C ±2 °C):

- Thermocouple input (K, J, T, PLII, E)
  Less than −100 °C: ±1.0 °C
  −100 °C to less than +500 °C: ±0.5 °C
  500 °C or more: ± (0.1 % of reading + 1digit)
  Less than −148 °F: ±1.8 °F
  −148 °F to less than +932 °F: ±0.9 °F
  932 °F or more: ± (0.1 % of reading + 1digit)
- Thermocouple input (R, S, N, W5Re/W26Re)
  −50 °C to less than +1000 °C: ±1.0 °C
  1000 °C or more: ± (0.1 % of reading + 1digit)
  −58 °F to less than +1832 °F: ±1.8 °F
  1832 °F or more: ± (0.1 % of reading + 1digit)
- Thermocouple input (B)
  Less than 400 °C: ±70.0 °C
  400 °C to less than 1000 °C: ±1.0 °C
  1000 °C or more: ± (0.1 % of reading + 1digit)
  Less than 752 °F: ±126.0 °F
  752 °F to less than 1832 °F: ±1.8 °F
  1832 °F or more: ± (0.1 % of reading + 1digit)
- RTD input
  Less than 200 °C: ±0.2 °C
  200 °C or more: ± (0.1 % of reading + 1digit)
  Less than 392 °F: ±0.4 °F
  392 °F or more: ± (0.1 % of reading + 1digit)
- Voltage/Current input
  ± 0.1 % of span
- Cold junction temperature compensation accuracy
  ±1.0 °C (Ambient temperature 23 °C ±2 °C)
  Within ±1.5 °C between 0 and 50 °C of ambient temperature
  ±1.8 °F (Ambient temperature 73.4 °F ±3.6 °F)
  Within ±2.7 °F between 14 and 122 °F of ambient temperature

Sampling cycle: 25 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: Approx. 1 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:
0.25 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: 0.01 to 10.00 seconds (Setting 0.00: Filter OFF)

PV bias: ±Input range span

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

CT input:
Number of inputs: 2 points
Sampling cycle: 500 ms (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)
  During self-diagnostic error: Green lamp: flashing
- 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

PLC/host communication side

- Operation state indication [RUN, FAIL] (2points)
  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 PLC communication environment setting mode:
  Red lamp: slow flashing (FAIL)
- Communication state indication [COM. PORT1, COM. PORT2/3] (2 points)
  During data send or receive: Yellow lamp: ON (COM. PORT1)
  During data send or receive: Yellow lamp: ON (COM. PORT2/3)

■ 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 direct action and the reverse action.
- Do not support the heat/cool control.

Additional functions: Autotuning function
Output limiter function
Output change rate limiter

Setting range: Proportional band:
Temperature input: 0 to Input span
Voltage/Current input: 0.0 to 1000.0 % of Input span
(0 or 0.0: ON/OFF action)
Integral time:
0.01 to 360.00 seconds or 0.1 to 3600.0 seconds
(Selectable)
Derivative time:
0.00 to 360.00 seconds or 0.0 to 3600.0 seconds
(Selectable)
(0.00 or 0.0: PI action)

Control response parameter: Slow, Medium, Fast

Output limiter (high limit): –5.0 to +105.0 %

Output limiter (low limit): –5.0 to +105.0 %

Output change rate limiter: 0.0 to 100.0 %/second

Proportioning cycle time: 0.2 to 50.0 seconds

Direct/Reverse action selection: Direct action, Reverse action

Hot/Cold start selection: Hot 1, Hot 2, Cold 1, Cold 2

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.

Start determination point: 0 to Input span

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

AT bias: ±Input span

Remote/Local transfer: Local mode, Remote mode

Setting method of PID constants:
Level PID
Eight types of PID parameters are selectable depending on level PID high limit setting positions.
Setting range of Level 1to 8: Same as input range
Level 1≤ Level 2≤ Level 3≤·····≤ Level 7≤ Level 8
(Set of level 8 is fixed with input scale high limit.)

■ 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

■ Program control

Program setting: Level setting (Setting of each channel)
Segment time (Setting of each channel)

Setting range:

Level:	Same as main set value
Segment time:	0.00 to 300.00 seconds (factory set value)
	0.0 to 3000.0 seconds
	0 to 30000 seconds
	0 to 30000 minutes
	Either transfer is possible.

Number of program execution times:
1 to 1000 times
(1000 times: Program executes an infinite number of times.)

Time accuracy: ± (0.01 % of Reading + 1digit)

Number of patterns: Up to 16 patterns (Up to 16 segments/pattern)
Pattern link function provided

Number of segments: Up to 256 segments (16 patterns × 16 segments)

Program operation start mode:
Zero start
PV start 1 (Fixed time type)
PV start 2 (Time shortening type)

Hold function:
- The program stops its progress temporarily.
- This function becomes valid during program operation.
- The hold status is not released if set to any of other program operation modes (FIX or MAN).

Step function:
- The program progress by one segment.
  (One segment progresses by the setting per one.)
- This function becomes valid during program operation.
- The step action cannot be used in the hold state.

Wait function: This is the function the program stops to wait for moving to the next segment when a measured value is difficult to follow the progress of the program.
Setting range of wait zone: 0 to Input span
(Setting 0: Wait function OFF)
- Wait zone is setting for each pattern
- Can confirm wait status with communication

Pattern end output: Number of outputs: 2 points
Pattern end output time:
0.00 to 300.00 seconds or 0.00 to 300.00 minutes
When 0 is set, the pattern end output is not turned off.
Output reset:
The output can be turned off by changing to the reset state.

Continued on the next page.

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- When program is repeated: Output turned on for about 0.5 seconds
- When programs are linked: To be turned on final pattern
- The pattern end output is turned off when fixed set point (FIX) or manual (MAN) control is performed, but the time signal output state returns to the original state if returned to the program control state.

Program operation mode:

- Reset mode (RESET state)
  Stop control and return the segment number to No. 1.
  Turn off the time signal output and the end output.
  An event becomes OFF.
  A set value becomes 0.
- Program control mode (RUN state)
  Execute program control.
- Fixed set point control mode (FIX state)
  Execute fixed set point.
- Manual control mode (MAN state)
  Manual control can be performed.

Time signal output:

Number of settings:	16 (per pattern)
Time signal ON segment:	1 to 16
Time signal ON time:	The time setting unit is the same as the segment time setting unit.
Time signal OFF segment:	1 to 16 (However, it needs to be the same as the start segment or larger.)
Time signal OFF time:	The time setting unit is the same as the segment time setting unit.

- Always make the setting as follows.
  "ON segment/ON time < OFF segment/OFF time"
  If the above inequality is not satisfied, no time signal is output.
- If the ON and OFF time are set larger than the segment time, become the same time as the segment time.
- When no time signal is used, set the same "ON segment/ON time" and "OFF segment/OFF rime." In this case, no time signal is output.
- The time signal output state is held in the wait or hold state.
- The pattern end output is turned off when fixed set point (FIX) or manual (MAN) control is performed, but the time signal output state returns to the original state if returned to the program control state.
- The time signal output is turned off when the autotuning (AT) function is activated.

■ 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 limit) ≥ PV or PV ≥ Input error determination point (high limit)] 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 limit): Within input scale range
Input error determination point (low limit): Within input scale 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

■ PLC communication

Interface: Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
COM. PORT1: Specify when ordering
COM. PORT2/COM. PORT3: RS-422A (fixed)

Connection method: RS-422A: 4-wire system, full-duplex multi-drop connection
RS-232C: Point-to-point connection

Synchronous method: Start/stop synchronous type

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

Data bit configuration: Start bit: 1
Data bit: 7 or 8
Parity bit: Without, Odd or Even (Without for 8 data bits)
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol: MITSUBISHI MELSEC series special protocol
–ACPU common command (A series, FX2N, FX2NCseries)
–AnA/AnUCPU common command (AnA/QnA series, Q series)
The protocol can be selected with switch

Maximum connections: Four modules (X-TIO-R) per communication port of PLC
[240 CH max.]

■ Host communication (modular connector side)

Interface: Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
COM. PORT1: Specify when ordering
COM. PORT2/COM. PORT3: RS-422A (fixed)

Connection method: RS-422A: 4-wire system, full-duplex multi-drop connection
RS-232C: Point-to-point 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: 7 or 8 (RKC communication)
8 (Modbus)
Parity bit: Without, Odd or Even (Without for 8 data bits)
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol:

- RKC communication
  Based on ANSI X3.28 subcategory 2.5 B1
  Polling/selecting type
  Error control: Vertical parity (with parity bit selected)
  Horizontal parity (BCC check)
  Data types: ASCII 7-bit code
- 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

RKC communication or Modbus protocol can be selected with switch

Maximum connections: RS-422A: 16 modules (X-TIO-R) per communication port of host computer [960 CH max.]
RS-232C: One module (X-TIO-R) per communication port of host computer [60 CH max.]

■ Host communication (host communication terminal side)

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: 7 or 8 (RKC communication)
8 (Modbus)
Parity bit: Without, Odd or Even (Without for 8 data bits)
Stop bit: 1 or 2
Data bit configuration can be selected with switch

Protocol:

- RKC communication
  Based on ANSI X3.28 subcategory 2.5 B1
  Polling/selecting type
  Error control: Vertical parity (with parity bit selected)
  Horizontal parity (BCC check)
  Data types: ASCII 7-bit code
- 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

RKC communication or Modbus protocol can be selected with switch

Maximum connections: 31 modules maximum including a host computer
(Up to 29 modules can be connected to one X-TIO-R module)

■ Self-diagnostic function

Check item (error code): Bit data items in the error state are expressed in decimal numbers from 0 to 255.

Memory backup error:	bit 0
Internal communication error:	bit 2
Adjustment data error:	bit 3
Input A/D error:	bit 4
Current transformer input A/D error:	bit 5
Temperature compensation A/D error:	bit 6
	(bit 1 and bit 7: Unused)

■ General specifications

Power supply:

Power supply voltage:	24 V DC
Power supply voltage range:	21.6 to 26.4 V DC
Current consumption:	120 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.

Memory backup: 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/m^3 dry air at 101.3 kPa

■ Mounting and structure

Mounting procedure: DIN rail mounting

Case color:

Terminal base:	Black
Module mainframe:	Gray

Dimensions: 40.5 (W) ×125.0 (H) ×110.0 (D) mm

Weight: Approx. 280 g

■ Standard

Safety standard:	UL:	UL61010-1
	cUL:	CAN/CSA-C22.2 No.61010-1
CE marking:	LVD:	EN61010-1 OVERVOLTAGE CATEGORYII, POLLUTION DEGREE 2, Class II (Reinforced insulation)
	EMC:	EN61326-1
RCM:	EN55011	

APPENDIX B. ASCII 7-BIT CODE TABLE

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

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