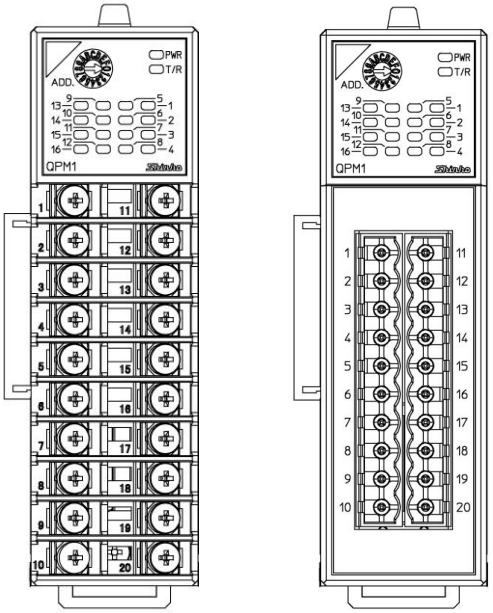
16 points Pulse Input Module

QPM1-PI16 Series

INSTRUCTION MANUAL



Shinko

Preface

Thank you for purchasing our 16 points pulse input module [QPM1-PI16].
This manual contains instructions for the mounting, functions, operations and notes when operating the 16 points pulse input module [QPM1-PI16].
To prevent accidents arising from the misuse of this instrument, please ensure the operator receives this manual

Notes

- This instrument should be used in accordance with the specifications described in the manual.
  If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed on a DIN rail within a control panel indoors. If it is not, measures must be taken to ensure that the operator does not touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos Co., Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

SAFETY PRECAUTIONS (Be sure to read these precautions before using our products.)

The safety precautions are classified into categories: “Warning” and “Caution”.
Depending on circumstances, procedures indicated by ⚠ Caution may result in serious consequences, so be sure to follow the directions for usage.

⚠ Warning Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.

⚠ Caution Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

⚠ Warning

- To prevent an electrical shock or fire, only Shinko or qualified service personnel may handle the inner assembly.
- To prevent an electrical shock, fire, or damage to instrument, parts replacement may only be undertaken by Shinko or qualified service personnel.

⚠ Safety Precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after purpose-of-use consultation with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Proper periodic maintenance is also required.
- This instrument must be used under the conditions and environment described in this manual.
  Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

⚠ Caution with Respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument.
In the case of resale, ensure that this instrument is not illegally exported.

Precautions for Use

1. Installation Precautions

⚠ Caution

This instrument is intended to be used under the following environmental conditions (EN61010-1):

- Overvoltage Category II, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of -10 to 50°C(14°F to 122°F) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or the vapors of these substances can come into direct contact with the unit.
- When installing this unit within a control panel, please note that ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 50°C (122°F).
  Otherwise the life of electronic components (especially electrolytic capacitor) may be shortened.

* Avoid setting this instrument directly on or near flammable material even though the case of this instrument is made of flame-resistant resin.

2. Wiring Precautions

⚠ Caution

- Do not leave bits of wire in the instrument, because they could cause a fire and malfunction.
- When wiring, use a crimping pliers and a solderless terminal with an insulation sleeve in which an M3 screw fits.
- The terminal block of this instrument has a structure that is wired from the left side.
  Be sure to insert the lead wire into the terminal of the instrument from the left side and tighten the terminal screw.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the screw or case may be damaged.
- Do not pull or bend the lead wire with the terminal as the base point during or after wiring work.
  It may cause malfunction.
- This instrument does not have a built-in power switch, circuit breaker and fuse. It is necessary to install a power switch, circuit breaker and fuse near the instrument.
- When wiring the power supply (24 VDC), do not confuse the polarities.

3. Operation and Maintenance Precautions

⚠ Caution

- Do not touch live terminals. This may cause electrical shock or problems in operation.
- Turn the power supply to the instrument OFF when retightening the terminal or cleaning. Working on or touching the terminal with the power switched ON may result in severe injury or death due to electrical shock.
- Use a soft, dry cloth when cleaning the instrument. (Alcohol based substances may tarnish or deface the unit.)
- As the panel part is vulnerable, be careful not to put pressure on, scratch or strike it with a hard object.

● About description of reference page

In the case of "Refer to 2-2.", it is described as (P.2-2).

● How to read this manual

• When connecting to host computer

Refer to “1 Overview” to “12 Operation”.

Refer to “15 Action Explanation” to “18 Troubleshooting” as necessary.

• When connecting to PLC

Refer to “1 Overview” to “3 Name and Functions” and “13 Communication with PLC Using SIF Function”.

Refer to “15 Action Explanation” to “18 Troubleshooting” as necessary.

• When connecting to CUnet

Refer to “1 Overview” to “3 Name and Functions” and “14 CUnet Communication”.

Refer to “15 Action Explanation” to “18 Troubleshooting” as necessary.

Contents

1 Overview

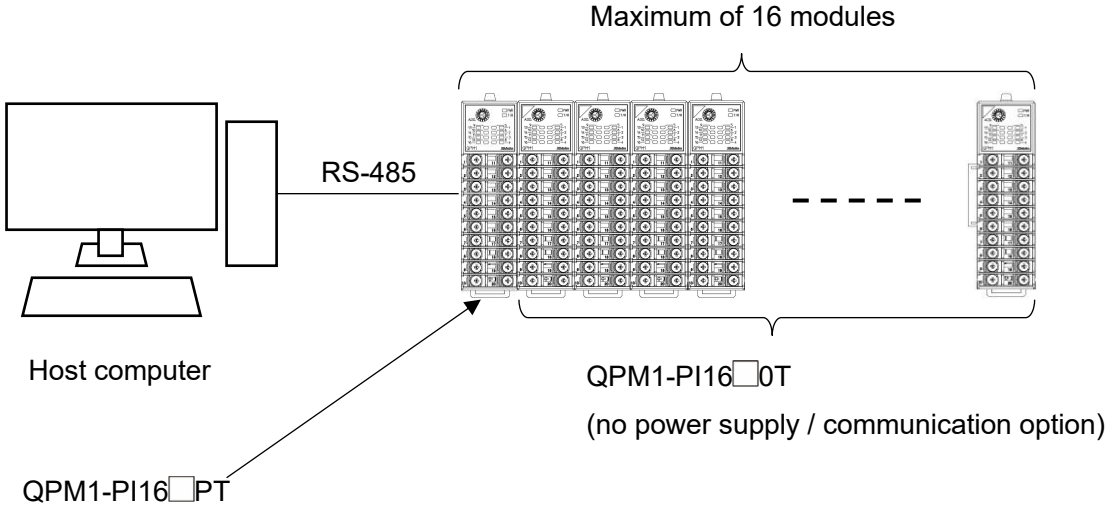
1.1 Overview of Pulse Input Module QPM1-PI16

This instrument is a 16 points pulse input module.

A multi-point measurement system can be configured via a host computer or PLC.

A maximum of 16 instruments can be connected to the BUS, and a maximum of 256 points can be measured.

One block connected to BUS is called "1 unit".



(Fig. 1.1-1)

1.2 Description of Module

This instrument is available in both terminal block type and connector type.

The following options are available.

- Power supply / communication option

  With power supply / host communication function

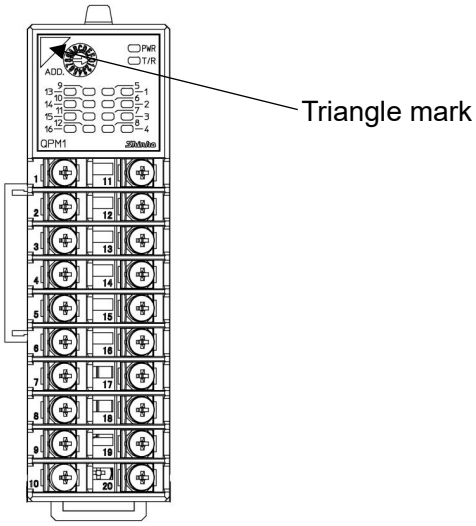
  With power supply / CUnet communication function

Depending on whether have the option, the panel design differs.
There is a triangle mark on the upper left of the panel, when the power supply / communication option is not available.

Terminal block type

QPM1-PI16□0T

No options

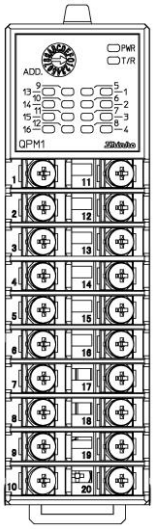


(Fig. 1.2-1)

QPM1-PI16□PT, QPM1-PI16□CT

With power supply / host communication function

With power supply / CUnet communication function

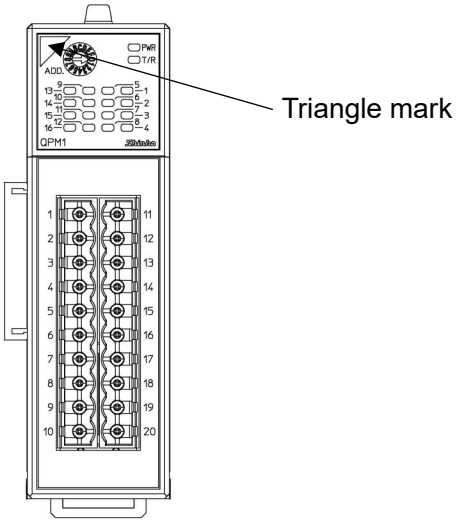


(Fig. 1.2-2)

Connector type

QPM1-PI16□0C

No options

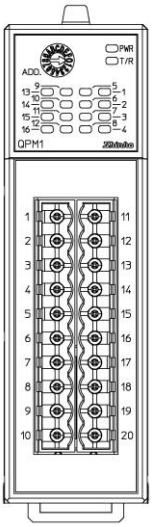


(Fig. 1.2-3)

QPM1-PI16□PC, QPM1-PI16□CC

With power supply / host communication function

With power supply / CUnet communication function



(Fig. 1.2-4)

1.3 System Configuration

1.3.1 Connecting to Host Computer

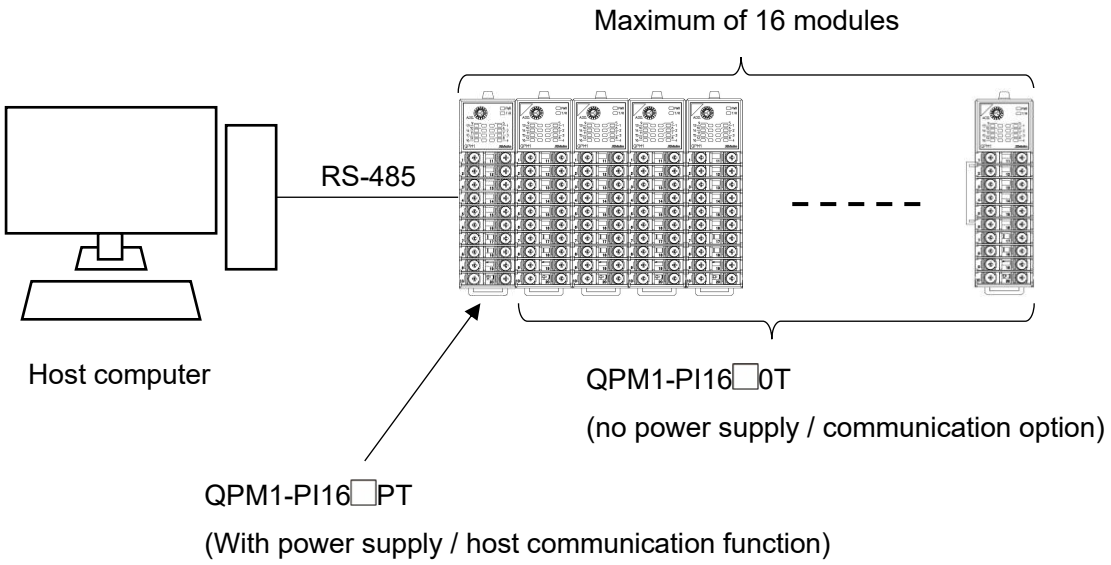
When connecting to the host computer, one QPM1-PI16□P□ (with power supply / host communication function) is required for host communication.

The second and subsequent power lines to the QPM1-PI16 are BUS-connected by the connector.

For the second and subsequent control modules, use the QPM1-PI16□0□ (no power supply / communication option).

Maximum of 16 control modules can be connected.

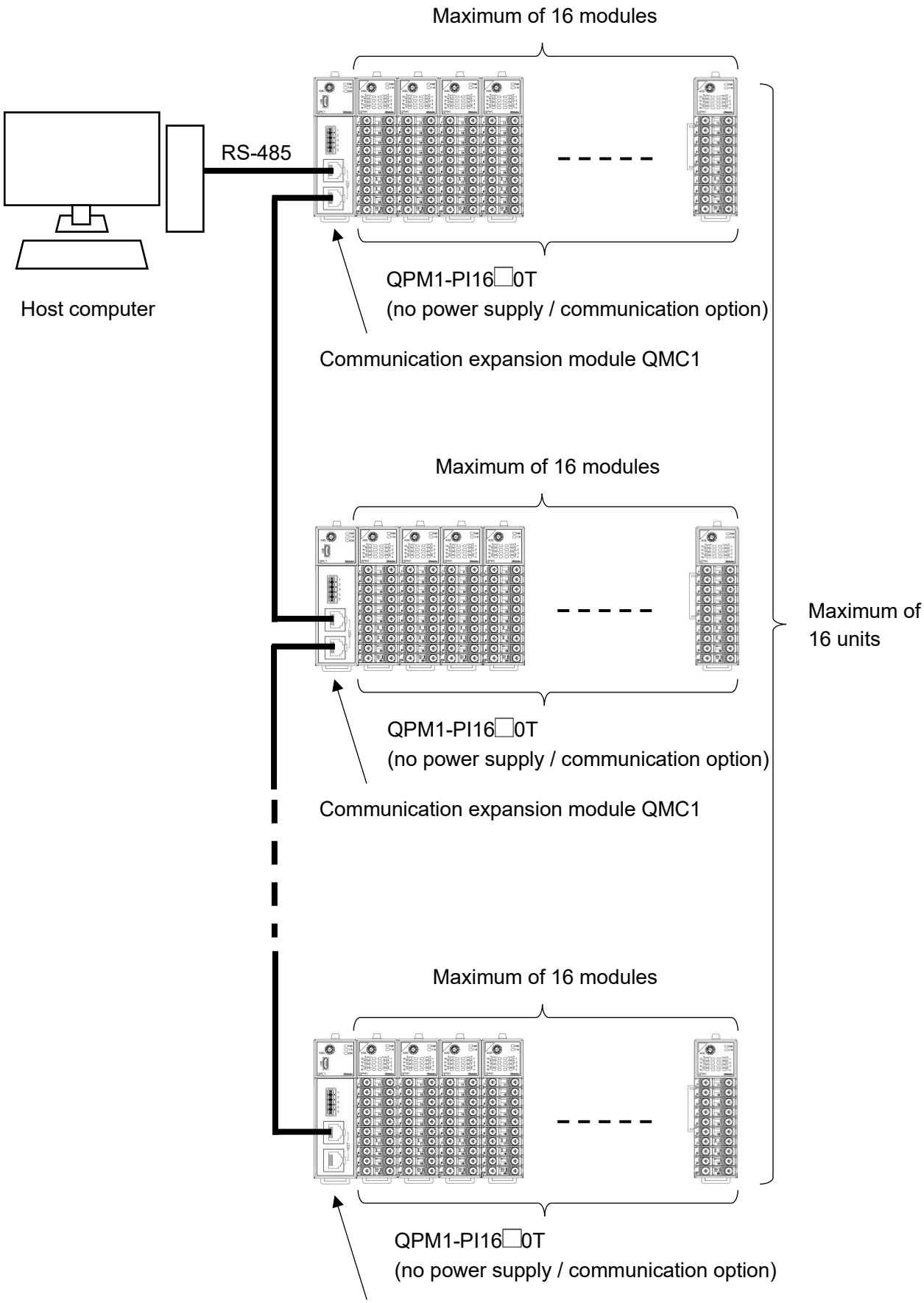
Configuration example of host computer and QPM1-PI16□PT, QPM1-PI16□0T



(Fig. 1.3.1-1)

A maximum of 16 units can be connected by connecting the communication expansion module QMC1s.
Refer to communication expansion module QMC1 instruction manual for detail.

Configuration example of host computer and QMC1, QAM1-40



(Fig. 1.3.1-2)

1.3.2 Connecting to PLC

(1) When connecting to MELSEC Q, QnA series by Mitsubishi Electric Corporation

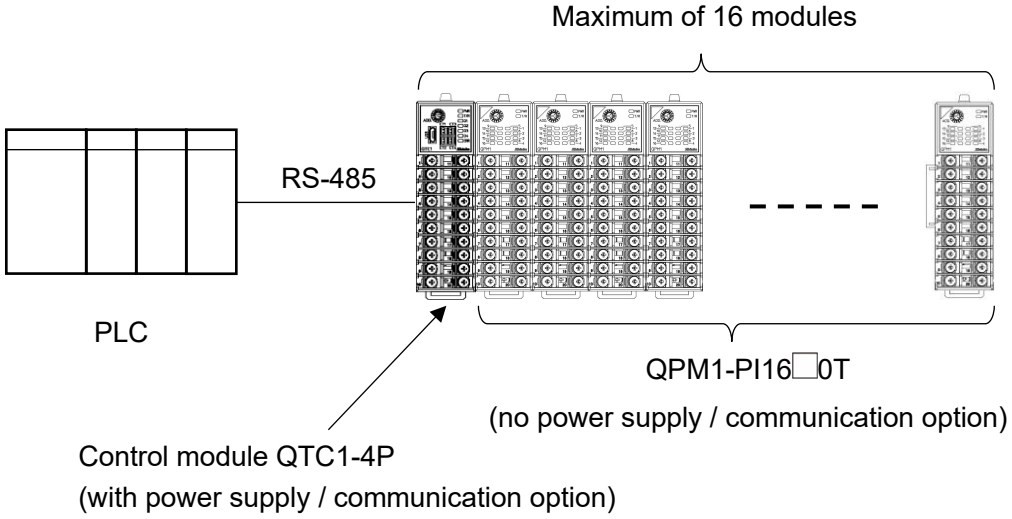
When connecting to the MELSEC Q, QnA series by Mitsubishi Electric Corporation, one control module QTC1-2P (with power supply / communication option) or QTC1-4P (with power supply / communication option) is required for host communication.

The second and subsequent power lines to the QPM1-PI16 are BUS-connected by the connector.

For the second and subsequent control modules, use the QPM1-PI16□0□ (no power supply / communication option).

Maximum of 16 control modules can be connected.

Configuration example of host computer and QTC1-4P, QAM1-40



(Fig. 1.3.2-1)

(2) When connecting to PLC by Mitsubishi Electric Corporation, PLC by OMRON Corporation and PLC by KEYENCE CORPORATION

When connecting to the PLC by Mitsubishi Electric Corporation, PLC by OMRON Corporation (*) and PLC by KEYENCE CORPORATION, one communication expansion module QMC1 is required for host communication per unit.

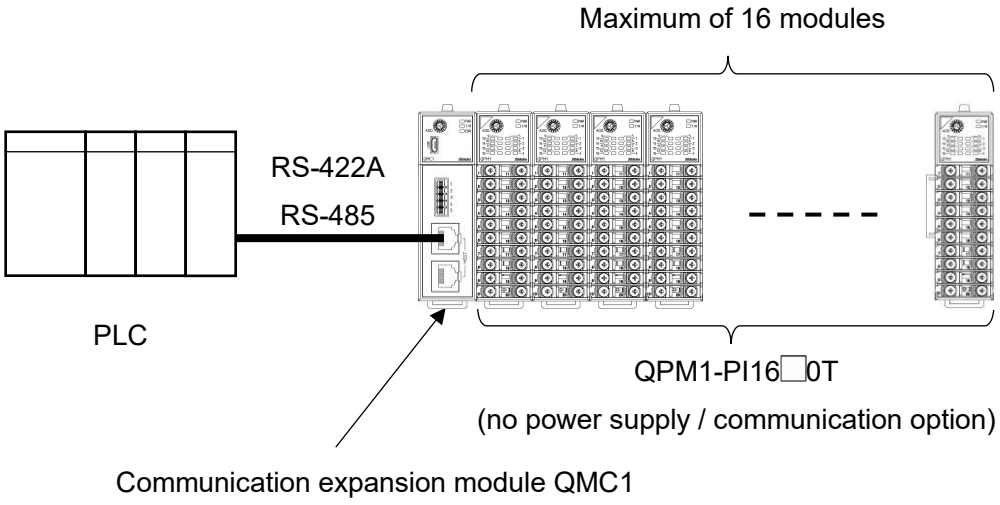
The power and communication lines to the QPM1-PI16 are BUS-connected with the connector.

Use the QPM1-PI16□0□ (no power supply / communication option).

Maximum of 16 control modules can be connected.

(*): When connecting to an OMRON PLC with the SIF function of communication expansion module QMC1, the RS-485 communication type cannot be used.
Only RS-422A communication type can be connected.

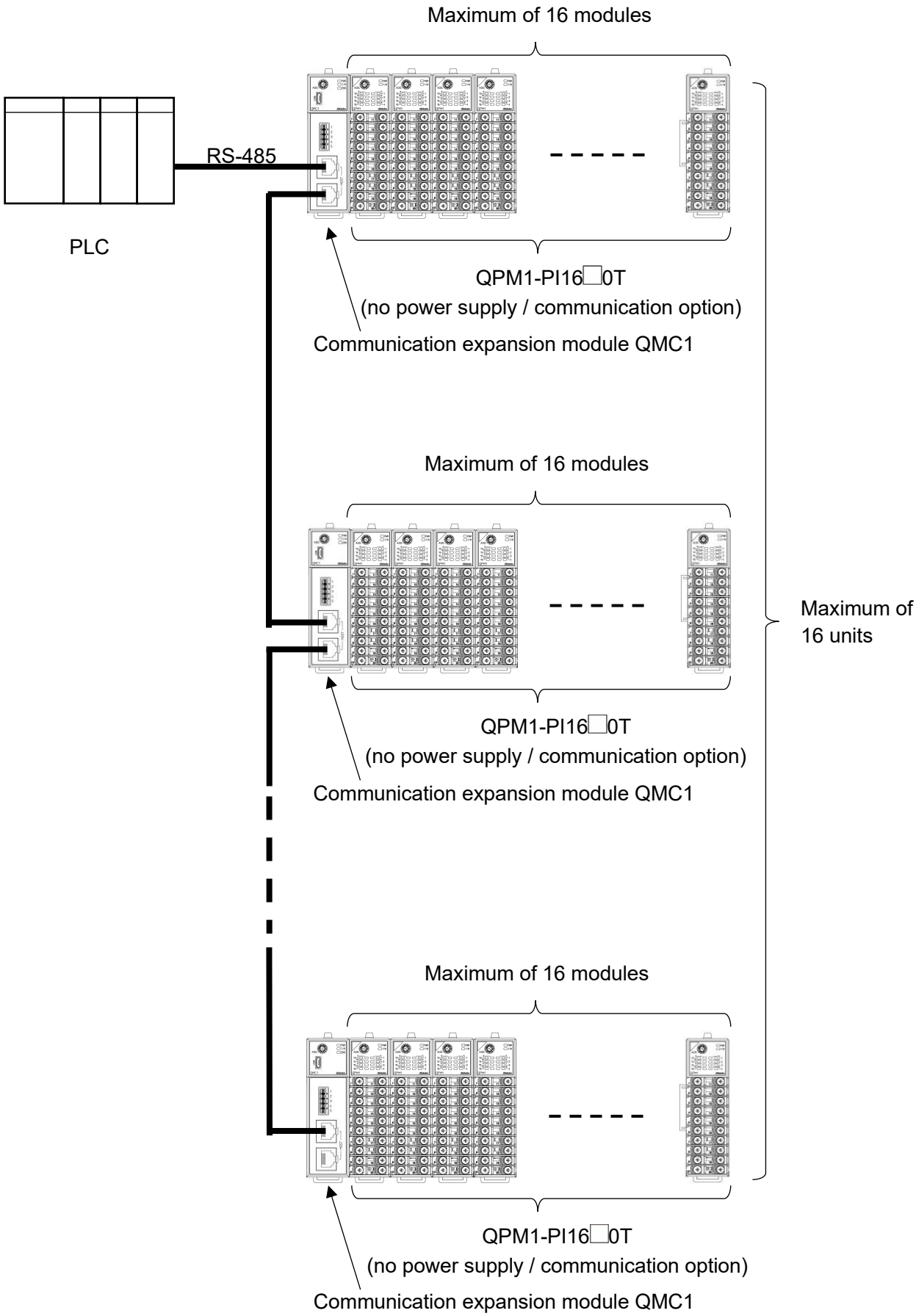
Configuration example of PLC and QMC1, QPM1-PI16□0T



(Fig. 1.3.2-2)

A maximum of 16 units can be connected by connecting the communication expansion module QMC1s.
Refer to communication expansion module QMC1 instruction manual for detail.

Configuration example of PLC and QMC1, QPM1-PI16□0T



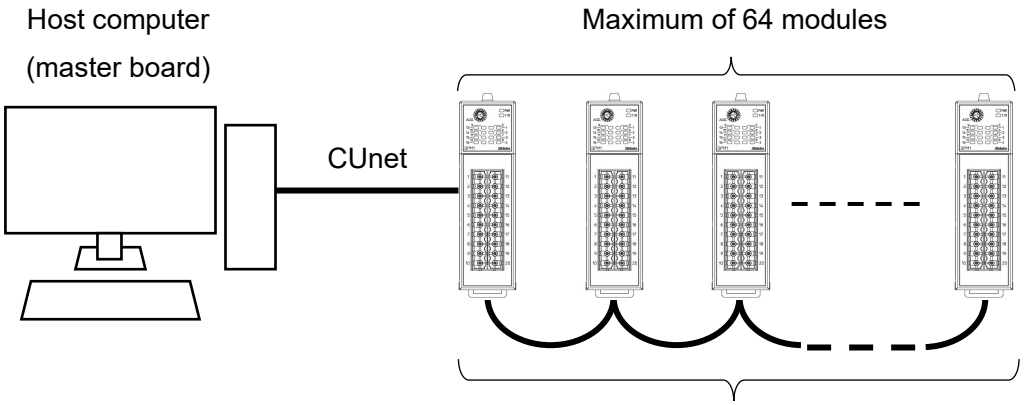
(Fig. 1.3.2-3)

1.3.3 Connecting to CUnet

When connecting to CUnet, the QPM1-PI16□C□ (with power supply / CUnet communication function) is required for CUnet communication.

Maximum of 64 control modules can be connected.

Configuration example of host computer (master board) and QPM1-PI16□CC

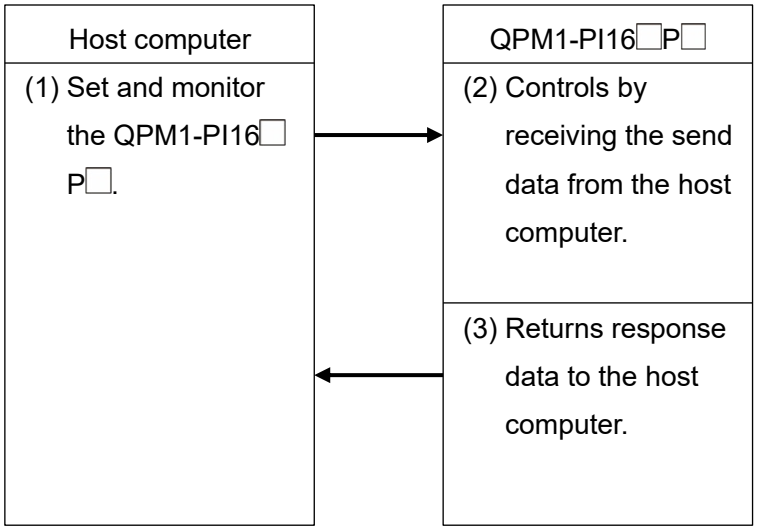


(Fig. 1.3.3-1)

1.4 Parameter Passing

1.4.1 Using the QPM1-PI16□P□ (with power supply / host communication function)

When the QPM1-PI16□P□ (with power supply / host communication function) is used, the parameter passing is as shown below.

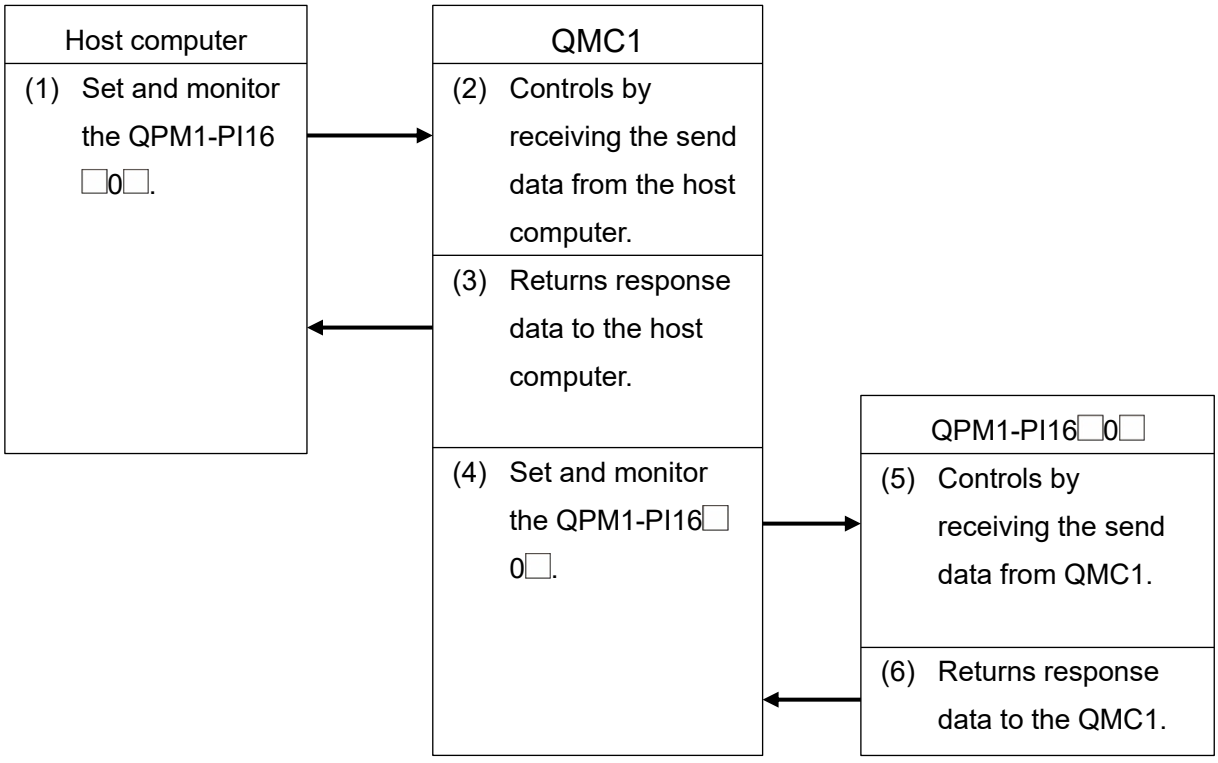


(Fig. 1.4-1)

1.4.2 Using the Communication Expansion Module QMC1

When the communication expansion module QMC1 is used, the parameter passing is as shown below.

Refer to the communication expansion module QMC1 instruction manual for detail.



(Fig. 1.4-2)

2 Model

2.1 Model

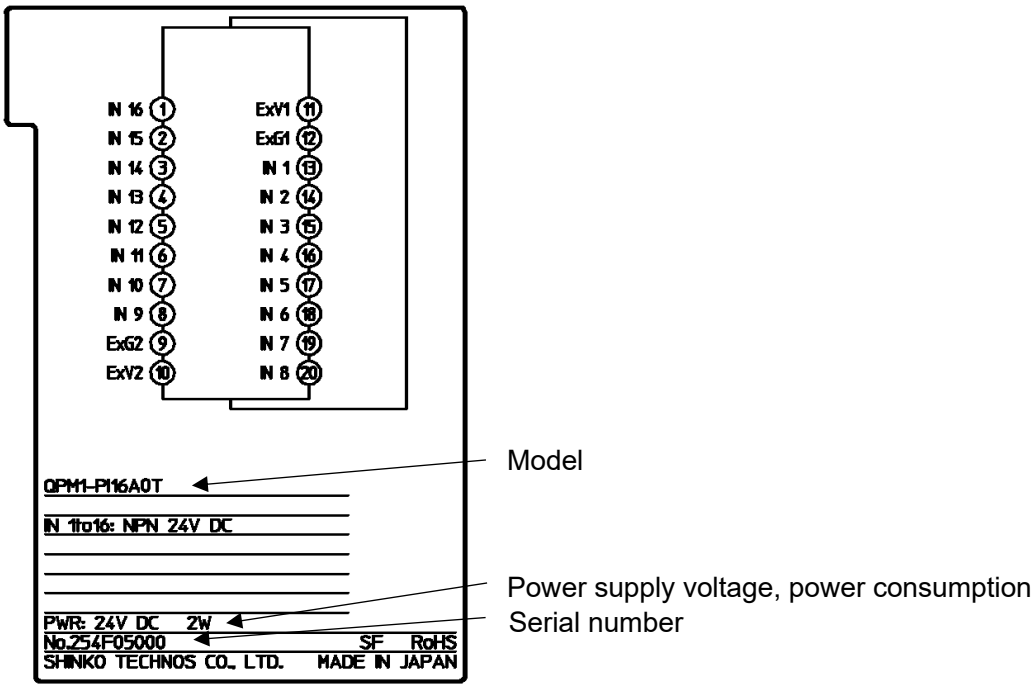
QPM1-	PI16	□	□	□	
Points	PI16				Input 16 points
Plus/Minus common		A			Plus common (NPN)
		B			Minus common (PNP)
Power supply / communication option			0		No option
			P		With power supply / host communication function
			C		With power supply / CUnet communication function
Wiring type				T	Terminal block type
				C	Connector type

2.2 How to Read the Model Label

The model label is attached to the right side of this instrument.

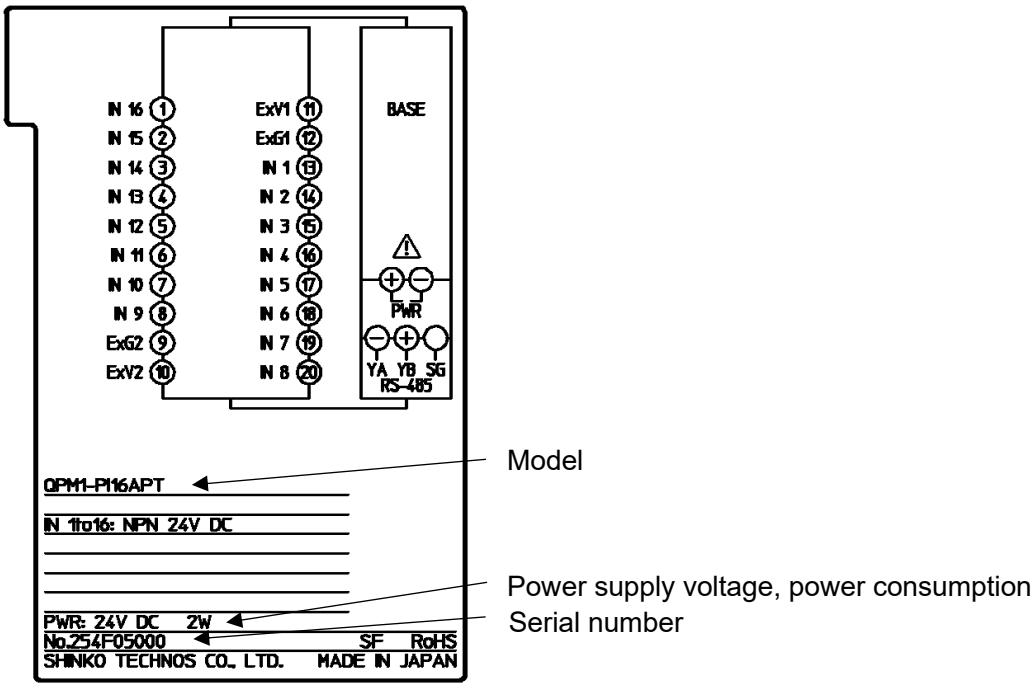
Terminal block type

No power supply / communication option



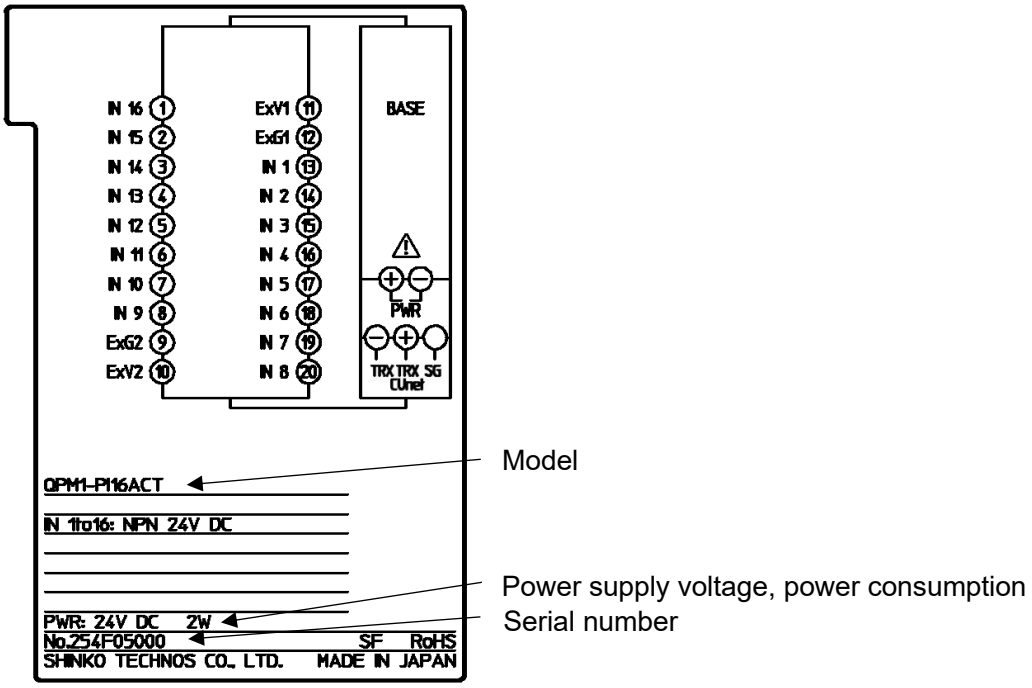
(Fig. 2.2-1)

With power supply / host communication function



(Fig. 2.2-2)

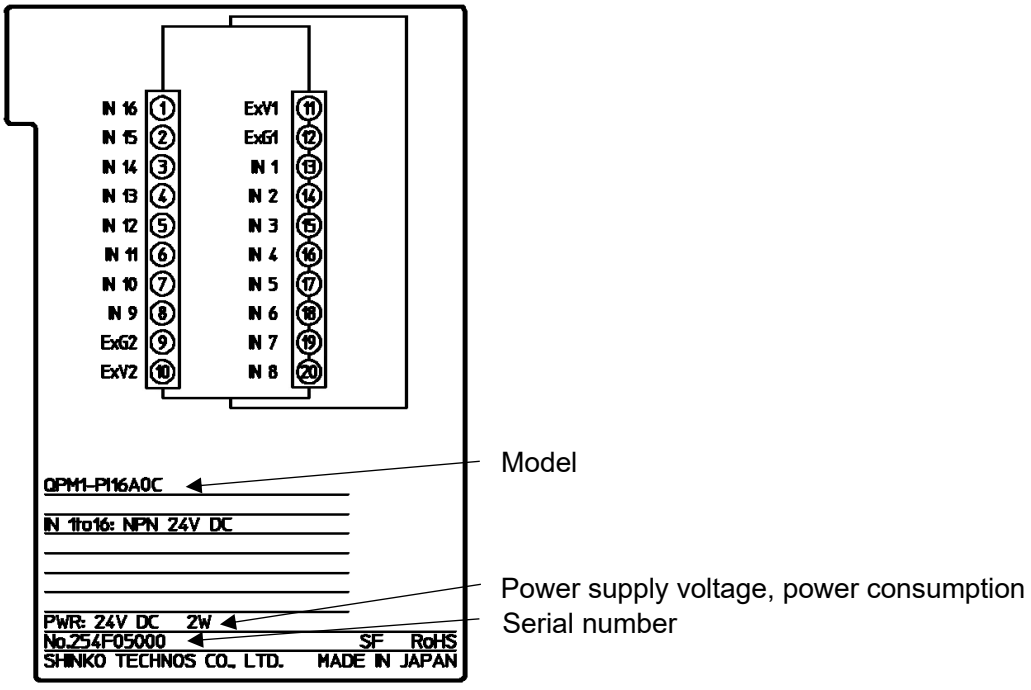
With power supply / CUnet communication function



(Fig. 2.2-3)

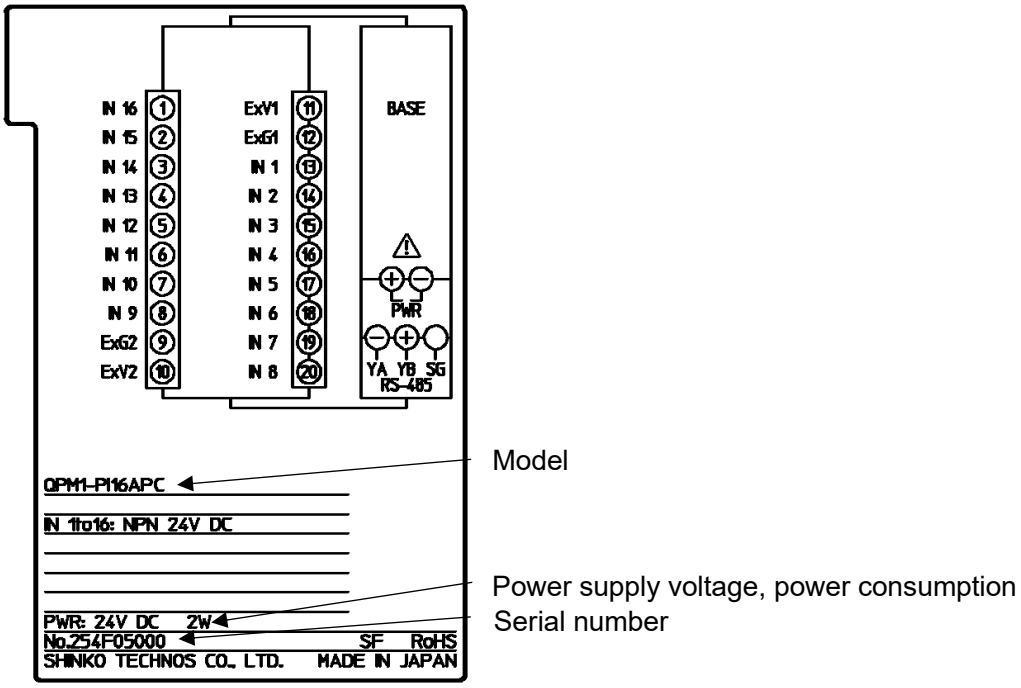
Connector type

No power supply / communication option



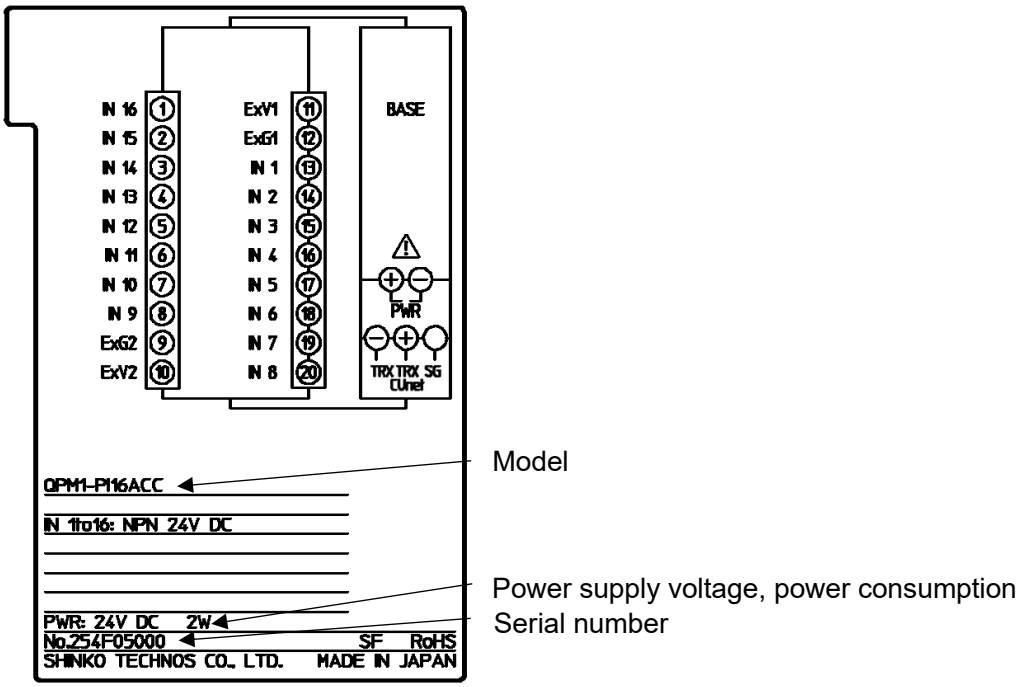
(Fig. 2.2-4)

With power supply / host communication function



(Fig. 2.2-5)

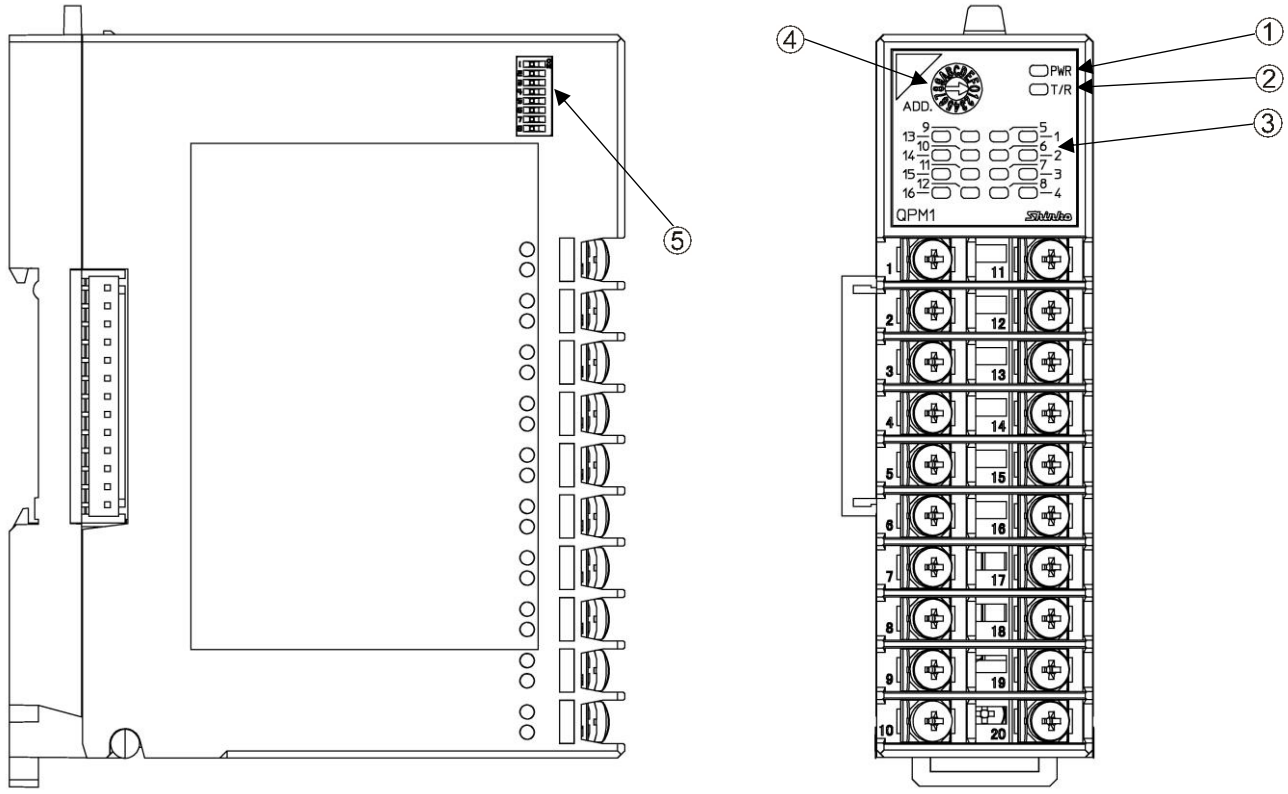
With power supply / CUnet communication function



(Fig. 2.2-6)

3 Name and Functions

Terminal block type

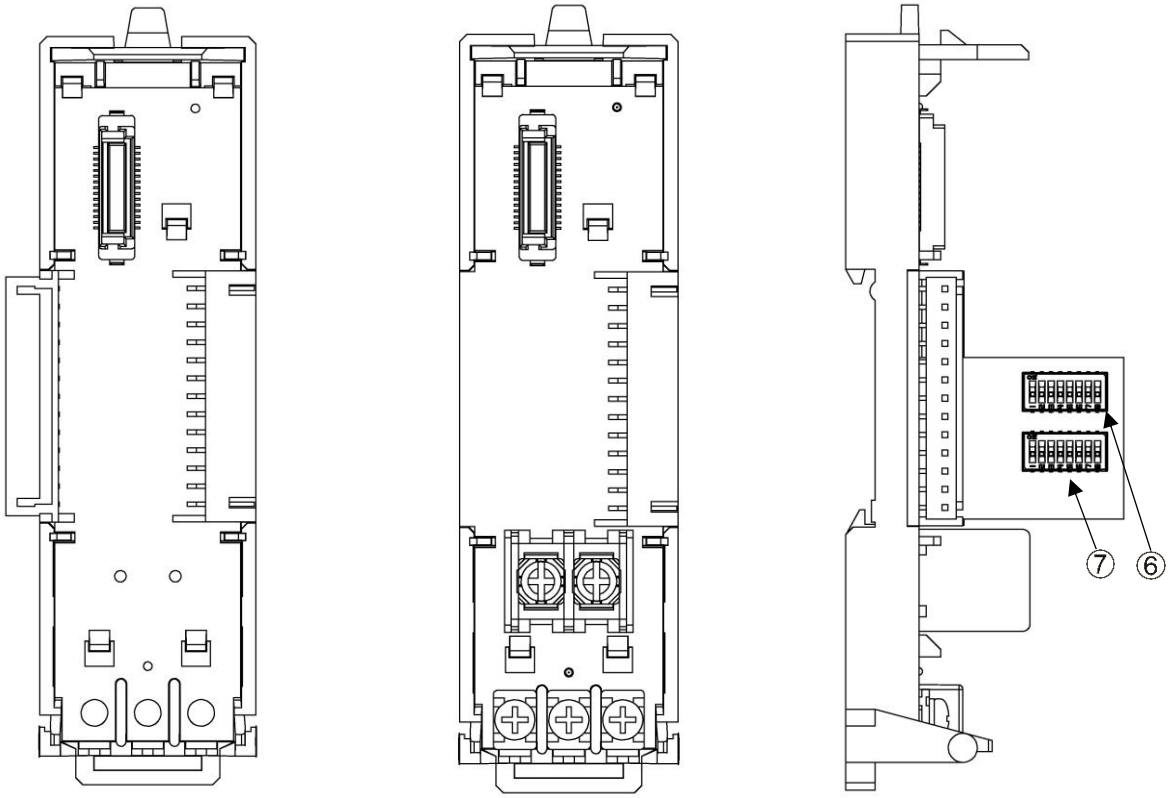


Base part

No power supply / communication option

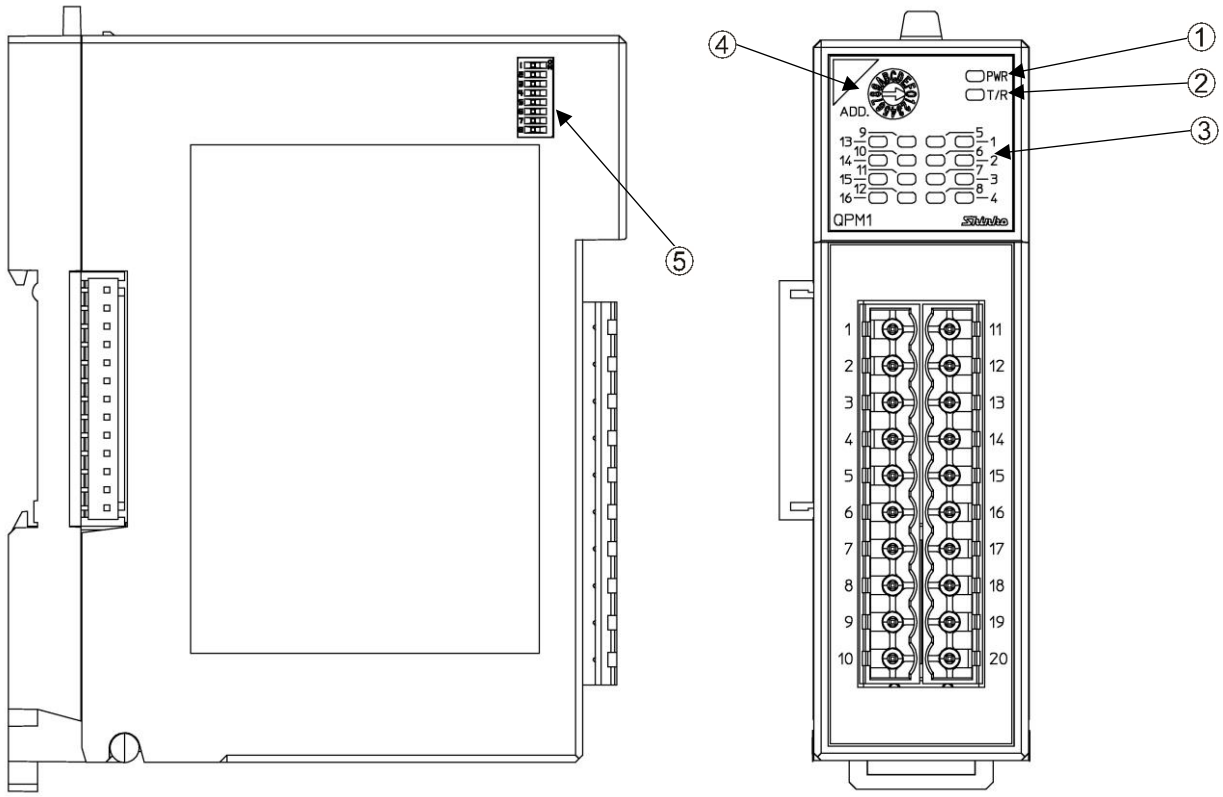
With power supply / host communication option

With power supply / CUnet communication option



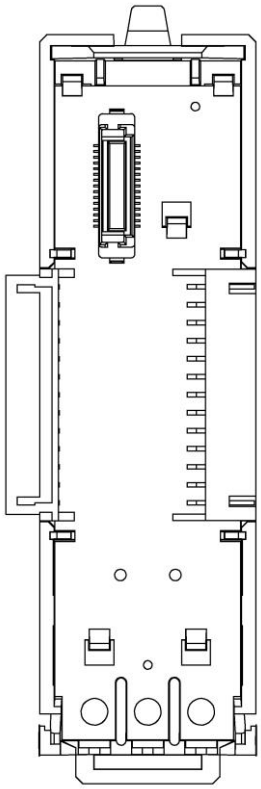
(Fig. 3-1)

Connector type

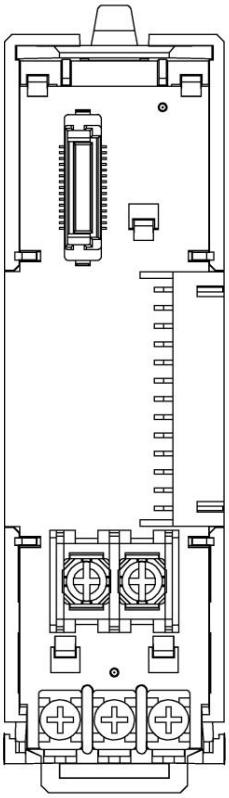


Base part

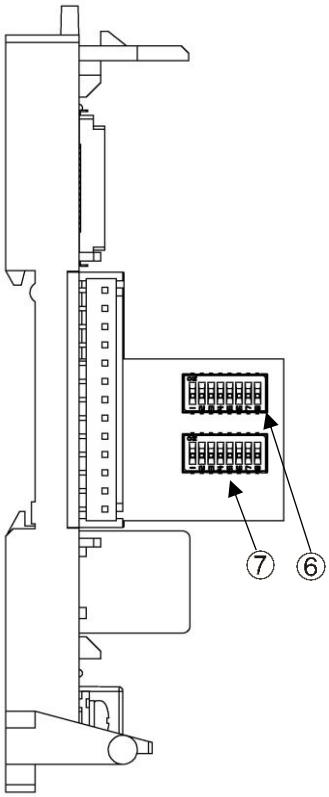
No power supply / communication option



With power supply / host communication option



With power supply / CUnet communication option



(Fig. 3-2)

Operation indicator

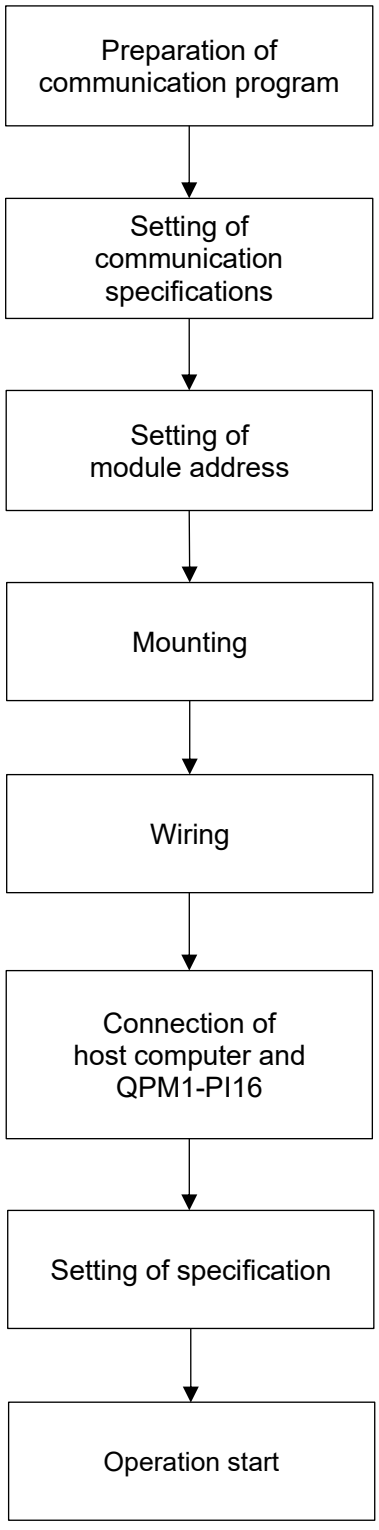
No.	Symbol (color)	Name and Function
(1)	PWR (Green)	Power indicator • Lights off (always): No power supply to the instrumen • Lights up (always): Power supply to the instrumen • Flashing for 500 ms (3 seconds): Warming up the instrument • Flashing for 500 ms (always): Internal failure of the instrument [When non-volatile IC memory error or ADC (internal circuit) error]
(2)	T/R (Yellow)	Communication indicator • Lights off (always): Communication error (no response) or USB communication • Flashing (slow): Communication error (reception error) • Flashing (fast): Communication is normal
(3)	INx (Green)	Input indicator • Lights off (always): When pulse input is OFF (1 point/1 channel) • Lights up (always): When pulse input is ON (1 point/1 channel)

Switch and connector

No.	Symbol	Name and Function
(4)	ADD.	Module address setting rotary switch Rotary switch for module address selection. The module address is the value of the selected rotary switch plus one.
(5)		Communication specification setting dip switch DIP switch for setting communication specifications. Set the communication specifications such as communication speed, data bit, parity, stop bit and communication protocol.
(6)	SW10	CUnet communication specification setting dip switch DIP switches for setting CUnet communication specifications. Set the station address and communication speed.
(7)	SW11	CUnet communication specification setting dip switch DIP switches for setting CUnet communication specifications. Set the master address and number of occupied (OWN) items.

4 Procedure Before Starting Operation

The procedure up to the start of operation when connecting to a host computer is shown below.



A communication program is required to connect and use the host computer.
Refer to “10 MODBUS Protocol (P.10-1)”, to create the communication program.

Set the communication specifications such as communication speed, data bit, and parity.
Refer to “5.1 Selection of Communication Specifications (P.5-1)”.

Set the module address.
Refer to “5.2 Selection of Module Address (P.5-4)”.

QPM1-PI16 to the DIN rail.
Refer to “6 Mounting (P.6-1)”.

Wire the QPM1-PI16.
Refer to “7 Wiring (P.7-1)”.

Connect the host computer and QPM1-PI16.
Refer to “7.5 Connection of Host Computer and QPM1-PI16 (P.7-8)”.

Set the specifications such as input parameters.
Refer to “8 Setting of Specification (P.8-1)”.

Start operation.
Refer to “12 Operation (P.12-1)”.

(Fig. 4-1)

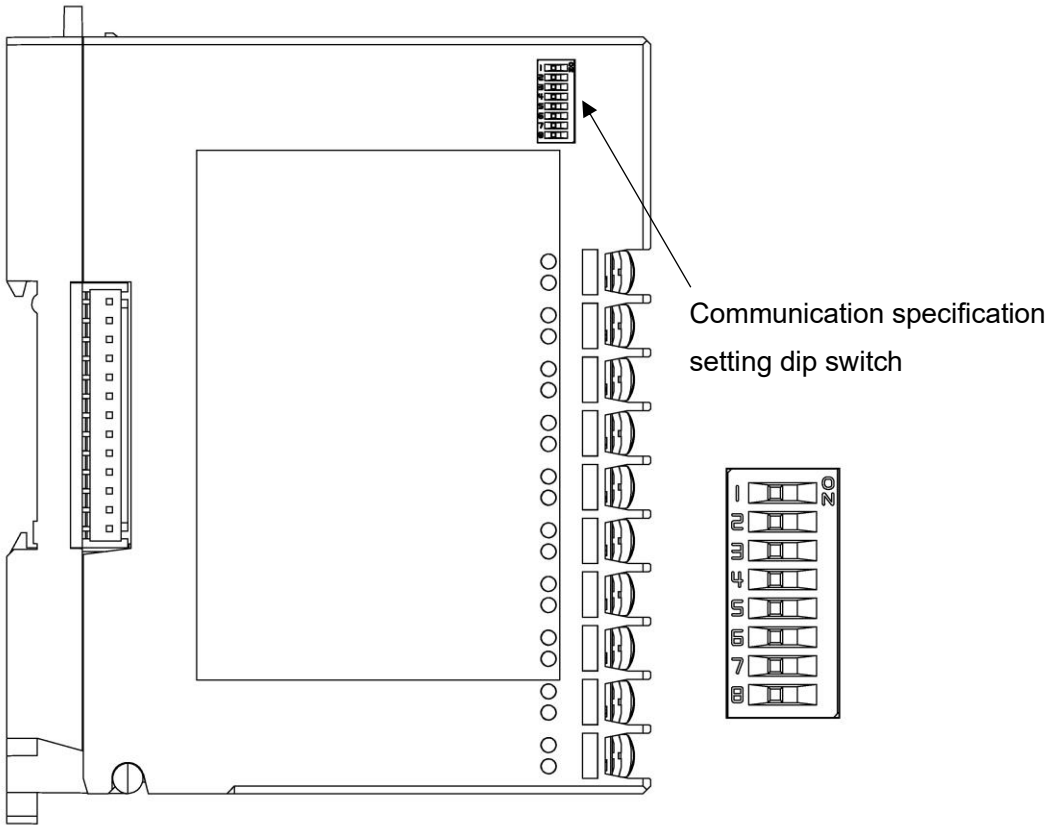
5 Communication Parameter Setting

5.1 Communication Parameter Setting

> **⚠ Caution**
>
> When connecting to the communication expansion module QMC1, the communication specification selection is not required.
> Use it in the factory default (all OFF).

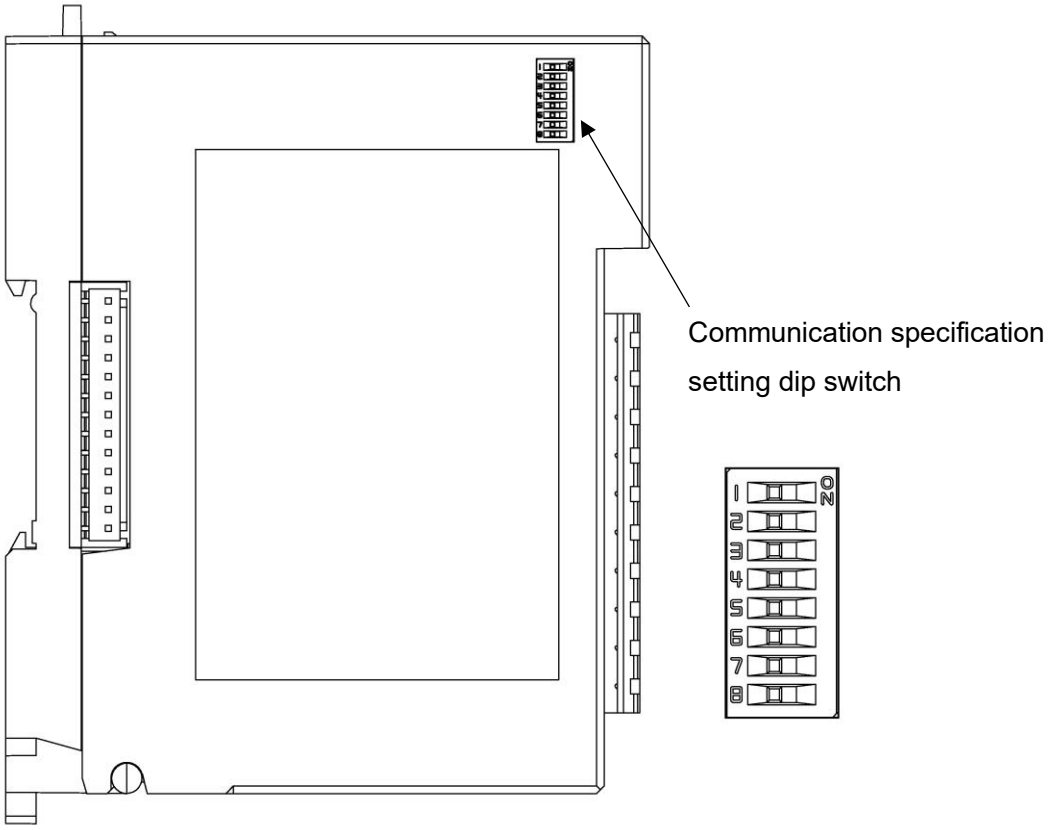
Use the communication specification setting dip switch on the left side of the instrument to set communication specifications.

Terminal block type



(Fig. 5.1-1)

Connector type



(Fig. 5.1-2)

Set the communication speed, data bit, parity, and stop bit.

The factory defaults are as follows.

- Communication speed

  With power supply / host communication option: 57600 bps

  With power supply / CUnet communication option: 38400 bps
- Data bit: 8 bits
- Parity: Even
- Stop bit: 1 bit

(1) Setting of communication speed

Communication specification setting dip switch		Communication speed
1	2	
OFF	OFF	57600 bps
ON	OFF	38400 bps
OFF	ON	19200 bps
ON	ON	9600 bps

Select 38,400 bps for CUnet communication, and 57,600 bps when connecting to the QMC1 communication expansion module.

(2) Setting of data bit, parity and stop bit

Communication specification setting dip switch			Data bit, parity and stop bit
3	4	5	
OFF	OFF	OFF	8 bits, Even, 1 bit
ON	OFF	OFF	8 bits, Even, 2 bits
OFF	ON	OFF	8 bits, Odd, 1 bit
ON	ON	OFF	8 bits, Odd, 2 bits
OFF	OFF	ON	8 bits, None, 1 bit
ON	OFF	ON	8 bits, None, 2 bits

When connecting to CUnet communication or the QMC1 communication expansion module, leave the settings at their factory defaults.

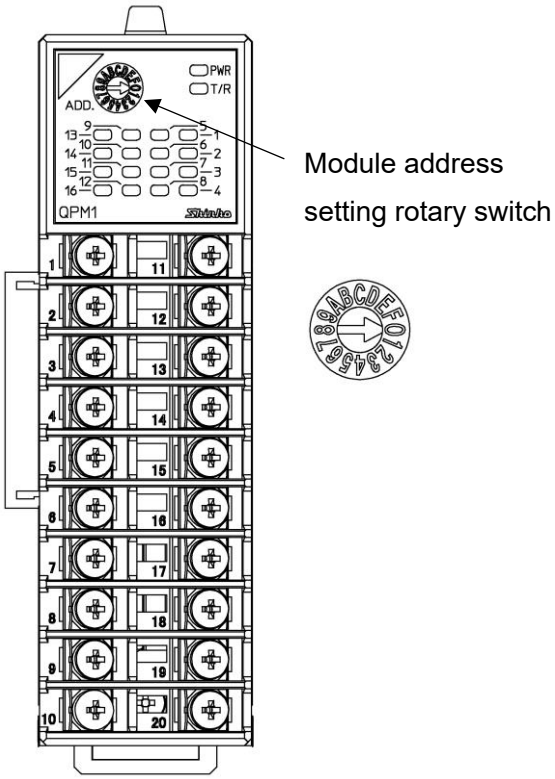
Dip switches No.6, No.7 and No.8 does not use. Leave it OFF.

5.2 Setting of Module Address

> **⚠ Caution**
>
> When using the SIF function, module addresses should be set to consecutive numbers starting from 1.
> When using the MODBUS specification, any number between 0 to F (1 to 16) can be set.

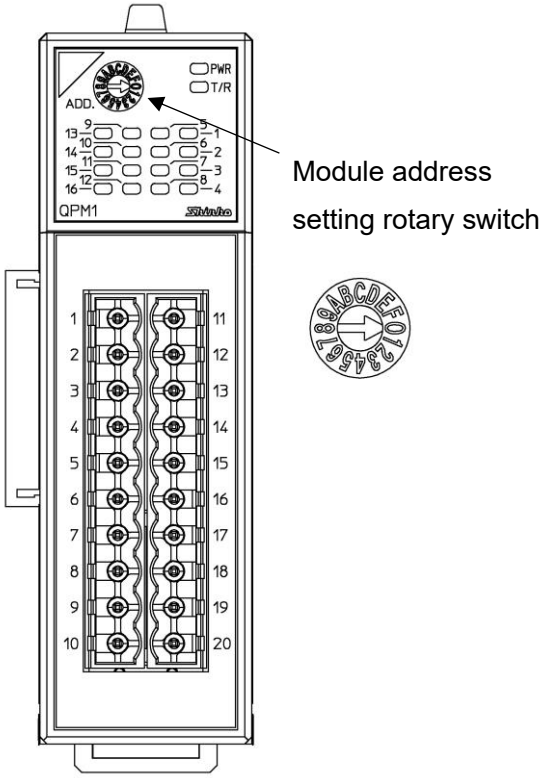
The module addresses are set with the rotary switch.

Terminal block type



(Fig. 5.2-1)

Connector type



(Fig. 5.2-2)

Use a small flat-blade screwdriver to set the module addresses.

The value obtained by adding 1 to the value of the set rotary switch becomes the module addresses.

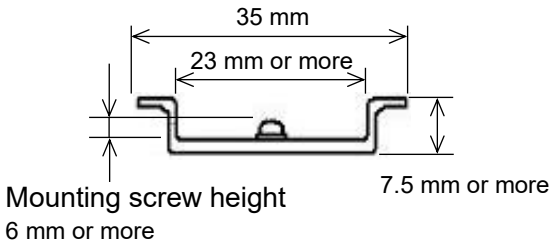
Module address: 0 to F (1 to 16)

Rotary switch	0	1		9	A	B		F
Module address	1	2		10	11	12		16

6 Mounting

⚠ Caution

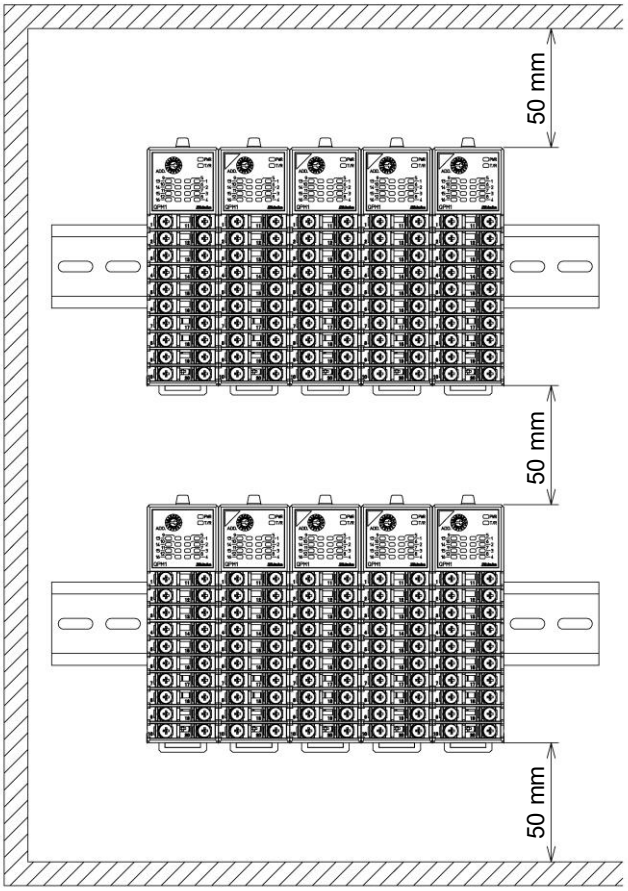
- When mounting or removing this instrument, be sure to turn off the power supply to this instrument.
- Mount the DIN rail horizontally.
- This instrument fits the following DIN rails.
  Top hat rail TH35 JIS C 2812-2025



Width: 35 mm
Height: 7.5 mm or more
Groove width: 23 mm or more
DIN rail mounting screw height:
6 mm or more
(For DIN rail height 7.5 mm)

(Fig. 6-1)

- If this instrument is mounted in a position susceptible to vibration or shock, mount commercially available stopper at both ends of the instrument.
  Recommended stooper: HDV-3, manufactured by TOYOGIKEN CO., LTD.
- When installing, make sure that the orientation (upper and lower) of this instrument is correct.
- When mounting or removing this instrument on the DIN rail, it must be tilted slightly
  Secure a space of 50 mm or more in the vertical direction of the instrument, considering the wiring space of the power supply/communication line and heat dissipation.



(Fig. 6-2)

6.1 Selection of Location

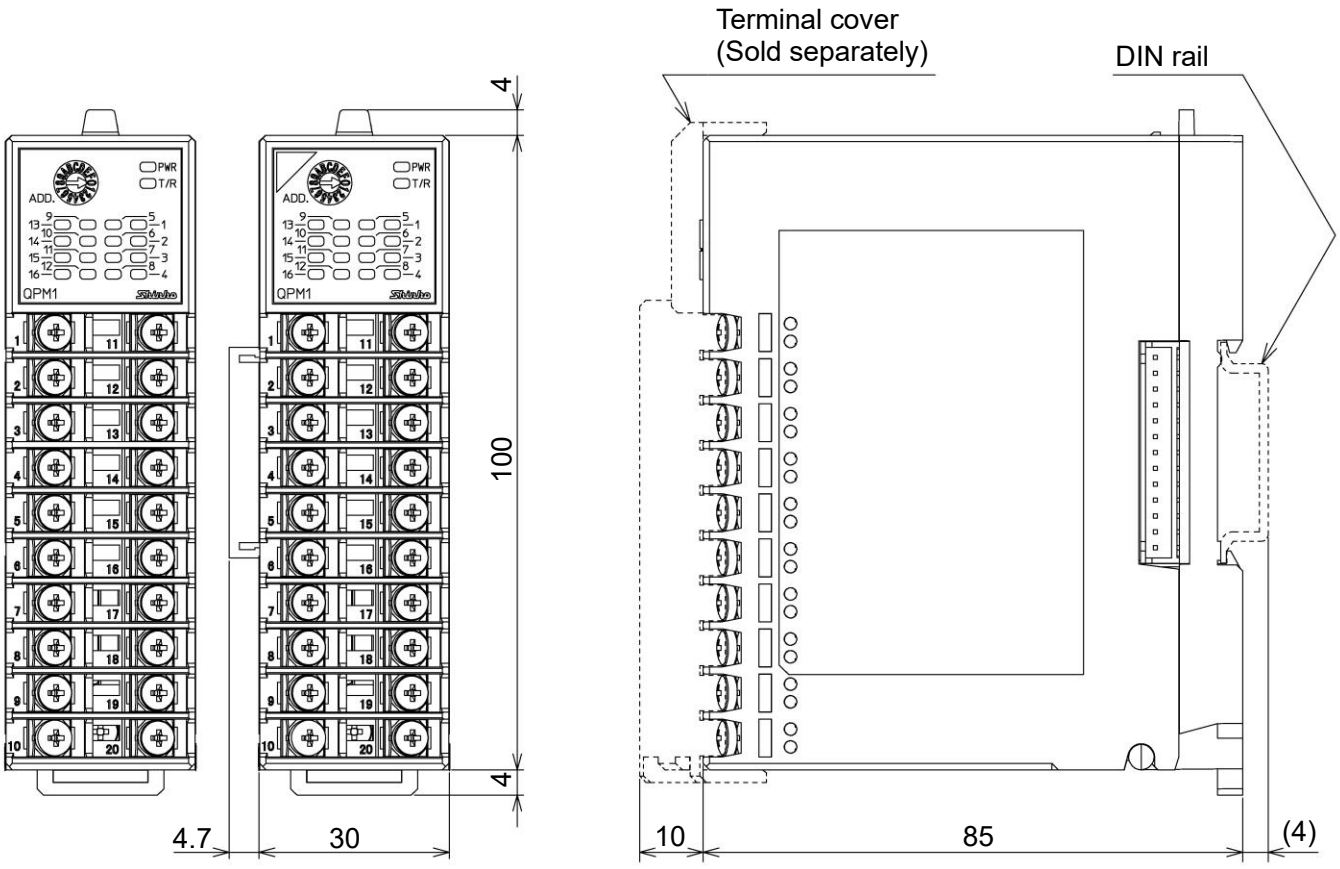
Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of -10 to 50°C(14°F to 122°F) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or the vapors of these substances can come into direct contact with the unit.
- When installing this unit within a control panel, please note that ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 50°C (122°F).
  Otherwise the life of electronic components (especially electrolytic capacitor) may be shortened.

* Avoid setting this instrument directly on or near flammable material even though the case of this instrument is made of flame-resistant resin.

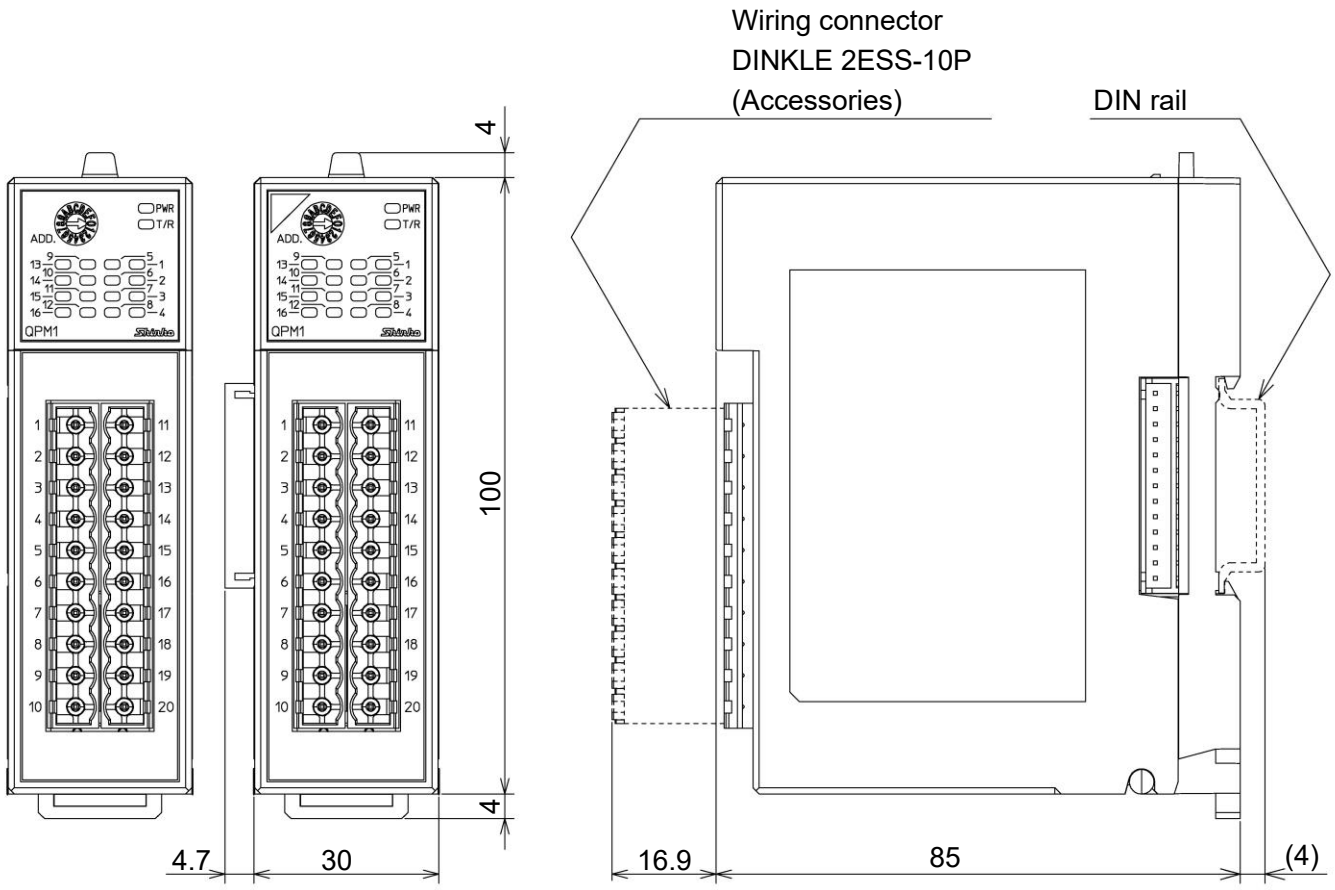
6.2 External Dimensions (Scale: mm)

Terminal block type



(Fig. 6.2-1)

Connector type



(Fig. 6.2-2)

6.3 Mounting

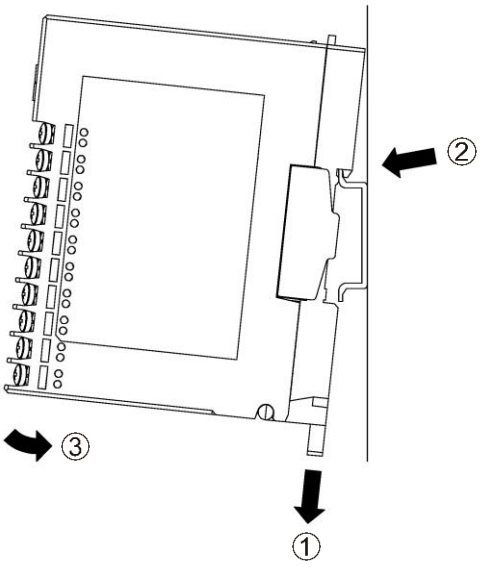
Mounting to the DIN rail

① Lower the lock lever of this instrument. (The lock lever of this instrument has a spring structure, but if lower it in the direction of the arrow until it stops, it will be locked in that position.)

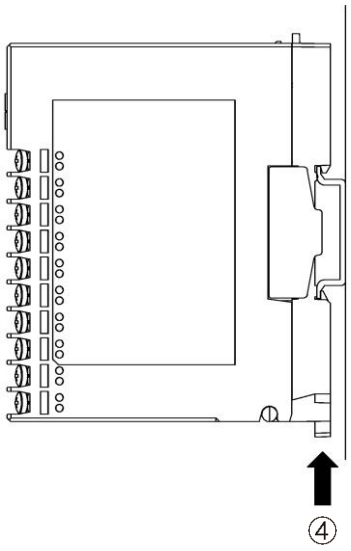
② Hook the part ② of this instrument onto the top of the DIN rail.

③ Insert the lower part of this instrument with the part ② as a fulcrum.

④ Raise the lock lever of this instrument.
Make sure it is fixed to the DIN rail.



(Fig. 6.3-1)

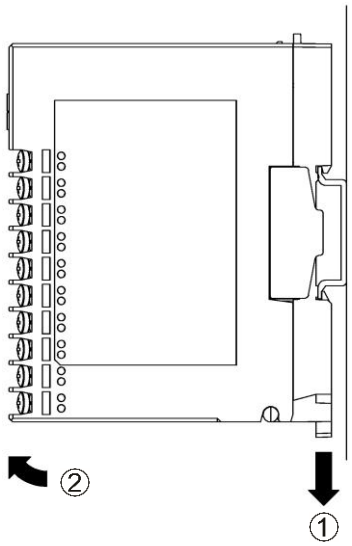


(Fig. 6.3-2)

Removal from the DIN rail

① Insert a flat blade screwdriver into the lock lever of this instrument and lower the lock lever until it stops.

② Remove this instrument from the DIN rail by lifting it from below.



(Fig. 6.3-3)

Mounting multiple modules to the DIN rail

This section describes an example of mounting multiple modules on the DIN rail.

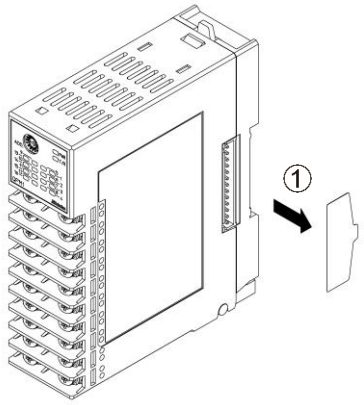
① Remove the protective sticker on the right side of the QPM1-PI16□PT.

② Lower the lock lever of the QPM1-PI16□0T, and mounting the QPM1-PI16□0T to the DIN rail.

③ Slide the QPM1-PI16□0T to the left and connect the connectors to each other.

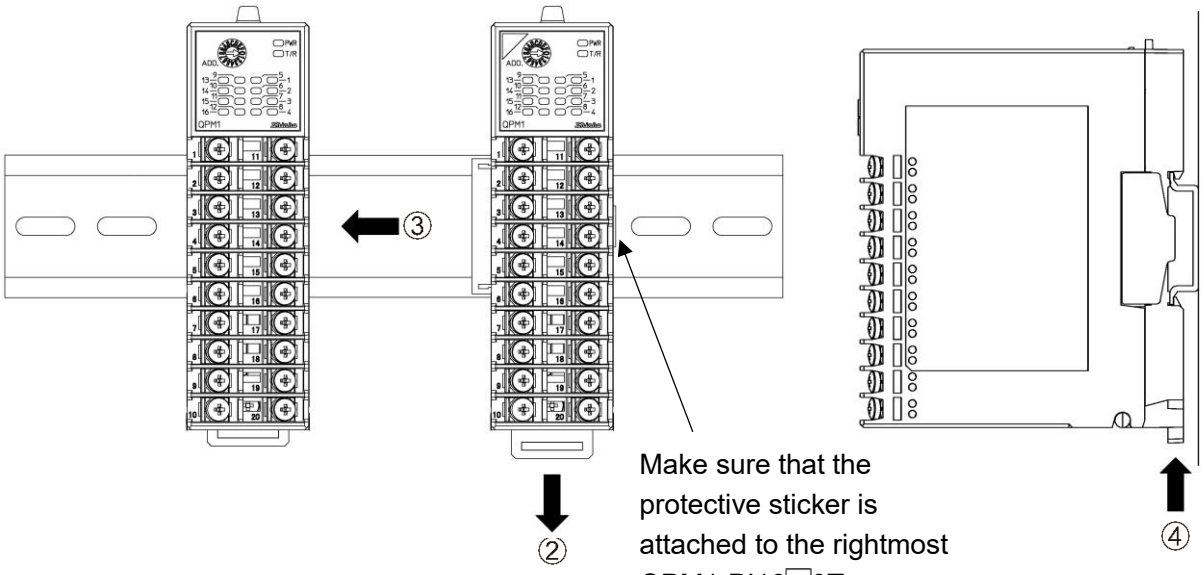
④ Raise the lock lever of the QPM1-PI16□0T.
Make sure it is fixed to the DIN rail.

QPM1-PI16□PT



(Fig. 6.3-4)

QPM1-PI16□PT QPM1-PI16□0T



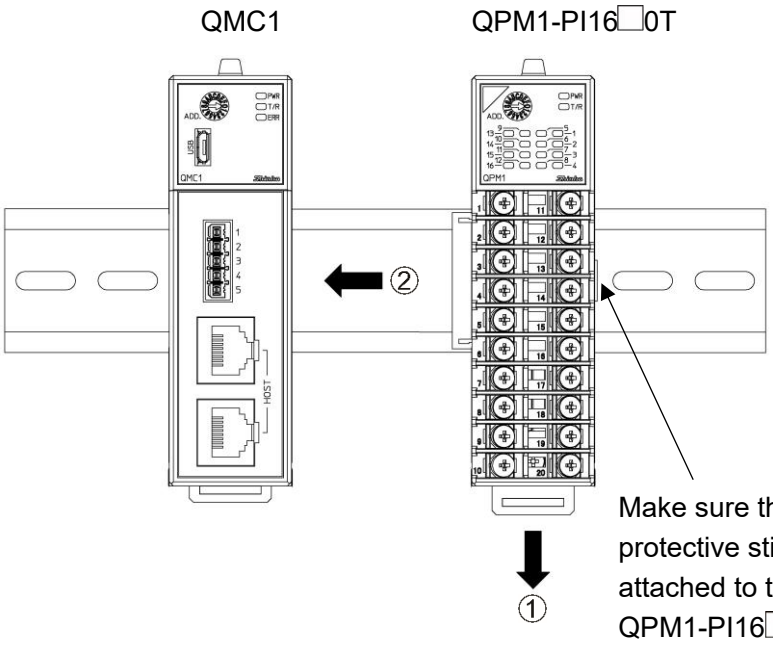
(Fig. 6.3-5) (Fig. 6.3-6)

This section describes an example of mounting communication expansion module QMC1 and QPM1-PI16□0T on the DIN rail.

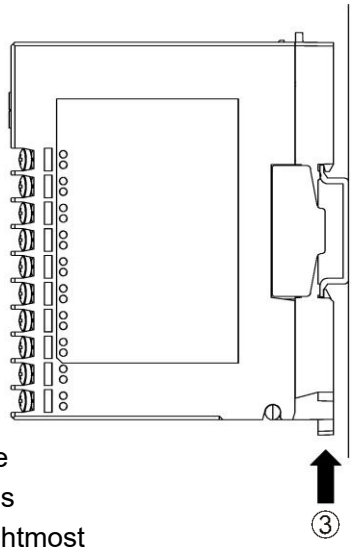
① Lower the lock lever of the QPM1-PI16□0T, and mounting the QPM1-PI16□0T to the DIN rail.

② Slide the QPM1-PI16□0T to the left and connect the connectors to each other.

③ Raise the lock lever of the QPM1-PI16□0T.
Make sure it is fixed to the DIN rail.



(Fig. 6.3-7)



(Fig. 6.3-8)

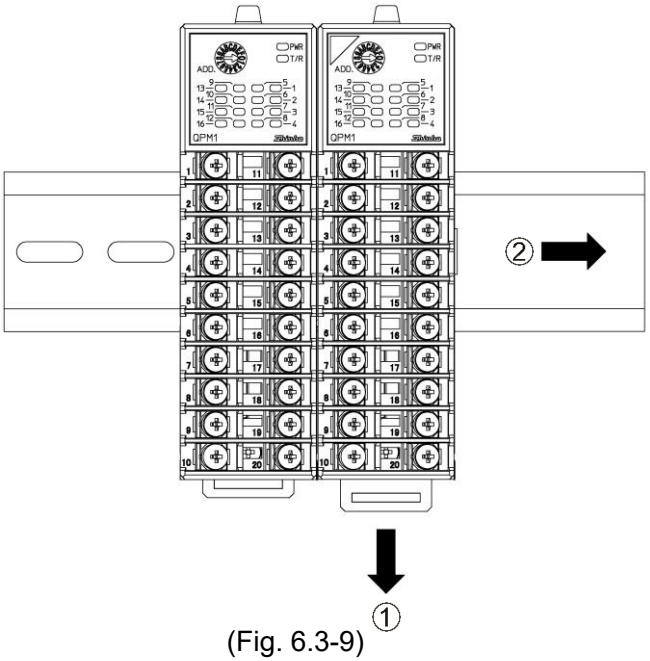
Removal multiple modules from the DIN rail

This section describes an example of removing multiple QPM1-PI16□0T on the DIN rail.

① Insert a flat blade screwdriver into the lock lever of the QPM1-PI16□0T and lower the lock lever until it stops.

② Slide QPM1-PI16□0T to the right side and disconnect it from the connector, then remove it from the DIN rail.

QPM1-PI16□PT　　QPM1-PI16□0T



(Fig. 6.3-9)

7 Wiring

⚠ Warning

Turn off the power supply to this instrument before wiring.
If you work while the power is supplied, you may get an electric shock, which could result in an accident resulting in death or serious injury.

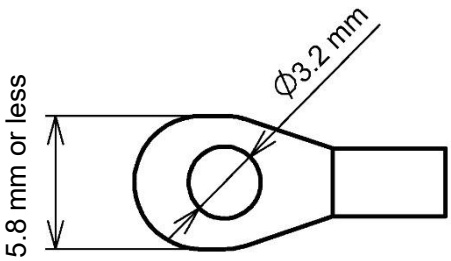
7.1 Recommended Terminal and Recommended Rod Terminal

Recommended terminal

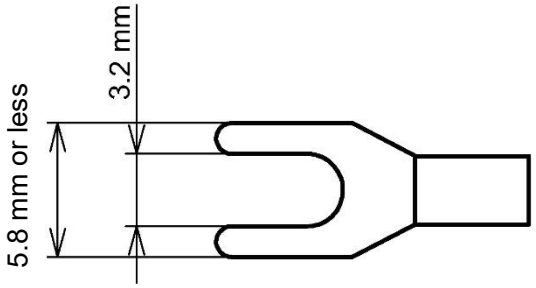
Use a solderless terminal with an insulation sleeve in which an M3 screw fits as shown below.

Ring-type for power supply, serial communication section, and CUnet communication section.

Solderless terminal	Manufacturer	Model	AWG	Tightening torque
Y-type	NICHIFU TERMINAL INDUSTRIES CO., LTD.	TMEX1.25Y-3	AWG22 to 16	Input/output section: 0.63 N•m Power supply section: 0.5 N•m Serial communication section: 0.3 N•m CUnet communication section: 0.3 N・m
	J.S.TMFG.CO.,LTD.	VD1.25-B3A		
Ring-type	NICHIFU TERMINAL INDUSTRIES CO., LTD.	TMEX1.25-3	AWG22 to 16	
		TMEX2-3S	AWG16 to 14	
	J.S.TMFG.CO.,LTD.	V1.25-3	AWG22 to 16	
		V2-MS3	AWG16 to 14	



(Fig. 7.1-1)



(Fig. 7.1-2)

Recommended rod terminal (connector specifications)

For connector specifications, use PHOENIX CONTACT brand rod terminals with insulating sleeves and crimping tools for the input/output sections.

Model	AWG	Crimping tool
AI 0,25-10 YE	AWG24	ZA3 CRIMPFOX UD 6
AI 0,34-10 TQ	AWG22	
AI 0.5-10 WH	AWG20	
AI 0,75-10 GY or AI 1-10 RD	AWG18	
AI 1,5-10 BK	AWG16	
AI 2,5-10 BU	AWG14	
AI 4-10 GY	AWG12	

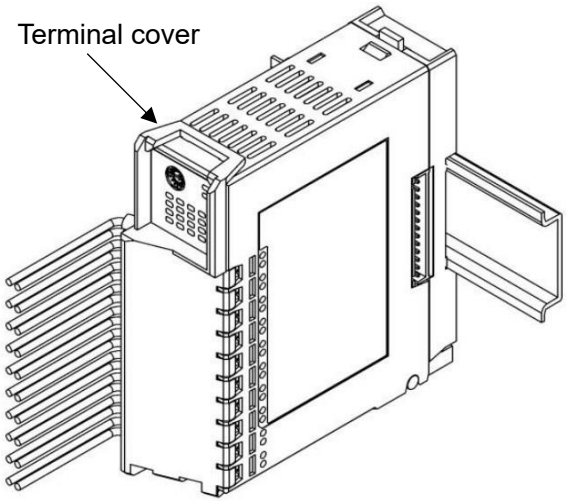
7.2 Using Terminal Cover Precaution

Attach the terminal cover TC-QTC (sold separately) (*) so that the shorter one is on the right side of the case.

For the wiring of terminal numbers 11 to 20, pass through the left side of the terminal cover.

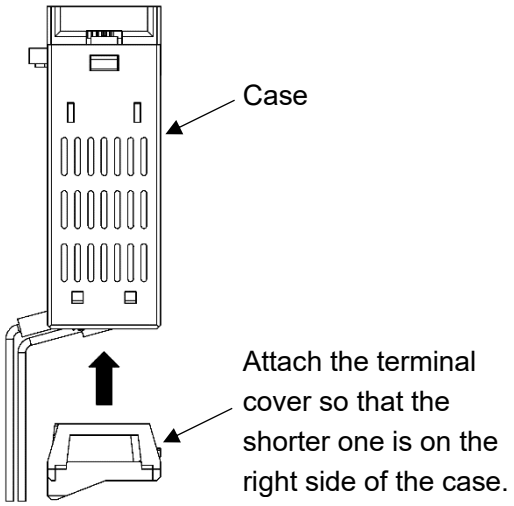
(*): QPM1-PI16 has the same case shape as QTC1, so the terminal cover of QTC1 is used.

QPM1-PI16□PT



(Fig. 7.2-1)

Top of QPM1-PI16□PT



(Fig. 7.2-2)

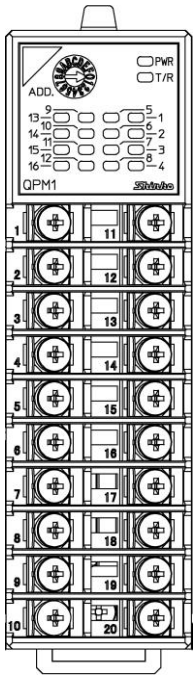
7.3 Terminal Arrangement

7.3.1 Input Terminal Arrangement

> **⚠ Caution**
>
> • Please note that terminal No.1 to 10 and terminal No.11 to 20 have different terminal arrangements.

Terminal block type

1	IN16
2	IN15
3	IN14
4	IN13
5	IN12
6	IN11
7	IN10
8	IN9
9	ExG2
10	ExV2

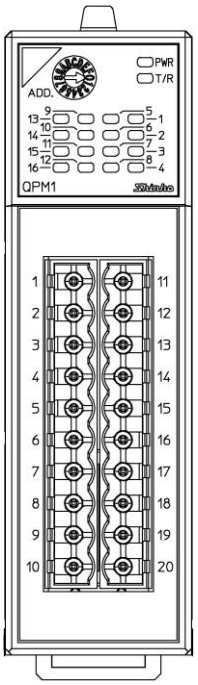


11	ExV1
12	ExG1
13	IN1
14	IN2
15	IN3
16	IN4
17	IN5
18	IN6
19	IN7
20	IN8

(Fig. 7.3.1-1)

Connector type

1	IN16
2	IN15
3	IN14
4	IN13
5	IN12
6	IN11
7	IN10
8	IN9
9	ExG2
10	ExV2

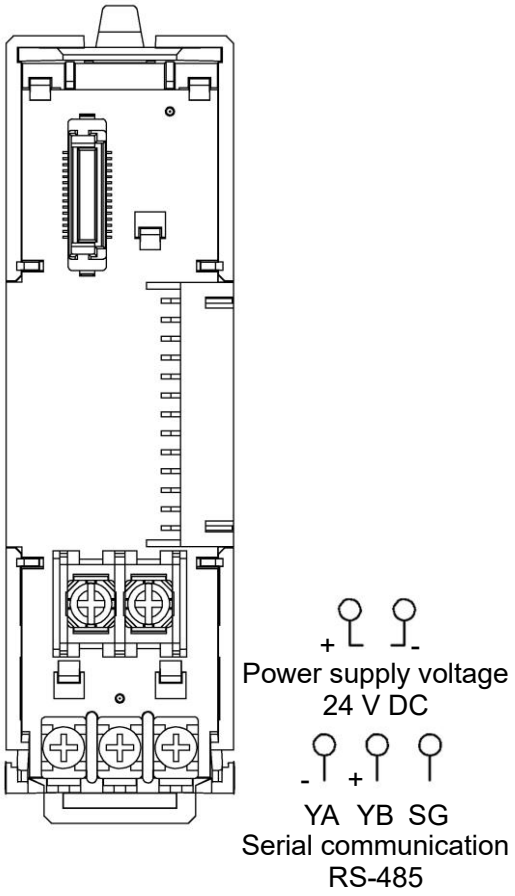


11	ExV1
12	ExG1
13	IN1
14	IN2
15	IN3
16	IN4
17	IN5
18	IN6
19	IN7
20	IN8

(Fig. 7.3.1-2)

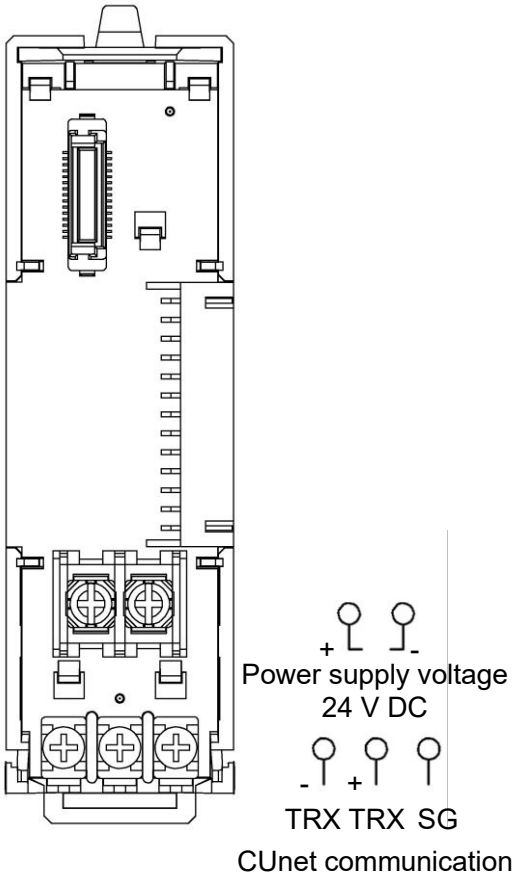
7.3.2 Power Supply and Serial Communication Terminal Arrangement

Serial communication RS-485



(Fig. 7.3.2-1)

CUnet communication



(Fig. 7.3.2-2)

7.4 Wiring

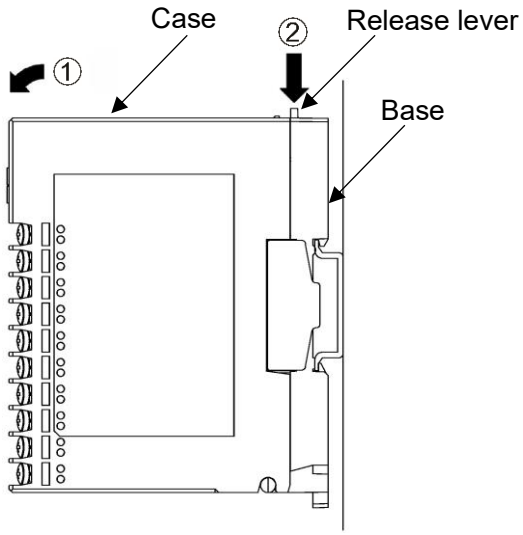
7.4.1 Wiring for Power Supply and Communication

The terminal block for power supply and communication is located on the base of this instrument. Wiring by the following procedure.

(1) Case removal

① Push the release lever on the top of this instrument to unlock it.

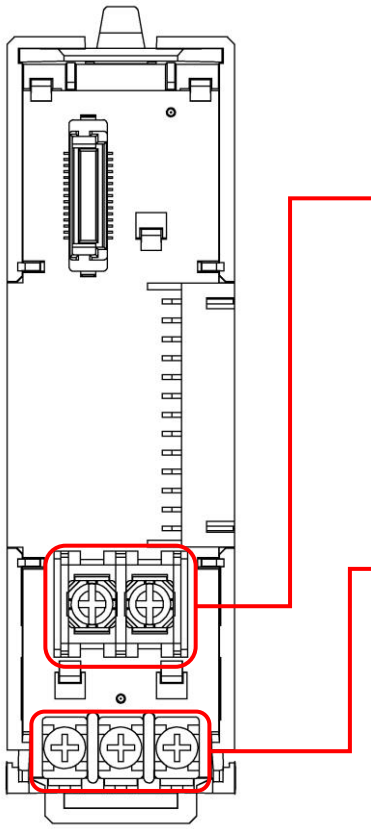
② Remove the case.



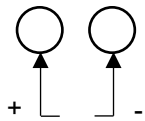
(Fig. 7.4.1-1)

(2) Wiring

Serial communication RS-485



Power supply



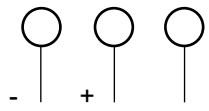
24 V DC

⚠ Caution

- Do not confuse the polarities.
- Use the ring-type solderless terminal.
- The tightening torque should be 0.5 N•m.

Serial communication

RS-485



YA YB SG

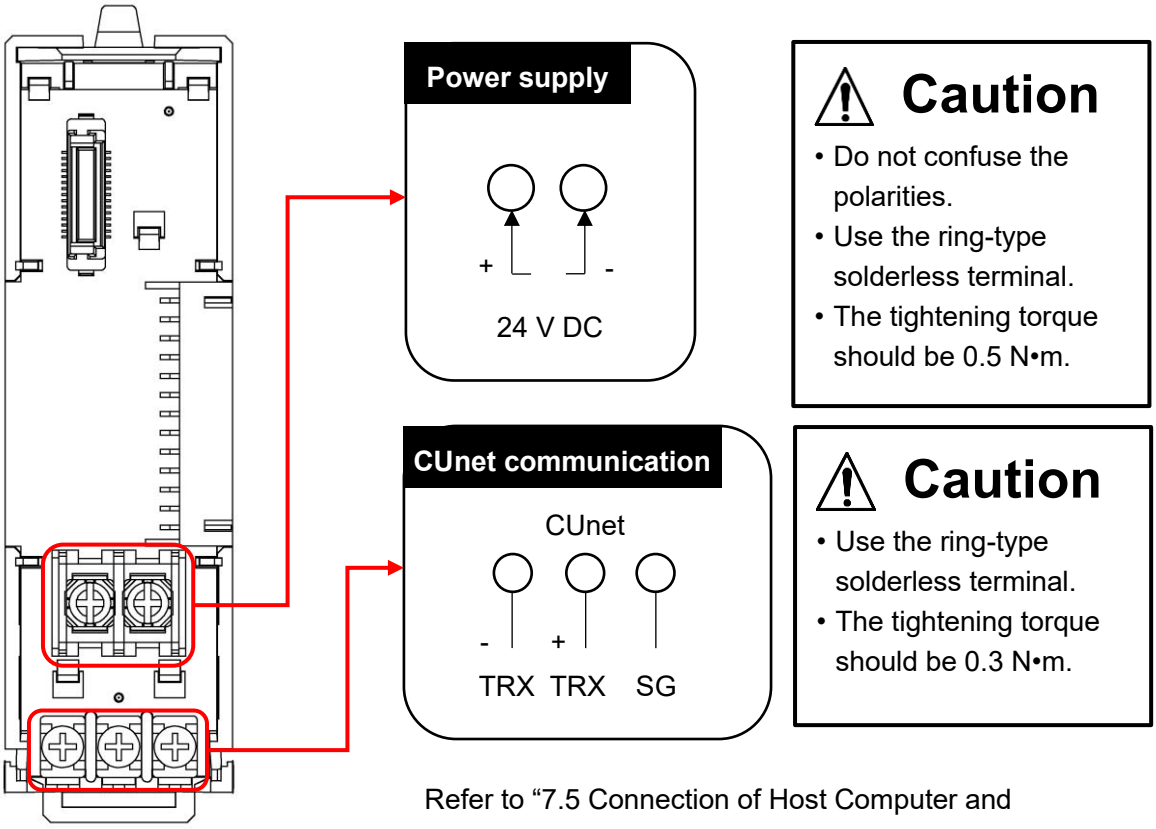
⚠ Caution

- Use the ring-type solderless terminal.
- The tightening torque should be 0.3 N•m.

Refer to “7.5 Connection of Host Computer and QPM1-PI16 (P.7-8)” for the serial communication wiring.

(Fig. 7.4.1-2)

CUnet communication



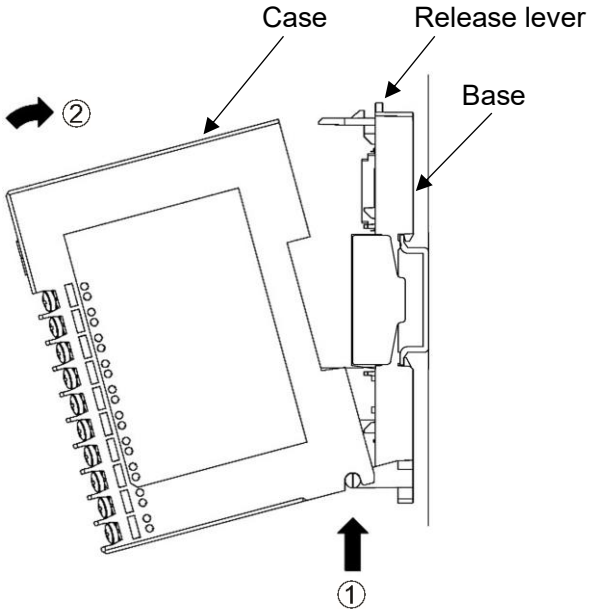
Refer to “7.5 Connection of Host Computer and QPM1-PI16 (P.7-8)” for the CUnet communication wiring.

(Fig. 7.4.1-3)

(3) Case mounting

① Hook the case on the lower part ① of this instrument.

② Mount the case so that the lower part ① of this instrument is the fulcrum and covers the release lever. There is a clicking sound.



(Fig. 7.4.1-4)

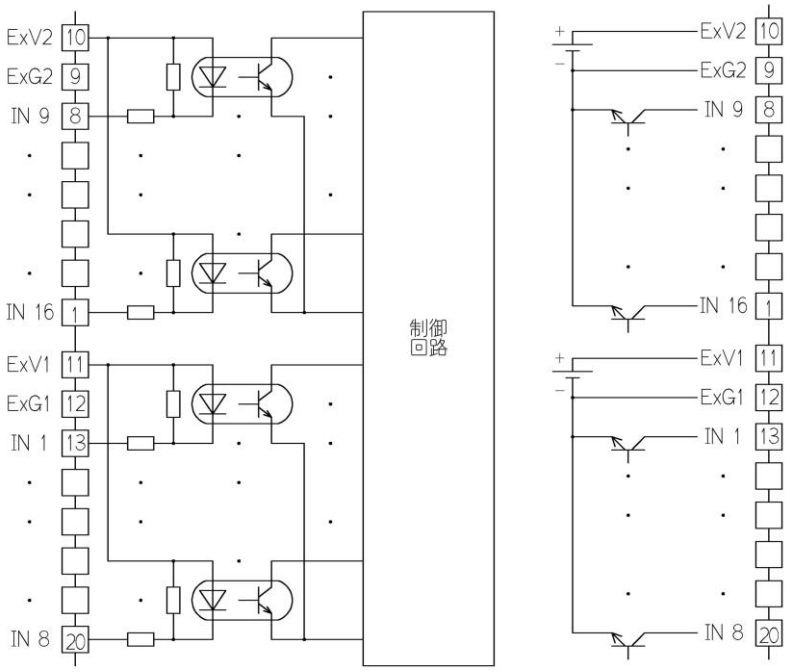
7.4.2 Wiring for Input

⚠ Caution

- Please note that terminal No.1 to 10 and terminal No.11 to 20 have different terminal arrangements.
- The tightening torque should be 0.63 N•m.

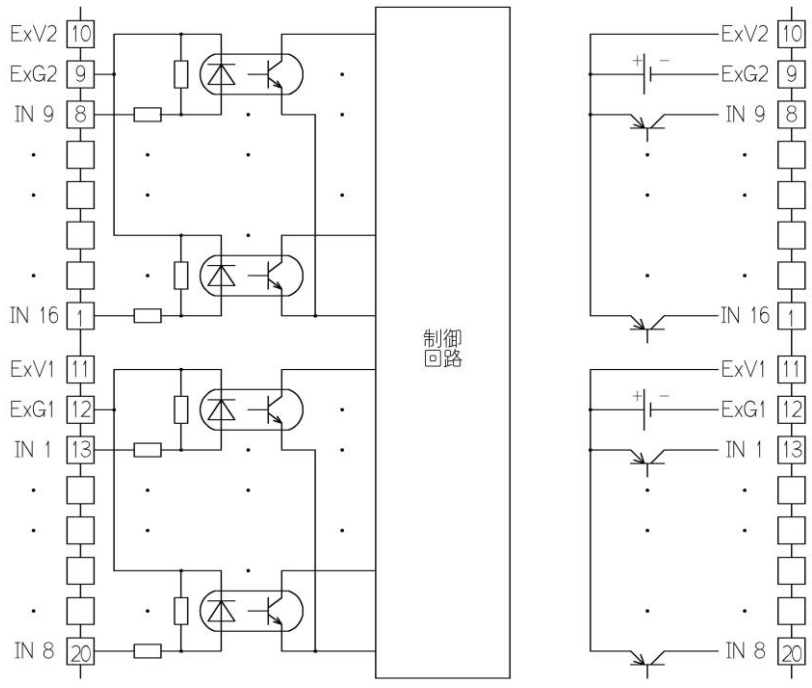
(1) Circuit configuration and wiring examples for pulse input module

QPM1-PI16A□□



(Fig. 7.4.2-1)

QPM1-PI16B□□



(Fig. 7.4.2-2)

7.5 Connection of Host Computer and QPM1-PI16

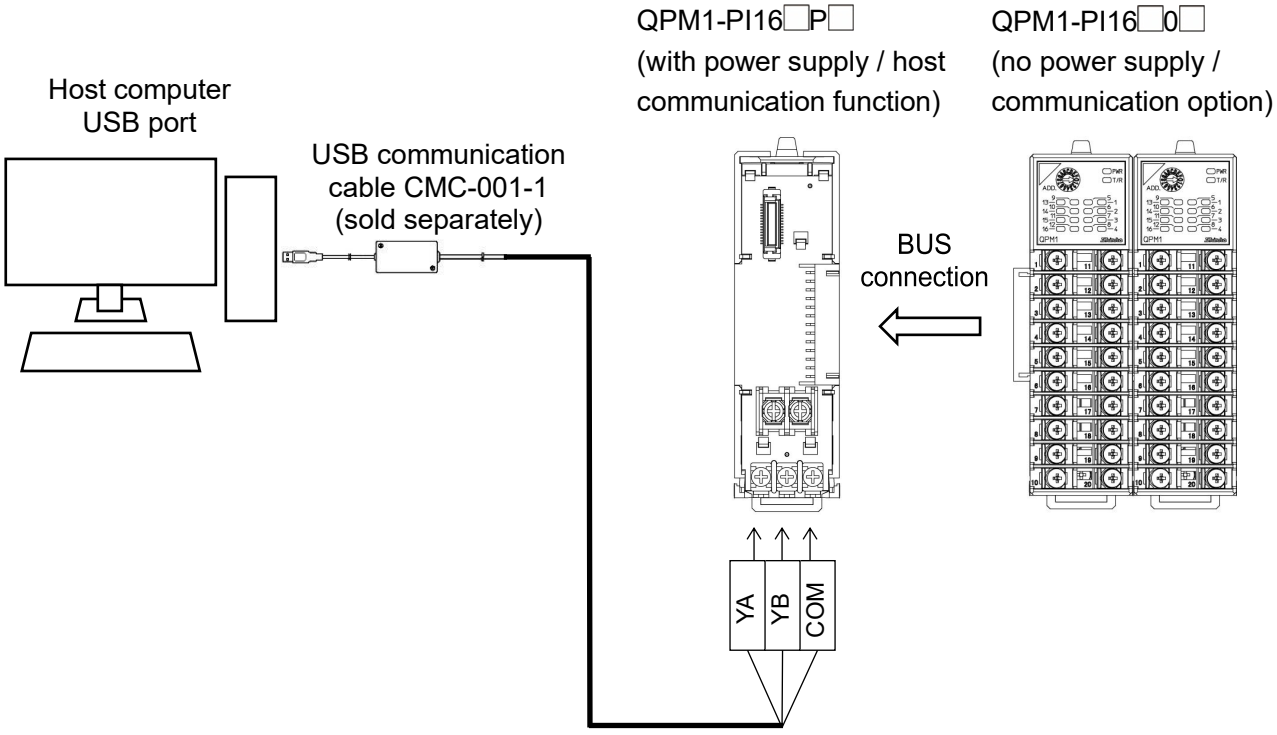
7.5.1 Wiring Example for Using USB Communication Cable CMC-001-1 (Sold separately)

When connecting using USB communication cable CMC-001-1 (sold separately), one QPM1-PI16□P□ (with power supply / host communication function) is required for host communication.

The power supply and communication lines to the second and subsequent QPM1-PI16 are connected to the BUS using connectors.

For the second and later modules, use the QPM1-PI16□0□ (no power supply / communication option).

A maximum of 16 modules can be connected.



(Fig. 7.5.1-1)

7.5.2 Wiring Example for Using Communication Converter IF-400 (Sold separately)

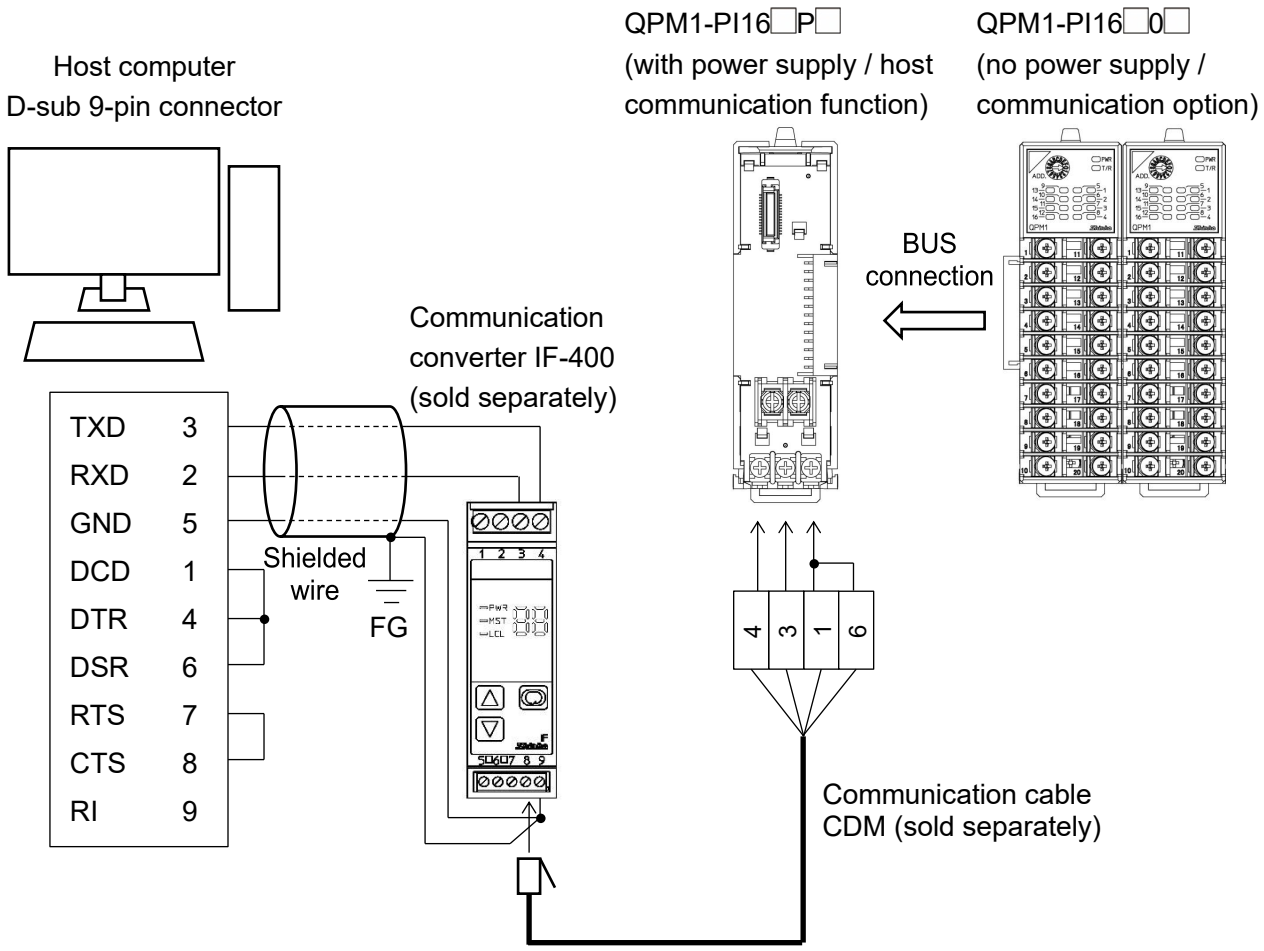
When connecting using the communication converter IF-400 (sold separately), one QPM1-PI16□P□ (with power supply / host communication function) is required for host communication.

The power supply and communication lines to the second and subsequent QPM1-PI16 are connected to the BUS using connectors.

For the second and later modules, use the QPM1-PI16□0□ (no power supply / communication option).

A maximum of 16 modules can be connected.

The communication converter IF-400 (sold separately) does not support communication speeds of 38400 bps and 57600 bps.



(Fig. 7.5.2-1)

Shielded wire

Connect only one side of the shielded wire to FG so that no current flows in the shield part.
If both sides of the shield are connected to FG, a closed circuit will be created between the shielded wire and the ground, and a current will flow through the shielded wire, making it more susceptible to noise. Be sure to ground FG.

Recommended cable: OTSC-VB 2PX0.5SQ by Onamba Co., Ltd. or equivalent (use twisted pair shielded wire).

Termination resistor (terminator)

The communication converter IF-400 (sold separately) has a built-in termination resistor.
The termination resistor is also called a terminator. It is a resistor attached to the end of wiring when peripheral devices are connected to the host computer in a chain, and prevents signal reflection and signal disturbance at the end.
Since this instrument has a built-in pull-up resistor and pull-down resistor, no termination resistor is required on the communication line.

8 Setting of Specification

Set the specifications.

This section describes how to set specifications using console software (SWC-RIOx01M).

8.1 Preparation

8.1.1 Preparation of USB Communication Cable and Console Software

Please prepare the USB communication cable and the console software.

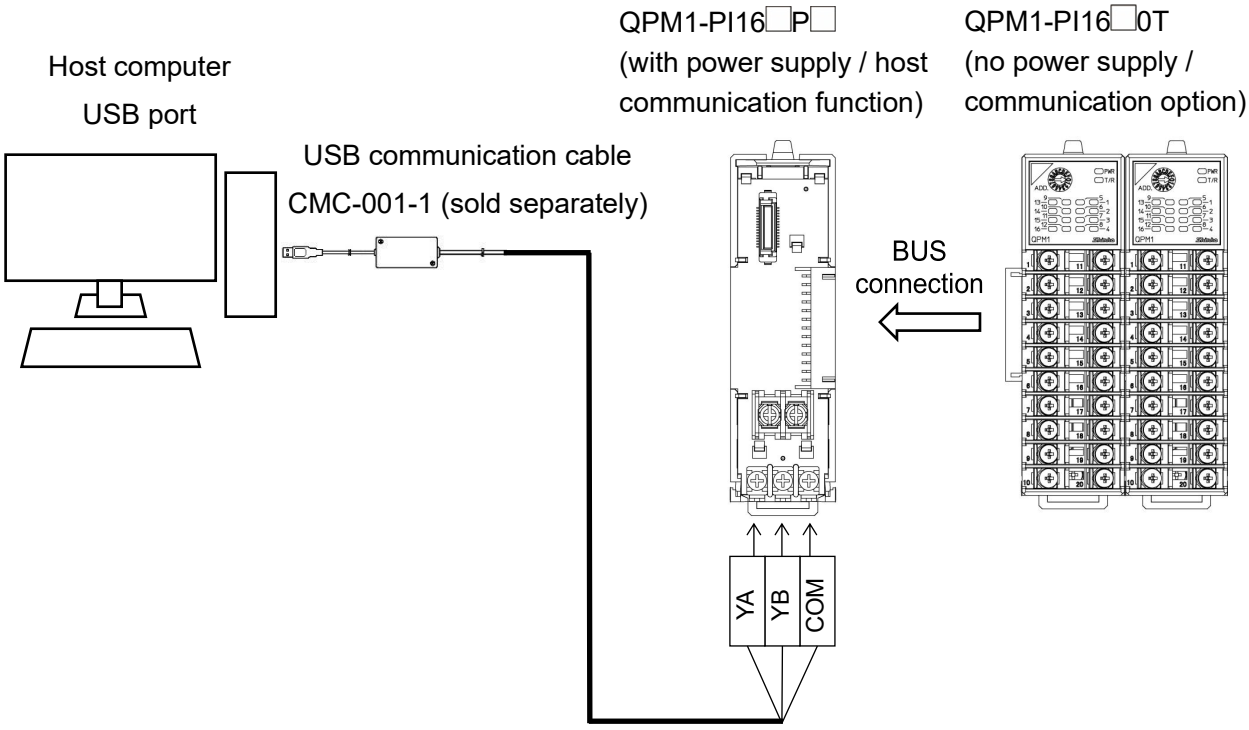
- USB communication cable

  CMC-001-1 (sold separately)
- Console software (SWC-RIOx01M)

  Please download from our website and install.

  Click https://shinko-technos.co.jp/e/ → Support/Download → Software

8.1.2 Connecting to Host Computer



(Fig. 8.1.2-1)

(1) Checking the COM port number

Follow the procedure below to check the COM port number.

① Right-click “Start” → Click “Device manager” from menu.

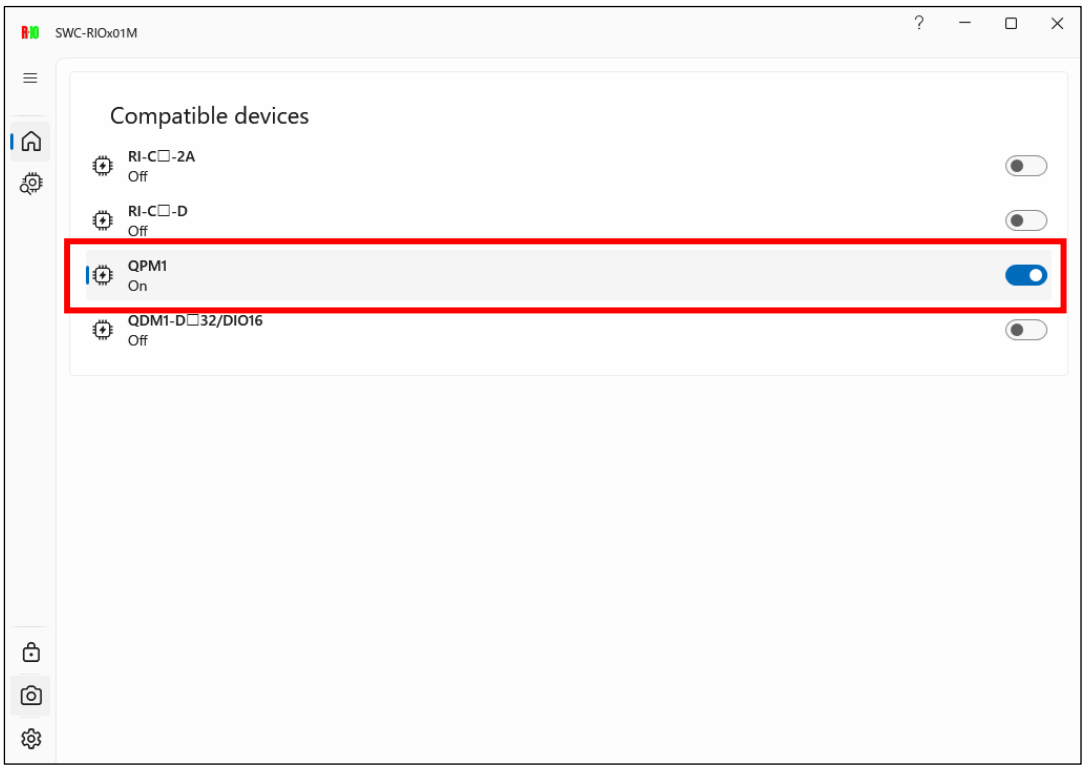
② When “USB Serial Port (COM3)” is displayed in “Port (COM and LPT)”, the COM port is assigned to No. 3.

Check the COM port number, and then close “Device Manager”.

(2) Starting the console software (SWC-RIOx01M)

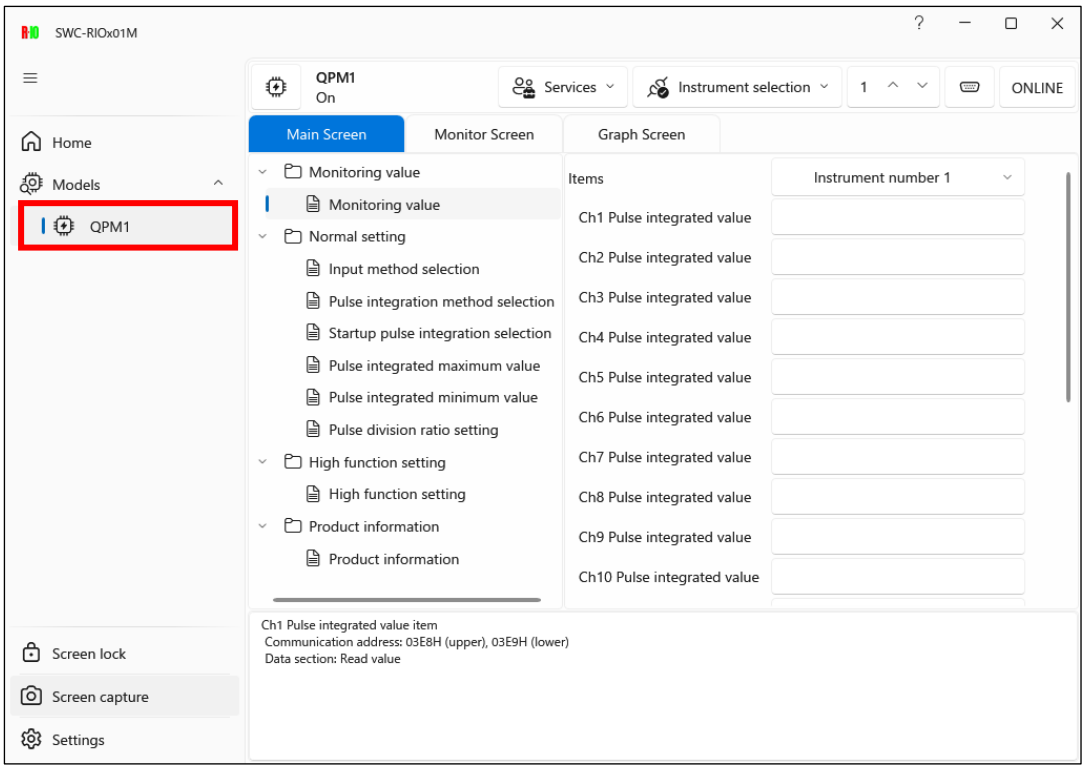
① Start the console software (SWC-RIOx01M).

Select “QPM1” in the Compatible devices.



(Fig. 8.1.2-2)

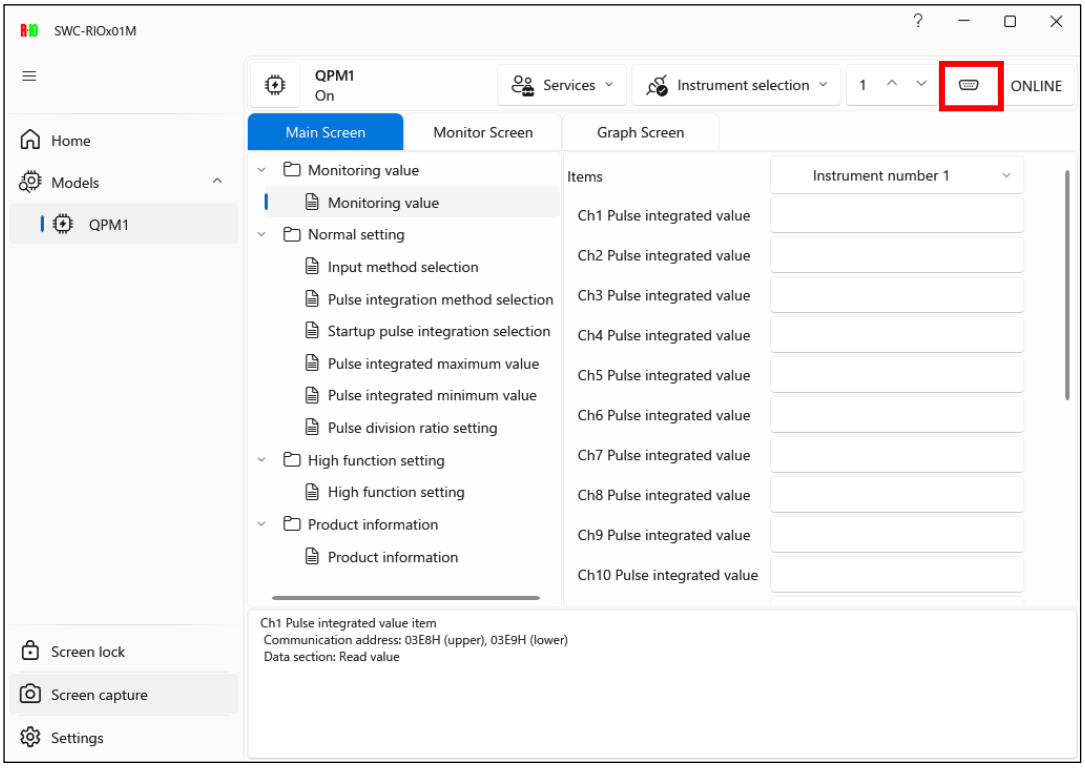
② Click “QPM1” icon in the Models.



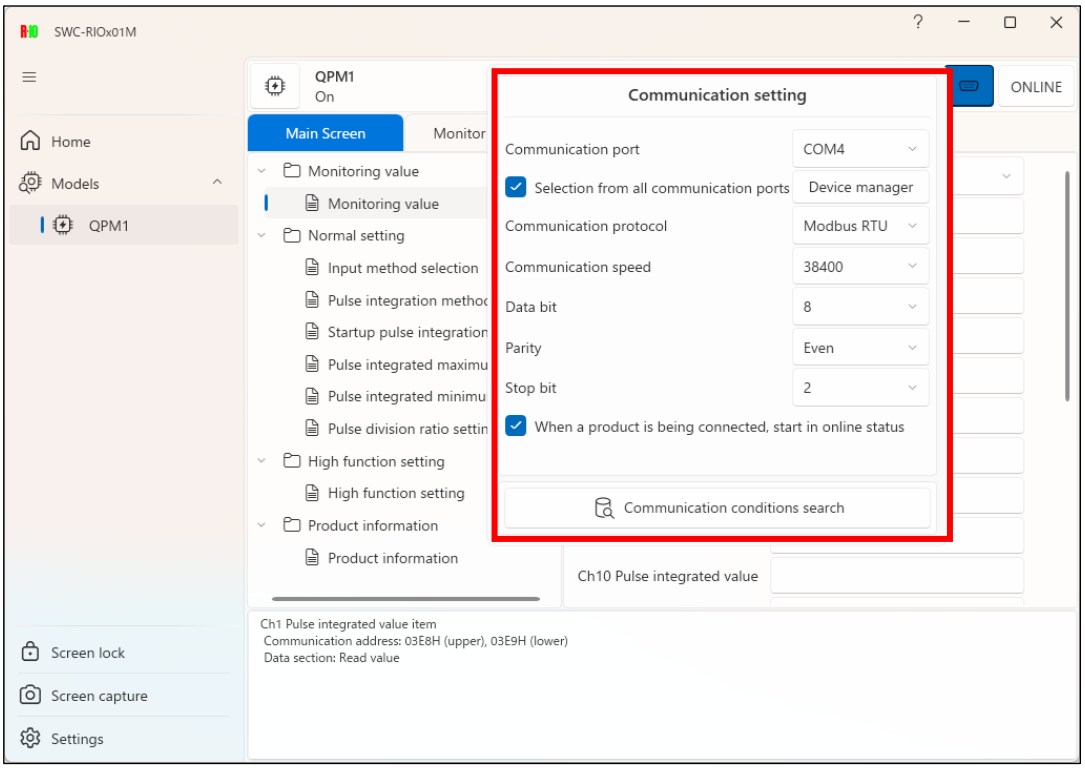
(Fig. (8.1.2-3)

③ Click “Communication condition”.

Display the communication condition setting screen.



(Fig. 8.1.2-4)



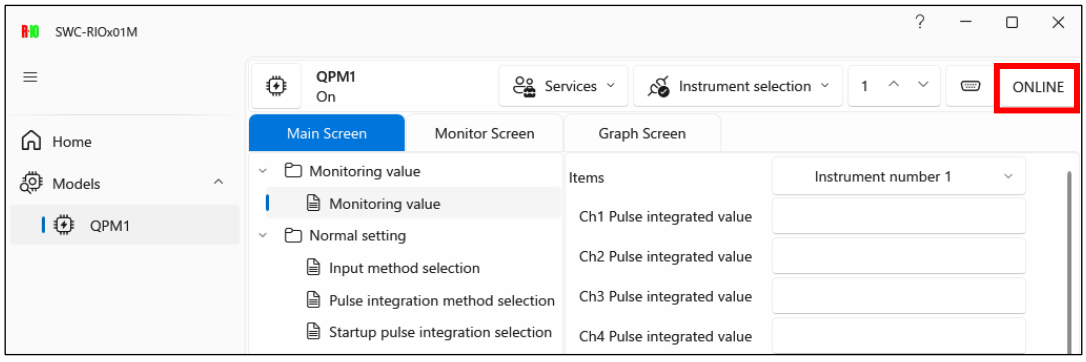
(Fig. 8.1.2-5)

④ Set the communication condition as shown below.

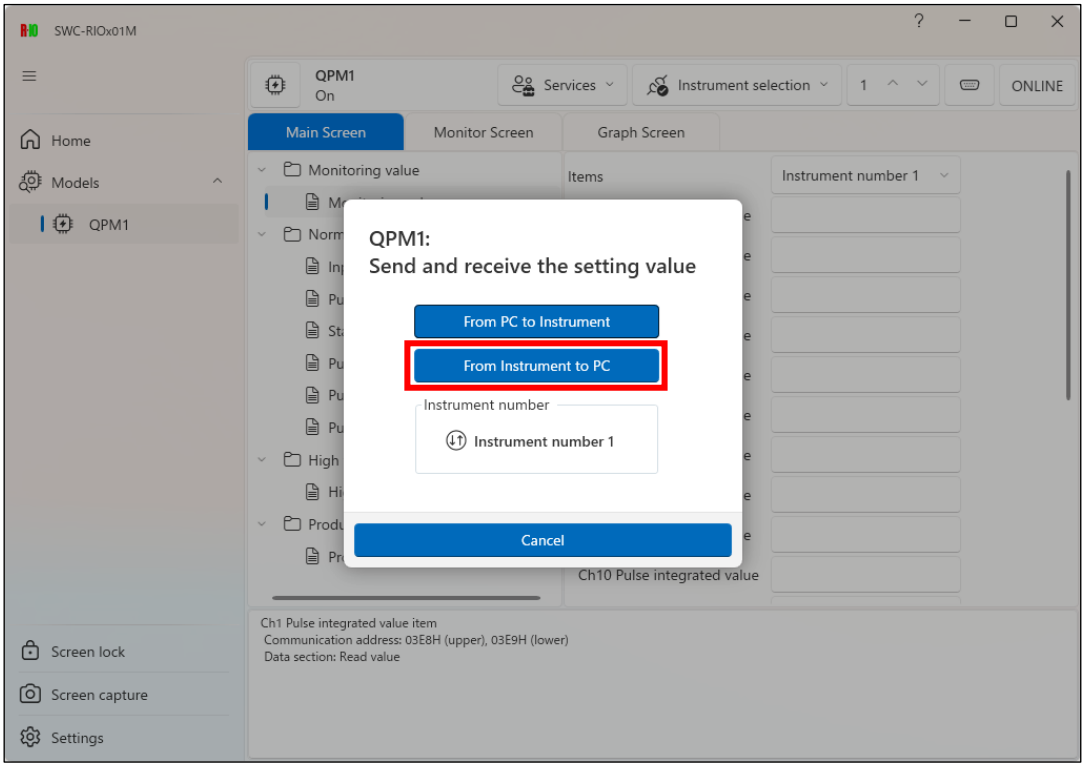
Setup Items	Setting Value
Communication port	Select the COM port number confirmed in ② of (3).
Communication protocol	MODBUS RTU

⑤ Click “ONLINE” → “From Instrument to PC”.

Read all the setting values of the connected QPM1-PI16.

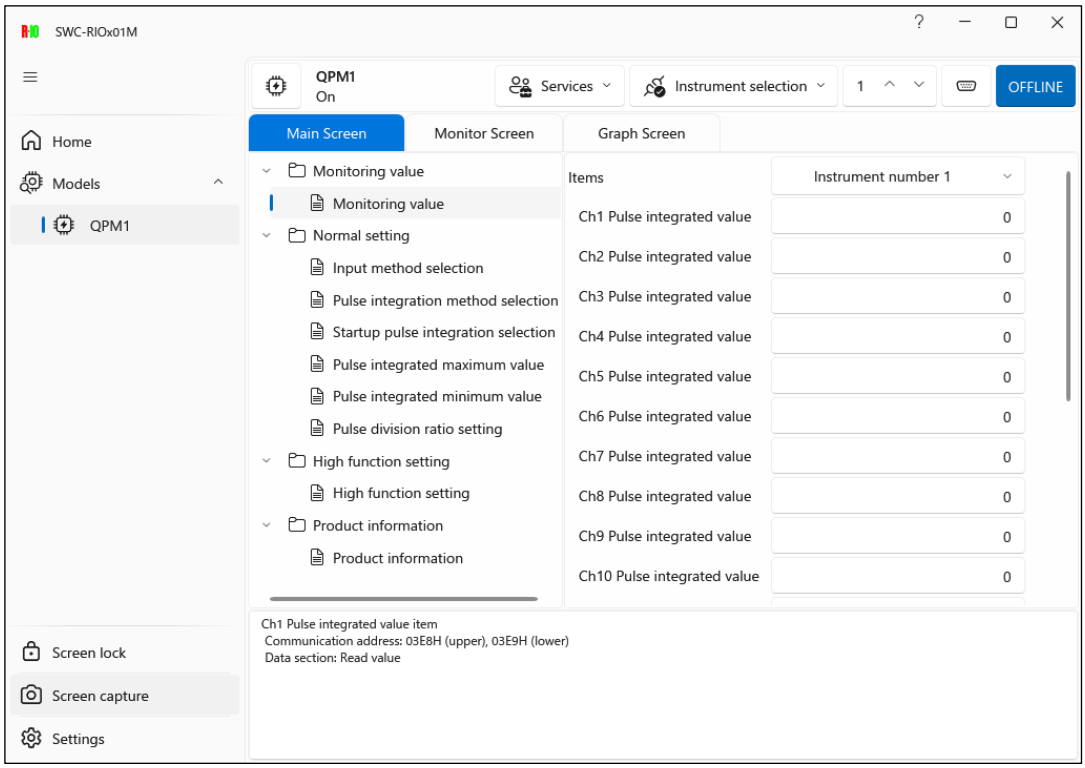


(Fig. 8.1.2-6)



(Fig. 8.1.2-7)

⑥ Display the Main screen.



(Fig. 8.1.2-8)

The specifications are ready.

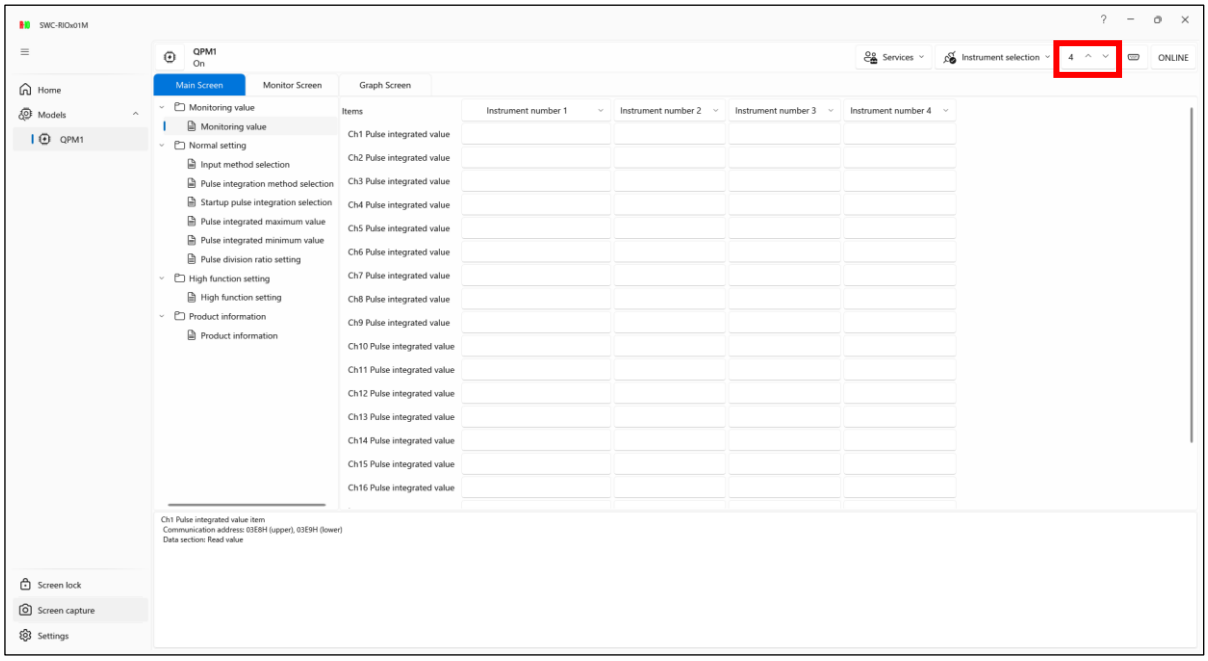
Please refer to "8.2 Specification Setting (P.8-19)" to set the specifications.

Setting the specifications for the second and subsequent modules

To set the specifications of the second and subsequent QPM1-PI16, follow the procedure below.

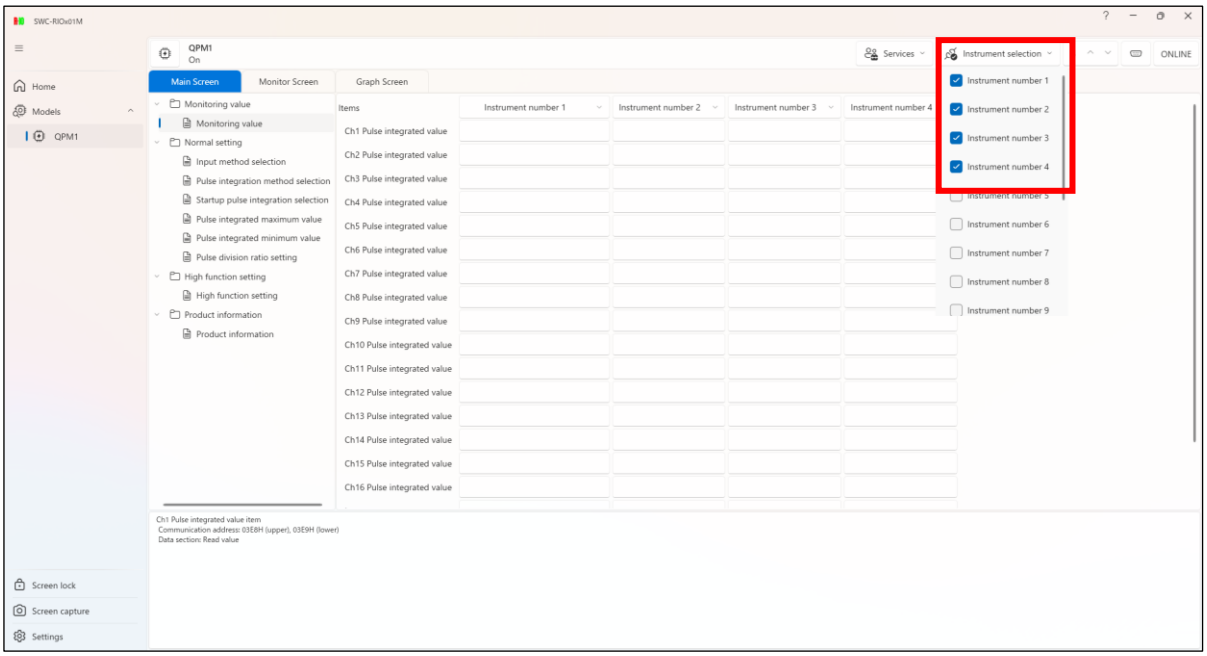
① Set the number of connected modules.

The explanation uses the example of connecting four modules.



(Fig. 8.1.2-9)

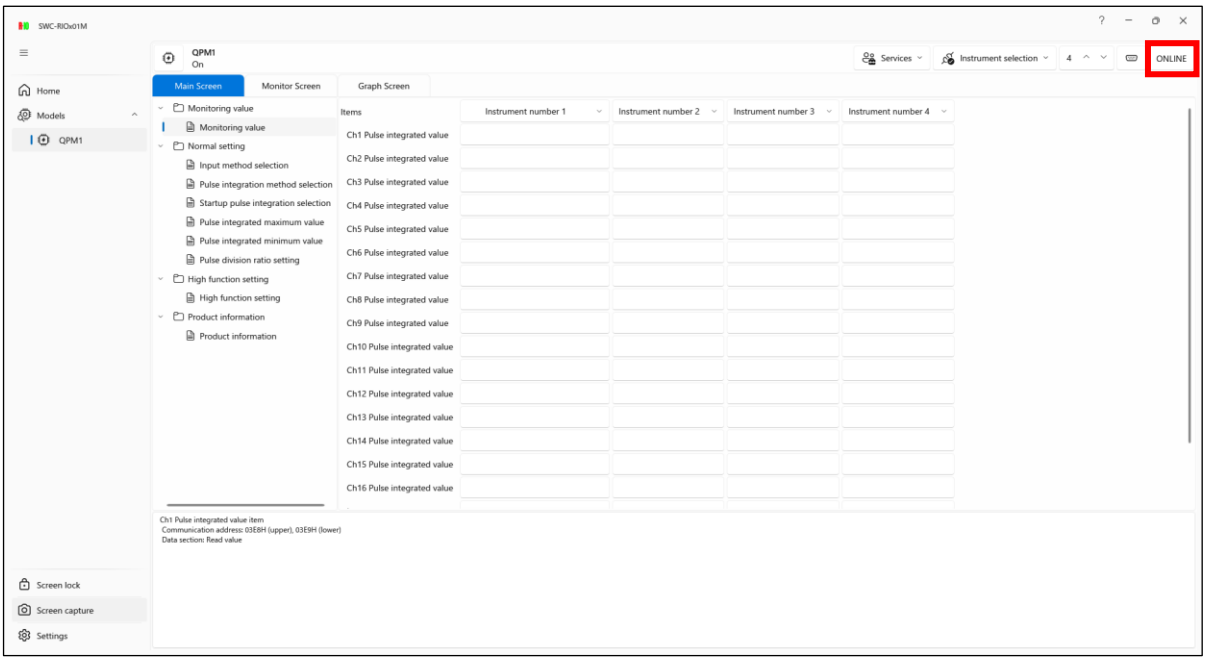
② Click “Instrument Selection” and select module numbers 1 through 4.



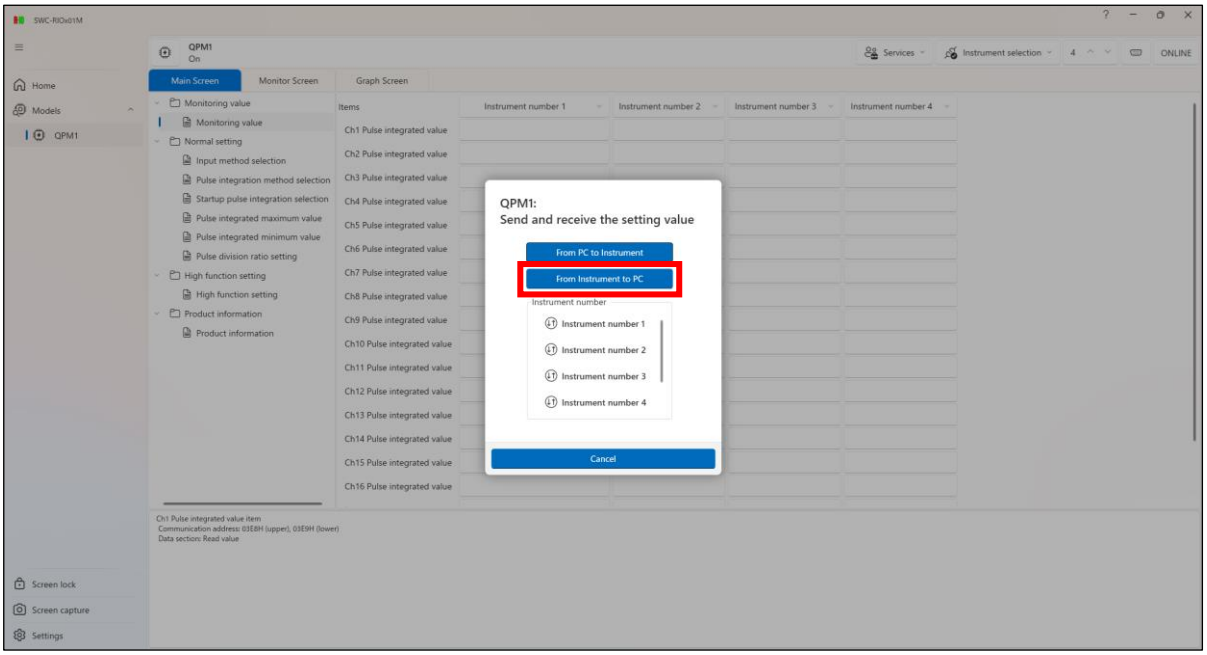
(Fig. 8.1.2-10)

③ Click “ONLINE” → “From Instrument to PC”.

Read all the setting values of the connected QPM1-PI16.



(Fig. 8.1.2-11)



(Fig. 8.1.2-12)

④ Display the Main screen.

(Fig. 8.1.2-13)

Please refer to "8.2 Specification Setting (P.8-19)" to set the specifications.

8.2 Specification Setting

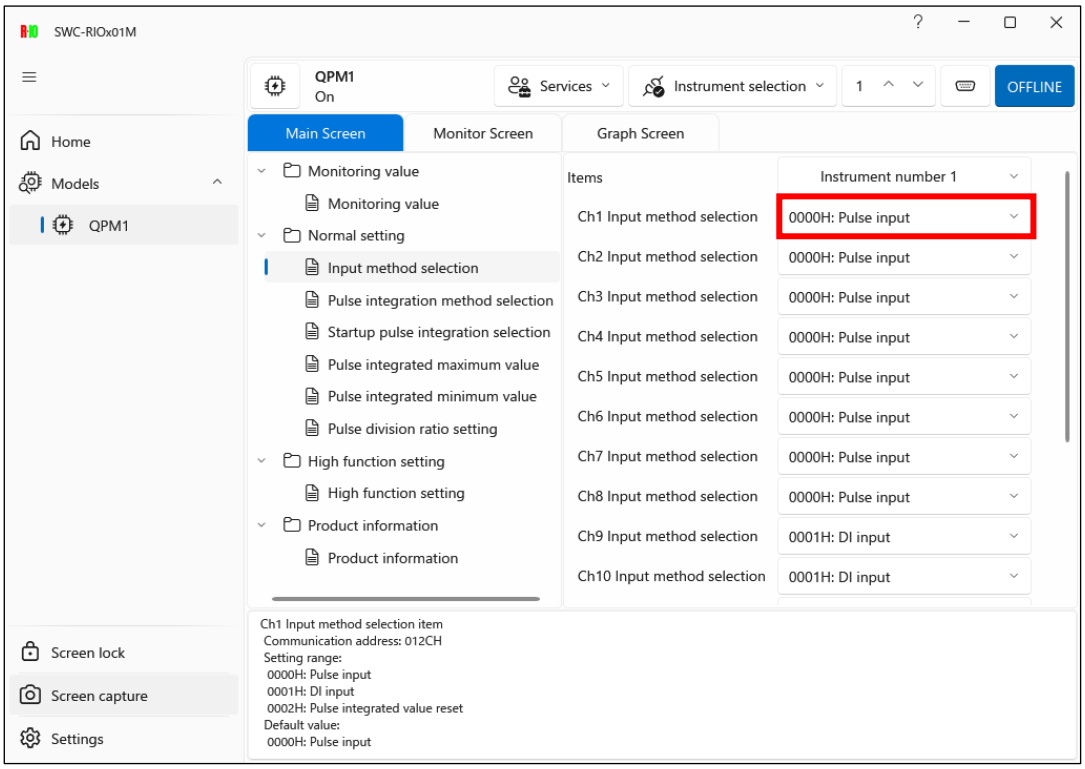
Basic operation of specification setting

Before setting the specifications, how to select the selection item and how to set the setting item are explained.

Select the selection item

This section explains how to select items using the “CH1 Input method selection” for Instrument number 1 as an example.

Click the name of the item you want to select.

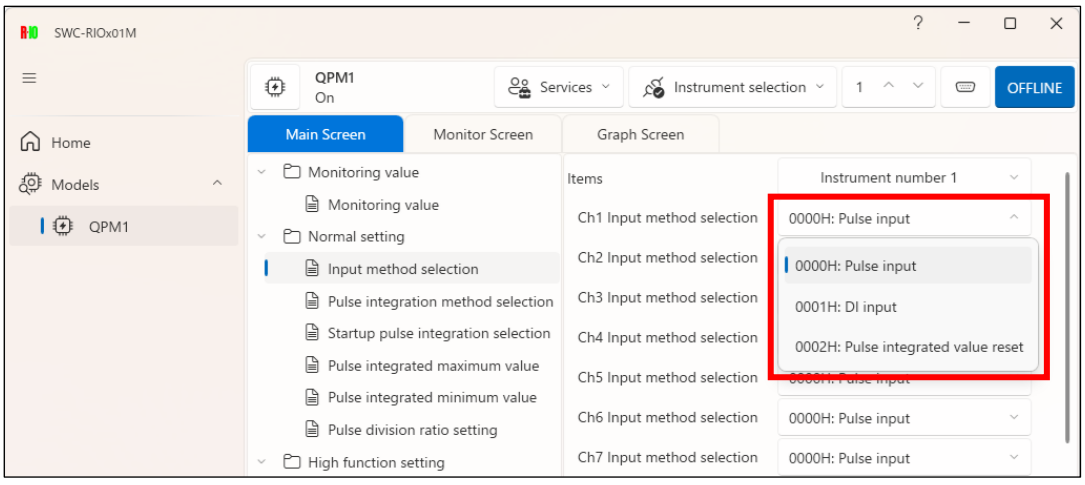


(Fig. 8.2-1)

Display the selection item list.

Select from “0000H: Pulse input”, “0001H: DI input” and “0002: Pulse integrated value reset” and click.

Transfers the selected contents to the QPM1-PI16.

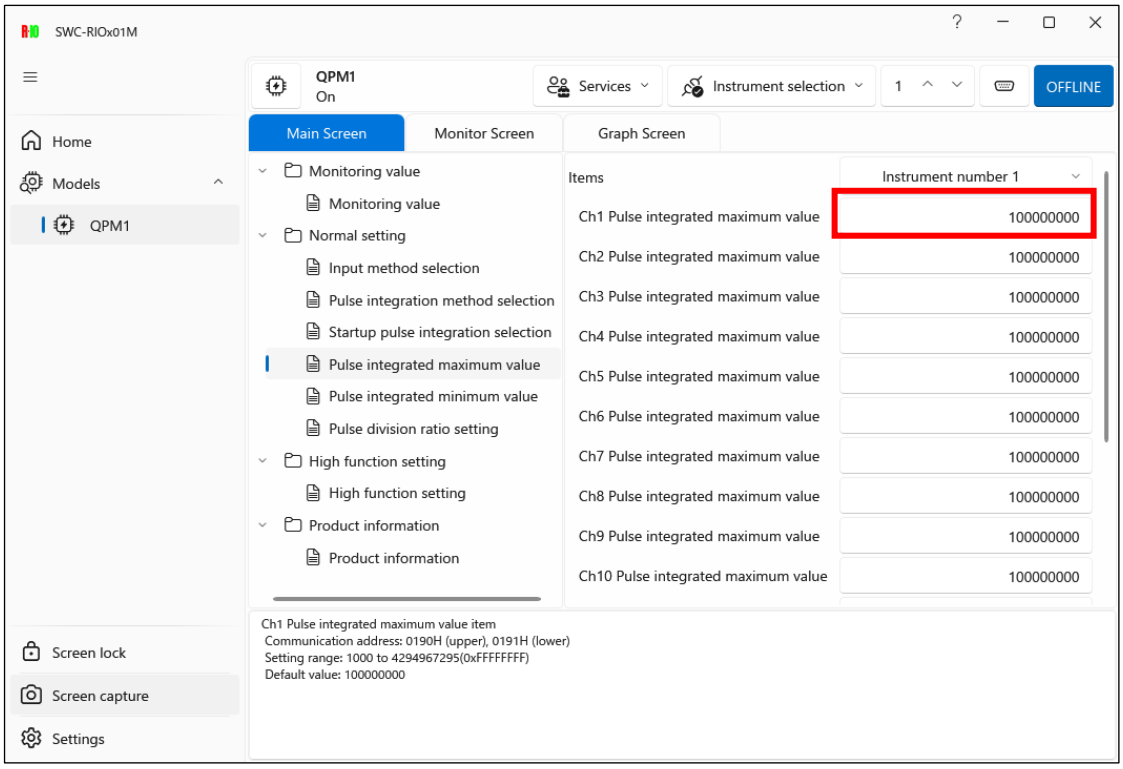


(Fig. 8.2-2)

Set the setting item

This section explains how to select items using the “CH1 Pulse integrated maximum value” for Instrument number 1 as an example.

Click the setting value of the Instrument number you want to set.



(Fig. 8.2-3)

Display the numeric keypad screen.

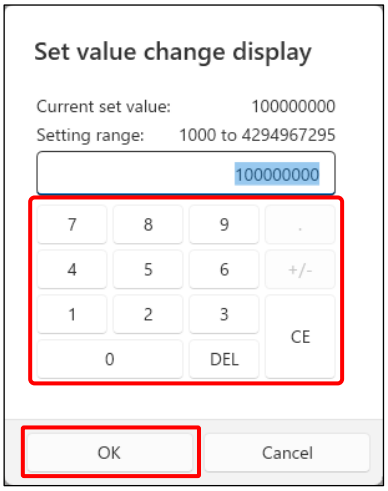
The current setting value and setting range are displayed on the numeric keypad screen.

Set within the setting range.

Input the setting value, and click [OK]. (*)

Transfer the setting value to the QPM1-PI16.

(*): The setting value can also be entered from the keyboard of the host computer.



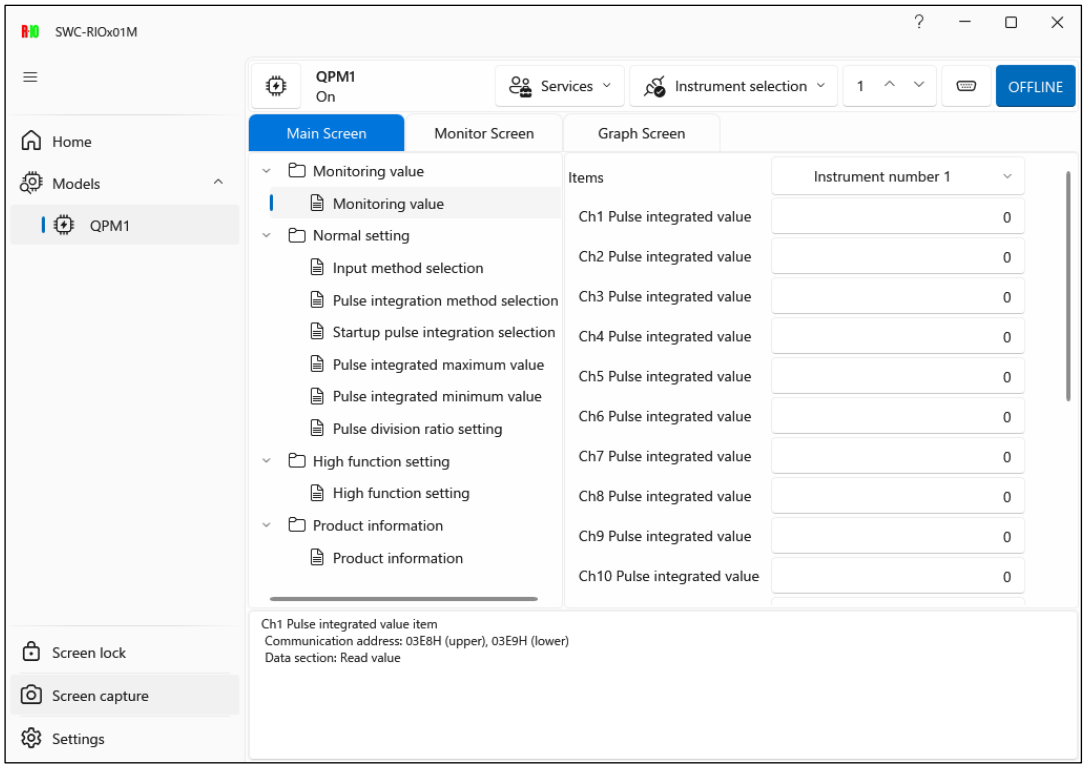
(Fig. 8.2-4)

8.2.1 Monitoring Value Setting

Set monitor value parameters such as CH1 Pulse integrated value to CH16 Pulse integrated value, input state, state 1 and state 2.

Click [Monitoring value] of [Main screen] tab → [Monitoring value].

Display the monitoring value screen.



(Fig. 8.2.1-1)

This section describes each setting item.

- Setting item

  This is the setting item of QPM1-PI16.
- Address [HEX (Hexadecimal)]

  This is the address of each channel of QPM1-PI16.
- Description, setting range and selection item

  This is the description of setting item, the setting range and the selection item.
- Factory default

  This is the factory shipment default value of the setting item.

Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Pulse integrated value (High)	03E8	Pulse integrated value	0
CH1 Pulse integrated value (Low)	03E9		
CH2 Pulse integrated value (High)	03EA		
CH2 Pulse integrated value (Low)	03EB		
CH3 Pulse integrated value (High)	03EC		
CH3 Pulse integrated value (Low)	03ED		
CH4 Pulse integrated value (High)	03EE		
CH4 Pulse integrated value (Low)	03EF		
CH5 Pulse integrated value (High)	03E0		
CH5 Pulse integrated value (Low)	03F1		
CH6 Pulse integrated value (High)	03F2		
CH6 Pulse integrated value (Low)	03F3		
CH7 Pulse integrated value (High)	03F4		
CH7 Pulse integrated value (Low)	03F5		
CH8 Pulse integrated value (High)	03F6		
CH8 Pulse integrated value (Low)	03F7		
CH9 Pulse integrated value (High)	03F8		
CH9 Pulse integrated value (Low)	03F9		
CH10 Pulse integrated value (High)	03FA		
CH10 Pulse integrated value (Low)	03FB		
CH11 Pulse integrated value (High)	03FC		
CH11 Pulse integrated value (Low)	03FD		
CH12 Pulse integrated value (High)	03FE		
CH12 Pulse integrated value (Low)	03FF		
CH13 Pulse integrated value (High)	0400		
CH13 Pulse integrated value (Low)	0401		
CH14 Pulse integrated value (High)	0402		
CH14 Pulse integrated value (Low)	0403		
CH15 Pulse integrated value (High)	0404		
CH15 Pulse integrated value (Low)	0405		

Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH16 Pulse integrated value (High)	0406		
CH16 Pulse integrated value (Low)	0407		
Input state	0408	Input state B0: CH1 to B15: CH16 bit allocation bit 0: OFF / 1: ON	0: OFF
Status flag 1	0409	B0: Input power supply fault (CH1 to CH8) 0: Normal / 1: Error B1: Input power supply fault (CH9 to CH16) 0: Normal / 1: Error B2 to B14: Not used (indefinite) B15: Non-volatile IC memory error 0: Normal / 1: Error	0: Normal
Status flag 2(*)	040A	Pulse integrated status B0: CH1 to B15: CH16 bit allocation 0: Normal / 1: Overflow	0: Normal

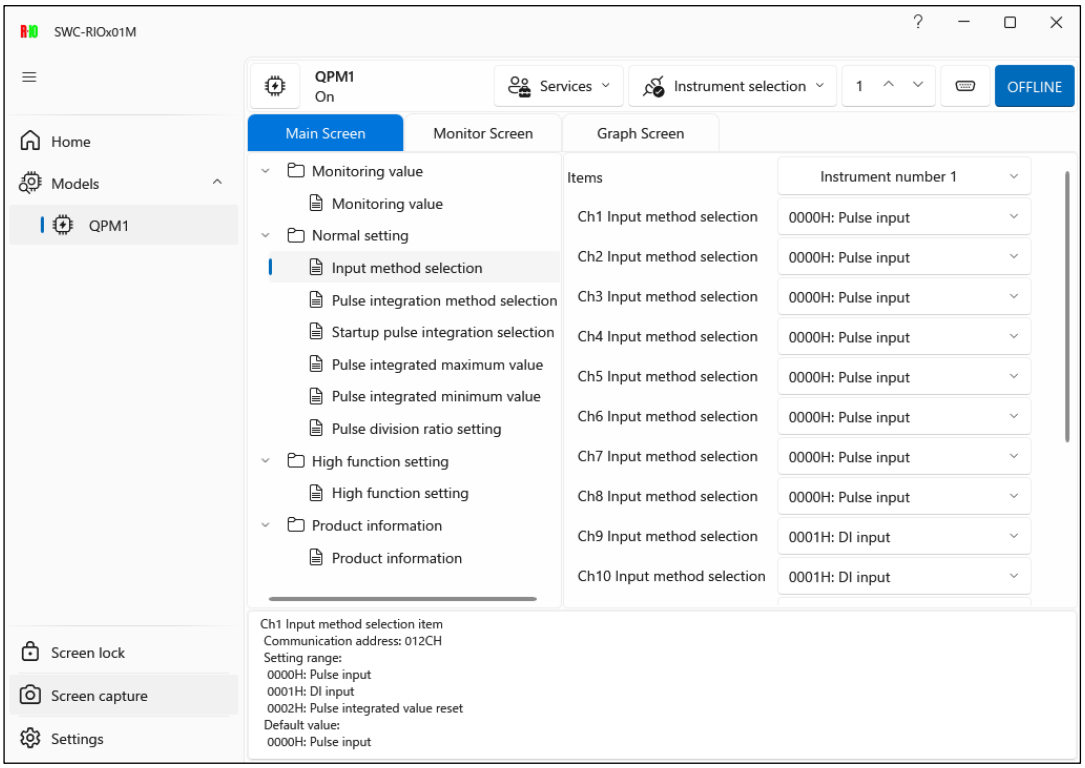
(*): The pulse integration method becomes active during linear counting.

8.2.2 Input Method Selection

Set CH1 Input method selection to CH16 Input method selection.

Click [Normal setting] of [Main screen] tab → [Input method selection].

Display the input method selection screen.



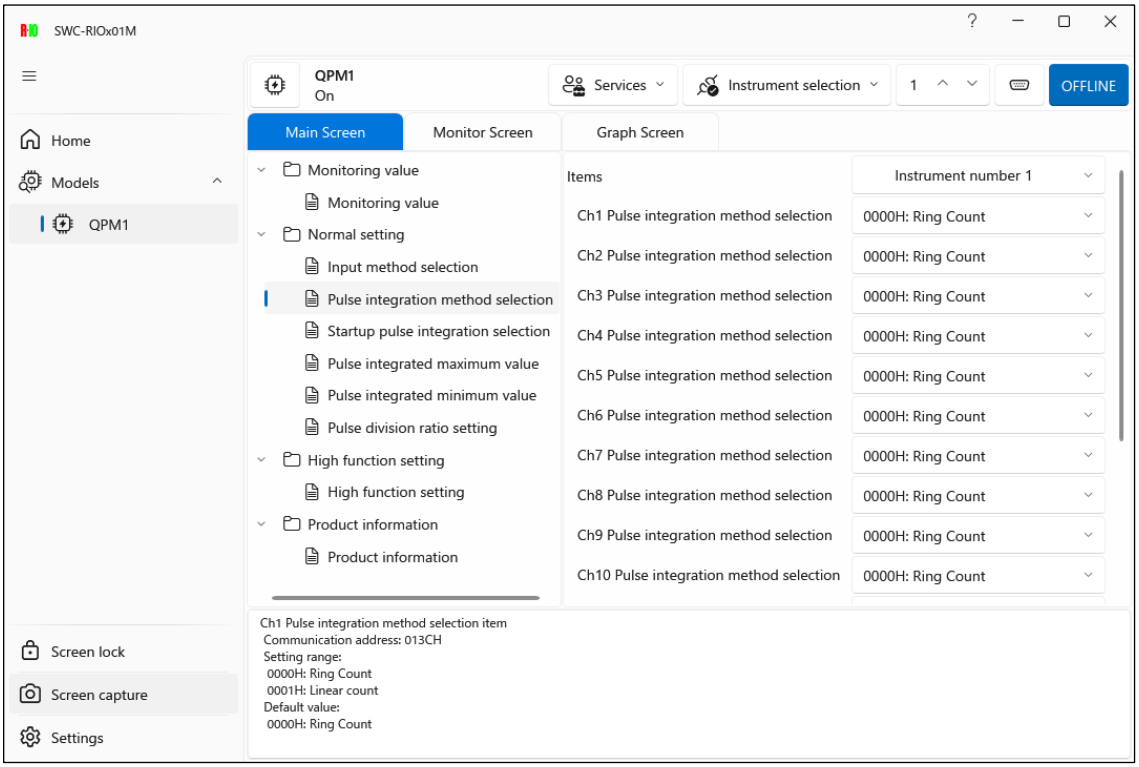
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Input method selection	012C	Select input method. 0000H: Pulse input 0001H: DI input 0002H: Pulse integrated value reset	0000H: Pulse input
CH2 Input method selection	012D		
CH3 Input method selection	012E		
CH4 Input method selection	012F		
CH5 Input method selection	0130		
CH6 Input method selection	0131		
CH7 Input method selection	0132		
CH8 Input method selection	0133		
CH9 Input method selection	0134		0001H: DI input
CH10 Input method selection	0135		
CH11 Input method selection	0136		
CH12 Input method selection	0137		
CH13 Input method selection	0138		
CH14 Input method selection	0139		
CH15 Input method selection	013A		
CH16 Input method selection	013B		

8.2.3 Pulse Integration Method Selection

Set CH1 Pulse integration method selection to CH16 Pulse integration method selection.

Click [Normal setting] of [Main screen] tab → [Pulse integration method selection].

Display the pulse integration method selection screen.



(Fig. 8.2.3-1)

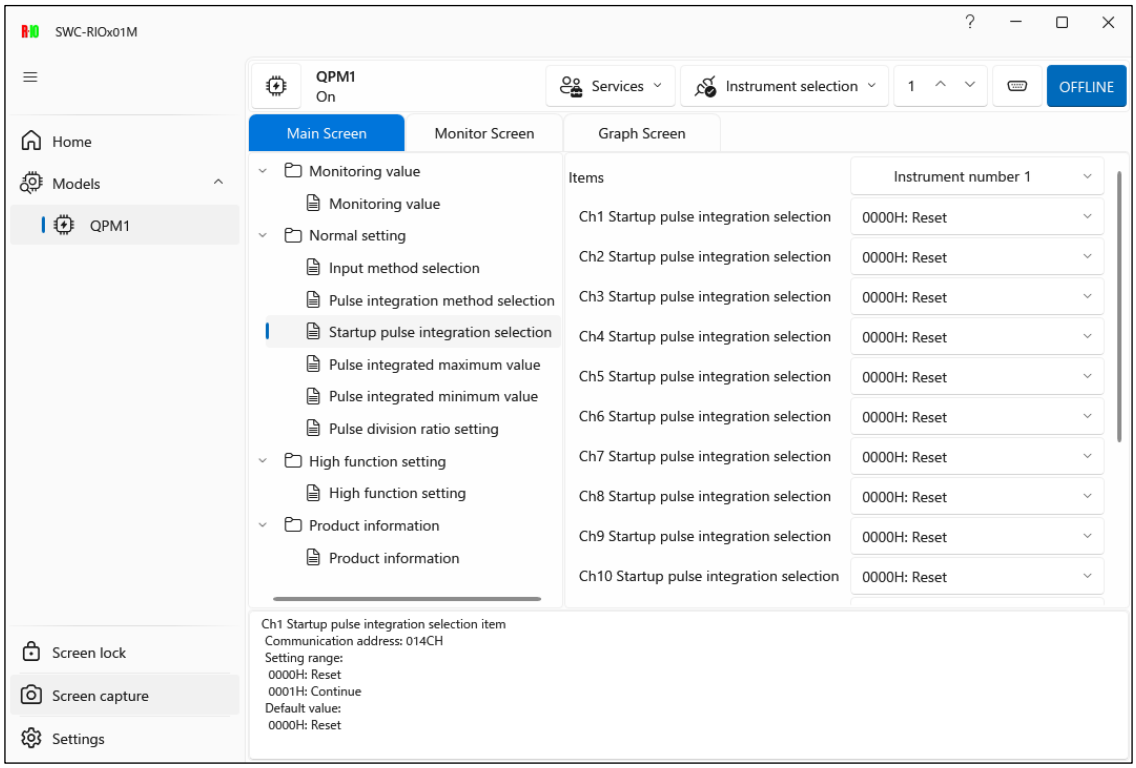
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Pulse integration method selection	013C	Select pulse integration method. 0000H: Ring Count 0001H: Linear Count	0000H: Ring Count
CH2 Pulse integration method selection	013D		
CH3 Pulse integration method selection	013E		
CH4 Pulse integration method selection	013F		
CH5 Pulse integration method selection	0140		
CH6 Pulse integration method selection	0141		
CH7 Pulse integration method selection	0142		
CH8 Pulse integration method selection	0143		
CH9 Pulse integration method selection	0144		
CH10 Pulse integration method selection	0145		
CH11 Pulse integration method selection	0146		
CH12 Pulse integration method selection	0147		
CH13 Pulse integration method selection	0148		
CH14 Pulse integration method selection	0149		
CH15 Pulse integration method selection	014A		
CH16 Pulse integration method selection	014B		

8.2.4 Startup Pulse Integration Selection

Set CH1 Startup pulse integration selection to CH16 Startup pulse integration selection.

Click [Normal setting] of [Main screen] tab → [Startup pulse integration selection].

Display the startup pulse integration selection screen.



(Fig. 8.2.4-1)

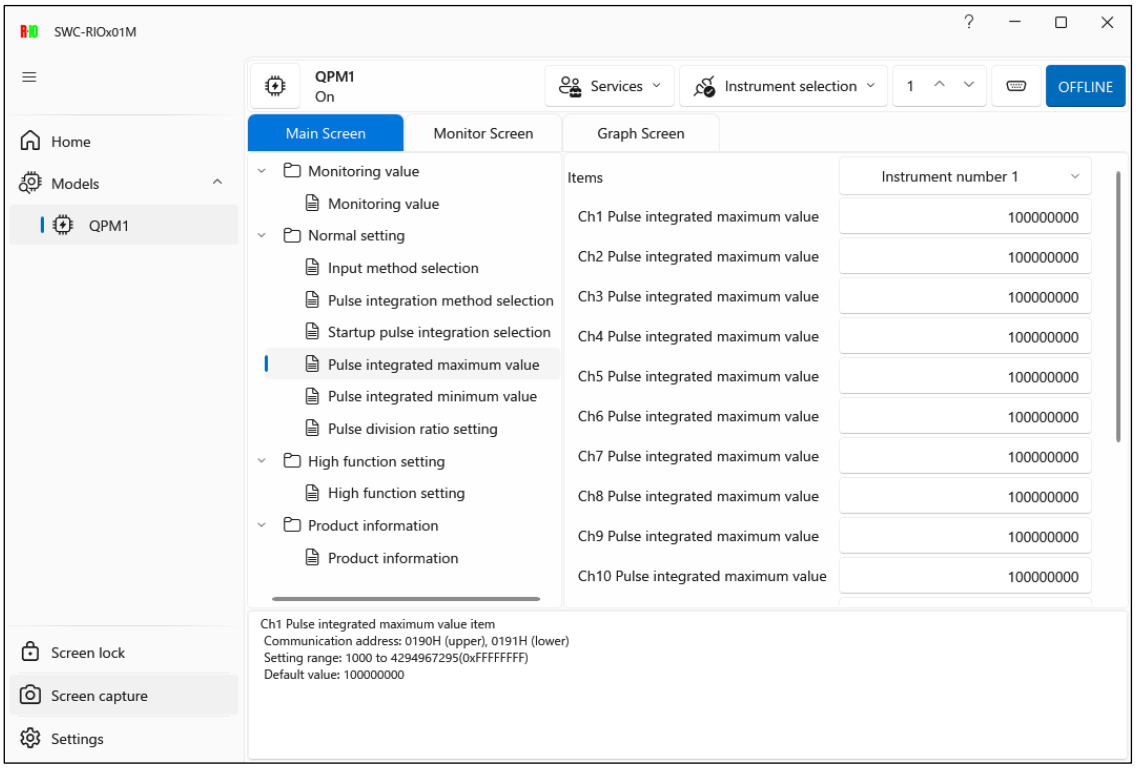
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Startup pulse integration selection	014C	Select startup pulse integration value. 0000H: Reset (0 to count) 0001H: Continue (counting from the backed-up value)	0000H: Reset
CH2 Startup pulse integration selection	014D		
CH3 Startup pulse integration selection	014E		
CH4 Startup pulse integration selection	014F		
CH5 Startup pulse integration selection	0150		
CH6 Startup pulse integration selection	0151		
CH7 Startup pulse integration selection	0152		
CH8 Startup pulse integration selection	0153		
CH9 Startup pulse integration selection	0154		
CH10 Startup pulse integration selection	0155		
CH11 Startup pulse integration selection	0156		
CH12 Startup pulse integration selection	0157		
CH13 Startup pulse integration selection	0158		
CH14 Startup pulse integration selection	0159		
CH15 Startup pulse integration selection	015A		
CH16 Startup pulse integration selection	015B		

8.2.5 Pulse Integrated Maximum Value Setting

Set CH1 Pulse integrated maximum value to CH16 Pulse integrated maximum value.

Click [Normal setting] of [Main screen] tab → [Pulse integrated maximum value].

Display the Pulse integrated maximum value screen.



(Fig. 8.2.5-1)

Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Pulse integrated maximum value (High)	0190	Set Pulse integrated maximum value. Setting range: 1000 to 4294967295(0xFFFFFFFF)	100000000
CH1 Pulse integrated maximum value (Low)	0191		
CH2 Pulse integrated maximum value (High)	0192		
CH2 Pulse integrated maximum value (Low)	0193		
CH3 Pulse integrated maximum value (High)	0194		
CH3 Pulse integrated maximum value (Low)	0195		
CH4 Pulse integrated maximum value (High)	0196		
CH4 Pulse integrated maximum value (Low)	0197		
Ch5 Pulse integrated maximum value (High)	0198		
CH5 Pulse integrated maximum value (Low)	0199		
CH6 Pulse integrated maximum value (High)	019A		
CH6 Pulse integrated maximum value (Low)	019B		
CH7 Pulse integrated maximum value (High)	019C		
CH7 Pulse integrated maximum value (Low)	019D		
CH8 Pulse integrated maximum value (High)	019E		
CH8 Pulse integrated maximum value (Low)	019F		
CH9 Pulse integrated maximum value (High)	01A0		
CH9 Pulse integrated maximum value (Low)	01A1		

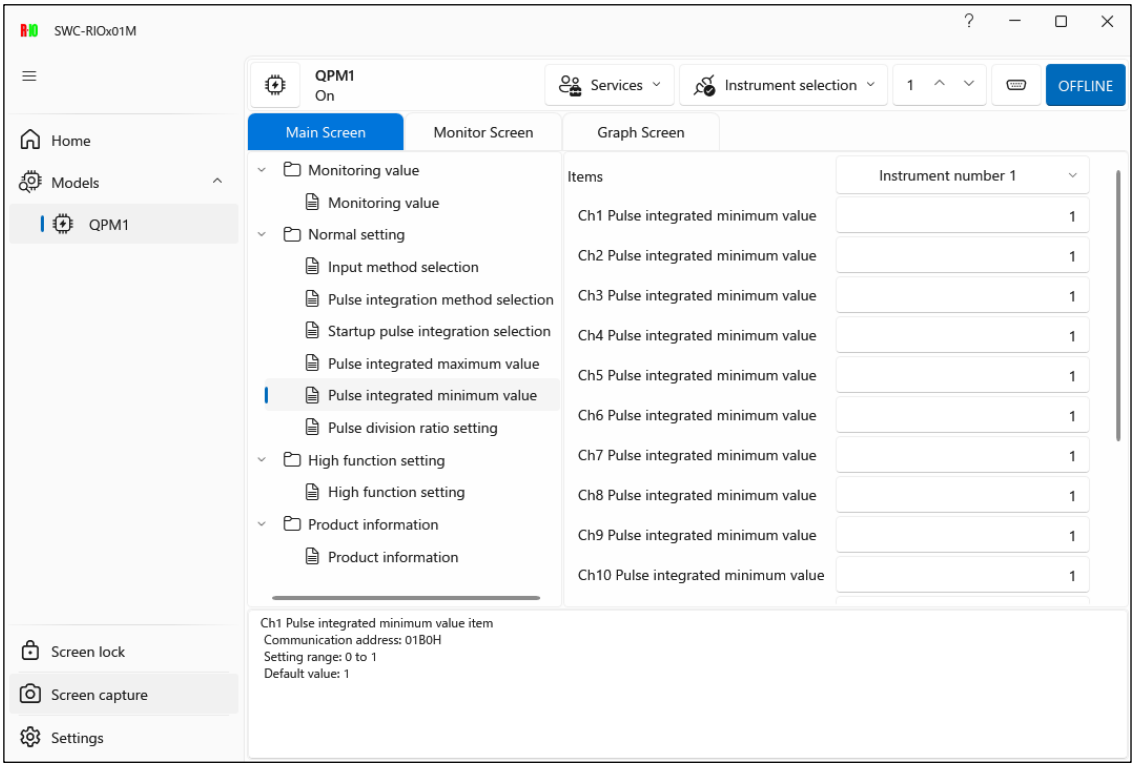
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH10 Pulse integrated maximum value (High)	01A2		
CH10 Pulse integrated maximum value (Low)	01A3		
CH11 Pulse integrated maximum value (High)	01A4		
CH11 Pulse integrated maximum value (Low)	01A5		
CH12 Pulse integrated maximum value (High)	01A6		
CH12 Pulse integrated maximum value (Low)	01A7		
CH13 Pulse integrated maximum value (High)	01A8		
CH13 Pulse integrated maximum value (Low)	01A9		
CH14 Pulse integrated maximum value (High)	01AA		
CH14 Pulse integrated maximum value (Low)	01AB		
CH15 Pulse integrated maximum value (High)	01AC		
CH15 Pulse integrated maximum value (Low)	01AD		
CH16 Pulse integrated maximum value (High)	01AE		
CH16 Pulse integrated maximum value (Low)	01AF		

8.2.6 Pulse Integrated Minimum Value Setting

Set CH1 Pulse integrated minimum value to CH16 Pulse integrated minimum value.

Click [Normal setting] of [Main screen] tab → [Pulse integrated minimum value].

Display the Pulse integrated minimum value screen.



(Fig. 8.2.6-1)

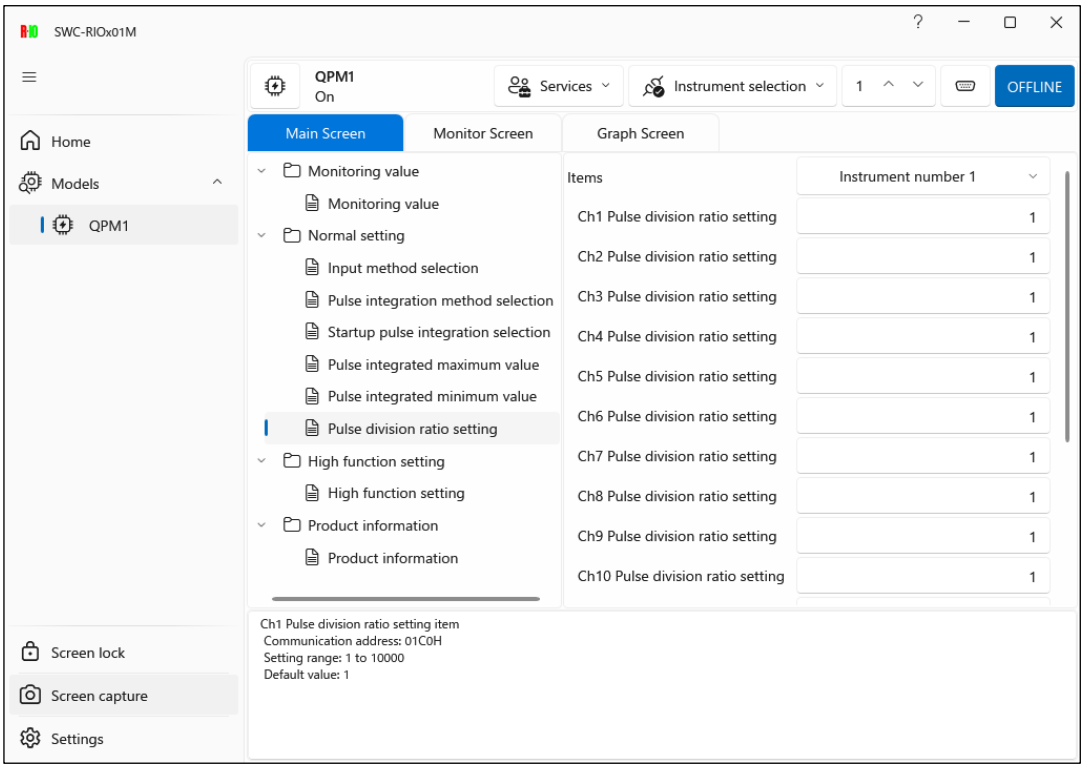
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Pulse integrated minimum value	01B0	Set Pulse integrated minimum value. Setting range: 0 to 1	1
CH2 Pulse integrated minimum value	01B1		
CH3 Pulse integrated minimum value	01B2		
CH4 Pulse integrated minimum value	01B3		
CH5 Pulse integrated minimum value	01B4		
CH6 Pulse integrated minimum value	01B5		
CH7 Pulse integrated minimum value	01B6		
CH8 Pulse integrated minimum value	01B7		
CH9 Pulse integrated minimum value	01B8		
CH10 Pulse integrated minimum value	01B9		
CH11 Pulse integrated minimum value	01BA		
CH12 Pulse integrated minimum value	01BB		
CH13 Pulse integrated minimum value	01BC		
CH14 Pulse integrated minimum value	01BD		
CH15 Pulse integrated minimum value	01BE		
CH16 Pulse integrated minimum value	01BF		

8.2.7 Pulse Division Ratio Setting

Set CH1 Pulse division ratio setting to CH16 Pulse division ratio setting.

Click [Normal setting] of [Main screen] tab → [Pulse division ratio setting].

Display the Pulse division ratio setting screen.



(Fig. 8.2.7-1)

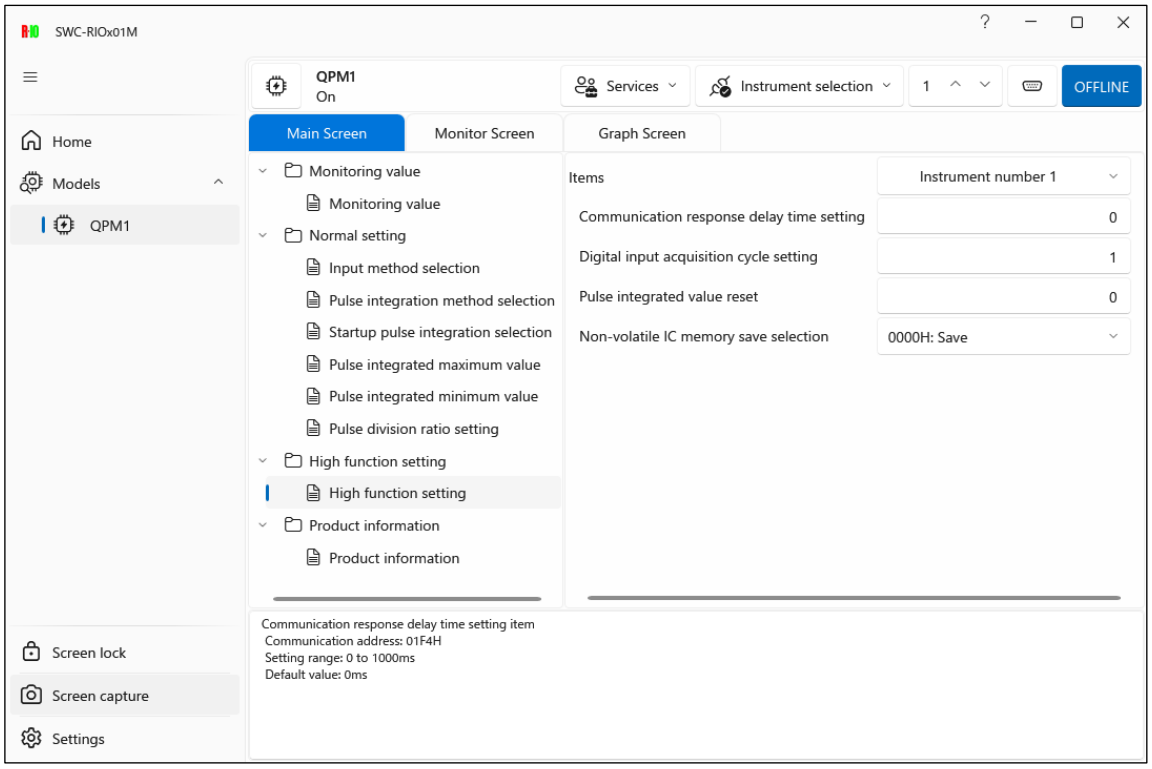
Setting item	Address [HEX]	Description, setting range and selection item	Factory default
CH1 Pulse division ratio setting	01C0	Set Pulse division ratio. Setting range: 1 to 10000	1
CH2 Pulse division ratio setting	01C1		
CH3 Pulse division ratio setting	01C2		
CH4 Pulse division ratio setting	01C3		
CH5 Pulse division ratio setting	01C4		
CH6 Pulse division ratio setting	01C5		
CH7 Pulse division ratio setting	01C6		
CH8 Pulse division ratio setting	01C7		
CH9 Pulse division ratio setting	01C8		
CH10 Pulse division ratio setting	01C9		
CH11 Pulse division ratio setting	01CA		
CH12 Pulse division ratio setting	01CB		
CH13 Pulse division ratio setting	01CC		
CH14 Pulse division ratio setting	01CD		
CH15 Pulse division ratio setting	01CE		
CH16 Pulse division ratio setting	01CF		

8.2.8 High Function Setting

Set High function setting.

Click [High function setting] of [Main screen] tab → [High function setting].

Display the High function setting screen.



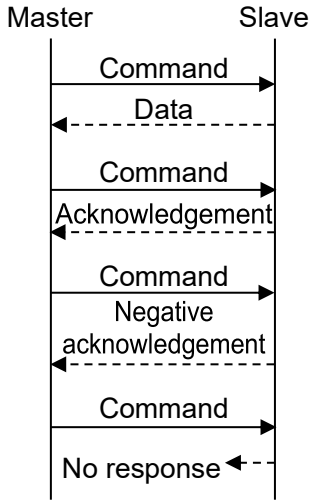
(Fig. 8.2.8-1)

Setting item	Address [HEX]	Description, setting range and selection item	Factory default
Communication response delay time setting	01F4	Set Communication response delay time. Setting range: 0 to 1000 ms	0 ms
Digital input acquisition cycle setting	01F5	Set Digital input acquisition cycle. Setting range: 1 to 100 ms (For pulse input, fixed at 0.2 ms)	1 ms
Pulse integrated value reset (*)	01F6	Set Pulse integrated value reset. Setting range: 0 to 65535 (B0: CH1 to B15: CH16 bit allocation) 0: No action 1: Reset	0: No action
Non-volatile IC memory save selection	020B	Select Non-volatile IC memory save. 0000H: Save 0001H: Do not save	0000H: Save

(*): If the same value is set, it becomes invalid.
If changed from 0 to 1, it resets.
When set to 1, it becomes valid only after being set to 0 and then back to 1.
It resets to 0 when power is turned on.

9 Communication Procedure

Communication starts with command transmission from the host computer (hereafter Master), and ends with the response of this instrument (hereafter Slave).



(Fig. 9-1)

- Response with data
  When the master sends the Read command, the slave responds with the corresponding set value or current status.
- Acknowledgement
  When the master sends the Write command, the slave responds by sending the acknowledgement after the processing is terminated.
- Negative acknowledgement
  When the master sends a non-existent command or value out of the setting range, the slave returns a negative acknowledgement.
- No response
  The slave will not respond to the master in the following cases:
  - Broadcast address is set.
  - Communication error (framing error, parity error)
  - CRC-16 discrepancy

Communication timing of the RS-485

Master Side (Take note while programming)

When the master starts transmission through the RS-485 communication line, the master is arranged so as to provide an idle status (mark status) transmission period of 1 or more characters before sending the command to ensure synchronization on the receiving side.

Set the program so that the master can disconnect the transmitter from the communication line within a 1 character transmission period after sending the command in preparation for reception of the response from the slave.

To avoid collision of transmissions between the master and the slave, send the next command after carefully checking that the master has received the response.

If a response to the command is not returned due to communication errors, set the Retry Processing to send the command again. (It is recommended to execute Retry twice or more.)

Slave Side

When the slave starts transmission through the RS-485 communication line, the slave is arranged so as to provide an idle status (mark status) transmission period of 1 ms or more (*) before sending the response to ensure synchronization on the receiving side.

The slave is arranged so as to disconnect the transmitter from the communication line within a 1 character transmission period after sending the response.

(*): Can be set in “Communication response delay time setting (P.8-31)” within a range of 0 to 1000 ms.

10 MODBUS Protocol

10.1 Transmission Mode

It becomes the RTU mode, and 8-bit binary data in command is transmitted as it is.

Data format	Start bit:	1 bit
	Data bit:	8 bits
	Parity:	Even (Odd, No parity) (Selectable)
	Stop bit:	1 bit (2 bits) (Selectable)
Error detection:		CRC-16 (Cyclic Redundancy Check)

10.2 Data Communication Interval

1.5 character transmission times or less

(Communication speed 9600 bps, 19200 bps: 1.5 character transmission times,

Communication speed 38400 bps, 57600 bps: 750 μs)

To transmit continuously, an interval between characters which consist of one message, must be within 1.5 character transmission times.

If the time is longer than the above, it is assumed that transmission from the master side has finished, and a communication error occurs and no response is returned.

10.3 Message Configuration

Message is configured to start after idle time is processed for more than 3.5 character transmissions, and end after idle time is processed for more than 3.5 character transmissions.

(Communication speed 9600 bps, 19200 bps: 3.5 character transmission times,

Communication speed 38400 bps, 57600 bps: 1.75 ms)

The data part has a maximum of 252 bytes.

3.5 idle characters	Slave address	Function code	Data	Error check CRC-16	3.5 idle characters

(1) Slave Address

Slave address is an individual instrument number on the slave side, and is set within the range 1 to 16 (01H to 10H). The master identifies slaves by the slave address of the requested message.

The slave informs the master which slave is responding to the master by placing its own address in the response message.

Slave address 0 (00H, Broadcast address) can identify all the slaves connected. However, slaves do not respond.

(2) Function Code

The function code is the command code for the slave to undertake one of the following actions.

Function Code	Contents
03(03H)	Reads a single or multiple piece(s) of data from slave(s) (Amount of data: Max. 100).
06(06H)	Writes a single piece of data to slave(s).
16(10H)	Writes multiple pieces of data to slave(s) (Amount of data: Max. 20).

The function code is used to discern whether the response is normal (acknowledgement) or if any error (negative acknowledgement) has occurred when the slave returns the response message to the master.

When acknowledgement is returned, the slave simply returns the original function code.

When negative acknowledgement is returned, the MSB of the original function code is set as 1 for the response.

For example, if the master sends request message setting 13H to the function code by mistake, slave returns 93H by setting the MSB to 1, because the former is an illegal function.

For negative acknowledgement, the exception codes below are set to the data of the response message, and returned to the master in order to inform it of what kind of error has occurred.

Exception Code	Contents
1(01H)	Illegal function (Non-existent function)
2(02H)	Illegal data address (Non-existent data address)
3(03H)	Illegal data value (Value out of the setting range)
17(11H)	Status unable to be written.

(3) Data

Data differs depending on the function code.

A request message from the master is composed of a data item, amount of data and setting data.

A response message from the slave is composed of the byte count , data and exception codes in negative acknowledgements, corresponding to the request message.

The effective range of data is -32768 to 32767 (8000H to 7FFFH).

Refer to “11.1 Communication Command List (P.11-1)”.

(4) Error Check

After calculating CRC-16 (Cyclic Redundancy Check) from the slave address to the end of the data, the calculated 16-bit data is appended to the end of message in sequence from low order to high order.

[How to calculate CRC-16]

In the CRC-16 system, the information is divided by the polynomial series. The remainder is added to the end of the information and transmitted. The generation of a polynomial series is as follows.

(Generation of polynomial series: $X^{16} + X^{15} + X^2 + 1$)

① Initialize the CRC-16 data (assumed as X) (FFFFH).

② Calculate exclusive OR (XOR) with the 1st data and X. This is assumed as X.

③ Shift X one bit to the right. This is assumed as X.

④ When a carry is generated as a result of the shift, XOR is calculated by X of ③ and the fixed value (A001H). This is assumed as X. If a carry is not generated, go to step ⑤.

⑤ Repeat steps ③ and ④ until shifting 8 times.

⑥ XOR is calculated with the next data and X. This is assumed as X.

⑦ Repeat steps ③ to ⑤.

⑧ Repeat steps ③ to ⑤ up to the final data.

⑨ Set X as CRC-16 to the end of message in sequence from low order to high order.

10.4 Message Example

Numerals written below the command represent the number of characters.

(1) Read [Slave address 1, CH1 Input method selection (012CH)]

• A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Data item (012CH)	Amount of data (0001H)	Error check CRC-16 (443FH)	Idle 3.5 characters
	1	1	2	2	2	

• Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Response byte count (02H)	Data (xxxxH)	Error check CRC-16 (xxxxH)	Idle 3.5 characters
	1	1	1	2	2	

(2) Read 32 data from [Slave address 1, CH1 Pulse integrated value (03E8H)]

• A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Data item (03E8H)	Amount of data (0020H)	Error check CRC-16 (C462H)	Idle 3.5 characters
	1	1	2	2	2	

• Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Response byte count (40H)	Data (xxxxH)	Error check CRC-16 (xxxxH)	Idle 3.5 characters
	1	1	1	2 × 32	2	

• Response message from the slave in exception (error) status (When data item is incorrect)

The function code MSB is set to 1 for the response message in exception (error) status, and 83H is returned.

The exception code 02H (Non-existent data address) is returned (error).

Idle 3.5 characters	Slave address (01H)	Function code (83H)	Exception code (02H)	Error check CRC-16 (C0F1H)	Idle 3.5 characters
	1	1	1	2	

(3) Write [Slave address 1, CH1 Input method selection (012CH)]

• A request message from the master [When Output volume 1000 (03E8H)]

Idle 3.5 characters	Slave address (01H)	Function code (06H)	Data item (012CH)	Data (0000H)	Error check CRC-16 (49FFH)	Idle 3.5 characters
	1	1	2	2	2	

• Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (06H)	Data item (012CH)	Data (0000H)	Error check CRC-16 (49FFH)	Idle 3.5 characters
	1	1	1	2	2	

• Response message from the slave in exception (error) status (When a value out of the setting range is set)

The function code MSB is set to 1 for the response message in exception (error) status, and 86H is returned.

The exception code 02H (03H Value out of the setting range) is returned (error).

Idle 3.5 characters	Slave address (01H)	Function code (86H)	Exception code (03H)	Error check CRC-16 (0261H)	Idle 3.5 characters
	1	1	1	2	

(4) Write multiple data using 20 commands from [Slave address 1, CH1 Input method selection (012CH)]

• A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (10H)	Data item (012CH)	Amount of data (0014H)	Number of bytes (28H)	Data (xxxxH)	Error check CRC-16 (xxxxH)	Idle 3.5 characters
	1	1	2	2	1	2×20	2	

• Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (10H)	Data item (012CH)	Amount of data (0014H)	Error check CRC-16 (0033H)	Idle 3.5 characters
	1	1	2	2	2	

• Response message from the slave in abnormal states (when a value outside the configuration range is set)

Idle 3.5 characters	Slave address (01H)	Function code (90H)	Exception code (03H)	Error check CRC-16 (0C01H)	Idle 3.5 characters
	1	1	1	2	

11 Communication Command List

11.1 Communication Command List

This section explains each item of communication command.

- Data Item
  This is a setting item for the QPM1-PI16.
- Address [HEX (Hexadecimal), DEC (Decimal)]
  This is an each channel address of the QPM1-PI16.
- Attribute
  R/W: Read and write (Host ◄► QPM1-PI16)
  RO: Read only (Host ◄— QPM1-PI16)
- Data
  This is an explanation of the setting range and setting conditions for each data.

Data Item	Address		Attribute	Data
	HEX	DEC		
System	0000 0001 0002 0003	0 1 2 3		This is a system item for internal processing. Please do not use.
Reservation (*1)	0004 to 012B			
CH1 Input method selection	012C	300	R/W	0000H: Pulse input 0001H: DI input 0002H: Pulse integrated value reset
CH2 Input method selection	012D	301		
CH3 Input method selection	012E	302		
CH4 Input method selection	012F	303		
CH5 Input method selection	0130	304		
CH6 Input method selection	0131	305		
CH7 Input method selection	0132	306		
CH8 Input method selection	0133	307		
CH9 Input method selection	0134	308		
CH10 Input method selection	0135	309		
CH11 Input method selection	0136	310		
CH12 Input method selection	0137	311		
CH13 Input method selection	0138	312		
CH14 Input method selection	0139	313		
CH15 Input method selection	013A	314		
CH16 Input method selection	013B	315		
CH1 Pulse integration method selection	013C	316	R/W	0000H: Ring Count 0001H: Linear Count
CH2 Pulse integration method selection	013D	317		
CH3 Pulse integration method selection	013E	318		
CH4 Pulse integration method selection	013F	319		
CH5 Pulse integration method selection	0140	320		
CH6 Pulse integration method selection	0141	321		
CH7 Pulse integration method selection	0142	322		
CH8 Pulse integration method selection	0143	323		
CH9 Pulse integration method selection	0144	324		

Data Item	Address		Attribute	Data
	HEX	DEC		
CH10 Pulse integration method selection	0145	325		
CH11 Pulse integration method selection	0146	326		
CH12 Pulse integration method selection	0147	327		
CH13 Pulse integration method selection	0148	328		
CH14 Pulse integration method selection	0149	329		
CH15 Pulse integration method selection	014A	330		
CH16 Pulse integration method selection	014B	331		
CH1 Startup pulse integration selection	014C	332	R/W	0000H: Reset (0 to count) 0001H: Continue (counting from the backed-up value)
CH2 Startup pulse integration selection	014D	333		
CH3 Startup pulse integration selection	014E	334		
CH4 Startup pulse integration selection	014F	335		
CH5 Startup pulse integration selection	0150	336		
CH6 Startup pulse integration selection	0151	337		
CH7 Startup pulse integration selection	0152	338		
CH8 Startup pulse integration selection	0153	339		
CH9 Startup pulse integration selection	0154	340		
CH10 Startup pulse integration selection	0155	341		
CH11 Startup pulse integration selection	0156	342		
CH12 Startup pulse integration selection	0157	343		
CH13 Startup pulse integration selection	0158	344		
CH14 Startup pulse integration selection	0159	345		
CH15 Startup pulse integration selection	015A	346		
CH16 Startup pulse integration selection	015B	347		
Reservation (*1)	015C to 018F			
CH1 Pulse integrated maximum value (High)	0190	400	R/W	Pulse integrated maximum value (High) Pulse integrated maximum value (Low)
CH1 Pulse integrated maximum value (Low)	0191	401		
CH2 Pulse integrated maximum value (High)	0192	402		
CH2 Pulse integrated maximum value (Low)	0193	403		
CH3 Pulse integrated maximum value (High)	0194	404		
CH3 Pulse integrated maximum value (Low)	0195	405		
CH4 Pulse integrated maximum value (High)	0196	406		
CH4 Pulse integrated maximum value (Low)	0197	407		
Ch5 Pulse integrated maximum value (High)	0198	408		
CH5 Pulse integrated maximum value (Low)	0199	409		
CH6 Pulse integrated maximum value (High)	019A	410		
CH6 Pulse integrated maximum value (Low)	019B	411		
CH7 Pulse integrated maximum value (High)	019C	412		
CH7 Pulse integrated maximum value (Low)	019D	413		
CH8 Pulse integrated maximum value (High)	019E	414		
CH8 Pulse integrated maximum value (Low)	019F	415		
CH9 Pulse integrated maximum value (High)	01A0	416		
CH9 Pulse integrated maximum value (Low)	01A1	417		
CH10 Pulse integrated maximum value (High)	01A2	418		
CH10 Pulse integrated maximum value (Low)	01A3	419		
CH11 Pulse integrated maximum value (High)	01A4	420		

Data Item	Address		Attribute	Data
	HEX	DEC		
CH11 Pulse integrated maximum value (Low)	01A5	421		
CH12 Pulse integrated maximum value (High)	01A6	422		
CH12 Pulse integrated maximum value (Low)	01A7	423		
CH13 Pulse integrated maximum value (High)	01A8	424		
CH13 Pulse integrated maximum value (Low)	01A9	425		
CH14 Pulse integrated maximum value (High)	01AA	426		
CH14 Pulse integrated maximum value (Low)	01AB	427		
CH15 Pulse integrated maximum value (High)	01AC	428		
CH15 Pulse integrated maximum value (Low)	01AD	429		
CH16 Pulse integrated maximum value (High)	01AE	430		
CH16 Pulse integrated maximum value (Low)	01AF	431		
CH1 Pulse integrated minimum value	01B0	432	R/W	Pulse integrated minimum value
CH2 Pulse integrated minimum value	01B1	433		
CH3 Pulse integrated minimum value	01B2	434		
CH4 Pulse integrated minimum value	01B3	435		
CH5 Pulse integrated minimum value	01B4	436		
CH6 Pulse integrated minimum value	01B5	437		
CH7 Pulse integrated minimum value	01B6	438		
CH8 Pulse integrated minimum value	01B7	439		
CH9 Pulse integrated minimum value	01B8	440		
CH10 Pulse integrated minimum value	01B9	441		
CH11 Pulse integrated minimum value	01BA	442		
CH12 Pulse integrated minimum value	01BB	443		
CH13 Pulse integrated minimum value	01BC	444		
CH14 Pulse integrated minimum value	01BD	445		
CH15 Pulse integrated minimum value	01BE	446		
CH16 Pulse integrated minimum value	01BF	447		
CH1 Pulse division ratio setting	01C0	448	R/W	Pulse division ratio setting
CH2 Pulse division ratio setting	01C1	449		
CH3 Pulse division ratio setting	01C2	450		
CH4 Pulse division ratio setting	01C3	451		
CH5 Pulse division ratio setting	01C4	452		
CH6 Pulse division ratio setting	01C5	453		
CH7 Pulse division ratio setting	01C6	454		
CH8 Pulse division ratio setting	01C7	455		
CH9 Pulse division ratio setting	01C8	456		
CH10 Pulse division ratio setting	01C9	457		
CH11 Pulse division ratio setting	01CA	458		
CH12 Pulse division ratio setting	01CB	459		
CH13 Pulse division ratio setting	01CC	460		
CH14 Pulse division ratio setting	01CD	461		
CH15 Pulse division ratio setting	01CE	462		
CH16 Pulse division ratio setting	01CF	463		
Reservation (*1)	01D0 to 01F3			
Communication response delay time setting	01F4	500	R/W	0 to 1000 ms

Data Item	Address		Attribute	Data
	HEX	DEC		
Digital input acquisition cycle setting	01F5	501	R/W	1 to 100 ms (For pulse input, fixed at 0.2 ms)
Pulse integrated value reset (*2)	01F6	502	R/W	B0: CH1 to B15: CH16 bit allocation 0: No action 1: Reset
Reservation (*1)	01F7 to 020A			
Non-volatile IC memory save selection	020B	523	R/W	0000H: Save 0001H: Do not save
Reservation (*1)	020C to 03E7			
CH1 Pulse integrated value (High)	03E8	1000	RO	Pulse integrated value (High) Pulse integrated value (Low)
CH1 Pulse integrated value (Low)	03E9	1001		
CH2 Pulse integrated value (High)	03EA	1002		
CH2 Pulse integrated value (Low)	03EB	1003		
CH3 Pulse integrated value (High)	03EC	1004		
CH3 Pulse integrated value (Low)	03ED	1005		
CH4 Pulse integrated value (High)	03EE	1006		
CH4 Pulse integrated value (Low)	03EF	1007		
CH5 Pulse integrated value (High)	03E0	1008		
CH5 Pulse integrated value (Low)	03F1	1009		
CH6 Pulse integrated value (High)	03F2	1010		
CH6 Pulse integrated value (Low)	03F3	1011		
CH7 Pulse integrated value (High)	03F4	1012		
CH7 Pulse integrated value (Low)	03F5	1013		
CH8 Pulse integrated value (High)	03F6	1014		
CH8 Pulse integrated value (Low)	03F7	1015		
CH9 Pulse integrated value (High)	03F8	1016		
CH9 Pulse integrated value (Low)	03F9	1017		
CH10 Pulse integrated value (High)	03FA	1018		
CH10 Pulse integrated value (Low)	03FB	1019		
CH11 Pulse integrated value (High)	03FC	1020		
CH11 Pulse integrated value (Low)	03FD	1021		
CH12 Pulse integrated value (High)	03FE	1022		
CH12 Pulse integrated value (Low)	03FF	1023		
CH13 Pulse integrated value (High)	0400	1024		
CH13 Pulse integrated value (Low)	0401	1025		
CH14 Pulse integrated value (High)	0402	1026		
CH14 Pulse integrated value (Low)	0403	1027		
CH15 Pulse integrated value (High)	0404	1028		
CH15 Pulse integrated value (Low)	0405	1029		
CH16 Pulse integrated value (High)	0406	1030		
CH16 Pulse integrated value (Low)	0407	1031		
Input state	0408	1032	RO	B0: CH1 to B15: CH16 bit allocation bit 0: OFF/1: ON

Data Item	Address		Attribute	Data
	HEX	DEC		
Status flag 1	0409	1033	RO	B0: Input power supply fault (CH1 to CH8) 0: Normal / 1: Error B1: Input power supply fault (CH9 to CH16) 0: Normal / 1: Error B2 to B14: Not used (indefinite) B15: Non-volatile IC memory error 0: Normal / 1: Error
Status flag 2 (*3)	040A	1034	RO	B0: CH1 to B15: CH16 bit allocation 0: Normal / 1: Overflow
Status flag 3	040B	1035	RO	Not used (indefinite)
Reservation (*1)	040C to 04A3			
Total energizing time (High)	04A4	1188	RO	Total energizing time count value This is the sum of the High and Low values, with 1 count representing 1 hour.
Total energizing time (Low)	04A5	1189	RO	
Reservation (*1)	04A6 to 04B7			
Product code	04B8	1208	RO	Product code
Presence of communication option	04B9	1209	RO	0000H: No option 0001H: RS-485 communication 0002H: CUnet communication
Wiring type	04BA	1210	RO	0000H: Terminal type 0001H: Connector type
Reservation (*1)	04BB 04BC			
Software version	04BD	1213	RO	Software version
Manufacturing date	04BE	1214	RO	Manufacturing date
Hardware version	04BF	1215	RO	Hardware version
Reservation (*1)	04C0 to 05FF			
CH1 Input	0600	1536	RO	0000H : OFF 0001H : ON
CH2 Input	0601	1537	RO	0000H : OFF 0001H : ON
CH3 Input	0602	1538	RO	0000H : OFF 0001H : ON
CH4 Input	0603	1539	RO	0000H : OFF 0001H : ON
CH5 Input	0604	1540	RO	0000H : OFF 0001H : ON
CH6 Input	0605	1541	RO	0000H : OFF 0001H : ON
CH7 Input	0606	1542	RO	0000H : OFF 0001H : ON
CH8 Input	0607	1543	RO	0000H : OFF 0001H : ON
CH9 Input	0608	1544	RO	0000H : OFF 0001H : ON
CH10 Input	0609	1545	RO	0000H : OFF 0001H : ON

Data Item	Address		Attribute	Data
	HEX	DEC		
CH11 Input	060A	1546	RO	0000H : OFF 0001H : ON
CH12 Input	060B	1547	RO	0000H : OFF 0001H : ON
CH13 Input	060C	1548	RO	0000H : OFF 0001H : ON
CH14 Input	060D	1549	RO	0000H : OFF 0001H : ON
CH15 Input	060E	1550	RO	0000H : OFF 0001H : ON
CH16 Input	060F	1551	RO	0000H : OFF 0001H : ON

(*1): A single or multiple data are read, the reserved item returns the initial value (0) in acknowledgment.

When writing single or multiple, Acknowledgement is returned and the data is discarded.

(*2): If the same value is set, it becomes invalid.

If changed from 0 to 1, it resets.

When set to 1, it becomes valid only after being set to 0 and then back to 1.

It resets to 0 when power is turned on.

(*3): The pulse integration method becomes active during linear counting.

11.2 Data

11.2.1 Notes About Write/Read Command

- The data (set value, decimal) is converted to a hexadecimal number.
  Negative numbers are represented in 2's complement.
- Do not use undefined Data items. If they are used, negative acknowledgement will be returned or a random value will be written or read, resulting in malfunction.
- MODBUS protocol uses Holding Register addresses. The Holding Register addresses are created as follows.
  A data item is converted to decimal number, and the offset of 40001 is added. The result is the Holding Register address.
  Using CH1 Input method selection (012CH) as an example: Data item in the sending message is 012CH, however, MODBUS protocol Holding Register address is 40301 (300+40001).

11.2.2 Write Command

- The lifetime of the non-volatile IC memory is about 1 trillion times.
  Do not change the set value frequently by communication, as the set value storage retention time may be shortened if the number of times is exceeded. (If the set value is the same as the value before setting, it is not written to the non-volatile IC memory.)
- When data (set value) has a decimal point, a whole number (hexadecimal) without a decimal point is used.
- Communication parameters such as module address and communication speed of this instrument cannot be written by software communication. Set it with the rotary switch for module address selection and the dip switch for selecting communication specifications.
- When Write is executed using the Broadcast address [(00H) MODBUS protocol] command, the command is sent to all the connected slaves. However, a response is not returned.

11.2.3 Read Command

- When the data (set value) has a decimal point, a whole number (hexadecimal) without a decimal point is used for a response.

11.3 Negative Acknowledgement

11.3.1 Error Code 2 (02H)

The slave will return Error code 2 (02H) in the following case.

- When non-existent data item is read or written.

11.3.2 Error Code 3 (03H)

The slave will return Error code 3 (03H) in the following case.

- When a value out of the setting range is written.

11.3.3 Error Code 17 (11H)

The slave will return Error code 17 (11H) in the following case.

- In the case of a condition that cannot be written.

11.4 Notes on Programming Monitoring Software

11.4.1 How to Speed up the Scan Time

When monitoring multiple this instrument, set the program so that the requisite minimum pieces of data such as Input state (0408H), Status flag 1 (0409H), Status flag 2 (040AH) can be read.

For other data, set the program so that they can be read only when their set value has changed.

This will speed up the scan time.

12 Operation

This section describes the operation when operating by communicating with the host computer.
Refer to “11.1 Communication Command List (P.11-1)” for setting the control parameters such as Input method selection, Pulse integration method selection, Startup pulse integration selection required for operation.

12.1 Start measurement

(1) Before turning the power ON

Check the following contents before turning the power ON to this instrument.

- Preparation of communication program
  A communication program is required to connect and use the host computer.
  Refer to “10 MODBUS Protocol (P.10-1)” to create the communication program.
- Select communication specifications
  Select the communication specifications such as communication speed, data bit, and parity.
  Refer to “5.1 Communication Parameter Setting (P.5-1)”.
- Setting module address
  Set the module address.
  Refer to “5.2 Setting of Module Address (P.5-4)”.
- Mounting
  Mount the QPM1-PI16 to the DIN rail.
  Refer to “6 Mounting (P.6-1)”.
- Wiring
  Wire the QPM1-PI16.
  Refer to “7 Wiring (P.7-1)”.
- Connection of host computer and QPM1-PI16
  Connect the host computer and QPM1-PI16.
  Refer to “7.5 Connection of Host Computer and QPM1-PI16 (P.7-8)”.

(2) After turning the power ON

Check the following contents after turning the power ON to this instrument.

- Specification setting
  Set specifications such as expansion parameters and optional function parameters.
  Refer to “8 Setting of Specification (P.8-1)”.

(3) Turn OFF → ON the QPM1-PI16 power

Turn OFF → ON the power of QPM1-PI16. The set value becomes effective.

(4) Operation

Start measurement.

Refer to “11.1 Communication Commands List (P.11-1)” to perform communication.

Read [Slave address 1, CH1 Pulse integrated value (03E8H, 03E9H)]

- A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Data item (03E8H)	Amount of data (0002H)	Error check CRC-16 (7B44H)	Idle 3.5 characters
	1	1	2	2	2	

- Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Response byte count (04H)	Data (xxxxxxxxH)	Error check CRC-16 (xxxxH)	Idle 3.5 characters
	1	1	1	2	2	

12.2 Read and Write Input Method Data

Read [Slave address 1, CH1 Input method (012CH)]

- A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Data item (012CH)	Amount of data (0001H)	Error check CRC-16 (443FH)	Idle 3.5 characters
	1	1	2	2	2	

- Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (03H)	Response byte count (02H)	Data (xxxxH)	Error check CRC-16 (xxxxH)	Idle 3.5 characters
	1	1	1	2	2	

Write [Slave address 1, CH1 Input method (012CH)]

- A request message from the master

Idle 3.5 characters	Slave address (01H)	Function code (06H)	Data item (0012H)	Data (0000H)	Error check CRC-16 (49FFH)	Idle 3.5 characters
	1	1	2	2	2	

- Response message from the slave in normal status

Idle 3.5 characters	Slave address (01H)	Function code (06H)	Data item (0012H)	Data (0000H)	Error check CRC-16 (49FFH)	Idle 3.5 characters
	1	1	2	2	2	

13 Communication with PLC Using SIF Function

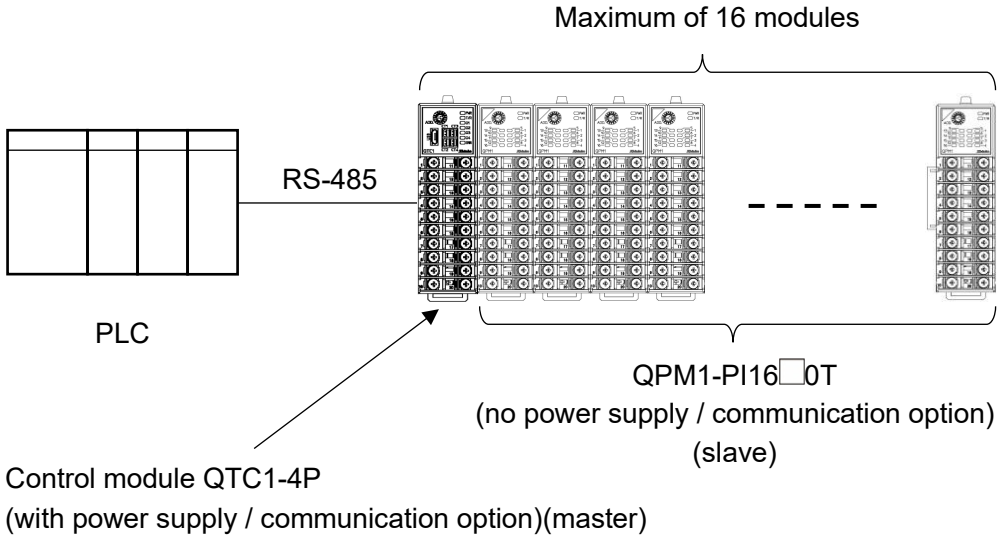
The SIF function (Smart InterFace, programless communication function) is a function that serially connects the PLC Q series (manufactured by Mitsubishi Electric Corp.) and this instrument, and reads and writes various data to and from PLC registers using the communication protocol of the PLC.
The following communication protocols and commands are supported.

Communication protocol	Format 4
Communication command	A compatible 1C frame AnA/AnU common command (QR/QW)

Using the console software (SWC-QTC101M), select the PLC register start number, PLC register address, the monitoring items and setting items to be linked, and set the specifications.

The control module QTC1-2P (with power supply / communication options) or QTC1-4P (with power supply / communication options) becomes the master and the selected monitor item is periodically written to the PLC register using the QW command, and the PLC register value is constantly updated.
In addition, the selected setting items are read from the PLC register in response to a setting request using the QR command.
When the read data is changed, the set value of control module QTC1-2P (with power / communication option) or QTC1-4P (with power supply / communication option) and QPM1-PI16□0□ (no power supply / communication option) is updated.

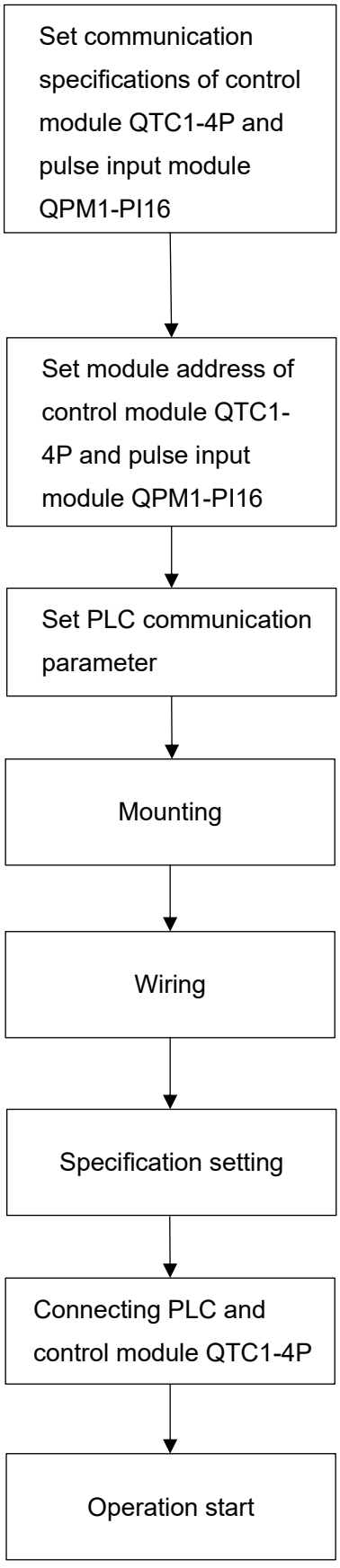
Configuration example of PLC and QTC1-4P, QPM1-PI16□0T



(Fig. 13-1)

13.1 Flow of Before Operation

The flow of operation when the QTC1-4P and QPM1-PI16□0T are connected to the PLC is shown below.



Select the communication specifications such as communication speed, data bits, and parity for the control module QTC1-4P and the pulse input module QPM1-PI16. Refer to “5.1 Communication Parameter Setting (P.5-1)”.
For control module QTC1-4P, select “SIF specification” in the selection of communication protocol (set DIP switch 6 for selection of communication specifications to ON). For details, refer to “5.1.1 Selection of Communication Specifications (P.5-1)” in the QTC1-4 Control Module Instruction Manual.

Set the module address of control module QTC1-4P and pulse input module QPM1-PI16.
Select a consecutive number from 1 for the address.
Refer to “5.2 Setting of Module Address (P.5-4)”.

Set the PLC communication parameters.
Refer to “13.2 PLC Communication Parameter Setting (P.13-3)”.

Mount the control module QTC1-4P and pulse input module QPM1-PI16 to the DIN rail.
Refer to “13.3 Mounting (P.13-6)”.

Wire the control module QTC1-4P and pulse input module QPM1-PI16.
Refer to “13.4 Wiring (P.13-8)”.

Set the communication settings with PLC.
Refer to “13.5 Specification Setting (P.13-12)”.

Connect the PLC and control module QTC1-4P.
Refer to “13.6 Connection of PLC and Control Module QTC1-4P (P.13-33)”.

Communication is performed between the QTC1-4P and PLC, and operation starts.
Refer to “13.7 Operation (P.13-36)”.

(Fig. 13.1-1)

13.2 PLC Communication Parameter Setting

Set the PLC communication parameters.

The setting method using GX Works3 is explained.

Connect the GX Works3 installed PC, set the communication speed, transmission specifications, communication protocol, etc., and then set the communication parameters using the PC write function.

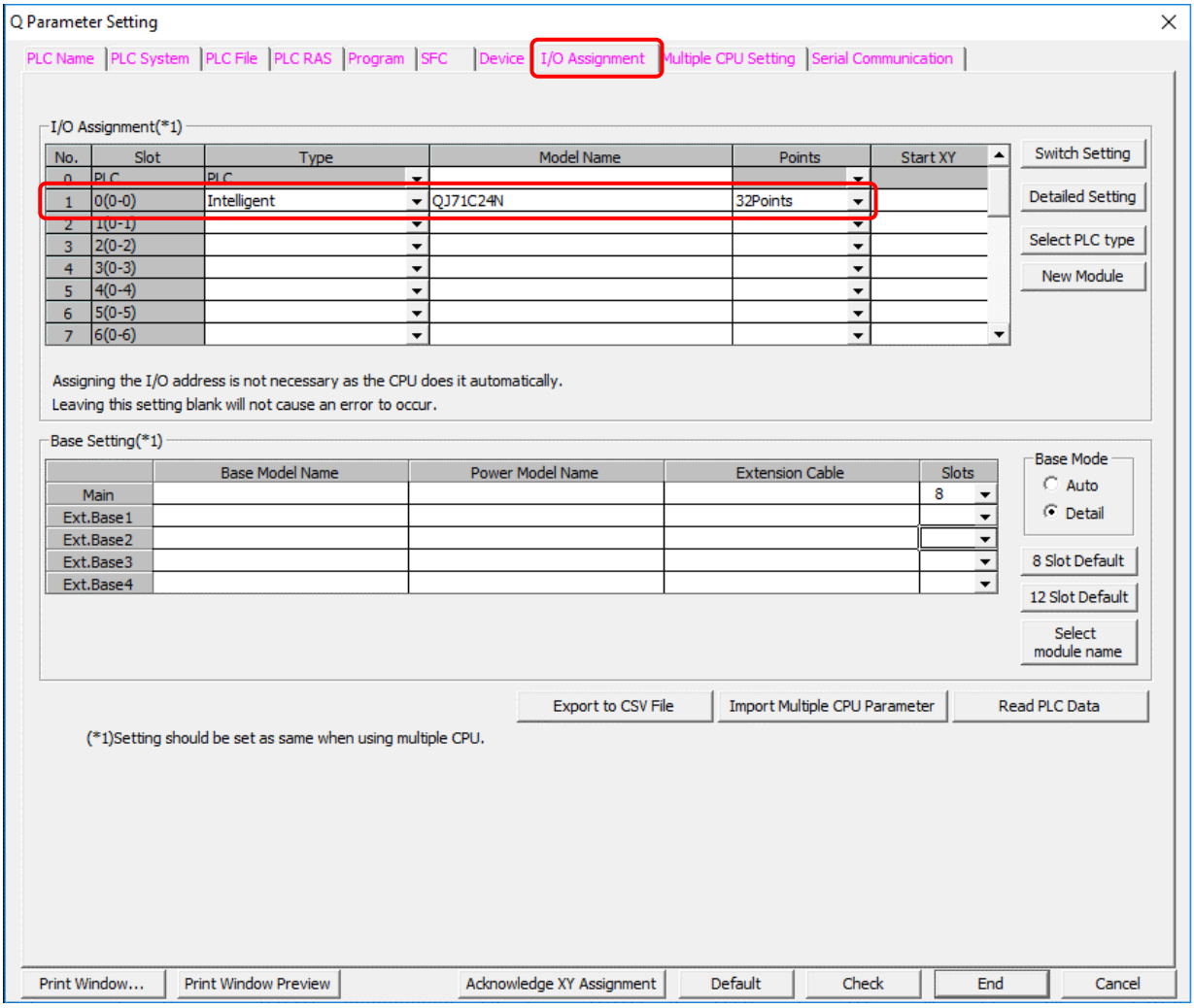
Refer to “Serial Communication Module User's Manual (Basic)” for detail.

(1) I/O assignment setting

Double-click [PLC parameter] on Project data list -> Parameter.

Display the Parameter Setting screen.

Click “I/O Assignment” tab, and set “Type”, “Model Name” and “Points”.



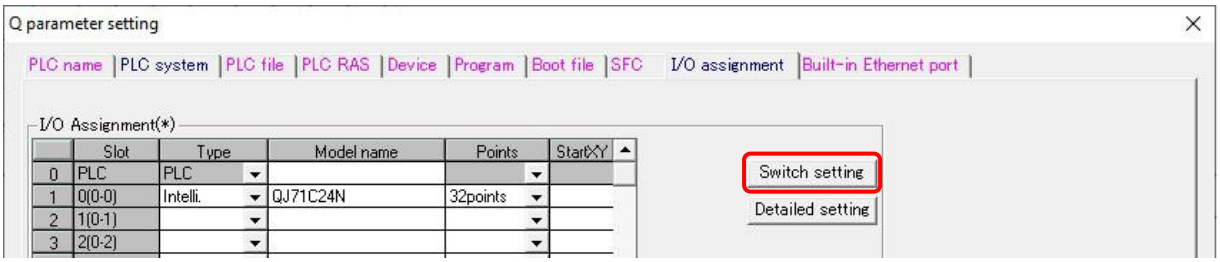
(Fig. 13.2-1)

[Setting Example]

Setting item	Setting contents
Type	Intelligent
Model Name	Model name of mounted unit (Example: QJ71C24N)
Points	32 points

(2) Switch setting

Click [Switch Setting] button to the right of the I/O Assignment setting.

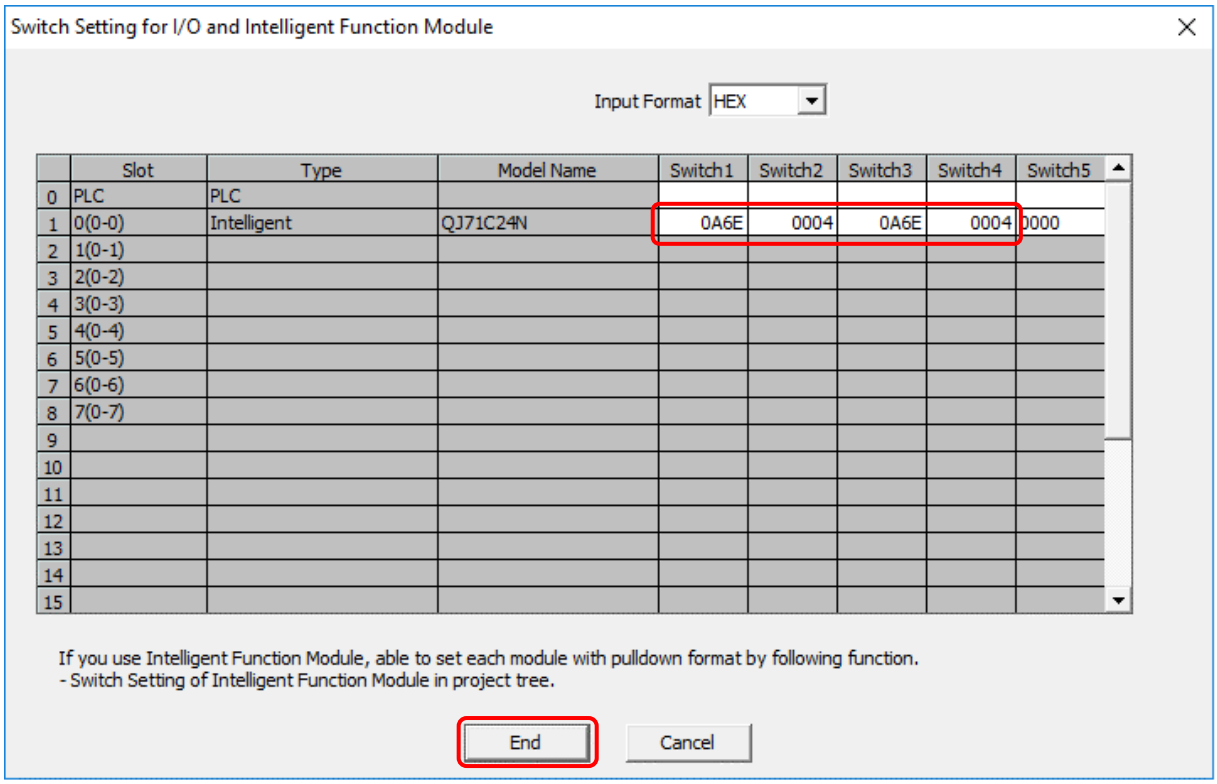


(Fig. 13.2-2)

Displays the Switch Setting for I/O and Intelligent Function Module screen.

Set the data bit, parity bit, stop bit, communication speed and communication protocol settings.

After setting, click [End] button.



(Fig. 13.2-3)

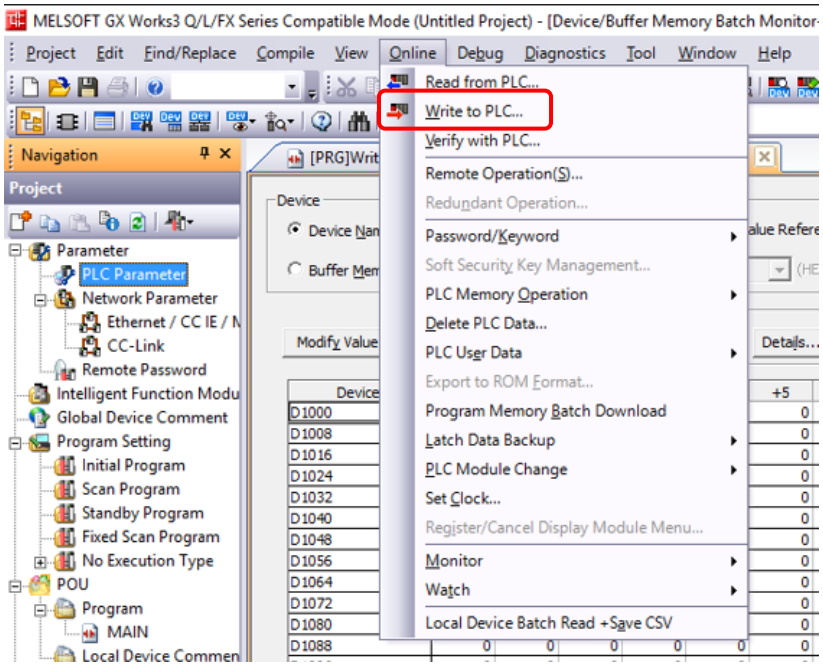
[Setting Example]

Setting item	Setting contents
Action setting	Independent
Data bit	8 bits
Parity bit	Even
Stop bit	1 bit
Sum check code	Yes
Write during RUN	Enable
Setting change	Disable
Communication speed setting	Set the same communication speed as the control module QTC1-4P (Setting example: 57600 bps)
Communication protocol setting	Format 4

(3) PLC writing

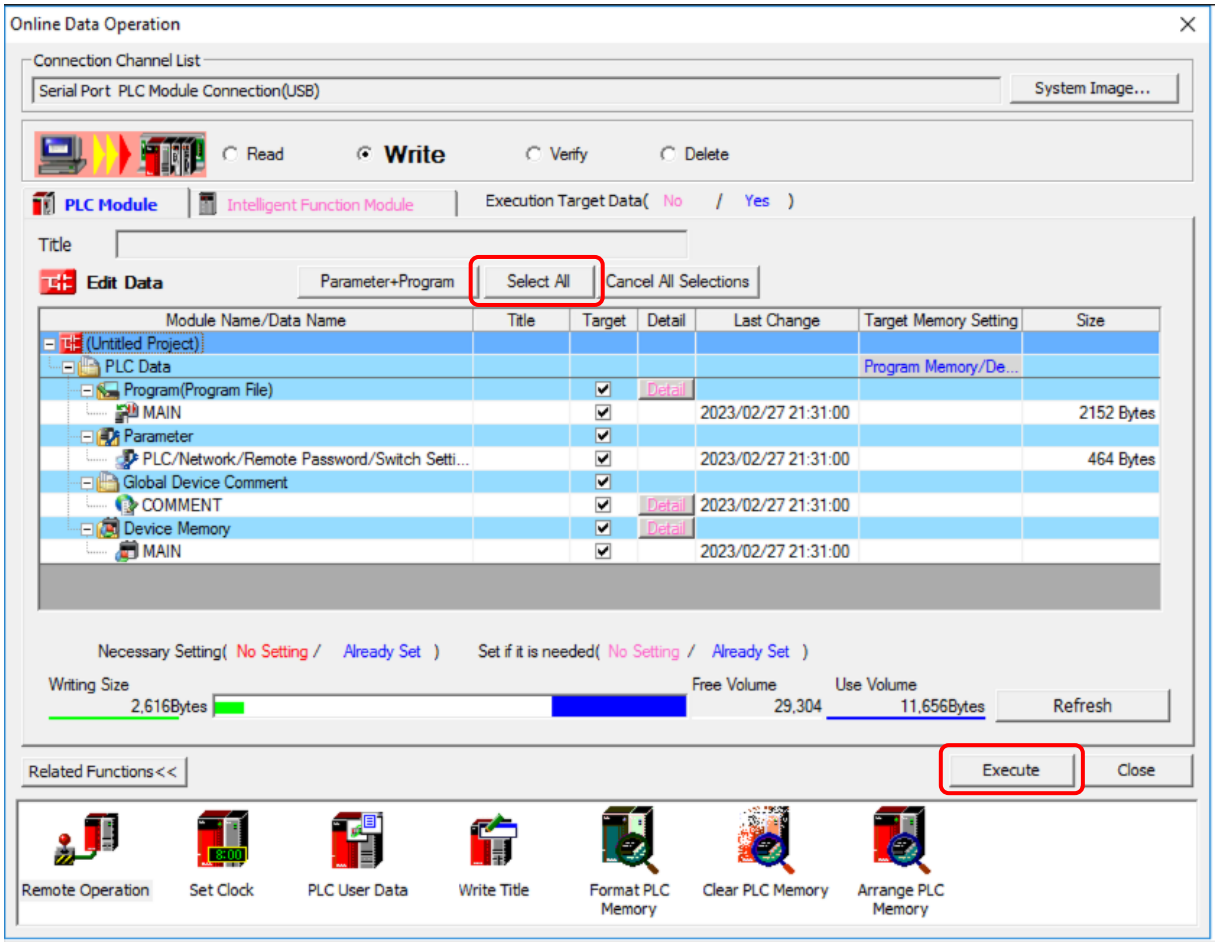
Click [Write to PLC...] on Menu bar -> Online.

Display the PC writing screen.



(Fig. 13.2-4)

Click [Select all] button -> [Execute] button.



(Fig. 13.2-5)

This completes the PLC communication parameter settings.

13.3 Mounting

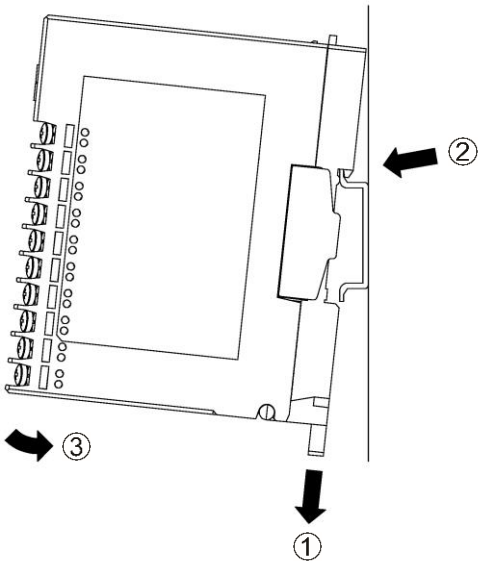
Mounting to the DIN rail

① Lower the lock lever of this instrument. (The lock lever of this instrument has a spring structure, but if lower it in the direction of the arrow until it stops, it will be locked in that position.)

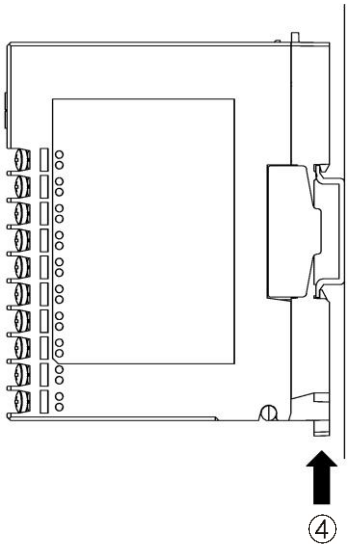
② Hook the part ② of this instrument onto the top of the DIN rail.

③ Insert the lower part of this instrument with the part ② as a fulcrum.

④ Raise the lock lever of this instrument.
Make sure it is fixed to the DIN rail.



(Fig. 13.3-1)

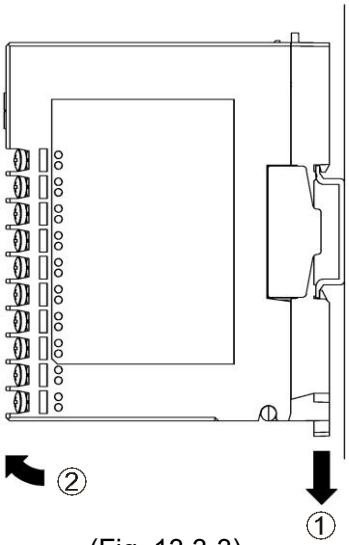


(Fig. 13.3-2)

Removal from the DIN rail

① Insert a flat blade screwdriver into the lock lever of this instrument and lower the lock lever until it stops.

② Remove this instrument from the DIN rail by lifting it from below.



(Fig. 13.3-3)

Mounting multiple modules to the DIN rail

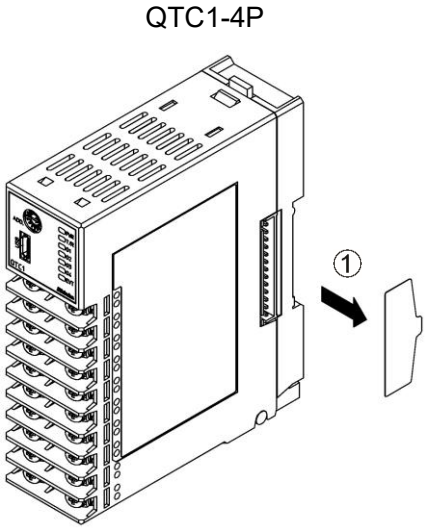
This section describes an example of mounting multiple modules on the DIN rail.

① Remove the protective sticker on the right side of the QTC1-4P.

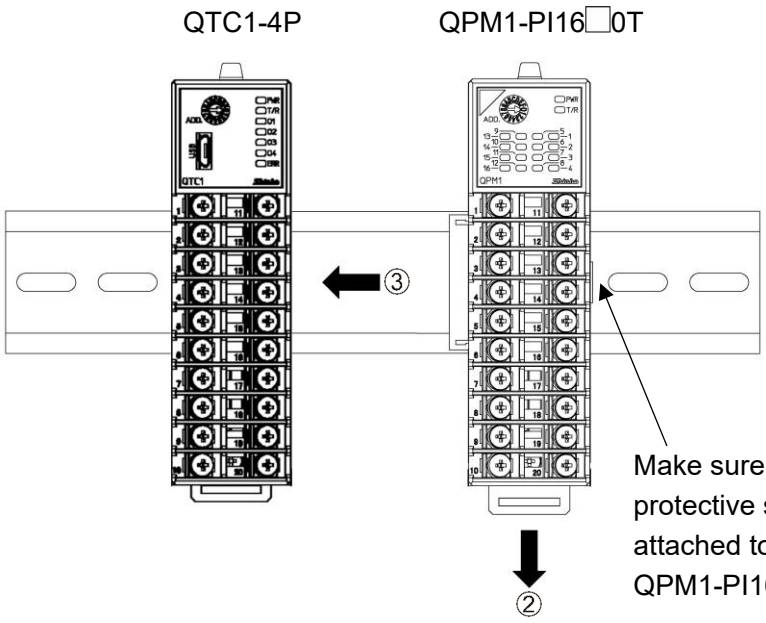
② Lower the lock lever of the QPM1-PI16□0T, and mounting the QPM1-PI16□0T to the DIN rail.

③ Slide the QPM1-PI16□0T to the left and connect the connectors to each other.

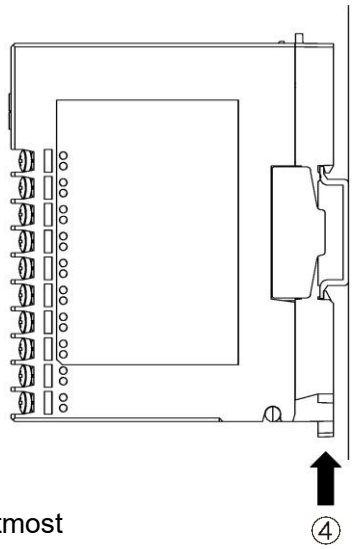
④ Raise the lock lever of the QPM1-PI16□0T.
Make sure it is fixed to the DIN rail.



(Fig. 13.3-4)



(Fig. 13.3-5)



(Fig. 13.3-6)

13.4 Wiring

13.4.1 Wiring for Power Supply and Communication

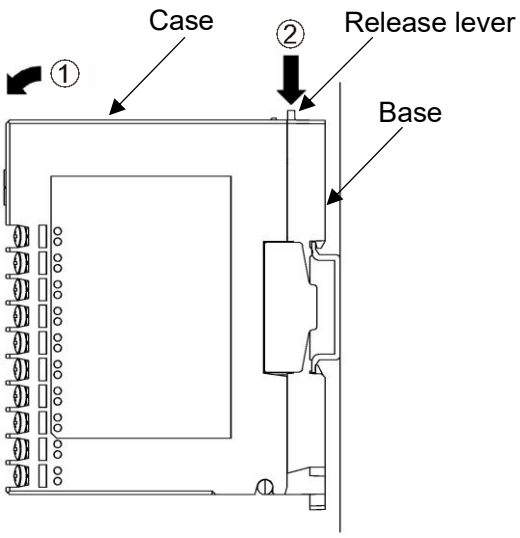
The terminal block for power supply and communication is located on the base of the control module QTC1-4P.

Wiring by the following procedure.

(1) Case removal

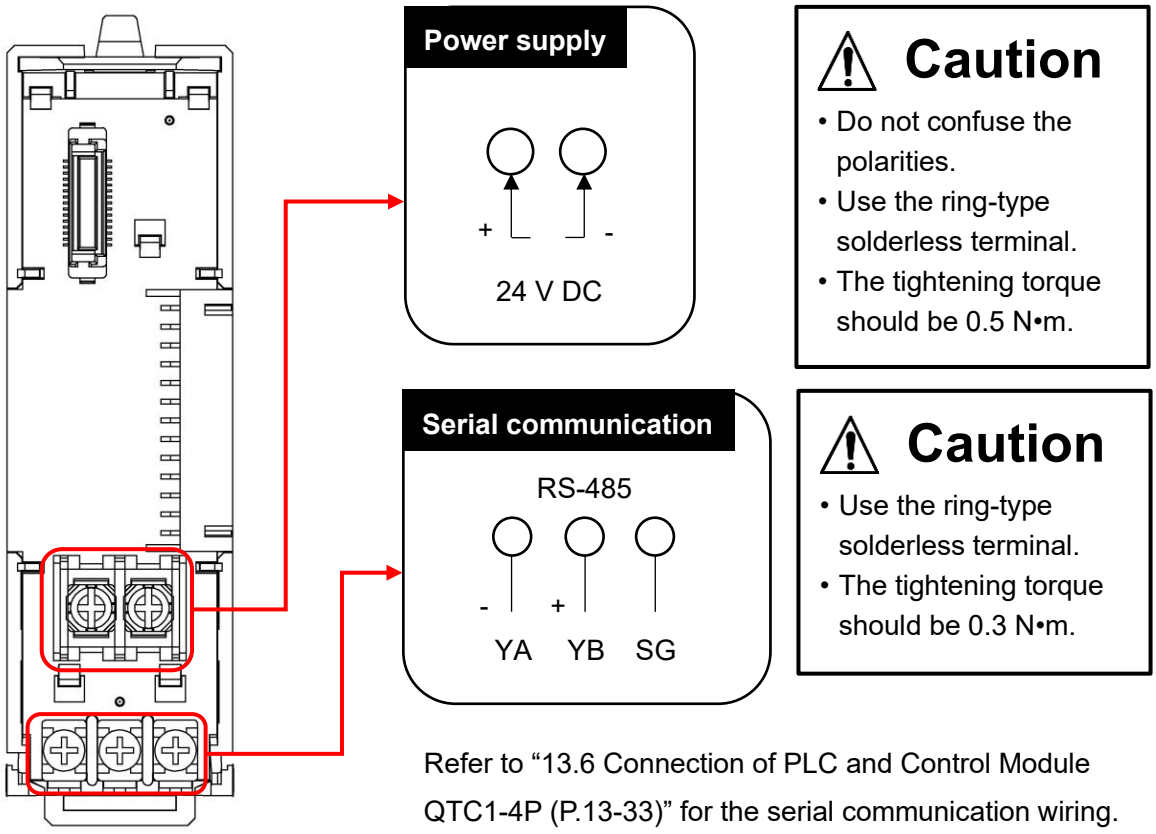
① Push the release lever on the top of QTC1-4P to unlock it.

② Remove the case.



(Fig. 13.4.1-1)

(2) Wiring



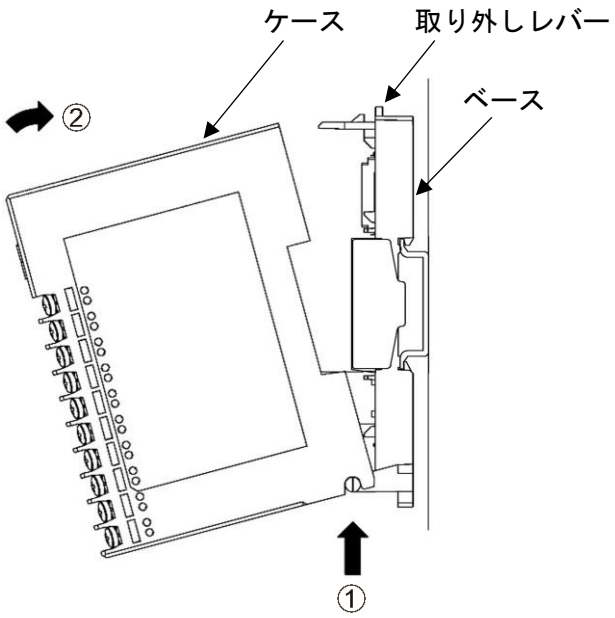
Refer to “13.6 Connection of PLC and Control Module QTC1-4P (P.13-33)” for the serial communication wiring.

(Fig. 13.4.1-2)

(3) Case mounting

① Hook the case on the lower part ① of QTC1-4P.

② Mount the case so that the lower part ① of QTC1-4P is the fulcrum and covers the release lever.
There is a clicking sound.



(Fig. 13.4.1-3)

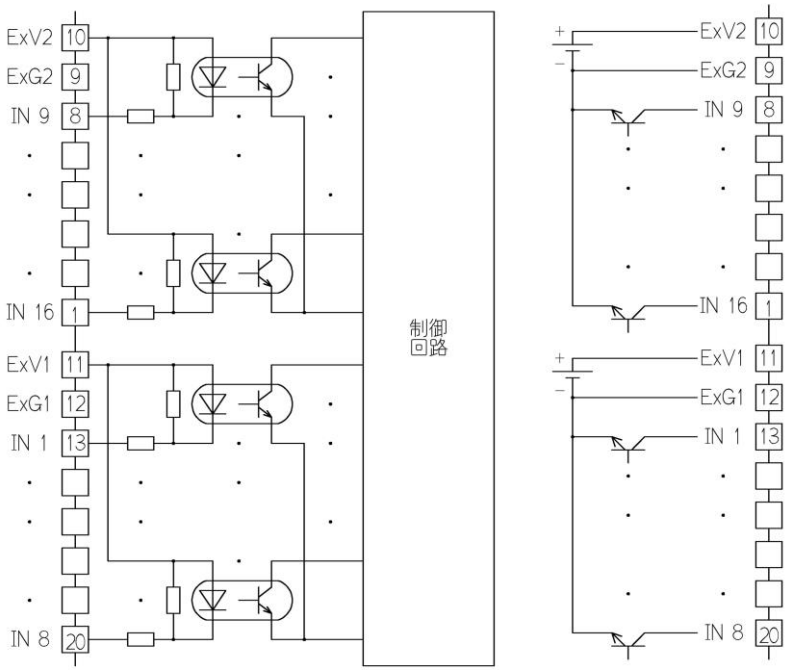
13.4.2 Wiring for Input

⚠ Caution

- Please note that terminal No.1 to 10 and terminal No.11 to 20 have different terminal arrangements.
- The tightening torque should be 0.63 N•m.

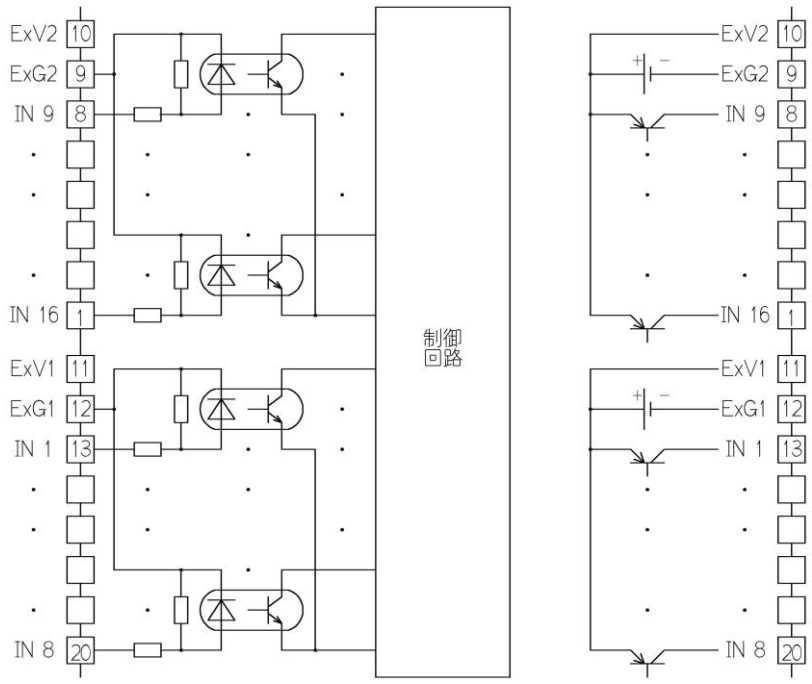
(1) Circuit configuration and wiring examples for pulse input module

QPM1-PI16A□□



(Fig. 13.4.2-1)

QPM1-PI16B□□



(Fig. 13.4.2-2)

13.5 Specification Setting

Set the specifications of the control module QTC1-4P and QPM1-PI16□0□ to communicate with the PLC.

This section describes how to set specifications using console software (SWC-QTC101M).

13.5.1 Preparation of USB Communication Cable and Console Software

Please prepare the USB communication cable and the console software.

- USB communication cable
  USB-micro USB Type-B (commercial item)
- Console software (SWC-QTC101M)
  Please download from our website and install.
  Click https://shinko-technos.co.jp/e/ → Support/Download → Software

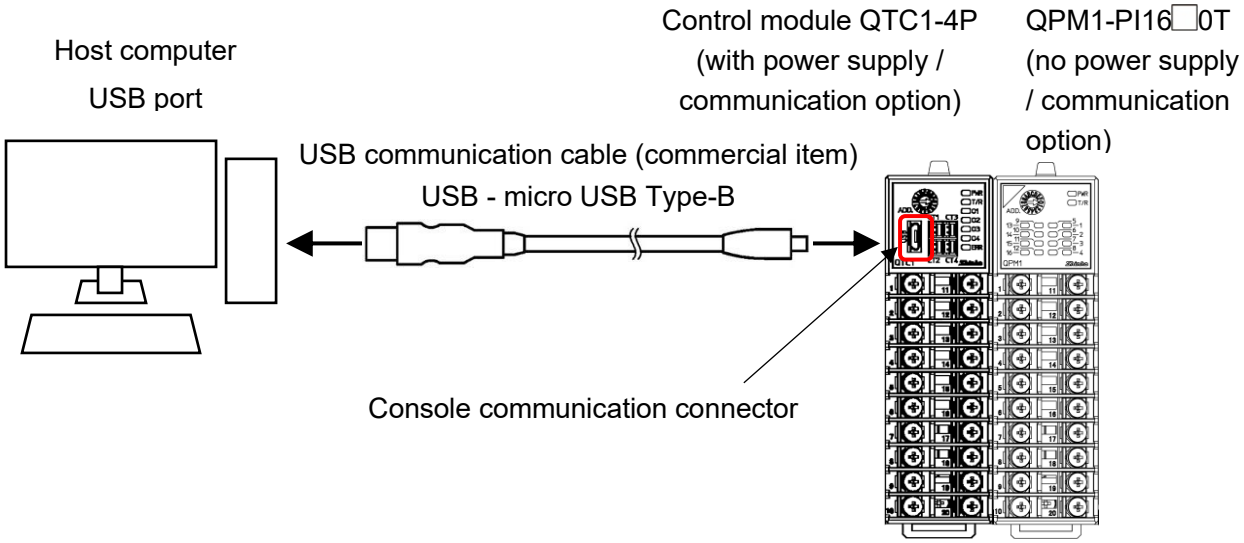
13.5.2 Connecting to Host Computer

⚠ Caution

Do not use the logging function of the console software when communicating by connecting the USB communication cable.

(1) Connect the micro USB Type-B side of the USB communication cable to the console communication connector of this instrument.

(2) Connect the USB plug of the USB communication cable to the USB port of the host computer.



(Fig. 13.5.2-1)

(3) Checking the COM port number

Follow the procedure below to check the COM port number.

① Right-click “Start” → Click “Device manager” from menu.

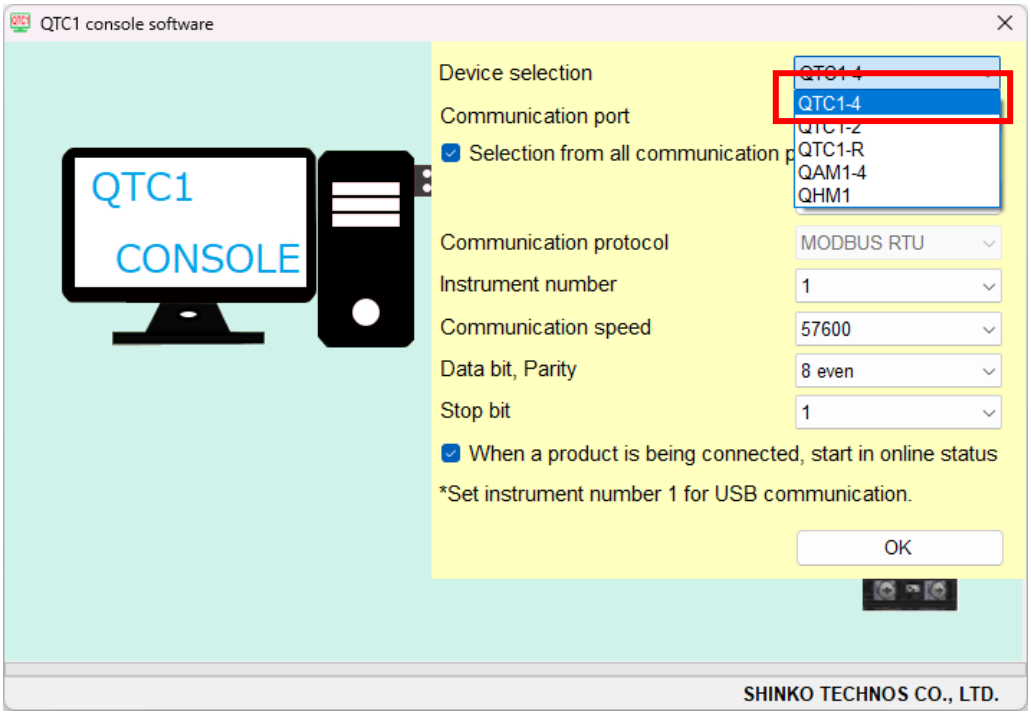
② When “USB Serial Port (COM3)” is displayed in “Port (COM and LPT)”, the COM port is assigned to No. 3.

Check the COM port number, and then close “Device Manager”.

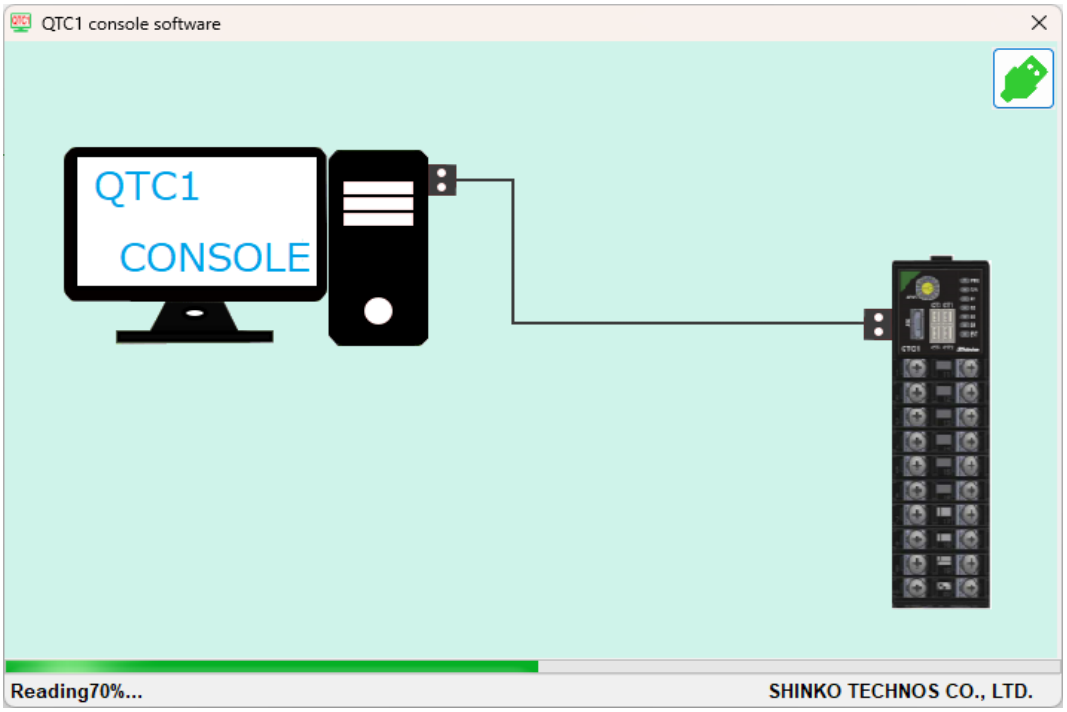
(4) Starting the console software (SWC-QTC101M)

① Start the console software (SWC-QTC101M).

Select “QTC1-4” in the Device selection.

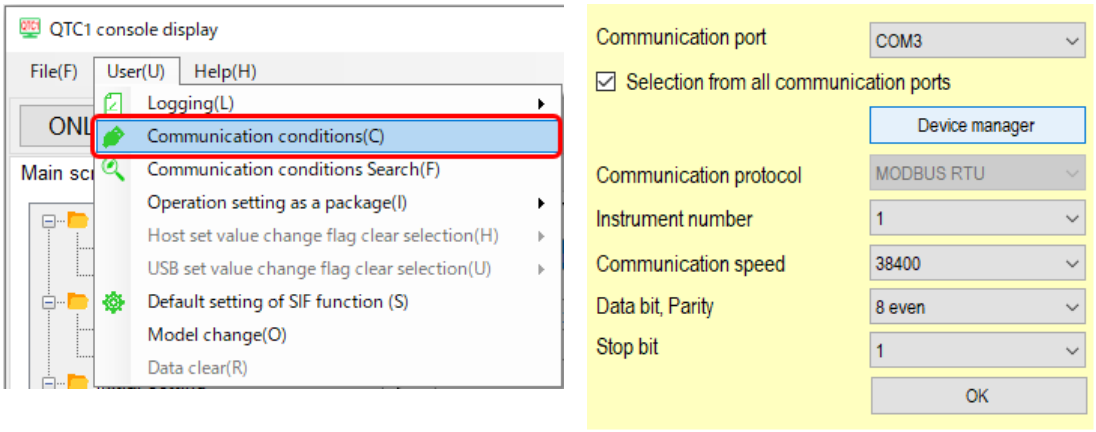


(Fig. 13.5.2-2)



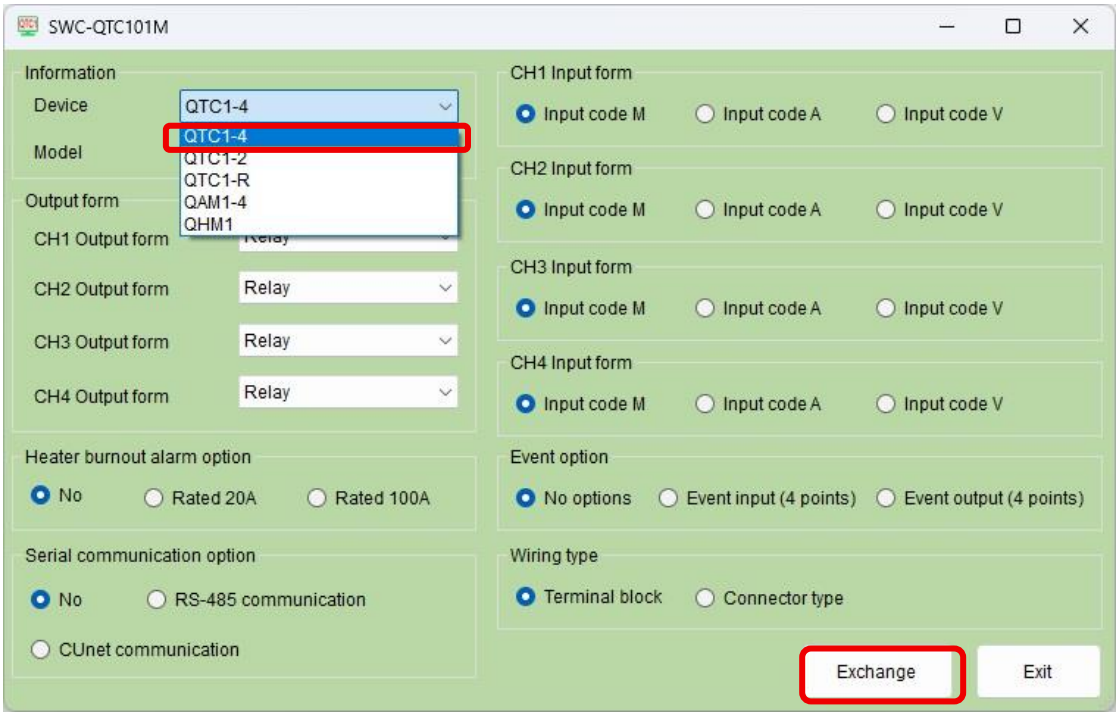
(Fig. 13.5.2-3)

② Click [User (U)] on the menu bar → [Communication conditions (C)].
Display the communication condition setting screen.



(Fig. 13.5.2-4)

*The model “QTC1-4” can also be selected from User (U) - Model change (o) in the menu bar.



(Fig. 13.5.2-5)

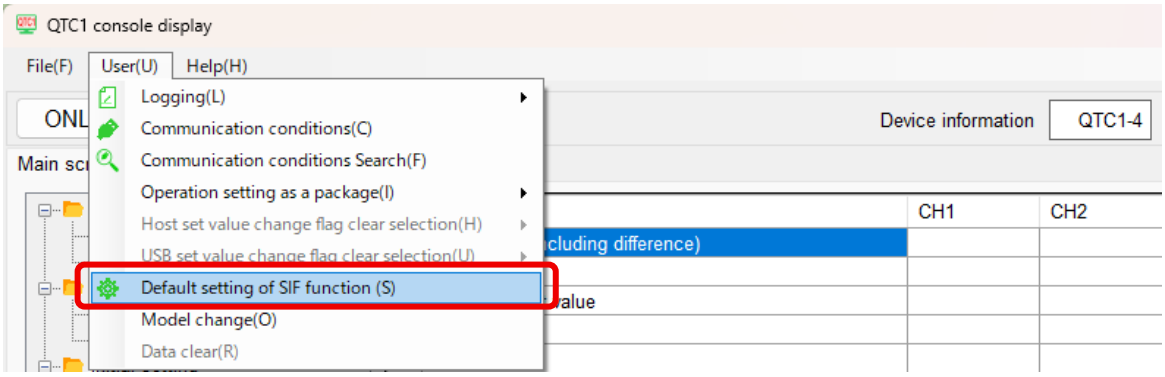
③ Set the communication condition as shown below.

Setup Items	Setting Value
Communication port	Select the COM port number confirmed in ② of (3).
Communication protocol	MODBUS RTU

④ Click [OK]

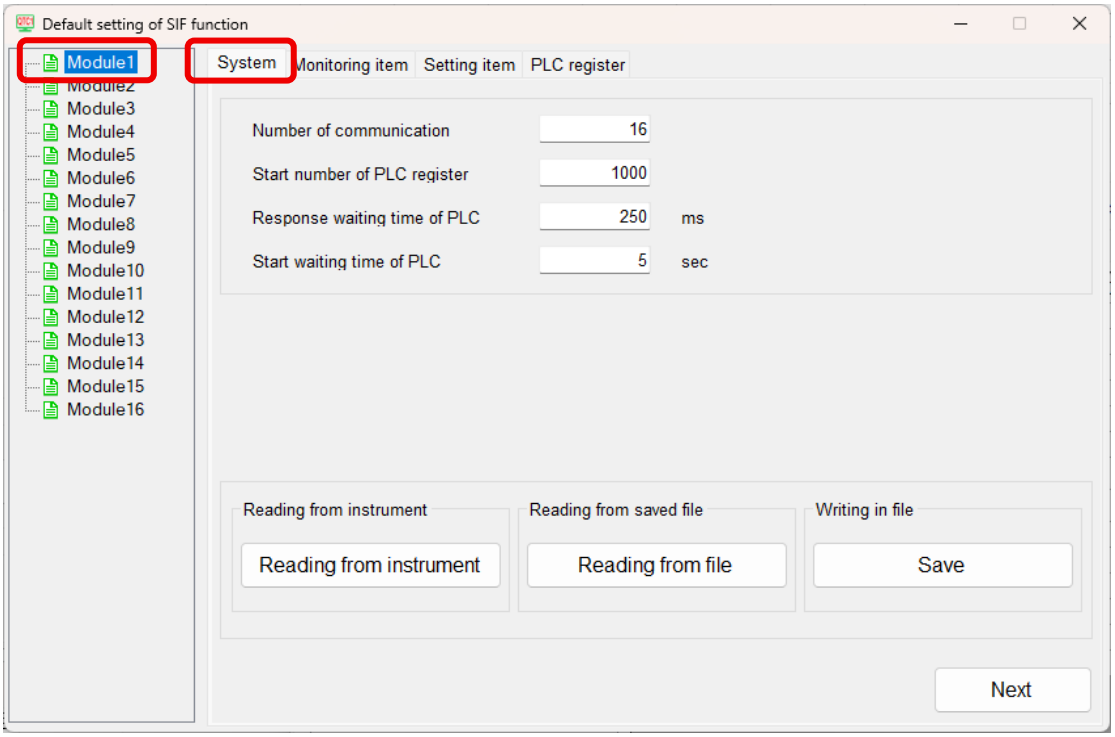
⑤ Click “Default setting of SIF function(S)” from “User(U)” of menu ber.

Display “Default setting of SIF function” screen.



(Fig. 13.5.2-6)

⑥ Select “Module 1” and click “System” tab.



(Fig. 13.5.2-7)

The specifications are ready.

13.5.3 Specification Setting

Specification setting of control module QTC1-4P

Set the specifications of the control module QTC1-4P with reference to the SIF function initial setting items.

SIF function initial setting items

MODBUS address		Name	Settings • Selection range	Initial value	Remarks (*)
HEX	DEC				
020A	522	Communication management module number setting	1 to 16 modules	1	1
0384	900	PLC register start number	0 to 65535	1000	0
0385	901	PLC response wait time	100 to 3000 ms	200	1
0386	902	PLC communication start wait time	1 to 255 seconds	5	1
0387	903	Reservation (Not used)		0	0
0388	904	Reservation (Not used)		0	0
0389	905	Monitor item 1	Refer to Monitor item 1 (P.13-17)	31	0
038A	906	Monitor item 2	Refer to Monitor item 2 (P.13-17)	0	0
038B	907	Monitor item 3	Refer to Monitor item 3 (P.13-18)	0	0
038C	908	Reservation (Not used)		0	0
038D	909	Reservation (Not used)		0	0
038E	910	Setting item 1	Refer to Setting item 1 (P.13-18)	57827	0
038F	911	Setting item 2	Refer to Setting item 2 (P.13-19)	2721	0
0390	912	Setting item 3	Refer to Setting item 3 (P.13-19)	0	0
0391	913	Setting item 4	Refer to Setting item 4 (P.13-20)	0	0
0392	914	Setting item 5	Refer to Setting item 5 (P.13-20)	0	0
0393	915	Setting item 6	Refer to Setting item 6 (P.13-21)	0	0
0394	916	Setting item 7	Refer to Setting item 7 (P.13-21)	0	0

(*) 0: The value set in each module is a valid item.

1: The value set in the control module QTC1-4P is a valid item.

(1) Communication management module number setting

Set the number of modules managed by the master module.

Set the number of modules including the master module.

(2) PLC register start number

Set the start number of the register used in PLC communication. It is fixed to the D register.

Please set in the range of 0 to 65535.

For A compatible 1C frame AnA/AnU, set within the range of 0 to 8191.

A maximum of 170 registers are used per control module. [System area: 10 registers, Monitor item: 80 registers (20 × 4ch), Setting item: 80 registers (20 × 4ch)]

When using multiple control modules, be careful not to duplicate them.

(3) PLC response wait time

Set the retransmission interval time when there is no response from the PLC.

Please set in the range of 100 to 3000 ms.

(4) PLC communication start wait time

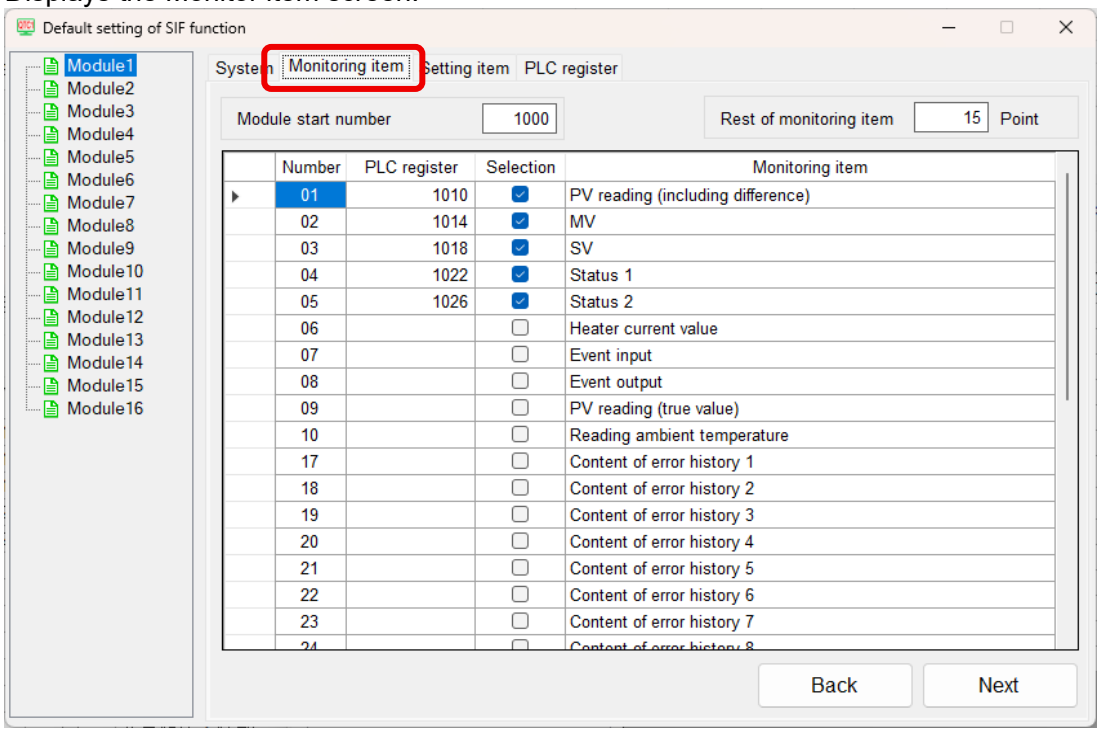
Set the time from when the control module QTC1-4P power is turned on until communication is started to the PLC.

Please set in the range of 1 to 255 seconds.

(5) Monitor item 1 to 3

Click [Monitor item] tab or [Next] button.

Displays the Monitor item screen.



(Fig. 13.5.3-1)

Select any of Monitor item 1 to 3. The maximum number of valid item selections is 20. The excess is invalid for all channels in the control module.

Monitor item 1 (Initial value: 31)

Bit	No.	Selection	Description
0	01	1	PV reading (including difference)
1	02	1	MV reading
2	03	1	SV reading
3	04	1	Status flag 1 reading
4	05	1	Status flag 2 reading
5	06	0	Heater current value reading
6	07	0	Event input reading
7	08	0	Event output reading
8	09	0	PV reading (true value)
9	10	0	Ambient temperature reading
10	11	0	Not used
11	12	0	Not used
12	13	0	Not used
13	14	0	Not used
14	15	0	Not used
15	16	0	Not used

Monitor item 2 (Initial value: 0)

Bit	No.	Selection	Description
0	17	0	Alarm history 1 Error No.
1	18	0	Alarm history 2 Error No.
2	19	0	Alarm history 3 Error No.
3	20	0	Alarm history 4 Error No.
4	21	0	Alarm history 5 Error No.
5	22	0	Alarm history 6 Error No.
6	23	0	Alarm history 7 Error No.
7	24	0	Alarm history 8 Error No.
8	25	0	Alarm history 9 Error No.
9	26	0	Alarm history 10 Error No.
10	27	0	Alarm history 1 Total energizing time
11	28	0	Alarm history 2 Total energizing time
12	29	0	Alarm history 3 Total energizing time
13	30	0	Alarm history 4 Total energizing time
14	31	0	Alarm history 5 Total energizing time
15	32	0	Alarm history 6 Total energizing time

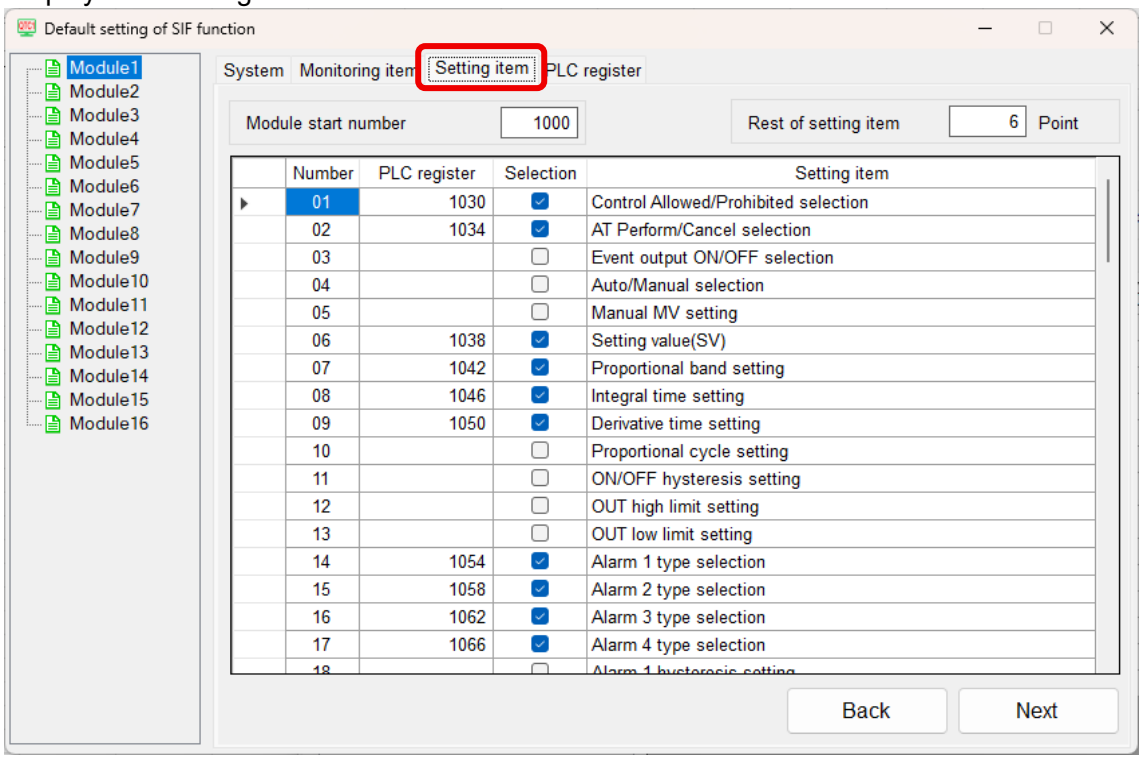
Monitor item 3 (Initial value: 0)

Bit	No.	Selection	Description
0	33	0	Alarm history 7 Total energizing time
1	34	0	Alarm history 8 Total energizing time
2	35	0	Alarm history 9 Total energizing time
3	36	0	Alarm history 10 Total energizing time
4	37	0	Contact switching total number of times (High)
5	38	0	Contact switching total number of times (Low)
6	39	0	Total energizing time (High, Low)
7	40	0	Heater accumulated energizing time (High)
8	41	0	Heater accumulated energizing time (Low)
9	42	0	Not used
10	43	0	Not used
11	44	0	Not used
12	45	0	Not used
13	46	0	Not used
14	47	0	Not used
15	48	0	Not used

(6) Setting item 1 to 7

Click [Setting item] tab or [Next] button.

Displays the Setting item screen.



(Fig. 13.6.3-2)

Select any of Setting item 1 to 7. The maximum number of valid item selections is 20. The excess is invalid for all channels in the control module.

Setting item 1 (Initial value: 57827)

Bit	Setting request item number	Selection	Description
0	1	1	Control Allowed/Prohibited selection
1	2	1	AT Perform/Cancel selection
2	3	0	Event output ON/OFF selection
3	4	0	Auto/Manual control selection
4	5	0	Manual MV setting
5	6	1	SV setting
6	7	1	Proportional band setting
7	8	1	Integral time setting
8	9	1	Derivative time setting
9	10	0	Proportional cycle setting
10	11	0	ON/OFF hysteresis setrting
11	12	0	Output high limit setting
12	13	0	Output low limit setting
13	14	1	Alarm 1 action selection
14	15	1	Alarm 2 action selection
15	16	1	Alarm 3 action selection

Setti ng item 2 (Initial value: 2721)

Bit	Setting request item number	Selection	Description
0	17	1	Alarm 4 action selection
1	18	0	Alarm 1 hysteresis setting
2	19	0	Alarm 2 hysteresis setting
3	20	0	Alarm 3 hysteresis setting
4	21	0	Alarm 4 hysteresis setting
5	22	1	Alarm 1 value setting
6	23	0	Alarm 1 high limit value setting
7	24	1	Alarm 2 value setting
8	25	0	Alarm 2 high limit value setting
9	26	1	Alarm 3 value setting
10	27	0	Alarm 3 high limit value setting
11	28	1	Alarm 4 value setting
12	29	0	Alarm 4 high limit value setting
13	30	0	Heater burnout alarm setting
14	31	0	Loop break alarm band setting
15	32	0	Loop break alarm time setting

Setting item 3 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	33	0	Sensor correction factor setting
1	34	0	Sensor correction setting
2	35	0	PV filter time constant setting
3	36	0	SV rise rate setting
4	37	0	SV fall rate setting
5	38	0	MV bias setting
6	39	0	Not used
7	40	0	Not used
8	41	0	Not used
9	42	0	Not used
10	43	0	Not used
11	44	0	Not used
12	45	0	Not used
13	46	0	Not used
14	47	0	Not used
15	48	0	Not used

Setting item 4 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	49	0	Input type selection
1	50	0	Temperature unit selection
2	51	0	Scaling high limit setting
3	52	0	Scaling low limit setting
4	53	0	Input sampling selection
5	54	0	Direct/Reverse action selection
6	55	0	AT action mode selection
7	56	0	AT bias setting
8	57	0	ATgain setting
9	58	0	Alarm 1 value 0 Enabled/Disabled selection
10	59	0	Alarm 2 value 0 Enabled/Disabled selection
11	60	0	Alarm 3 value 0 Enabled/Disabled selection
12	61	0	Alarm 4 value 0 Enabled/Disabled selection
13	62	0	Event output allocation selection
14	63	0	Event input allocation selection
15	64	0	CH Enabled/Disabled selection

Setting item 5 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	65	0	Number of moving average setting
1	66	0	Input math function selection
2	67	0	Input difference selection
3	68	0	Input difference setting
4	69	0	Control action selection
5	70	0	Proportional gain 2 DOF coefficient (α) setting
6	71	0	Integral 2 DOF coefficient (β) setting
7	72	0	Derivative 2 DOF coefficient (γ, Cd) setting
8	73	0	Desired value proportional coefficient (Cp) setting
9	74	0	Gap width setting
10	75	0	Gap coefficient setting
11	76	0	Output minimum ON/OFF time setting
12	77	0	Integral/Derivative decimal point position selection
13	78	0	Power-on restore action selection
14	79	0	Not used
15	80	0	Not used

Setting item 6 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	81	0	Control function selection
1	82	0	Cooling P-band setting
2	83	0	Cooling Integral time setting
3	84	0	Cooling Derivative time setting
4	85	0	Cooling proportional cycle setting
5	86	0	Cooling ON/OFF hysteresis setting
6	87	0	Overlap/Dead band setting
7	88	0	Cooling output high limit setting
8	89	0	Cooling output low limit setting
9	90	0	Cooling action mode selection
10	91	0	Slave scale high limit setting
11	92	0	Slave scale low limit setting
12	93	0	Output bias setting
13	94	0	Output gain setting
14	95	0	Output channel selection
15	96	0	Output rate-of-change setting

Setting item 7 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	97	0	Communication response delay time setting
1	98	0	Extension function selection
2	99	0	Total current setting
3	100	0	Current value setting
4	101	0	OUT ON delay setting
5	102	0	Auto balance control Interlock/Single selection
6	103	0	Auto balance control Master/Slave selection
7	104	0	Auto balance control Enabled/Disabled selection
8	105	0	Auto balance control start output setting
9	106	0	Auto balance control cancel area setting
10	107	0	Number of communication management module setting
11	108	0	Non-volatile IC memory save selection
12	109	0	Not used
13	110	0	Not used
14	111	0	Not used
15	112	0	Not used

(7) Control module power OFF → ON

Turn the control module power off and then on. The set value becomes effective.

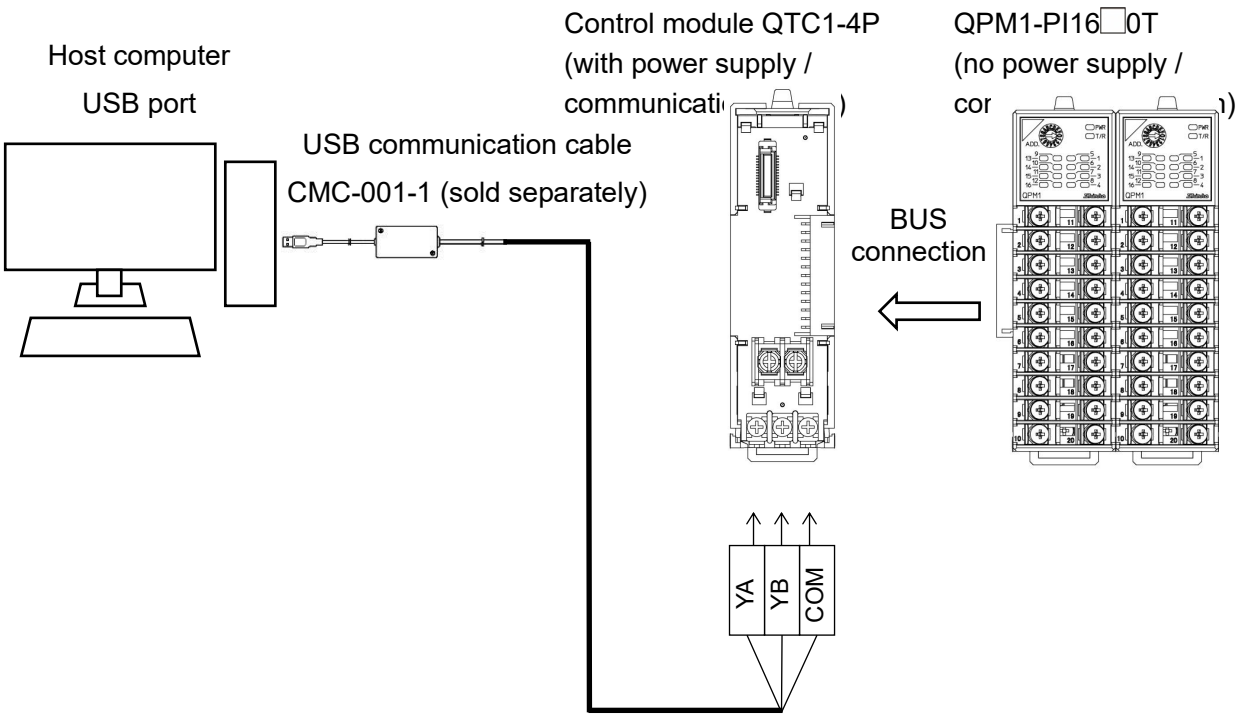
This completes the specification setting of control module QTC1-4P.

Next, the specifications for the pulse input module QPM1-PI16 will be configured.
This section explains how to configure the specifications using the console software (SWC-RIOx01M).

(1) Preparation of USB communication cable and console software

- USB communication cable
  CMC-001-1 (sold separately)
- Console software (SWC-RIOx01M)
  Please download from our website and install.
  Click https://shinko-technos.co.jp/e/ → Support/Download → Software

(2) Connecting to host computer



(Fig. 13.5.3-3)

(3) Set the module address to 1 using the rotary switch on the QPM1-PI16□0T.

(4) Checking the COM port number.

Follow the procedure below to check the COM port number.

① Right-click “Start” → Click “Device manager” from menu.

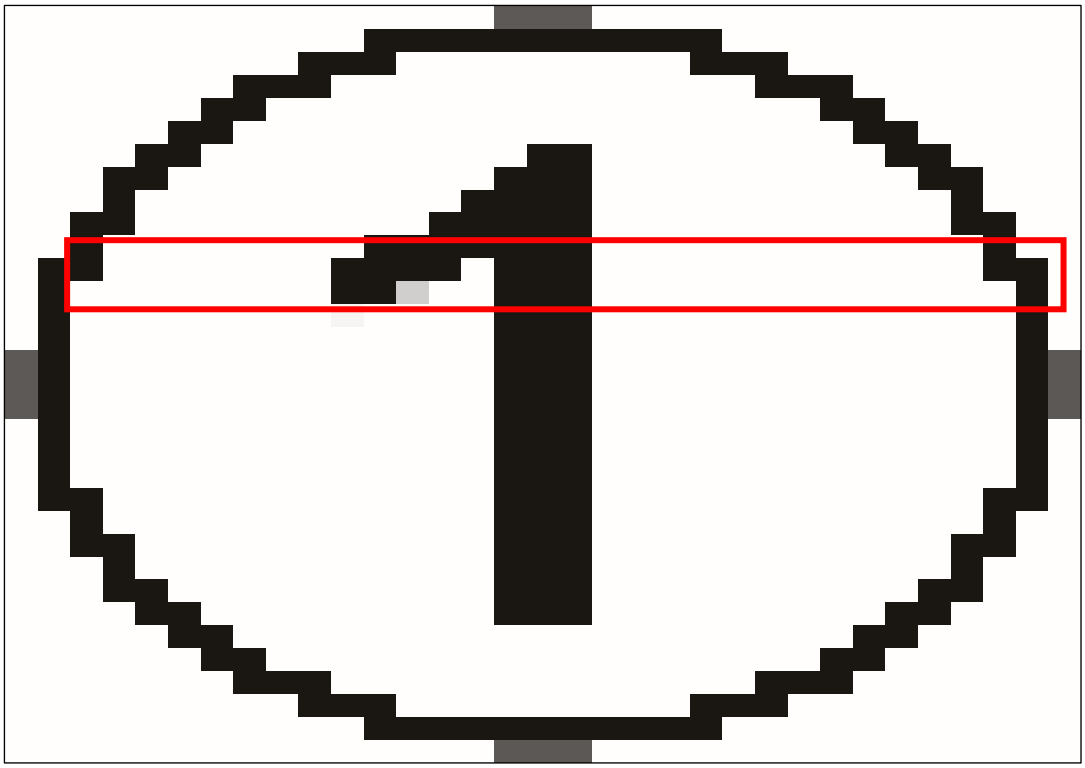
② When “USB Serial Port (COM3)” is displayed in “Port (COM and LPT)”, the COM port is assigned to No. 3.

Check the COM port number, and then close “Device Manager”.

(5) Start the console software (SWC-RIOx01M)

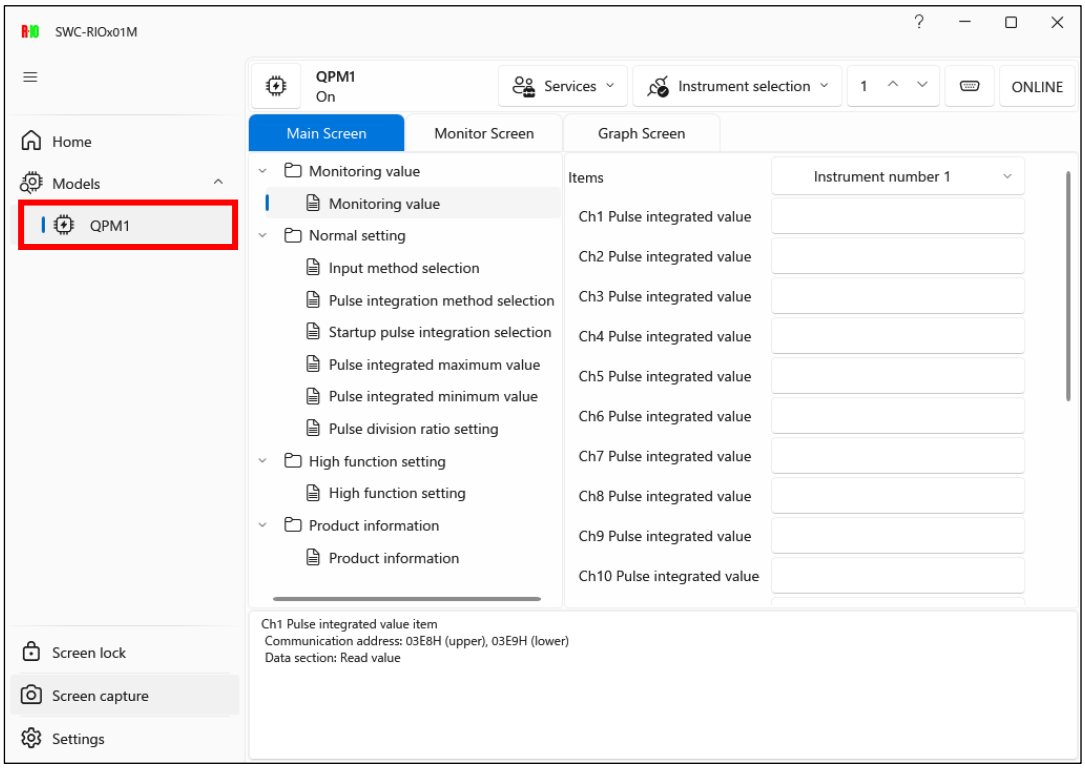
① Start the console software (SWC-RIOx01M).

Select “QPM1” in the Compatible devices.



(Fig. 13.5.3-4)

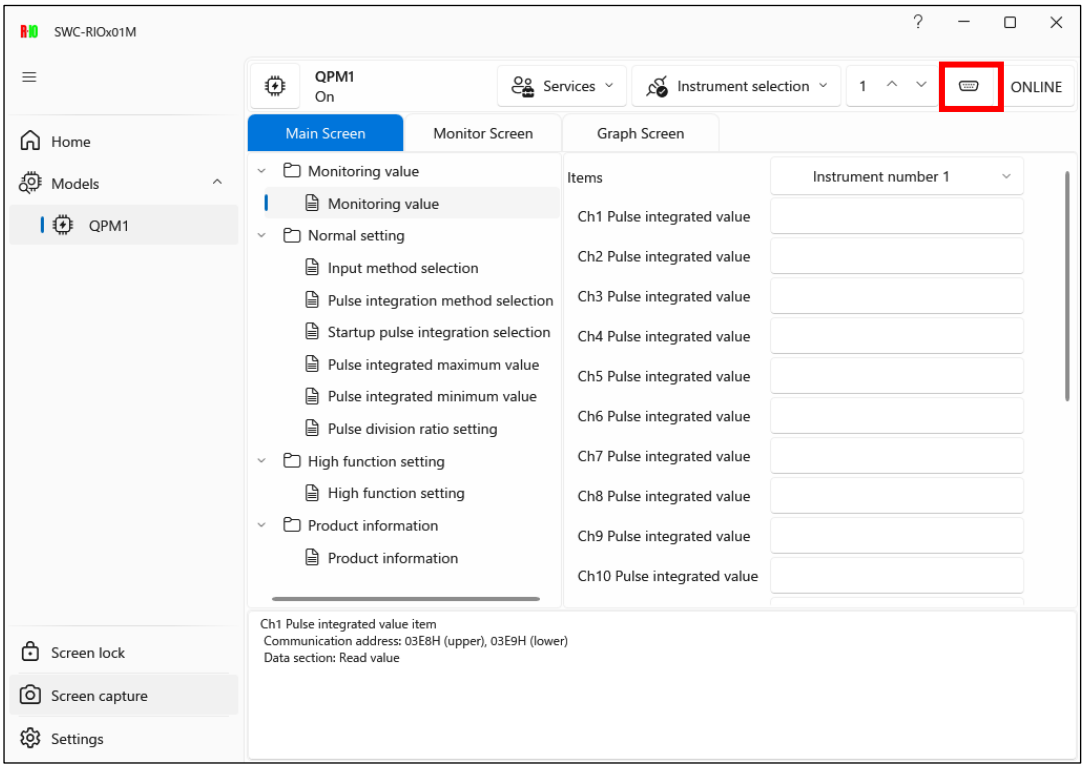
② Click “QPM1” icon in the Models.



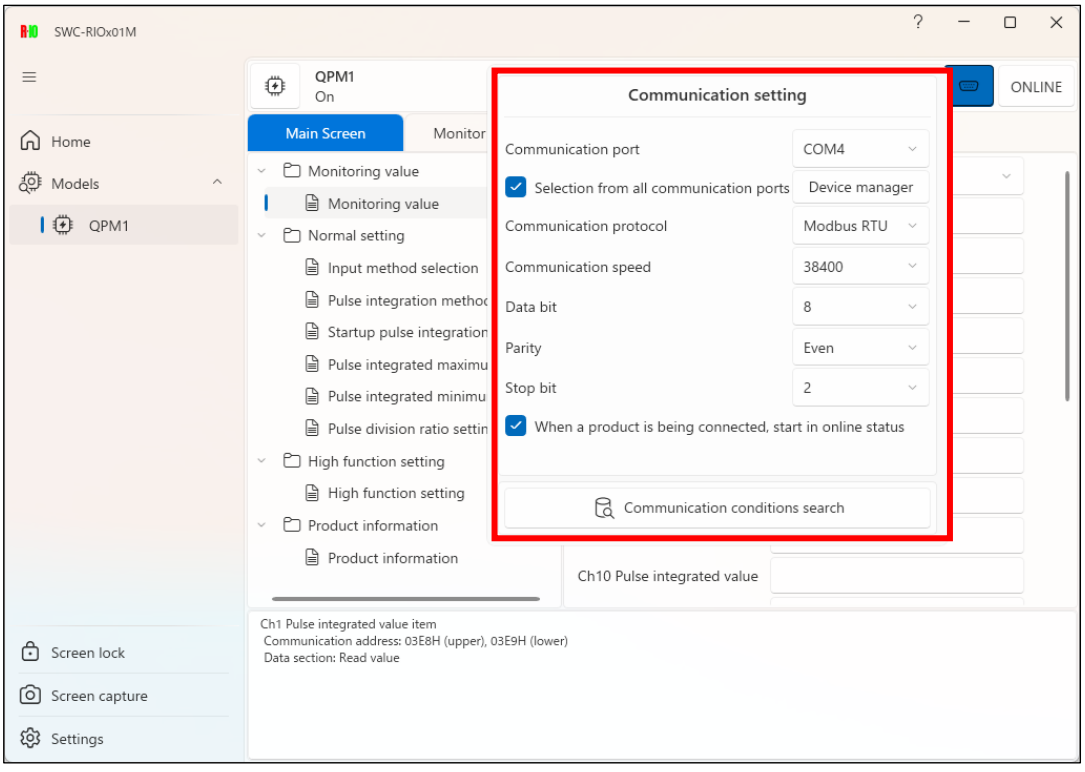
(Fig. 13.5.3-5)

③ Click “Communication condition”.

Display the communication condition setting screen.



(Fig. 13.5.3-6)



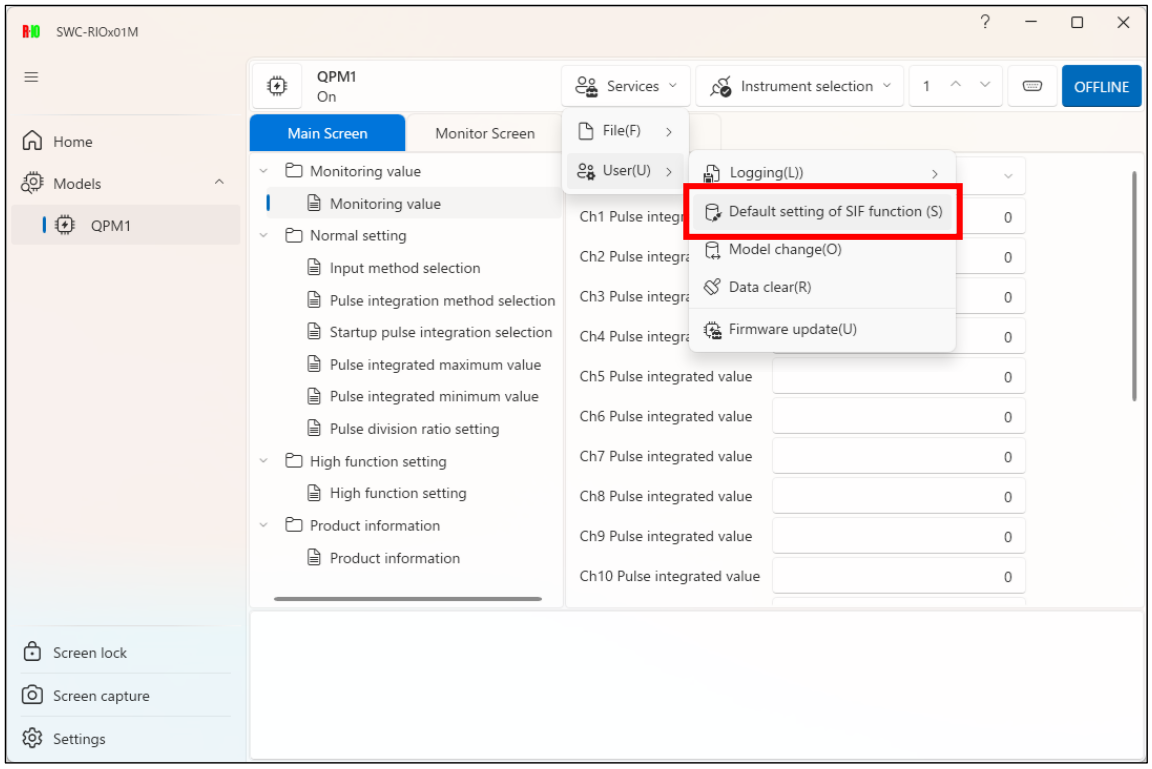
(Fig. 13.5.3-7)

④ Set the communication condition as shown below.

Setup Items	Setting Value
Communication port	Select the COM port number confirmed in ② of (3).
Communication protocol	MODBUS RTU

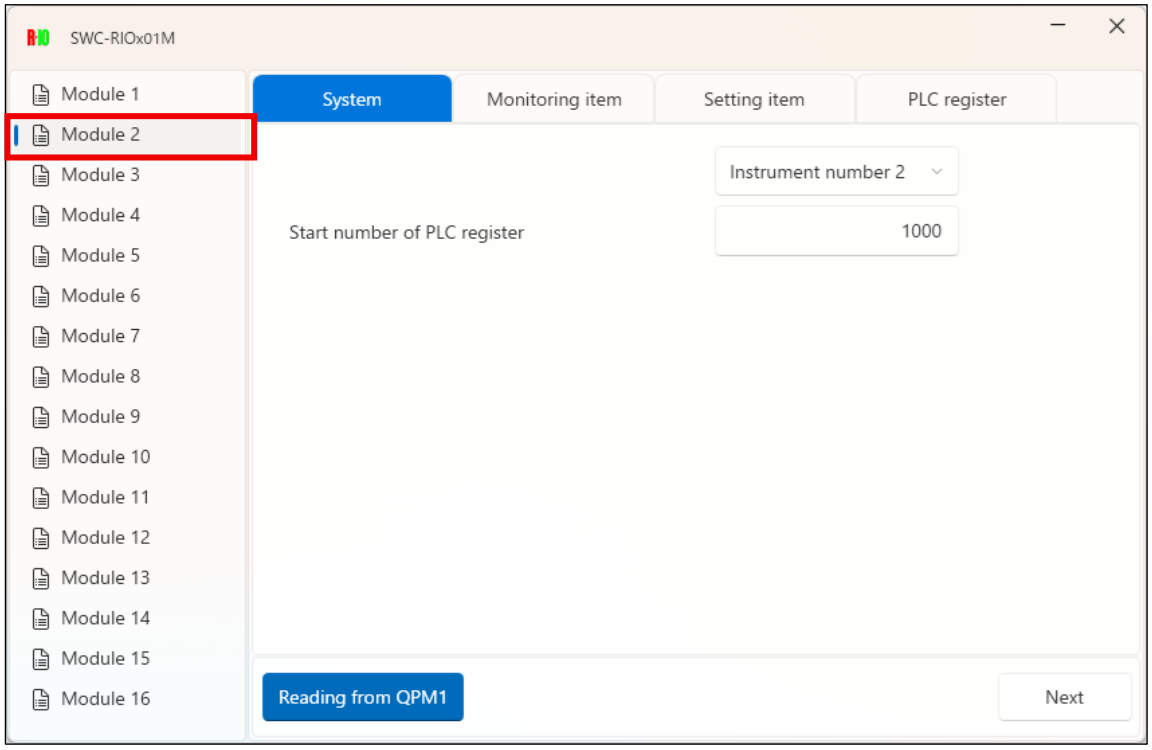
⑤ Click “Services” → “User(U)” → “Default setting of SIF function (S)”.

Display the Default setting of SIF function screen.



(Fig. 13.5.3-8)

⑥ Select the connected module number (e.g., Module 2), and then click the System tab.



(Fig. 13.5.3-9)

The specifications are ready.

Specification setting of QPM1-PI16□0□

Set the specifications of QPM1-PI16□0□ by referring to the “SIF Function Initial Setting Items”.

SIF function initial setting items

MODBUS address		Name	Settings • Selection range	Initial value	Remarks (*)
HEX	DEC				
0384	900	PLC register start number	0 to 65535	1100	0
0385	901	PLC response wait time	100 to 3000 ms	250	1
0386	902	PLC communication start wait time	1 to 255 seconds	5	1
0387	903	Reservation (Not used)		0	0
0388	904	Reservation (Not used)		0	0
0389	905	Monitor item 1	Refer to Monitor item 1 (P.13-29)	511	0
038A	906	Monitor item 2	Refer to Monitor item 2 (P.13-29)	0	0
038B	907	Monitor item 3	Refer to Monitor item 3 (P.13-30)	0	0
038C	908	Reservation (Not used)		0	0
038D	909	Reservation (Not used)		0	0
038E	910	Setting item 1	Refer to Setting item 1 (P.13-30)	0	0
038F	911	Setting item 2	Refer to Setting item 2 (P.13-31)	0	0
0390	912	Setting item 3	Refer to Setting item 3 (P.13-31)	0	0
0391	913	Setting item 4	Refer to Setting item 4 (P.13-32)	0	0
0392	914	Setting item 5	Refer to Setting item 5 (P.13-32)	0	0
0393	915	Setting item 6	Refer to Setting item 6 (P.13-33)	0	0
0394	916	Setting item 7	Refer to Setting item 7 (P.13-33)	2	0

(*) 0: The value set in each module is a valid item.

1: The value set in the control module QTC1-4P is a valid item.

(1) Communication management module number setting

Set the number of modules managed by the master module.

Set the number of modules including the master module.

(2) PLC register start number

Set the start number of the register used in PLC communication. It is fixed to the D register.

Please set in the range of 0 to 65535.

For A compatible 1C frame AnA/AnU, set within the range of 0 to 8191.

A maximum of 170 registers are used per control module. [System area: 10 registers, Monitor item: 80 registers (20 × 4ch), Setting item: 80 registers (20 × 4ch)]

When using multiple control modules, be careful not to duplicate them.

(3) PLC response wait time

Set the retransmission interval time when there is no response from the PLC.

Please set in the range of 100 to 3000 ms.

(4) PLC communication start wait time

Set the time from when the control module QTC1-4P power is turned on until communication is started to the PLC.

Please set in the range of 1 to 255 seconds.

(5) Monitor item 1 to 3

Click [Monitor item] tab or [Next] button.

Displays the Monitor item screen.

Select any combination of monitor item 1 to 3.

The maximum number of items to select is 20.

This applies to all channels within the module; any selections exceeding this limit will be invalid.

Monitor item 1 (Initial value: 511)

Bit	No.	Selection	Description
0	01	1	CH1, CH2 Pulse integrated value
1	02	1	CH3, CH4 Pulse integrated value
2	03	1	CH5, CH6 Pulse integrated value
3	04	1	CH7, CH8 Pulse integrated value
4	05	1	CH9, CH10 Pulse integrated value
5	06	1	CH11, CH12 Pulse integrated value
6	07	1	CH13, CH14 Pulse integrated value
7	08	1	CH15, CH16 Pulse integrated value
8	09	1	Input state, Status 1, Status 2, Status 3
9	10	0	Not used
10	11	0	Not used
11	12	0	Not used
12	13	0	Not used
13	14	0	Not used
14	15	0	Not used
15	16	0	Not used

Monitor item 2 (Initial value: 0)

Bit	No.	Selection	Description
0	17	0	Not used
1	18	0	Not used
2	19	0	Not used
3	20	0	Not used
4	21	0	Not used
5	22	0	Not used
6	23	0	Not used
7	24	0	Not used
8	25	0	Not used
9	26	0	Not used
10	27	0	Not used
11	28	0	Not used
12	29	0	Not used
13	30	0	Not used
14	31	0	Not used
15	32	0	Not used

Monitor item 3 (Initial value: 0)

Bit	No.	Selection	Description
0	33	0	Not used
1	34	0	Not used
2	35	0	Not used
3	36	0	Not used
4	37	0	Not used
5	38	0	Not used
6	39	0	Total energizing time
7	40	0	Not used
8	41	0	Not used
9	42	0	Not used
10	43	0	Not used
11	44	0	Not used
12	45	0	Not used
13	46	0	Not used
14	47	0	Not used
15	48	0	Not used

(6) Setting item 1 to 7

Click [Setting item] tab or [Next] button.

Displays the Setting item screen.

Select any combination of setting item 1 to 7.

The maximum number of items to select is 20.

This applies to all channels within the module; any selections exceeding this limit will be invalid.

Setting item 1 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	1	0	Not used
1	2	0	Not used
2	3	0	Not used
3	4	0	Not used
4	5	0	Not used
5	6	0	Not used
6	7	0	Not used
7	8	0	Not used
8	9	0	Not used
9	10	0	Not used
10	11	0	Not used
11	12	0	Not used
12	13	0	Not used
13	14	0	Not used
14	15	0	Not used
15	16	0	Not used

Setting item 2 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	17	0	Not used
1	18	0	Not used
2	19	0	Not used
3	20	0	Not used
4	21	0	Not used
5	22	0	Not used
6	23	0	Not used
7	24	0	Not used
8	25	0	Not used
9	26	0	Not used
10	27	0	Not used
11	28	0	Not used
12	29	0	Not used
13	30	0	Not used
14	31	0	Not used
15	32	0	Not used

Setting item 3 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	33	0	Not used
1	34	0	Not used
2	35	0	Not used
3	36	0	Not used
4	37	0	Not used
5	38	0	Not used
6	39	0	Not used
7	40	0	Not used
8	41	0	Not used
9	42	0	Not used
10	43	0	Not used
11	44	0	Not used
12	45	0	Not used
13	46	0	Not used
14	47	0	Not used
15	48	0	Not used

Setting item 4 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	49	0	Not used
1	50	0	Not used
2	51	0	Not used
3	52	0	Not used
4	53	0	Not used
5	54	0	Not used
6	55	0	Not used
7	56	0	Not used
8	57	0	Not used
9	58	0	Not used
10	59	0	Not used
11	60	0	Not used
12	61	0	Not used
13	62	0	Not used
14	63	0	Not used
15	64	0	Not used

Setting item 5 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	65	0	Not used
1	66	0	CH1 to CH4 Input method selection
2	67	0	CH5 to CH8 Input method selection
3	68	0	CH9 to CH12 Input method selection
4	69	0	CH13 to CH16 Input method selection
5	70	0	CH1 to CH4 Pulse integration method selection
6	71	0	CH5 to CH8 Pulse integration method selection
7	72	0	CH9 to CH12 Pulse integration method selection
8	73	0	CH13 to CH16 Pulse integration method selection
9	74	0	CH1 to CH4 Startup pulse integration selection
10	75	0	CH5 to CH8 Startup pulse integration selection
11	76	0	CH9 to CH12 Startup pulse integration selection
12	77	0	CH13 to CH16 Startup pulse integration selection
13	78	0	Not used
14	79	0	Not used
15	80	0	Not used

Setting item 6 (Initial value: 0)

Bit	Setting request item number	Selection	Description
0	81	0	CH1, CH2 Pulse integrated maximum value
1	82	0	CH3, CH4 Pulse integrated maximum value
2	83	0	CH5, CH6 Pulse integrated maximum value
3	84	0	CH7, CH8 Pulse integrated maximum value
4	85	0	CH9, CH10 Pulse integrated maximum value
5	86	0	CH11, CH12 Pulse integrated maximum value
6	87	0	CH13, CH14 Pulse integrated maximum value
7	88	0	CH15, CH16 Pulse integrated maximum value
8	89	0	CH1 to CH4 Pulse integrated minimum value
9	90	0	CH5 to CH8 Pulse integrated minimum value
10	91	0	CH9 to CH12 Pulse integrated minimum value
11	92	0	CH13 to CH16 Pulse integrated minimum value
12	93	0	CH1 to CH4 Pulse division ratio setting
13	94	0	CH5 to CH8 Pulse division ratio setting
14	95	0	CH9 to CH12 Pulse division ratio setting
15	96	0	CH13 to CH16 Pulse division ratio setting

Setting item 7 (Initial value: 2)

Bit	Setting request item number	Selection	Description
0	97	0	Communication response delay time setting
1	98	1	Digital input acquisition cycle setting
2	99	0	Pulse integrated value reset
3	100	0	Not used
4	101	0	Not used
5	102	0	Not used
6	103	0	Not used
7	104	0	Not used
8	105	0	Not used
9	106	0	Not used
10	107	0	Not used
11	108	0	Non-volatile IC memory save selection
12	109	0	Not used
13	110	0	Not used
14	111	0	Not used
15	112	0	Not used

(7) Control module power OFF → ON

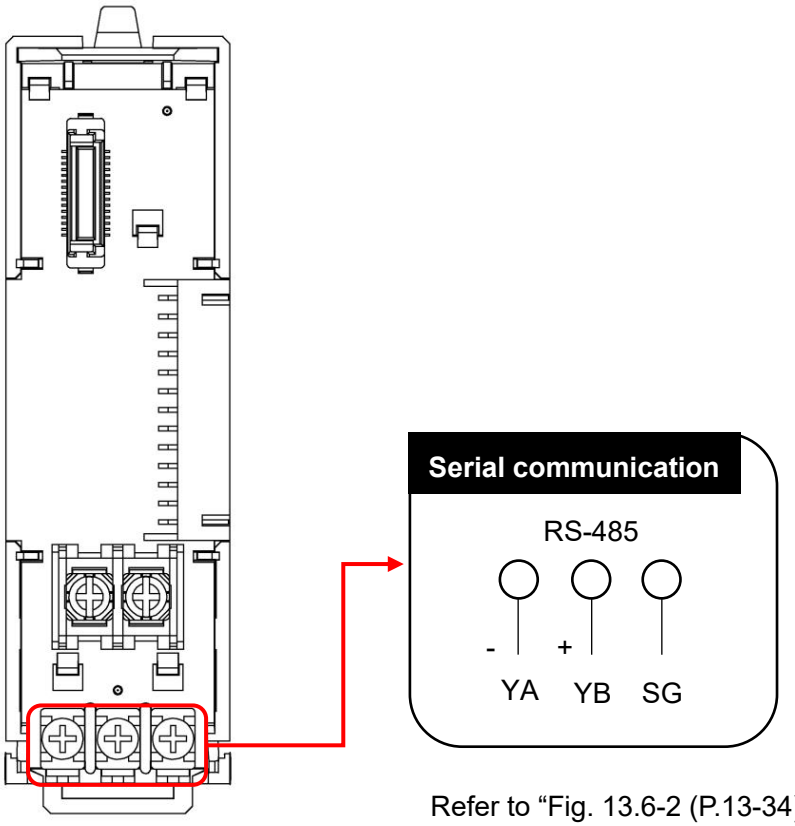
Turn the control module power off and then on. The set value becomes effective.

This completes the specification setting of QPM1-PI16□0□.

13.6 Connection of PLC and Control Module QTC1-4P

⚠ Warning

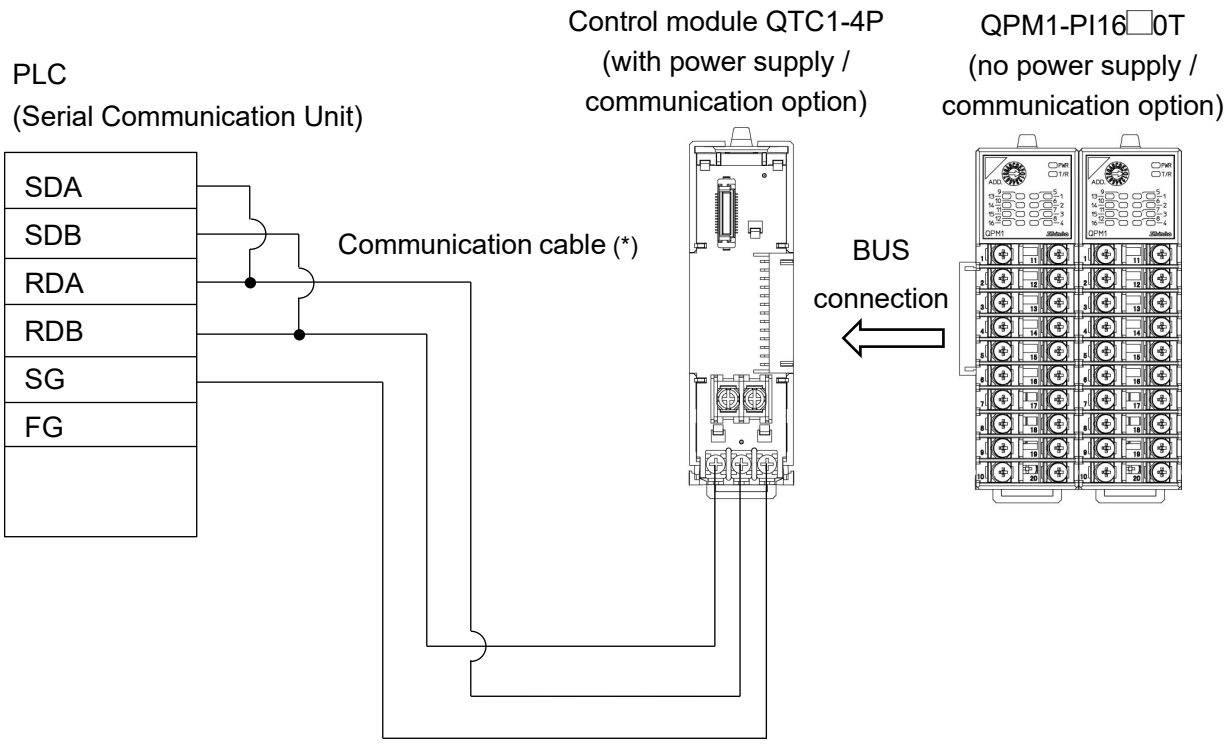
Turn off the power supply to this instrument before wiring.
If you work while the power is supplied, you may get an electric shock, which could result in an accident resulting in death or serious injury.



Refer to “Fig. 13.6-2 (P.13-34)” for the serial communication wiring.

(Fig. 13.6-1)

Example of connection between PLC and QTC1-4P, QPM1-PI16□0T



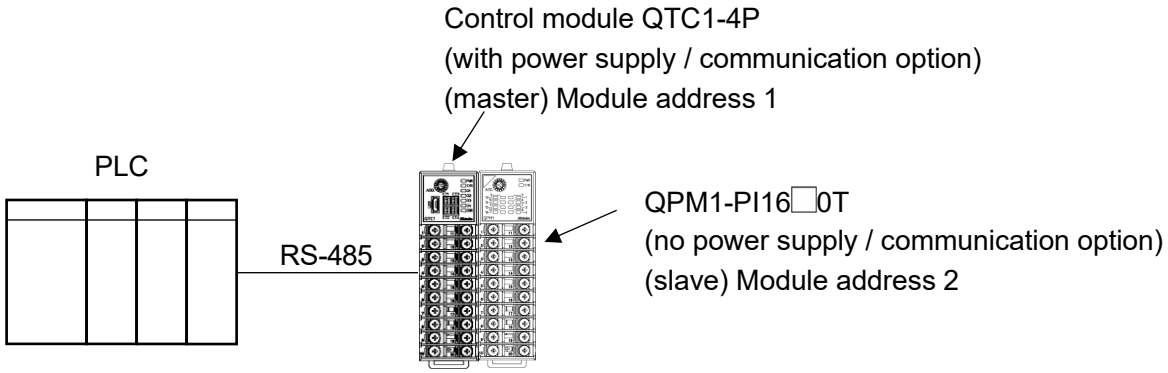
(*): For communication cables, please contact the store where you purchased the product or our sales office.

(Fig. 13.6-2)

13.7 Operation

The following explains how to connect two modules to the PLC.

Connection example of PLC and QTC1-4P, QPM1-PI16□0T

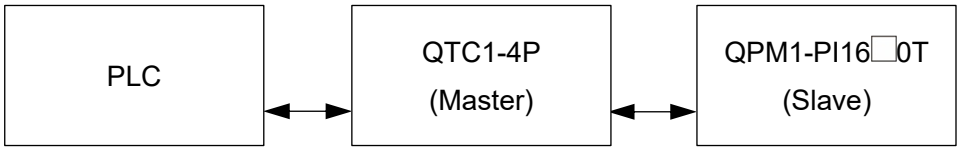


(Fig. 13.7-1)

13.7.1 Communication Procedure

(1) The control module QTC1-4P becomes the master and collects the valid monitor items and setting items of the QPM1-PI16□0T (slave).

(2) After the PLC communication start waiting time has elapsed, the control module QTC1-4P periodically writes the item selected in the monitor items to the PLC register.
Also, the item selected from the setting items is read from the PLC register in response to a setting request.



All items

Reading item:
Item selected in Monitor item.
Writing item:
Item selected in Setting item at startup
Items set by the Setting request item number after startup

(Fig. 13.7.1-1)

13.7.2 PLC Communication Data Map

Shown below is the PLC communication data map when the initial setting example for PLC communication is set.

Example of initial setting for PLC communication

MODBUS address		Name	QTC1-4P (Master) setting	QAM1-40 (Slave) setting
HEX	DEC			
0384	900	PLC register start number	1000	1100
0385	901	PLC response wait time	250	250
0386	902	PLC communication start wait time	5	5
0387	903	Reservation (Not used)	0	0
0388	904	Reservation (Not used)	0	0
0389	905	Monitor item 1	31	511
038A	906	Monitor item 2	0	0
038B	907	Monitor item 3	0	0
038C	908	Reservation (Not used)	0	0
038D	909	Reservation (Not used)	0	0
038E	910	Setting item 1	57827	0
038F	911	Setting item 2	2721	0
0390	912	Setting item 3	0	0
0391	913	Setting item 4	0	0
0392	914	Setting item 5	0	0
0393	915	Setting item 6	0	0
0394	916	Setting item 7	2	2

PLC data register layout

	QTC1-4P (Master)	QAM1-40 (Slave)
Information between QTC1-4 and PLC (system data)	1000 to 1009	1100 to 1109
Monitor item	1010 to 1029(*)	1110 to 1142(*)
Setting item	1030 to 1085(*)	1146(*)

(*) The PLC data registers are assigned the monitor items and configuration items selected in the console software.

Monitor items are assigned starting from the first address, and configuration items are assigned after them.

Therefore, the register addresses for each item vary depending on the number of items selected.

Details of information (system data) between control module QTC1-4P and PLC

Control module QTC1-4P (Master)

Data	PLC data register	Attribute	Description
Communication status	1000	RO	0: QTC1-4P collecting data 1: QTC1-4P completes data collection (Startup: Initial setting value of each slave)
QTC1-4P - PLC Normal communication monitor	1001	RO	Increment counter Repeat 0 to 65535 → 0 to 65535
QTC1-4P Error code	1002	RO	B0: PLC register R/W error 0: Normal 1: Error B1: QTC1-4P communication error 0: Normal 1: Error B2: QTC1-4P Negative acknowledgement when setting0: 0: Normal 1: Error (It will be cleared when B0 of 1006 is cleared.)
Setting request monitor	1003	RO	B0: Setting (Reflect and set to B0 of 1006.) B1: Monitoring (Reflect and set until B1 of 1006 is cleared.)
Reservation	1004	RO	
Setting request item number	1005	R/W	0: All items selected in setting items 1 to 7 1 to 112: Items selected in setting items 1 to 7 (1 data) Only the data (1 data) of the selected item will be read or written. However, because communication with the PLC is a batch process, all the selected items are read or written.
Setting request command (*)	1006	R/W	B0: Setting request (PLC → QTC1-4P) QTC1-4P requests to read the setting item data from the PLC register. B1: Monitor request (QTC1-4P → PLC) QTC1-4P requests to write the setting item data to the PLC register. After the setting request or monitor request is completed, QTC1-4P clears each bit.
Reservation	1007	R/W	
Reservation	1008	R/W	
Reservation	1009	R/W	

(*): If the setting request and the monitor request are set at the same time, processing is performed in the following procedure: ① setting request (QTC1-4P reads PLC register data), ② monitor request (writing data to PLC register).
If the setting request is set during the monitor request, the monitor request is discarded and the monitoring request is made again after the setting request.

QPM1-PI16□0T (Slave)

Data	PLC data register	Attribute	Description
Communication status	1100	RO	0: QTC1-4P collecting data of QPM1-PI16□0T 1: QTC1-4P completes data collection of QPM1-PI16□0T (Startup: Initial setting value of each slave)
QTC1-4P - PLC Normal communication monitor	1101	RO	Increment counter Repeat 0 to 65535 → 0 to 65535
QTC1-4P Error code	1102	RO	B0: PLC register R/W error 0: Normal 1: Error B1: Communication error between QTC1-4P and QAM1-40 0: Normal 1: Error B2: Negative acknowledgement when setting QTC1-4P to QPM1-PI16□0T (It will be cleared when B0 of 1006 is cleared.) 0: Normal 1: Error
Setting request monitor	1103	RO	B0: Setting (Reflect and set to B0 of 1006.) B1: Monitoring (Reflect and set until B1 of 1006 is cleared.)
Reservation	1104	RO	
Setting request item number	1105	R/W	0: All items selected in setting items 1 to 7 1 to 112: Items selected in setting items 1 to 7 (1 data) Only the data (1 data) of the selected item will be read or written. However, because communication with the PLC is a batch process, all the selected items are read or written.
Setting request command (*)	1106	R/W	B0: Setting request (PLC → QTC1-4P) QTC1-4P requests to read the setting item data from the PLC register. B1: Monitor request (QTC1-4P → PLC) QTC1-4P requests to write the setting item data to the PLC register. After the setting request or monitor request is completed, QTC1-4P clears each bit.
Reservation	1107	R/W	
Reservation	1108	R/W	
Reservation	1109	R/W	

(*): If the setting request and the monitor request are set at the same time, processing is performed in the following procedure: ① setting request (QTC1-4P reads PLC register data), ② monitor request (writing data to PLC register).
If the setting request is set during the monitor request, the monitor request is discarded and the monitoring request is made again after the setting request.

Details of monitor item and setting item between control module QTC1-4 and PLC

Control module QTC1-4P (Master)

Data item	Channel	PLC data register	Attribute	Data
PV reading (Including difference)	CH1 CH2 CH3 CH4	1010 1011 1012 1013	RO	Reading value (decimal point omitted)
MV reading	CH1 CH2 CH3 CH4	1014 1015 1016 1017	RO	Output low limit to Output high limit
SV reading	CH1 CH2 CH3 CH4	1018 1019 1020 1021	RO	Scaling low limit to Scaling high limit
Status flag 1 reading	CH1 CH2 CH3 CH4	1022 1023 1024 1025	RO	B0: Control Allowed/Prohibited 0: Prohibited 1: Allowed B1: AT Perform/Cancel 0: Cancel 1: Perform B2: Auto/Manual control 0: Automatic 1: Manual B3: Control output 0: OFF 1: ON B4: Input error (Overscale) 0: Normal 1: Error B5: Input error (Underscale) 0: Normal 1: Error B6: Alarm 1 output 0: OFF 1: ON B7: Alarm 2 output 0: OFF 1: ON B8: Alarm 3 output 0: OFF 1: ON B9: Alarm 4 output 0: OFF 1: ON B10: Loop brake alarm output 0: OFF 1: ON B11: Heater burnout alarm output 0: OFF 1: ON B12: Input difference 0: Within range 1: Out of range B13: Not used (indefinite) B14: Power supply identification 0: 24 V DC 1: USB bus power B15: Non-volatile IC memory error 0: Normal 1: Error

Data item	Channel	PLC data register	Attribute	Data
Status flag 2 reading	CH1 CH2 CH3 CH4	1026 1027 1028 1029	RO	B0: Auto balance control 0: None 1: During auto balance control B1 to B3: Not used (indefinite) B4: Cold junction error 0: Normal 1: Error B5: Sensor error 0: Normal 1: Error B6: ADC error 0: Normal 1: Error B7: Host setting value change flag 0: Without flag 1: With flag B8: USB setting value change flag 0: Without flag 1: With flag B9 to B11: Not used (indefinite) B12 to B14: Peak power suppress function output status flag 0: Output enabled. 1: Output standby 2: Output enabled in next cycle 3: Output enabled (MV=0 %) B15: Not used (indefinite)
Control Allowed/Prohibited selection	CH1 CH2 CH3 CH4	1030 1031 1032 1033	R/W	0: Prohibited 1: Allowed
AT Perform/Cancel selection	CH1 CH2 CH3 CH4	1034 1035 1036 1037	R/W	0: AT Cancel 1: AT Perform
SV setting	CH1 CH2 CH3 CH4	1038 1039 1040 1041	R/W	Scaling low limit to Scaling high limit
Proportional band setting	CH1 CH2 CH3 CH4	1042 1043 1044 1045	R/W	1 to Input span °C (°F) or 0.1 to Input span °C (°F) when direct current and DC voltage input 0.10 to 100.00%
Integration time setting	CH1 CH2 CH3 CH4	1046 1047 1048 1049	R/W	0 to 3600 seconds or 0.0 to 2000.0 seconds when "2: Slow-PID control" is selected in control action selection. 1 to 3600 seconds or 0.1 to 2000.0 seconds
Derivative time setting	CH1 CH2 CH3 CH4	1050 1051 1052 1053	R/W	0 to 3600 seconds or 0.0 to 2000.0 seconds

Data item	Channel	PLC data register	Attribute	Data
Alarm 1 action selection	CH1 CH2 CH3 CH4	1054 1055 1056 1057	R/W	0: No action 1: High limit alarm 2: Lowh limit alarm 3: High/Low limits alarm 4: High/Low limit s range 5: Process High alarm 6: Process low alarm 7: High limit with standby 8: Low limit with standby 9: High/Low limits alarm with 10: High/Low limits alarm individually 11: High/Low limit s range alarm individually 12: High/Low limits alarm with standby individually
Alarm 2 action selection	CH1 CH2 CH3 CH4	1058 1059 1060 1061	R/W	
Alarm 3 action selection	CH1 CH2 CH3 CH4	1062 1063 1064 1065	R/W	
Alarm 4 action selection	CH1 CH2 CH3 CH4	1066 1067 1068 1069	R/W	
Alarm 1 value setting	CH1 CH2 CH3 CH4	1070 1071 1072 1073	R/W	Refer to “Alarm 1 to 4 value setting range table”.
Alarm 2 value setting	CH1 CH2 CH3 CH4	1074 1075 1076 1077	R/W	
Alarm 3 value setting	CH1 CH2 CH3 CH4	1078 1079 1080 1081	R/W	
Alarm 4 value setting	CH1 CH2 CH3 CH4	1082 1083 1084 1085	R/W	

Alarm 1 to 4 value setting range table

Alarm type	Setting range
No action	
High limit alarm	-(Input span) to Input span (*1)
Lowh limit alarm	-(Input span) to Input span (*1)
High/Low limits alarm	0 to Input span (*1)
High/Low limit s range	0 to Input span (*1)
Process High alarm	Input range lower limit to Input range high limit (*2)
Process low alarm	Input range lower limit to Input range high limit (*2)
High limit with standby	-(Input span) to Input span (*1)
Low limit with standby	-(Input span) to Input span (*1)
High/Low limits alarm with	0 to Input span (*1)
High/Low limits alarm individually	0 to Input span (*1)
High/Low limit s range alarm individually	0 to Input span (*1)
High/Low limits alarm with standby individually	0 to Input span (*1)

(*1): When direct current input and DC voltage input, the input span is the scaling width.

(*2): When direct current input and DC voltage input, the Input range lower limit is the scaling lower limit, and the Input range high limit is the scaling high limit.

Details of monitor item and setting item between QPM1-PI16□PT and PLC

QPM1-PI16□PT (Slave)

Monitor item

Up to 20 items can be selected.

Data item	PLC data register	Attribute	Data
CH1, CH2 Pulse integrated value	1110	RO	Reading value
CH3, CH4 Pulse integrated value	1114	RO	
CH5, CH6 Pulse integrated value	1118	RO	
CH7, CH8 Pulse integrated value	1122	RO	
CH9, CH10 Pulse integrated value	1126	RO	
Ch11, Ch12 Pulse integrated value	1130	RO	
CH13, CH14 Pulse integrated value	1134	RO	
CH15, CH16 Pulse integrated value	1138	RO	
Input state, Status 1, Status 2, Status 3	1142	RO	Input state B0: CH1 to B15: CH16 bit allocation bit 0: OFF/1: ON Status 1 B0: Input error (CH1 to CH8) 0: Normal/1: Error B1: Input error (CH9 to CH16) 0: Normal/1: Error B2 to B14: Not used (indefinite) B15: Non-volatile IC memory error 0: Normal/1: Error Status 2 Pulse integrated state B0: CH1 to B15: CH16 bit allocation 0: Normal/1: Overflow Status 3 Not used (indefinite)

Setting item

Up to 20 items can be selected.

Data item	PLC data register	Attribute	Data
Digital input acquisition cycle setting	1146	R/W	1 to 100 ms (For pulse input, fixed at 0.2 ms)

13.7.1 Data Exchange between Control Module QTC1 and P-PLC

Data transfer between the control module QTC1-4P and PLC is performed by the setting request item number and setting request command.

(1) Setting request item number

Set whether to transfer the data of all items selected in setting item 1 to 7 selection or only the data (1 data) of the selected item.

0: Transfers the data of all items selected in setting item 1 to 7 selection.

1 to 112: Transfers only the data (1 data) of the item selected in setting item 1 to 7 selection.

(2) Setting request command

The setting request command includes setting request and monitor request.

B0: Setting request (PLC → QTC1-4P)

The control module QTC1-4P is a command to request to read the data of the setting item of the PLC register.

B1: Monitor request (QTC1-4P → PLC)

The control module QTC1-4P is a command to request to write the data of the setting item of the PLC register.

If setting request and monitor request are set at the same time, processing is performed in the order of setting request (QTC1-4P reads the data of the setting item in the PLC register) and then monitor request (writing the data of the setting item in the PLC register).

If a setting request is set during monitor request, the monitor request is discarded and the monitor request is made again after the setting request.

13.7.2 Data Settings

⚠ Caution

When setting data, first write all the setting item data to the PLC register.
Note that if you change the setting items of the QPM1-PI16□0T without writing all the setting item data, it may be overwritten with an undefined value and malfunction may occur.

Data setting procedure
When setting the output volume of the analog I/O module QAM1-40

(1) Set 0 to the setting request item number
To write all the setting item data to the PLC register, set 0 to 1105 (setting request item number).

(2) Set B1 (monitor request) of the setting request command
Set 1 (decimal number: 2) to B1 (monitor request) of 1106 (setting request command).
The control module QTC1-4P starts writing the setting item data to the PLC register.

(3) Check B1 (monitor request) of the setting request command
When the writing of the setting item data to the PLC register is completed, B1 (monitor request) of 1106 (setting request command) is cleared.

(4) Set data
Set the digital input acquisition cycle in PLC register 1146 (Digital Input Acquisition Cycle Setting).

(5) Set 5 to the setting request item number
To read the data for the “digital input acquisition cycle setting” in the PLC register, set 1105 (setting request item number) to 98.

(6) Set B0 (setting request) of the setting request command
Set 0 (decimal number: 1) to B0 (monitor request) of 1106 (setting request command).
The control module QTC1-4P starts reading the setting item data of the PLC register.

(7) Check B0 (monitor request) of the setting request command
When the reading of the setting item data to the PLC register is completed, B0 (monitor request) of 1106 (setting request command) is cleared.

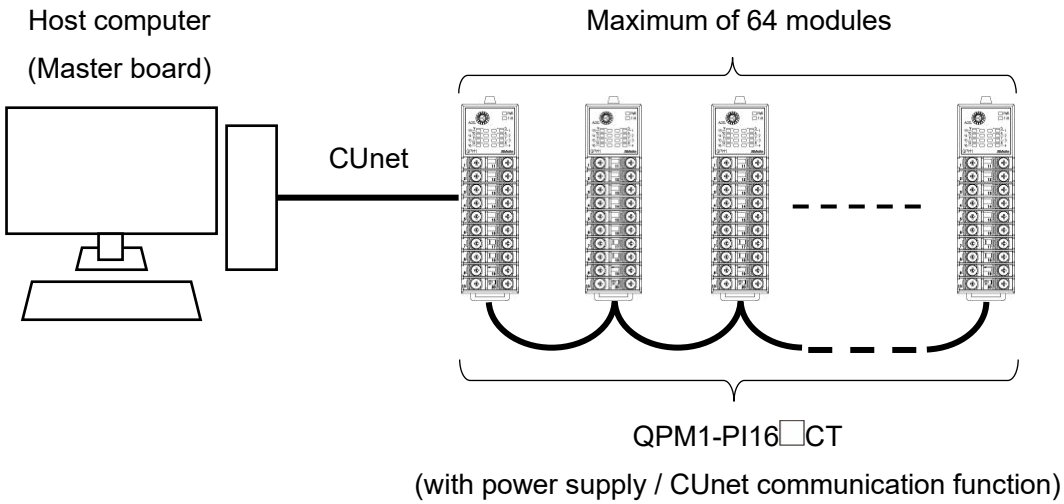
14 CUnet Communication

CUnet communication writes the reading value from the module to the global memory (GM) specified by the station address (SA).

It reads the setting values from the master address (DOSA) and sets them to the module.

The setting value can also be changed by using the mail function of CUnet.

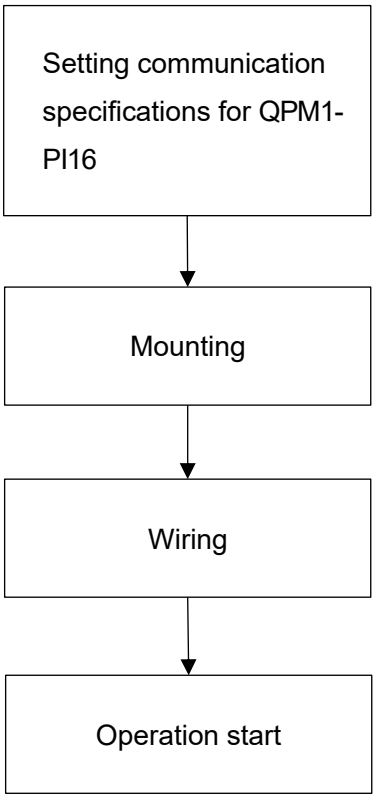
Configuration example of host computer (master board) and QPM1-PI16□CT



(Fig. 14-1)

14.1 Flow of Before Operation

The flow of operation when using CUnet communication is shown below.



Set the station address (SA), communication speed, master address (DOSA), and number of occupied (OWN) items for the QPM1-PI16.
Refer to “14.2 Setting CUnet communication specifications (P.14-3)”.

Mount the QPM1-PI16 to the DIN rail.
Refer to “14.3 Mounting (P.14-6)”.

Wire the QPM1-PI16.
Refer to “14.4 Wiring (P.14-7)”.

CUnet communication is performed and operation is started.

(Fig. 14.1-1)

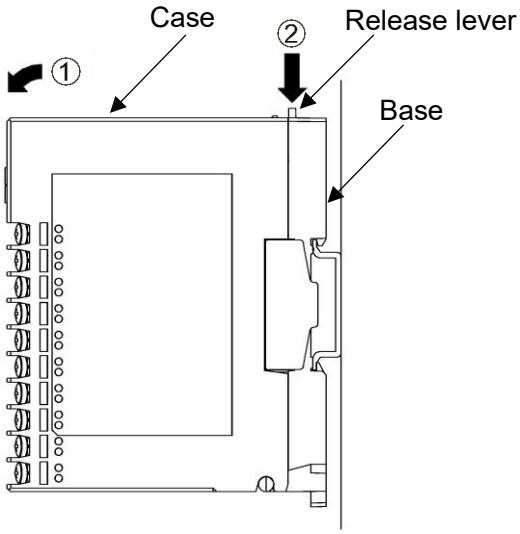
14.2 Setting CUnet communication specifications

The CUnet communication specifications are set by the dip switches (SW10, SW11) on the base part.

(1) Case removal

① Push the release lever on the top of this instrument to unlock it.

② Remove the case.

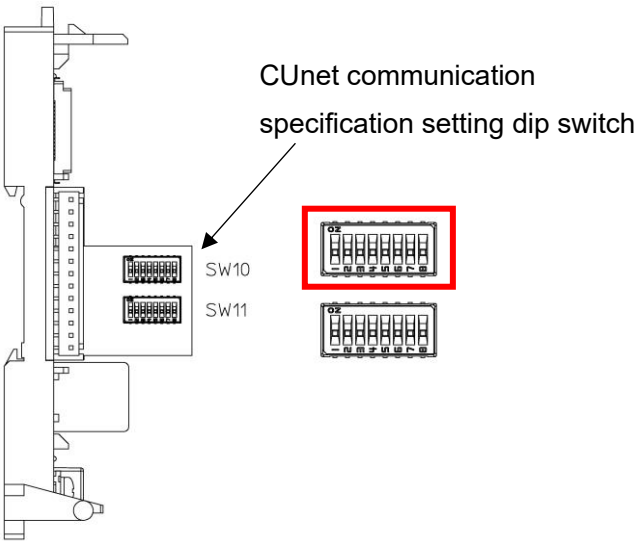


(Fig. 14.2-1)

(2) Station address (SA), communication speed setting (SW10)

> **⚠ Caution**
>
> Please set the station address (SA) so that there are no duplicate addresses.

The station address (SA) and communication speed are set by DIP switch (SW10).



(Fig. 14.2-2)

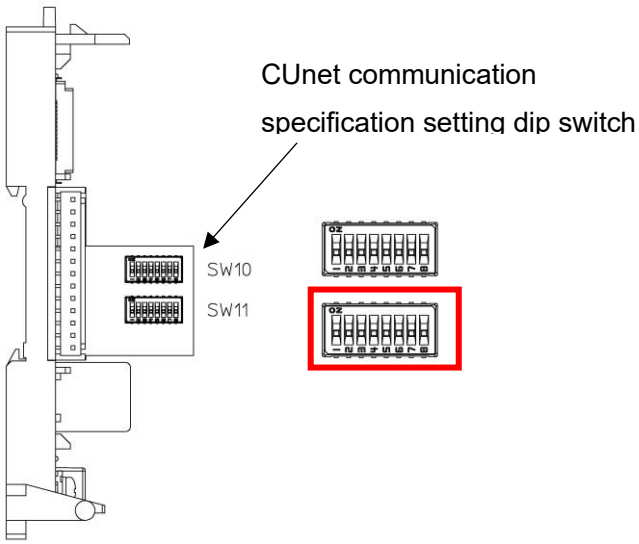
Set the station address (SA) and communication speed.

The setting range of the station address (SA) is 00 to 63.

No.	Setting item	Status	Factory default
1	Station address setting	Bit0 ON: Enable, OFF: Disable	Disable
2		Bit1 ON: Enable, OFF: Disable	Disable
3		Bit2 ON: Enable, OFF: Disable	Disable
4		Bit3 ON: Enable, OFF: Disable	Disable
5		Bit4 ON: Enable, OFF: Disable	Disable
6		Bit5 ON: Enable, OFF: Disable	Disable
7	Communication speed setting	7: OFF 8: OFF 12 Mbps 7: ON 8: OFF 6 Mbps 7: OFF 8: ON 3 Mbps 7: ON 8: ON Disable (12 Mbps)	12 Mbps
8			

(3) Master address (DOSA) and number of occupied (OWN) items selection (SW11)

The master address (DOSA) and the number of occupied (OWN) items are set by DIP switch (SW11).



(Fig. 14.2-3)

Set the master address (DOSA) and the number of occupied (OWN) items.

Set which master global memory (GM) area data is output to the analog output terminal.

The setting range of the master address (DOSA) is 00 to 63.

No.	Setting item	Status	Factory default
1	Master address setting	Bit0 ON: Enable, OFF: Disable	Disable
2		Bit1 ON: Enable, OFF: Disable	Disable
3		Bit2 ON: Enable, OFF: Disable	Disable
4		Bit3 ON: Enable, OFF: Disable	Disable
5		Bit4 ON: Enable, OFF: Disable	Disable
6		Bit5 ON: Enable, OFF: Disable	Disable
7	Number of occupied (OWN) items selection(*)	7: OFF 8: OFF 2 items 7: ON 8: OFF 3 items 7: OFF 8: ON 5 items 7: ON 8: ON 9 items	2 items
8			

(*): The following items are allocated to global memory for each module.

Number of occupied (OWN) items	QPM1-PI16	
	Read item	Write item
2	Each state, CH1 and CH2 Pulse integrated value 0408-040B, 03E8-03EB	
3	Each state, CH1 to CH4 Pulse integrated value 0408-040B, 03E8-03EF	
5	Each state, CH1 to CH8 Pulse integrated value 0408-040B, 03E8-03F7	
9	Each state, CH1 to CH16 Pulse integrated value 0408-040B, 03E8-0407	

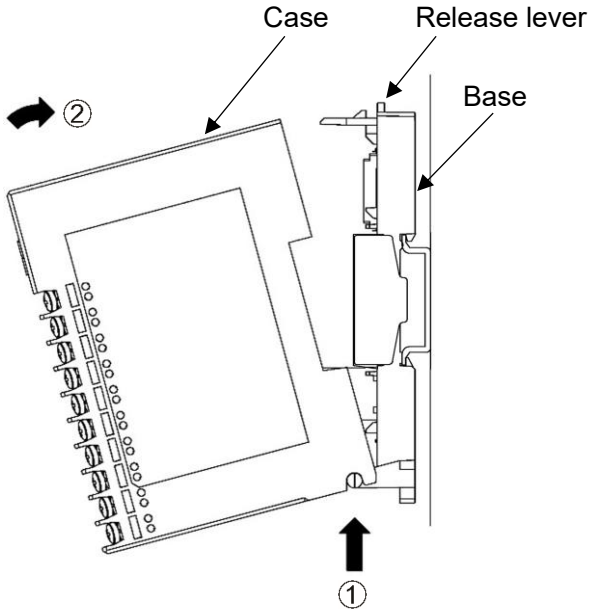
The second line of the read items contains the communication data items.

Shaded area is invalid because there is no allocation (no area is allocated in global memory)

(4) Case mounting

① Hook the case on the lower part ① of this instrument.

② Mount the case so that the lower part ① of this instrument is the fulcrum and covers the release lever. There is a clicking sound.



(Fig. 14.2-4)

14.3 Mounting

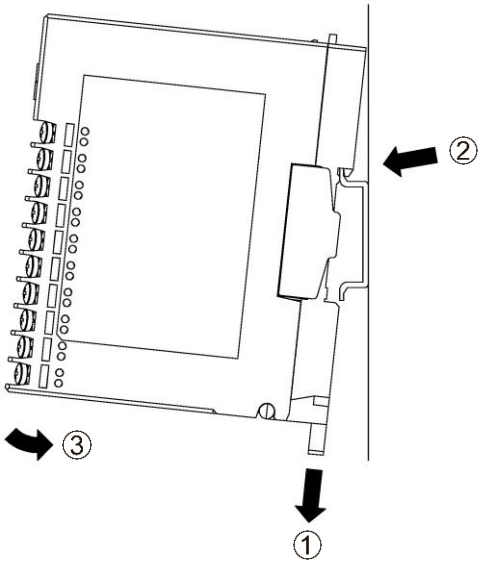
Mounting to the DIN rail

① Lower the lock lever of this instrument. (The lock lever of this instrument has a spring structure, but if lower it in the direction of the arrow until it stops, it will be locked in that position.)

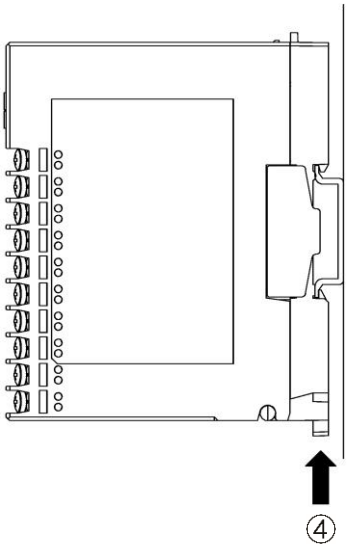
② Hook the part ② of this instrument onto the top of the DIN rail.

③ Insert the lower part of this instrument with the part ② as a fulcrum.

④ Raise the lock lever of this instrument.
Make sure it is fixed to the DIN rail.



(Fig. 14.3-1)

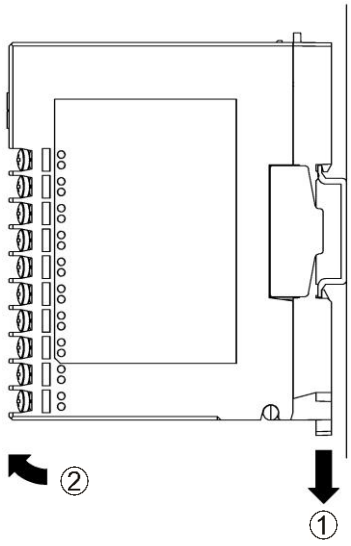


(Fig. 14.3-2)

Removal from the DIN rail

① Insert a flat blade screwdriver into the lock lever of this instrument and lower the lock lever until it stops.

② Remove this instrument from the DIN rail by lifting it from below.



(Fig. 14.3-3)

14.4 Wiring

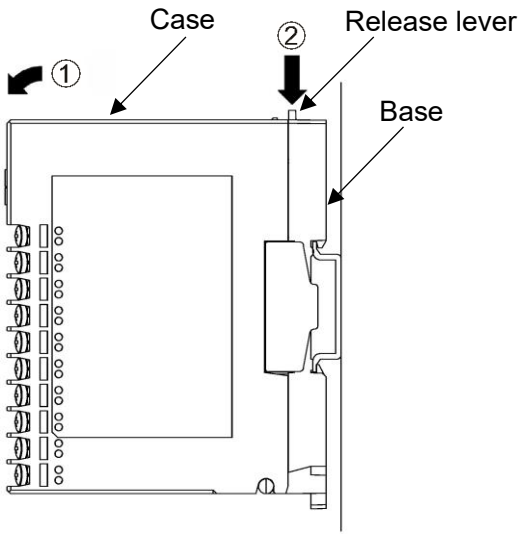
14.4.1 Wiring for Power Supply and Communication

The terminal block for power supply and communication is located on the base of this instrument. Wiring by the following procedure.

(1) Case removal

① Push the release lever on the top of this instrument to unlock it.

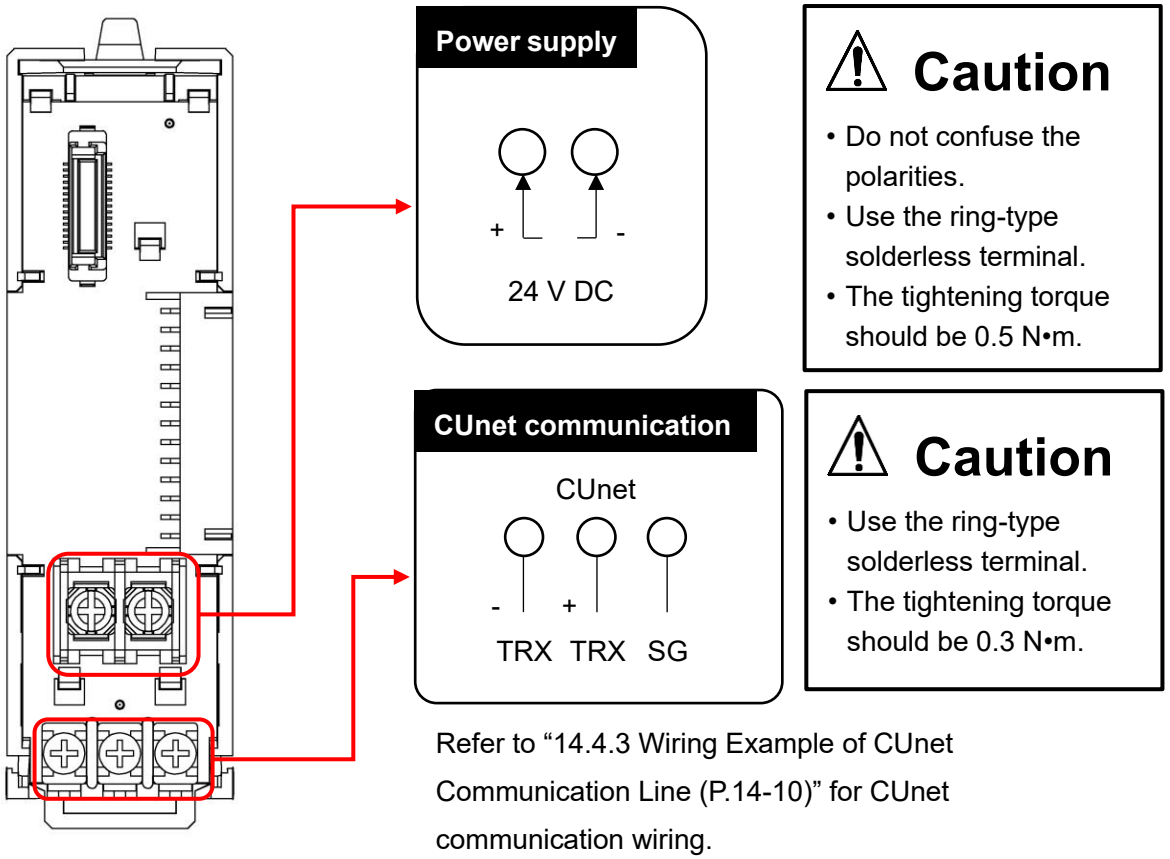
② Remove the case.



(Fig. 14.4.1-1)

(2) Wiring

CUnet communication



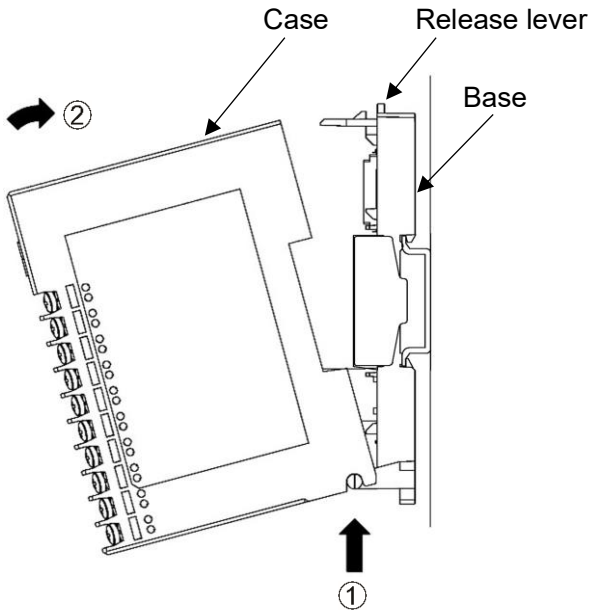
Refer to “14.4.3 Wiring Example of CUnet Communication Line (P.14-10)” for CUnet communication wiring.

(Fig. 14.4.1-2)

(3) Case mounting

① Hook the case on the lower part ① of this instrument.

② Mount the case so that the lower part ① of this instrument is the fulcrum and covers the release lever.
There is a clicking sound.



(Fig. 14.4.1-3)

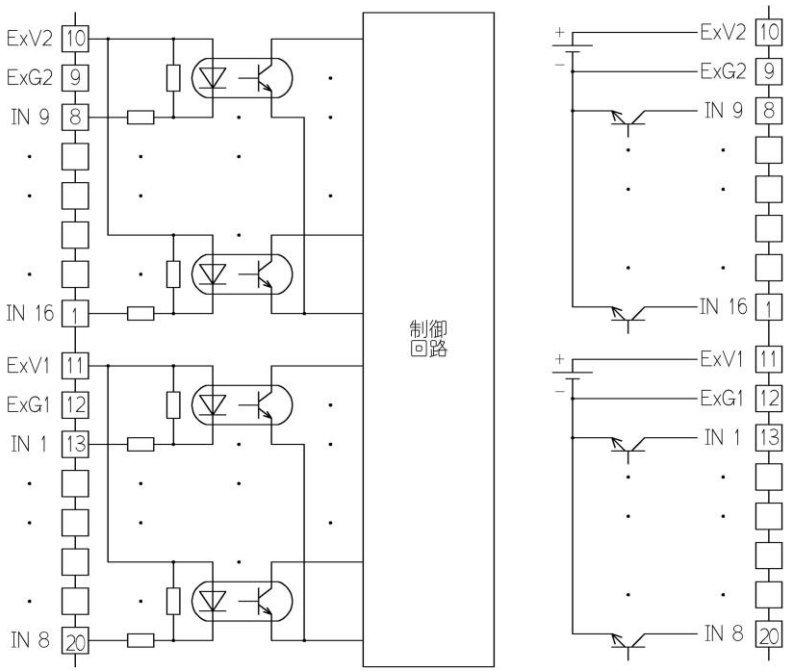
14.4.2 Wiring for Input

⚠ Caution

- Please note that terminal No.1 to 10 and terminal No.11 to 20 have different terminal arrangements.
- The tightening torque should be 0.63 N•m.

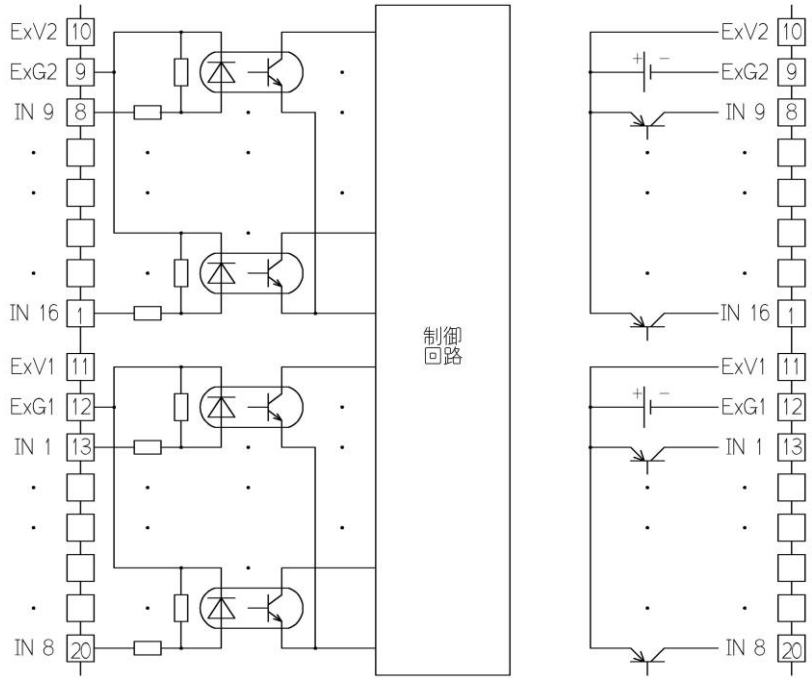
(1) Circuit configuration and wiring examples for pulse input module

QPM1-PI16A□□



(Fig. 14.4.2-1)

QPM1-PI16B□□

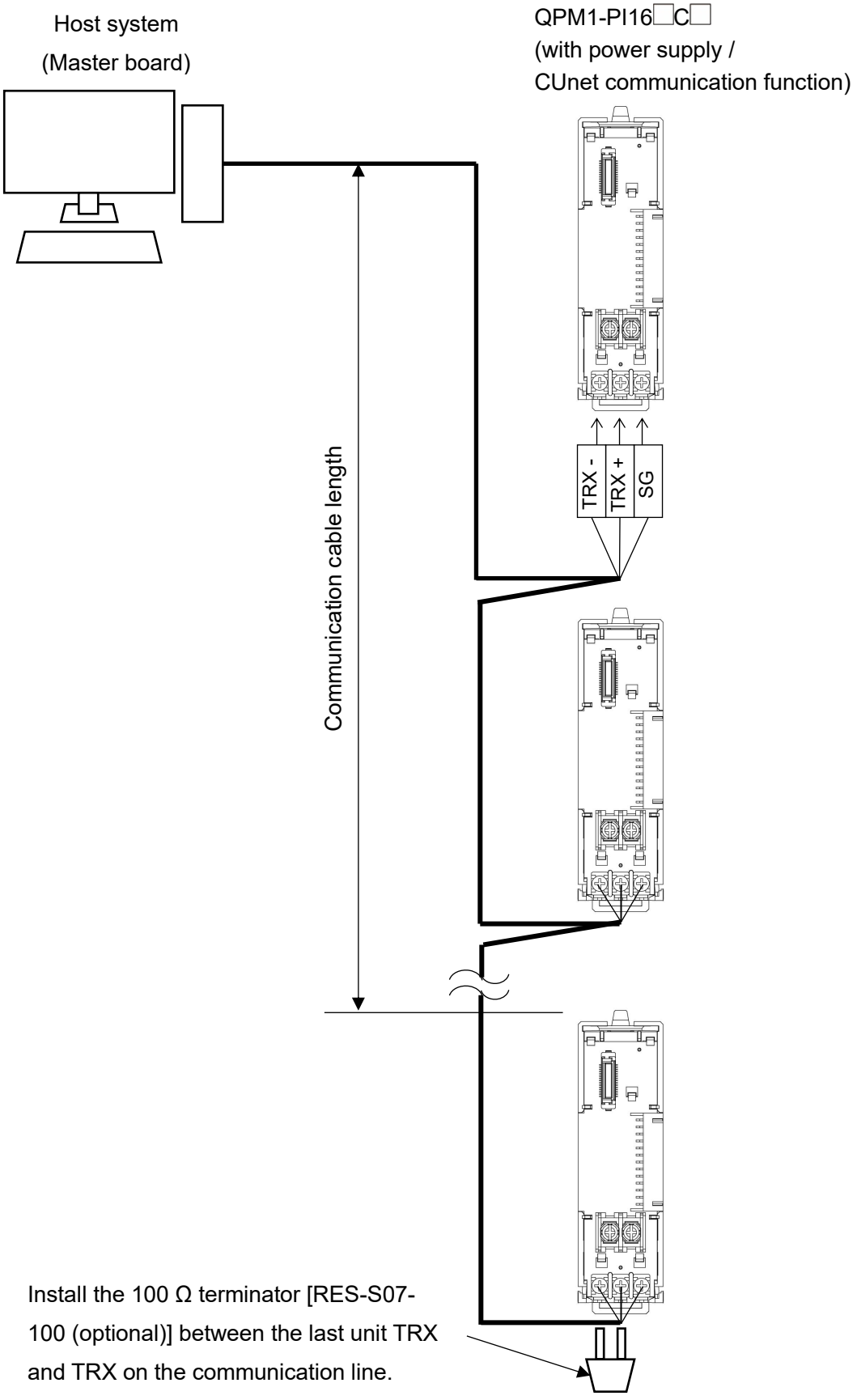


(Fig. 14.4.2-2)

14.4.3 Wiring Example of CUnet Communication Line

Connect the LAN cable between the upper system (master) and this instrument.
Recommended cable: LAN cable (straight cable) / Category 5 or higher shielded cable

Install a 100 Ω terminator [RES-S07-100 (optional)] on the last unit in the communication line.



(Fig. 14.4.3-1)

The communication cable length is the total length of the communication cable from the upper system (master) to the last unit, and varies depending on the communication speed.
The communication cable length can be extended by inserting a dedicated HUB for CUnet.

Communication speed	Communication cable length		
	No HUB	HUB 1-deck	HUB 2-deck
12 Mbps	100 m	200 m	300 m
6 Mbps	200 m	400 m	600 m
3 Mbps	300 m	600 m	900 m

14.5 Global Memory (GM)

The memory space where memory data is shared is called global memory (GM).
The size of global memory (GM) is 512 bytes and is divided into 64 areas in 8-byte units corresponding to station addresses (SA).
The addresses in global memory (GM) correspond to station addresses (SA).

Station addresses (SA)	Global memory (GM)
00(0x00)	000H to 007H
01(0x01)	008H to 00FH
02(0x02)	010H to 017H
63(0x3F)	1F8H to 1FFH

The basic unit of the amount of data that can be written to global memory (GM) by one station is 8 bytes.

- Station 00 (0x00) writes data in the 000H to 007H area of the global memory (GM).
- Station 63 (0x3F) writes data in the 1F8H to 1FFH area of the global memory (GM).

All stations can read all areas of the global memory (GM).

- All units can read the 000H to 007H area of the global memory (GM) to obtain the data written by the 00 (0x00) station.
- All units can read the 1F8H to 1FFH area of the global memory (GM) to obtain the data written by the 63 (0x3F) station.

14.6 Software

CUnet master board and software are required for CUnet communication.
Using the software, the CUnet communication status and the input/output status of the unit can be controlled on the PC screen.

	Manufacturer	Model name
CUnet master board	StepTechnica Co., Ltd.	CU-43USB
Software	StepTechnica Co., Ltd.	ASSIST-CU

14.7 Global Memory (GM) Map

When setting by CUnet communication, please set within the range of the module.

The data out of the setting range will be invalid.

For items not covered by global memory (GM), set them in the console software of each module or via e-mail communication.

GM: Global Memory

Global Memory	Data Item	Number of occupied (OWN) items			
		9	5	3	2
GM+0	Input state	●	●	●	●
GM+2	Status flag 1	●	●	●	●
GM+4	Status flag 2	●	●	●	●
GM+6	Status flag 3	●	●	●	●
GM+8	CH1 Pulse integrated value (High)	●	●	●	●
GM+10	CH1 Pulse integrated value (Low)	●	●	●	●
GM+12	CH2 Pulse integrated value (High)	●	●	●	●
GM+14	CH2 Pulse integrated value (Low)	●	●	●	●
GM+16	CH3 Pulse integrated value (High)	●	●	●	
GM+18	CH3 Pulse integrated value (Low)	●	●	●	
GM+20	CH4 Pulse integrated value (High)	●	●	●	
GM+22	CH4 Pulse integrated value (Low)	●	●	●	
GM+24	CH5 Pulse integrated value (High)	●	●		
GM+26	CH5 Pulse integrated value (Low)	●	●		
GM+28	CH6 Pulse integrated value (High)	●	●		
GM+30	CH6 Pulse integrated value (Low)	●	●		
GM+32	CH7 Pulse integrated value (High)	●	●		
GM+34	CH7 Pulse integrated value (Low)	●	●		
GM+36	CH8 Pulse integrated value (High)	●	●		
GM+38	CH8 Pulse integrated value (Low)	●	●		
GM+40	CH9 Pulse integrated value (High)	●			
GM+42	CH9 Pulse integrated value (Low)	●			
GM+44	CH10 Pulse integrated value (High)	●			
GM+46	CH10 Pulse integrated value (Low)	●			
GM+48	CH11 Pulse integrated value (High)	●			
GM+50	CH11 Pulse integrated value (Low)	●			
GM+52	CH12 Pulse integrated value (High)	●			
GM+54	CH12 Pulse integrated value (Low)	●			
GM+56	CH13 Pulse integrated value (High)	●			
GM+58	CH13 Pulse integrated value (Low)	●			
GM+60	CH14 Pulse integrated value (High)	●			
GM+62	CH14 Pulse integrated value (Low)	●			
GM+64	CH15 Pulse integrated value (High)	●			

Global Memory	Data Item	Number of occupied (OWN) items			
		9	5	3	2
GM+66	CH15 Pulse integrated value (Low)	●			
GM+68	CH16 Pulse integrated value (High)	●			
GM+70	CH16 Pulse integrated value (Low)	●			

The areas marked with diagonal lines do not reserve space in GM memory.

14.8 Attached Function

Automatic recognition function of connection modules

At power-on, the configuration of connected modules is checked and the data of modules whose connection is recognized is expanded in global memory (GM).

15 Action Explanation

15.1 Standard Function

15.1.1 Input Function

For the input function, select either Pulse input, Digital input, or Integrated value reset.

If Pulse input is selected, the number of pulses is accumulated when the input state changes from OFF to ON.

If Digital input is selected, changes in the input status are reflected in the input status communication items, allowing you to check the input status via communication.

If Integrated value reset is selected, the pulse count for all channels is reset when the input status changes from OFF to ON.

(By default, CH1 through CH8 are configured as pulse inputs and CH9 through CH16 as digital inputs; these settings can be configured via communication.)

15.1.2 Pulse Integration

Integration method

The pulse integration method can be set to either ring count or linear count.

If ring count is selected, integration continues even if the integrated value exceeds the integrated maximum value.

If linear count is selected, when the accumulated value exceeds the integrated maximum value, the value remains at the integrated maximum value, and the overflow flag is set.

If the accumulated value is reset or the integrated maximum value is changed, the overflow flag is cleared.

(The default setting is ring count, and this can be configured via communication.)

Integrated maximum value

The pulse integrated maximum value can be set within the range of 1,000 to 4,294,967,295 (0xFFFFFFFF).

(The factory default is 100,000,000, and this value can be configured via communication.)

Integrated minimum value

If ring count is selected as the accumulation method, set the reset value to 0 or 1 when the integrated value exceeds the integrated maximum value.

When the integrated value is reset, it returns to 0 regardless of the integrated minimum value setting.

(The factory default is 1, and this value can be configured via communication.)

Division ratio

The pulse division ratio can be set from 1 to 10,000. The number of measured pulses is calculated as the number of input pulses divided by the pulse division ratio. Any remainder is cleared when the total count is reset or when the power is cycled.

(The factory default is 1, and this value can be configured via communication.)

Integrated value reset

If integrated value reset is selected in the input method selection, the pulse integrated value for all channels will be reset to 0 when the input status changes from OFF to ON.

The integrated value for each channel can also be reset via communication.

15.2 Attached Function

15.2.1 Self-Diagnosis

The watchdog timer monitors the CPU and resets the instrument to its factory defaults in the event of an abnormality.

15.2.2 Warm-up Display

For about 3 seconds after the power is turned on, the operation indicator will flash (on for 500 ms, off for 500 ms).

15.2.3 Contact Switching Total Number of Times

The control output ON/OFF count can be integrated and measured.

This allows you to grasp the approximate contact life as the number of switching times of the switch used externally.

However, since the saving cycle is 1 hour, the number of times within 1 hour may not be saved due to a power failure.

15.2.4 Pulse Integrated Value Backup Function

The pulse integrated value is backed up periodically. When power is restored, you can choose whether to continue the accumulation. However, since the backup interval is 1 minute, data for periods shorter than 1 minute may not be saved due to a power outage or other issues.

If Continue is selected in the “Startup pulse integration selection,” the count will resume from the backed-up value when power is restored.

If Reset is selected in the “Startup pulse integration selection,” the count will start from 0 when power is restored.

(The factory default is “Reset,” and this setting can be configured via communication.)

15.2.5 Power Failure Countermeasure

The non-volatile IC memory backs up the setting data.

15.2.6 Non-volatile IC Memory Save Selection

All settings can be temporarily changed. When the power is turned on, the settings will revert to the values that were in effect before the “Disable Non-Volatile IC Memory Storage” option was selected. However, this does not apply to the cumulative operating time, cumulative pulse count, or the “Enable Non-Volatile IC Memory Storage” setting.

(The factory default is “Enable,” and this setting can be configured via communication.)

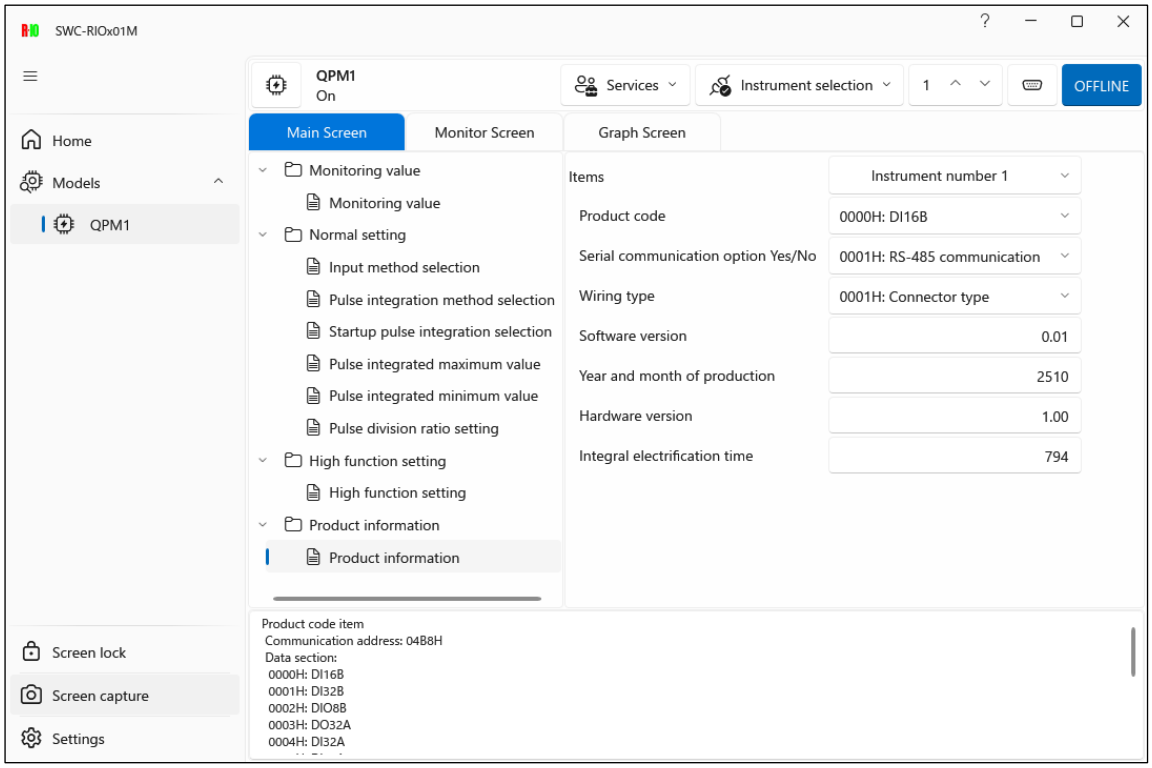
16 Maintenance

Using the console software (SWC-RIOx01M), it is possible to check the energizing integrated time and product information.

Energizing integrated time/Product information

Click Product Information - Product Information on the Main Screen tab.

Display the Product Information screen.



(Fig. 16-1)

Energizing integrated time

Check the estimated product lifespan of the pulse input module.

Product information

Product information can be checked using the product code and other details.

Item	Product Information Examples
Product code	0000H: DI16B
Serial communication option Yes/No	0001H: RS-485 communication
Wiring type	0001H: Connector type
Software Version	Ver. 0.01
Year and month of production	2510: October 2025
Hardware Version	Ver. 1.00

17 Specifications

17.1 Standard Specifications

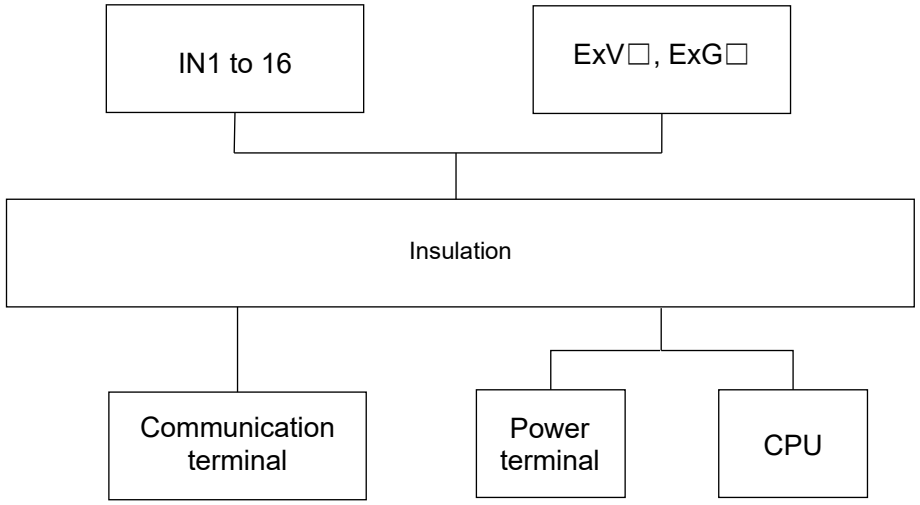
Input

Rated scale	Common	Plus/Minus common (NPN/PNP compatible)
	Input points	16 points (Pulse input, digital input, and integrated value reset input are selected via communication using a common setting.)
	Input indicator	Green LED lights up when ON
	Allowable range of input power supply voltage	24 V DC ±10%, ripple content 5% p-p or less
	Input ON voltage/ON current	15V DC or more / 3.5mA or more
	Input OFF voltage/OFF current	5 V DC or less / 1 mA or less
	Input current	5.5 mA or less (at 24 V DC)
	Input resistance	Approximately 4.7 kΩ
	Digital input ON delay time	0.2 ms or less
	Digital input OFF delay time	0.5ms or less
	Integrated value reset input delay time	0.2ms or less
	Integrated value reset input minimum width	0.5 ms or more (both ON and OFF)
	Pulse input minimum pulse width	500 μs or more (both ON and OFF)
	Input acquisition cycle	1 to 100 ms (default: 1 ms; configurable via communication; applies to all CHs) (Fixed at 0.2 ms for pulse input)

Power supply

Power supply voltage	24 V DC Allowable voltage fluctuation: 20 to 28 V DC
Power consumption	2 W or less
Inrush current	Max. 10 A

Circuit insulation configuration

Circuit insulation configuration	 (Fig. 17.1-1)
Insulation resistance	500 V DC 10 MΩ or more
Dielectric strength	Between Power terminal – Ground (GND): 1.5 kV AC for 1 minute Between Input terminal – Ground (GND): 1.5 kV AC for 1 minute Between Input terminal – Power terminal: 1.5 kV AC for 1 minute Between Communication terminal – Power terminal: 1.5 kV AC for 1 minute Between Input terminal – Communication terminal 1.5 kV AC for 1 minute

Recommended Environment

Ambient temperature	-10 to 50°C (no condensation or freezing)
Ambient humidity	35 to 85%RH (no condensation)
Environmental specification	RoHS directive compliant

General Structure

Weight	Approx. 160 g
External dimensions	30 × 100 × 85 mm (W × H × D excluding protrusion) 95 mm depth when the terminal cover is attached
Mounting type	DIN rail mounting type
Case	Flame-resistant resin, Color: Black
Panel	Polycarbonate sheet
Applicable standard	EN: EN61010-1 (Pollution degree 2) EC Directive: EMI: EN61326 Radiated interference field strength: EN55011 Group1 ClassA EMS: EN61326

Setting Structure

Communication specification setting	Set the communication speed, data bit, parity, and stop bit, using the DIP switch.
Module address setting	Set the module address 0 to F (1 to 16) with the rotary switch. The value obtained by adding 1 to the value of the setting rotary switch becomes the module address.
CUnet communication specification setting	The station address (SA), communication speed, master address (DOSA), and number of occupied (OWN) items are set by the DIP switches (SW10, SW11) on the board mounted in the base section.

Standard Function

Input method selection	For the input function, select either Pulse input, Digital input, or Integrated value reset. If Pulse input is selected, the number of pulses is accumulated when the input state changes from OFF to ON. If Digital input is selected, changes in the input status are reflected in the input status communication items, allowing you to check the input status via communication. If Integrated value reset is selected, the pulse count for all channels is reset when the input status changes from OFF to ON. (By default, CH1 through CH8 are configured as pulse inputs and CH9 through CH16 as digital inputs; these settings can be configured via communication.)
Pulse Integration	• Integration method The pulse integration method can be set to either ring count or linear count. If ring count is selected, integration continues even if the integrated value exceeds the integrated maximum value. If linear count is selected, when the accumulated value exceeds the integrated maximum value, the value remains at the integrated maximum value, and the overflow flag is set. If the accumulated value is reset or the integrated maximum value is changed, the overflow flag is cleared. (The default setting is ring count, and this can be configured via communication.) • Integrated maximum value The pulse integrated maximum value can be set within the range of 1,000 to 4,294,967,295 (0xFFFFFFFF). (The factory default is 100,000,000, and this value can be configured via communication.) • Integrated minimum value If ring count is selected as the accumulation method, set the reset value to 0 or 1 when the integrated value exceeds the integrated maximum value. When the integrated value is reset, it returns to 0 regardless of the integrated minimum value setting. (The factory default is 1, and this value can be configured via communication.) • Division ratio The pulse division ratio can be set from 1 to 10,000. The number of measured pulses is calculated as the number of input pulses divided by the pulse division ratio. Any remainder is cleared when the total count is reset or when the power is cycled. (The factory default is 1, and this value can be configured via communication.) • Integrated value reset If integrated value reset is selected in the input method selection, the pulse integrated value for all channels will be reset to 0 when the input status changes from OFF to ON. The integrated value for each channel can also be reset via communication.

Attached Function

Self-Diagnosis	The watchdog timer monitors the CPU and resets the instrument to its factory defaults in the event of an abnormality.
Warm-up Display	For about 3 seconds after the power is turned on, the operation indicator will flash (on for 500 ms, off for 500 ms).
Contact Switching Total Number of Times	The control output ON/OFF count can be integrated and measured. This allows you to grasp the approximate contact life as the number of switching times of the switch used externally. However, since the saving cycle is 1 hour, the number of times within 1 hour may not be saved due to a power failure.
Pulse Integrated Value Backup Function	The pulse integrated value is backed up periodically. When power is restored, you can choose whether to continue the accumulation. However, since the backup interval is 1 minute, data for periods shorter than 1 minute may not be saved due to a power outage or other issues. If Continue is selected in the “Startup pulse integration selection,” the count will resume from the backed-up value when power is restored. If Reset is selected in the “Startup pulse integration selection,” the count will start from 0 when power is restored. (The factory default is “Reset,” and this setting can be configured via communication.)
Power Failure Countermeasure	The non-volatile IC memory backs up the setting data.
Non-volatile IC Memory Save Selection	All settings can be temporarily changed. When the power is turned on, the settings will revert to the values that were in effect before the “Disable Non-Volatile IC Memory Storage” option was selected. However, this does not apply to the cumulative operating time, cumulative pulse count, or the “Enable Non-Volatile IC Memory Storage” setting. (The factory default is “Enable,” and this setting can be configured via communication.)

Other Item

Accessories	Mounting and wiring instruction manual: 1 Wiring Connector (2ESS-10P): 1 piece (connector type) Power supply terminal cover: 1 (Included when adding “With power supply / host communication function” and “With power supply / CUnet communication function”)
Sold separately	Front terminal cover: TC-QTC (*) Termination resistor: RES-S07-100 100 Ω

(*): QPM1-PI16 has the same case shape as QTC1, so the terminal cover of QTC1 is used.

17.2 Optional Specifications

Power supply / RS-485 communication function

Perform the following operations from the external computer.

(1) Reading and setting of various set values

(2) Pulse integrated value and operation status reading

(3) Change of function

Communication line	EIA RS-485 (C5 option)
Communication method	Half-duplex communication
Synchronization method	Start-stop synchronization
Communication protocol	MODBUS RTU or SIF specifications can be selected by DIP switch
Communication speed	9600 bps, 19200 bps, 38400 bps or 57600 bps can be selected by DIP switch
Data bit/Parity/Stop bit	Select the following with the DIP switch Data bit: 8 Parity: Even, Odd, No parity Stop bit: 1 or 2
Communication response delay time	Set the delay time to return the response from the module after receiving the command from the host. 0 to 1000 ms

Power supply / CUnet communication function

Connection type	Multi-drop	
Communication method	2-wire half-duplex	
Synchronization method	Bit-synchronous	
Error detection	CRC-16	
Number of occupied slave addresses	1	
Maximum number of connected nodes	64 nodes	
Communication speed, Communication distance	Communication speed	Maximum network length
	12 Mbps	100 m
	6 Mbps	200 m
	3 Mbps	300 m
Isolation method	Pulse transformer isolation	
Impedance	100 Ω	
Termination resistance	Last connection, set by CUnet slave This instrument is not equipped.	

- Data structure
  Write the reading from the module to the GM memory specified by the Station Address (SA), then read the setting value from the master address specified by SW11 and set it on the module.
- Email function
  The CUnet email function can be used to change configuration settings.
  For communication specifications, refer to the communication specifications for each module.
- Communication settings for module (Fixed)
  Baud rate: 38,400 bps Parity: Even
  Data: 8 bits Stop bit: 1 bit

18 Troubleshooting

If any malfunctions occur, refer to the following items after checking that power is being supplied to the master module and slave module.

18.1 Host Communication

Problem	Possible Cause	Solution
Cannot communicate.	Is the communication cable disconnected?	Check the communication cable.
	Is the communication cable wiring correct?	Refer to “7 Wiring (P.7-1)” or “13.5 Wiring (P.13-8)”, and check the communication cable.
	Is there any disconnection or contact failure of the communication cable?	Check the communication cable.
	Is communication speed of the master and slave same?	Refer to “5.1 Setting of Communication Specifications (P.5-1)”, and check the communication speed of the master and slave.
	Are data bits, parity, and stop bits of the master and slave same?	Refer to “5.1 Setting of Communication Specifications (P.5-1)”, and check the data bit, parity, and stop bit of the master and slave.
	Is the module address of the command and slave same?	Refer to “5.2 Setting of Module Address (P.5-4)”, and check the module address of the command and slave.
	Are there any slaves that have the same module address?	Refer to “5.2 Setting of Module Address (P.5-4)”, and check the module address.
	Is the program considering the transmission timing?	Refer to “9. Communication Procedure (P.9-1)”, and check the program.
Communication is possible, but a negative acknowledgement is returned.	Are sending a command code that does not exist?	Refer to “11.1 Communication Command List (P.11-1)”, and check the command code.
	Is the data of the write command exceeding the setting range?	Refer to “11.1 Communication Command List (P.11-1)”, and check the setting range of write command.
	Is it not possible to write?	Check the state of a slave.

18.2 CUnet Communication

Problem	Possible Cause	Solution
Cannot communicate.	Is the communication line wiring correct?	Refer to “14.4.3 Wiring Example of CUnet Communication Line (P.14-10)”, and check the wiring of the communication line.
	Is the termination resistance attached to the last module in the communication line?	Refer to “14.4.3 Wiring Example of CUnet Communication Line (P.14-10)”, and attach the termination resistance to the last module in the communication line.
	Is the LAN cable a straight cable?	If the LAN cable is a crossover cable, communication is not possible. Use a straight cable.
	Is the station address correct?	Refer to “14.2 Setting CUnet communication specifications (P.14-3)”, and check the settings.
	Are there duplicate station addresses?	Refer to “14.2 Setting CUnet communication specifications (P.14-3)” and set the station address to avoid duplication.
	Is the communication speed between the host system (master) and the module the same?	Refer to “14.2 Setting CUnet communication specifications (P.14-3)” and check the communication speed.

18.3 Status Flag 1

Problem	Possible Cause	Solution
"1: Error" is set in B0: Input error (CH1 to CH8).	Input power supply error (CH1 to CH8).	Check that there are no problems with the input power supply.
"1: Error" is set in B1: Input error (CH9 to CH16).	Input power supply error (CH9 to CH16).	Check that there are no problems with the input power supply.

18.4 Status Flag 2

Problem	Possible Cause	Solution
"1: Overflow" is set in B0: CH1 Pulse integrated state.	Pulse integration overflow on CH1.	Check the pulse integrated value for CH1.
"1: Overflow" is set in B1: CH2 Pulse integrated state.	Pulse integration overflow on CH2.	Check the pulse integrated value for CH2.
"1: Overflow" is set in B2: CH3 Pulse integrated state.	Pulse integration overflow on CH3.	Check the pulse integrated value for CH3.
"1: Overflow" is set in B3: CH4 Pulse integrated state.	Pulse integration overflow on CH4.	Check the pulse integrated value for CH4.
"1: Overflow" is set in B4: CH5 Pulse integrated state.	Pulse integration overflow on CH5.	Check the pulse integrated value for CH5.
"1: Overflow" is set in B5: CH6 Pulse integrated state.	Pulse integration overflow on CH6.	Check the pulse integrated value for CH6.
"1: Overflow" is set in B6: CH7 Pulse integrated state.	Pulse integration overflow on CH7.	Check the pulse integrated value for CH7.
"1: Overflow" is set in B7: CH8 Pulse integrated state.	Pulse integration overflow on CH8.	Check the pulse integrated value for CH8.
"1: Overflow" is set in B8: CH9 Pulse integrated state.	Pulse integration overflow on CH9.	Check the pulse integrated value for CH9.
"1: Overflow" is set in B9: CH10 Pulse integrated state.	Pulse integration overflow on CH10.	Check the pulse integrated value for CH10.
"1: Overflow" is set in B10: CH11 Pulse integrated state.	Pulse integration overflow on CH11.	Check the pulse integrated value for CH11.
"1: Overflow" is set in B11: CH12 Pulse integrated state.	Pulse integration overflow on CH12.	Check the pulse integrated value for CH12.
"1: Overflow" is set in B12: CH13 Pulse integrated state.	Pulse integration overflow on CH13.	Check the pulse integrated value for CH13.
"1: Overflow" is set in B13: CH14 Pulse integrated state.	Pulse integration overflow on CH14.	Check the pulse integrated value for CH14.
"1: Overflow" is set in B14: CH15 Pulse integrated state.	Pulse integration overflow on CH15.	Check the pulse integrated value for CH15.
"1: Overflow" is set in B15: CH16 Pulse integrated state.	Pulse integration overflow on CH16.	Check the pulse integrated value for CH16.

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