Module Type Controller

SRV

PROFIBUS Communication Instruction Manual

RKC® RKC INSTRUMENT INC.

IMS01P07-E3

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

SYMBOLS

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

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

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

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

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

 : This mark indicates where additional information may be located.

⚠ WARNING

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

CAUTION

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

NOTICE

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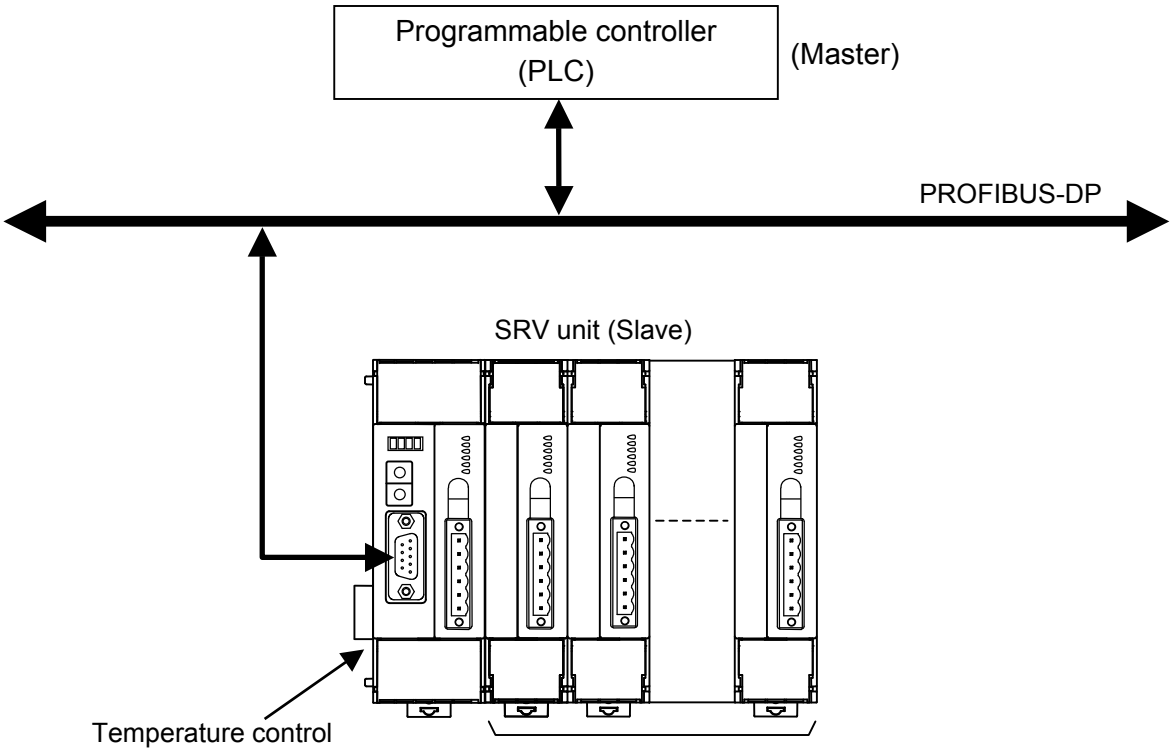
CONTENTS

1. OUTLINE

This manual describes the PROFIBUS specifications, mounting, wiring, setting and data instructions for the Module Type Controller SRV.

The SRV enables communication with the programmable controller (hereafter called the PLC) for PROFIBUS by using V-TIO-G/H of temperature control module for PROFIBUS.
The V-TIO-G/H module supports PROFIBUS-DP protocol. This protocol includes master and slave. The PLC is the master and the V-TIO-G/H module (or the SRV unit including the V-TIO-G/H module) is the slave.



☞ For specifications, parts description, mounting, and wiring of V-TIO-G/H module, refer to **Temperature Control Module for PROFIBUS V-TIO-G/V-TIO-H Instruction Manual (IMS01P06-E□)**.

☞ For PROFIBUS, refer to the home page of PROFIBUS International.
http://www.profibus.com/

2. COMMUNICATION SPECIFICATIONS

■ PROFIBUS communication

Interface: Based on RS-485, EIA standard

Protocol: PROFIBUS-DP (EN50170)
Correspond to both static data request and dynamic data request

- Static data request specification
  The PROFIBUS address of the module with data to be read and written and the communication item number to obtain that data are determined when system configured data is downloaded to the PLC.
  In static data read and write, it is not required to write a sequence program when data assigned.
  Number of communication item:
  16 items max. (Number of read item + Number of write item)
  Communication data: Data of temperature control (TIO) module

  ☞ For details of communication items, refer to **6. LIST OF COMMUNICATION ITEMS (P. 31)**.

- Dynamic data request specification
  The PROFIBUS address of the module with data to be read and written and the communication item number to obtain that data are specified to certain specific registers in the PLC.
  In dynamic data read and write, a sequence program is required when data assigned.
  Communication data: Data of temperature control (TIO) module

  ☞ For details of communication items, refer to **6. LIST OF COMMUNICATION ITEMS (P. 31)**.

Communication speed: 12 Mbps max.
Communication speed is set as follows:
- A master judges the quality situation of a line, and set it automatically.
- Set it with a sequence program of PLC.

Communication data length:
200 bytes max. (For both data read and write)

Internal communication data updating cycle of SRV:
(Number of read item × 30 ms × Number of channels) +
(Number of write item × 60 ms × Number of channels)

🕮 Internal communication data updating cycle of SRV is the time until all of the module in SRV unit is complete of procedure for the data request from PLC.

☞ For the specification of connecting PLC, refer to the instruction manual for the used PLC.

3. WIRING

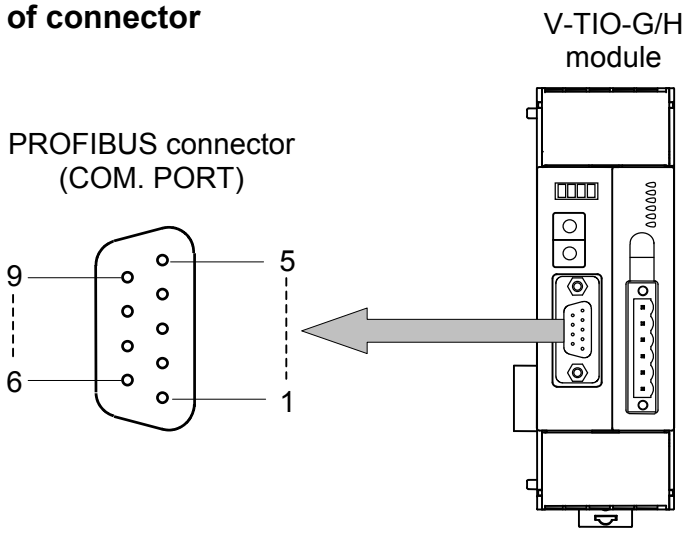
⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

3.1 PROFIBUS Connection

The V-TIO-G/H module has one port (COM.PORT) to be connected to PLC with PROFIBUS. Communication interface is RS-485.

■ Pin layout of connector



☞ For the connectable connector of the PLC, refer to the instruction manual for the used PLC.

■ Connector pin number and signal details (RS-485)

Pin No.	Signal name	Symbol
1	—	Unused
2	—	Unused
3	Receive data/transmission data (plus)	RxD/TxD-P
4	—	Unused
5	Signal ground	DGND
6	Termination resistor supply voltage (5 V)	VP
7	—	Unused
8	Receive data/transmission data (negative)	RxD/TxD-N
9	—	Unused

■ PROFIBUS cables

Use the PROFIBUS cable which fitted the following requirement.

- Use the shielded twisted pair wire
- Based on EN50170, European standard (Recommend cable type A)

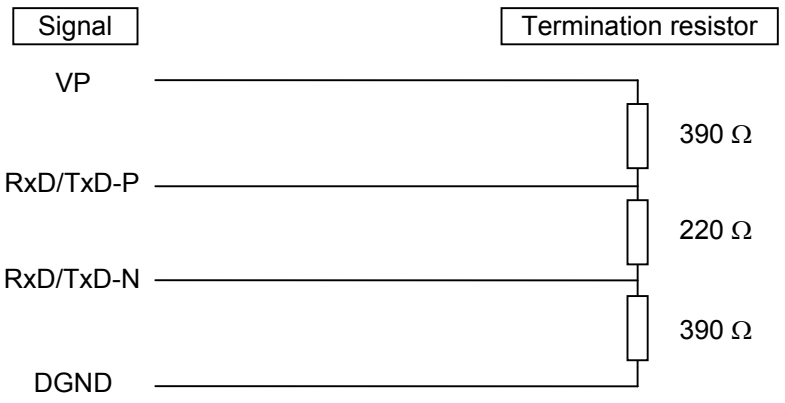
Cable type A specification

Impedance: 135 to 165 Ω
Capacitance: < 30 pF/m
Loop resistance: 110 Ω/km
Core diameter: 0.64 mm
Core cross section: > 0.34 mm^2

Maximum cable length by communication speed (For cable type A)

Communication speed (kbps)	9.6	19.2	93.75	187.5	500	1500	12000
Cable length (m)	1200	1200	1200	1000	400	200	100

- Connect the termination resistor to the end of a bus (Refer to below)



Termination resistor of a bus

The cable must be provided by the customer.
As for the PROFIBUS cable (a connection cable of PLC and V-TIO-G/H), there is a case prepared by a PLC manufacturer.

The details except the above are connected to a home page of PROFIBUS International, and obtain necessary information.
http://www.profibus.com/

3.2 Module Connection

■ SRV usable modules

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

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

Up to 30 modules (V-TIO-A, V-TIO-B, V-TIO-C or V-TIO-D) can be connected to one module (V-TIO-G or V-TIO-H).

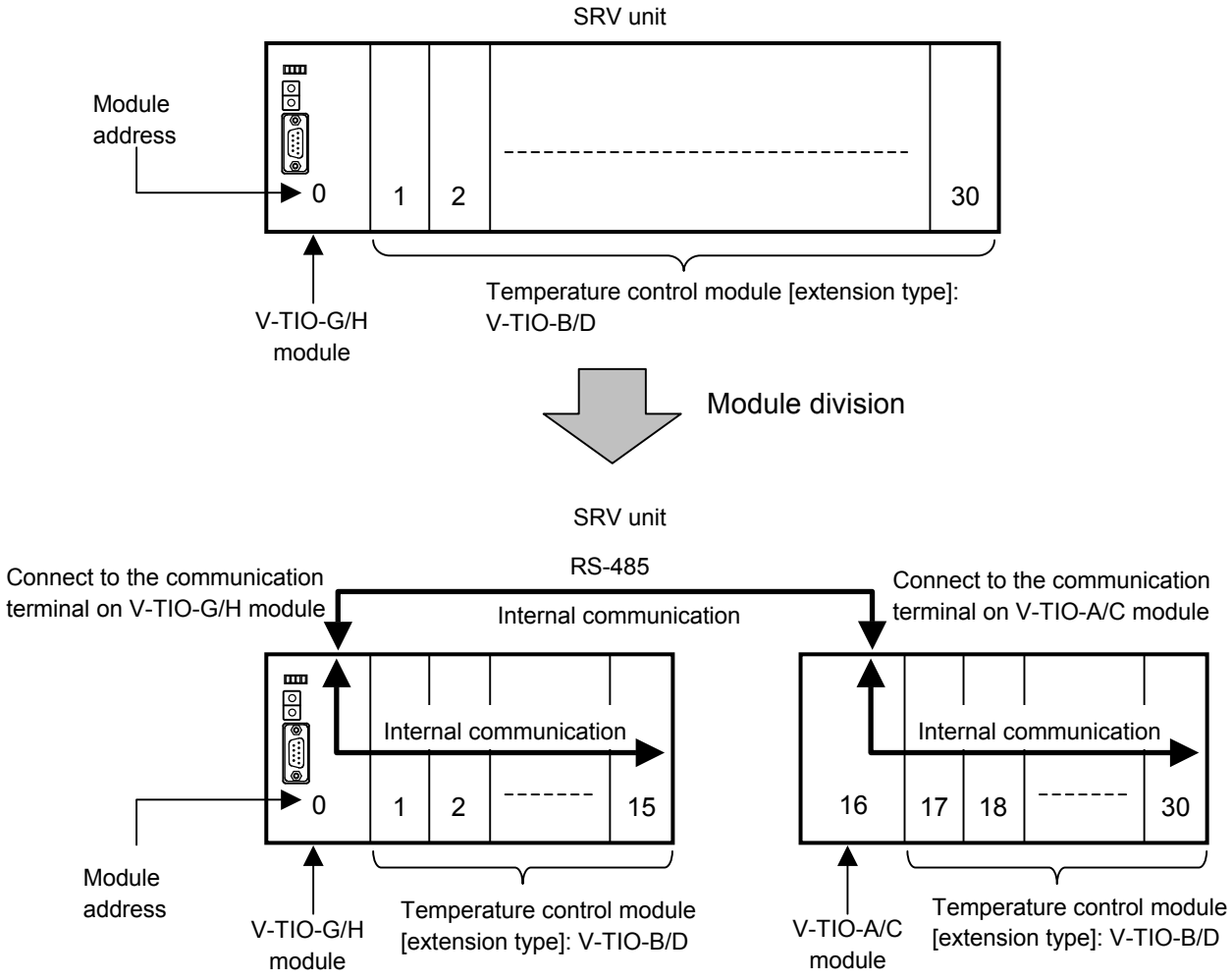
Be careful of the following when connected to the module (V-TIO-A or V-TIO-C).

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

For host communication (Modbus) using communication terminals, refer to **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.

■ Connection in the module division

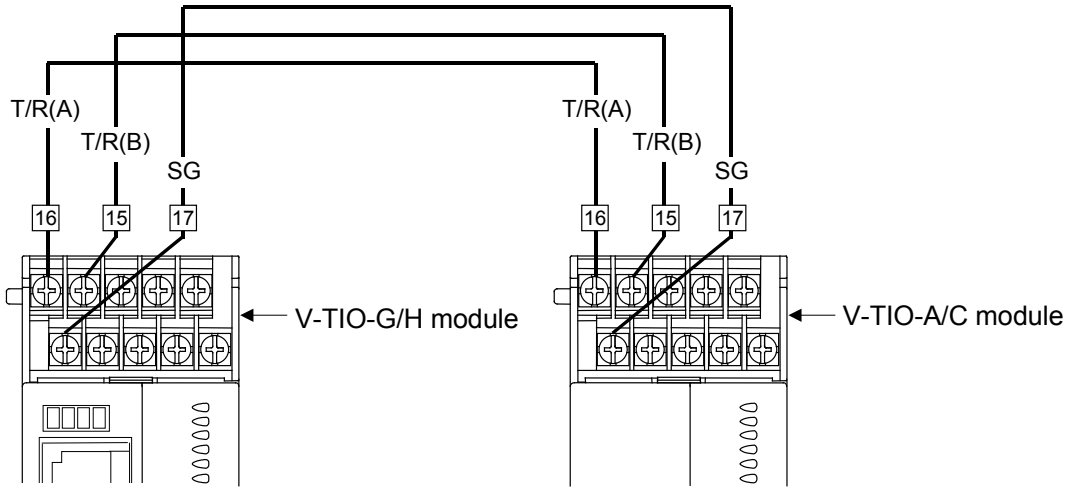
If there are restrictions on the number of modules in one unit due to environments at installing locations, it is possible to divide these modules in one unit into some groups for their installation.
When connecting the modules divided into some groups, use communication terminals (internal communication) on the terminal board for communication between each module. Therefore, one module (V-TIO-A or V-TIO-C) with the communication terminals is required for those modules divided into each group.



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

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

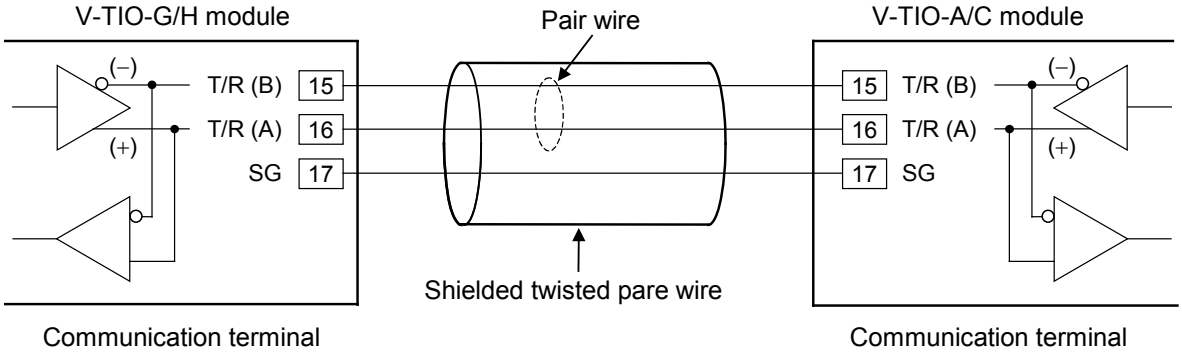
- **Connection terminals**



- **Communication terminal number and signal details (V-TIO-G/H, V-TIO-A/C)**

Terminal No.	Signal name	Symbol
15	Send/receive data	T/R (B)
16	Send/receive data	T/R (A)
17	Signal ground	SG

- **Diagram of RS-485 wiring**



The communication cable must be provided by the customer.

■ Installation of termination resistor

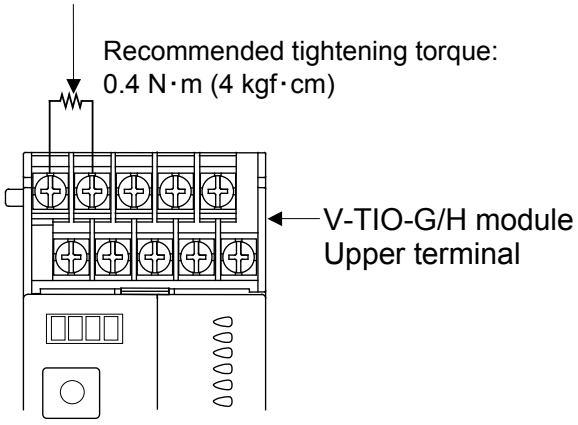
When a termination resistor is connected to the RS-485 communication line, a procedure for connecting the termination resistor on the SRV side is described.

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

● Installation of termination resistor when connected V-TIO-G/H module alone

Install termination resistor in terminal directly.

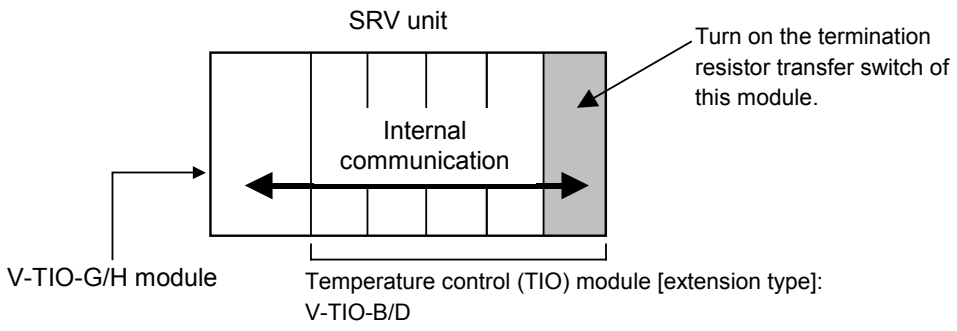
Termination resistor
(Example: 120 Ω 1/2 W)



The termination resister must be provided by the customer.

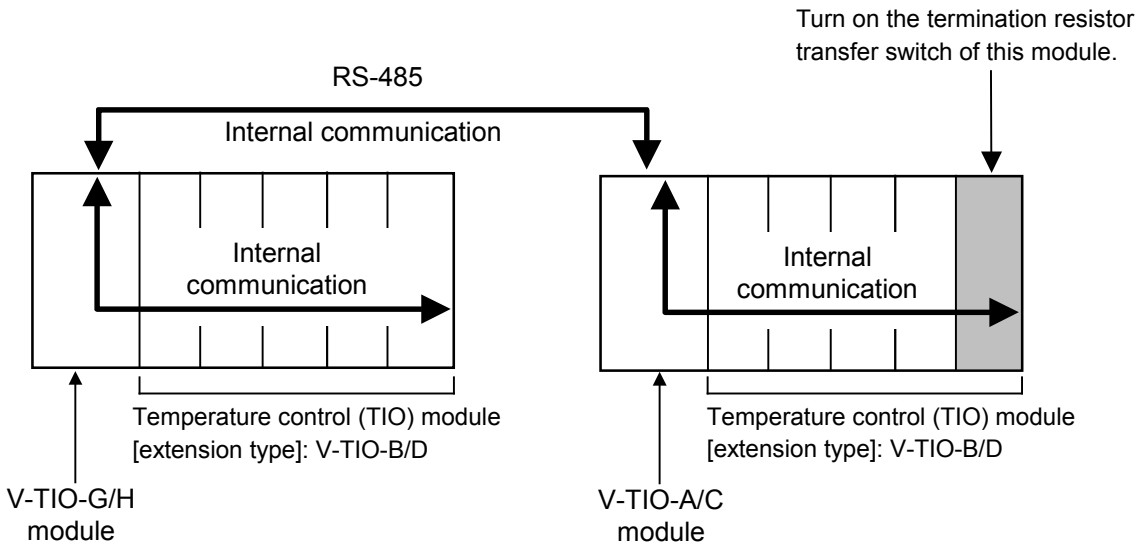
● Installation of termination resistor when two or more TIO module [extension type] are connected to one module (V-TIO-G or V-TIO-H)

When the extension module is connected to the module (V-TIO-G or V-TIO-H), connect a termination resistor to the termination of the communication line in the extension module at the extreme end.
As a termination resistor is not externally connected to the TIO module [extension type], a termination resistor built in the module is switch-selected. (Refer to P. 10)



● Installation of termination resistor when the modules divided into some groups

Even when connecting the modules divided into some groups, connect a termination resistor to the termination of the communication line in module at the extreme end.
The module (V-TIO-A or V-TIO-C) install termination resistor in terminal directly. (Refer to P. 8)
As a termination resistor is not externally connected to the TIO module [extension type], a termination resistor built in the module is switch-selected. (Refer to P. 10)

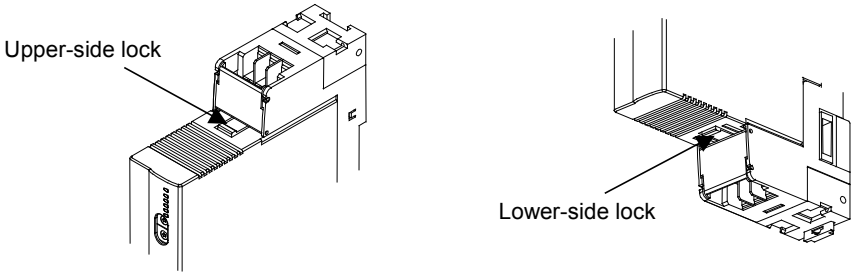


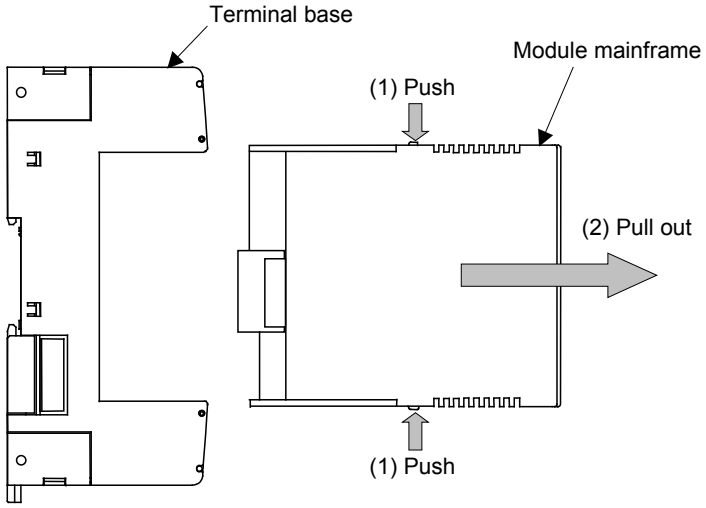
- **Transfer procedure of termination resistor built-in the terminal base**

1. Turn off the power supply of the module.

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

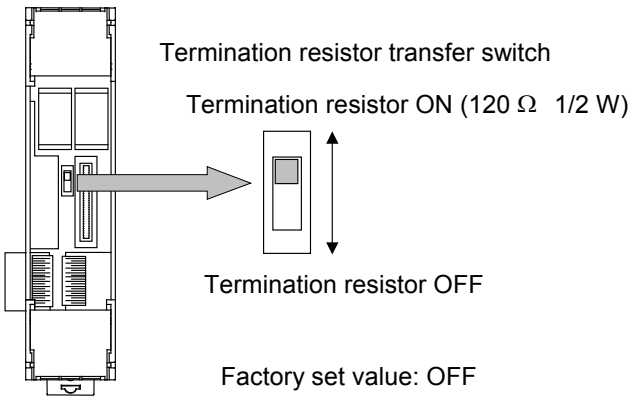
2. Pull out the module mainframe itself toward you while pushing the locks at its top and bottom, and then separate it from the terminal base.





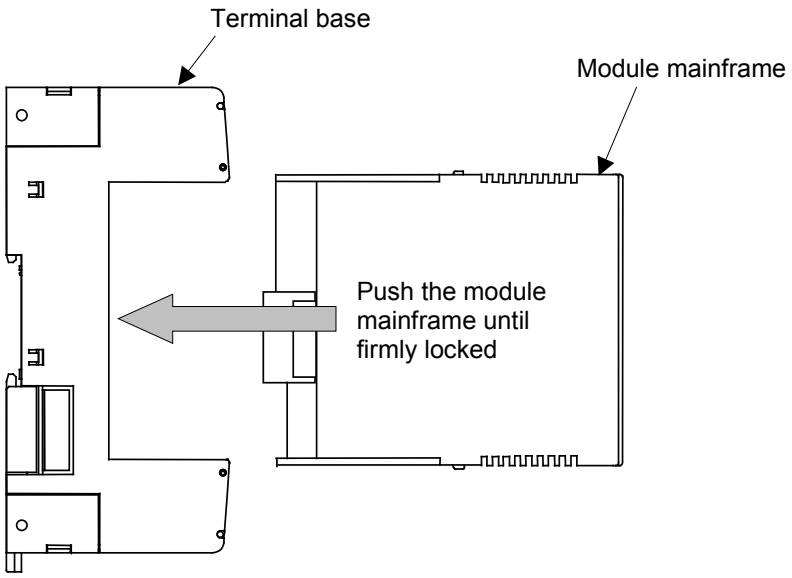
Removing the module mainframe

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



A terminal base of the state which removed module mainframe

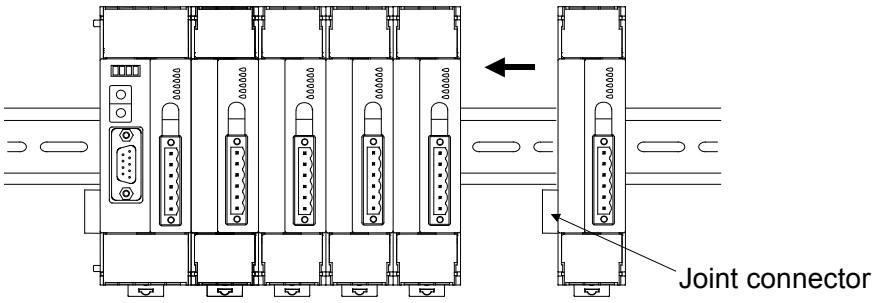
4. Push the module mainframe thus separated in the terminal base until firmly locked.

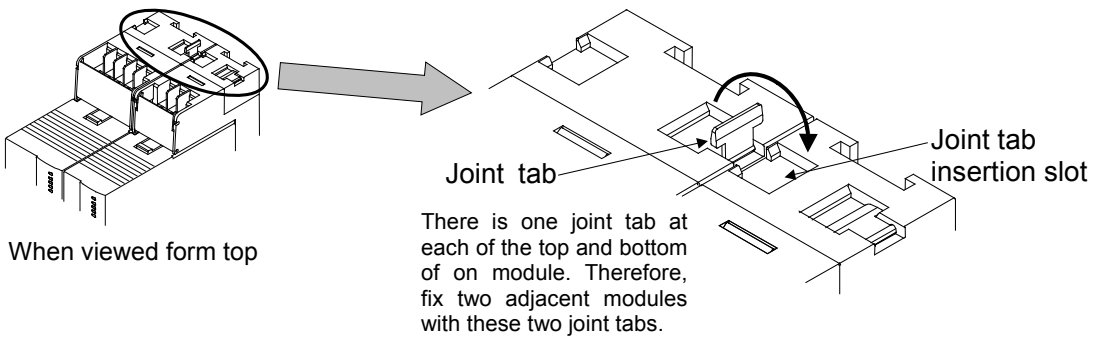


Mounting the module mainframe

5. Connect the module whose termination resistor transfer switch is turned to the ON position to the right end.

Connect each module using joint connector while sliding the module. And, lift each of the joint tabs located at the top and bottom of the module and then insert it in the slot of the adjacent module to fix these two modules.





3.3 Host Communication Connection

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

☞ For details of the dip switch 1 setting, refer to **4.2 PROFIBUS/Host Communication Transfer Setting (P. 16)**.

☞ For host communication (Modbus) using communication terminals, refer to **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.

4. SETTING

⚠ WARNING

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

CAUTION

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

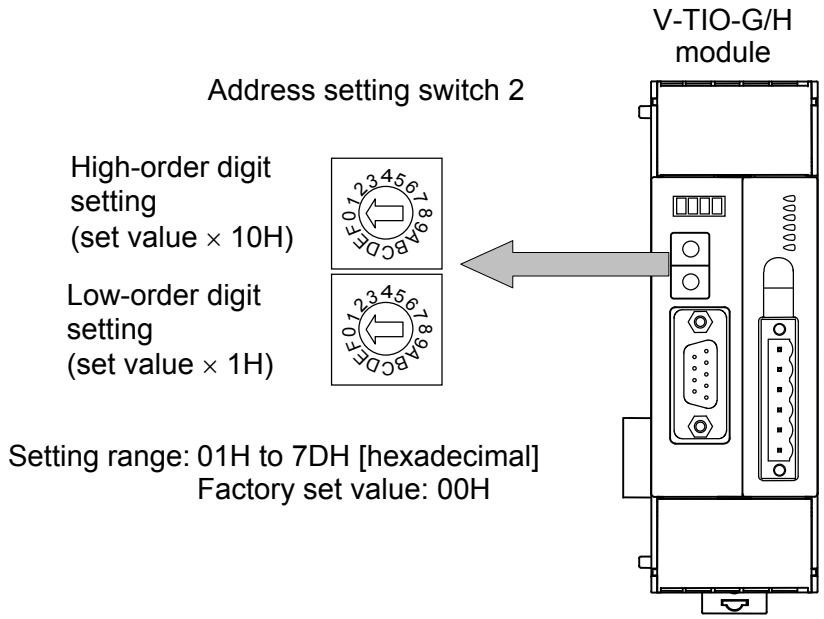
Set the following communication setting before operation.

4.1 Address Setting

■ PROFIBUS address setting

The master communicates with the selected slave by specifying that slave's address number. Each slave must have a unique address number for this data transmission. Set the slave address with the address setting switch prior to operation.
With the "Address setting switch 2" of the front left side of the module (V-TIO-G or V-TIO-H), set an address number on the PROFIBUS. For this setting, use a small blade screwdriver.

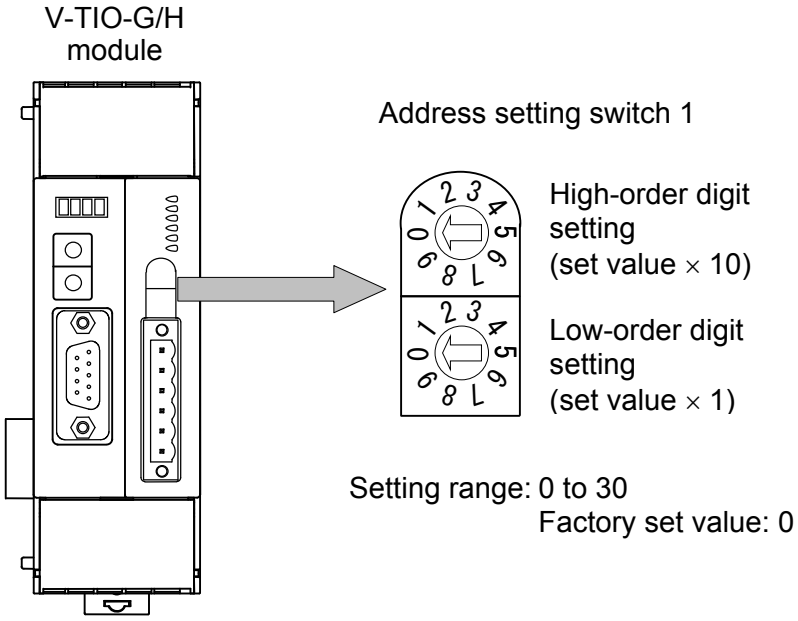
No communication with PROFIBUS can be conducted with each factory set value (00H) left as it is. Set it to the same value as the PROFIBUS address set when system configured.



■ Module address setting

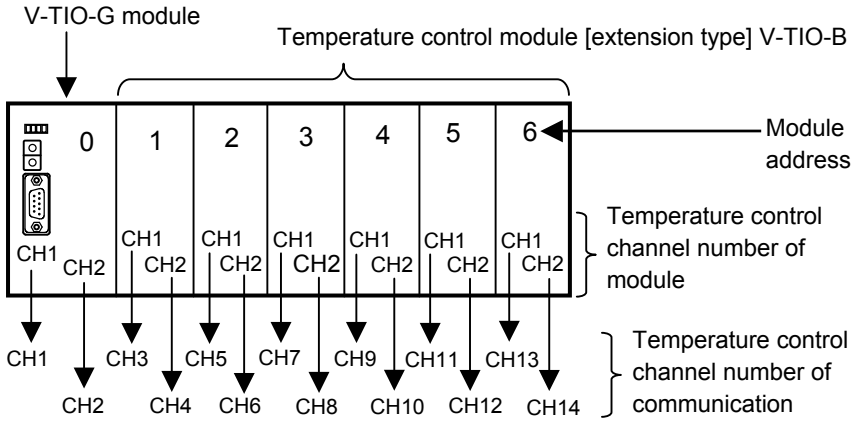
In addition to the PROFIBUS address, the module address used to identify each module of the SRV is set to the module (V-TIO-G or V-TIO-H).
Set the module address by the "Address setting switch 1" of front right side of module. For this setting, use a small blade screwdriver.

When setting module address, always set their address from address number "0" in succession. Otherwise, problems or malfunction may result.



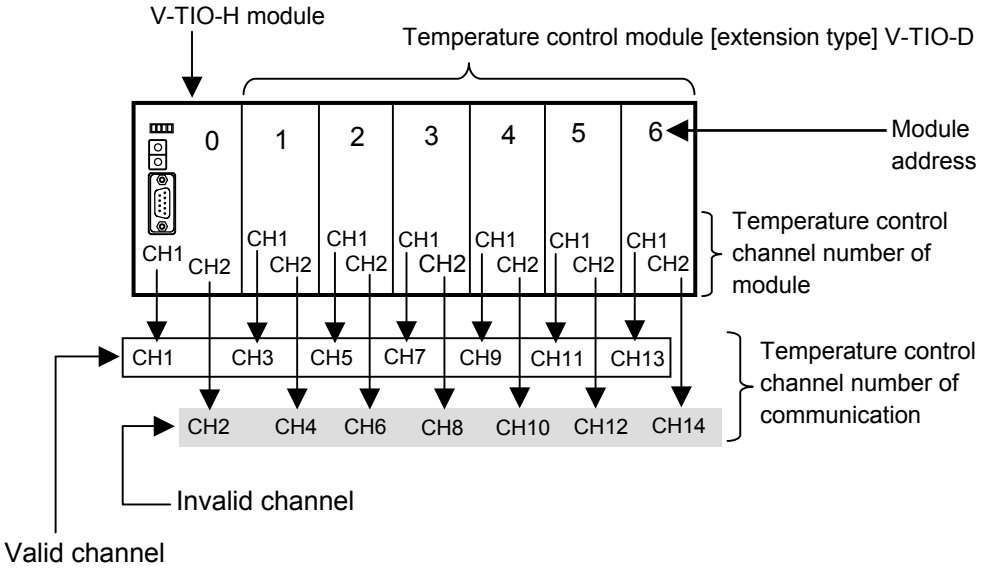
When in the continuous setting, set the V-TIO-G/H module address to 0 and also set other module addresses to consecutive numbers starting from 1. In addition, each temperature control channel number is automatically assigned in order of smaller module address number.

[Setting example]



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

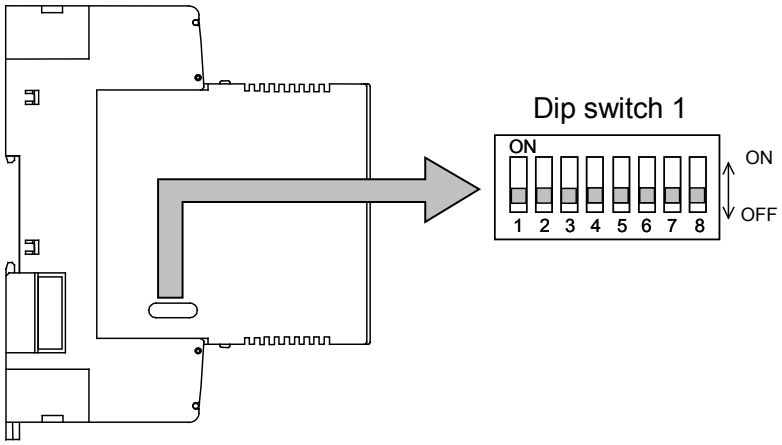
[Example] If module addresses of one V-TIO-H module and six V-TIO-D modules which are Heat/Cool temperature control modules are set as follows by the free setting, data in odd channels is used because data in even channels is invalid.
Valid channel number: 1, 3, 5, 7, 9, 11, 13
Invalid channel number: 2, 4, 6, 8, 10, 12, 14



4.2 PROFIBUS/Host Communication Transfer Setting

With the "Dip switch 1" which there is on the left side of module in SRV unit, select PROFIBUS/Host communication transfer, communication speed for internal communication in PROFIBUS.

Internal communication is communication that V-TIO-G/H module conduct to other temperature control modules in PROFIBUS.



V-TIO-G/H module left side view (PROFIBUS side)

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

7	PROFIBUS/Host communication transfer	
OFF	PROFIBUS (Internal communication validity)	← Factory set value
ON	Host communication (Internal communication invalidity)	

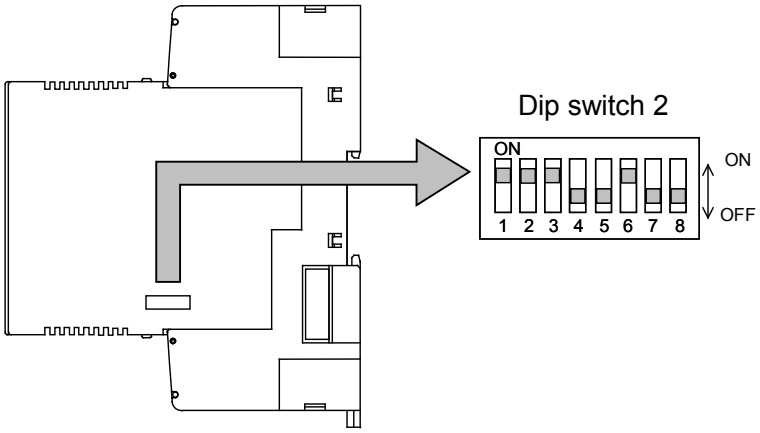
Switch No. 3 to 6, 8: OFF fixed (Do not change the factory set values)

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

4.3 Host Communication Setting

With the "Dip switch 2" which there is on the right side of module in SRV unit, select communication speed for host communication.

When host communication (Modbus) is not used, the "Dip switch 2" need not be set.



V-TIO-G/H module right side view (temperature control side)

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

Switch No. 3 to 8: OFF fixed (Do not change the factory set values)

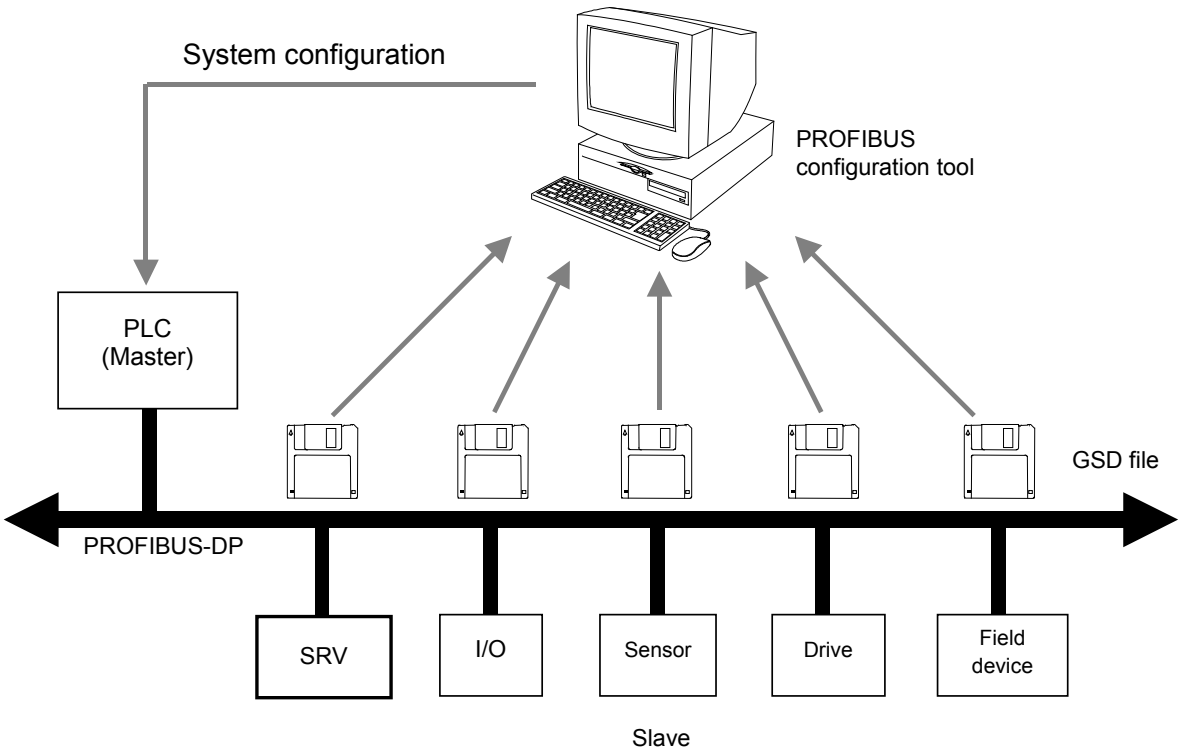
When connecting two or more modules (V-TIO-A, V-TIO-B, V-TIO-C or V-TIO-D) to the module (V-TIO-G or V-TIO-H), match all of the switch No. 1, 2 settings with the internal settings of the module (V-TIO-G or V-TIO-H).

For host communication (Modbus) using communication terminals, refer to **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.

5. PROFIBUS COMMUNICATION

5.1 PROFIBUS System Configuration

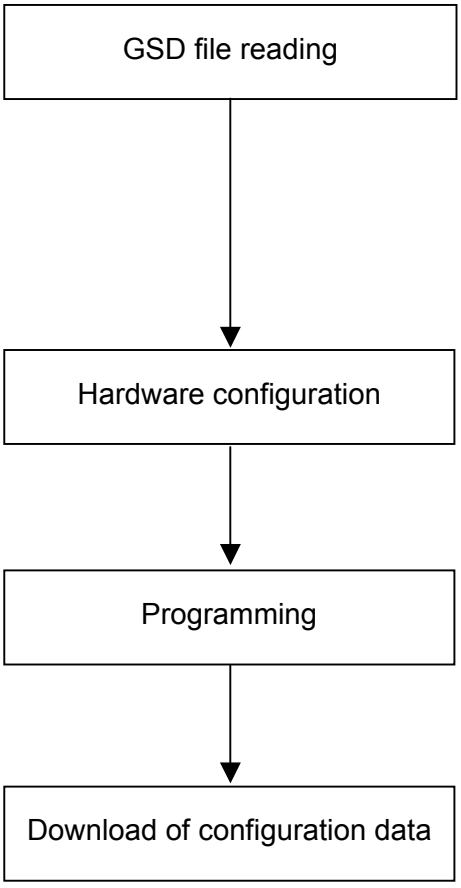
For system configuration with PROFIBUS-DP protocol, have to offer the communication information about each slave for a master in the form of electronic device data seat (GSD file).
A manufacturer of PLC (master) has prepared configuration tool for a system configuration of PROFIBUS. By combining all GSD files of the slaves to be connected, the configuration tool creates a master parameter record containing all pertinent data for the bus system. The configuration of a PROFIBUS system is enabled by downloading these data to a master.



About configuration tool, please ask a manufacturer of a master product.

■ The procedure of system configuration

When a master is PLC, and a slave is SRV (V-TIO-G/H module), the procedure of system configuration is as follows.



Read a GSD file of SRV on the PC by using a PLC configuration tool.

The GSD file for SRV can be downloaded from the official RKC website:
http://www.rkcinst.com/english/download/field_network.htm.

The configuration tool is used to set the PLC and SRV hardware and also the SRV static/dynamic data handled on PROFIBUS.

Create the sequence program that used static/dynamic data of SRV with a configuration tool.

Download the configuration data and sequence program to PLC.

5.2 Data of Static Data Request

Static data are the data which can always be read/write by PLC (a master). Select the items of static data with a configuration tool of PLC.
In addition, as the static data register address is set when system configured, it is not required to create a sequence program for static data assignment.

Number of communication item of static data request:
16 items max. (Number of read item + Number of write item)

Communication item of static data request: Refer to following "List of communication item names"

- Some item names displayed when system configured may be abbreviated due to limitations on the number of characters used.
- If item names are abbreviated, those not abbreviated are described in the remarks column.
- Each item name affixed with R at its end: Read only
- Each item name affixed with RW or not affixed with R/RW: Read and write

List of communication item names

Communication item name in configuration	Remarks
Measured value: R	Measured value (PV)
Comprehensive event state: R	—
Heat-side manip. output val.: R	Heat-side manipulated output value
Set value monitor: R	—
Error code: R	—
Cool-side manip. output val.: R	Cool-side manipulated output value
Current transformer input: R	Current transformer (CT) input value
Burnout state: R	—
Event 1 state: R	—
Event 2 state: R	—
HBA state: R	Hater break alarm (HBA) state
LBA state: R	Control loop break alarm (LBA) state
Temp. rise completion state: R	Temperature rise completion state
Operation mode: RW	—
Set value: RW	—
Heat-side proportional band: RW	—
Integral time: RW	—
Derivative time: RW	—
Control response parameters: RW	—
PV bias: RW	—
Event 1 set value: RW	—

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Communication item name in configuration	Remarks
Event 2 set value: RW	—
Cool-side proportional band: RW	—
Overlap/Deadband: RW	—
Setting change rate limiter: RW	—
PID/AT transfer: RW	—
Auto/Manual transfer: RW	—
Manual output value: RW	—
Output limiter (H): RW	Output limiter high
Output limiter (L): RW	Output limiter low
Heat-side prop. cycle time: RW	Heat-side proportional cycle time
Cool-side prop. cycle time: RW	Cool-side proportional cycle time
Digital filter: RW	—
HBA set value: RW	Heater break alarm (HBA) set value
Number of HBA delay times: RW	Number of heater break alarm (HBA) delay times
Control RUN/STOP transfer: RW	—
Input err. determin. point (H)	Input error determination point (high)
Input err. determin. point (L)	Input error determination point (low)
Action at input error (H): RW	Action at input error (high)
Action at input error (L): RW	Action at input error (low)
Manip. output val. at input err	Manipulated output value at input error
AT differential gap time: RW	—
AT bias: RW	—
Event LED mode setting: RW	—
DI setting: RW	—
DI state: R	—
DO1 setting: RW	—
DO2 setting: RW	—
DO state: R	—
Event interlock release: RW	—
Temp. rise completion range: RW	Temperature rise completion range
Temp. rise completion soak time	Temperature rise completion soak time
LBA use selection: RW	Control loop break alarm (LBA) use selection
LBA time: RW	Control loop break alarm (LBA) time
LBA deadband: RW	Control loop break alarm (LBA) deadband
Input range number: RW	—
Input scale high limit: RW	—
Input scale low limit: RW	—
Input range decimal point pos.	Input range decimal point position

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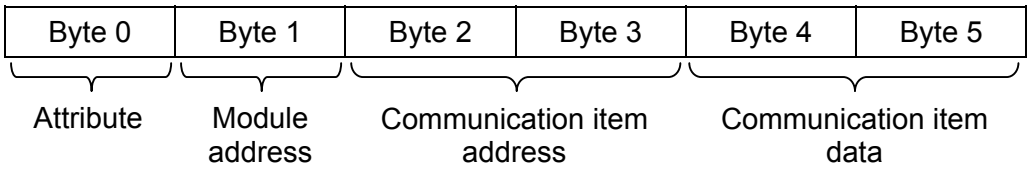
Communication item name in configuration	Remarks
Temperature unit selection: RW	—
Control type selection: RW	—
ON/OFF control diff. gap (U):RW	ON/OFF control differential gap (upper)
ON/OFF control diff. gap (L):RW	ON/OFF control differential gap (lower)
Event 1 differential gap: RW	—
Event 2 differential gap: RW	—
Event 1 type selection: RW	—
Event 2 type selection: RW	—
Event 1 action selection: RW	—
Event 2 action selection: RW	—
Event delay timer: RW	—
Operation mode holding setting	—

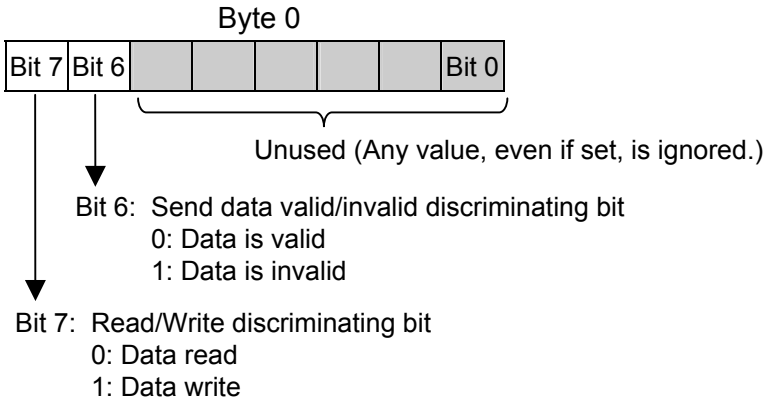
5.3 Data Send/Receive by Dynamic Data Request

Dynamic data is that whose read/write is requested by the sequence program from the PLC (master). The dynamic data request uses 3-word (6-byte) data for both send and receive.
The specifications for each byte are as follows.

■ When send data from PLC to SRV



- **Byte 0:** **Specify an attribute of data. Only Bit 7 and Bit 6 are used.**



- **Byte 1:** **Specify an accessing module address of SRV.**

  Data range: 0 to 30

- **Byte 2, Byte 3: The communication item address of SRV, to/from which data is written/read is specified.**

  Data range: Communication item of CH1: 0000H to 0884H
  Communication item of CH2: 1000H to 1884H

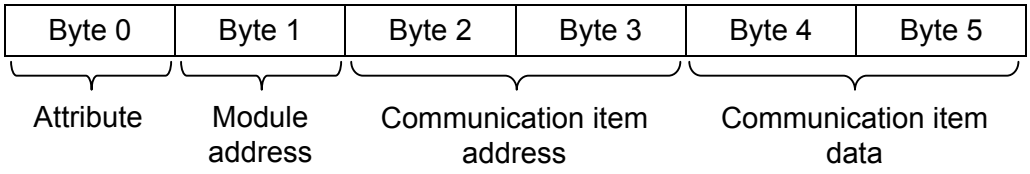
- **Byte 4, Byte 5: Write data of a communication item.**

  – If MSB (Bit 7) in Byte 0 is set to "1: Data write," data in the address specified by Bytes 1, 2, and 3 is written.
  – If MSB (Bit 7) in Byte 0 is set to "0: Data read," data in Byte 4 and 5 will be ignored.

☞ For communication item, refer to **6. LIST OF COMMUNICATION ITEMS (P. 31)**.

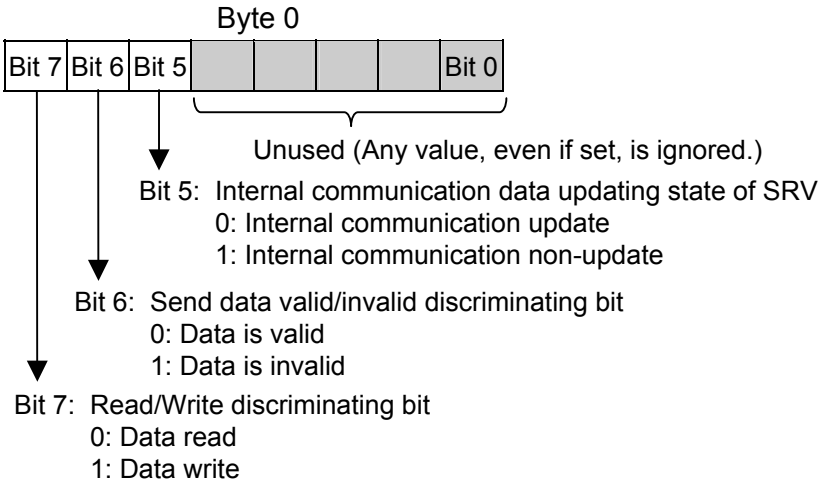
■ When PLC received data from SRV

The contents of the following registers are re-written if the module (V-TIO-G or V-TIO-H) recognizes the details of data sent to the SRV from the PLC.



- **Byte 0:** **Echo back of Byte 0 of send data, and internal communication data updating state of SRV (Bit 5)**

  The details of data in Byte 0 sent to the SRV from the PLC and internal communication data updating state of SRV (Bit 5) are returned.



- **Byte 1:** **Echo back of Byte 1 of send data**

  The specified SRV module address is returned.
  However, if there is no specified module address, "FFH" is returned.

- **Byte 2, Byte 3: Echo back of Byte 2 and Byte 3 of send data**

  The communication item address of SRV, to/from which data is written/read is returned. However, if any communication item address out of the data range or of unused item is specified, "FFFFH" is returned.
  Data range: Communication item of CH1: 0000H to 0884H
  Communication item of CH2: 1000H to 1884H

- **Byte 4, Byte 5: Data of communication item**

  – For data read, the relevant communication item value is stored.
  – For data write, the current value of relevant communication item is stored.
  If the written data is valid, the written value is returned.
  If the written data is invalid, the present (before data write) value is returned.

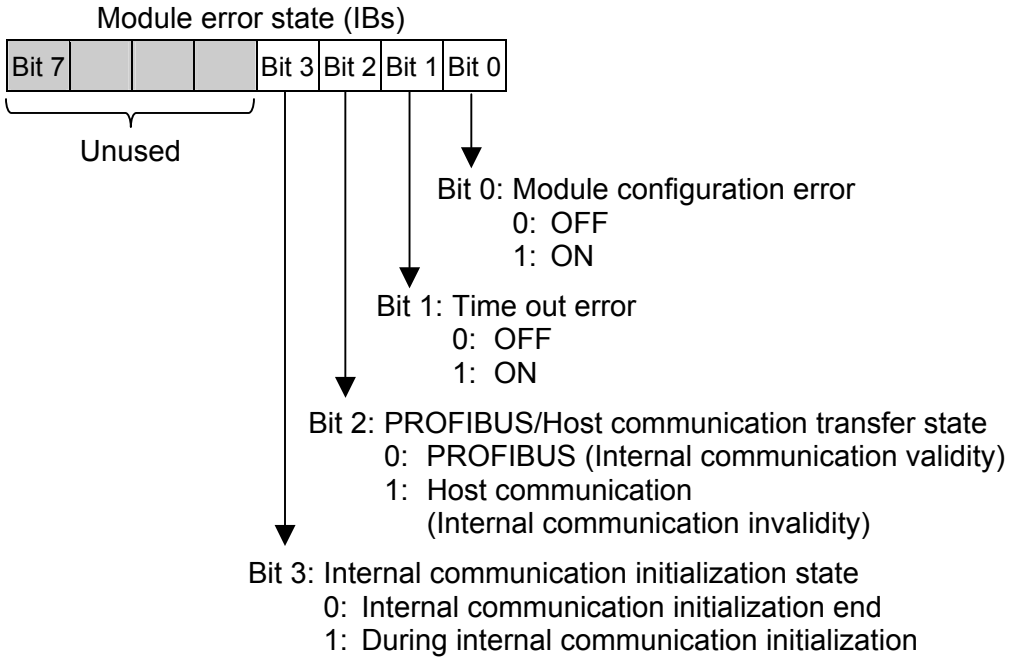
  Even if the written data is valid, the value before data write is returned depending on the period of internal communication data updating cycle of SRV (9 seconds max.).

5.4 Registers Assigned to PLC

Set the register area after the GSD file is read to the configuration tool for the PLC.
The dynamic data request, static data request read and static data request write registers are set to the register area.
In addition to the above register area setting, the "Module error state" and "Write permission flags" are set to the first 2 bytes of the read register and to the first 1 byte of the write register, respectively.

■ Module error state (IBs)

The first read only 1-byte register (IBs) consists of bits of module error state.
The respective bit configuration is as follows. (Bit 0 corresponding to LSB and Bit 7, MSB.)



● Module configuration error

A module configuration error occurs when:

- other modules (including the temperature control side of the V-TIO-G/H module) cannot be recognized after establishing PROFIBUS communication,
- two or more V-TIO-G/H modules connected,
- a V-TIO-E/F (Temperature Control Module for PLC Communication) module connected.

If a module configuration error occurs, the RUN lamp at the front of V-TIO-G/H module flashes.

● Time out error

A time out error occurs when:

- other modules (including the temperature control side of the V-TIO-G/H module) cannot be recognized after establishing PROFIBUS communication,
- two or more V-TIO-G/H modules connected,
- a V-TIO-E/F (Temperature Control Module for PLC Communication) module connected,
- the number of channels specified by the PLC configuration tool differs from that of temperature control modules actually connected (including the temperature control side of the V-TIO-G/H module),
- a module address of connection modules within the SRV unit does not continue from address number 0.

● PROFIBUS/Host communication transfer state

The PROFIBUS/Host communication transfer state expresses the setting state of switch No. 7 of the dip switch 1 which there is on the left side of V-TIO-G/H module.

☞ For details of the dip switch 1 setting, refer to **4.2 PROFIBUS/Host Communication Transfer Setting (P. 16)**.

● Internal communication initialization state

After the SRV unit is connected to PROFIBUS, data acquisition by static data request starts to indicate whether or not the first internal communication has been completed to all modules.

■ Write permission flags (QBw, IBw)

Data may be written by static data request depending on the PLC even if the PLC is not in the RUN state.

In order to prevent this, the module (V-TIO-G/H) is provided with the following 1-byte register.

- Write permission flag register (QBw)
- Read register to check that the write permission flag is set (IBw)

Only when the flag value in this one byte corresponds to “0FH” (hexadecimal), data is written to each module of the SRV. If “0FH” is stored in the write permission flag register, “0FH” is also set to the read side.

📖 **The operation of writing a hexadecimal value of “0FH” to the write permission flag register (QBw) is necessary for both static and dynamic data requests.**

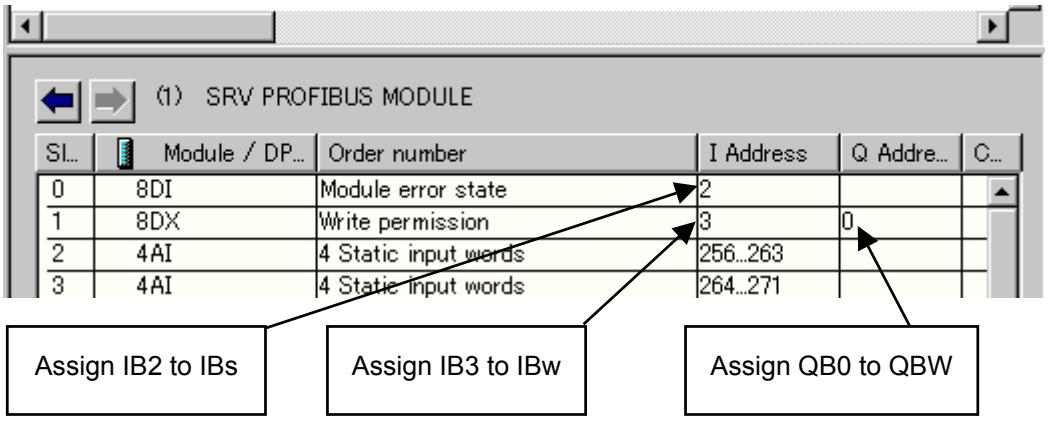
📖 If any value other than “0FH” is stored in the write permission flag register, “00H” is set to the read side.

■ Setting example of "Module error state (IBs)" and "Write permission flags (QBw, IBw)"

This section shows a setting example using STEP7 (programming software) from SIEMENS.

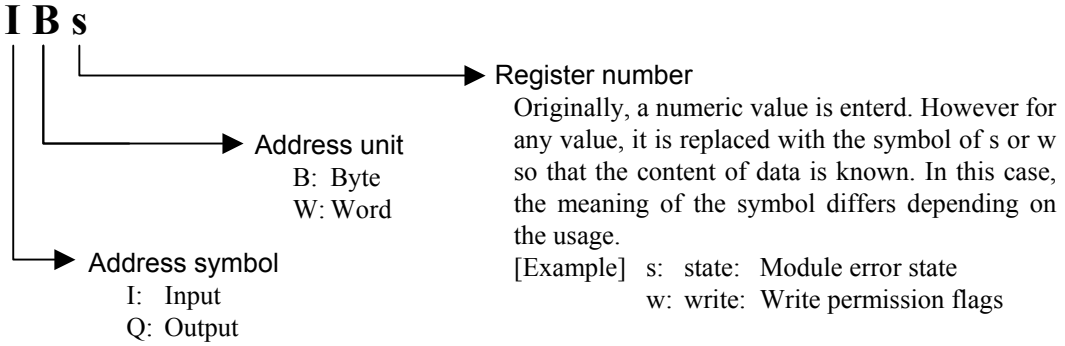
● Setting example of PLC configuration

If the SRV hardware configuration is conducted in STEP7, an address is assigned to the "Module error state (IBs)" and "Write permission flags (QBw and IBw)."
In the following example, IB2 is assigned to "Module error state (IBs)," and QB0 and IB3 are assigned to "Write permission flags [Write permission] (QBw and IBw)."



Display example of STEP 7

Symbols:
The symbols of IBs, QBw and IBw are used for a description of the register. The meaning of these symbols are as follows.



[Relation of word data, byte data and bit data]

For example, the "IW10" word data becomes as follows if expressed in byte and bit.

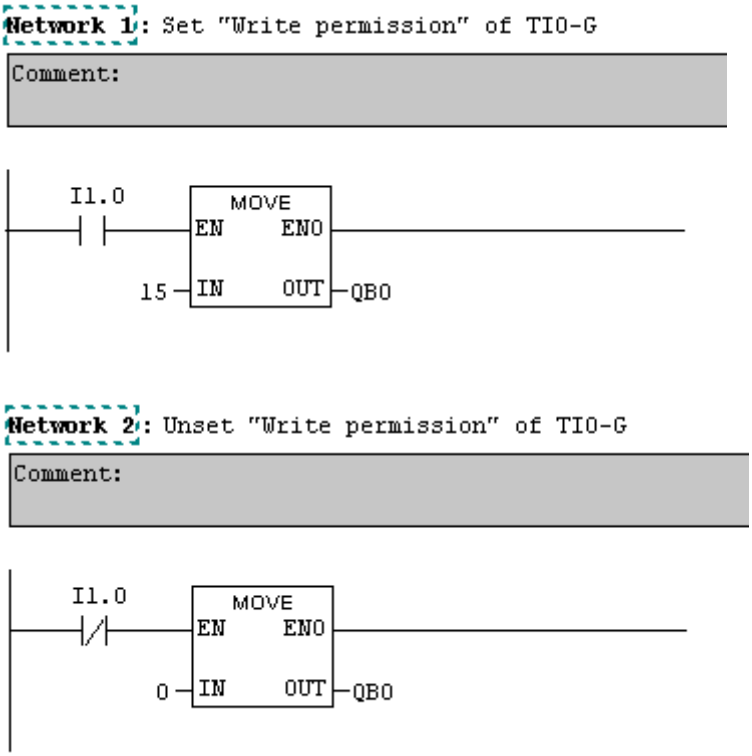
Word data: IW10
Byte data: IB10, IB11
Bit data: I10.0 to I10.7, I11.0 to I11.7
(Bit data is arranged in the order of address symbol, register number and bit number.)

- **Example of sequence program (data written by static data request)**

V-TIO-G/H module performs data writing for a temperature control module connected to it by writing a hexadecimal number “0FH” to the “write permission flag register (QBw)” of “Write permission flags.”

In the following example, the above operation is performed with a MOVE instruction.

The example on this page is related to the “**Setting example of PLC configuration**” on a previous page. Therefore, QB0 is assigned to the “write permission flag register (QBw)” in the sequence programming of a PLC.



When I1.0 is ON, a hexadecimal number: 0FH is written to QB0 and a write of static data request is done.

When I1.0 is OFF, a hexadecimal number: 00H is written to QB0 and a write of static data request is stopped.

Example of sequence program

■ Example of data assignment

The registers for static and dynamic data requests are assigned as follows it the following conditions are satisfied.

- Number of temperature control channel: 4 channels
- Number of registers used by dynamic data request: 1
- Number of data items read by static data request: 3 items [Measured value (PV), Comprehensive event state, Set value (SV)]
- Number of data items written by static data request: 1 item [Set value (SV)]

● Assignment of registers read by static data request (4 channels × 3 items = 12 words)

Base address: IWr

Register address	IWr	IWr + 1	IWr + 2	IWr + 3	IWr + 4	IWr + 5	IWr + 6	IWr + 7
Temperature control channel	1	2	3	4	1	2	3	4
Read item	Measured value (PV)	Measured value (PV)	Measured value (PV)	Measured value (PV)	Compre-hensive event state	Compre-hensive event state	Compre-hensive event state	Compre-hensive event state

IWr + 8	IWr + 9	IWr + 10	IWr + 11
1	2	3	4
Set value (SV)	Set value (SV)	Set value (SV)	Set value (SV)

● Assignment of registers written by static data request (4 channels × 1 item = 4 words)

Base address: QWw

Register address	QWw	QWw + 1	QWw + 2	QWw + 3
Temperature control channel	1	2	3	4
Read item	Set value (SV)	Set value (SV)	Set value (SV)	Set value (SV)

● Assignment of registers input by dynamic data request (6 bytes × 1 = 6 bytes)

Base address: IBdr

Register address	IBdr	IBdr + 1	IBdr + 2	IBdr + 3	IBdr + 4	IBdr + 5
Input item	Attribute	Module address	Communication item address		Communication item data	

● Assignment of registers output by dynamic data request (6 bytes × 1 = 6 bytes)

Base address: QBdw

Register address	QBdw	QBdw + 1	QBdw + 2	QBdw + 3	QBdw + 4	QBdw + 5
Output item	Attribute	Module address	Communication item address		Communication item data	

5.5 Processing of Numeric Data Values

Numeric data values used via communication with the PLC and processed by SRV include those with and without decimal points and also those with minus signs.

● For numeric data value without decimal point

If there is no decimal point, the value is processed as it is.
In parameters which only have ON or OFF status, 1 = ON, 0 = OFF.

[Example]

A signal wire for temperature input is disconnected and the burnout state occurs.
→ Read value corresponding to communication item address 0008H (burnout):
1 (Hexadecimal number: 0001H)

● For numeric data value with decimal point

The decimal point is omitted.

[Example 1]

When temperature measured value of SRV is 120.5 °C
→ Read value corresponding to communication item address 0000H (temperature measured value):
1205 (Hexadecimal number: 04B5H)

[Example 2]

When temperature measured value of SRV is 130 °C
→ Read value corresponding to communication item address 0000H (temperature measured value):
130 (Hexadecimal number: 0082H)

● For numeric data value with minus sign

The value is expressed as a 2's complement value which is obtained by subtracting the minus value from the hexadecimal number 10000H.

[Example 1]

When temperature measured value of SRV is –1 °C
→ Read value corresponding to communication item address 0000H (temperature measured value):
Hexadecimal number: FFFFH
(10000H – 1 = FFFFH)

[Example 2]

When temperature measured value of SRV is –2.5 °C
→ Read value corresponding to communication item address 0000H (temperature measured value):
Hexadecimal number: FFE7H
(10000H – 25 = 10000H – 19H = FFE7H)

The original minus value can be found by revising the WORD value to the INT value on the sequence program side.

6. LIST OF COMMUNICATION ITEMS

6.1 Reference to List of Communication Items

A list of communication items shows data on SRV which can make communication via PROFIBUS.

(1) Communication item address (Hexadecimal) CH1	(1) Communication item address (Hexadecimal) CH2	(2) Name	(3) Attribute	(4) Structure	(5) Data range	(6) Factory set value
0000	1000	Measured value (PV)	RO	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	—
0001	1001	Comprehensive event state	RO	C	Bit data Bit 0: Burnout Bit 1: Event 1 state Bit 2: Event 2 state Bit 3: Heater break alarm (HBA) state Bit 4: Control loop break alarm (LBA) state Bit 5 to Bit 7: Unused Data 0: OFF 1: ON [Decimal numbers expression: 0 to 31]	—
0002	1002	Heat-side manipulated output value	RO	C	−5.0 to +105.0 %	—
0003	1003	Set value monitor	RO	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	—

(1) Communication item address:
The communication item address is the address number to specify with configuration tool when carry out read/write of data.

(2) Name: The communication item name is written.

(3) Attribute: RO: Read only
Slave (SRV) → Master (PLC)
R/W: Read and Write
Slave (SRV) ↔ Master (PLC)

(4) Structure: C: Data for each channel M: Data for each module

(5) Data range: The data range of communication item is written.

(6) Factory set value: The factory set value of communication item is written.

6.2 Communication Item

6.2.1 Normal setting data

Communication item address (Hexadecimal)		Name	Attribute	Structure	Data range	Factory set value
CH1	CH2					
0000	1000	Measured value (PV)	RO	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	—
0001	1001	Comprehensive event state	RO	C	Bit data Bit 0: Burnout Bit 1: Event 1 state Bit 2: Event 2 state Bit 3: Heater break alarm (HBA) state Bit 4: Control loop break alarm (LBA) state Bit 5 to Bit 7: Unused Data 0: OFF 1: ON [Decimal numbers expression: 0 to 31]	—
0002	1002	Heat-side manipulated output value	RO	C	−5.0 to +105.0 %	—
0003	1003	Set value monitor	RO	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	—
0004		Error code	RO	M	Bit data Bit 0: Memory backup error Bit 1: Unused Bit 2: Internal communication error Bit 3: Adjustment data error Bit 4: Input error Bit 5: Current transformer input error Bit 6: Temperature compensation error Bit 7: Unused Data 0: OFF 1: ON [Decimal numbers expression: 0 to 127]	—
0005	1005	Cool-side manipulated output value	RO	C	−5.0 to +105.0 %	—
0006	1006	Current transformer input measured value	RO	C	0.0 to 30.0 A or 0.0 to 100.0 A	—
0007	1007	Unused	—	—	—	—
0008	1008	Burnout state	RO	C	0: OFF 1: ON	—

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Communication item address (Hexadecimal)		Name	Attri-bute	Struc-ture	Data range	Factory set value
CH1	CH2					
0009	1009	Event 1 state	RO	C	0: OFF 1: ON	—
000A	100A	Event 2 state	RO	C		—
000B	100B	Heater break alarm (HBA) state	RO	C	0: OFF 1: Heater break 2: Relay welding	—
000C	100C	Control loop break alarm (LBA) state	RO	C	0: OFF 1: ON	—
000D	100D	Temperature rise completion state	RO	C	0: Temperature rise not complete 1: Temperature rise completion	—
000E	100E	Unused	—	—	—	—
000F	100F	Operation mode	R/W	C	0: Unused 1: Monitor 1 2: Monitor 2 3: Control	3
0010	1010	Set value (SV)	R/W	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	0 (0.0)
0011	1011	Heat-side proportional band	R/W	C	TC/RTD input: 0 (0.0) to Input span (°C or °F) Voltage (V)/Current (I) input: 0.0 to 100.0 % of input span 0: ON/OFF action	30 (30.0)
0012	1012	Integral time	R/W	C	1 to 3600 seconds	240
0013	1013	Derivative time	R/W	C	0 to 3600 seconds 0: Derivative action OFF (PI action)	60
0014	1014	Control response parameters	R/W	C	0: Slow 1: Medium 2: Fast	0
0015	1015	PV bias	R/W	C	–Input span to +Input span	0

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Communication item address (Hexadecimal)		Name	Attribute	Structure	Data range	Factory set value
CH1	CH2					
0016	1016	Event 1 set value	R/W	C	Deviation high/Deviation low: −Input span to +Input span Deviation high/low, Band: 0 (0.0) to Input span Process high/Process low: TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	0
0017	1017	Event 2 set value	R/W	C		0
0018 ⋮ 001B	1018 ⋮ 101B	Unused	—	—	—	—
001C	101C	Cool-side proportional band	R/W	C	TC/RTD input: 1 (0.1) to Input span (°C or °F) Voltage (V)/Current (I) input: 0.1 to 100.0 % of input span	30 (30.0)
001D	101D	Unused	—	—	—	—
001E	101E	Overlap/Deadband	R/W	C	−Input span to +Input span	0 (0.0)
001F	101F	Setting change rate limiter	R/W	C	0 (0.0) to Input span/minute 0 (0.0): Setting change rate limiter OFF	0 (0.0)
0020	1020	PID/AT transfer	R/W	C	0: PID control operation 1: AT (Autotuning) operation	0
0021	1021	Auto/Manual transfer	R/W	C	0: Auto mode 1: Manual mode	0
0022	1022	Manual output value	R/W	C	−5.0 to +105.0 %	0.0
0023	1023	Output limiter high	R/W	C	Output limiter low to +105.0 %	100.0
0024	1024	Output limiter low	R/W	C	−5.0 % to Output limiter high	0.0
0025	1025	Heat-side proportional cycle time	R/W	C	1 to 100 seconds	Relay contact output: 20 Voltage pulse output: 2
0026	1026	Cool-side proportional cycle time	R/W	C		

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Communication item address (Hexadecimal)		Name	Attri-bute	Struc-ture	Data range	Factory set value
CH1	CH2					
0027	1027	Digital filter	R/W	C	0 to 100 seconds 0: OFF (Not provided)	0
0028	1028	Heater break alarm (HBA) set value	R/W	C	0.0 to 30.0 A or 0.0 to 100.0 A	0.0
0029	1029	Number of heater break alarm (HBA) delay times	R/W	C	1 to 255 times	5
002A ⋮ 002F	102A ⋮ 102F	Unused	—	—	—	—
0030		Control RUN/STOP transfer (Data of each module)	R/W	M	0: Control STOP 1: Control RUN	0
0031	1031	Input error determination point (high)	R/W	C	TC/RTD input: Within input range Voltage (V)/Current (I) input: Input scale low to Input scale high	TC/RTD: Input range high V/I: Input scale high
0032	1032	Input error determination point (low)	R/W	C		TC/RTD: Input range low V/I: Input scale low
0033	1033	Action at input error (high)	R/W	C	0: Normal control 1: Manipulated output value at input error	0
0034	1034	Action at input error (low)	R/W	C		0
0035	1035	Manipulated output value at input error	R/W	C	−105.0 to +105.0 %	0.0

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Communication item address (Hexadecimal) CH1	CH2	Name	Attribute	Structure	Data range	Factory set value
0036	1036	AT differential gap time	R/W	C	0 to 100 seconds	1
0037	1037	Unused	—	—	—	—
0038	1038	AT bias	R/W	C	–Input span to +Input span	0
0039 ⋮ 003B	1039 ⋮ 103B	Unused	—	—	—	—
003C		Event LED mode setting	R/W	M	1: Mode 1 2: Mode 2 3: Mode 3 Except the above (within 0 to 255): Unused	0 (Unused)
003D		DI setting	R/W	M	1: Control RUN/STOP 2: Event interlock release Except the above (within 0 to 20): Unused	Based on model code.
003E		DI state	RO	M	0: Contact open (OFF) 1: Contact close (ON)	—
003F		DO1 setting	R/W	M	1: CH1 Event 1 state 2: CH2 Event 1 state 3: CH1 Event 2 state 4: CH2 Event 2 state 5: CH1 Heater break alarm (HBA) state 6: CH2 Heater break alarm (HBA) state 7: CH1 Control loop break alarm (LBA) state 8: CH2 Control loop break alarm (LBA) state 9: CH1 Burnout state 10: CH2 Burnout state 11: CH1 Temperature rise completion 12: CH2 Temperature rise completion Except the above (within 0 to 20): Unused	Based on model code.
0040		DO2 setting	R/W	M		Based on model code.

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Communication item address (Hexadecimal) CH1	CH2	Name	Attribute	Structure	Data range	Factory set value
0041		DO state	R/W	M	0: DO1: Contact open (OFF) DO2: Contact open (OFF) 1: DO1: Contact close (ON) DO2: Contact open (OFF) 2: DO1: Contact open (OFF) DO2: Contact close (ON) 3: DO1: Contact close (ON) DO2: Contact close (ON) Data write is possible only when the DO1 and DO2 setting values are "0."	0
0042		Event interlock release	R/W	M	0: Normal state 1: Event interlock release execution	0
0043	1043	Temperature rise completion range	R/W	C	0 (0.0) to Input span 0 (0.0): Unused	0 (0.0)
0044	1044	Temperature rise completion soak time	R/W	C	0 to 360 minutes	0
0045 ⋮ 0858	1045 ⋮ 1858	Unused	—	—	—	—
0859	1859	Control loop break alarm (LBA) use selection	R/W	C	0: Unused 1: Used	0
085A	185A	Control loop break alarm (LBA) time	R/W	C	1 to 7200 seconds	480
085B	185B	Control loop break alarm (LBA) deadband	R/W	C	0 (0.0) to Input span	0 (0.0)
085C ⋮ 086F	185C ⋮ 186F	Unused	—	—	—	—

6.2.2 Initial setting data

⚠ WARNING

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

When setting initial setting data items, stop control by normal setting data "Control RUN/STOP transfer."

Communication item address (Hexadecimal)		Name	Attribute	Structure	Data range	Factory set value
CH1	CH2					
0870	1870	Input range number	R/W	C	TC input 0: K −200 to +1372 °C −328 to +2501 °F 1: K 0 to 800 °C 32 to 1472 °F 2: K 0 to 400 °C 32 to 752 °F 3: K −200.0 to +400.0 °C −328.0 to +752.0 °F 4: K 0.0 to 400.0 °C 32.0 to 752.0 °F 5: J −200 to +1200 °C −328 to +2192 °F 6: J 0 to 800 °C 32 to 1472 °F 7: J 0 to 400 °C 32 to 752 °F 8: J −200.0 to +400.0 °C −328.0 to +752.0 °F 9: J 0.0 to 400.0 °C 32.0 to 752.0 °F 10: T −200 to +400 °C −328 to +752 °F 11: T 0 to 400 °C 32 to 752 °F 12: T 0 to 200 °C 32 to 392 °F 13: T −200.0 to +400.0 °C −328.0 to +752.0 °F 14: T 0.0 to 400.0 °C 32.0 to 752.0 °F	Based on model code.

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Communication item address (Hexadecimal)		Name	Attri-bute	Struc-ture	Data range	Factory set value
CH1	CH2					
0870	1870	Input range number	R/W	C	TC input 15: S 0 to 1768 °C 32 to 3214 °F 16: R 0 to 1768 °C 32 to 3214 °F 17: PLII 0 to 1390 °C 32 to 2534 °F 18: N 0 to 1300 °C 32 to 2372 °F 19: W5Re/W26Re 0 to 2300 °C 32 to 4172 °F 20: E 0 to 1000 °C 32 to 1832 °F 21: E 0 to 800 °C 32 to 1472 °F 22: B 0 to 1800 °C 32 to 3272 °F RTD input: 23: Pt100: 0 to 850 °C 32 to 1562 °F 24: Pt100: 0 to 400 °C 32 to 752 °F 25: Pt100: −200.0 to +400.0 °C −328.0 to +752.0 °F 26: Pt100: 0.0 to 400.0 °C 32.0 to 752.0 °F 27: JPt100: 0 to 600 °C 32 to 1112 °F 28: JPt100: 0 to 400 °C 32 to 752 °F 29: JPt100: −200.0 to +400.0 °C −328.0 to +752.0 °F 30: JPt100: 0.0 to 400.0 °C 32.0 to 752.0 °F Voltage (V)/Current (I) input: 31: 0 to 100 mV DC 32: Unused 33: 0 to 5 V DC 34: 1 to 5 V DC 35: 0 to 10 V DC 36: 0 to 20 mA DC 37: 4 to 20 mA DC	Based on model code.

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Communication item address (Hexadecimal)		Name	Attri-bute	Struc-ture	Data range	Factory set value
CH1	CH2					
0871	1871	Input scale high	R/W	C	Input scale low to 10000 [Effective only for Voltage (V)/ Current (I) input]	100.0
0872	1872	Input scale low	R/W	C	–2000 to Input scale high [Effective only for Voltage (V)/ Current (I) input]	0.0
0873	1873	Input range decimal point position	R/W	C	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places [Effective only for Voltage (V)/ Current (I) input]	1
0874	1874	Temperature unit selection	R/W	C	0: °C 1: °F	0
0875	1875	Control type selection	R/W	C	0: Heat control (direct action) 1: Heat control (reverse action) 2: Heat/Cool control (water cooling) 3: Heat/Cool control (air cooling)	Based on model code.
0876	1876	ON/OFF control differential gap (upper)	R/W	C	0 to Input span	TC/RTD: 1.0 V/I: 0.1 % of input span
0877	1877	ON/OFF control differential gap (lower)	R/W	C		
0878	1878	Event 1 differential gap	R/W	C	0 to Input span	TC/RTD: 2.0 V/I: 0.2 % of input span
0879	1879	Event 2 differential gap	R/W	C		
087A	187A	Event 1 type selection	R/W	C	0: Not provided 1: Process high 2: Process low 3: Deviation high 4: Deviation low 5: Deviation high/low 6: Band	Based on model code.

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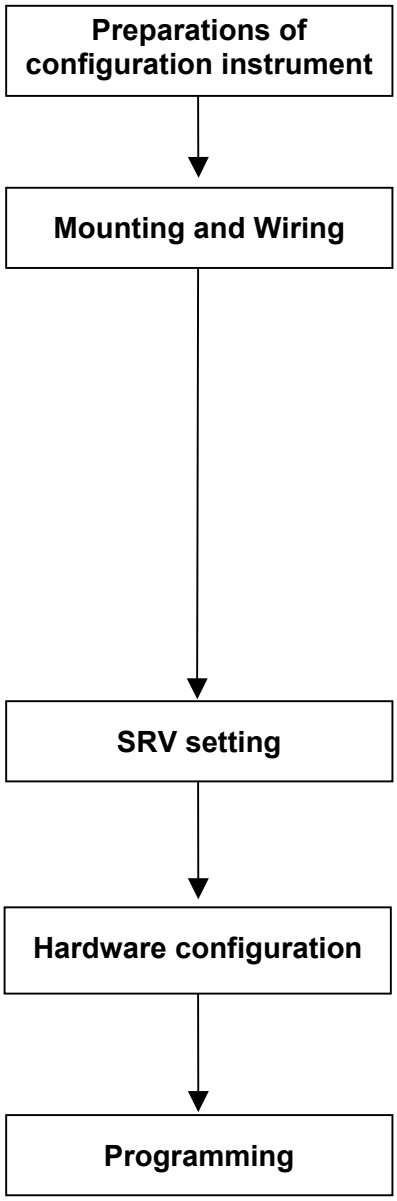
Communication item address (Hexadecimal)		Name	Attri-bute	Struc-ture	Data range	Factory set value
CH1	CH2					
087B	187B	Event 2 type selection	R/W	C	0: Not provided 1: Process high 2: Process low 3: Deviation high 4: Deviation low 5: Deviation high/low 6: Band	Based on model code.
087C	187C	Event 1 action selection	R/W	C	Bit data Bit 0: Hold action Bit 1: Re-hold action Bit 2: Interlock action Bit 3: Event action at input error Bit 4: Hold action at control start Bit 5 to Bit 7: Unused Data 0: OFF 1: ON [Decimal numbers expression: 0 to 31]	Bit 0 to Bit 2: Based on model code. Bit 3 to Bit 7: 0
087D	187D	Event 2 action selection	R/W	C		Bit 0 to Bit 2: Based on model code. Bit 3 to Bit 7: 0
087E	187E	Event delay timer	R/W	C	0 to 9999 seconds	0
087F	187F	Unused	—	—	—	—
0880	1880	Unused	—	—	—	—
0881		Operation mode holding setting	R/W	M	0: Not hold 1: Hold	1
0882 ⋮ 0884	1882 ⋮ 1884	Unused	—	—	—	—

7. USAGE EXAMPLE

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

📖 In this Chapter, are described by the V-TIO-G module as an example. In addition, the V-TIO-G module is the same.

7.1 Handling Procedures



☞ Refer to **7.2 System Configuration (P. 43)**.

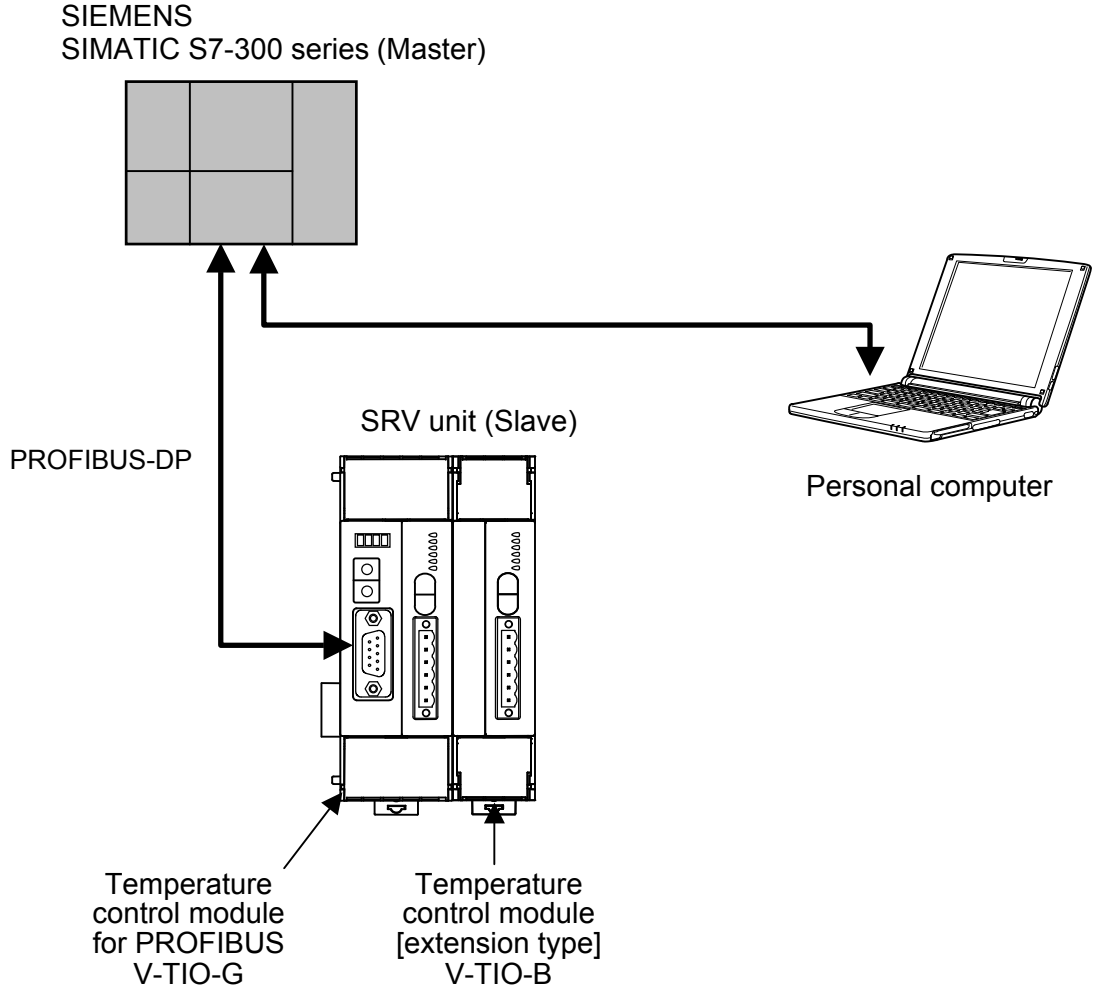
☞
- For mounting and wiring of the SRV, refer to the following
  - **3. WIRING (P. 3)**
  - **Temperature Control Module for PROFIBUS V-TIO-G/V-TIO-H Instruction Manual (IMS01P06-E□)**
  - **Temperature Control Module [extension type] V-TIO-B/V-TIO-D Instruction Manual (IMS01P03-E□)**
  - **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.
- For mounting and wiring of the PLC, refer to **PLC Instruction Manual**.

☞ Refer to **4. SETTING (P. 13)**, **7.3 Hardware Setting (P. 44)** and **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.

☞ Refer to **5. PROFIBUS COMMUNICATION (P. 18)**, **7.4 Setting Example of the Programming Software STEP7 (P. 45)** and **Instruction Manual of the Programming Software STEP7**.

☞ Refer to **7.4 Setting Example of the Programming Software STEP7 (P. 45)** and **Instruction Manual of the Programming Software STEP7**.

7.2 System Configuration



■ Use instruments

- **Module type controller SRV**
  - Temperature control module for PROFIBUS: V-TIO-G..... 1
  - Temperature control module [extension type]: V-TIO-B..... 1
- **PLC**

  SIMATIC S7-300 series (SIEMENS AG)
  - Power supply module: PS-300 (PS307 2A) 1
  - CPU module: S7-300 (CPU315-2DP)..... 1
  - Digital input module: DI-300 (SM321 DI16) 1
- **Personal computer**

  Software of the following must be installed in a personal computer.
  - Programming Software STEP7 V5.1 (SIEMENS AG)

☞ For the personal computer to be connected to the PLC, refer to Instruction Manual of PLC and STEP7.

7.3 Hardware Setting

Set each hardware's as the following.

📖 There is not the hardware setting of PLC: SIMATIC S7-300 series (SIEMENS AG).

■ SRV module setting

Set each module of SRV in requirement of the following.

- **V-TIO-G module**
  PROFIBUS address: 01H
  Module address: 0

- **V-TIO-B module**
  Module address: 1
  Termination resistor built-in the terminal base: ON

📖 **Always set the PROFIBUS address of the V-TIO-G module to any number other than "00H." In addition, match the PROFIBUS address with the address set when hardware configured. (Refer to No. 4 on page 51.)**

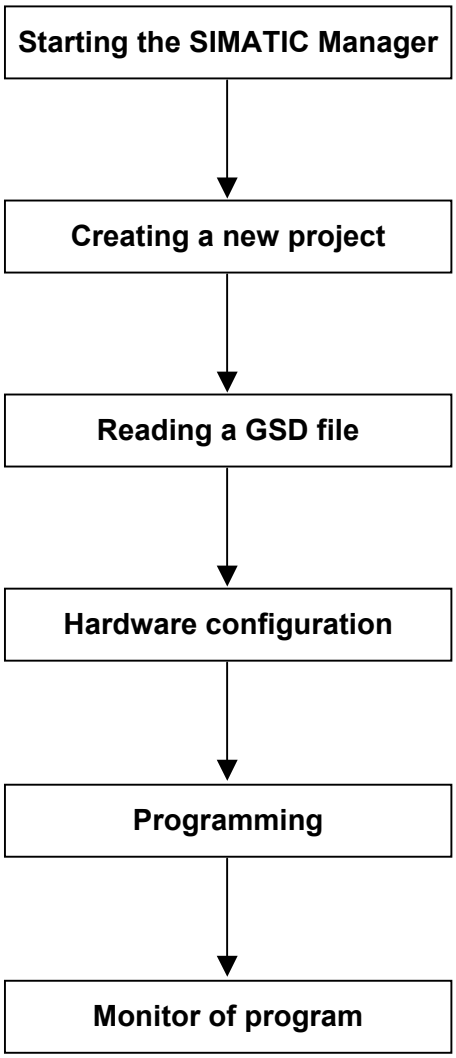
📖 **When setting module address, always set their address from address number "0" in succession. Otherwise, problems or malfunction may result.**

☞ For setting method, refer to **4. SETTING (P. 13)**.

7.4 Setting Example of the Programming Software STEP7

7.4.1 Outline

The procedure of using the Programming Software STEP7 V5.1 is as follows.



☞ Refer to **7.4.2 Starting the SIMATIC Manager and creating a new project (P. 46)**.

☞ Refer to **7.4.2 Starting the SIMATIC Manager and creating a new project (P. 46)**.

☞ Refer to **7.4.3 Reading a GSD file (P. 47)**.

☞ Refer to **7.4.4 Hardware configuration (P. 50)**.

☞ Refer to **7.4.5 Programming (P. 60)**.

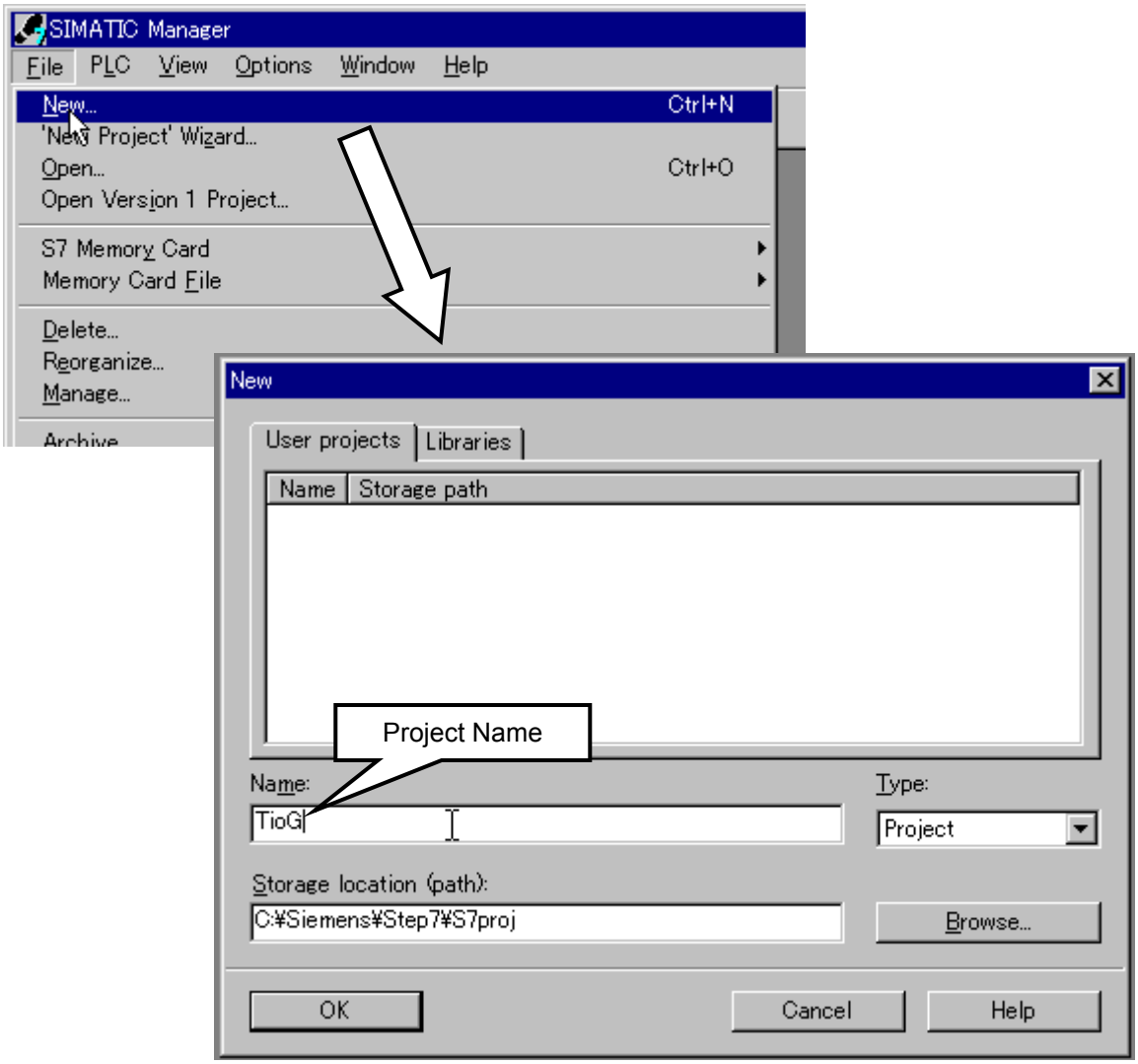
☞ Refer to **7.4.6 Program monitor (P. 80)**.

☞ For details, refer to Instruction Manual of the Programming Software STEP7.

7.4.2 Starting the SIMATIC Manager and creating a new project

1. Start SIMATIC Manager from an icon or start button.

2. Select the menu command **File > New…**, and creating a new project.
The project name is “TioG” (an example).

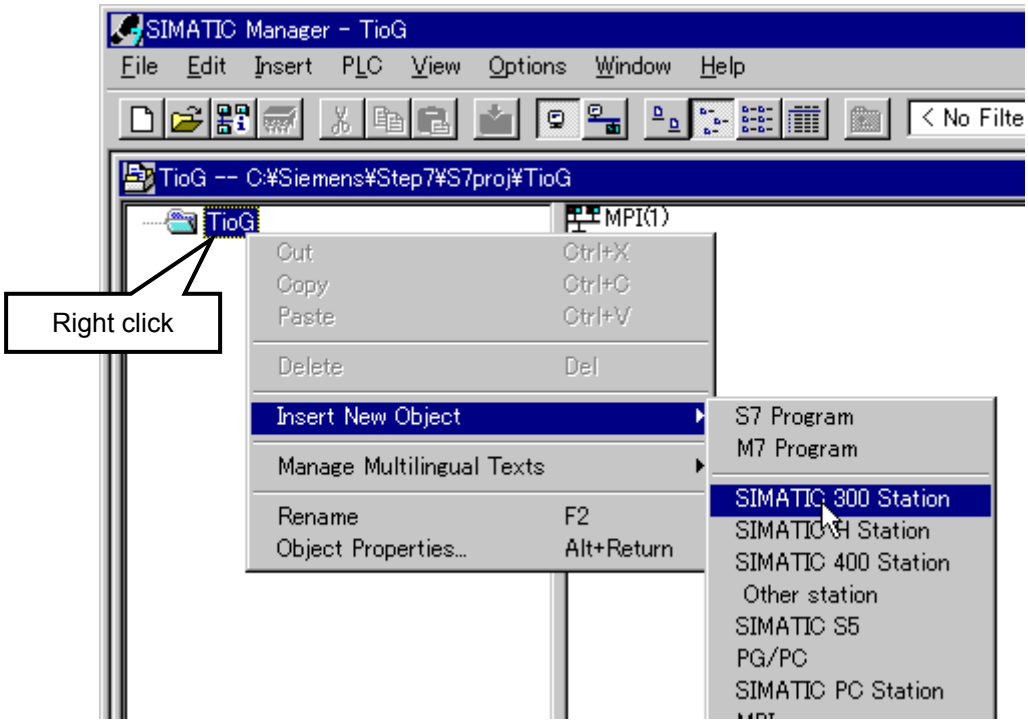


3. Clicking “OK” displays the project.

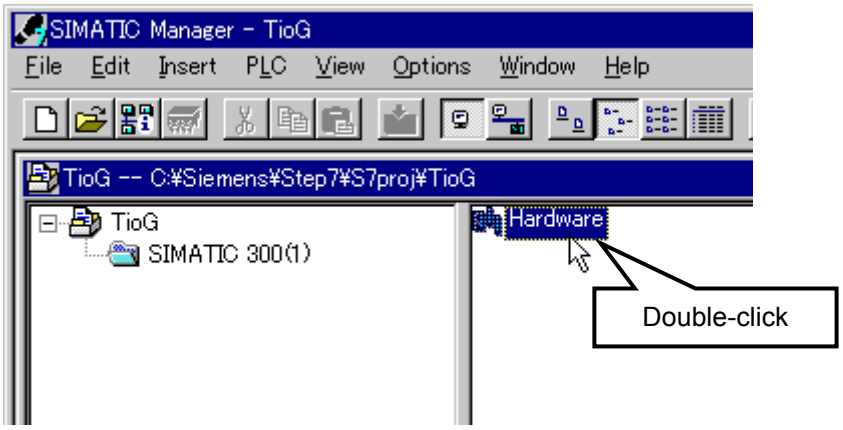
7.4.3 Reading a GSD file

1. The GSD file for SRV can be downloaded from the official RKC website: http://www.rkcinst.com/english/download/field_network.htm.

2. Right clicks a project “TioG” folder, and select the command **Insert new object > SIMATIC 300 Station**. This operation can create the “SIMATIC 300” folder under the “TioG” folder.



3. Clicking the “SIMATIC 300” folder displays “Hardware” on the right side of the window. Therefore, double click it.
Thus, hardware configuration tool “HW Config” starts.



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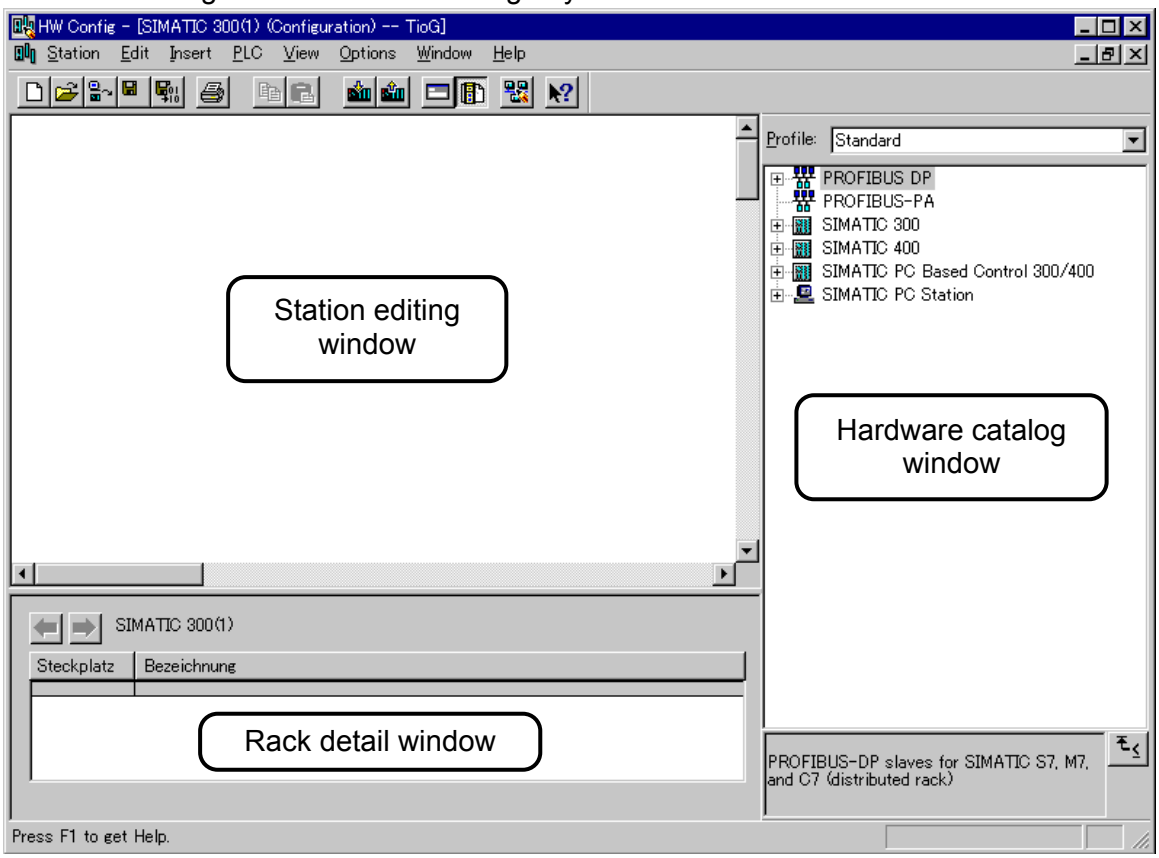
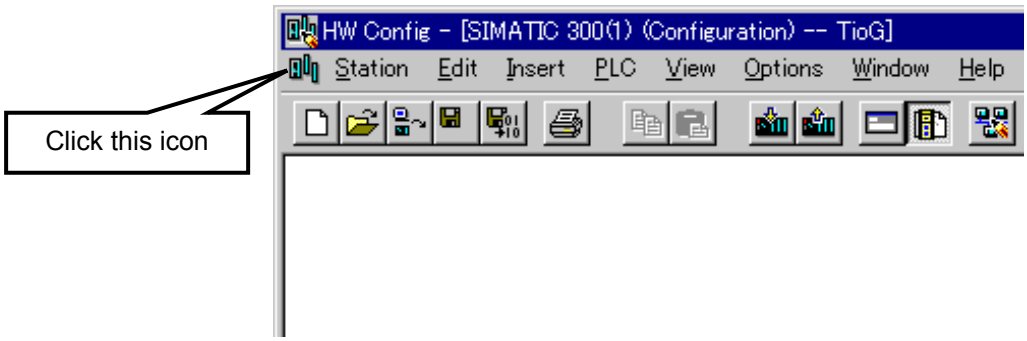
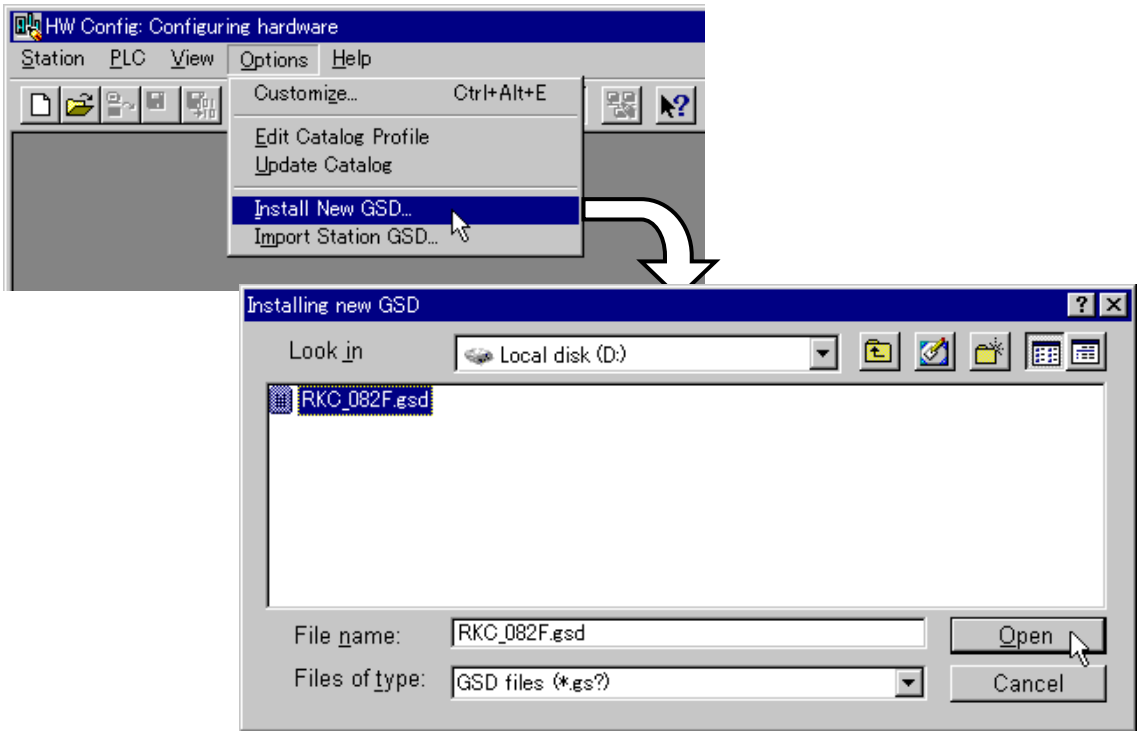
Hardware configuration tool “HW Config” layout



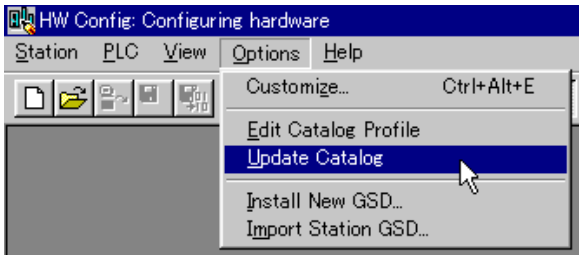
4. In order to read the GSD file, it is necessary to close the “HW Config” station editing and rack detail windows once.
Click the icon on the left side of the menu and then “Close (C).”



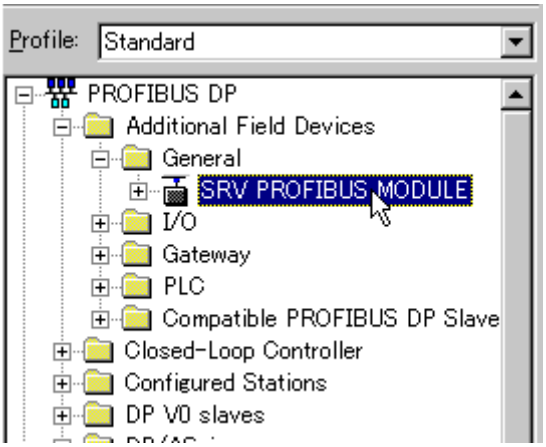
5. Next, select the menu command **Options > Install New GSD…**, and displayed the file selection window. If the folder stored with the GSD file is selected and then "RKC_082F.gsd" is specified, the GSD file is read.



6. The hardware catalogue is updated when select the menu command **Options > Update Catalog**.



7. Check that the V-TIO-G GSD file has been read. If the selection of **PROFIBUS DP > Additional Field Devices > General** is made in succession on the hardware catalog, GSD hardware information "SRV PROFIBUS MODULE" of V-TIO-G can be checked.



7.4.4 Hardware configuration

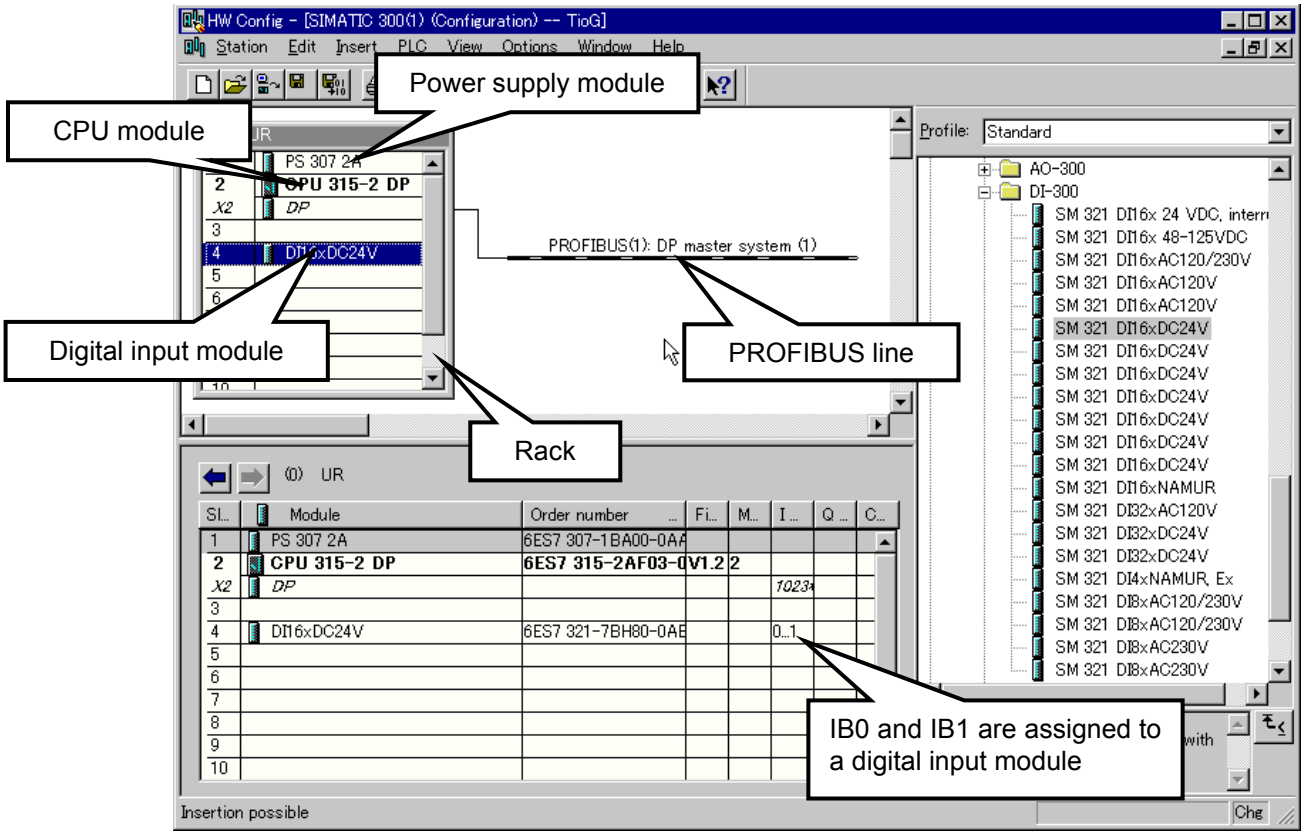
■ Hardware assignment

1. After checking that the GSD file was read, minimize “HW Config.”
As the screen returns to the main window of the “TioG” project, double click “Hardware” on the right side of the window again to display a screen on which configuration is made in hardware configuration including the SRV. (Same as No.3 in **7.4.3 Reading a GSD file**)

2. A rack is added on the station editing window and the Power supply, CPU and Digital input modules are added on it.
In addition, the CPU module has already been defined as the PROFIBUS master.
Here, the following Power supply, CPU and Digital input modules are specified as an example.

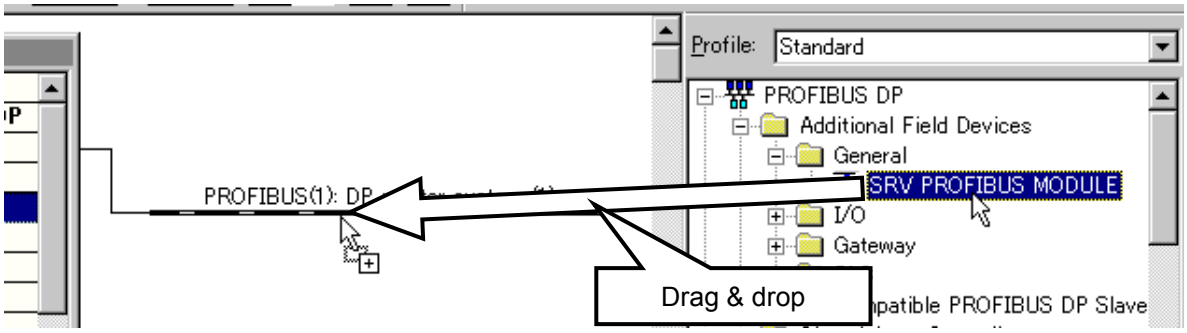
- Power supply module: PS 307A 2A (PS-300)
- CPU module: CPU 315-2 DP (S7-300A)
- Digital input module: SM321 DI16xDC24V (DI-300)

☞ For details of the procedure for adding the rack, and Power supply, CPU and Digital input modules and for defining the PROFIBUS master, refer to the instruction manual for Programming Software STEP7.

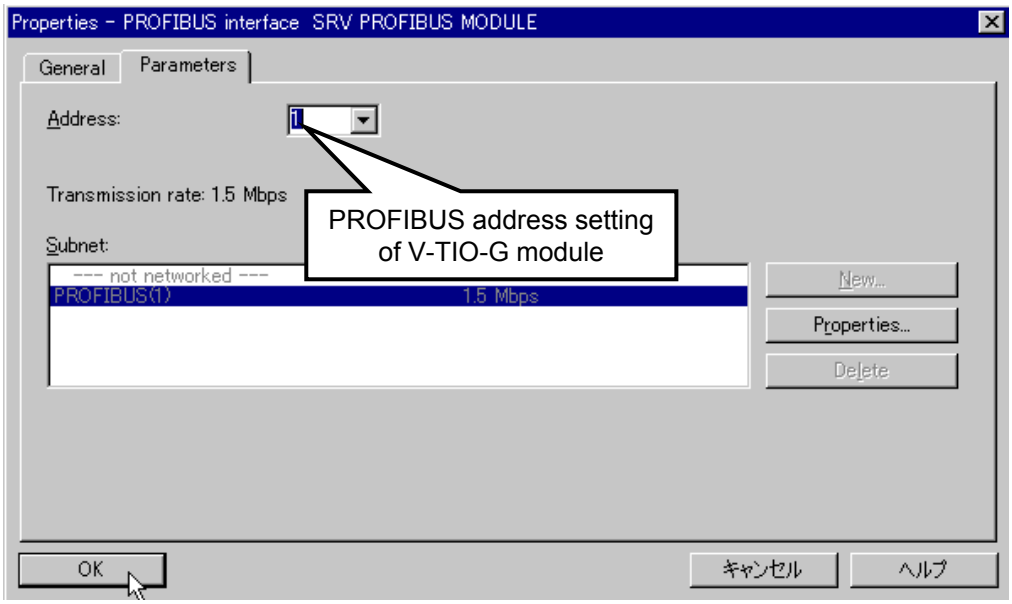


📖 Just when digital input module is mounted on the rack, IB0 and IB1 are automatically assigned.

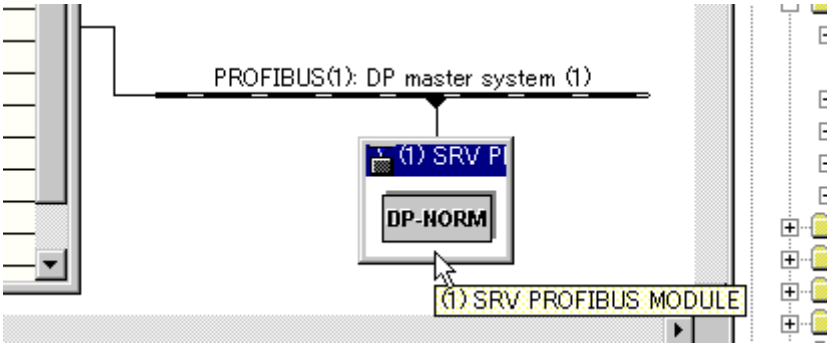
3. Select GSD hardware information "SRV PROFIBUS MODULE" of V-TIO-G read in the previous item from the hardware catalog and then drag and drop it on the PROFIBUS line.



4. As a dialog to set any V-TIO-G module address is displayed, enter the same value as that in the PROFIBUS address specified by the address setting switch of V-TIO-G module.
PROFIBUS address of V-TIO-G module: 1



5. SRV PROFIBUS MODULE is displayed on the PROFIBUS line.



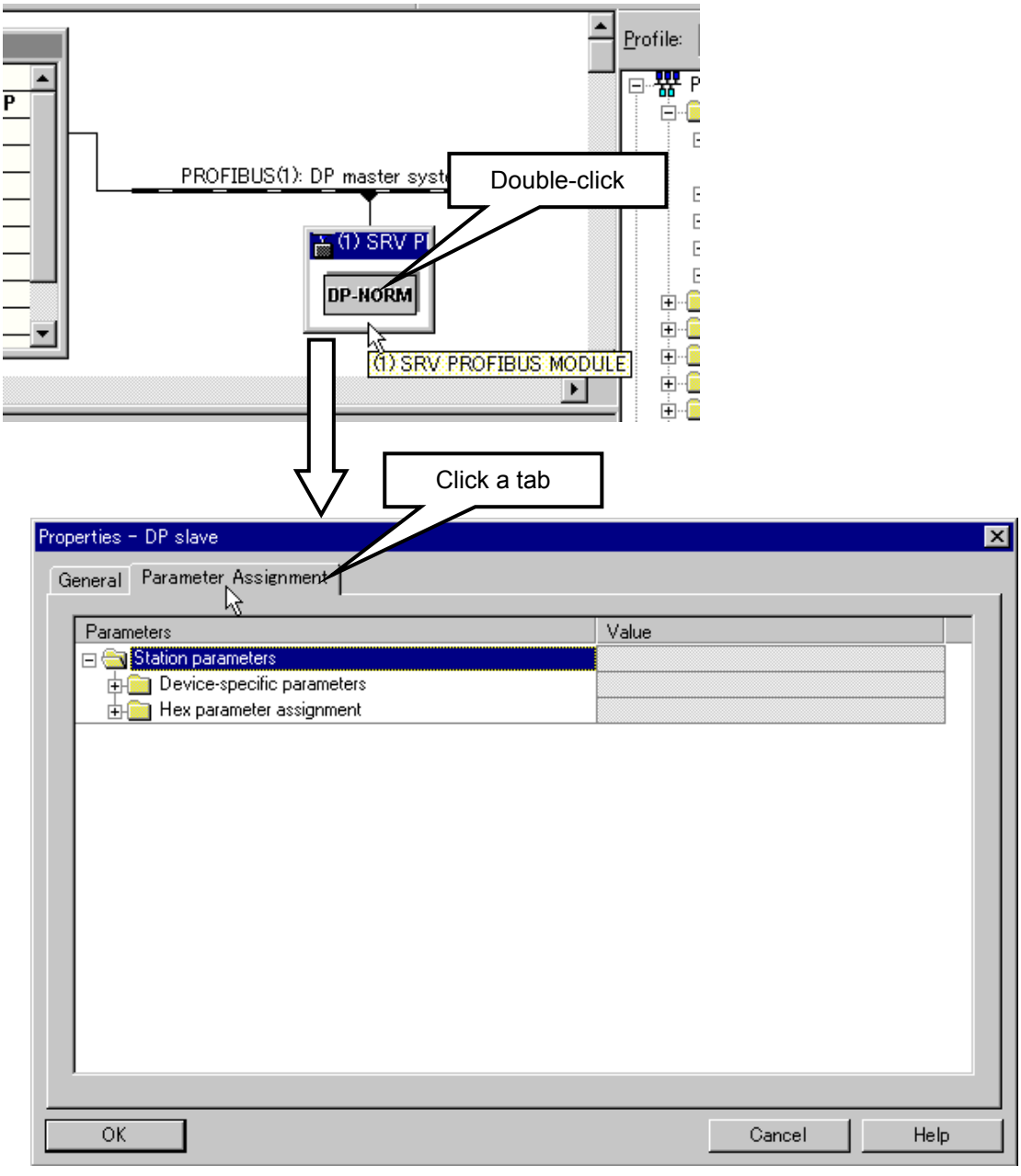
■ Assignment of SRV communication items

Next, SRV PROFIBUS MODULE is configured.
As an example here, conduct the setting so that the following static data can be read/written.

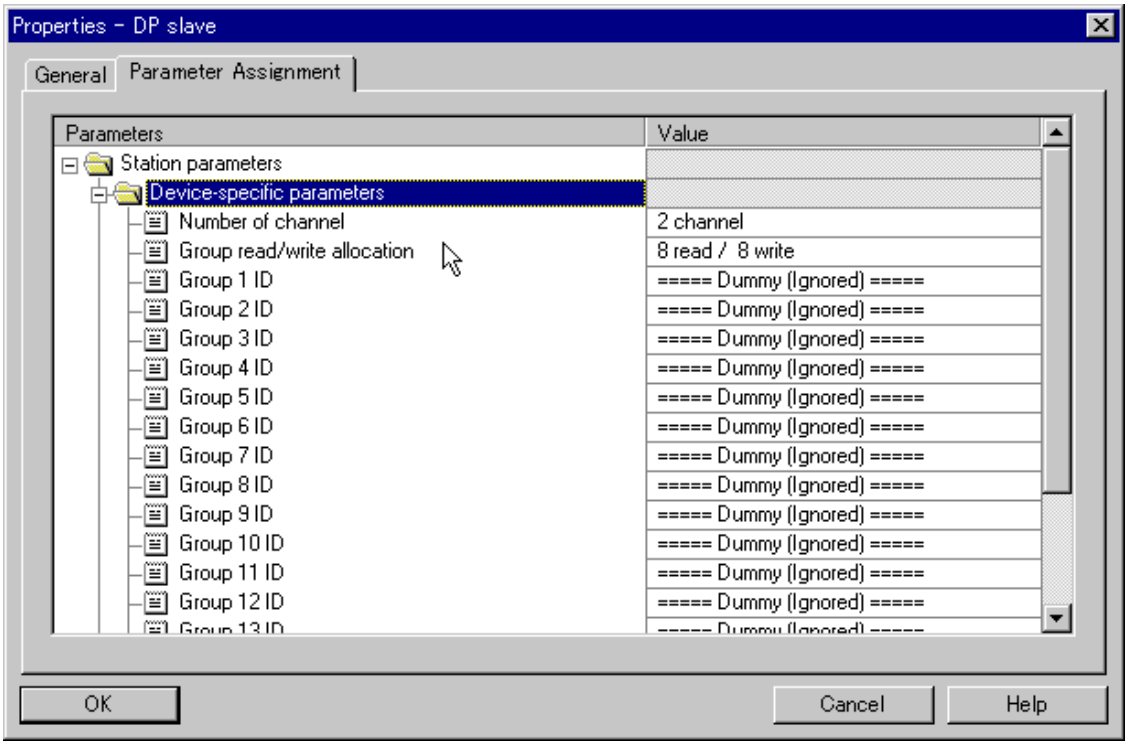
[Read items]
- Measured value (PV)
- Comprehensive event state
- Set value (SV)

[Write item]
- Set value (SV)

1. Double click the SRV PROFIBUS MODULE on the PROFIBUS line, and click the “Parameter Assignment” tab of a displayed “Properties - DP slave” window.



2. If the selection of **Station parameters** > **Device-specific parameters** is made in this order to unfold the folder, such items as "Number of Channel," "Group read/write allocation" and "Group 1 to 16 ID" appear.



- **Number of Channel**

Specify the number of temperature control channel connected to a V-TIO-G module.
As the V-TIO-G module has two temperature control channels, the minimum number of channels is 2, and as the SRV unit can connect up to 31 sets including one V-TIO-G module, the maximum number of channels is 62.

In this example, as one V-TIO-B module is connected to the V-TIO-G module, select "4 channel."

- **Group read/write allocation**

The read/write attribute of communication items specified by Group 1 to 16 ID is specified.
For example, if 10 read items/6 write items need to be set, select "10 read/6 write."
Group 1 to 16 ID communication items at that time become "Group 1 to 10 ID: Read items" and "Group 11 to 16 ID: Write items."

In this example, as 3 read items/1 write item need to be set, "8 read/8 write" in the initial state is used.

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- **Group 1 to 16 ID**

Select the communication item. "===== Dummy (Ignored) =====" is ignored.

As "8 read/8 write" is set by "Group read/write allocation," Group 1 to 8 become read items and Group 9 to 16, write items.

Set the following to 3 read items.

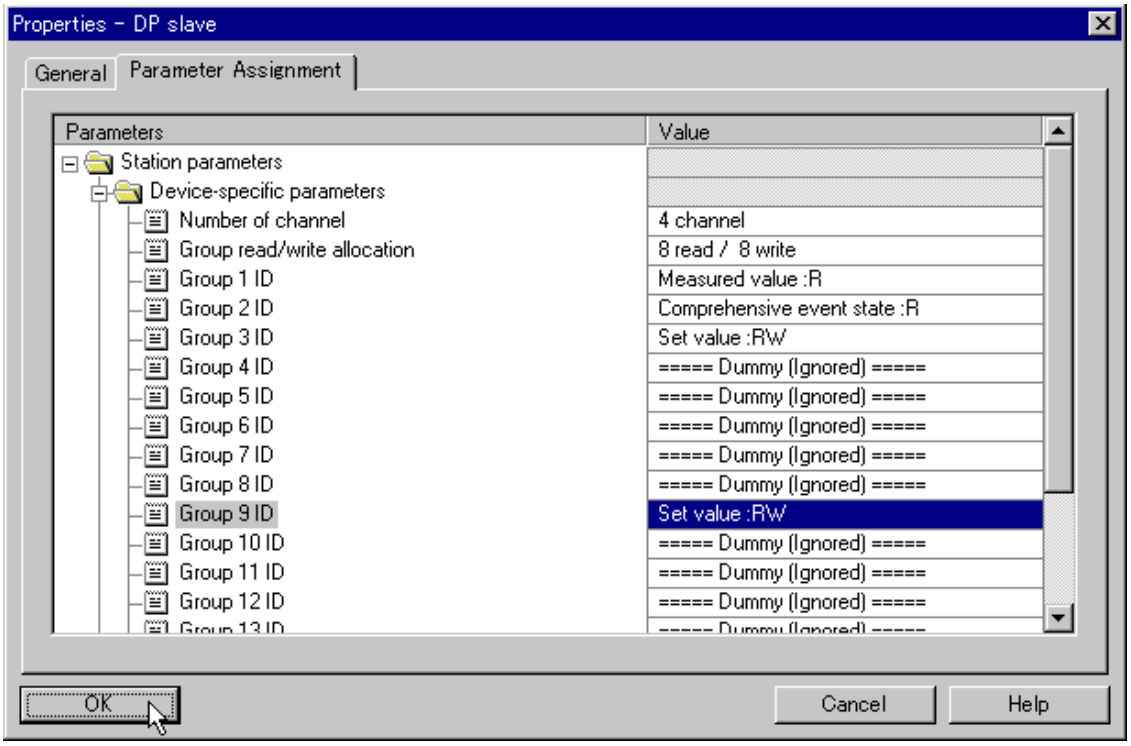
- Group 1 ID: Measured value: R
- Group 2 ID: Comprehensive event state: R
- Group 3 ID: Set value: RW

Sets the following to 1 write item.

- Group 9 ID: Set value: RW

Set "===== Dummy (Ignored) =====" to other items.

Set "===== Dummy (Ignored) =====" to empty read and write items.



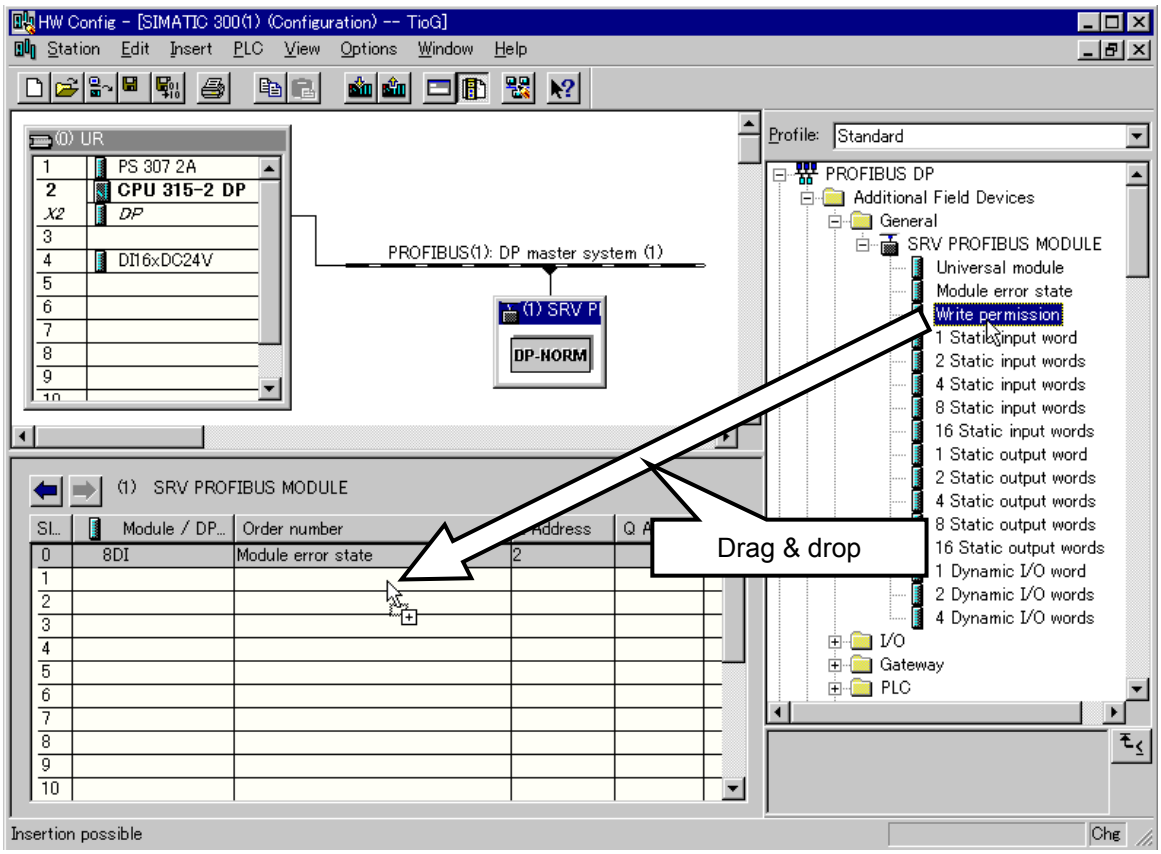
■ PLC register assignment

Assign the read/write items to the PLC register.

1. Open the folder of “SRV PROFIBUS MODULE” of a hardware catalogue.

- Drag “Module error state” in the second line from the top to drop it to the first line in the table on the rack detail window.
- Drag “Write permission” (write permission flag register) in the third line from the top to drop it to the second line in the table on the rack detail window.

Always set “Module error state” and “Write permission” regardless of the contents of communication items. In addition, always set “Module error state” to the first line and “Write permission” to the second line.



2. Assign the registers of static data.
In this example, the read item has 3 items, and the write item has 1 item. In addition, the number of temperature control channel is 4 channels. As the data length of one item corresponds to 1 word in the SRV temperature control channel, the following number of words is required for data read/write.

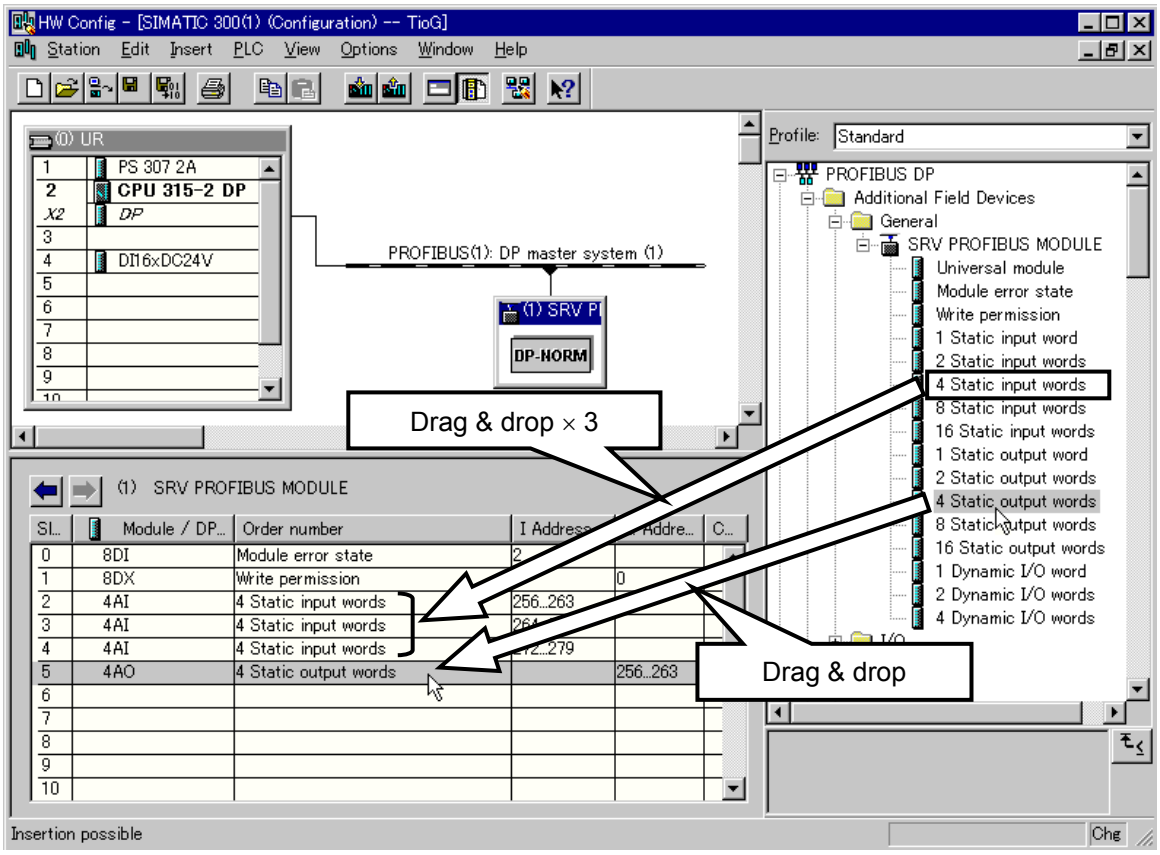
Number of read word: 4 channels × 3 items = 12 words
Number of write word: 4 channels × 1 item = 4 words

Select the number of above word from "SRV PROFIBUS MODULE" of a hardware catalog.

- Drag "4 Static input words" as a read item to drop these 3 items under "Write permission" on the rack detail window.
- Drag "4 Static output words" as a write item to drop that 1 item under "4 Static input words" on the rack detail window.

Always locate "Static input" above "Static output" on the rack detail window.

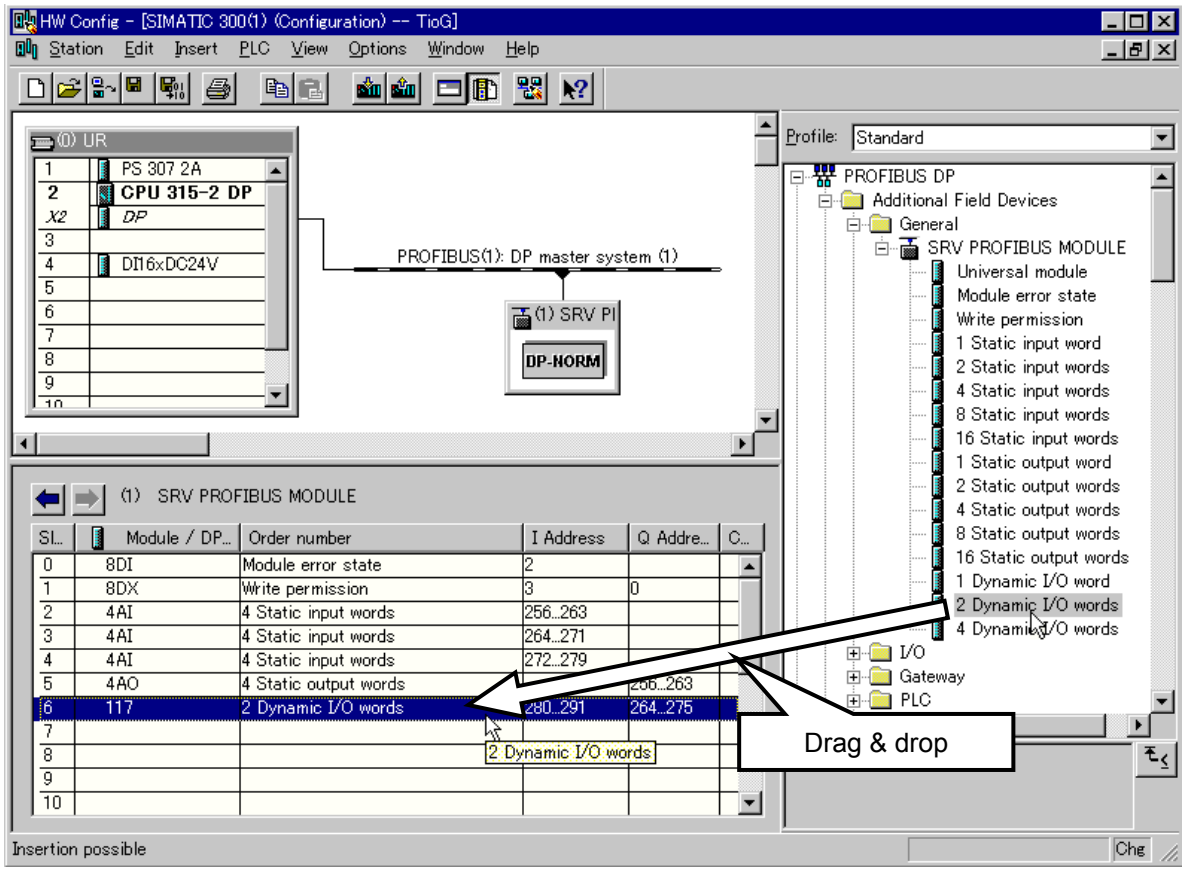
Here, "4 Static input words" × 3 is selected, but "8 Static input words" × 1 and "4 Static input words" × 1 may be selected. Any selection is acceptable if the total number of words is the same as "Number of channels × Number of items."



3. Assign the register of dynamic data.
This example indicates the method of setting the temperature rise completion range and that of monitoring the temperature rise completion state by dynamic data request. 2 dynamic data areas in total are reserved: 1 for setting the temperature rise completion range and 1 for monitoring the temperature rise completion state.

- Drag "2 Dynamic I/O words" from among "SRV PROFIBUS MODULE" in the hardware catalog to drop it under "4 Static output words" on the rack detail window.

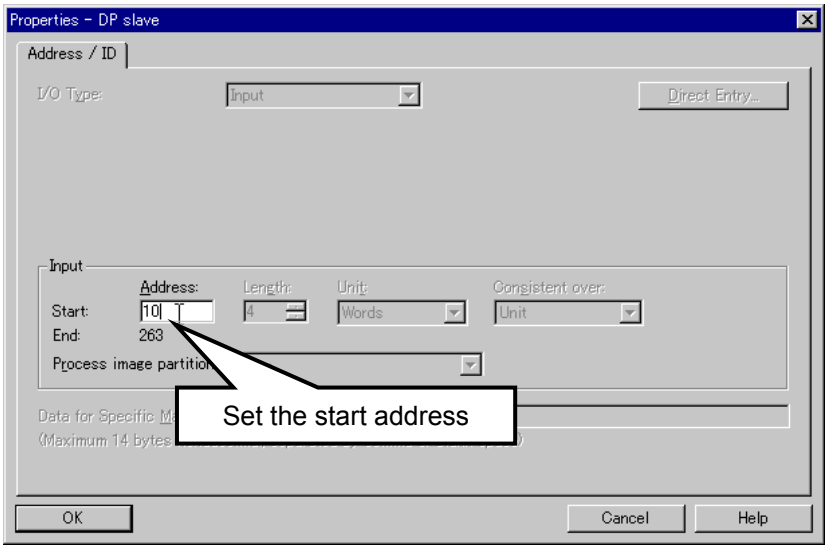
Locate "Dynamic I/O" lower than any other data on the rack detail window.



Order of locating data
Always locate data in the following order on the rack detail window.
"Module error state" > "Write permission" > "Static input" > "Static output" > "Dynamic I/O"

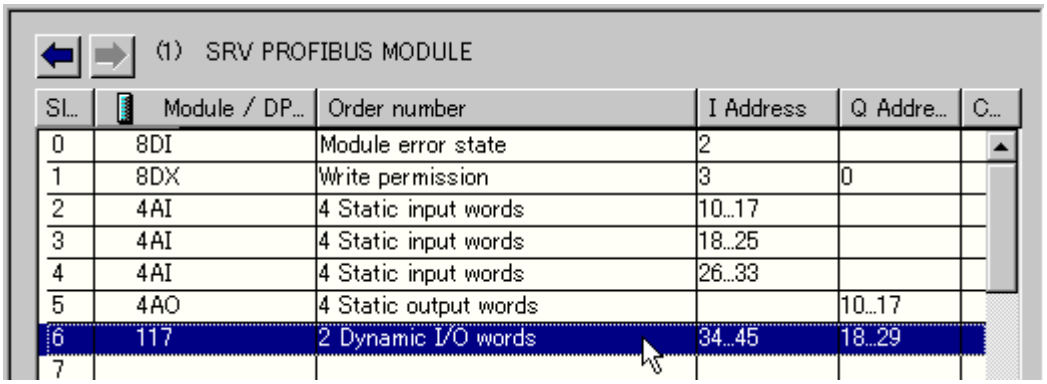
- "Module error state" and "Write permission" are required items.
  (Two or more items cannot be located.)
- "Static input," "Static output" and "Dynamic I/O" are optional.
  (Two or more items can be located.)

4. Assign the address of the PLC register.
Double-clicking each item on the rack detail window opens the “Properties - DP slave” window.
Set the PLC register address of each item with this window.



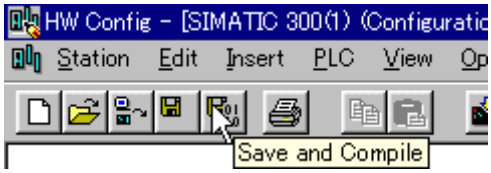
Assign each register address in this example as follows.

- Module error state: IB2
- Write permission: IB3, QB0
- Measured value (PV) [read]: IW10, IW12, IW14, IW16
- Comprehensive event state [read]: IW18, IW20, IW22, IW24
- Set value (SV) [read]: IW26, IW28, IW30, IW32
- Set value (SV) [write]: QW10, QW12, QW14, QW16
- Dynamic data request for the setting of temperature rise completion range:
  IB34 to IB39 (Response from SRV)
  QB18 to QB23 (Request for SRV)
- Dynamic data request for the monitoring of temperature rise completion state:
  IB40 to IB45 (Response from SRV)
  QB24 to QB29 (Request for SRV)



IB0 and IB1 are assigned to a digital input module of PLC.
(Refer to the rack detail window of a figure of No. 2 on page 50.)

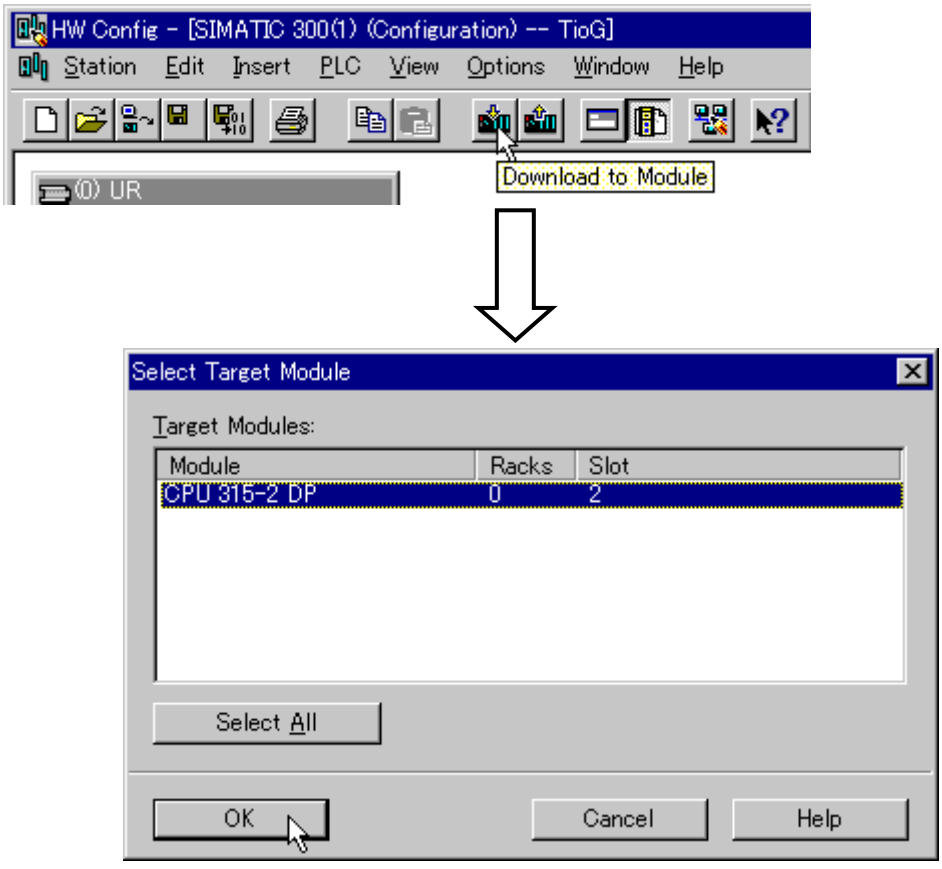
4. Click the “Save and Compile” button on the toolbar to store and compile the configuration.



5. Click the “Download to Module” button of toolbar, and download the data which did hardware configuration to the CPU module.
If communication between personal computer and PLC is normal, “Select Target Module” window opens.

If multi master system is used, first select the CPU module which downloads the hardware configured data, and then click the “OK” button at the lower left.
In this example, as a single master system is used, just click the “OK” button at the lower left.

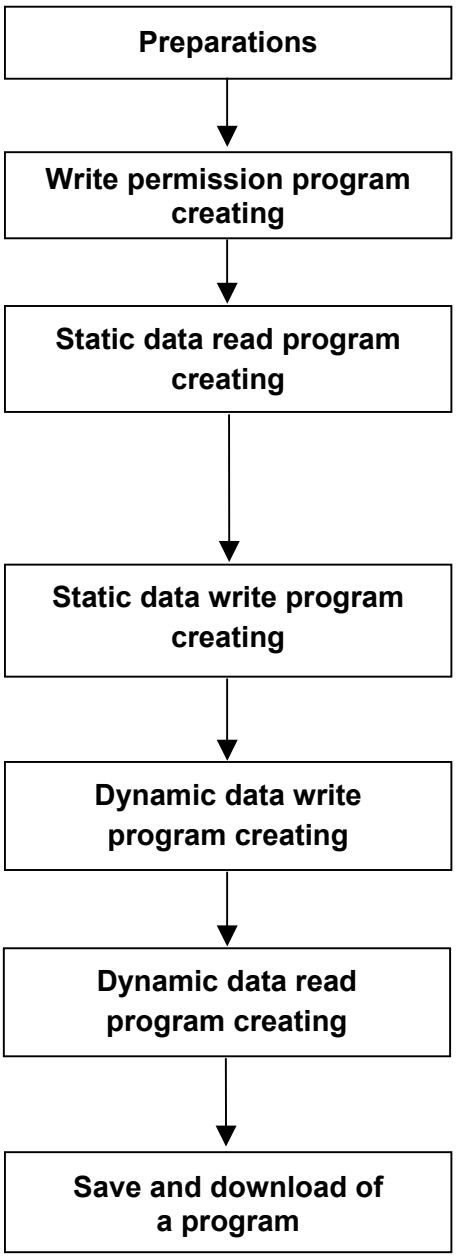
If normally downloaded, the window to inform the operator of the progress opens, and then returns to the window for hardware configuration.



7.4.5 Programming

■ Programming procedures

Creating a program example in the following procedures.



Before creating the program, perform the necessary operation.

☞ Refer to **Preparations (P. 61)**.

Create the write permission program using the write permission flag register.

☞ Refer to **Write permission program (P. 63)**.

Create a program to read static data

[Read items]

- Measured value (PV)
- Comprehensive event state
- Set value (SV)

☞ Refer to **Example of static data read (P. 65)**.

Create a program to write static data

[Write items]

- Set value (SV)

☞ Refer to **Example of static data write (P. 68)**.

Create a program to write dynamic data

[Write items]

- Temperature rise completion range

☞ Refer to **Example of dynamic data write (P. 69)**.

Create a program to read dynamic data

[Read items]

- Temperature rise completion state

☞ Refer to **Example of dynamic data read (P. 74)**.

Save the program, and download it to PLC.

☞ Refer to **Example of dynamic data read (P. 74)**.

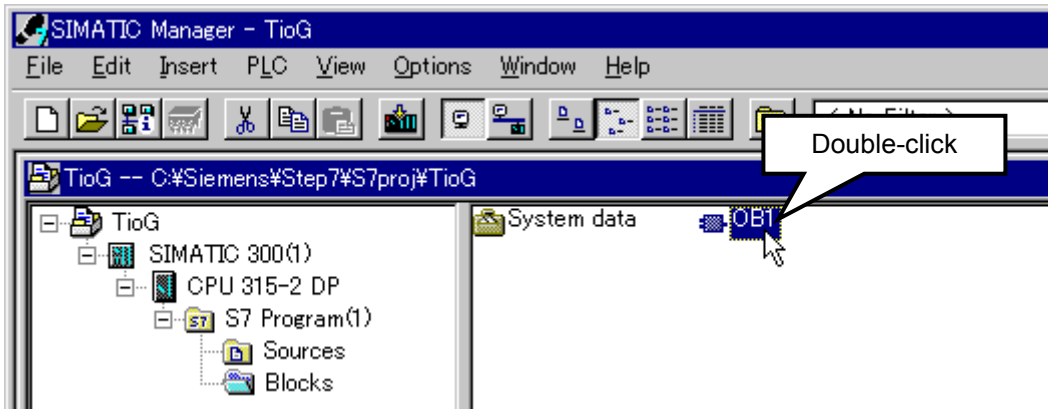
📖 This section is explained on the assumption that use language of STEP7 is “English” mode.

📖 In a description of program creation in this chapter, decimal numbers are used in the numeric value example. However, it is also possible to enter hexadecimal numbers for the same purpose.

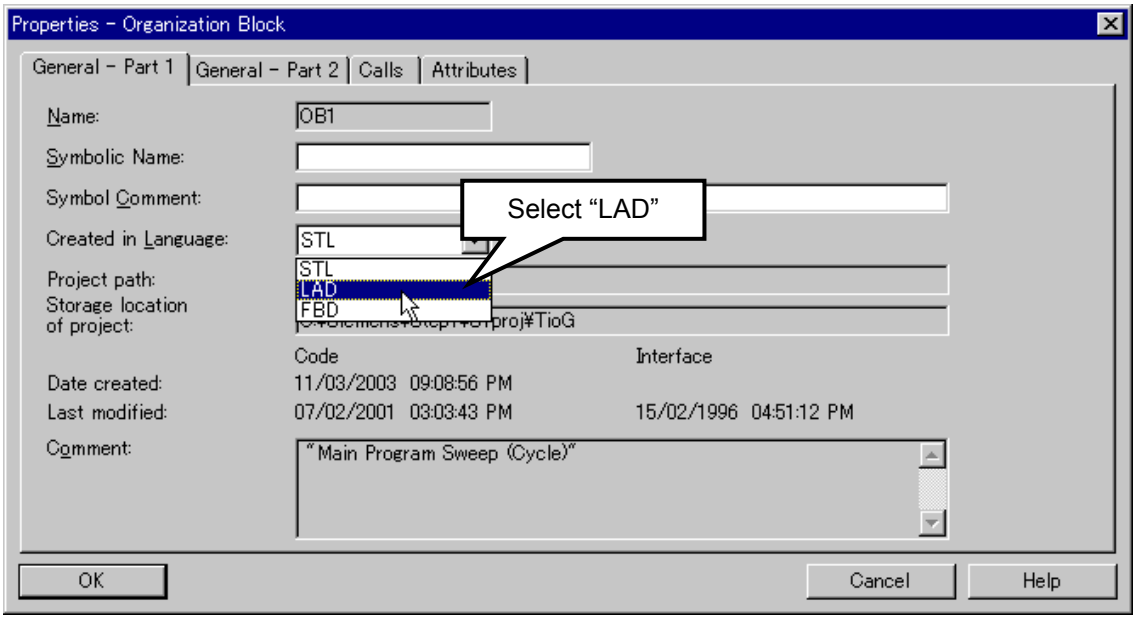
☞ For change method of use language, refer to Instruction Manual of the Programming Software STEP7.

■ Preparations

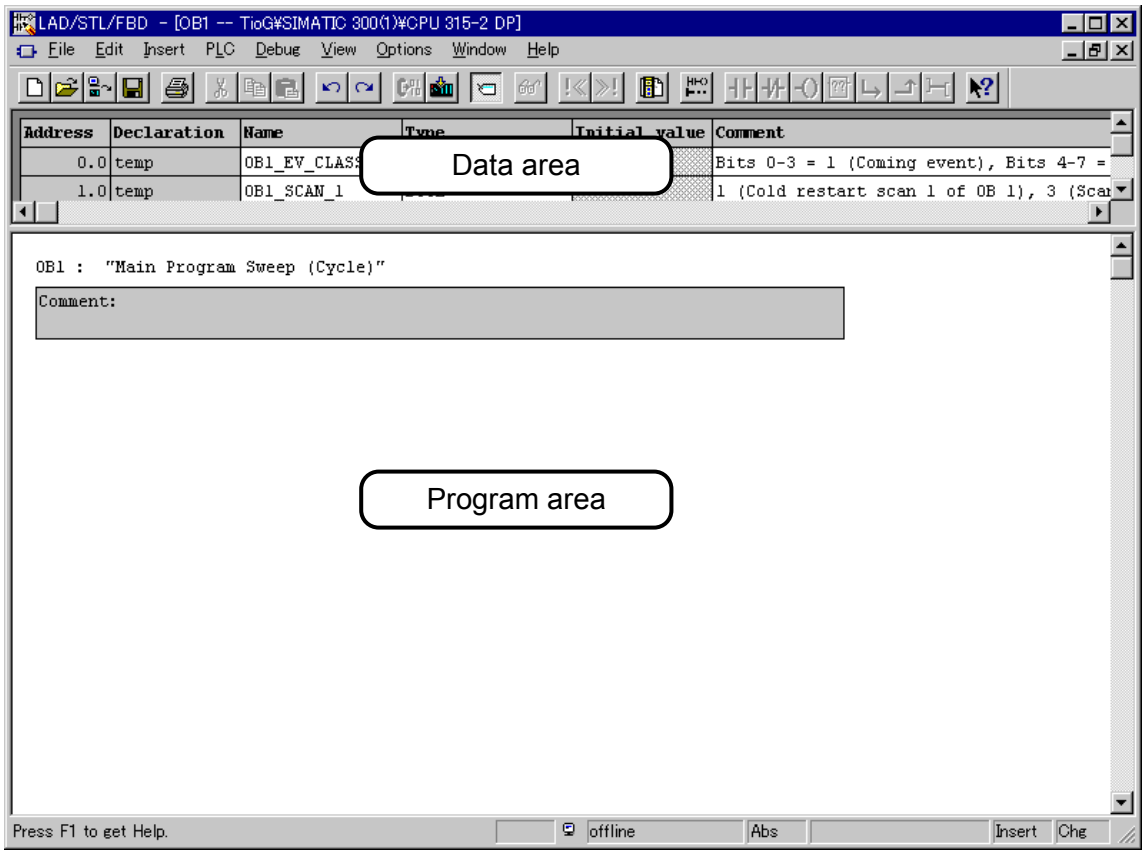
1. Open the project “TioG” folder in the order of **CPU 315-2 DP > S7 Program > Blocks**, and then double click “OB1” displayed on the right side of the window.



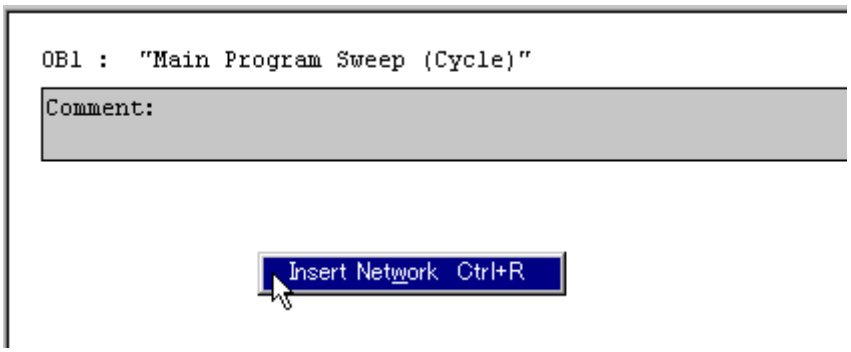
2. A window of “Properties - Organization block” is displayed.
Hereafter, as a sequence program is created by the ladder, change the “Created in Language:” column to “LAD.”



3. A window of “LAD/STL/FBD - [OB1 - TioG¥SIMATIC 300(1)¥CPU 315-2 DP]” is displayed. Creating a ladder program with this window.



4. Click the right on a program area, and select “Insert Network.”



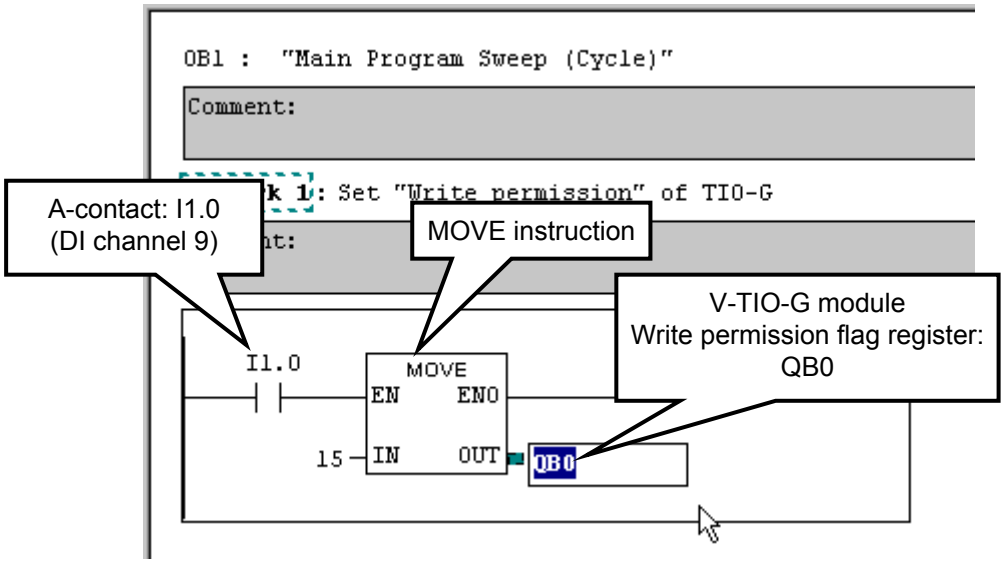
■ Write permission program

The following program is required for requesting both static and dynamic data read/write.

☞ For details of programming, refer to Instruction Manual of the Programming Software STEP7.

1. First, after the PLC digital input module contact is closed, write the "15" decimal number to the write permission flag register (Write Permission), and then create a program which validates write permission.
Click the A-contact (Normally Open Contact) button on the tool bar at the upper right of the screen to add the A-contact to the ladder

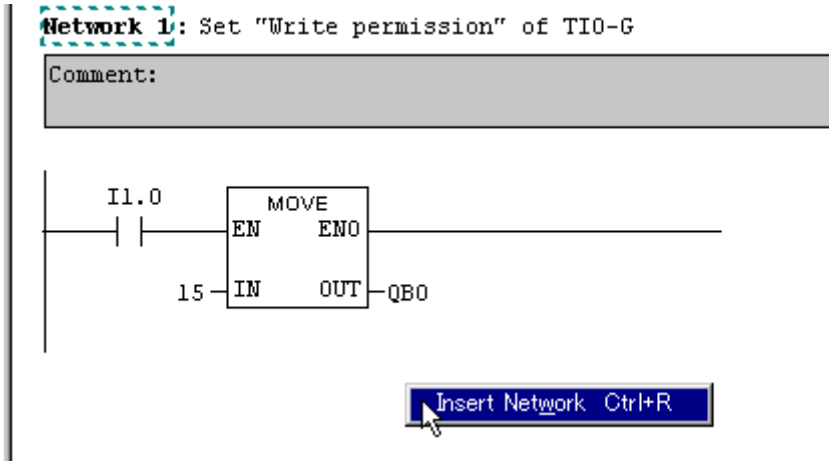
2. Similarly, select Empty Box on the tool bar to add the MOVE instruction to the ladder.
Assign I1.0 (DI channel 9) to A-contact. In addition, specify "15" to IN side and the QB0 Write Permission address of SRV PROFIBUS MODULE to the OUT side of the MOVE instruction, respectively.



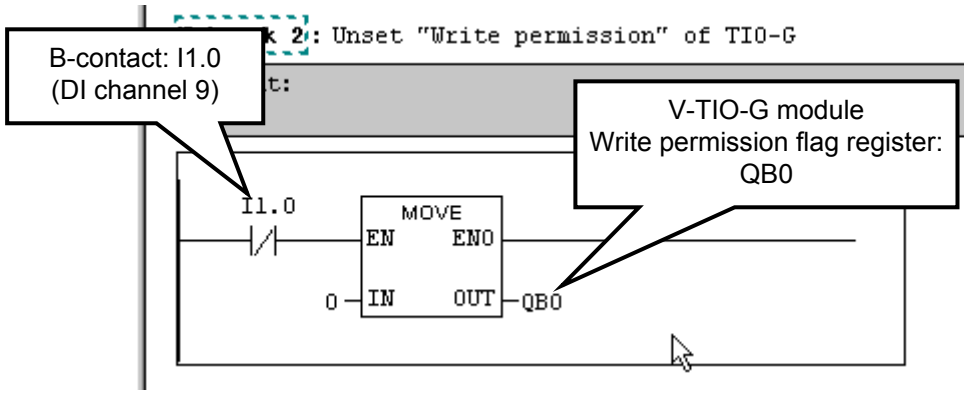
IB0 and IB1 are assigned to a digital input module of PLC.
Bit 0 to Bit 7 (I0.0 to I0.7) of IB0 corresponds to DI channel 1 to 8, and Bit 0 to Bit 7 (I1.0 to I1.7) of IB1 corresponds to DI channel 9 to 16.

☞ An assignment state of each register by this example, refer to **PLC register assignment No. 4 (P. 58)**.

3. Next, after the PLC digital input module contact opens, write the "0" decimal number to the write permission flag register (Write Permission), and then create a program which invalidates write permission.
Right-click the program area to select "Insert Network."



4. Insert the B-contact and a MOVE instruction in ladder.
Assign I1.0 (DI channel 9) to B-contact. In addition, specify "0" to IN side and the QB0 Write Permission address of SRV PROFIBUS MODULE to the OUT side of the MOVE instruction, respectively.

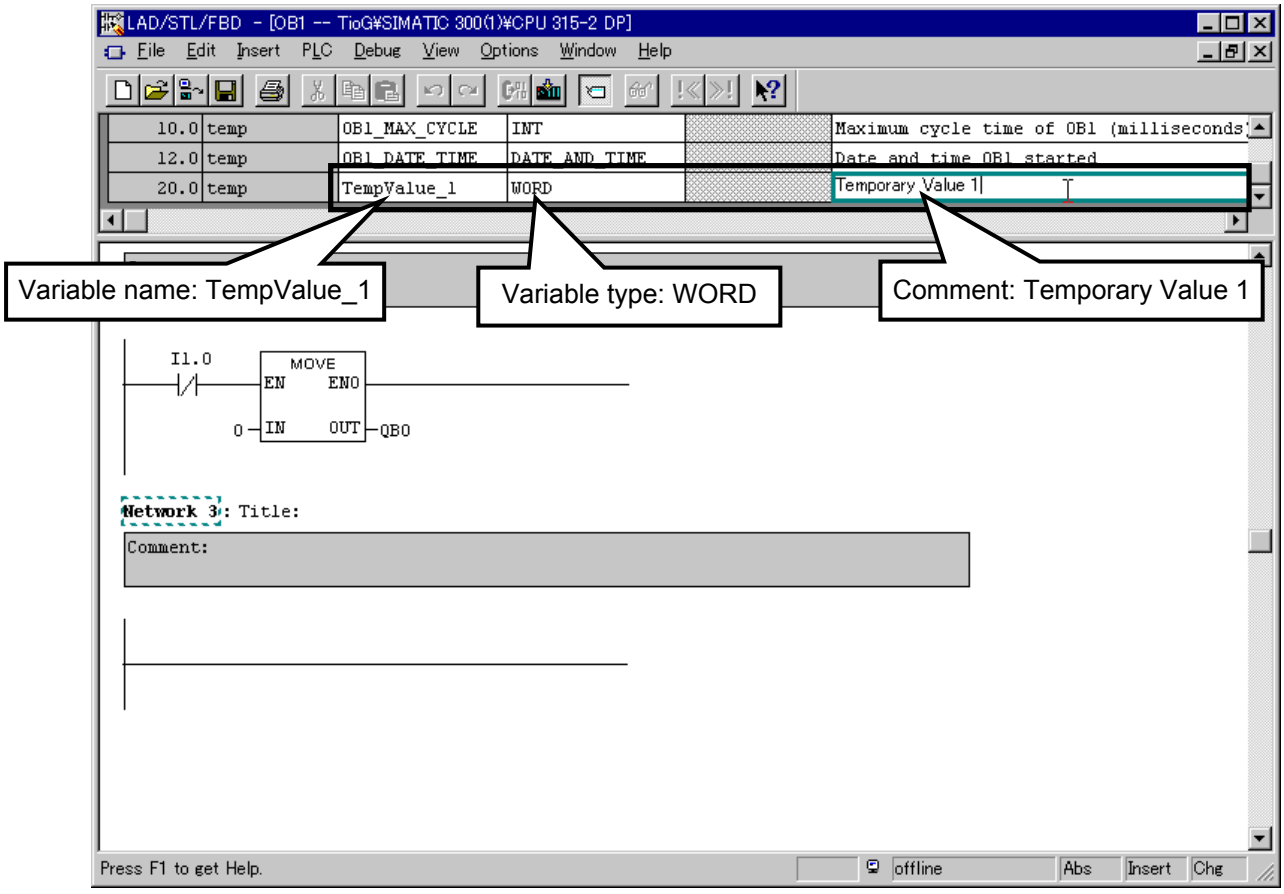


■ Example of static data read

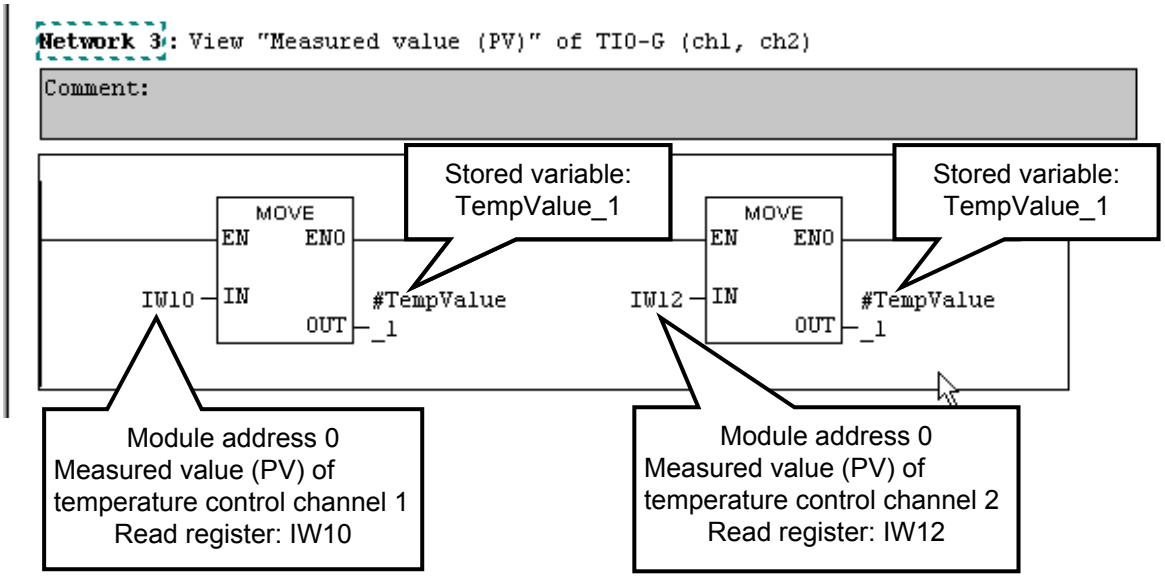
The following is a program example in which a Measured value (PV) of each temperature control channel of SRV is read and then stored into the variable.

☞ For details of programming, refer to Instruction Manual of the Programming Software STEP7.

1. Right-click the program area to select “Insert Network” and then generate ladders newly (Network 3). Before describing the sequence program, define the flag variable of writing the Measured value (PV). Describe a comment (Example: Temporary Value 1) if necessary with the variable name and type assumed to be “TempValue_1” and “WORD,” respectively.

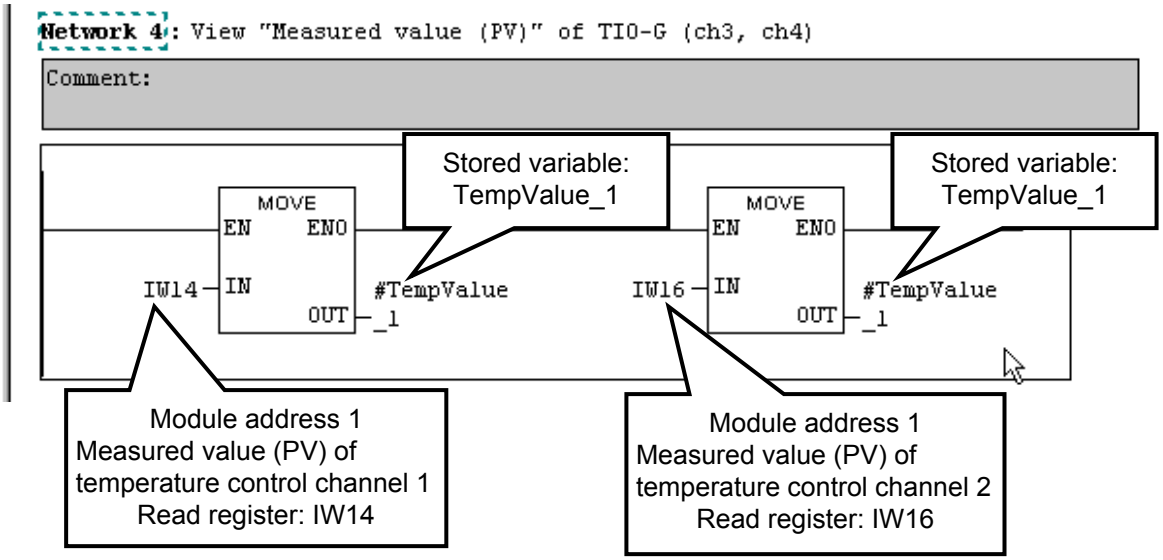


2. Read the Measured value (PV) of module address 0.
Store the Measured value (PV) of temperature control channel into the “TempValue_1” variable by using the MOVE instruction.
It is so defined when hardware configured that data read registers will be used from “IW10.” Thus, Measured values (PV) are stored in the following registers.
Measured value (PV) of temperature control channel 1 of module address 0: IW10
Measured value (PV) of temperature control channel 2 of module address 0: IW12
Therefore, set these PLC register addresses to the IN side and the “TempValue_1” variable to the OUT side of the MOVE instruction, respectively.



☞ An assignment state of each register by this example, refer to **PLC register assignment No. 4 (P. 58)**.

3. Read the Measured value (PV) of module address 1.
Measured value (PV) of temperature control channel 1 of module address 1: IW14
Measured value (PV) of temperature control channel 2 of module address 1: IW16



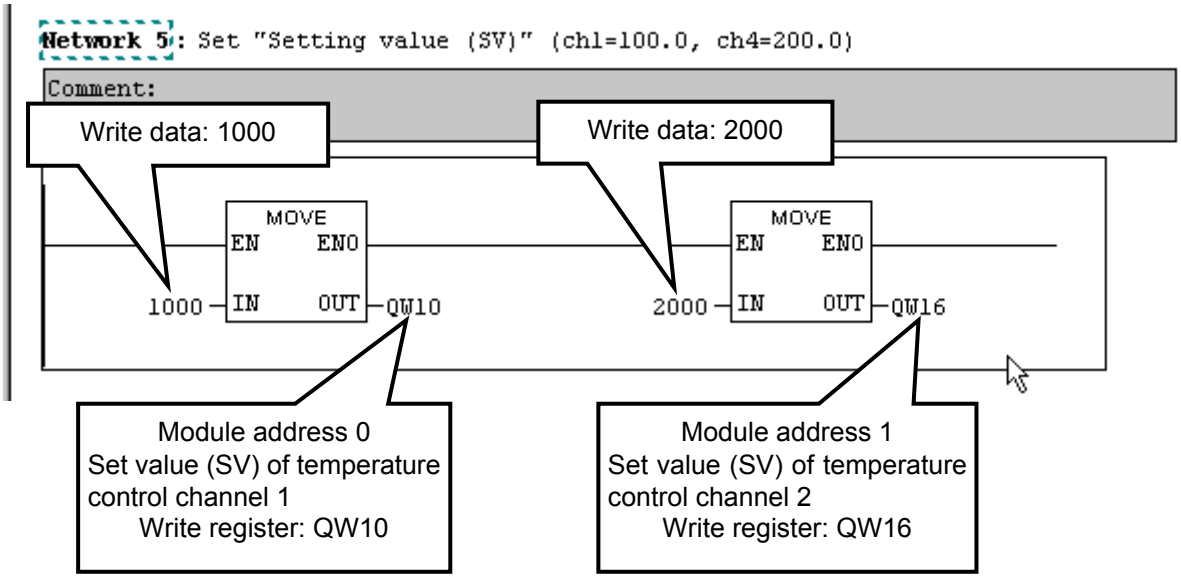
■ Example of static data write

Create a program used to write each Set value (SV) to the respective temperature control channel of the SRV.
Here, write Set value (SV): 100.0 to temperature control channel 1 with module address 0, and Set value (SV): 200.0 to temperature control channel 2 with module address 1.

☞ For details of programming, refer to Instruction Manual of the Programming Software STEP7.

1. Right-click the program area to select "Insert Network" and then generate ladders newly (Network 5).

2. Write Set value (SV): 100.0 to temperature control channel 1 with module address 0, and Set value (SV): 200.0 to temperature control channel 2 with module address 1 using the MOVE instruction.
It is so defined when hardware configured that data write registers will be used from "QW10." As a result, Set values (SV) are written to the following registers.
Set value (SV) of temperature control channel 1 of module address 0: QW10
Set value (SV) of temperature control channel 2 of module address 1: QW16
Set the "QW10" and "QW16" variables to the OUT side of the MOVE instruction. In addition, as the decimal point of each of "100.0" and "200.0" to be written is omitted, set "1000" and "2000" to the IN side.



☞ An assignment state of each register by this example, refer to **PLC register assignment No. 4 (P. 58)**.

■ Example of dynamic data write

Create a program used to write each temperature rise completion range to the respective temperature control channel of the SRV. Here, write Temperature rise completion range: 10.0 to temperature control channel 1 with module address 0, and Temperature rise completion range: 20.0 to temperature control channel 2 with module address 1.

☞ For details of programming, refer to Instruction Manual of the Programming Software STEP7.

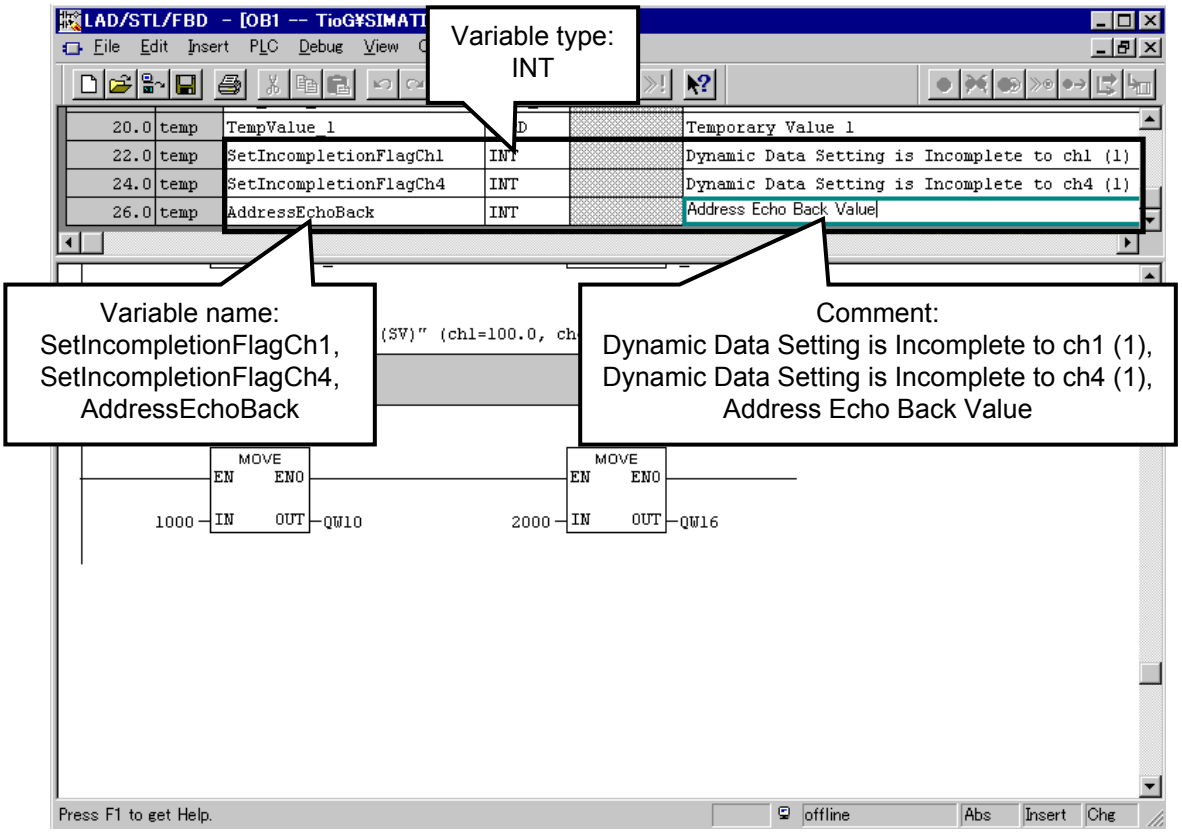
A register of dynamic data request is assigned as follows by hardware configuration.

- Dynamic data request for the setting of temperature rise completion range:
  IB34 to IB39 (Response from SRV)
  QB18 to QB23 (Request for SRV)

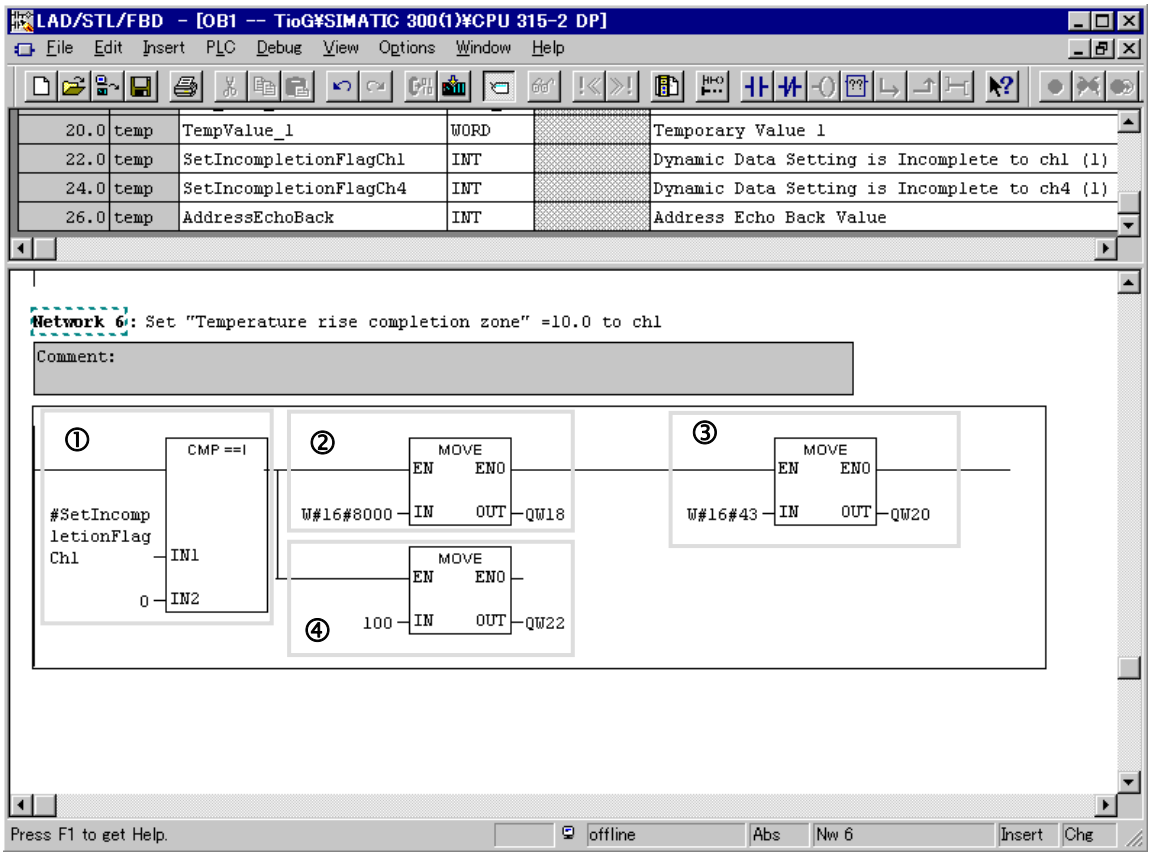
☞ An assignment state of each register by this example, refer to **PLC register assignment No. 4 (P. 58)**.

☞ For dynamic data request, refer to **5.3 Data Send/Receive by Dynamic Data Request (P. 23)**.

1. Before describing the sequence program, define the flag variable that another cannot use when either the temperature control channel 1 with module address 0 or temperature control channel 2 with module address 1 is using a register and the flag variable of checking the module address echo back. Describe such a comment as "Ex.: Dynamic Data Setting is Incomplete to ch1 (1)," "Ex.: Dynamic Data Setting is Incomplete to ch4 (1)" or "Address Echo Back Value," if necessary with a variable name designed as "SetIncompletionFlagCh1," "SetIncompletionFlagCh4" or "AddressEchoBack" and a variable type set to "INT."



2. Next, right-click the program area to select “Insert Network” and then generate ladders newly (Network 6).
Generate the ladder of “Making a request for writing a temperature rise completion range of 10.0 to the temperature control channel 1 with the module address 0.”



The above ladders are described in the following.

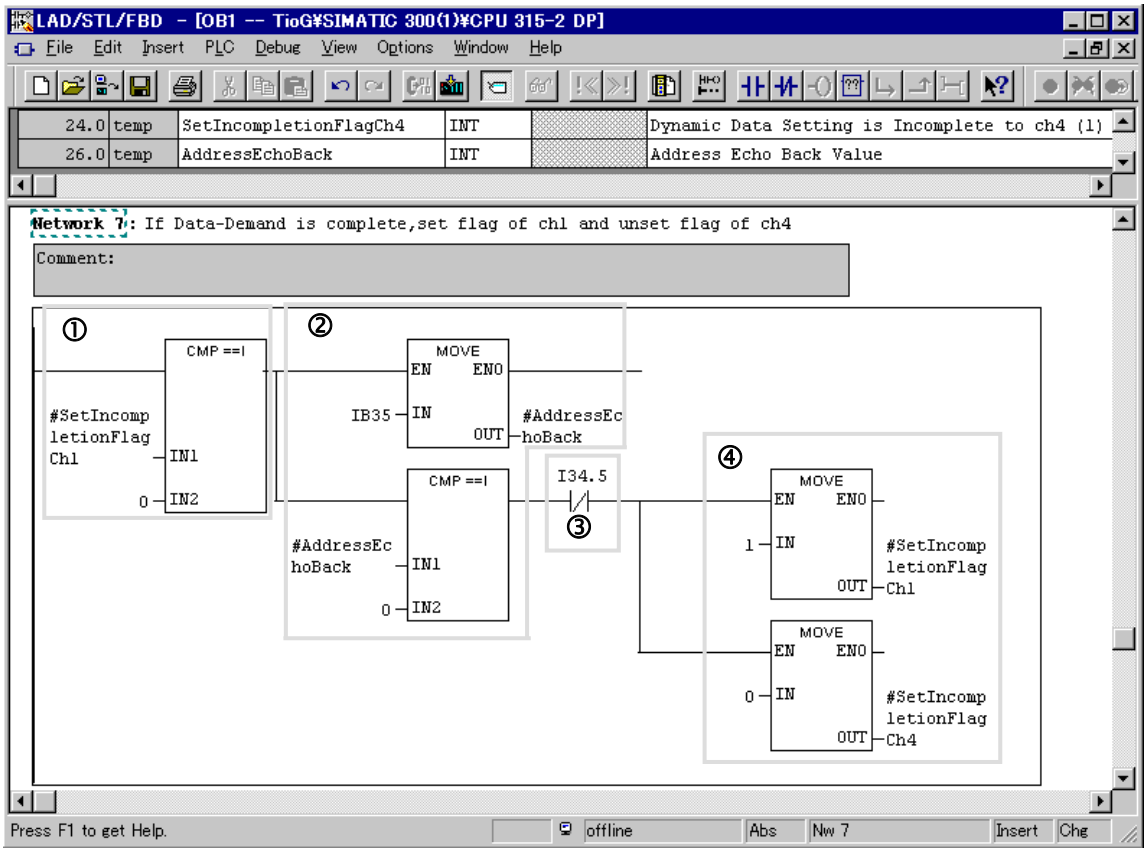
① First, it is determined whether or not a data request for the temperature control channel 1 with the module address 0 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ④ are activated.

② Sets 8000H (hexadecimal) to QW18. Thus, 80H is set to QB18 and 00H, to QB19.
As the Bit 7 of QB18 is set to 1, this data request becomes a data write request.
The module address number being subject to the data request becomes 0 by specifying 00H to QB19.

③ Specify 0043H (hexadecimal) to QW20.
This is the communication item ID of the temperature rise completion range corresponding to the temperature control channel 1.

④ Specify 100 (decimal) to QW22.
Thus the temperature rise completion range corresponding to the temperature control channel 1 with the respective module address 0 is set to 10.0 °C.

3. Succeedingly, right-click the program area to select “Insert Network” and then generate ladders newly (Network 7).
Generate the ladder of “Making the present channel request invalid if the data request is complete and making the request for other channels valid. ”



The above ladders are described in the following.

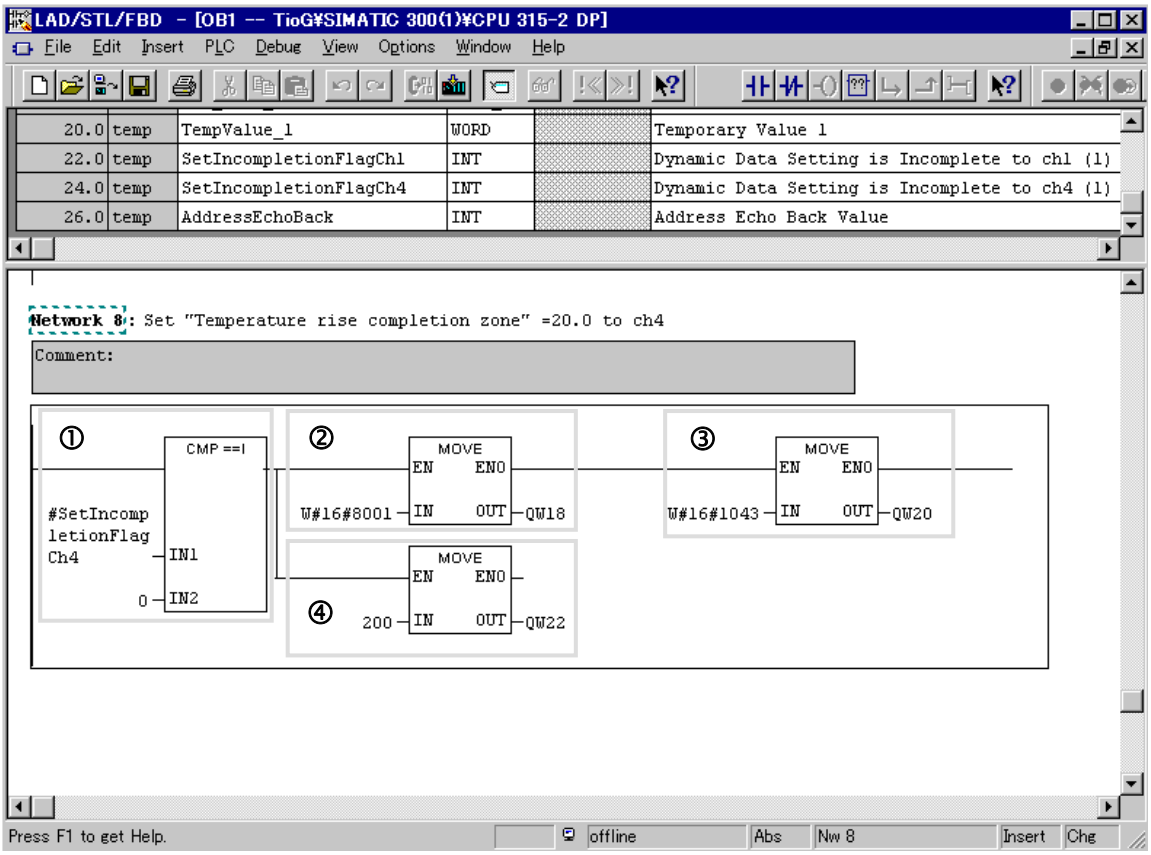
① First, it is determined whether or not a data request for the temperature control channel 1 with the module address 0 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ④ are activated.

② Copy the response of IB35 to the request address from among the responses of IB34 to IB39 from the SRV for the dynamic data request to the variable of AddressEchoBack and just after, check whether or not that value coincides with the set address 0. Only when the set address coincides with the echo back, the ladders of ③ and ④ are activated.

③ If the Bit 5 of IB34 from among the responses of IB34 to IB39 from the SRV is set to 1, no dynamic data request is complete and thus the value is indefinite. The B contact is installed here so that the ladder of ④ is not activated if this bit is set to 1. When the Bit 5 is set to 0, the ladder of ④ is activated.

④ If the dynamic data request is complete, set the data request flag corresponding to the temperature control channel 1 with the module address 0 to 1 and also set the flag corresponding to the temperature control channel 2 with the module address 1 to 0, and then select the address/channel being subject to the dynamic data request.

4. Right-click the program area again to select “Insert Network” and then generate ladders newly (Network 8).
Generate the ladder of “Making a request for writing a temperature rise completion range of 20.0 to the temperature control channel 2 with the module address 1.”



The above ladders are described in the following.

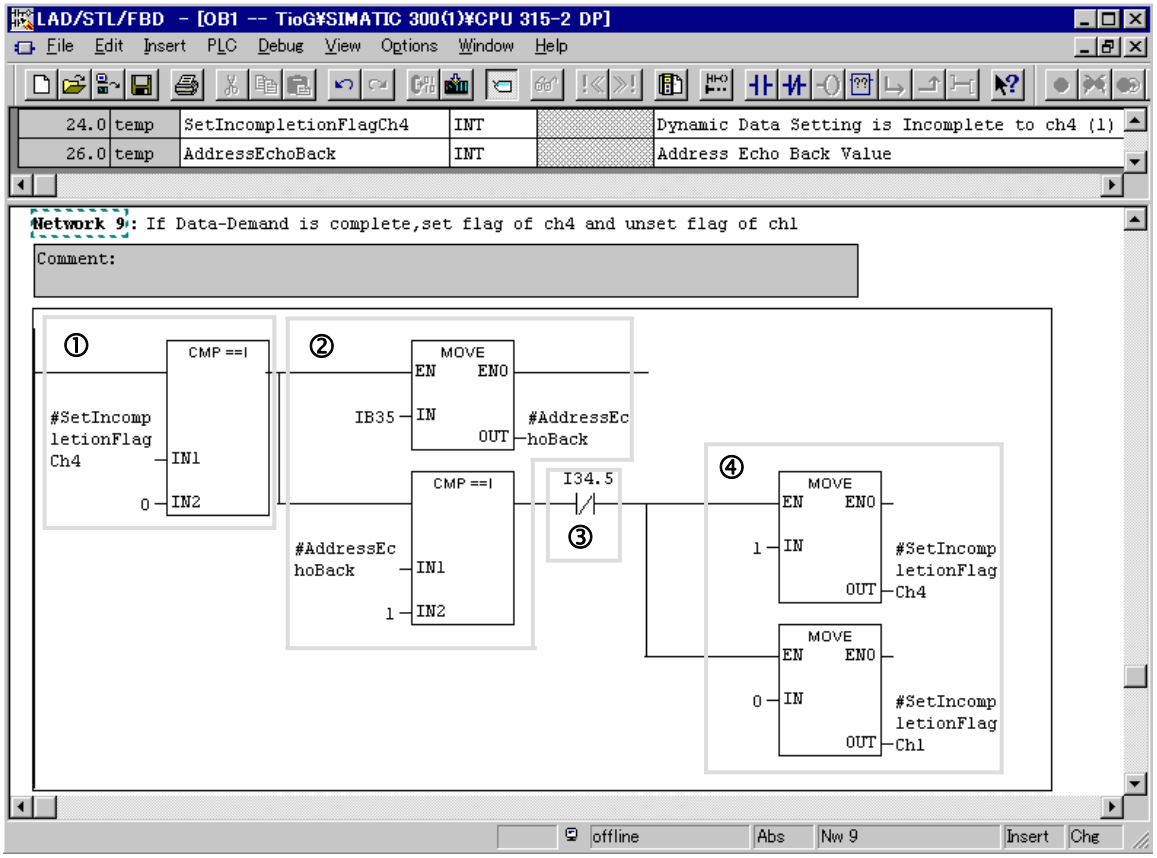
① First, it is determined whether or not a data request for the temperature control channel 2 with the module address 1 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ④ are activated.

② Sets 8001H (hexadecimal) to QW18. Thus, 80H is set to QB18 and 01H, to QB19.
As the Bit 7 of QB18 is set to 1, this data request becomes a data write request.
The module address number being subject to the data request becomes 1 by specifying 00H to QB19.

③ Specify 1043H (hexadecimal) to QW20.
This is the communication item ID of the temperature rise completion range corresponding to the temperature control channel 2.

④ Specify 200 (decimal) to QW22.
Thus the temperature rise completion range corresponding to the temperature control channel 2 with the respective module address 1 is set to 20.0 °C.

5. Further right-click the program area to select “Insert Network” and then generate ladders newly (Network 9).
Generate the ladder of “Making the present channel request invalid if the data request is complete and making the request for other channels valid.”



The above ladders are described in the following.

① First, it is determined whether or not a data request for the temperature control channel 2 with the module address 1 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ④ are activated.

② Copy the response of IB35 to the request address from among the responses of IB34 to IB39 from the SRV for the dynamic data request to the variable of AddressEchoBack and just after, check whether or not that value coincides with the set address 1. Only when the set address coincides with the echo back, the ladders of ③ and ④ are activated.

③ If the Bit 5 of IB34 from among the responses of IB34 to IB39 from the SRV is set to 1, no dynamic data request is complete and thus the value is indefinite. The B contact is installed here so that the ladder of ④ is not activated if this bit is set to 1. When the Bit 5 is set to 0, the ladder of ④ is activated.

④ If the dynamic data request is complete, set the data request flag corresponding to the temperature control channel 2 with the module address 1 to 1 and also set the flag corresponding to the temperature control channel 1 with the module address 0 to 0, and then select the address/channel being subject to the dynamic data request.

■ Example of dynamic data read

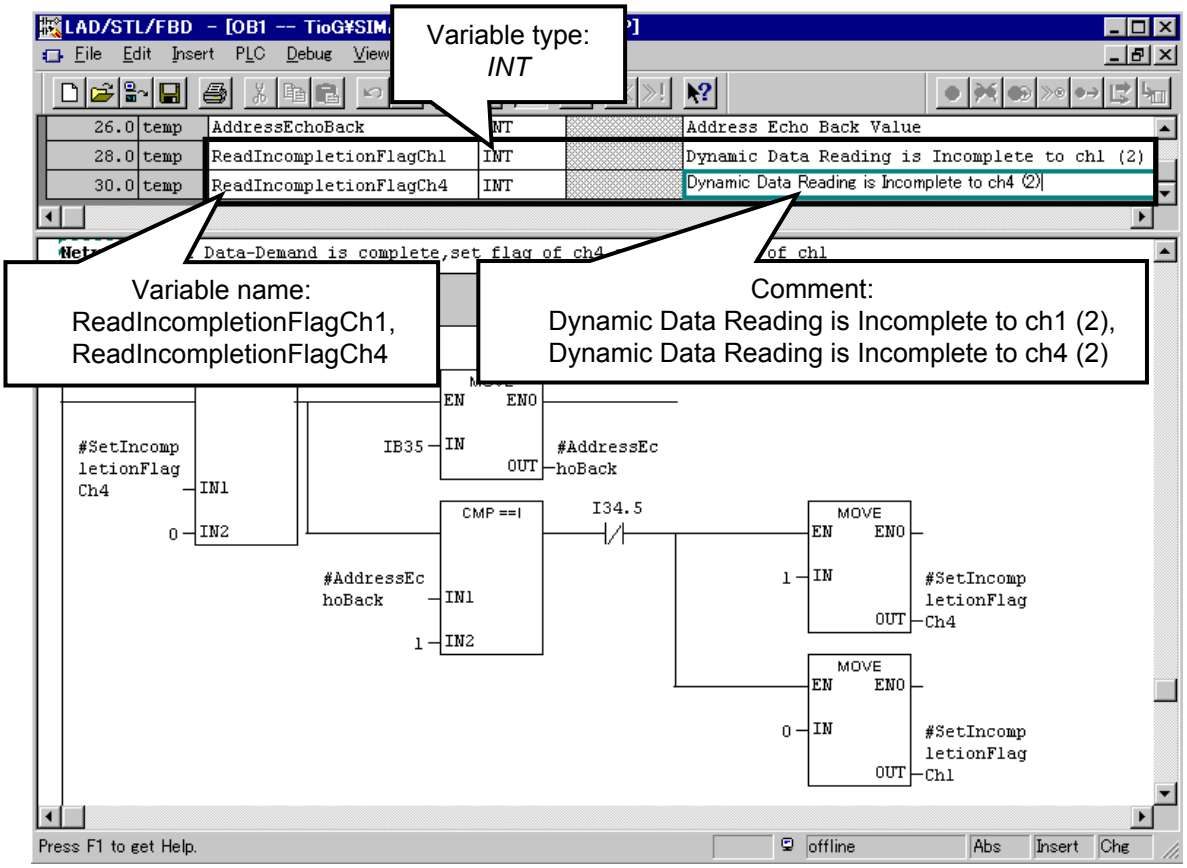
Create a program which monitor to the temperature rise completion state of the SRV.
A register of dynamic data request is assigned as follows by hardware configuration.

- Dynamic data request for the monitoring of temperature rise completion state:
  IB40 to IB45 (Response from SRV)
  QB24 to QB29 (Request for SRV)

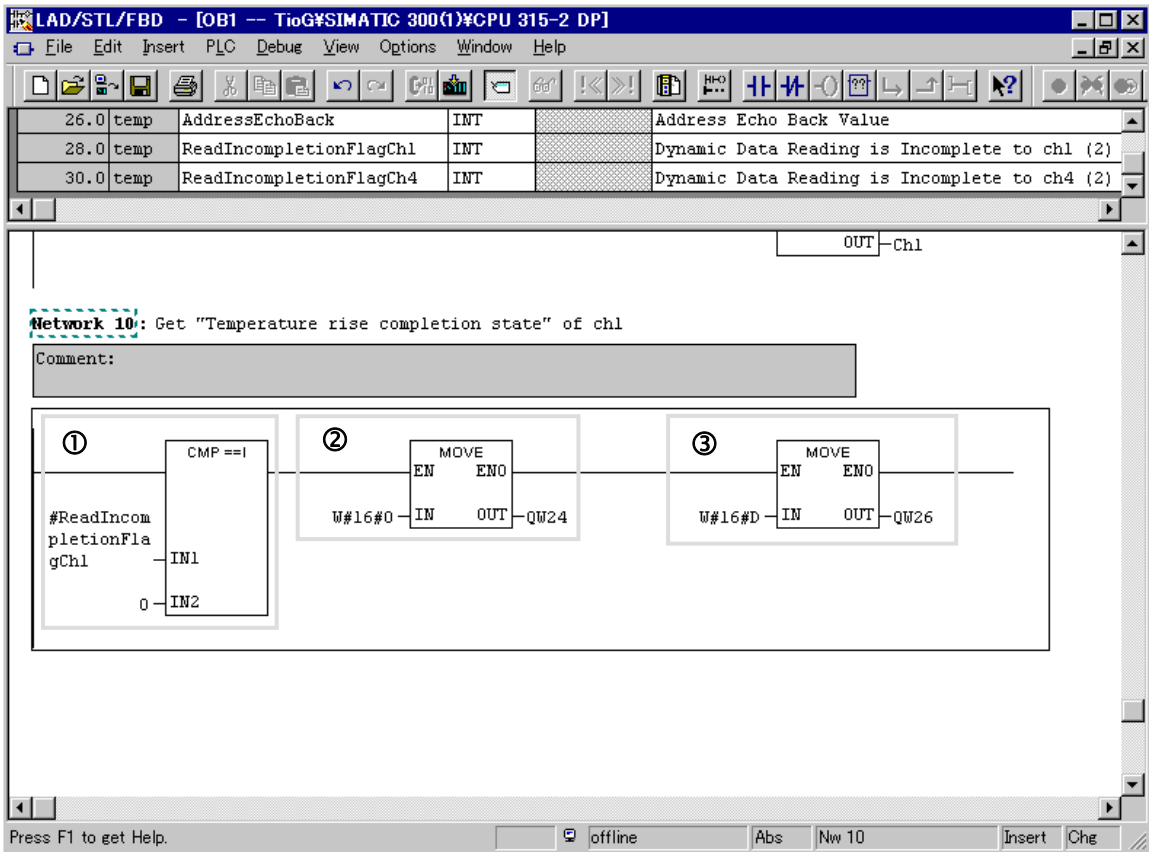
☞ An assignment state of each register by this example, refer to **PLC register assignment No. 4 (P. 58)**.

☞ For dynamic data request, refer to **5.3 Data Send/Receive by Dynamic Data Request (P. 23)**.

1. Before describing the sequence program, define the flag variable of checking whether or not reading of the temperature rise completion state is complete by dynamic data request.
Describe such a comment as "Ex.: Dynamic Data Reading is Incomplete to ch1 (2)," or "Ex.: Dynamic Data Reading is Incomplete to ch4 (2)," if necessary with a variable name designated as "ReadIncompletionFlagCh1" or "ReadIncompletionFlagCh4" and a variable type set to "INT."



2. Next, right-click the program area to select “Insert Network” and then generate ladders newly (Network 10).
Generate the ladder of “Making a request for reading the temperature rise completion state to the temperature control channel 1 with the module address 0.”



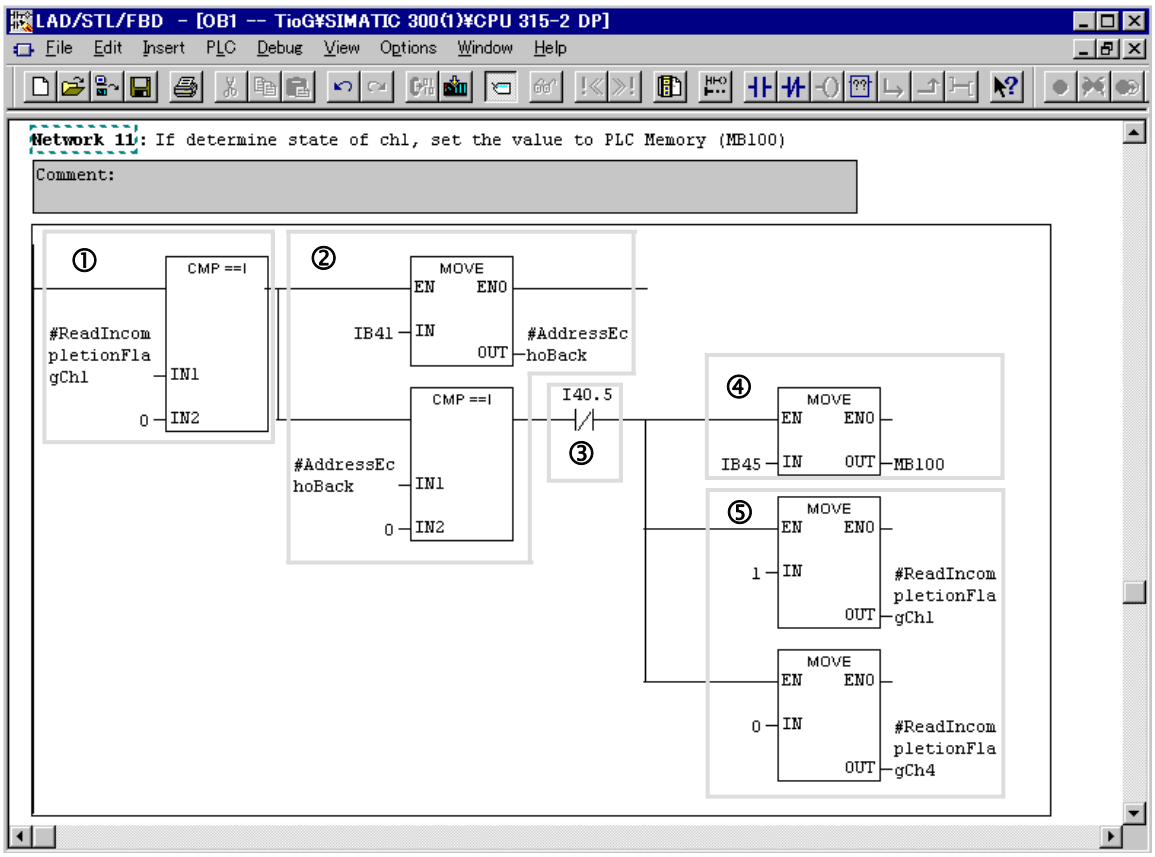
The above ladders are described in the following.

① First, it is determined whether or not a data request for the temperature control channel 1 with the module address 0 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② and ③ are activated.

② Set 0000H (hexadecimal) to QW24.
Thus, 00H is set to QB24 and 00H, to QB25.
As the Bit 7 of QB24 is set to 0, this data request becomes a read request.
The module address is assigned with 0 by setting 00H to QB25.

③ Set 000DH (hexadecimal) to QW26.
This is the communication item ID of the temperature rise completion state corresponding to the temperature control channel 1.

3. Succeedingly, right-click the program area to select “Insert Network” and then generate ladders newly (Network 11).
Generate the ladder of “Processing the response from the SRV and then acquiring the temperature rise completion state and updating the flag if the dynamic data request is complete.”



The above ladders are described in the following.

① First, it is determined whether or not a data request for the temperature control channel 1 with the module address 0 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ⑤ are activated.

② Copy the response of IB41 to the request address from among the responses of IB40 to IB45 from the SRV for the dynamic data request to the variable of AddressEchoBack and just after, check whether or not that value coincides with the set address 0. Only when the set address coincides with the echo back, the ladders of ③ to ⑤ are activated.

③ If the Bit 5 of IB40 from among the responses of IB40 to IB45 from the SRV is set to 1, no dynamic data request is complete and thus the value is indefinite. The B contact is installed here so that the ladder of ④ and ⑤ are not activated if this bit is set to 1. When the Bit 5 is set to 0, the ladder of ④ and ⑤ are activated.

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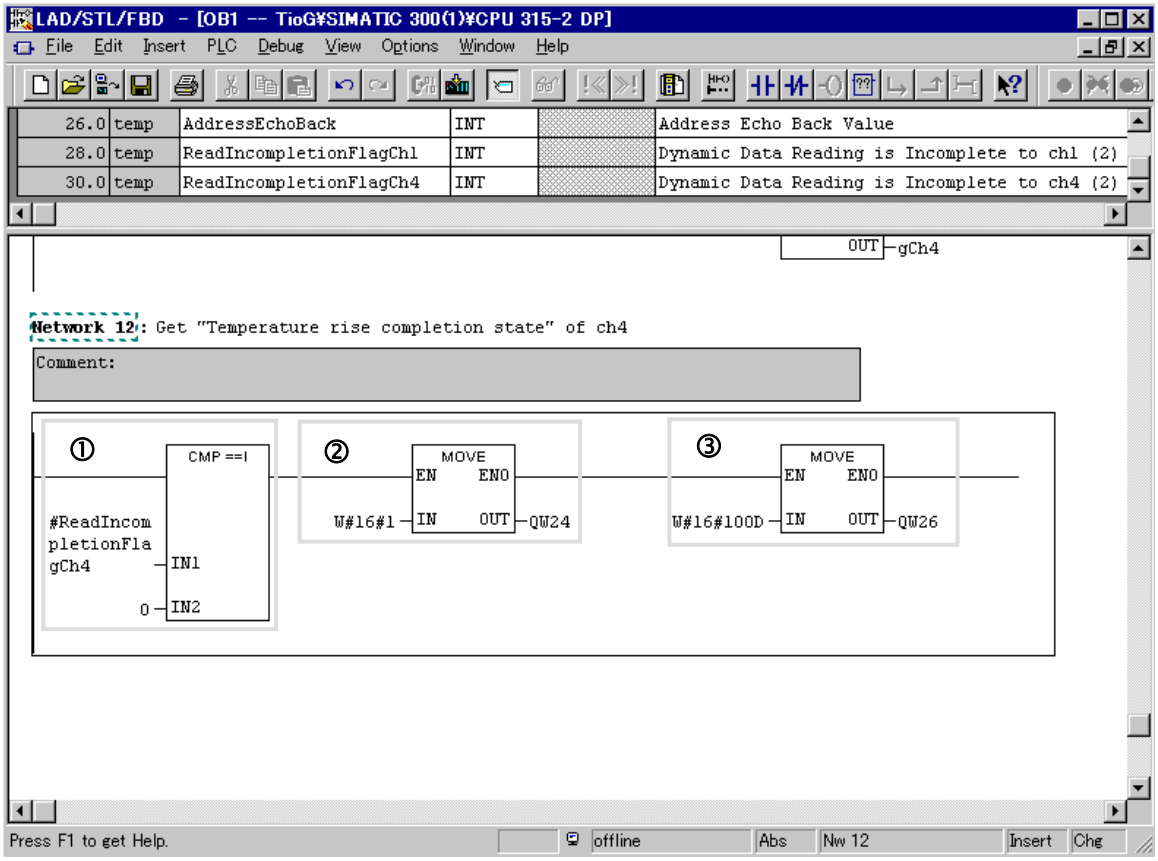
④ Take out the value if the dynamic data request is complete and the data is established.
As it is so designed that all data items in the SRV system are expressed as word values, in this example values are taken out by dynamic data request if the IW44 value is read. However, since any value in the temperature rise completion state is in the range of 0 to 1, the IB45 value is taken out and then is stored as a byte value. (Of course, it may be stored as bit data but in this example it is stored as a byte value.)
The IB45 value is stored in the MB100 area of the PLC memory by using the MOVE command to keep recording the temperature rise completion state.

⑤ Select the flag just after ④ is finished.
Set the data request flag corresponding to the temperature control channel 1 with the module address 0 to 1 and also set the flag corresponding to the temperature control channel 2 with the module address 1 to 0, and then select the address/channel being subject to the dynamic data request.

4. Right-click the program area again to select “Insert Network” and then generate ladders newly (Network 12). Generate the ladder of “Making a request for reading the temperature rise completion state to the temperature control channel 2 with the module address 1.”



The above ladders are described in the following.

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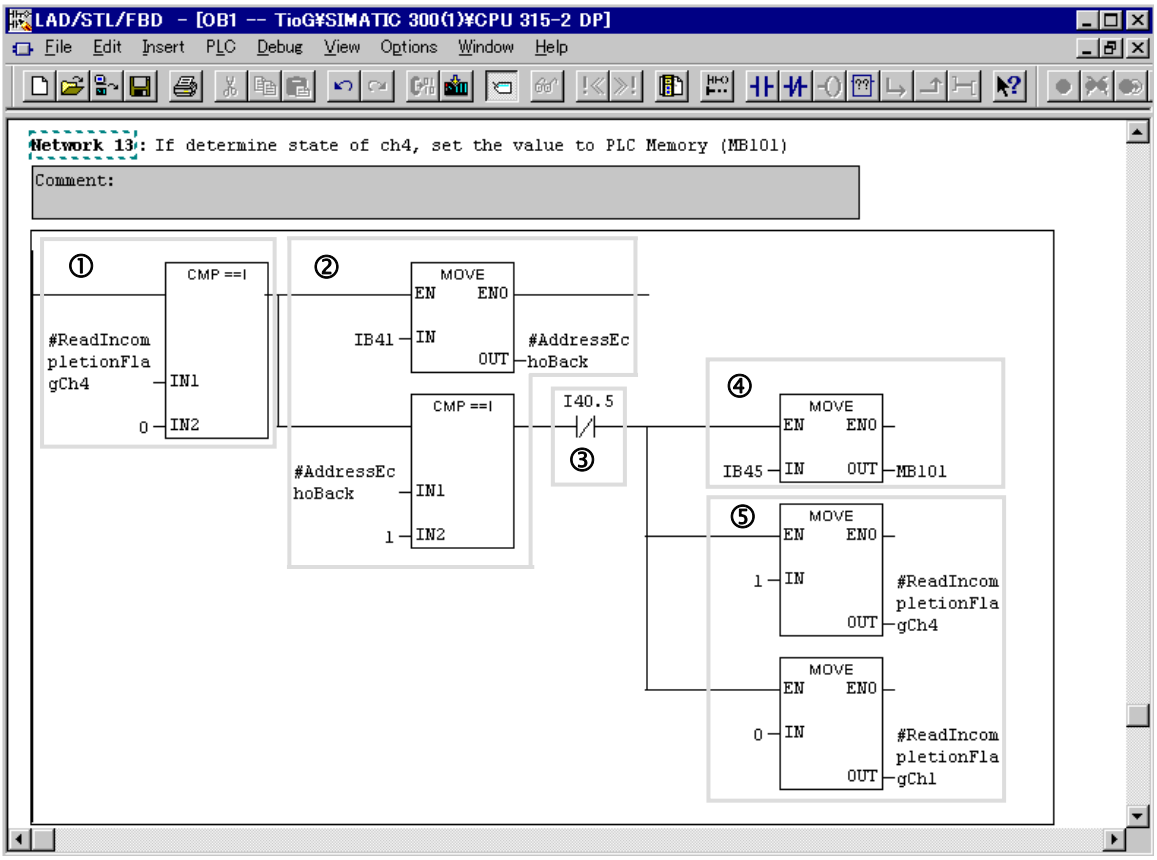
① First, it is determined whether or not a data request for the temperature control channel 2 with the module address 1 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② and ③ are activated.

② Set 0001H (hexadecimal) to QW24.
Thus, 00H is set to QB24 and 01H, to QB25.
As the Bit 7 of QB24 is set to 0, this data request becomes a read request.
The module address is assigned with 1 by setting 01H to QB25.

③ Set 100DH (hexadecimal) to QW26.
This is the communication item ID of the temperature rise completion state corresponding to the temperature control channel 2.

5. Further right-click the program area to select “Insert Network” and then generate ladders newly (Network 13).
Generate the ladder of “Processing a response from the SRV and then acquiring the temperature rise completion state and updating the flag if the dynamic data request is complete.”



The above ladders are described in the following.

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① First, it is determined whether or not a data request for the temperature control channel 2 with the module address 1 is valid using the CMP ==I command.
Only when valid (flag variable: 0), the ladders from ② to ⑤ are activated.

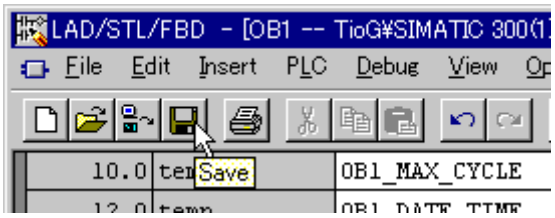
② Copy the response of IB41 to the request address from among the responses of IB40 to IB45 from the SRV for the dynamic data request to the variable of AddressEchoBack and just after, check whether or not that value coincides with the set address 1. Only when the set address coincides with the echo back, the ladders of ③ to ⑤ are activated.

③ If the Bit 5 of IB40 from among the responses of IB40 to IB45 from the SRV is set to 1, no dynamic data request is complete and thus the value is indefinite. The B contact is installed here so that the ladder of ④ and ⑤ are not activated if this bit is set to 1. When the Bit 5 is set to 0, the ladder of ④ and ⑤ are activated.

④ Take out the value if the dynamic data request is complete and the data is established.
As it is so designed that all data items in the SRV system are expressed as word values, in this example values are taken out by dynamic data request if the IW44 value is read. However, since any value in the temperature rise completion state is in the range of 0 to 1, the IB45 value is taken out and then is stored as a byte value. (Of course, it may be stored as bit data but in this example it is stored as a byte value.) The IB45 value is stored in the MB101 area of the PLC memory by using the MOVE command to keep recording the temperature rise completion state.

⑤ Select the flag just after ④ is finished.
Set the data request flag corresponding to the temperature control channel 1 with the module address 0 to 0 and also set the flag corresponding to the temperature control channel 2 with the module address 1 to 1, and then select the address/channel being subject to the dynamic data request.

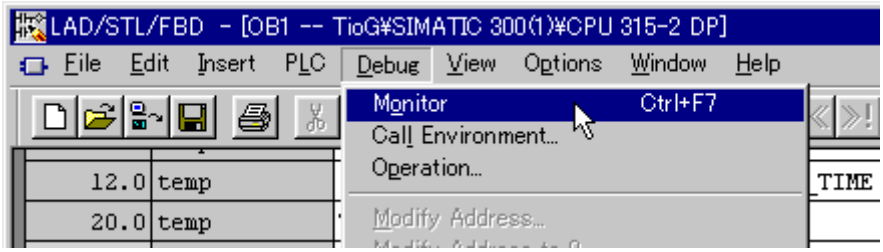
9. Thus, the program has been created.
Click the “Save” button on the toolbar to store and compile the sequence program. And, click the “Download” button of toolbar, and download a program in PLC.



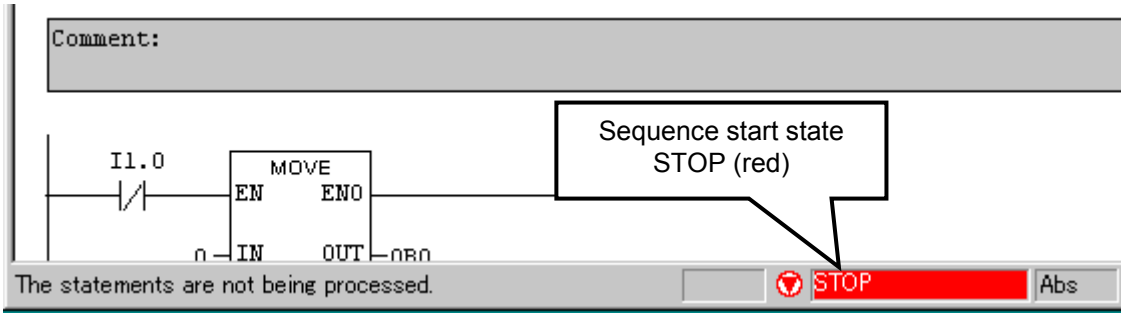
7.4.6 Program monitor

Confirm that a program works normally by a monitor function.

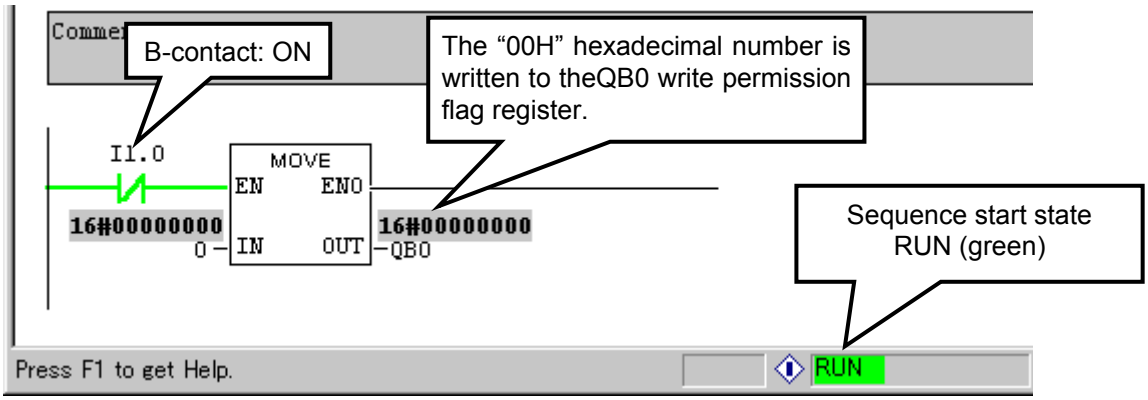
1. Select the menu command **Debug > Monitor**, and change a display to a monitor state.



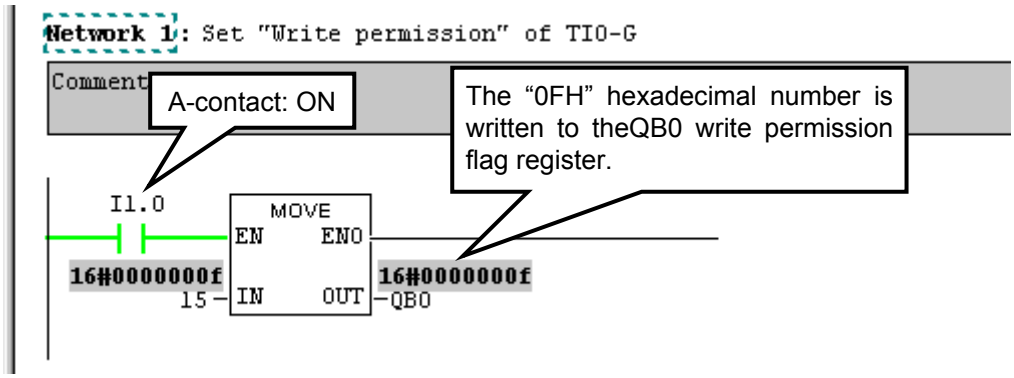
2. The sequence start state of PLC is displayed to bottom of a screen. As the program does not run at this time, “STOP” is displayed in red.



3. Start a sequence program of PLC.
The sequence start state on the lower side of the screen changes to “RUN” in green. In addition, the PLC register variables and contact ON/OFF states within the ladder are displayed.
As the B-contact of I1.0 (DI channel 9) is closed at this time and as a result “0” (hexadecimal number: 00H) is written to the QB0 write permission flag register, data write is not permissible.



4. Close the contact (DI channel 9) of a digital input module of PLC.
As the A-contact of I1.0 is closed and as a result “15” (hexadecimal number: 0FH) is written to the QB0 write permission flag register, data write becomes permissible.



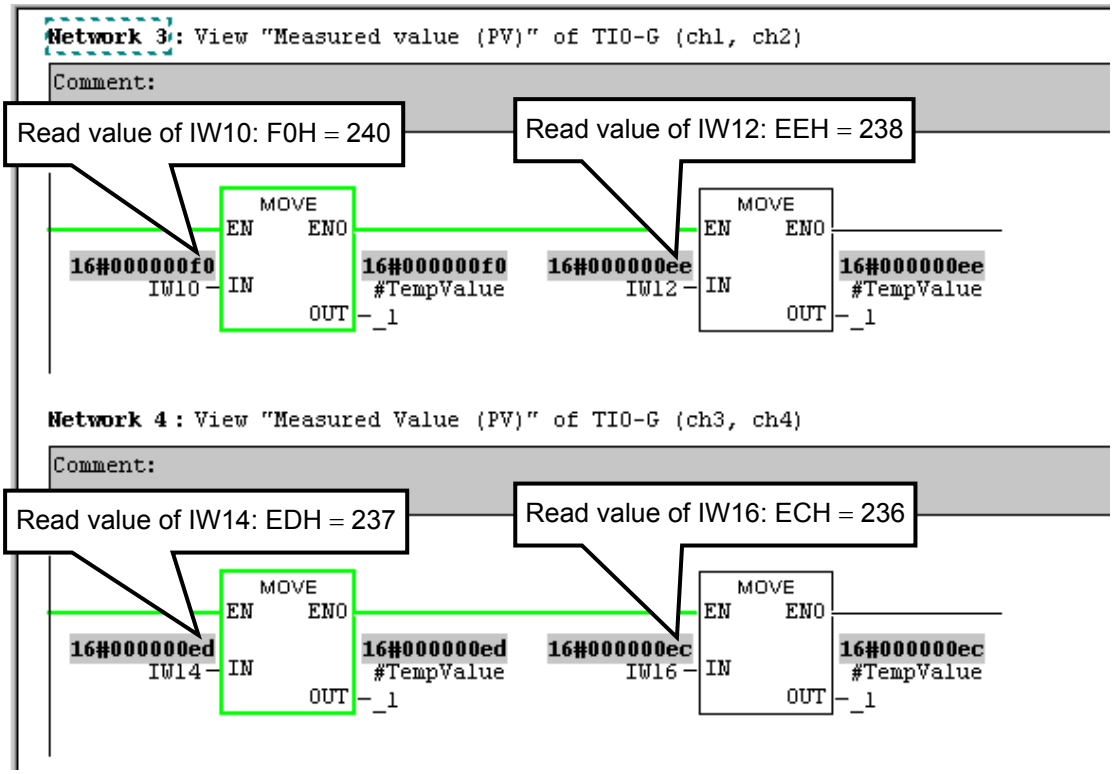
5. Confirm the Measured value (PV) of each temperature control channel.
Scroll the screen to display the ladder (Network 3, 4) in which the Measured value (PV) read program is described.
It can be checked that values are displayed on IW10, IW12, IW14 and IW16.
As the decimal point is positioned in the one decimal place of each Measured value (PV) of the relevant temperature control channel, each displayed value whose decimal point is positioned in the one decimal place becomes the actual Measured value (PV).

IW10 = F0H = 240 = 24.0 °C:
Measured value (PV) of temperature control channel 1 of module address 0

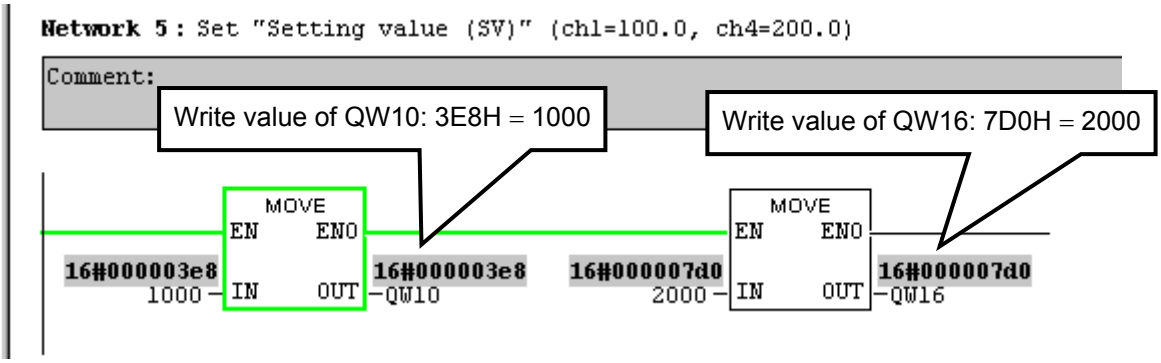
IW12 = EEH = 238 = 23.8 °C:
Measured value (PV) of temperature control channel 2 of module address 0

IW14 = EEH = 237 = 23.7 °C:
Measured value (PV) of temperature control channel 1 of module address 1

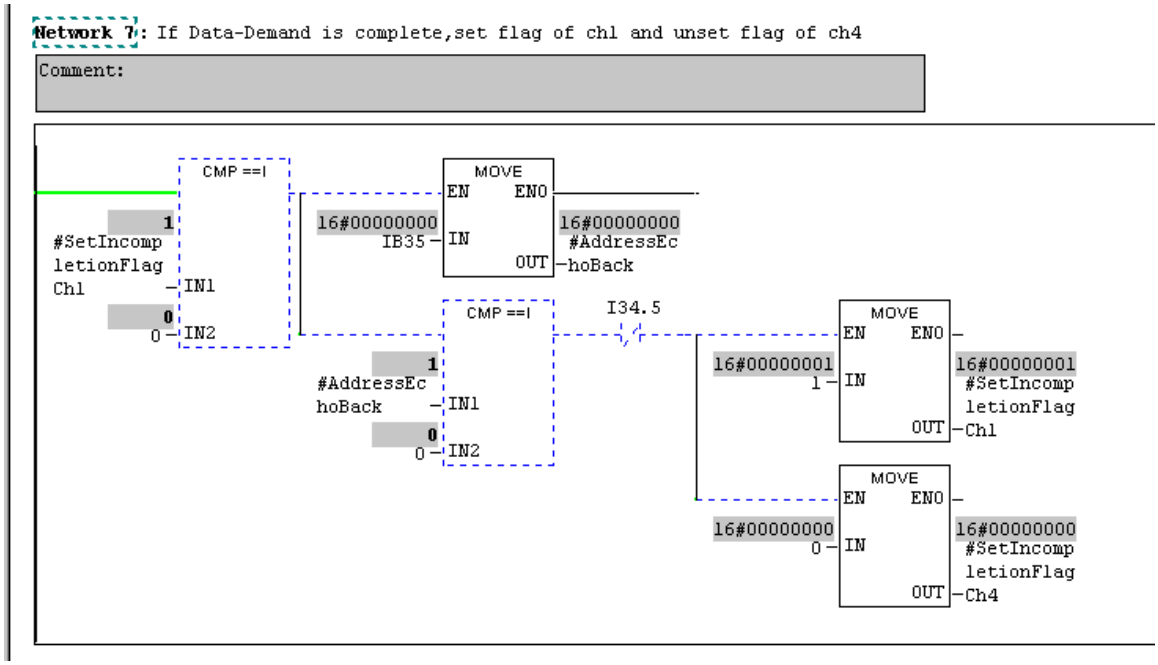
IW16 = ECH = 236 = 23.6 °C:
Measured value (PV) of temperature control channel 2 of module address 1



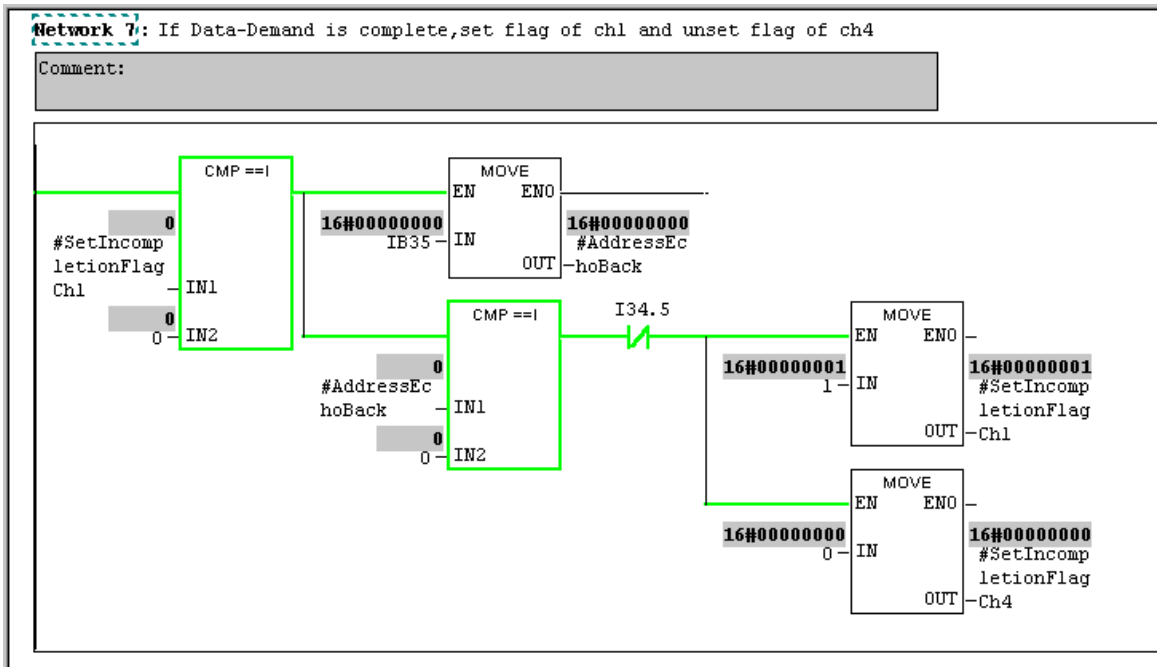
6. Check that the Set value (SV) is set.
Scroll the screen to display the ladder (Network 5) in which the Set value (SV) write program is described.
It can be checked that data is written to QW10 and QW16.
QW10 = 3E8H = 1000
QW16 = 7D0H = 2000



7. Succeedingly, check the dynamic data request.
Scroll the screen to display the ladder described with the dynamic data request program (Network 7). It can be viewed in the dynamic data request section that the request validity flag variable changes to 0 or 1 and accordingly the processed section changes to green or grey at fixed time intervals. The following screen shows an example when the flag variable is set to 1 and eventually no processing is made as there is no corresponding channel.



8. Next, the following screen shows an example when the flag variable is set to 0 and the dynamic data request is complete. At this time, the flag variable changes and the request processing moves to the other channel.

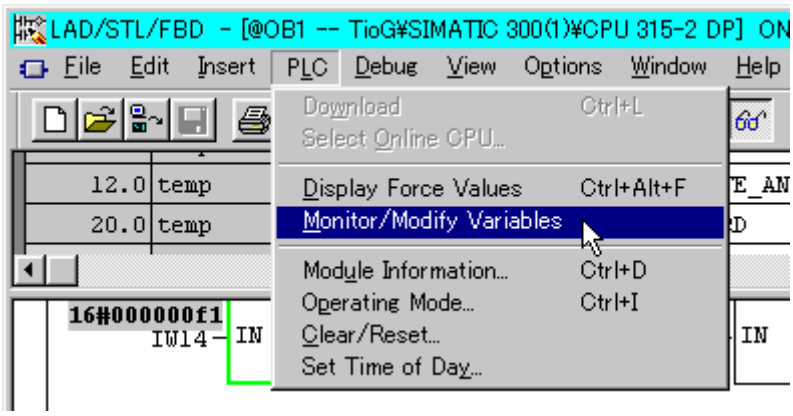


9. Thus, the program monitor has been finished.

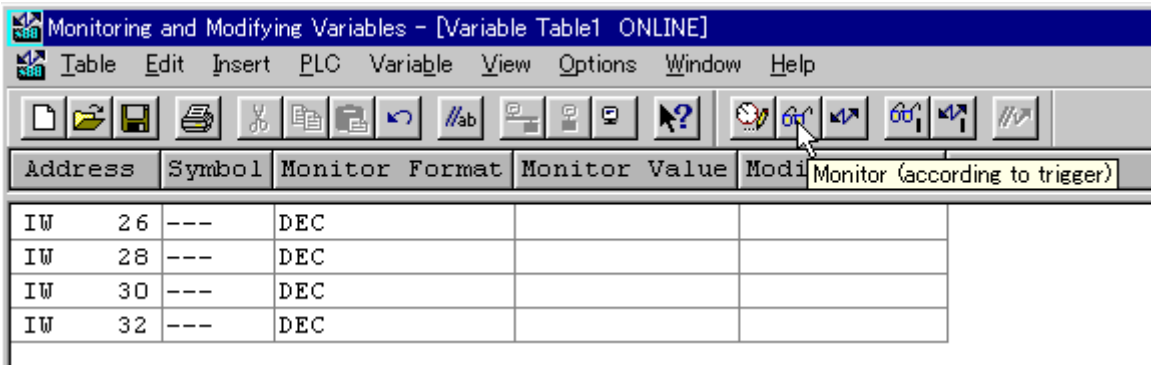
When static data write is checked, use of the PLC tool is better than the ladder.

[Usage of the PLC tool]

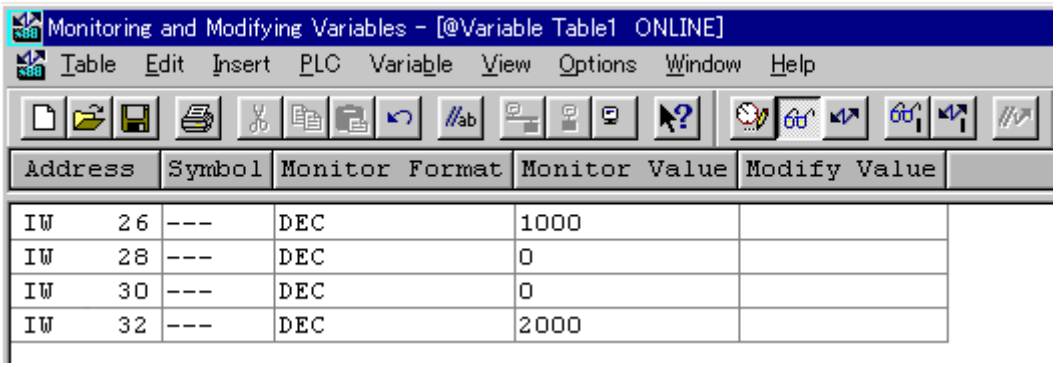
1. Select the menu command **PLC > Monitor/Modify Variables**, and display a window of "Monitor and Modify Variables – [Variable Table 1 ONLINE]."



2. Specify IW26, IW28, IW30 and IW32 assigned to the leftmost “Address” column as Set value (SV) read registers, and then set “DEC” (decimal) to “Monitor Format.”
Click the “Monitor (according to trigger)” of toolbar.



3. Values read are displayed in the “Monitor Value” column.
“1000” and “2000” are read to IW26 and IW32, respectively. Thus, it can be checked that the write value matches the read value.



8. TROUBLESHOOTING

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

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

⚠ WARNING

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

CAUTION

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

When replacing the module with a new one, always use the module with the same model code. If the module is replaced, it is necessary to re-set each data item.

■ V-TIO-G/V-TIO-H module

Problem	Possible cause	Solution
FAIL/RUN lamp does not light up [Temperature control side]	Power not being supplied	Check external breaker etc.
	Appropriate power supply voltage not being supplied	Check the power supply
	Power supply terminal contact defect	Retighten the terminals
	Power supply section defect	Replace V-TIO-G/H module
RX/TX lamp does not flash [Temperature control side]	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	CPU section defect	Replace V-TIO-G/H module
FAIL/RUN lamp is lit (red): FAIL status [Temperature control side]	CPU section or power section defect	Replace V-TIO-G/H module
RUN lamp: Turns on RX/TX lamp: Turns off [PROFIBUS side]	No connection, disconnection, breakage or wrong wiring of PROFIBUS cable	Confirm the connection method or condition and connect correctly
	Termination setting of a PROFIBUS connector is wrong	Sets termination setting correctly
RUN lamp: Turns on RX/TX lamp: Turns on ONL lamp: Turns off [PROFIBUS side]	The PROFIBUS address specified when hardware configured does not match that set by the V-TIO-G/H module	Match both of the PROFIBUS address
	The read/write static data length (number of words) when hardware configured does not match the data length (number of words) set when communication item assigned	Match both of the data length (number of words) (Data length can be calculated by "Number of channels × Number of items")

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Problem	Possible cause	Solution
RUN lamp: Turns on RX/TX lamp: Turns on ONL lamp: Turns off [PROFIBUS side]	The order of specifying data is incorrect at the time of assigning PLC registers when hardware configured, or two or more essential items are specified	Always specify the data in the following order 1. Module error state 2. Write permission 3. Static input 4. Static output 5. Dynamic I/O For the above 3 to 5, two or more items can be specified, but for the above 1 to 2 only one item can be specified
RUN lamp: Flashes [PROFIBUS side]	Internal communication is abnormal • Other modules (including the temperature control side of the V-TIO-G/H module) cannot be recognized within several seconds after the power is turned on • Initializing information is not received from other modules (including the temperature control side of the V-TIO-G/H module) within 30 seconds after the power is turned on	Sets communication speed for internal communication and module address correctly. Check to set module address from address number 0 in succession.
	Two or more network modules connected • Two or more V-TIO-G/H modules connected • Connected the V-TIO-E/F (temperature control module for PLC communication) module	Set the number of net work modules to one within the SRV unit

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Problem	Possible cause	Solution
RUN lamp: Flashes [PROFIBUS side]	The communication buffer overflows as the number of connecting modules within the SRV unit exceeds the maximum number (31 sets including one V-TIO-G/H module)	Set the connectable number of modules to the maximum number (31 sets including one V-TIO-G/H module) or smaller within the SRV unit
	Any modules of versions which are not connectable to the V-TIO-G/H module are connected	Replace these modules by modules of versions connectable to the V-TIO-G/H module

☞ For troubleshooting of Modbus, refer to **Module Type Controller SRV Communication Instruction Manual (IMS01P01-E□)**.

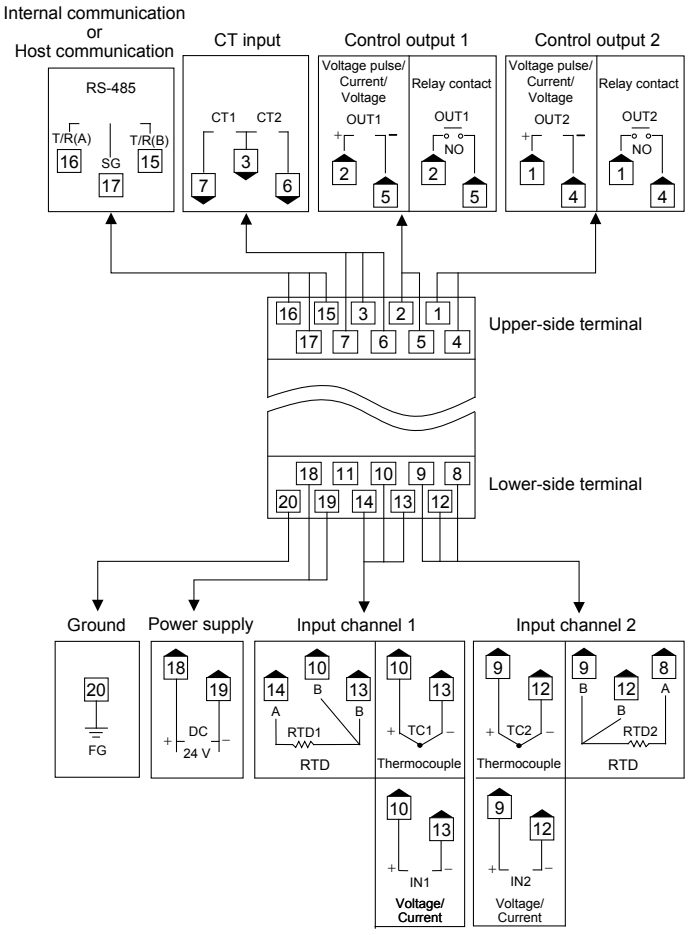
APPENDIX

1. Terminal Configuration

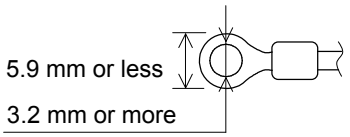
■ Wiring cautions

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

■ V-TIO-G/V-TIO-H



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



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

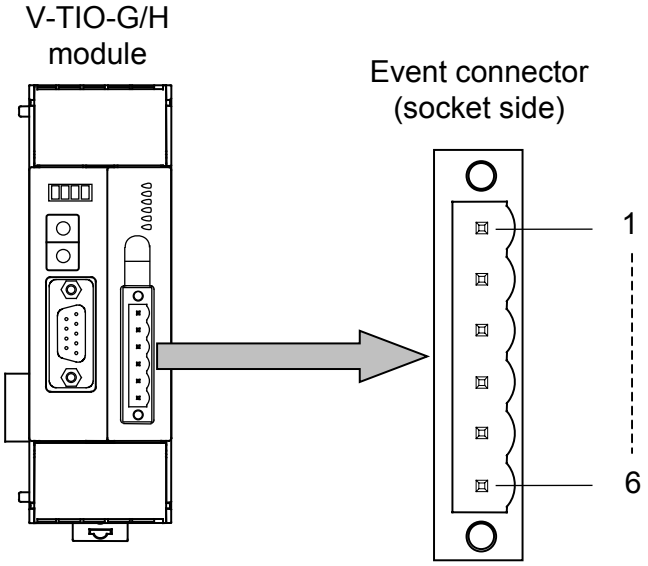
For Heat/Cool PID control (V-TIO-H), input channel 2 becomes unused.

For Heat/Cool PID control (V-TIO-H), Control output 1 corresponds to the heating output and Control output 2 corresponds to the cooling output.

2. Event Connector

This is a connector installed in the V-TIO-G/H module only when provided with the event input (optional) or the event output (optional).

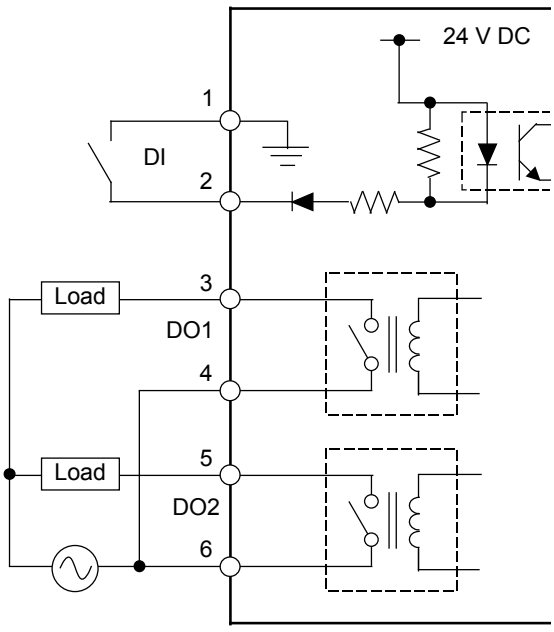
■ Pin layout of connector



■ Connector pin number and signal details

Pin No.	Description
1	Digital input (DI) (–)
2	Digital input (DI) (+)
3	Digital output (DO) 1 (Relay contact output)
4	
5	Digital output (DO) 2 (Relay contact output)
6	

■ Circuit configuration

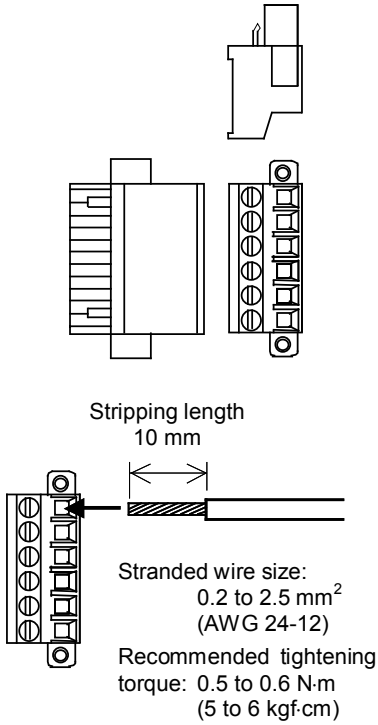


■ Attention in connector (plug) wiring

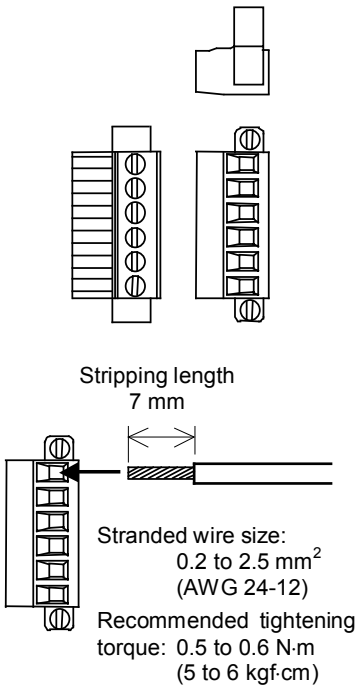
- Use the following connector (plug) as that connected to the event connector.
  Connector (plug) is sold separately.
  SRVP-01 (Front-screw type)
  SRVP-02 (Side-screw type)
- The lead wires use the stranded wire.
- Use the stranded wire from size 0.2 to 2.5 mm^2 (AWG 24-12).
- Stripping length is as follows.
  SRVP-01: 10 mm
  SRVP-02: 7 mm
- Recommended tightening torque of the lead wire in the connector (plug):
  0.5 to 0.6 N·m (5 to 6 kgf·cm)

(Screw size: SRVP-01: M2.5
SRVP-01: M3)

[SRVP-01] Front-screw type



[SRVP-02] Side-screw type



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