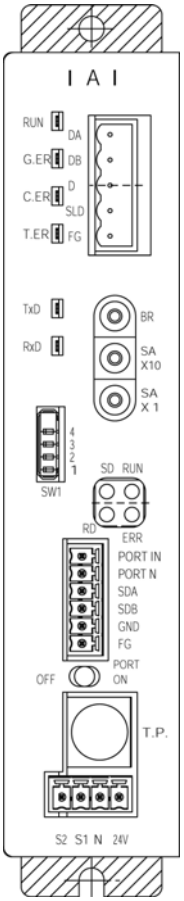
# CC-Link
# RCM-GW-CC
# Gateway Unit

## Operation ManualFirst Edition




*IAI Corporation*

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# 1. Outline

## 1.1 CC-Link gateway unit

CC-Link Gateway Unit (hereinafter, referred to as CC-Link gateway or gateway unit) is a unit to connect the network of CC-Link communication protocol for an upper programmable controller (hereinafter, referred to as PLC) and SIO communication network (Modbus communication protocol) for a controller (for robo-cylinder) which is a sub-network.

Physical standard for SIO communication network is RS-485, and slave addresses on this network are 1-16.

All data exchanged between the CC-Link and the Modbus protocol communication network are once stored in the internal memory of the gateway unit, and transmitted to CYCLIC. The gateway unit is handled from the PLC side as a remote I/O.

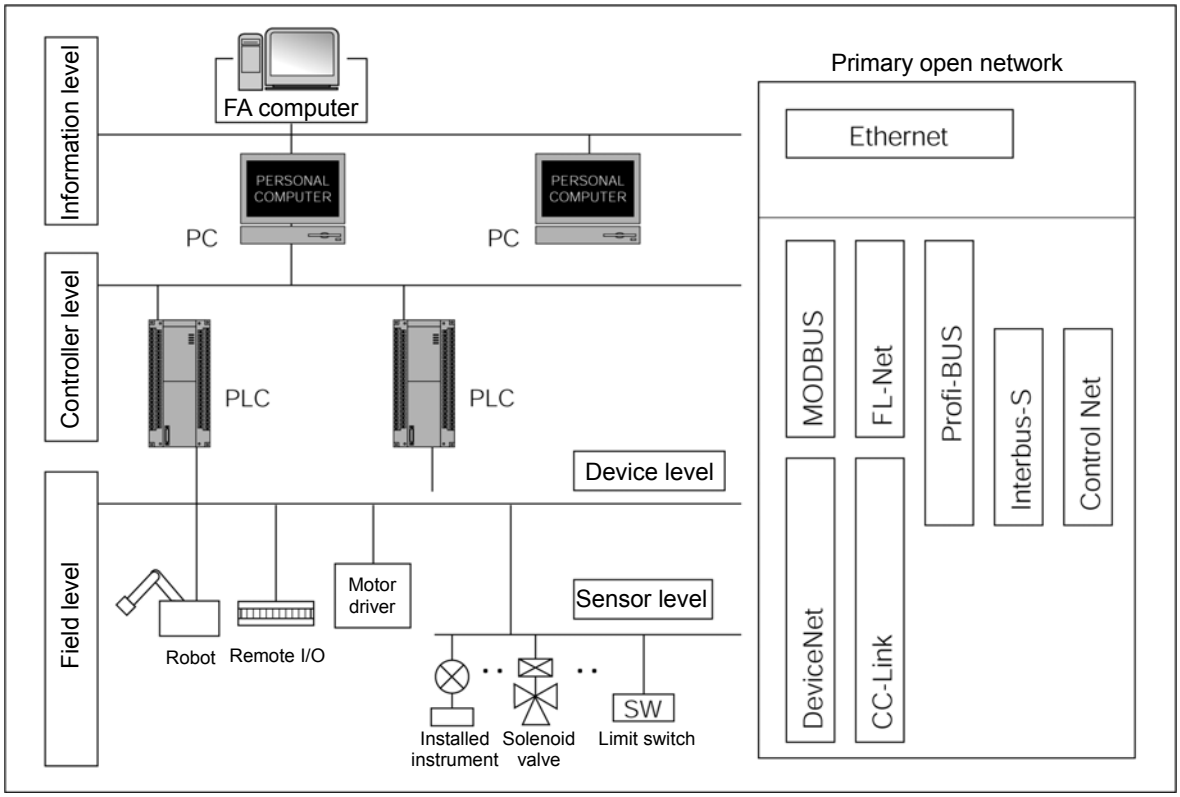
Adaptable controllers are PCON-SE, ACON-SE, SCON and ERC2-SE.

* Gateway is communication terminology, and is equipment which mutually converts data of which media and protocols are different on networks, and allows for communication.

## 1.2 What is CC-Link

### (1) System of FA communication

For FA communication, communication specifications depend on equipment on the communicating end, content of information and its purpose, however, are roughly divided into information level, controller level and field level as shown in the following diagram.




### (2) Information level

This is mainly used to transmit production information to an information terminal, and is referred to as “PLC upper network.” Ethernet is mostly used for this level.

### (3) Controller level

This frequently handles real time information for a production line, and is referred to as “Network between PLCs.”

### (4) Field level

This is referred to as “PLC lower network,” and is mainly used to save wiring for a control system of which one controller is in charge, and is positioned as “Wiring save communication.”
This level is largely classified into device level and sensor level.

(5) CC-Link

CC-Link has become wide spread mainly for FA as an open network for device level. Communication specifications are open to the public, therefore, equipment in compliance with CC-Link can be communicated without a program regardless of manufacturer.

Presently, CC-Link is spread and operated by CC-Link association (CLPA: CC-Link Partner Association), which is a non-profitable organization.

Main features are as follows.

[1] Highly perfected saved wiring communication which has realized complete multi-vendor connection.

[2] This is a unified standard, therefore, it can be used even overseas.

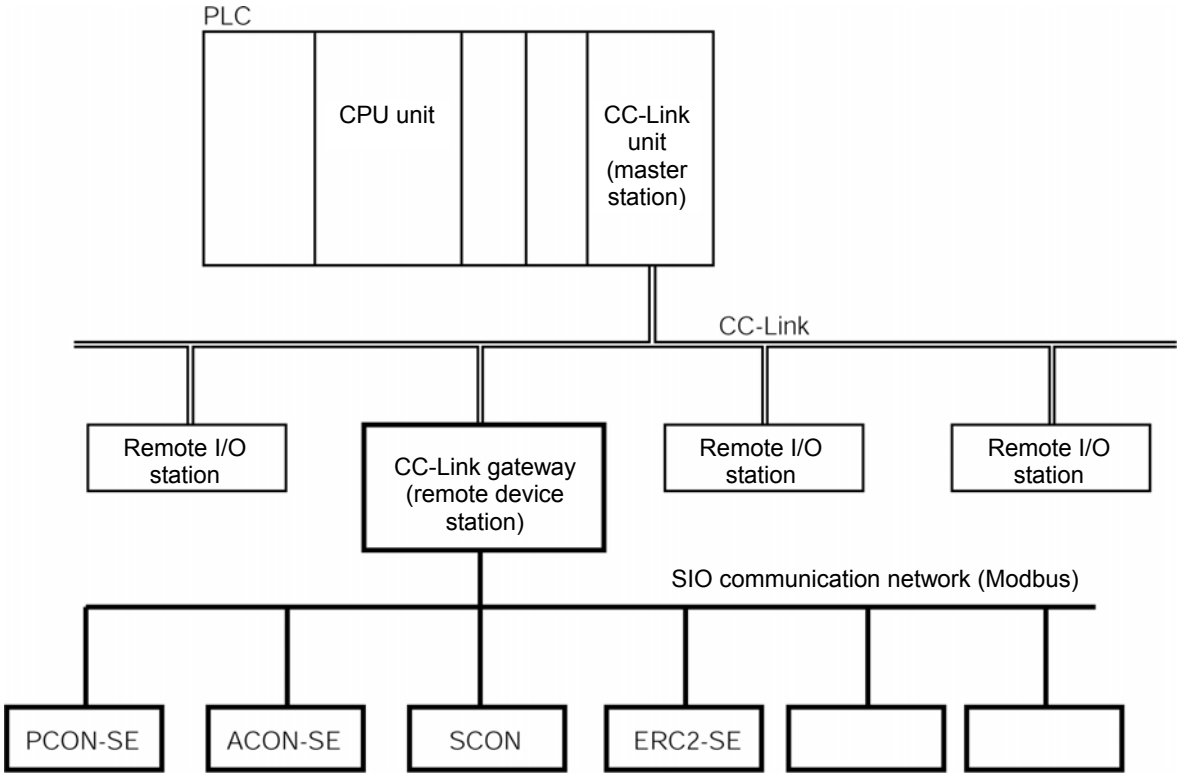
[3] Since slave equipment is handled as a PLC remote I/O to which CC-Link unit is installed, communication can be made without a particular program.

[4] Since line efficiency is high, communication with high-speed response can be made.

※ For details of CC-Link, refer to Operation Manuals of the master unit and the PLC to be installed.
Use this Operation Manual together with the Operation Manual of the controller to be connected.
This CC-Link gateway cannot be used in ways other than those for which this Operation Manual expressly allows. Further, do not perform setting and wiring other than those for which this Operation Manual expressly allows.

## 1.3 Application example of gateway unit

Application example is shown on the network in the following diagram.



## 1.4 Features

For CC-Link gateway, operation modes of the following four patterns can be selected.

(1) Position data limit designation mode

Only position data can be directly designated, and the maximum connecting axis number totals 14 axes.

Further, various status signals can be input and output, and present position data can be read.

Speed, acceleration and deceleration can be set for parameters for each axis as fixed values.

(2) Position No. designation mode

This is a mode to designate No. of position table for operation, and the maximum connecting axis number totals 14 axes.

Position data, speed, acceleration and deceleration are input into the position data table of each axis in advance. Input and output of various status signals and completed position No. can be read.

(3) Positioning data designation mode

This is a mode to directly designate position data for operation, and there are two patterns of normal positioning and push operation.

[1] Normal positioning mode

This mode directly designates speed, acceleration and deceleration in addition to position data, and the maximum connecting axis number totals 7 axes.

Further, input and output of various status signals and present position data can be read.

[2] Push operation mode

Push operation can be performed, and the maximum connecting axis number totals 3 axes.

This is a mode in which direct designation of current limit value (%) and positioning width for push is added to the normal positioning mode.

(4) Simple direct value/Position No. designation mode

This mode can mix position No. designated axis and simple direct value designated (position data is designated by numeric value, and the other movement data is designated by position table) axis.

Axis number is assigned from position No. designated axes, and subsequently, it is necessary to assign the number to simple direct value designated axis. Depending on the size of the assignment area, there is a Large pattern (88 words respectively for input and output), Middle pattern (68 words respectively for input and output) and Small pattern (34 words respectively for input and output), and the maximum connecting axis number totals 16 axes.

This Manual only describes content which can be controlled by using the Gateway unit. Content of this Manual takes precedence over content of the Operation Manual for the controller. For detailed contents of functions, parameter settings and alarms, refer to the Operation Manual for the controller.

Operation mode and primary functions

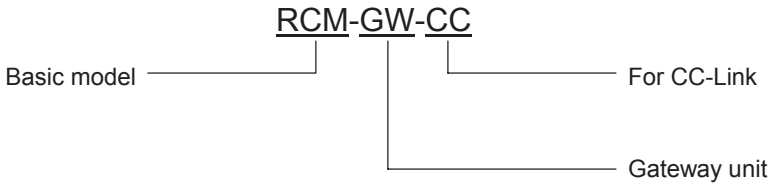
| Primary functions | Position data limit designated mode | Position No. designated mode | Positioning data designated mode | | Simple direct value/Position No. designated mode |
|---|---|---|---|---|---|
| | | | Normal positioning mode | Push operation mode | |
| Position data designated operation | ○ | × | ○ | ○ | ○ |
| Speed, acceleration and deceleration direct designation | × | × | ○ | ○ | × |
| Push operation | × | ○ | × | ○ | ○ |
| Present position reading | ○ | | ○ | ○ | ○ |
| Position No. designated operation | × | ○ | × | × | ○ |
| Completed position No. reading | × | ○ | × | × | ○ |
| Connectable axis number | 14 | 14 | 7 | 3 | 16 |
| Settable axis No. (*1) | 0 - 13 | 0 - 13 | 0 - 6 | 0 - 2 | 0 - 15 |
| Position data designated maximum value (*2) | 327.67mm | Designated to position table | 327.67mm | 9999.99mm | |
| Operable CC-Link version | Ver. 1, Ver. 2 | | | | Ver. 2 |

**⚠ CAUTION**

*1 A range of effective axis No. which is set to axis connected by SIO communication. Values set exceeding this range are ignored. This case does not generate an alarm.

*2 In the case of position data direct designated operation, maximum value of position data is limited by limiting data length of input and output register.

## 1.5 How to identify model




## 1.6 Accessories

[1] Power-supply input connector plug 1 pc
MC1.5/4-ST-3.81 (Phoenix Contact)

[2] SIO communication connector plug 1 pc
MC1.5/6-ST-3.5 (Phoenix Contact)

[3] CC-Link communication connector plug 1 pc
SMSTB2.5/5-ST-5.08AU (Phoenix Contact)

[4] CC-Link terminal resistor
130Ω, 1/2W 1 pc
110Ω, 1/2W 1 pc

# 2. Specifications and name of each part

## 2.1 General specifications

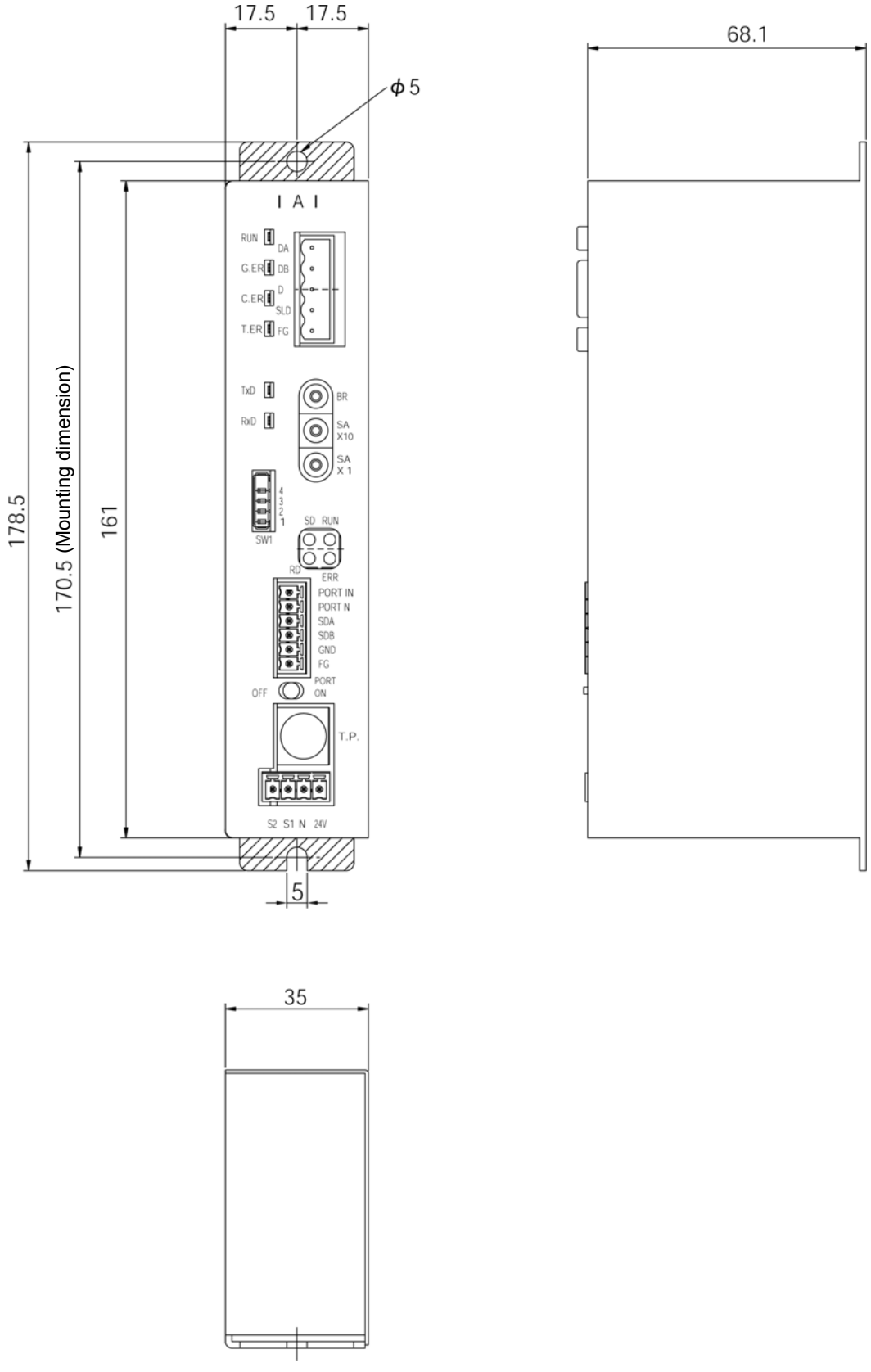
| Item | | Specification | | | | | |
|---|---|---|---|---|---|---|---|
| Power supply | | 24V DC ±10% | | | | | |
| Consuming current | | 300mA max. | | | | | |
| CC-Link specification | Communications standard | CC-Link Ver1.10 (*1) | | | | | |
| | Communications speed | 10M/5M/2.5M/625k/156kbps (Selection with rotary switch) | | | | | |
| | Communications system | Broadcast polling system | | | | | |
| | Synchronization system | Frame synchronization system | | | | | |
| | Encoding system | NRZI | | | | | |
| | Transmission path format | Bus format (EIA RS485 conformance) | | | | | |
| | Transmission format | HDLC conformance | | | | | |
| | Error control system | CRC ($X^{16} + X^{12} + X^5 + 1$) | | | | | |
| | Number of occupied stations | Remote device station 4 stations | | | | | |
| | Communications cable length (*2) | Communications speed (bps) | 10M | 5M | 2.5M | 625k | 156K |
| | | Overall cable length (m) | 100 | 160 | 400 | 900 | 1200 |
| | Communication cable | CC-Link dedicated cable | | | | | |
| SIO communication specification | Transmission path configuration | Our dedicated multi-drop difference communication | | | | | |
| | Communications system | Half-duplex | | | | | |
| | Synchronization system | Asynchronous type | | | | | |
| | Transmission path format | Equivalent to EIA RS485 2-wire type | | | | | |
| | Communication speed | 30.4kbps | | | | | |
| | Error control system | No parity bit, CRC (*3) | | | | | |
| | Communication cable length | Total cable length 100m or shorter | | | | | |
| | Connecting unit number | Maximum 3/7/14/16 axes (depending on operation mode) | | | | | |
| | Communication cable | Two-paired twist-pair shielded cable<br>(Recommended brand: Taiyo Electric Wire & Cable<br>HK-SB/20276×L 2P×AWG22) | | | | | |
| Environmental | Operating ambient temperature | 0 - 40°C | | | | | |
| | Operating ambient humidity | 85%RH or less (non-condensing) | | | | | |
| | Operating atmosphere | Not subject to corrosive gas, flammable gas, oil mist, powdered dust | | | | | |
| | Storage temperature | -10 - 65°C | | | | | |
| | Storage humidity | 90%RH or less (non-condensing) | | | | | |
| | Vibration resistance | $4.9m/s^2$ (0.5G) | | | | | |
| Protection class | | IP20 | | | | | |
| Weight | | 480g or less | | | | | |

(*1) Certification has been acquired

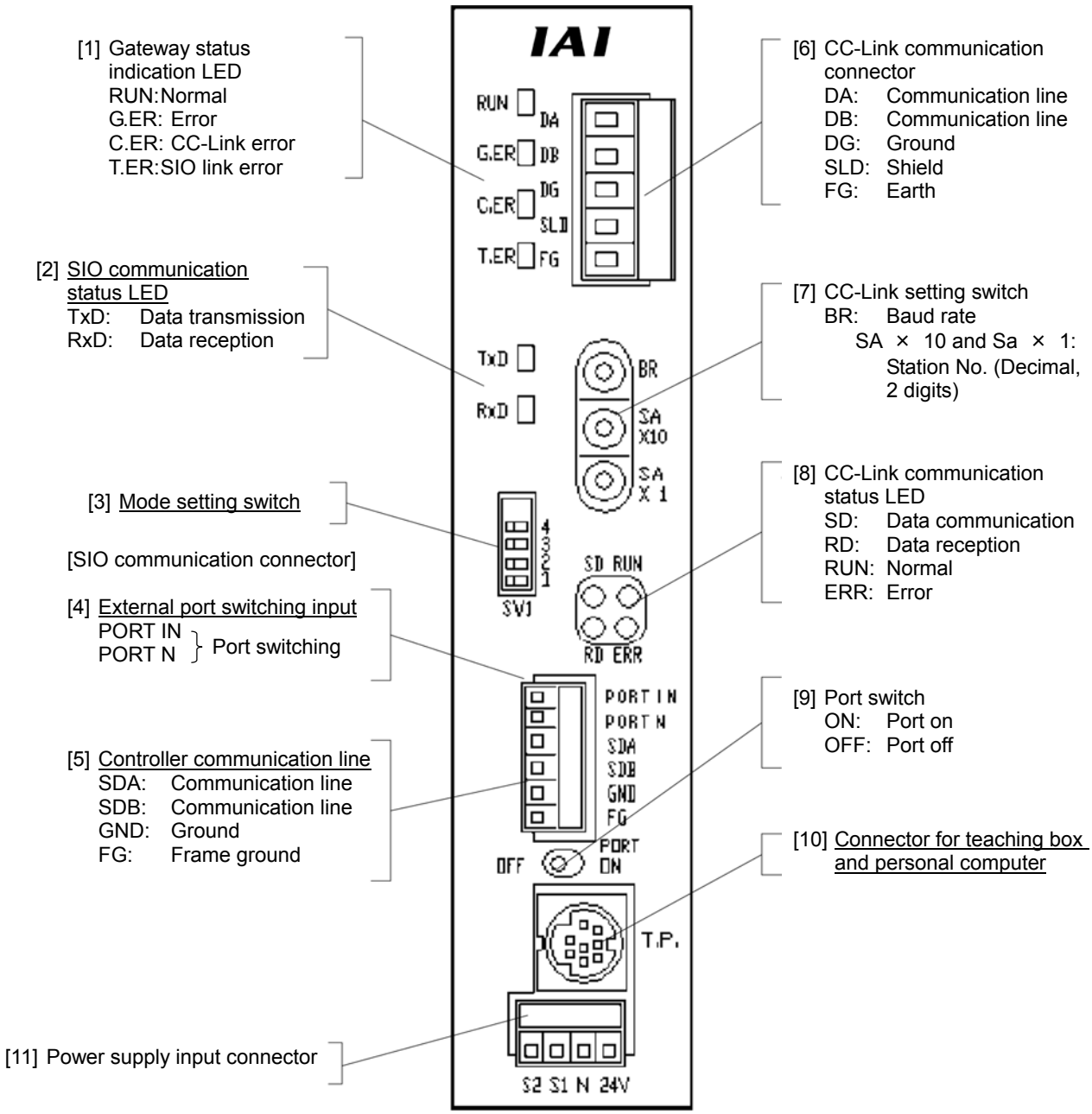
(*2) For T branch communication, refer to the Operation Manuals for the master unit and PLC to be mounted.

(*3) CRC: Cyclic Redundancy Check
Data error detecting method which is mostly used for synchronizing transmission

## 2.2 External dimension drawing



## 2.3 Name and function of each part



## [1] Gateway status indication LED

| Indicating status | | Description |
|---|---|---|
| RUN | Lit in green | Indicates that the CPU of the gateway is operating. |
| | Unlit | Indicates CPU operation stop status, and indicates that there is an error in the CPU of the gateway when this is not lit even if power is turned on. |
| G.ER | Lit in red | Gateway CPU is in error, major fault stop status. |
| | Unlit | Normal |
| C.ER | Lit in red | A status that CC-Link is in error, or CC-Link connection is not recognized from the gateway CPU. (Check CC-Link communication status in [8].)<br>It is necessary to connect the teaching box or personal computer supporting software if the RUN is lit even when this LED is lit. |
| | Flash in red | This flashes at an interval of one second in the case of port on status. |
| | Unlit | Normal |
| T.ER | Lit in red | Communication error occurs in communication between the CC-Link gateway and controller (No response, overrun, framing error or CRC(*) error) Normal |
| | Unlit | Normal |

* CRC: Cyclic Redundancy Check
Data error detecting method which is mostly used for synchronizing transmission

## [2] SIO communication status LED

Communication status between CC-Link gateway and controller can be checked.
This LED flashes when communication between the upper PLC and controller is being performed through CC-Link gateway, or communication is being performed with the controller by connecting the teaching box or personal computer supporting software to the CC-Link gateway.

| Indicating status | | Description |
|---|---|---|
| TxD | Flash in green | Data is transmitting (from the CC-Link gateway to controller) |
| | Unlit | Data transmission is suspended (from the CC-Link gateway to controller) |
| RxD | Flash in green | Data is receiving (from controller to the CC-Link gateway) |
| | Unlit | Data reception is suspended (from controller to the CC-Link gateway) |

## [3] Mode setting switch

This switch sets the operation mode of the CC-Link gateway.
Turn off the power for the CC-Link gateway to operate this switch.
When selecting No.1, No.3 and No.4, setting of the position table for the controller is disabled.

| No. | SW1 | | | | Description | Input and output byte number | |
|---|---|---|---|---|---|---|---|
| | 4 | 3 | 2 | 1 | | Output | Input |
| 1 | × | × | × | × | Position data limit designating mode | 46 | 46 |
| 2 | × | × | ○ | × | Position No. designating mode | 46 | 46 |
| 3 | × | ○ | × | × | Position/speed/acceleration and deceleration designating mode | 46 | 46 |
| 4 | × | ○ | ○ | × | Push operation enable mode | 46 | 46 |
| 5 | × | × | × | ○ | Simple direct value/Position No. designating mode Large | 176 | 176 |
| 6 | × | | × | ○ | Simple direct value/Position No. designating mode Middle | 136 | 136 |
| 7 | ○ | × | × | ○ | Simple direct value/Position No. designating mode Small | 68 | 68 |

## [4] External port switching input

Connector port for teaching box and personal computer can be switched ON/OFF by external signal (no-voltage contact).
When the port switch [9] for the CC-Link gateway main body is OFF, this input is enabled, and when the input signal is ON, the port is turned ON. (Refer to the [9] port switch.)

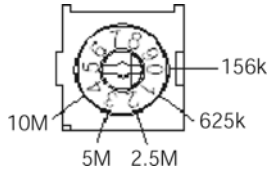
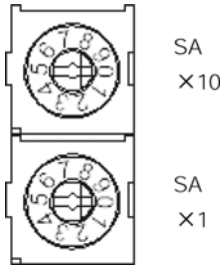
## [5] Controller communication line

This is a wiring connecting terminal for the communication line of the SIO communication (Modbus) connector.

## [6] CC-Link communication connector

This is a wiring connecting terminal for the CC-Link communication.

## [7] CC-Link setting switch

| Switch | Description |
|---|---|
| BR | [Baud rate setting switch]<br>This switch sets the communication rate.<br>Setting of 5 or higher is prohibited.<br>  |
| SA × 10<br>SA × 1 | [Station No. setting switch]<br>This switch sets with decimal two digits, however, effective setting is from 1 to 64.<br>Positions of SA × 10 ···10 are set.<br>Positions of SA × 1···1 are set.<br>(Example) When setting station No. 12,<br>set 1 to SA × 10, and<br>set 2 to SA × 1.<br>  |

* When changing the setting with the power on, the ERRLED of the next [8] is lit.

## [8] CC-Link communication status LED

Operating status of the CC-Link gateway and network status can be checked by the four LEDs.

| Indicating status | | | Description |
|---|---|---|---|
| RUN | Green | Lit | Normal operation (Lit by starting communication) |
| | | Unlit | Does not participate in network or time out status (Communication is interrupted for a certain time or longer) |
| ERR | Red | Lit | Reception data to self station is abnormal (CRC error).<br>Setting of baud rate setting switch or station No. setting switch is changed during communication. |
| | | Unlit | Normal |
| RD | Green | Lit | Data is being received |
| | | Unlit | No reception data |
| SD | Green | Flashing | Data is being transmitted |
| | | Unlit | No transmission data |

## [9] Port switch

This is a switch to enable the connector (T.P.) for teaching box and personal computer (PORT ON=Communication start).
When connecting and disconnecting the teaching box and the communication cable connector for personal computer supporting software, turn OFF this switch. When using this switch, turn ON after connecting the connector.
(Also pay attention to signal status of the port switching input [4].)
For communication rate between the teaching box, personal computer supporting software and the CC-Link gateway, up to 115.2kbps can be set. And, the communication rate between the CC-Link gateway and the controller is fixed to 230.4kbps.

When the PORT is ON, the CC-Link communication does not become abnormal, however, data communication for SIO communication stops. Therefore, output signal (data) from the PLC is not outputted to the controller, and input signal (data) from the controller keeps a value immediately before PORT was ON.
PORT ON status signal (TPC) is outputted from the CC-Link gateway to the PLC, therefore, performs processing such as interlock if necessary.

## [10] Connector for teaching box and personal computer

This is a connecting connector for the teaching box and personal computer.

## [11] Power supply input connector

This is a connecting connector for the power supply (24V DC) for the CC-Link gateway.

# 3. Installation and Noise Elimination

Pay sufficient attention to the installation environment.

## 3.1 Installation Environment

a. Since the gateway unit is not dust-proof or waterproof (oil proof), avoid using the gateway unit in a place subject to significant dust, oil mist or splashes of cutting oil.
b. Do not expose the gateway unit to direct sunlight or radiating heat from a large heat source such as heat treatment furnace.
c. Use the gateway unit in an environment free from corrosive or inflammable gasses, under a temperature of 0 to 40°C and humidity of 85% or less (non-condensing).
d. Use the gateway main body where it will not receive any external vibration or shock.
e. Prevent electrical noise from entering the gateway main body or its cable.

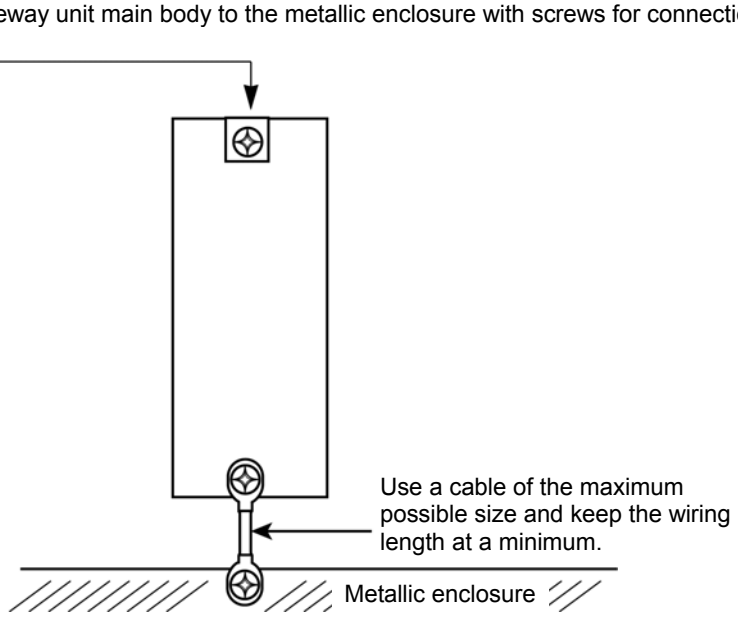
## 3.2 Power Supply

The power supply specification is 24V DC±10%.（Supply current: 300mA max.）

## 3.3 Noise Elimination and Grounding

### a. Installation of gateway unit main body

Directly fix the gateway unit main body to the metallic enclosure with screws for connection.




* Provide a dedicated class D grounding (Third class).

b. Precautions regarding wiring method

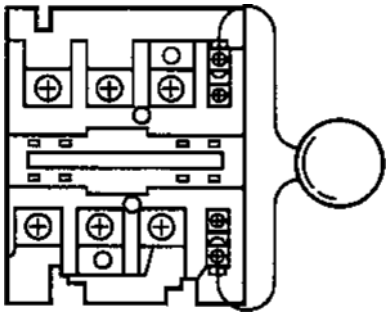
Separate the communication lines for the gateway unit and the wiring for the CC-Link communication line from high-power lines such as a cable connecting to a power circuit. (Do not bundle together wiring for the communication lines with high-power lines or place them in the same cable duct.)

c. Noise sources and elimination

Among the numerous noise sources, solenoid valves, magnet switches and relays are of particular concern when building up a system. Noise from these sources can be eliminated by implementing the measures specified below.

[1] AC solenoid valves, magnet switches and relays

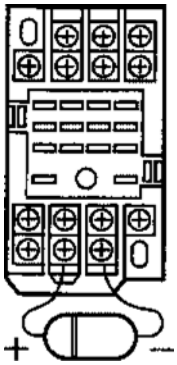
Measure: Install a surge absorber in parallel with the coil.



← Point
Install a surge absorber to each coil over a minimum wiring length. Installing a surge absorber to the terminal block or other part will be less effective because of a longer distance from the coil.

[2] DC solenoid valves, magnet switches and relays

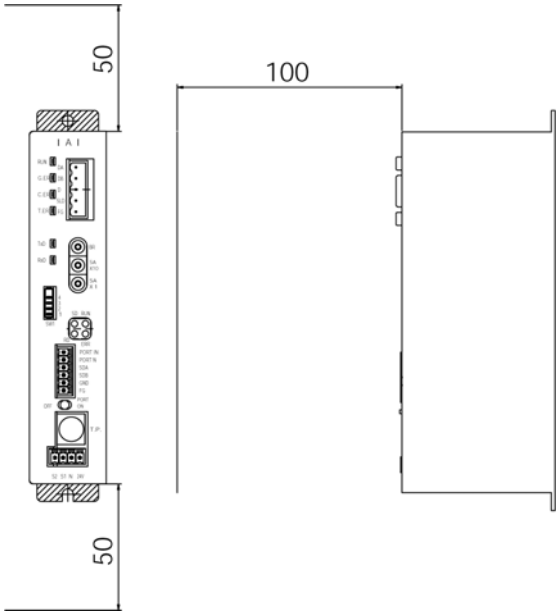
Measure: Install a diode in parallel with the coil. Determine the diode capacity in accordance with the load capacity.




In a DC circuit, connecting a diode in reverse polarity will damage the diode, internal parts of the controller and/or DC power supply, so exercise sufficient caution.

## 3.4 Installation

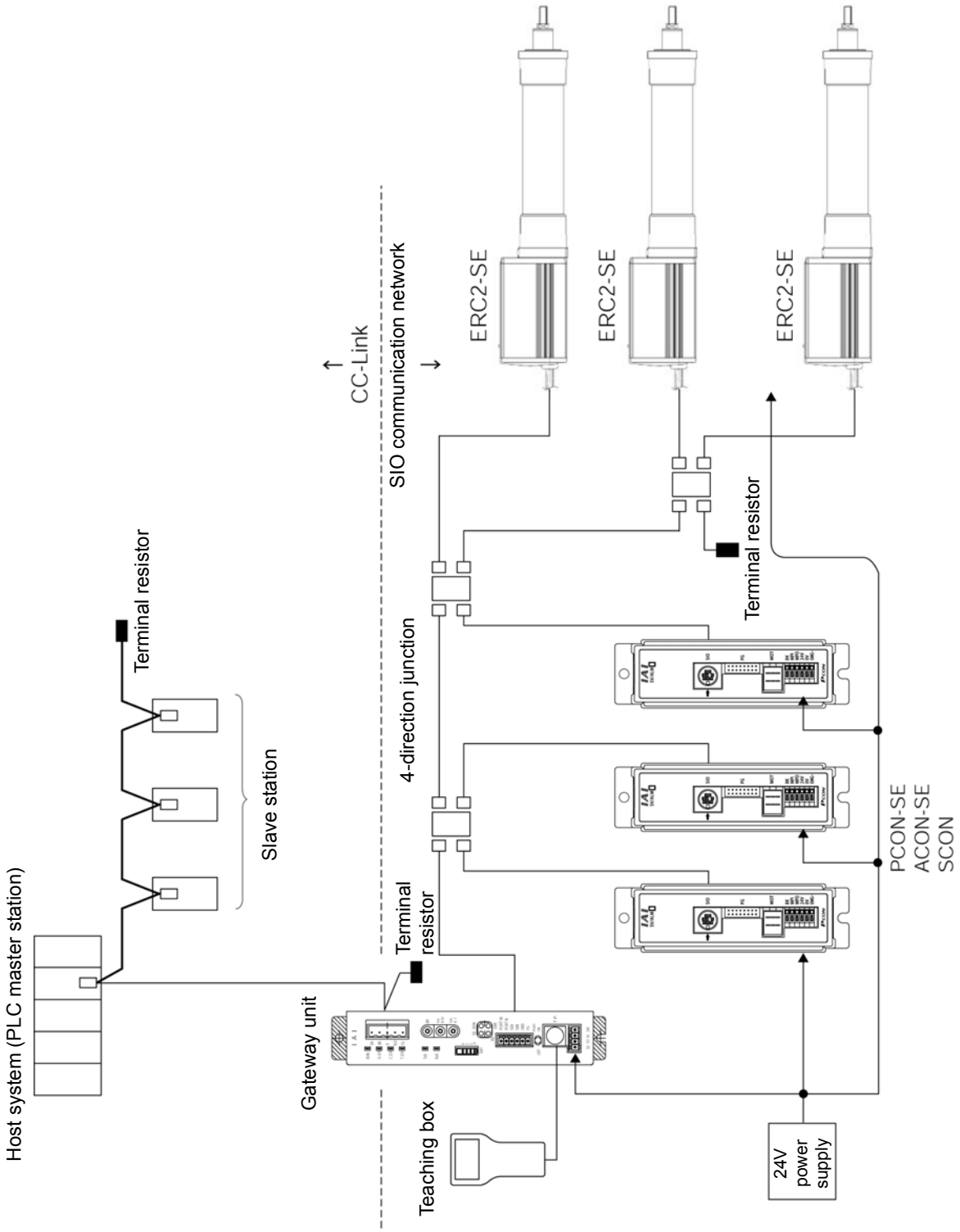
Design the control box size, installing position of the gateway unit and cooling method of the control box in such a way that the temperature around the gateway unit will not exceed 40°C.
Install the gateway unit vertically on a wall, as shown below, and provide a minimum clearance of 50mm above and below the gateway unit and a minimum clearance of 100mm on the front for wiring.
For lateral installation such as installing multiple gateway units side by side, secure a sufficient space so that the gateway unit is easily installed and removed.
If affection of heat or noise is a concern, take the measure into account.



# 4. Wiring

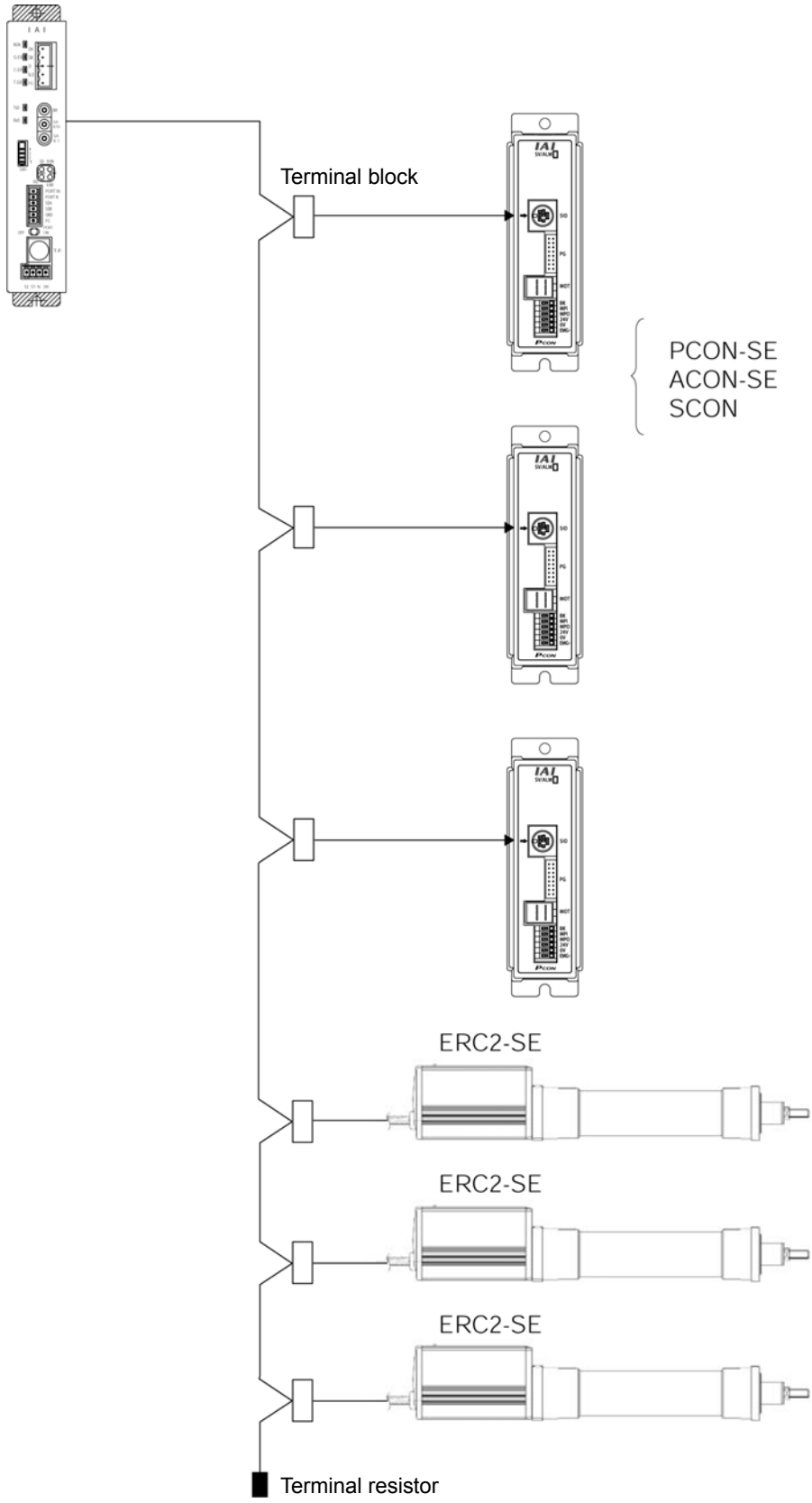
## 4.1 Overall Configuration

The following diagram shows an example of configuration to build a CC-Link by using a gateway unit.



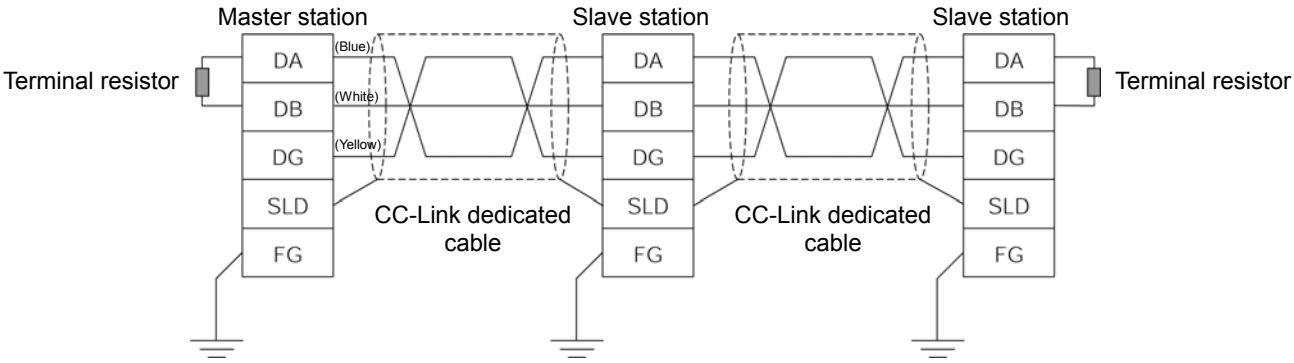
SIO communication connection is allowed even by multi-drop method using terminal blocks as follows.

Gateway unit

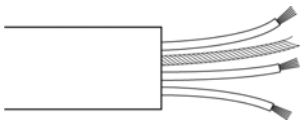


## Reference Outline of CC-Link network configuration

For details of the CC-Link, refer to the Operation Manual for the master side (PLC). This section describes a point for network wiring.
The following diagram shows an example of network connection.




(1) Equipment connected by the CC-Link is referred to as a station, and 0 to 64 can be set as a station No. The master station and slave station can be placed on any position.
(2) Connection is made by a multi-drop method directly branching at each station, and a T-branch using commercially available terminal block, etc., is allowed.
(3) Use a dedicated shielded 3-core twisted paired cable as a cable.
The dedicated cable is as follows.



| Color | Signal type |
|---|---|
| Blue | Communication line A (DA) |
| White | Communication line B (DB) |
| Yellow | Communication ground line (DG) |
| - | Shield (SLD) |

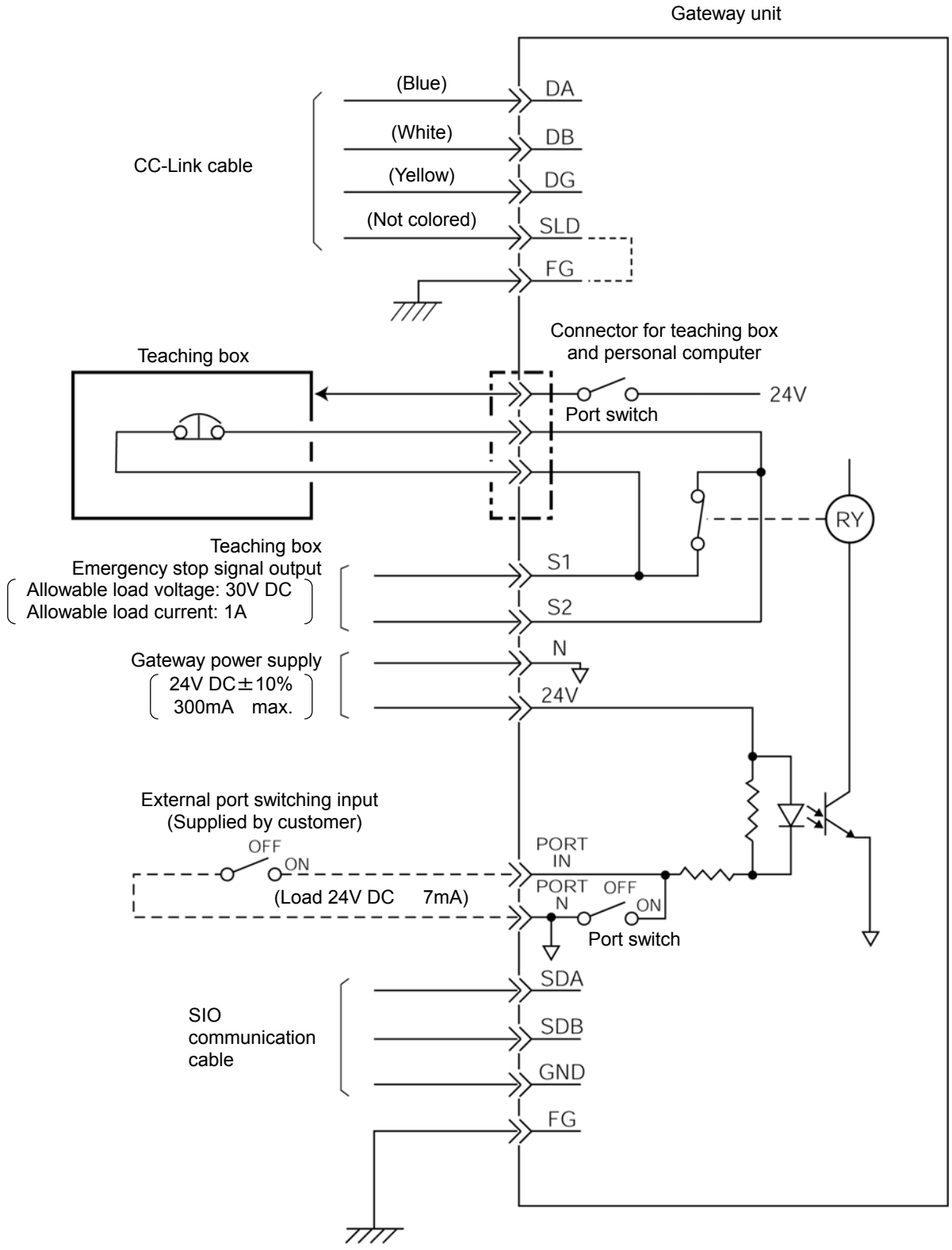
(4) It is necessary to install terminal resistors on both ends of the CC-Link system. The terminal resistor is connected between “DA” and “DB,” however, it differs with the cable being used.
(5) Communication rate is restricted by network length (total branch length, network maximum length).

**⚠ CAUTION**

Set the GND (ground) level of the power supply for each controller connected to the gateway to the power supply for the gateway.

## 4.2 Input and output signal of gateway unit

### (1) Connection diagram



## (2) Port control and emergency stop signal output

The connector port for the teaching box and personal computer can be also turned ON/OFF by an external signal other than the ON/OFF signal from the port switch on the gateway unit main body.
Further, since the contact signal from the emergency stop pushbutton switch on the teaching box is outputted to the outside while the port is ON, this signal can be incorporated into the emergency stop circuit for the whole system.

| External port switching input | Port switch | Teaching box emergency stop signal output | Connector port for teaching box and personal computer |
|---|---|---|---|
| OFF | OFF | Ineffective (S1-S2 short circuit) | Ineffective |
| ON | OFF | Effective (S1-S2= Teaching box emergency stop contact) | Effective |
| OFF | ON | | |
| ON | ON | | |

| | Symbol | Contents | Specification | Connector and applicable electric wire | |
|---|---|---|---|---|---|
| Power supply input connector | 24V | Gateway power supply Positive side of 24V DC | 24V DC ±10%<br>Consuming current 300mA max. | 0.8 – 1.3mm$^2$<br>AWG 18 – 16 | Connecting plug is standard attachment.<br>MC1.5/4-ST-3.81<br>(PHOENIX CONTACT) |
| | N | Gateway power supply Negative side of 24V DC | | | |
| | S1 | Teaching box emergency stop signal output | Allowable load voltage: 30V DC<br>Allowable load current: 1A | 0.08 – 1.5mm$^2$<br>AWG 28 - 16 | |
| | S2 | | | | |
| SIO communication connector | PORT IN | External port switching input | No voltage (dry) contact input load: 24V DC 7mA | 0.08 – 1.5mm$^2$<br>AWG 28 - 16 | Connecting plug is standard attachment.<br>MC1.5/6-ST-3.5<br>(PHOENIX CONTACT)<br>The gateway unit incorporates a terminal resistor, therefore, connect the terminal resistor to the end of the SIO communication. |
| | PORT N | | | | |
| | SDA | SIO communication line A | Set GND (ground) level to that of controller or ERC actuator to be connected. | Two-paired twist shielded cable (AWG22)<br>Recommended brand: Taiyo Electric Wire & Cable<br>HK-SB/20276 XL<br>2P × AWG22 | |
| | SDB | SIO communication line B | | | |
| | GND | Ground | | | |
| | FG | Frame ground | Internally connected to frame. | | |
| CC-Link communication connector | DA | CC-Link communication line A | | CC-Link Ver. 1.10 supporting dedicated cable (Such as FANC-SBH, FANC-SB) | Connecting plug is standard attachment.<br>SMSTB2.5/5-ST-5.08AU<br>(PHOENIX CONTACT)<br>It is necessary to connect a terminal resistor *1 to both ends of the CC-Link system (between DA and DB), therefore, check the Operation Manual for the master side (PLC). |
| | DB | CC-Link communication line B | | | |
| | DG | CC-Link communication ground line | | | |
| | SLD | Shield | Internally connected. | | |
| | FG | Frame ground | | | |

*1 The gateway unit is provided with the following one terminal resistor respectively. Since the terminal resistor depends on the CC-Link cable to be used, use a resistor suitable for the cable.
Cable FANC-SBH (CC-Link dedicated high-performance cable) . . . . 130Ω, 1/2W
Cable FANC-SB (CC-Link dedicated cable) . . . . . 110Ω, 1/2W

## 4.3 Building of SIO communication network (SIO communication)

### 4.3.1 Wiring

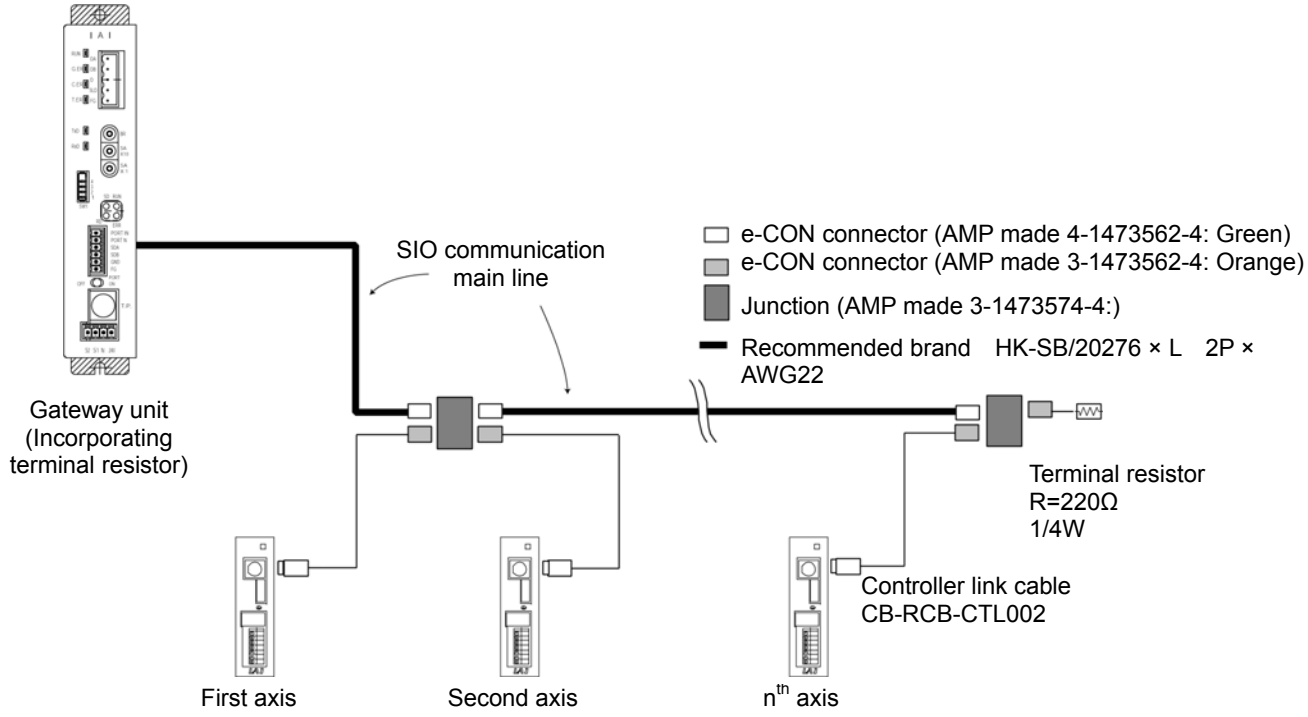
#### (1) Basic

| Item | Contents |
|---|---|
| Number of connecting units | 16 axes max. (Depends on the operation mode. Refer to “1.4 Features”) |
| Communication cable length | Total cable length 100m or shorter |
| Communication cable | Two-paired twisted pair shielded cable |
| Terminal resistor | Recommended cable: Taiyo Electric Wire & Cable |

**⚠ CAUTION**

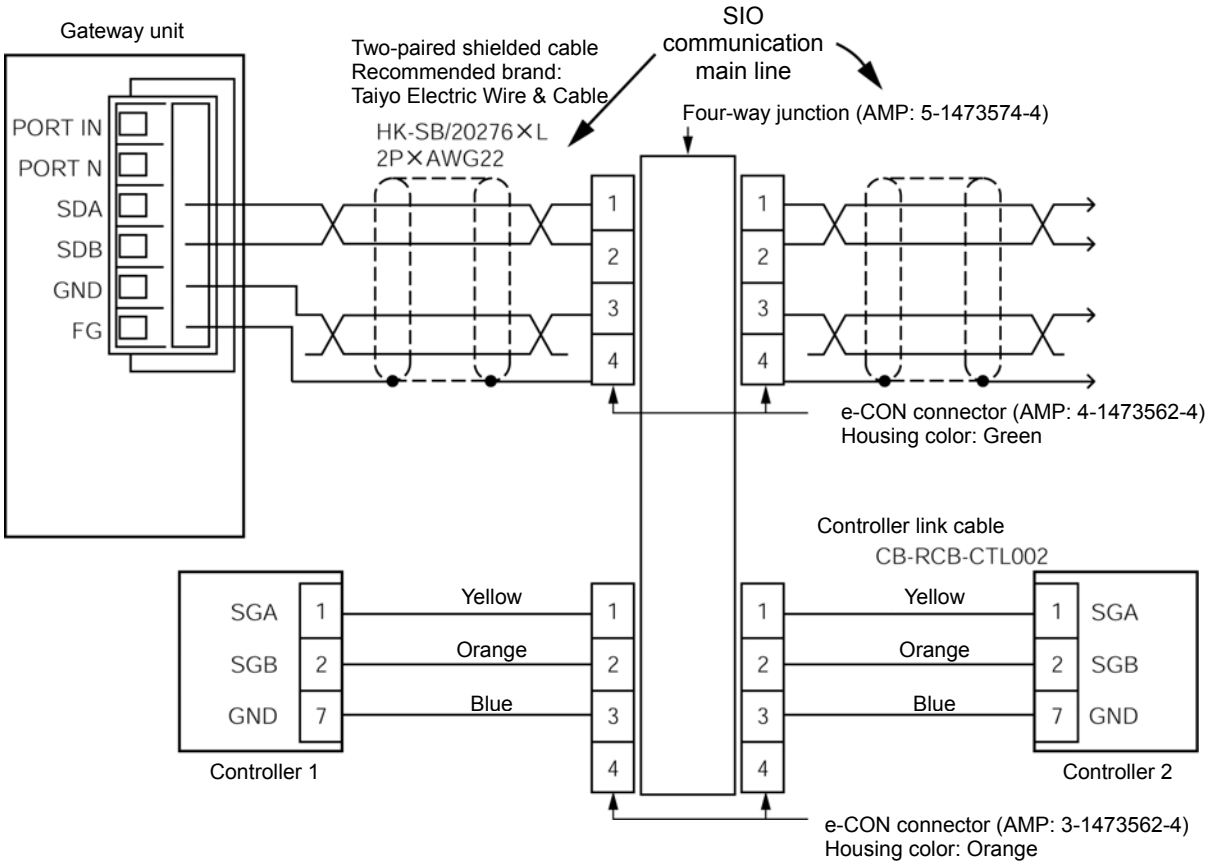
1. Provide a communication path via a bus connection, and be sure to connect a terminal resistor at the end. A terminal resistor is incorporated into the gateway unit side, therefore, it is unnecessary to connect it.
2. The communication cable should be supplied by customer. If the recommended communication cable is not used, use an electric wire size AWG22.

#### (2) Link connection for PCON-SE, ACON-SE



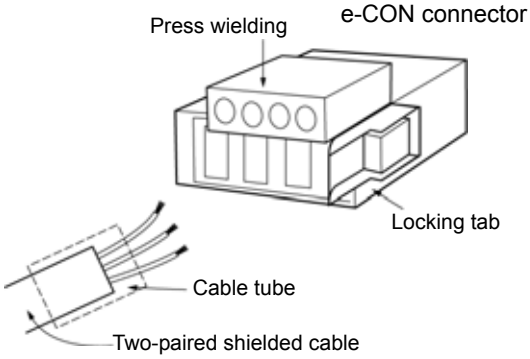
a. Detail Connection Diagram

The diagram below shows the details of the SIO communication connection. The controller link cables are optionally prepared, but the communication main line must be prepared by the customer.

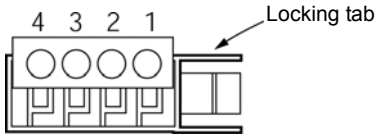



b. Preparation of Communication Main Line

[1] Strip off approx. 15-20mm of the sheath from the two-paired shielded cable.
[2] Install the cable protective tube.
[3] Insert three cables into the cable insertion hole of the connector without stripping off the envelope of the conductors.
[4] Pressure-weld the cable press-fit housing with the cables inserted from above.
[5] Heat-treat the cable protective tube.

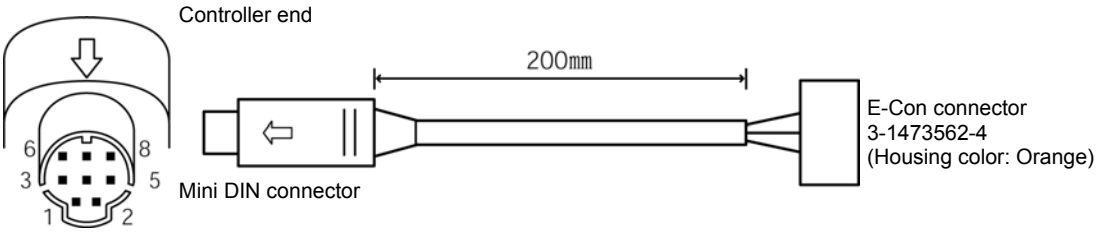



Pin numbers of e-CON connector




Be sure to insert the terminal resistor (220Ω, 1/4W) into the end of the communication main line. (between No. 1 and No. 2 of the e-CON connector)

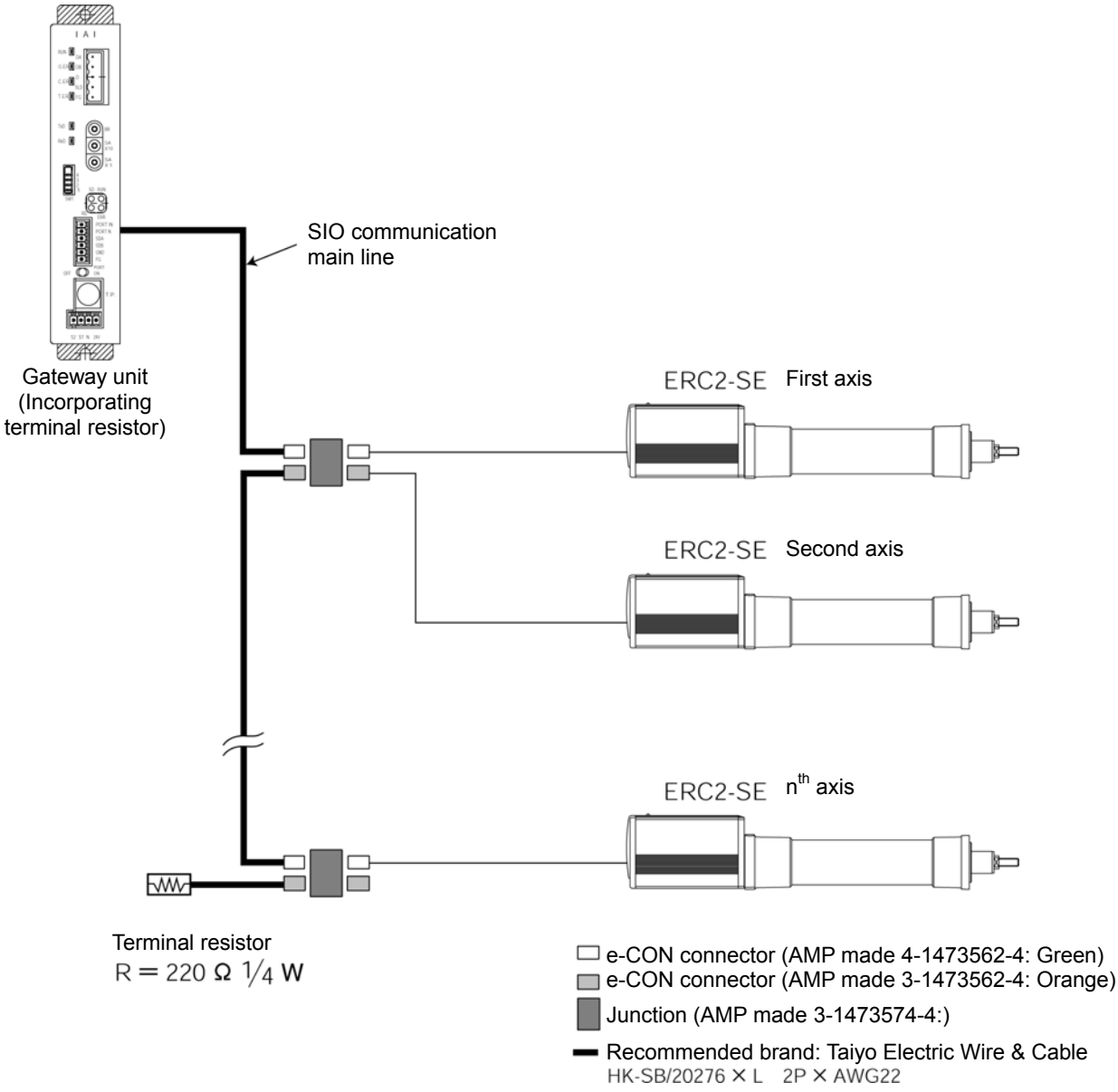
c. Controller Link Cable (CB-RCB-CTL002)
* Controller's option




| Signal | No. | | No. | Signal |
|---|---|---|---|---|
| SGA | 1 | Yellow | 1 | SGA |
| SGB | 2 | Orange | 2 | SGB |
| +5V | 3 | | 3 | GND |
| ENB | 4 | | 4 | |
| EMGA | 5 | Blue | | |
| +24V | 6 | | | |
| GND | 7 | | | |
| EMGB | 8 | | | |

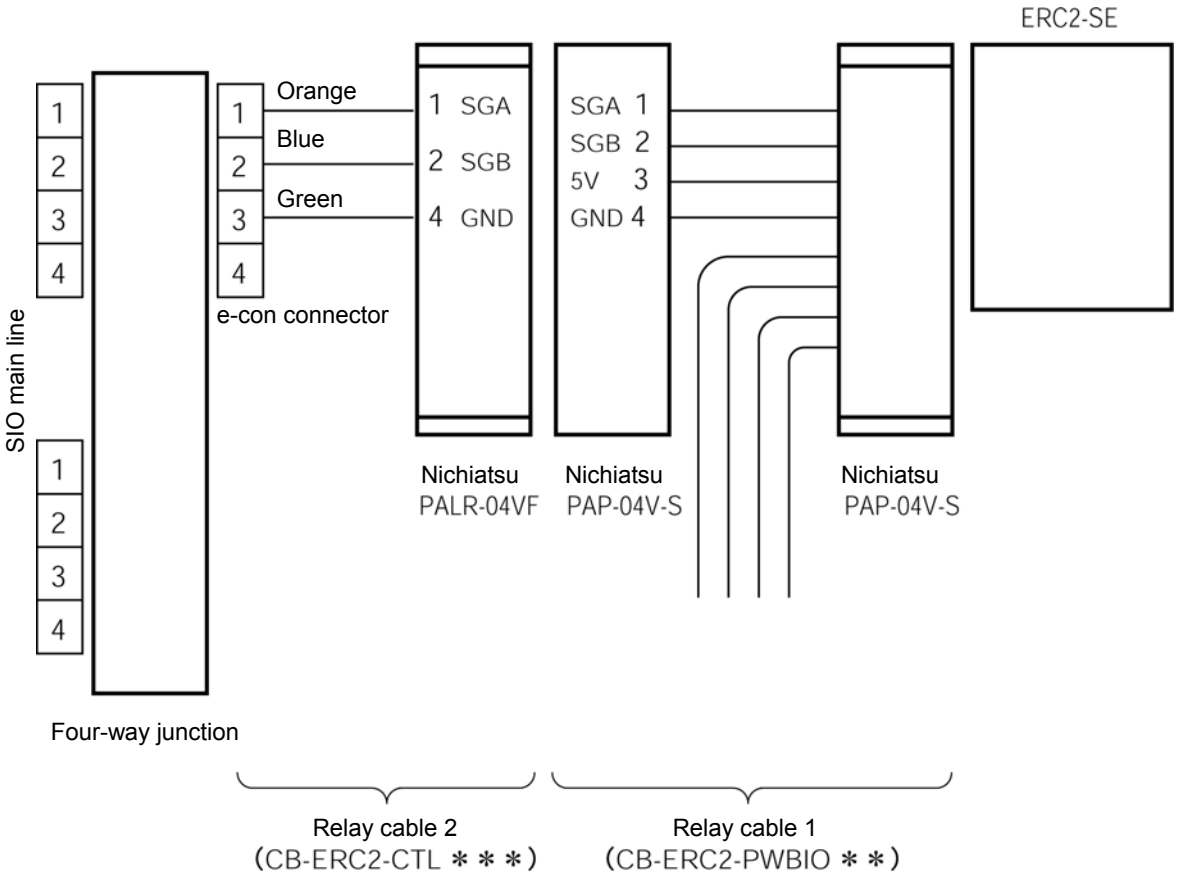
The following parts are provided together:
[1] Four-way junction
Model: 5-1473574-4, Manufacturer: MP, Quantity: 1
[2] E-Con connector
Model: 4-1473562-4, Manufacturer: MP, Quantity: 1
Compatible wire coating outline: 1.35-1.6mm
[3] Terminal resistor: 220Ω, 1/4W, with E-Con connector, Quantity: 1

(3) Link connection for ERC2-SE



## Detail connection diagram

Connection between the gateway unit and four-way junction is the same as in item (2).
Connection between each ERC2-SE and four-way junction is as shown in the following diagram.
For details, refer to the Operation Manual for the ERC2-controller.




## (4) In the case of a combination of PCON-SE, ACON-SE, ERC2-SE and SCON

The previous items (2) and (3) are basic connections. Perform wiring by the method introduced in 4.1 Overall configurations.

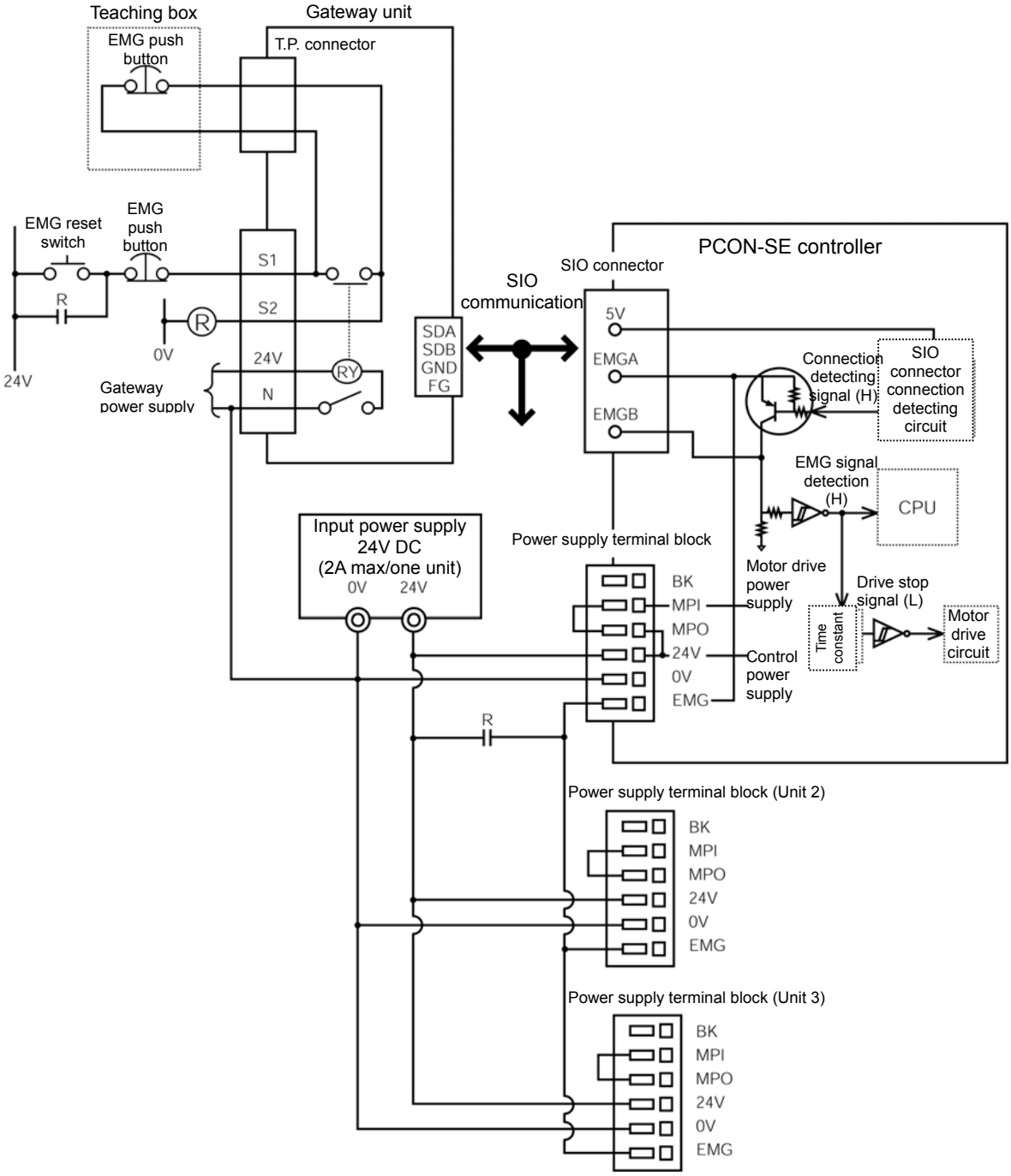
## (5) Wiring of emergency stop (EMG) circuit

When incorporating an emergency stop switch on the teaching box connected to the gateway unit into an emergency stop circuit, emergency stop signal output outputted from the “S1” and “S2” terminals for the gateway unit can be used.
The controller for all of the connected robo-cylinders can be put into an emergency stop status by the emergency stop switch on the teaching box connected to the gateway unit.

**⚠ CAUTION**

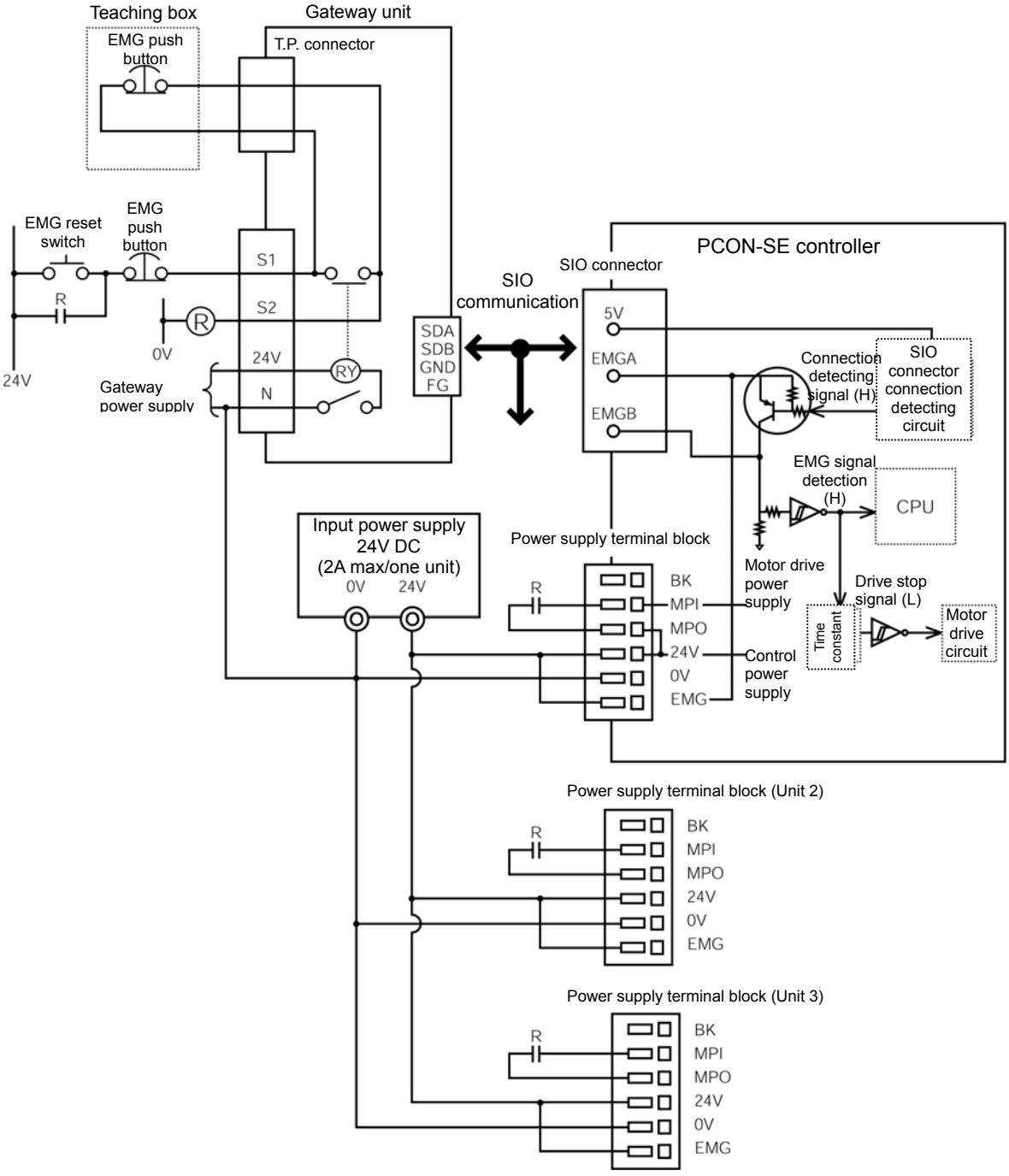
1. The following example shows a wiring path for an emergency signal, and does not show a safety circuit (such as emergency stop reset circuit). Provide a safety circuit including an emergency stop reset circuit, etc., on the outside for an actual emergency stop.
2. For details of emergency stop processing for the robo-cylinder, refer to the Operation Manuals for PCON-SE, ACON-SE, SCON and ERC2-SE.

[1] Example of drive signal shutdown




⚠ Caution: [1] The input current to the EMG terminal of PCON-SE is 5 mA. When connecting the contact of the EMG relay R to the EMG terminals of multiple controllers, check the current capacity of the relay contact.

[2] Example of motor drive power shutdown



### 4.3.2 Setting of axis No.
### For PCON-SE, ACON-SE and ERC2-SE

Set axis No. for slave station No. on the SIO link.
Set the axis No. in a hexadecimal of 0 to F so that the first axis No. is 0, and 16$^{th}$ axis No. is F.
Axis No. is set by the teaching box or personal computer supporting software.

◎ Operation of personal computer supporting software
[1] Open the main screen. [2] Click the setting (S). [3] Move the cursor to the controller setting (c). [4] Move the cursor to the axis No. assignment (N) and click. [5] Enter No. into the axis No. table.

◎ Operation of teaching box RCM-T
[1] Open the user adjusting screen. [2] Move the cursor to the assignment NO._ with ▼key. [3] Enter axis No. and press the Return key. [4] Enter 2 into adjusting NO._ and press the Return key.

◎ Operation of simple teaching box RCM-E
[1] Open the user adjusting screen. [2] Open the Return key to open a screen of the assignment NO._. [3] Enter axis No. and press the Return key. [4] Enter 2 into adjusting NO._ and press the Return key.

For details of the setting method, refer to the Operation Manuals for the teaching box or the personal computer supporting software.

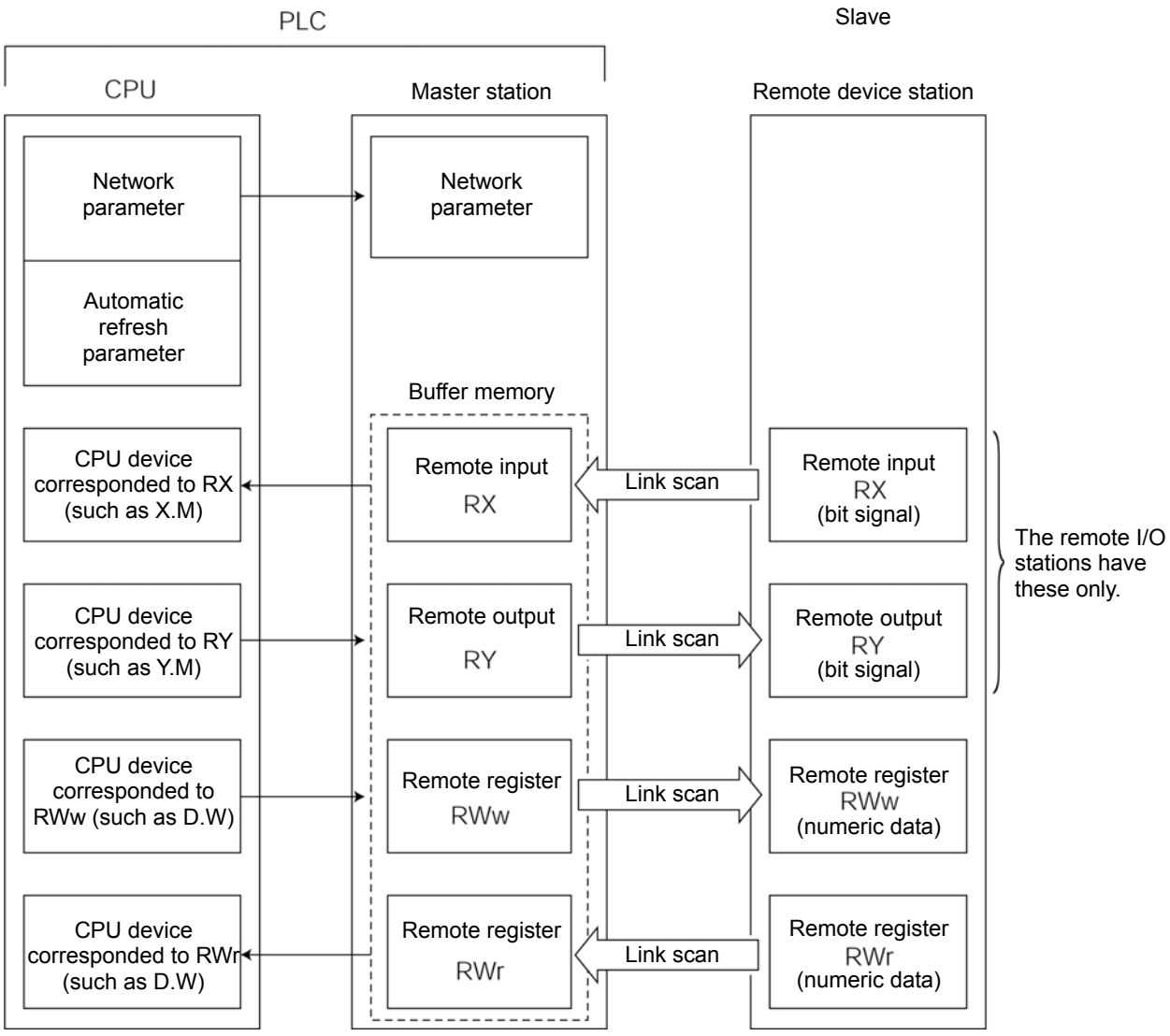
**⚠ CAUTION**

1. Set an axis No. so as not to be duplicated.
2. Remove the link connection for the axis to be set for setting and changing the axis No.
3. Connect the terminal resistor between SGA and SGB on the ends.

# 5. Outline of CC-Link

## 5.1 Data communication

A scheme for basic data communication of the CC-Link is as shown in the following diagram.
For slave to master station of the PLC, there are remote I/O stations which handle bit information only and remote device stations which handle bit information and word information (numeric data).
The master station has a buffer memory which is divided into remote input RX, remote output RY and remote register RWw/RWr. The remote input and output RX/RY handle bit information, and the remote register RWw/RWr handle word information (numeric data). Data is automatically communicated between the master station and slave station via this buffer memory regardless of the CPU for the PLC.
The CPU uses the buffer memory in the master station and the CPU internal device (such as X.Y.M.D.W) to communicate data.



* CPU internal user device for PLC

| | | |
|---|---|---|
| Bit device | Input: | X |
| | Output: | Y |
| | Internal relay: | M |
| Word device | Data register: | D |
| | Link register: | W |

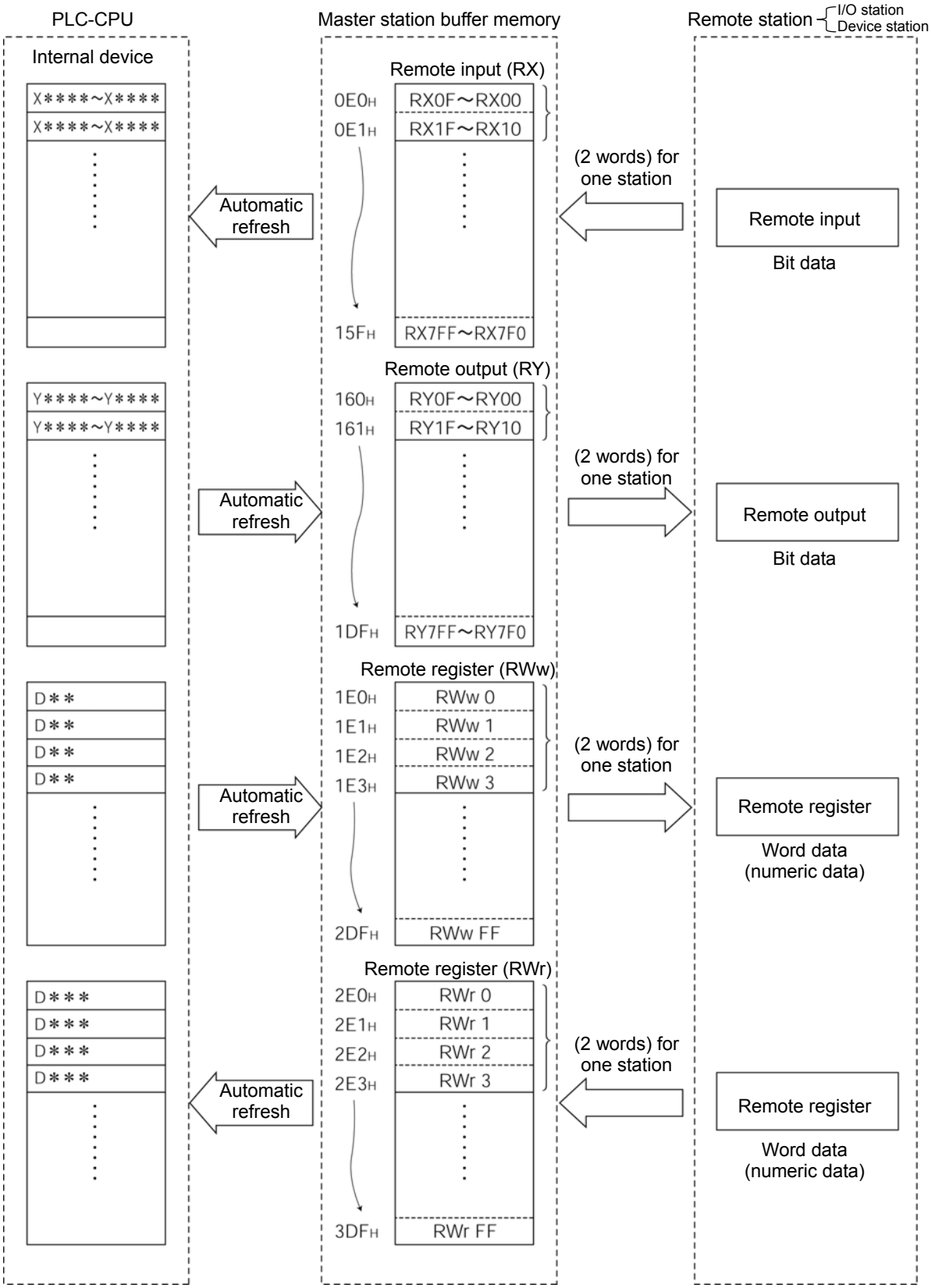
## 5.2 Address assignment of master PLC

Number of maximum link points per one system is respectively 2048 points for remote input and output (RX, RY) and 256 points for remote register (RWw, RWr), and a buffer memory for this size is available.
Address assignment for the master station buffer memory is as shown in a diagram on the next page.
The remote input RX is assigned to $0E0_H$-$15F_H$ addresses, the remote output RY is to $160_H$ -$1DF_H$ addresses, the remote register RWw is to $1E0_H$-$2DF_H$ addresses, and the remote register RWr is assigned to $2E0_H$ -$3DF_H$ addresses.

Number of links per one remote station is respectively 32 points (2 words) for remote input and output (RX, RY), and 4 points (4 words) for remote register (RWw, RWr), then links of a maximum 64 stations are available for one system.
Station No. of 1 to 64 can be set to a remote station, however, the number of exclusive stations vary with the remote station, so it is necessary to exercise sufficient caution to set the station No.

Data communication between the internal device of the CPU and the master station buffer memory is sometimes performed by sequence command such as FROM command and TO command, and is, in some case, automatically performed by setting the parameters in advance (automatic refresh).

CC-Link memory map (MITSUBISHI Q series)



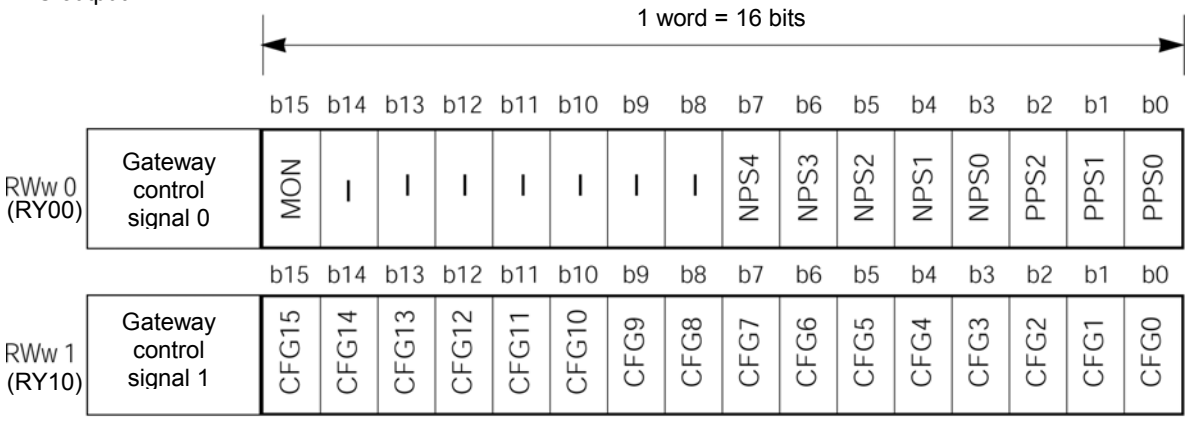
# 6. Address configuration of gateway

As described in 1.4 Features of gateway unit, actuators can be roughly operated by five modes.
Address configuration as a slave depends on each mode.

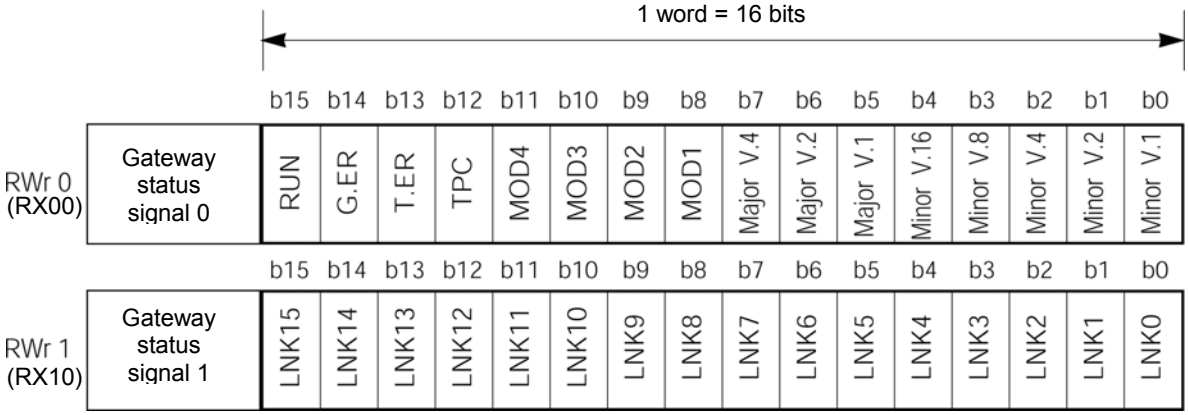
## 6.1 Gateway control signal

This is a signal to control the gateway, and consists of respective two words of word register for input and output.
It is recommended to use data of this word register on the bit register by performing transmission processing.
ON/OFF control for communication of SIO link, and monitoring of communication status of SIO link and status of gateway can be performed.

PLC output




PLC input



Details of input and output signal

| Signal type | | Bit | Signal name | Contents | |
|---|---|---|---|---|---|
| PLC output | Control signal 0 | 15 | MON | Link communication starts at ON, and stops at OFF.<br>When all of CFG15 to 0 (link connection axis selection) are OFF, do not turn ON MON signal.<br>Further, while MON signal is ON, do not turn OFF all of CFG15 to 0.<br>When all of CFG15 to 0 are OFF and MON signal is ON, the gateway unit becomes SIO link error, and the LED (T.ER) on the front of the unit is lit. | |
| | | 14 - 8 | - | This cannot be used.<br>Always turn this OFF (0). | |
| | | 7 | NPS4 | Use this in simple direct value/position No. designating mode.<br>In another mode, always turn this OFF (0).<br>Set number (0-16) of axes used in position No. designating mode by 5 bit binary. | |
| | | 6 | NPS3 | | |
| | | 5 | NPS2 | | |
| | | 4 | NPS1 | | |
| | | 3 | NPS0 | | |
| | | 2 | PPS2 | Use this in simple direct value/position No. designating mode.<br>In another mode, always turn this OFF (0).<br>Set I/O pattern (pattern 0-5) for position No. designating mode axis by 3 bit binary. | |
| | | 1 | PPS1 | | |
| | | 0 | PPS0 | | |
| | Control signal 1 | 15 | CFG15 | Link ON Axis No.15 | Set axis No. to which the link is connected.<br>Link is connected at ON (1), and is released at OFF (0).<br>Even while MON signal is ON, ON/OFF is allowed.<br><br>(Note)<br>● Do not turn ON axis No. which is not actually connected.<br>● Do not turn ON axes other than settable axis No. which is selected by the mode setting switch.<br>SIO link error occurs in each case. |
| | | 14 | CFG14 | 14 | |
| | | 13 | CFG13 | 13 | |
| | | 12 | CFG12 | 12 | |
| | | 11 | CFG11 | 11 | |
| | | 10 | CFG10 | 10 | |
| | | 9 | CFG9 | 9 | |
| | | 8 | CFG8 | 8 | |
| | | 7 | CFG7 | 7 | |
| | | 6 | CFG6 | 6 | |
| | | 5 | CFG5 | 5 | |
| | | 4 | CFG4 | 4 | |
| | | 3 | CFG3 | 3 | |
| | | 2 | CFG2 | 2 | |
| | | 1 | CFG1 | 1 | |
| | | 0 | CFG0 | 0 | |

| Signal type | | Bit | Signal name | Contents | |
|---|---|---|---|---|---|
| PLC input | Control signal 0 | 15 | RUN | Gateway unit now normally operating output | This is turned ON while gateway unit is normally operating. This is synchronized with light up of the LED (RUN) on the front of the unit. |
| | | 14 | G.ER | Gateway unit error detection output | This is turned ON when major fault stop status is detected. This is synchronized with light up of the LED (G.ER) on the front of the unit. |
| | | 13 | T.ER | SIO link communication error detection output | This is turned ON when communication error of the SIO link is detected. This is synchronized with light up of the LED (T.ER) on the front of the unit. |
| | | 12 | TPC | Port switch ON output | This outputs status of the port switch on the front of the unit. This is turned ON when the port switch is ON. |
| | | 11 | MOD4 | Mode setting switch 4 ON output | This outputs setting status of the mode setting switch. |
| | | 10 | MOD3 | Mode setting switch 3 ON output | |
| | | 9 | MOD2 | Mode setting switch 2 ON output | |
| | | 8 | MOD1 | Mode setting switch 1 ON output | |
| | | 7 | Major V.4 | Outputs Major Version No. by 3 bit binary. | This outputs version information of gateway unit. This may be checked when any fault occurs. Keep this in a status that this is read by the PLC. Example) In the case of Ver. 1.03 Major Version No.=1 (Data is 001) Minor Version No.=3 (Data is 0011) |
| | | 6 | Major V.2 | | |
| | | 5 | Major V.1 | | |
| | | 4 | Minor V.16 | Outputs Minor Version No. by 5 bit binary. | |
| | | 3 | Minor V.8 | | |
| | | 2 | Minor V.4 | | |
| | | 1 | Minor V.2 | | |
| | | 0 | Minor V.1 | | |
| | Control signal 1 | 15 | LINK15 | Link is being connected. Axis No.15 | For axis for which link connection is selected by CFG15-0, link connection becomes effective when MON signal is ON. Signal for link connection effective axis is turned ON. |
| | | 14 | LINK14 | 14 | |
| | | 13 | LINK13 | 13 | |
| | | 12 | LINK12 | 12 | |
| | | 11 | LINK11 | 11 | |
| | | 10 | LINK10 | 10 | |
| | | 9 | LINK9 | 9 | |
| | | 8 | LINK8 | 8 | |
| | | 7 | LINK7 | 7 | |
| | | 6 | LINK6 | 6 | |
| | | 5 | LINK5 | 5 | |
| | | 4 | LINK4 | 4 | |
| | | 3 | LINK3 | 3 | |
| | | 2 | LINK2 | 2 | |
| | | 1 | LINK1 | 1 | |
| | | 0 | LINK0 | 0 | |

## 6.2 Position data limit designation mode

This is an operation mode in which function of the controller is limited only to positioning, and allows for control of a maximum 14 axes.
Position data for positioning is directly written in the data register of the PLC, and operation is performed.
Communication for setting of speed, acceleration and deceleration cannot be performed.
Speed, acceleration and deceleration are set to parameter No.8 “Speed initial value” and No.9 “Acceleration and deceleration initial value” for each axis.
Setting of position table for each axis is unnecessary.

Primary functions controllable in this mode are as shown in the following table.

| Primary functions | ○: Direct control<br>△: Indirect control<br>×: Ineffective | Remarks |
|---|---|---|
| Home return operation | ○ | |
| Positioning operation | ○ | |
| Speed, acceleration and deceleration setting | △ | This is set to a parameter.<br>Therefore, this is fixed during operation. |
| Pitch (incremental) feed | △ | Pitch feed data cannot be directly processed.<br>Give command by adding or subtracting data of same moving amount to/from the present position by host PLC. |
| Push operation | × | |
| Speed change during movement | × | |
| Operation in different acceleration and deceleration | × | |
| Pause | ○ | |
| Zone signal output | △ | Monitor the present position data by the PLC. (*) |
| PIO pattern selection | × | |

* There is no strobe signal in the present position data. Therefore, when checking the present position by the PLC during movement, provide a range to check that there is data of 2 scans or more in the range.

## (1) Address configuration

In this mode, gateway control signal/status signal consists of two words respectively for input and output word register (RWr, RWw), and control signal/status signal for each axis consists of one byte respectively for input and output bit register (RX, RY) and one word for input and output word register (RWr, RWw).
Numeric values in parentheses represent axis Nos.

PLC output⇒Gateway unit⇒Each axis input　　Each axis output⇒Gateway unit⇒PLC input

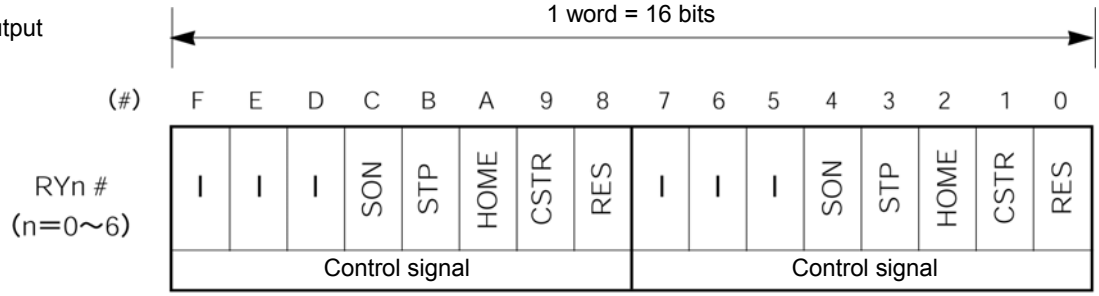
| Output register | bF Higher byte b8 | b7 Lower byte b0 | Input register | bF Higher byte b8 | b7 Lower byte b0 |
|---|---|---|---|---|---|
| RY 0F – 00 | Control signal (1) | Control signal (0) | RX 0F – 00 | Status signal (1) | Status signal (0) |
| RY 1F – 10 | Control signal (3) | Control signal (2) | RX 1F – 10 | Status signal (3) | Status signal (2) |
| RY 2F – 20 | Control signal (5) | Control signal (4) | RX 2F – 20 | Status signal (5) | Status signal (4) |
| RY 3F – 30 | Control signal (7) | Control signal (6) | RX 3F – 30 | Status signal (7) | Status signal (6) |
| RY 4F – 40 | Control signal (9) | Control signal (8) | RX 4F – 40 | Status signal (9) | Status signal (8) |
| RY 5F – 50 | Control signal (11) | Control signal (10) | RX 5F – 50 | Status signal (11) | Status signal (10) |
| RY 6F – 60 | Control signal (13) | Control signal (12) | RX 6F – 60 | Status signal (13) | Status signal (12) |
| RY 7F – 70 | Prohibited from use because this is in CC-Link system region | | RX 7F – 70 | Prohibited from use because this is in CC-Link system region | |

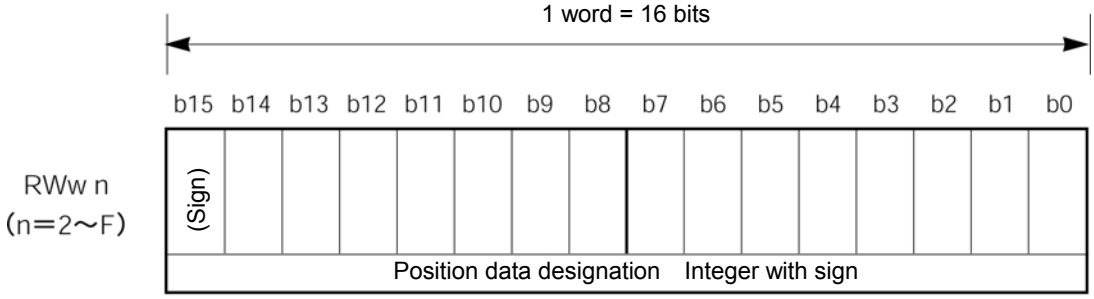
| Output (writing) Register=Word register | | Input (writing) Register=Word register | |
|---|---|---|---|
| RWw 0 | Gateway control signal 0 | RWr 0 | Gateway status signal 0 |
| RWw 1 | Gateway control signal 1 | RWr 1 | Gateway status signal 1 |
| RWw 2 | Position data designation (0) | RWr 2 | Present position data (0) |
| RWw 3 | Position data designation (1) | RWr 3 | Present position data (1) |
| RWw 4 | Position data designation (2) | RWr 4 | Present position data (2) |
| RWw 5 | Position data designation (3) | RWr 5 | Present position data (3) |
| RWw 6 | Position data designation (4) | RWr 6 | Present position data (4) |
| RWw 7 | Position data designation (5) | RWr 7 | Present position data (5) |
| RWw 8 | Position data designation (6) | RWr 8 | Present position data (6) |
| RWw 9 | Position data designation (7) | RWr 9 | Present position data (7) |
| RWw A | Position data designation (8) | RWr A | Present position data (8) |
| RWw B | Position data designation (9) | RWr B | Present position data (9) |
| RWw C | Position data designation (10) | RWr C | Present position data (10) |
| RWw D | Position data designation (11) | RWr D | Present position data (11) |
| RWw E | Position data designation (12) | RWr E | Present position data (12) |
| RWw F | Position data designation (13) | RWr F | Present position data (13) |

## (2) Assignment for each axis

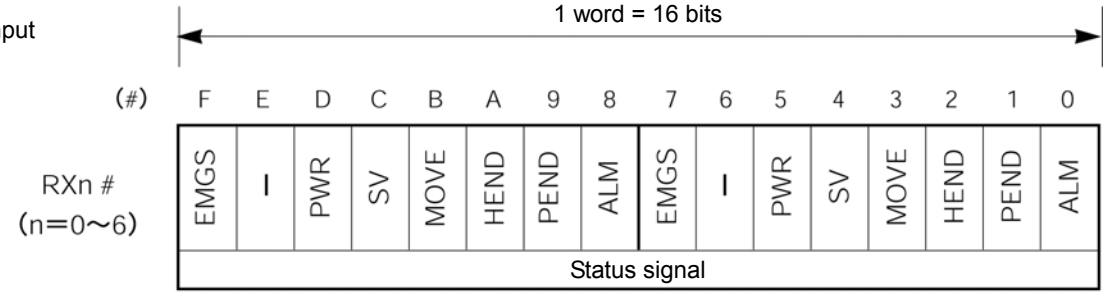
Input and output signal for each signal consists of one byte respectively for input and output bit register (RX, RY) and one word for input and output word register (RWr, RWw).
Control signal and status signal are ON/OFF signals in bit units.
Position data designation and present position data are integers with a sign of one word (16 bits), and the PLC can handle numeric values of –32,768 to +32,767 (unit=1/100mm), however, set the position data in a range (0 to effective stroke length) of soft stroke for its actuator.

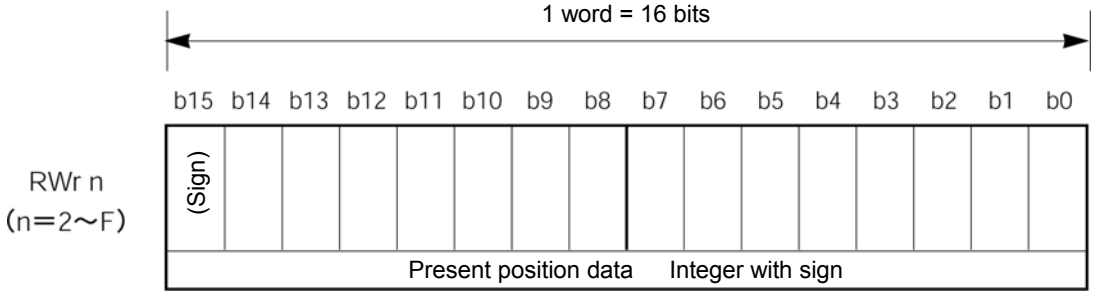
PLC output




PLC input



Details of input and output signal

| Signal type | | Bit | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC output | Control signal | F/7 | - | Cannot be used. | - |
| | | E/6 | - | Cannot be used. | - |
| | | D/5 | - | Cannot be used. | - |
| | | C/4 | SON | Servo on command | |
| | | B/3 | STP | Pause command | |
| | | A/2 | HOME | Home return command | |
| | | 9/1 | CSTR | Start command | |
| | | 8/0 | RES | Reset command | |
| | Position data designation | 16 bit data | - | 16 bit integer with sign (unit: 0.01mm)<br>Set position data in hexadecimal number.<br>Example) The signal becomes $09EC_H$ (decimal 2540) in the case of +25.4.<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes "1." | |
| PLC input | Status signal | F/7 | EMGS | On emergency stop | |
| | | E/6 | - | Cannot be used. | - |
| | | D/5 | PWR | Controller preparation completion | |
| | | C/4 | SV | Operation preparation completion (Servo on status) | |
| | | B/3 | MOVE | On moving | |
| | | A/2 | HEND | Home return completion | |
| | | 9/1 | PEND | Positioning completion | |
| | | 8/0 | ALM | Alarm occurring | |
| | Present position data | 16 bit data | - | 16 bit integer with sign (unit: 0.01mm)<br>Present position data is outputted in hexadecimal number.<br>Example) $09EC_H$ (decimal 2540) is outputted in the case of +25.4.<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes "1." | |

## 6.3 Position No. designation mode

This is an operation mode to operate by designating position No. of the position table, and allows for control of a maximum 14 axes.
It is necessary to set the position table for each axis by personal computer supporting software or teaching box. Operation is performed by writing the position No. into the data register of the PLC.
Positions which can be designated are 64 points of No.0 to No.63, however, number of points depends on setting mode for each axis.

Primary functions controllable in this mode are as shown in the following table.

| Primary functions | ○: Direct control<br>△: Indirect control<br>×: Ineffective | Remarks |
|---|---|---|
| Home return operation | ○ | |
| Positioning operation | △ | This operation is performed by designating No. of position table. |
| Speed, acceleration and deceleration setting | △ | This is set to position table |
| Pitch (incremental) feed | △ | This is set to position table |
| Push operation | △ | This is set to position table |
| Speed change during movement | △ | This is performed by combining two or more position Nos. (Refer to the Operation Manual for the main body.) |
| Operation in different acceleration and deceleration | △ | This is set to position table |
| Pause | ○ | |
| Zone signal output | ○ | |
| PIO pattern selection | × | |

## (1) Address configuration

In this mode, the input and output signal for gateway control signals consist of two words respectively, and control signals for each axis consist of one byte respectively for input and output bit register and one byte respectively in input and output word register.
Numeric values in the parentheses represent axis Nos.

PLC output⇒Gateway unit⇒Each axis input　　Each axis output⇒Gateway unit⇒PLC input

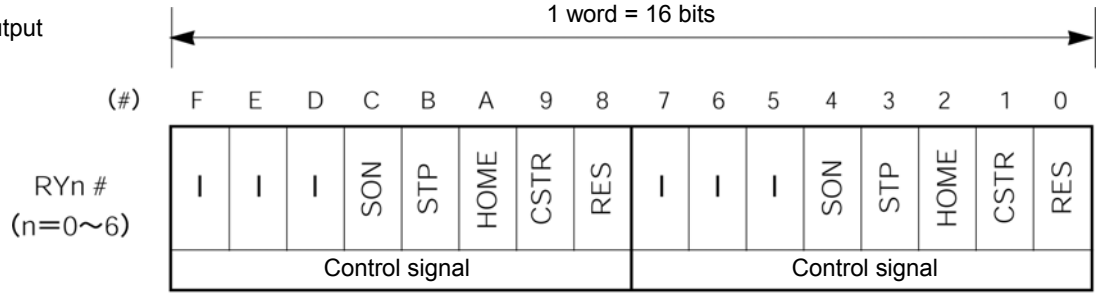
| Output register | bF Higher byte b8 | b7 Lower byte b0 | Input register | bF Higher byte b8 | b7 Lower byte b0 |
|---|---|---|---|---|---|
| RY 0F – 00 | Control signal (1) | Control signal (0) | RX 0F – 00 | Status signal (1) | Status signal (0) |
| RY 1F – 10 | Control signal (3) | Control signal (2) | RX 1F – 10 | Status signal (3) | Status signal (2) |
| RY 2F – 20 | Control signal (5) | Control signal (4) | RX 2F – 20 | Status signal (5) | Status signal (4) |
| RY 3F – 30 | Control signal (7) | Control signal (6) | RX 3F – 30 | Status signal (7) | Status signal (6) |
| RY 4F – 40 | Control signal (9) | Control signal (8) | RX 4F – 40 | Status signal (9) | Status signal (8) |
| RY 5F – 50 | Control signal (11) | Control signal (10) | RX 5F – 50 | Status signal (11) | Status signal (10) |
| RY 6F – 60 | Control signal (13) | Control signal (12) | RX 6F – 60 | Status signal (13) | Status signal (12) |
| RY 7F – 70 | Prohibited to use because this is in CC-Link system region | | RX 7F – 70 | Prohibited to use because this is in CC-Link system region | |

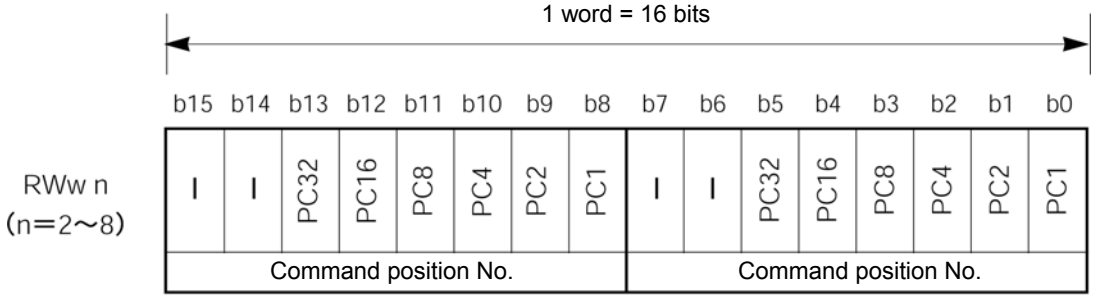
| Output (writing) Register=Word register | | | Input (writing) Register=Word register | | |
|---|---|---|---|---|---|
| RWw 0 | Gateway control signal 0 | | RWr 0 | Gateway status signal 0 | |
| RWw 1 | Gateway control signal 1 | | RWr 1 | Gateway status signal 1 | |
| RWw 2 | Command position No. (1) | Command position No. (0) | RWr 2 | Completion No. + zone signal (1) | Completion No. + zone signal (0) |
| RWw 3 | Command position No. (3) | Command position No. (2) | RWr 3 | Completion No. + zone signal (3) | Completion No. + zone signal (2) |
| RWw 4 | Command position No. (5) | Command position No. (4) | RWr 4 | Completion No. + zone signal (5) | Completion No. + zone signal (4) |
| RWw 5 | Command position No. (7) | Command position No. (6) | RWr 5 | Completion No. + zone signal (7) | Completion No. + zone signal (6) |
| RWw 6 | Command position No. (9) | Command position No. (8) | RWr 6 | Completion No. + zone signal (9) | Completion No. + zone signal (8) |
| RWw 7 | Command position No. (11) | Command position No. (10) | RWr 7 | Completion No. + zone signal (11) | Completion No. + zone signal (10) |
| RWw 8 | Command position No. (13) | Command position No. (12) | RWr 8 | Completion No. + zone signal (13) | Completion No. + zone signal (12) |
| RWw 9 | Cannot be used | | RWr 9 | Cannot be used | |
| RWw A | | | RWr A | | |
| RWw B | | | RWr B | | |
| RWw C | | | RWr C | | |
| RWw D | | | RWr D | | |
| RWw E | | | RWr E | | |
| RWw F | | | RWr F | | |

## (2) Assignment for each axis

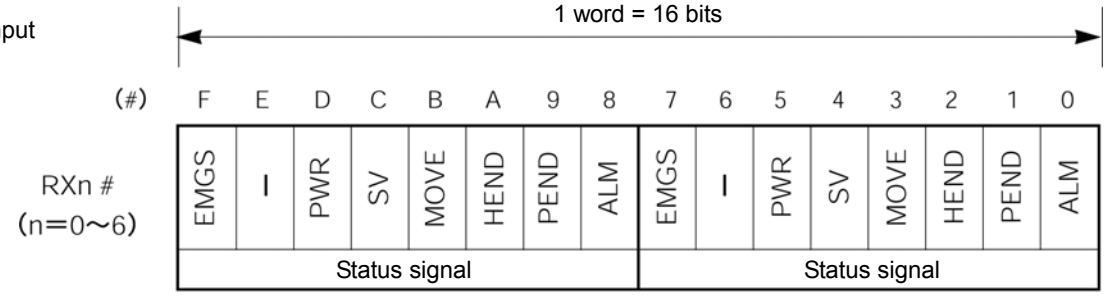
Input and output signal for each axis consists of one byte respectively for input and output bit register and one byte respectively for input and output word register.
Control signal and status signal are ON/OFF signals in bit units.
Command position No. and completed position No. are handled in binary data of one byte (8 bits). Set the command position No. in a range of position number set by the controller for each axis.

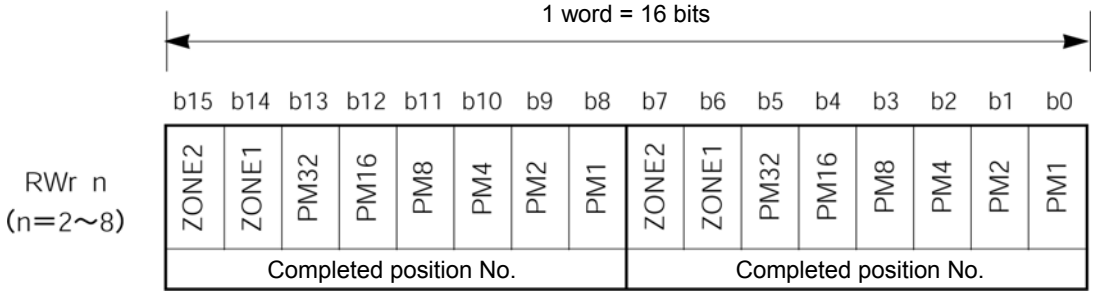
PLC output




PLC input



Details of input and output signal

| Signal type | | Application | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC output | Position data designation | F/7 | - | Cannot be used. | - |
| | | E/6 | - | Cannot be used. | - |
| | | D/5 | - | Cannot be used. | - |
| | | C/4 | SON | Servo on command | |
| | | B/3 | STP | Pause command | |
| | | A/2 | HOME | Home return command | |
| | | 9/1 | CSTR | Start command | |
| | | 8/0 | RES | Reset command | |
| | Position data designation | 16 bit data | - | Set command position No. in hexadecimal number.<br>Example)<br>Perform setting for two axes on higher byte and lower byte. When the higher byte axis is position No. 15 and lower byte axis is position No.33, the setting is Hex0F21. | |
| PLC input | Status signal | F/7 | EMGS | On emergency stop | |
| | | E/6 | - | Cannot be used. | - |
| | | D/5 | PWR | Controller preparation completion | |
| | | C/4 | SV | Operation preparation completion (Servo on status) | |
| | | B/3 | MOVE | On moving | |
| | | A/2 | HEND | Home return completion | |
| | | 9/1 | PEND | Positioning completion | |
| | | 8/0 | ALM | Alarm occurring | |
| | Zone signal output 2 | b15/b17 | ZONE2 | Outputs completed position No. and status of zone signal in hexadecimal number. Read the completed position No. in binary value of 6 bits.<br>And, alarm content is outputted to the completed position No. while an alarm occurring (ALM signal is ON).<br>(For alarm content to be outputted, refer to the “List of alarm content” in the next table.) | |
| | Zone signal output 1 | b14/b6 | ZONE1 | | |
| | Completed position No. (Alarm output) | 6 bit data (b13-8/b5-0) | PM32 – PM1 | | |

[List of alarm content]

This list shows alarm content to be outputted (binary code) in PM8 to PM1 while an alarm occurring. For details of alarm content, refer to the Operation Manual for the controller.

○: ON ×: OFF

| ALM | PM8 | PM4 | PM2 | PM1 | Output code | Contents | Remarks |
|---|---|---|---|---|---|---|---|
| × | - | - | - | - | - | Normal | |
| ○ | × | × | × | ○ | 1 | For manufacturer | * |
| ○ | × | × | ○ | × | 2 | For manufacturer | * |
| ○ | × | × | ○ | ○ | 3 | Moving command in servo off status (80)<br>Position command in home return non-completion status (82)<br>Absolute position moving command in home return non-completion status (83)<br>Moving command in home return executing (84) | |
| ○ | × | ○ | × | × | 4 | PCB inconsistency error (F4) | |
| ○ | × | ○ | × | ○ | 5 | Non-volatile memory writing abnormality (F7) | * |
| ○ | × | ○ | ○ | × | 6 | Parameter data abnormality (A1)<br>Position data abnormality (A2)<br>Position command information data abnormality (A3) | |
| ○ | × | ○ | ○ | ○ | 7 | Excitation detection error (B8)<br>Operation time time-out in home return operation (BE) | |
| ○ | ○ | × | × | × | 8 | Actual speed excessively large (C0) | |
| ○ | ○ | × | × | ○ | 9 | Overvoltage (C9)<br>Overheat (CA)<br>Control power voltage abnormality (CC)<br>Control power voltage drop (CE) | |
| ○ | ○ | × | ○ | × | A | For manufacturer | * |
| ○ | ○ | × | ○ | ○ | B | Position deviation counter overflow (D8) | |
| ○ | ○ | ○ | × | × | C | Servo abnormality (C1) | |
| ○ | ○ | ○ | × | ○ | D | A, B phase breakage (E8)<br>A phase breakage (E9)<br>B phase breakage (E9)<br>RCP2 absolute encoder abnormality detection 1 (ED)<br>RCP2 absolute encoder abnormality detection 2 (EE)<br>RCP2 absolute encoder abnormality detection 3 (EF) | |
| ○ | ○ | ○ | ○ | × | E | CPU abnormality (FA)<br>FPGA abnormality (FB) | |
| ○ | ○ | ○ | ○ | ○ | F | Non-volatile memory writing times over (F5)<br>Non-volatile memory writing time-out (F6)<br>Non-volatile memory data destruction (F8) | |

Insides of parentheses represent alarm codes indicated by personal computer supporting software or teaching box.

* Error which never occurs when gateway is used

## 6.4 Position/speed/acceleration and deceleration designation

This is an operation mode to perform operation by directly writing position data, acceleration and deceleration and speed in the register of the PLC, and allows for control of a maximum seven axes.
Further, it is always possible to read present position data.
Setting of position table for each axis is unnecessary.

Primary functions controllable in this mode are as shown in the following table.

| Primary functions | ○: Direct control<br>△: Indirect control<br>×: Ineffective | Remarks |
|---|---|---|
| Home return operation | ○ | |
| Positioning operation | ○ | |
| Speed, acceleration and deceleration setting | ○ | |
| Pitch (incremental) feed | △ | Pitch feed data cannot be directly processed. Give command by adding or subtracting data of same moving amount to/from the present position by host PLC. |
| Push operation | × | |
| Speed change during movement | ○ | Speed data is accepted at start of positioning. Therefore, if you attempt to change the speed in process of movement, change the speed data and restart during moving. |
| Operation in different acceleration and deceleration | ○ | Acceleration and deceleration data is accepted at start of positioning. Therefore, if you attempt to designate deceleration different from acceleration, change the acceleration and deceleration data during movement and restart. |
| Pause | ○ | |
| Zone signal output | △ | Monitor the present position data by the PLC. (*) |
| PIO pattern selection | × | |

* There is no strobe signal in the present position data. Therefore, when checking the present position by the PLC during movement, provide a range to check that there is data of 2 scans or more in the range.

## (1) Address configuration

In this mode, input and output for gateway control signal consist of two words respectively, and control signal for each signal consists of one word respectively for input and output bit register and two words respectively for input and output word register.
Numeric values in the parentheses represent axis Nos.

PLC output⇒Gateway unit⇒Each axis input　　Each axis output⇒Gateway unit⇒PLC input

| Output register | bF Higher byte b8 | b7 Lower byte b0 | Input register | bF Higher byte b8 | b7 Lower byte b0 |
|---|---|---|---|---|---|
| RY 0F – 00 | Acceleration and deceleration designation (1) | Control signal (0) | RX 0F – 00 | Cannot be used | Status signal (0) |
| RY 1F – 10 | Acceleration and deceleration designation (3) | Control signal (2) | RX 1F – 10 | Cannot be used | Status signal (1) |
| RY 2F – 20 | Acceleration and deceleration designation (5) | Control signal (4) | RX 2F – 20 | Cannot be used | Status signal (2) |
| RY 3F – 30 | Acceleration and deceleration designation (7) | Control signal (6) | RX 3F – 30 | Cannot be used | Status signal (3) |
| RY 4F – 40 | Acceleration and deceleration designation (9) | Control signal (8) | RX 4F – 40 | Cannot be used | Status signal (4) |
| RY 5F – 50 | Acceleration and deceleration designation (11) | Control signal (10) | RX 5F – 50 | Cannot be used | Status signal (5) |
| RY 6F – 60 | Acceleration and deceleration designation (13) | Control signal (12) | RX 6F – 60 | Cannot be used | Status signal (6) |
| RY 7F – 70 | Prohibited from use because this is in CC-Link system region | | RX 7F – 70 | Prohibited from use because this is in CC-Link system region | |

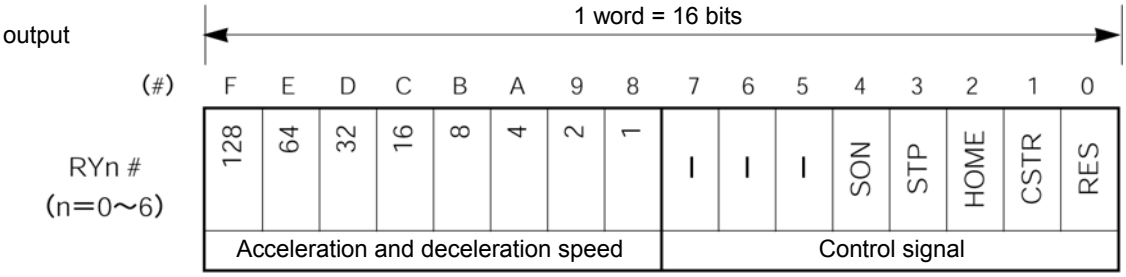
| Output (writing) Register=Word register | | Input (writing) Register=Word register | |
|---|---|---|---|
| RWw 0 | Gateway control signal 0 | RWr 0 | Gateway status signal 0 |
| RWw 1 | Gateway control signal 1 | RWr 1 | Gateway status signal 1 |
| RWw 2 | Speed designation (0) | RWr 2 | Cannot be used |
| RWw 3 | Position data designation (0) | RWr 3 | Present position data (0) |
| RWw 4 | Speed designation (1) | RWr 4 | Cannot be used |
| RWw 5 | Position data designation (1) | RWr 5 | Present position data (1) |
| RWw 6 | Speed designation (2) | RWr 6 | Cannot be used |
| RWw 7 | Position data designation (2) | RWr 7 | Present position data (2) |
| RWw 8 | Speed designation (3) | RWr 8 | Cannot be used |
| RWw 9 | Position data designation (3) | RWr 9 | Present position data (3) |
| RWw A | Speed designation (4) | RWr A | Cannot be used |
| RWw B | Position data designation (4) | RWr B | Present position data (4) |
| RWw C | Speed designation (5) | RWr C | Cannot be used |
| RWw D | Position data designation (5) | RWr D | Present position data (5) |
| RWw E | Speed designation (6) | RWr E | Cannot be used |
| RWw F | Position data designation (6) | RWr F | Present position data (6) |

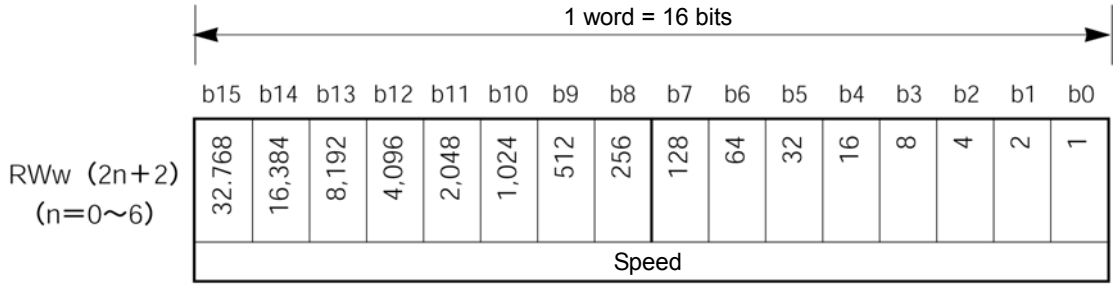
## (2) Assignment for every axis

Control signal and status signal are set by ON/OFF signal in bit units, and acceleration and deceleration are set by binary data of one byte (8 bits). Further, speed, position data designation and present position data can be handled in binary data of one word (16 bits), and the PLC can handle numeric values of –32,768 to +32,767.
Set the acceleration and deceleration and speed in a range of specification of the actuator, and set position data in a range of soft stroke.

Unit: Acceleration and deceleration = 0.01G Speed = 1/100mm/sec Position data = 1/100mm

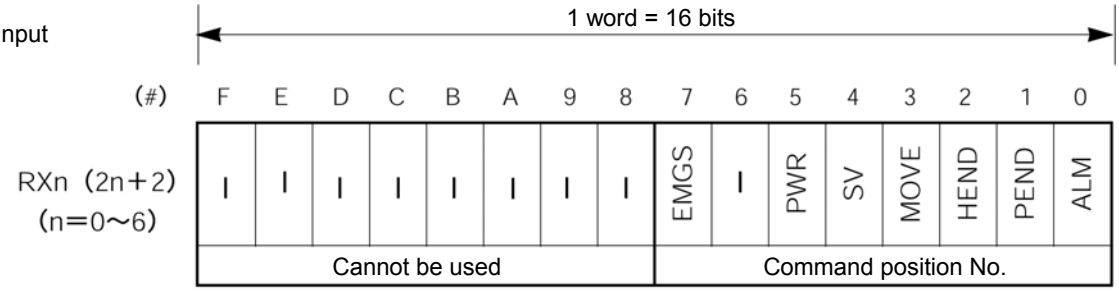
PLC output

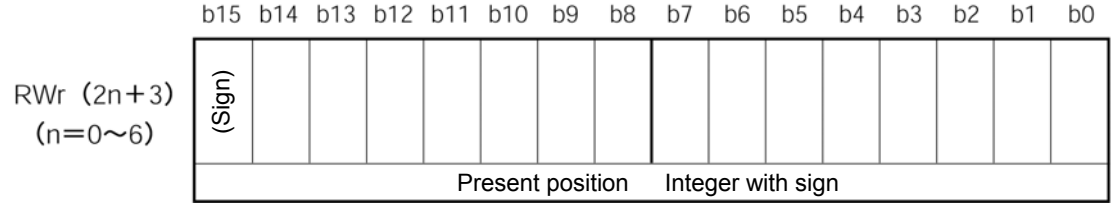




PLC input



Details of input and output signal

| Signal type | | Bit | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC output | Acceleration and deceleration designation | 8 bit data | | Set acceleration and deceleration in hexadecimal number.<br>(Unit: 0.01G)<br>Example) When setting to 0.2G, designate 14H (RynC and RynA are ON).<br>$C8_H$ (decimal 200) at maximum 2G.<br>● When acceleration and deceleration are not set, note that setting of parameter No.9 "Acceleration and deceleration initial value" is not applied. | |
| | Control signal | 7 | - | Cannot be used. | - |
| | | 6 | - | Cannot be used. | - |
| | | 5 | - | Cannot be used. | - |
| | | 4 | SON | Servo on command | |
| | | 3 | STP | Pause command | |
| | | 2 | HOME | Home return command | |
| | | 1 | CSTR | Start command | |
| | | 0 | RES | Reset command | |
| | Speed designation | 16 bit data | - | 16 bit integer (Unit 0.01mm/sec)<br>Set command speed in hexadecimal number.<br>Example) In the case of 200mm/sec., it is set $E20_H$ (decimal 2000)<br>(Note)<br>● When speed is not set, or the setting is "0," stop is kept. Alarm does not occur.<br>When changing the speed by changing the setting to "0" during movement, it decelerates and stops. | |
| | Position data designation | 16 bit data | | 16 bit integer with sign (Unit: 0.01mm)<br>Set position data in hexadecimal number.<br>Example) In the case of +25.4mm, it is set to $09EC_H$ (decimal 2540).<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes "1." | |

| Signal type | | Bit | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC input | Status signal | 7 | EMGS | On emergency stop | |
| | | 6 | - | Cannot be used. | - |
| | | 5 | PWR | Controller preparation completion | |
| | | 4 | SV | Operation preparation completion (Servo on status) | |
| | | 3 | MOVE | On moving | |
| | | 2 | HEND | Home return completion | |
| | | 1 | PEND | Positioning completion | |
| | | 0 | ALM | Alarm occurring | |
| | Present position data | 16 bit data | - | 16 bit integer with sign (Unit: 0.01mm)<br>Set position data in hexadecimal number.<br>Example) In the case of +25.4mm, it is set to $09EC_H$ (decimal 2540).<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes “1.” | |

## 6.5 Push operation enable mode

This is an operation mode to perform operation by directly writing current limit value (%) and positioning width for push in addition to direct designation of position data, acceleration and deceleration and speed into the register of the PLC, and allows for control of a maximum 3 axes.
Further, it is always possible to read present position data.
Setting of position table for each axis is unnecessary.

Primary functions controllable in this mode are as shown in the following table.

| Primary functions | ○: Direct control<br>△: Indirect control<br>×: Ineffective | Remarks |
|---|---|---|
| Home return operation | ○ | |
| Positioning operation | ○ | |
| Speed, acceleration and deceleration setting | ○ | |
| Pitch (incremental) feed | △ | Pitch feed data cannot be directly processed. Give command by adding or subtracting data of same moving amount to/from the present position by host PLC. |
| Push operation | ○ | |
| Speed change during movement | ○ | Speed data is accepted at start of positioning. Therefore, if you attempt to change the speed in process of movement, change the speed data and restart during moving. |
| Operation in different acceleration and deceleration | ○ | Acceleration and deceleration data is accepted at start of positioning. Therefore, if you attempt to designate deceleration different from acceleration, change the acceleration and deceleration data during movement and restart. |
| Pause | ○ | |
| Zone signal output | △ | Monitor the present position data by the PLC. (*) |
| PIO pattern selection | × | |

* There is no strobe signal in the present position data. Therefore, when checking the present position by the PLC during movement, provide a range to check that there is data of 2 scans or more in the range.

## (1) Address configuration

In this mode, input and output for gateway control signal consist of two words respectively, and control signal for each axis consists of six words respectively for input register and three words respectively for output register.
Further, axis No.0 uses bit register, and axis No.1 and 2 use word register.
Numeric values in the parentheses represent axis Nos.

PLC output⇒Gateway unit⇒Each axis input　　Each axis output⇒Gateway unit⇒PLC input

| Output register | bF Higher byte b8 | b7 Lower byte b0 | Input register | bF Higher byte b8 | b7 Lower byte b0 |
|---|---|---|---|---|---|
| RY 0F – 00 | Position data designation (0) | | RX 0F – 00 | Status signal (0) | |
| RY 1F – 10 | Current limit value (0) | Position data designation (0) | RX 1F – 10 | Present position data (0) | |
| RY 2F – 20 | Speed designation (0) | | RX 2F – 20 | Cannot be used | Present position data (0) |
| RY 3F – 30 | Acceleration and deceleration designation (0) | Speed designation (0) | RX 3F – 30 | Cannot be used | |
| RY 4F – 40 | Positioning width designation (0) | | RX 4F – 40 | | |
| RY 5F – 50 | Control signal (0) | Positioning width designation (0) | RX 5F – 50 | | |
| RY 6F – 60 | Cannot be used | | RX 6F – 60 | | |
| RY 7F – 70 | Prohibited from use because this is in CC-Link system region | | RX 7F – 70 | Prohibited from use because this is in CC-Link system region | |

| Output (writing) Register=Word register | | | Input (writing) Register=Word register | | |
|---|---|---|---|---|---|
| RWw 0 | Gateway control signal 0 | | RWr 0 | Gateway status signal 0 | |
| RWw 1 | Gateway control signal 1 | | RWr 1 | Gateway status signal 1 | |
| RWw 2 | Position data designation (1) | | RWr 2 | Status signal (1) | |
| RWw 3 | Current limit value (1) | Position data designation (1) | RWr 3 | Present position data (1) | |
| RWw 4 | Speed designation (1) | | RWr 4 | Cannot be used | Present position data (1) |
| RWw 5 | Position data designation (1) | Speed designation (1) | RWr 5 | Status signal (2) | |
| RWw 6 | Positioning width designation (1) | | RWr 6 | Present position data (2) | |
| RWw 7 | Control signal (1) | Positioning width designation (1) | RWr 7 | Cannot be used | Present position data (2) |
| RWw 8 | Position data designation (2) | | RWr 8 | Cannot be used | |
| RWw 9 | Current limit value (2) | Position data designation (2) | RWr 9 | | |
| RWw A | Speed designation (2) | | RWr A | | |
| RWw B | Position data designation (2) | Speed designation (2) | RWr B | | |
| RWw C | Positioning width designation (2) | | RWr C | | |
| RWw D | Control signal (2) | Positioning width designation (2) | RWr D | | |
| RWw E | Cannot be used | | RWr E | | |
| RWw F | | | RWr F | | |

## (2) Assignment for each axis

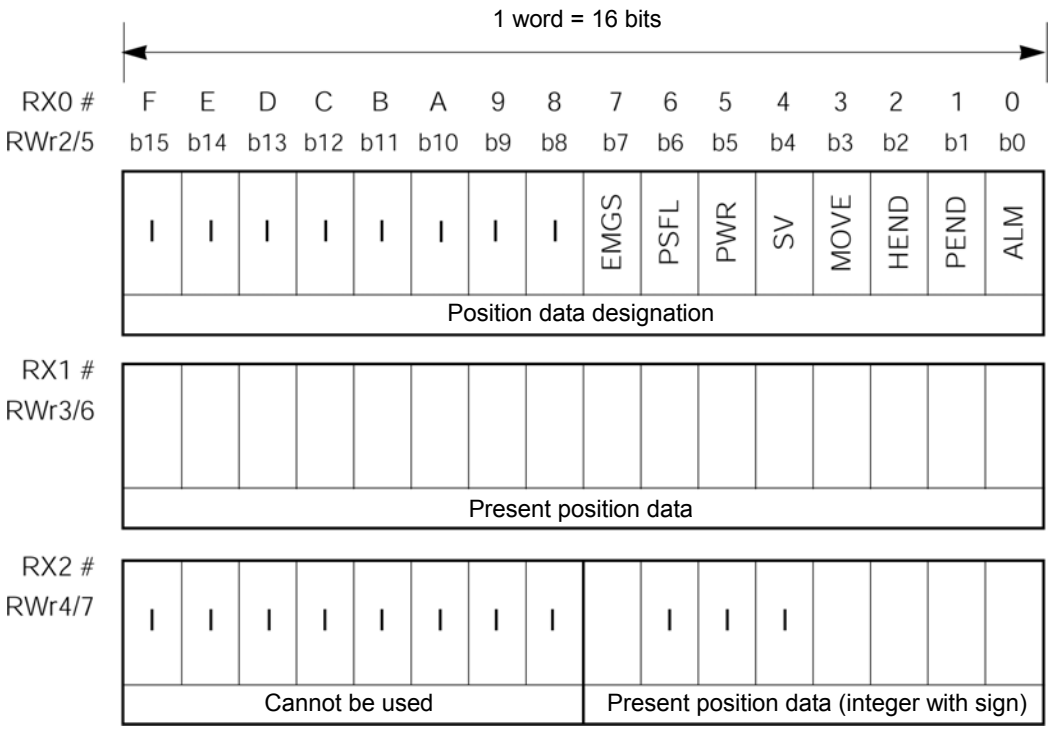
Control signal and status signal are set by ON/OFF signal in bit units, and acceleration and deceleration are set by binary data of one byte (8 bits). Designations of speed, position and positioning width and present position data handle numeric values in binary data of 1.5 words (24 bits).
It is recommended to use control signal and status signal on bit register by performing transmission processing.
Set current limit value, acceleration and deceleration and speed in a range of the specification of the actuator, and set position data in a range of the soft stroke.

| Unit: | Current limit value=1% Acceleration and deceleration=0.01G Speed=1/100mm/sec<br>Position, positioning width=1/100mm |
|---|---|

PLC output — 1 word = 16 bits

| | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RY0 # / RWw2/8 | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
| | Position data designation | | | | | | | | | | | | | | | |
| RY1 # / RWw3/9 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | (Sign) | — | — | — | | | | |
| | Current limit value | | | | | | | | Position data designation (integer with sign) | | | | | | | |
| RY2 # / RWw4/A | 32,768 | 16,384 | 8,192 | 4,096 | 2,048 | 1,024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| | Speed designation | | | | | | | | | | | | | | | |
| RY3 # / RWw5/B | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | — | — | — | — | 524,288 | 262,144 | 131,072 | 65,536 |
| | Acceleration and deceleration designation | | | | | | | | Speed designation | | | | | | | |
| RY4 # / RWw6/C | 32,768 | 16,384 | 8,192 | 4,096 | 2,048 | 1,024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| | Positioning width designation | | | | | | | | | | | | | | | |
| RY5 # / RWw7/D | — | DIR | PUSH | SON | STP | HOME | CSTR | RES | — | — | — | — | 524,288 | 262,144 | 131,072 | 65,536 |
| | Control signal | | | | | | | | Positioning width designation | | | | | | | |

PLC input




**⚠ CAUTION**

1. 24 bit binary data with a sign of PLC output and input is handled as a negative number when the uppermost bit is “1.” However, note that the data is handled as normal numeric data on the PLC.

Details of input and output signal

| Signal type | | Application | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC input | Position data designation | 24bit data | - | 24 bit integer with sign (unit: 0.01mm)<br>Set position data in hexadecimal number of 24 bits.<br>Example) In the case of +25.4mm, designate $0009EC_H$ (decimal 2540).<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes “1.” | |
| | Current limit value | 8bit data | - | Set current limit value when push to set push force in hexadecimal number. (unit%)<br>Setting range is from $00_H$ to $FF_H$, and $FF_H$ =100%.<br>Example) When setting to 50%, set it as $FF_H50\%=255\times50\%=127(decimal)=7F_H$. | |
| | Speed designation | 24bit data | - | 24 bit integer (unit 0.01mm/sec)<br>Set command speed in hexadecimal number.<br>Example) In the case of 200mm/sec, the data is $0004E20_H$ (decimal 20000).<br>(Note)<br>● <u>When speed is not set, or setting is “0,” or the setting is “0,” stop is kept. Alarm does not occur.</u> When changing the speed by changing the setting to “0” during movement, it decelerates and stops. | |
| | Acceleration and deceleration | 8bit data | - | Set acceleration and deceleration in hexadecimal number.<br>(Unit: 0.01G)<br>Example) When setting to 0.2G, it is $14_H$. It is $C8_H$ (decimal 200) at maximum 2G.<br>(Note)<br>● When acceleration and deceleration are not set, note that setting of parameter No.9 “Acceleration and deceleration initial value” is not applied. | |

| Signal type | | Application | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC output | Positioning width designation | 24 bit data | - | 24 bit integer (Unit: 0.01mm)<br>Set it in hexadecimal number.<br>Example) In the case of +25.4mm, designate it as 0009EC$_H$ (decimal 2540).<br>● Set position data in a range of soft stroke.<br>● Designate push operation direction in DIR.<br>● When positioning width designating data is not set, note that setting of parameter No.10 "Positioning width initial value" is not set. | |
| | Control signal | F/b 15 | - | Cannot be used | |
| | | E/b 14 | DIR | Designation of push direction<br>(0－Home return direction, 1－Home return reverse direction) | |
| | | D/b 13 | PUSH | Push operation mode designation | |
| | | C/b 12 | SON | Servo on command | |
| | | B/b 11 | STP | Pause command | |
| | | A/b 10 | HOME | Home return command | |
| | | 9/b9 | CSTR | Start command | |
| | | 8/b8 | RES | Reset command | |
| PLC input | Status signal | F-8/b15-8 | - | Cannot be used | |
| | | 7/b7 | EMGS | On emergency stop | |
| | | 6/b6 | PSFL | Push outside | |
| | | 5/b5 | PWR | Controller preparation completion | |
| | | 4/b4 | SV | Operation preparation completion (Servo on status) | |
| | | 3/b3 | MOVE | On moving | |
| | | 2/b2 | HEND | Home return completion | |
| | | 1/b1 | PEND | Positioning completion | |
| | | 0/b0 | ALM | Alarm occurring | |
| | Present position data | 24 bit data | - | 24 bit integer with sign (Unit: 0.01mm)<br>Data of present position is outputted in hexadecimal number.<br>Example) In the case of +25.4mm, the data is 0009EC$_H$ (decimal 2540).<br>(Note)<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes "1." | |
| | - | - | b15-8 | Cannot be used | |

## 6.6 Simple direct value/Position No. designation mode

This is an operation mode for operation by mixing a mode to operate by designating position No. and a simple direct value mode in which target position data is designated by numeric value and the other movement parameters are designated by position No.
However, this mode is allowed only for CC-Link Ver. 2, and not used for Ver. 100 and Ver. 1.10.
Primary controllable functions are as shown in the following table.

| Primary functions | | | Remarks |
|---|---|---|---|
| | Position No. designated axis | Simple direct value axis | |
| Home return operation | ○ | ○ | |
| Positioning operation | △ | ○ | Position table/Position direct command |
| Speed, acceleration and deceleration setting | △ | ○ | Position table |
| Pitch (incremental) feed | △ | × | Position table |
| Push operation | △ | △ | Position table |
| Speed change during movement | △ | △ | |
| Operation in different acceleration and deceleration | △ | △ | Position table |
| Pause | ○ | △ | |
| Zone signal output | ○ | × | Zone is set by parameter |
| PIO pattern selection | △ | × | |

### 6.6.1 Overall address configuration

Input and output for gateway control signal are two words respectively, and only in this mode, patterns of position No. designated axes and number of axes are set by PPS0 to PPS2 and NPS0 to NPS4 of control word 0. Subsequently, command input and output regions are exclusive, and gateway control signal and input and output are in a fixed region together with command region.
Control region for each axis is assigned after fixed region, however, position No. designated axis is assigned at first, then simple direct value mode axis is assigned. They cannot be alternately assigned.
Size of input and output region of overall gateway is determined by the mode setting switch SW1 as shown in the following table.

| Mode No. | SW1 | | | | | Overall input and output region | Fixed region | Axis control region | 88 words respectively |
|---|---|---|---|---|---|---|---|---|---|
| | 4 | 3 | 2 | 1 | | | | | |
| 5 | × | × | × | ○ | | | | | |
| 6 | × | ○ | × | ○ | | | | | |
| 7 | ○ | × | × | ○ | | | | | |

Up to 16 axes including position No. designated axis/simple direct value mode axis can be assigned.
Each axis control signal is one word respectively for input and output in the case of position No. designated axis, and each control signal is three words for PLC input, and four words for PLC output.
For CC-Link master side, it is necessary to perform expansion cyclic setting by remote net Ver. 2 mode or remote net addition mode to expand number of cyclic points.

PLC output⇒Gateway unit⇒Each axis input　　Each axis output⇒Gateway unit⇒PLC input

| Output register | 0F Higher byte 08 \| 07 Lower byte 00 | Input register | 0F Higher byte 08 \| 07 Lower byte 00 |
|---|---|---|---|
| RY0F～00 | Gateway control signal 0 | RX0F～00 | Gateway control signal 0 |
| RY1F～10 | Gateway control signal 1 | RX1F～10 | Gateway control signal 1 |
| RY2F～20 | Request command | RX2F～20 | Response command |
| RY3F～30 | Data 0 | RX3F～30 | Data 0 |
| RY4F～40 | Data 1 | RX4F～40 | Data 1 |
| RY5F～50 | Data 2 | RX5F～50 | Data 2 |
| RY6F～60 | Data 3 | RX6F～60 | Data 3 |
| RY7F～70 | Data 4 (Reserve) | RX7F～70 | Data 4 (Reserve) |
| RY8F～80 | Data 5 (Reserve) | RX8F～80 | Data 5 (Reserve) |
| RY9F～90 | – | RX9F～90 | – |
| ⋮ RY13F～130 | – | | – |
| ⋮ RY17F～170 | – | | – |

Fixed region
Small (10 word)
Middle (20 word)
Large (24 word)

| | Output (writing) Register=Word register | | Input (writing) Register=Word register | | |
|---|---|---|---|---|---|
| 1 word | RWw 00H | Position No. designated axis control signal | RWr 00H | Position No. designated axis status signal | 1 word |
| | | | | | |
| | | | | | |
| | | | | | |
| 4 word | | Simple direct value axis control signal | | Simple direct value axis control signal | 3 word |
| | | | | | |
| | | | | | |
| Small (24 word) | RWw 17H | | RWr 17H | | |
| Middle (48 word) | RWw 2FH | | RWr 2FH | | |
| Large (64 word) | RWw 3FH | | RWr 3FH | | |

## 6.6.2 Assignment for each axis

Input and output signals for each axis position No. designated mode and those in simple direct value mode are different from each other in size of region and its content. Further, in the position No. designated mode, meaning of each bit depends on the pattern set by gateway control signal PPS.

### (1) Control signal and status signal of position No. designated axis

| | | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLC output RWw | Pattern 0 (Standard) PPS=000 | SON | RES | CSTR | STP | HOME | — | BKRL | — | — | — | PC32 | PC16 | PC8 | PC4 | PC2 | PC1 |
| | | Control signal | | | | | | | | Command position No. | | | | | | | |
| | Pattern 1 (Teach) PPS=001 | SON | RES | CSTR/PWRT | STP | HOME | — | JOG- | JOG+ | JISL | MOD | PC32 | PC16 | PC8 | PC4 | PC2 | PC1 |
| | | Control signal | | | | | | | | Command position No. | | | | | | | |
| | Pattern 2 (Positioning 256 points) PPS=010 | SON | RES | CSTR | STP | HOME | — | BKRL | — | PC128 | PC64 | PC32 | PC16 | PC8 | PC4 | PC2 | PC1 |
| | | Control signal | | | | | | | | Command position No. | | | | | | | |
| | Pattern 3 (Positioning 512 points) PPS=011 | SON | RES | CSTR | STP | HOME | — | BKRL | PC256 | PC128 | PC64 | PC32 | PC16 | PC8 | PC4 | PC2 | PC1 |
| | | Control signal | | | | | | | | Command position No. | | | | | | | |
| | Pattern 4 (Air cylinder) PPS=100 | SON | RES | — | STP | HOME | — | BKRL | — | — | ST6 | ST5 | ST4 | ST3 | ST2 | ST1 | ST0 |
| | | Control signal | | | | | | | | Start position No. | | | | | | | |
| PLC input RWr | Pattern 0 | BALM | ALM | EMGS | SV | PEND | HEND | RMDS | PZONE | ZONE1 | MOVE | PM32 | PM16 | PM8 | PM4 | PM2 | PM1 |
| | | Status signal | | | | | | | | Completed position No. | | | | | | | |
| | Pattern 1 | BALM | ALM | EMGS | SV | PEND/WEND | HEND | RMDS | PZONE | MODS | MOVE | PM32 | PM16 | PM8 | PM4 | PM2 | PM1 |
| | | Status signal | | | | | | | | Completed position No. | | | | | | | |
| | Pattern 2 | BALM | ALM | EMGS | SV | PEND | HEND | RMDS | PZONE | PM128 | PM64 | PM32 | PM16 | PM8 | PM4 | PM2 | PM1 |
| | | Status signal | | | | | | | | Completed position No. | | | | | | | |
| | Pattern 3 | BALM | ALM | EMGS | SV | PEND | HEND | RMDS | PM256 | PM128 | PM64 | PM32 | PM16 | PM8 | PM4 | PM2 | PM1 |
| | | Status signal | | | | | | | | Completed position No. | | | | | | | |
| | Pattern 4 | BALM | ALM | EMGS | SV | PEND | HEND | RMDS | PZONE | ZONE1 | PE6 | PE5 | PE4 | PE3 | PE2 | PE1 | PE0 |
| | | Status signal | | | | | | | | Completed position No. | | | | | | | |

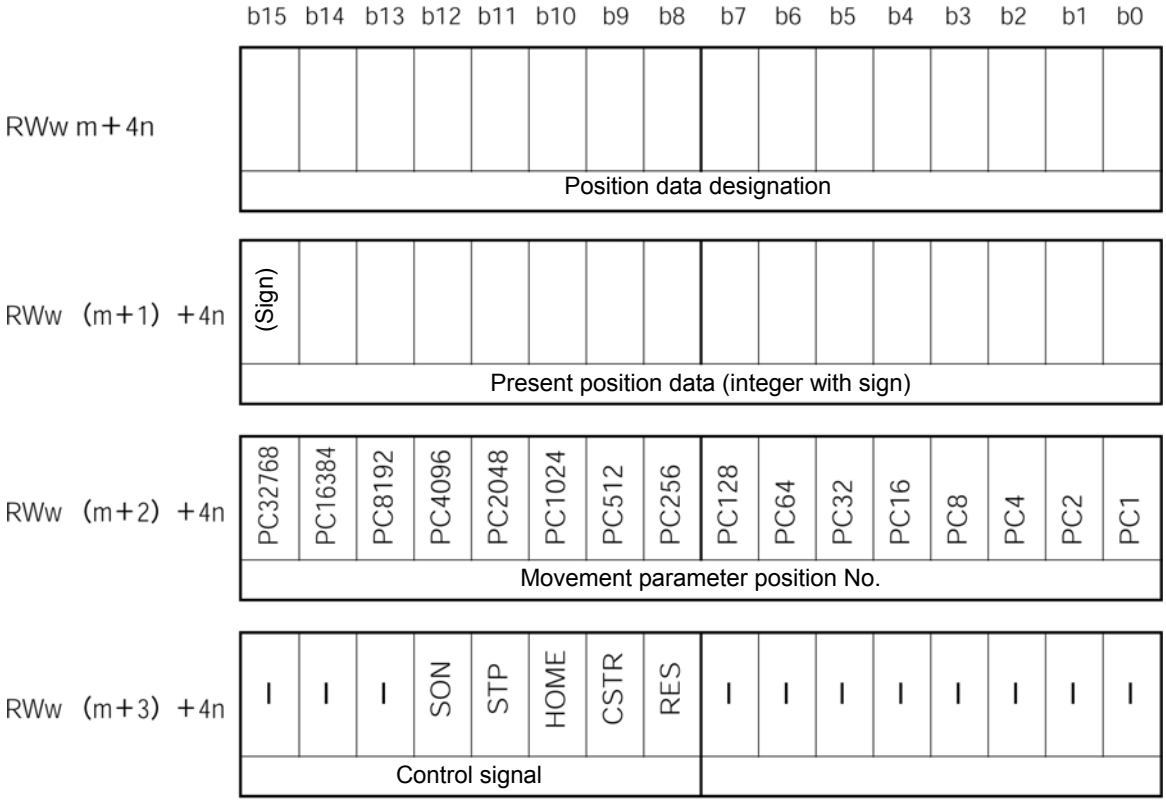
Detail of input and output signal

| Signal type | | Bit | Signal name | Pattern No. | Contents | Detail |
|---|---|---|---|---|---|---|
| PLC output | Control signal 0 | b15 | SON | 0 – 4 | Servo on command | |
| | | b14 | RES | 0 – 4 | Reset command | |
| | | b13 | CSTR | 0, 2, 3 | Start command | |
| | | | PWRT | 1 | Position data capturing command TEAC | |
| | | b12 | STP | 0 – 4 | Pause command | |
| | | b11 | HOME | 0 – 4 | Home return command | |
| | | b10 | BKRL | 0, 2 – 4 | Brake compulsory release | |
| | | b9 | JOG- | 1 | Jog- command | |
| | | b8 | JOG+ | 1 | Jog+ command | |
| | | b7 | JISL | 1 | Jog/inching changeover | |
| | | b6 | MOD | 1 | Teach mode command | |
| | Command position No. | b8–b0 | PC*** | 0 – 3 | Command position No. is designated by command position No. | |
| | | b6–b0 | ST0-ST6 | 4 | Start position is designated by bit pattern. | |
| PLC input | Status signal | b15 | BALM | 0 – 4 | Battery voltage drop alarm | |
| | | b14 | ALM | 0 – 4 | Alarm occurring | |
| | | b13 | EMGS | 0 – 4 | On emergency stop | |
| | | b12 | SV | 0 – 4 | Operation preparation completion (Servo on status) | |
| | | b11 | PEND | 0, 2 – 4 | Positioning completion | |
| | | b11 | WEND | 1 | Position data capturing command status TEAC | |
| | | b10 | HEND | 0 – 4 | Home return completion | |
| | | b9 | RMDS | 0 – 4 | Operation mode status | |
| | | b8 | PZONE | 0, 2 – 4 | Position zone output monitor | |
| | | b7 | ZONE1 | 0, 4 | Zone output monitor 1 | |
| | | b7 | MODS | 1 | Teach mode status | |
| | | b6 | MOVE | 0, 1 | On moving | |
| | Completed position No. | b8-b0 | PM*** | 0 – 3 | Completed position No. is read by binary number. | |
| | | b6-b0 | PE0-PE6 | 4 | Completed position is read by bit pattern. | |

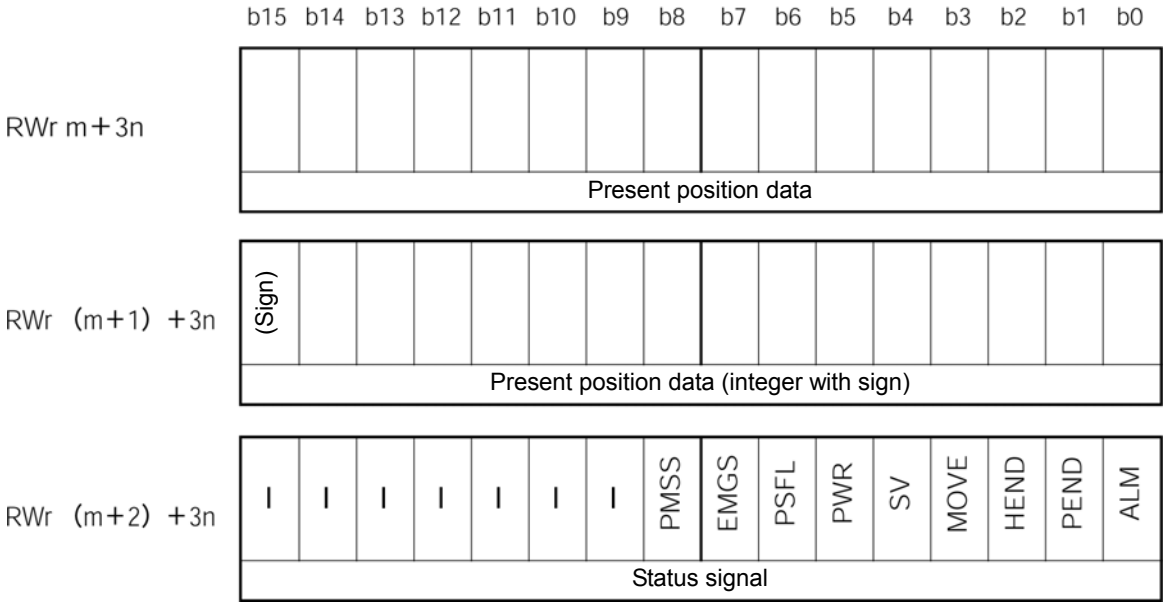
## (2) Simple direct value designated axis

Each axis consists of four words for output and three words for input as shown below.
Position data designation and present data are hexadecimal numbers of 32 bit integer with the sign in units of 0.01mm.

PLC output = Control signal




PLC input = Status signal




m is a head address assigned as simple direct value axis.
n is a number of simple direct designated axis.

Details of input and output signal

| Signal type | | Bit | Signal name | Contents | Detail |
|---|---|---|---|---|---|
| PLC output | Target position data | 32 bit data | - | This is a 32 bit integer with sign (Unit: 0.01mm), and is set in hexadecimal number.<br>Example) In the case of +25.4mm, set it to $0009EC_H$ (decimal 2540).<br>● When the integer is negative, it is indicated by complement of 2, therefore, the uppermost bit becomes "1." | - |
| | Movement parameter position No | 16 bit data | - | Set movement parameters other than target position data on the position table, however, designate the position No. in hexadecimal number. | - |
| | Control signal | b15-b13 | - | Cannot be used. | |
| | | b12 | SON | Servo on command | |
| | | b11 | STP | Pause command | |
| | | b10 | HOME | Home return command | |
| | | b9 | CSTR | Start command | |
| | | b8 | RES | Reset command | |
| | | b7-b0 | - | Cannot be used. | |
| PLC input | Present position data | 32 bit data | - | This is a 32 bit integer with sign (Unit: 0.01mm), and the present position data is outputted in hexadecimal number.<br>Example) and (Note) are the same as those for the target position data. | |
| | Position data designation | b15-b9 | - | Cannot be used. | |
| | | b8 | PMSS | PIO/Modbus switching status<br>0: PIO, 1: Modbus<br>Switching is performed by PIO/Modbus switching command. | |
| | | b7 | EMGS | Emergency stop status | |
| | | b6 | PSFL | Push outside | - |
| | | b5 | PWR | Controller preparation completion | |
| | | b4 | SV | Operation preparation completion (Servo on status) | |
| | | b3 | MOVE | On moving | |
| | | b2 | HEND | Home return completion | |
| | | b1 | PEND | Positioning completion | |
| | | b0 | ALM | Alarm occurring | |

**⚠ CAUTION**

Setting of the “Parameter initial value” is not applied to the movement data which must be directly designated in numeric value from the PLC. Therefore, note that if it is not designated in numeric value, operation is not performed or alarm occurs.
The following summarizes how to designate movement data for each operation mode.

| Designated data | Position data limit designation | Position No. designation | Position data designation | | Simple/Position No. designation | |
|---|---|---|---|---|---|---|
| | | | Normal | Push | Simple direct value | Position No. designation |
| Position | PLC numeric value designation | Position table | PLC numeric value designation | PLC numeric value designation | PLC numeric value designation | Position table |
| Speed | Parameter | Position table (Parameter) | PLC numeric value designation (× Parameter) | PLC numeric value designation (× Parameter) | Position table (Parameter) | Position table (Parameter) |
| Acceleration and deceleration speed | Parameter | Position table (Parameter) | PLC numeric value designation (× Parameter) | PLC numeric value designation (× Parameter) | Position table (Parameter) | Position table (Parameter) |
| Positioning width | Parameter | Position table (Parameter) | Parameter | PLC numeric value designation (× Parameter) | Position table (Parameter) | Position table (Parameter) |
| Push current limit value | × | Position table | × | PLC numeric value designation | Position table | Position table |

### 6.6.3 Command region

When request command RY (2F-20) and data RY (8F-30) related to the request command are outputted from the PLC, response command (2F-20) and data related to the response command are inputted to the PLC input.
The request command and response command respectively consist of one word, and the request data and response data respectively consist of seven words, however, actually use five words. (Refer to the overall address configuration.)

#### (1) Command list

Commands which can be used and command codes are as follows.

| Classification of functions | Code | Description |
|---|---|---|
| Hand shake | $0000_H$ | Request command clear |
| Position table data write | $1000_H$ | Target position write |
| | $1001_H$ | Positioning width write |
| | $1002_H$ | Speed write |
| | $1003_H$ | Individual zone boundary + side write |
| | $1004_H$ | Individual zone boundary - side write |
| | $1005_H$ | Acceleration write |
| | $1006_H$ | Deceleration write |
| | $1007_H$ | Current limit value write at push |
| | $1008_H$ | Load current threshold value write |
| Position table data read | $1040_H$ | Target position read |
| | $1041_H$ | Positioning width read |
| | $1042_H$ | Speed read |
| | $1043_H$ | Individual zone boundary + side read |
| | $1044_H$ | Individual zone boundary - side read |
| | $1045_H$ | Acceleration read |
| | $1046_H$ | Deceleration read |
| | $1047_H$ | Current limit value read at push |
| | $1048_H$ | Load current threshold value read |
| Position table data recorded on ROM | $0DA0_H$ | POS writing coil write |
| | $02E0_H$ | POS writing completion coil read |
| Present occurring alarm code read | $0342_H$ | Presently occurring alarm code read |
| Present value monitor | $0440_H$ | Designated axis present position monitor |
| Group designated broadcast operation | $0D03_H$ | Synchronizing movement to same POS No. position |
| PIO/Modbus control switching | $0DA1_H$ | PIO/Modbus switching |

## (2) Each command and data format

[1] Position table data write command

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Target position write | +2 | $1000_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Position data (24 bit integer with sign) | |
| | 5 | | |
| | 6 | Axis No. 0 to $F_H$ (0-15) | |
| | 7 | 0 | |
| | 8 | 0 | |
| Position width write | +2 | $1001_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Positioning width data (24 bit integer) | |
| | 5 | | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Speed write | +2 | $1002_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Speed data (24 bit integer) | |
| | 5 | | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Individual zone boundary + side write | +2 | $1003_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Position data (24 bit integer with sign) | |
| | 5 | | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Individual zone boundary - side write | +2 | $1004_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Position data (24 bit integer with sign) | |
| | 5 | | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Acceleration write | +2 | $1005_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Acceleration data (8 bit integer) | |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Deceleration write | +2 | $1006_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | Deceleration data (8 bit integer) | |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ (0-15) | |
| | 7 | 0 | |
| | 8 | 0 | |
| Current limit value write at push *2 | +2 | $1007_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0000 to $00FF_H$ ($00FF_H$: Maximum current) | |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Load current threshold value write | +2 | $1008_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0000 to $00FF_H$ ($00FF_H$: Maximum current) | |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |

(Note)
1) Relative RY and relative RX from the head
2) This is not enabled unless push operation is set.

[2] Position table data read command

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Target position read | +2 | $1040_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Target position data *2 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ (0-15) | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |
| Positioning width read | +2 | $1041_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Positioning width data *3 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |
| Speed read | +2 | $1042_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Speed data *3 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |
| Individual zone boundary + side read | +2 | $1043_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Individual zone boundary + data *2 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |
| Individual zone boundary - side read | +2 | $1044_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Individual zone boundary - data *2 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |
| Acceleration read | +2 | $1045_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | Acceleration data *4 |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | Same value as request at normal |
| | 7 | 0 | |
| | 8 | 0 | |

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Deceleration read | +2 | $1046_H$ | Same value as request at normal |
| | 3 | Deceleration reading POS No. | |
| | 4 | 0 | Deceleration data *4 |
| | 5 | 0 | Same value as request at normal |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Current limit value read at push *5 | +2 | $1047_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | 0000 – $00FF_H$ ($00FF_H$: Max current) |
| | 5 | 0 | Same value as request at normal |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Load current threshold value read | +2 | $1048_H$ | Same value as request at normal |
| | 3 | Position No. | |
| | 4 | 0 | 0000 – $00FF_H$ ($00FF_H$: Max current) |
| | 5 | 0 | Same value as request at normal |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |

* 1) Relative RY and relative RX from the head
2) 24 bit integer data with sign
3) 24 bit integer data
4) 8 bit integer data
5) This is not enabled unless push operation is set.

[3] Position table data ROM writing command

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Position table data ROM writing coil write | +2 | $0DA0_H$ | Same value as request at normal |
| | 3 | 0 | |
| | 4 | Coil ON/OFF<br>$00FF_H$ = ON<br>$0000_H$ = OFF | |
| | 5 | 0 | |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |
| Position table data ROM writing completion coil read | +2 | $02E0_H$ | Same value as request at normal |
| | 3 | 0 | |
| | 4 | 0 | $00FF_H$= Now recording on ROM<br>$0000_H$= Recording on ROM completed |
| | 5 | 0 | Same value as request at normal |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |

[4] Presently occurring alarm code read command

| Command name | *1 | PLC output (request) | PLC input (response) |
|---|---|---|---|
| Presently occurring alarm code read | +2 | $0342_H$ | Same value as request at normal |
| | 3 | 0 | |
| | 4 | 0 | Alarm code |
| | 5 | 0 | Same value as request at normal |
| | 6 | Axis No. 0 to $F_H$ | |
| | 7 | 0 | |
| | 8 | 0 | |

* 1) Relative RY and relative RX from the head

[5] Group designated broadcast POS movement start

This command simultaneously starts an axis designated by group No. to a position designated by POS No. This command performs communication between gateway and controller by broadcast, therefore, response from the controller does not return.

The response result displayed on the PCL input means that communication to the controller normally ended, and does not indicate status of the controller. Determine the status from the status signal to each axis.

| *1 | PLC output (request) | PLC input (response) |
|---|---|---|
| +2 | $0D03_H$ | Same value as request at normal |
| 3 | POS No. *2 | |
| 4 | Group ID No. *3 | |
| 5 | 0 | |
| 6 | 0 | |
| 7 | 0 | |
| 8 | 0 | |

*1) Relative RY and relative RX from the head
*2) Possible values depend on type of robo-cylinder and its setting.
*3) If this is 0, all of the linked axes move regardless of group designation.
Setting of group No. is performed by system parameter setting of personal computer supporting software.
*4) When movement command is issued by control word for every axis in process of movement by this command, movement by this command is cancelled and operation is performed by the latest movement command. Note that each axis has two movement command interfaces.
Use these two interfaces exclusively.
*5) Even if a link to CFG of gateway control signal is eliminated by bit OFF operation, the controller always receives this command and executes after the link is once established.

[6] PIO/Modbus switching command

| *1 | PLC output (request) | PLC input (response) |
|---|---|---|
| +2 | $0DA1_H$ | Same value as request at normal |
| 3 | 0 | |
| 4 | Coil ON/OFF<br>$00FF_H$=ON: Modbus (PIO command ineffective)<br>$0000_H$=OFF: PIO (PIO command effective) *2 | |
| 5 | 0 | |
| 6 | Axis No. 0 to $F_H$ | |
| 7 | 0 | |
| 8 | 0 | |

*1) Relative RY and relative RX from the head
*2) PIO/Modbus switching status is reflected on the status signal PMSS. And, this is not allowed to be set for the position No. designated movement axis (Invalid request command error (0103H) occurs).
*3) When coil OFF (PIO command effective) is designated, it is also possible to change position data of axis from the PLC by Modbus communication (The link should be held).
*4) When control right for the controller is on the PIO, do not issue movement command from the Modbus.

(3) Error response

When command error occurs, the uppermost bit (b15) is turned ON. Further, the following error codes are set to the response data 1.

| Code | Description |
|---|---|
| $0101_H$ | Invalid axis No. *1 |
| $0102_H$ | Invalid position No. *1 |
| $0103_H$ | Invalid request command *1 |
| $0201_H$ | Communication fault |
| $0202_H$ | Controller execution impossible |

*1) If data from the PLC is checked and this is found, an error code is set to the response data without transmitting to the controller.
*2) Nothing is displayed on the response command in a status that link is not completely formed.

MEMO

# 7. Contents of communication signal

## 7.1 Outline of timing for communication signal

In order to operate robo-cylinder by the sequence program for the PLC, any of the control signals is turned ON, and maximum response time until the response (status) returns to the PLC is expressed by the following equation.

Maximum response time (msec) = Yt + Xt + 2 × Mt + Command processing time (such as operating time)

Mt = 10(msec) × (n + 1) : SIO link (Modbus) Cycle time

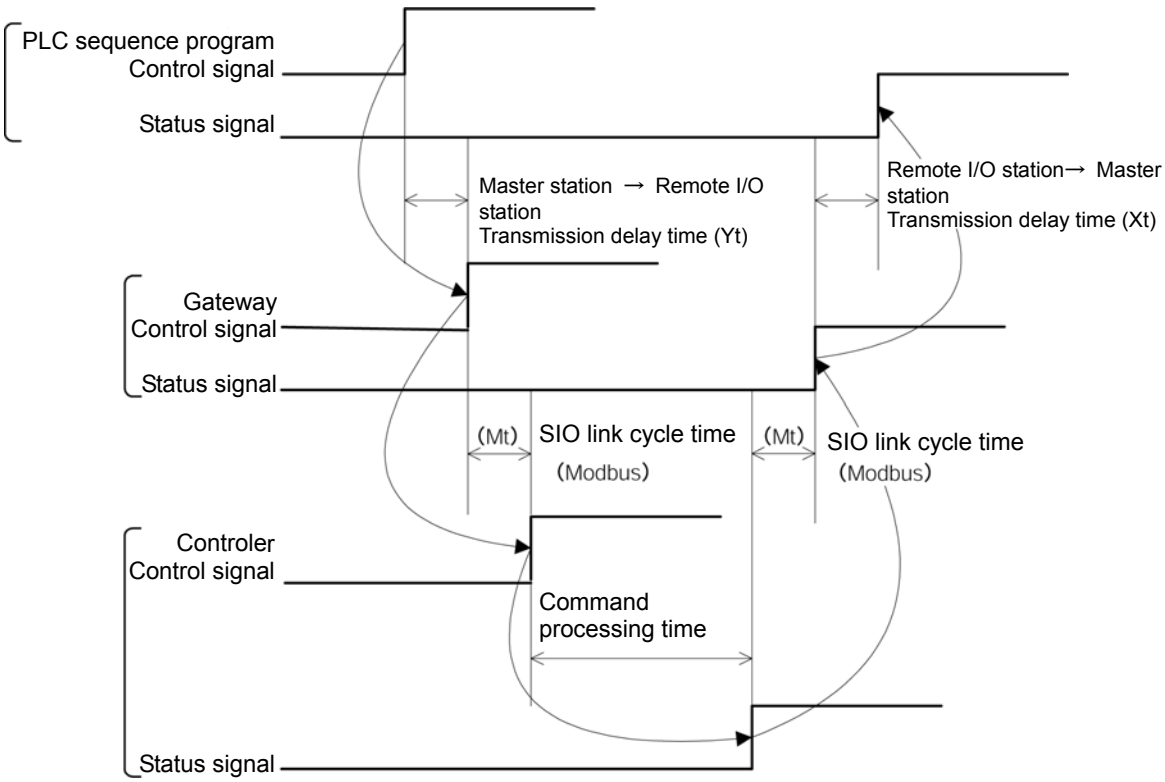
n : Number of controlled axes

Yt : Master station → Remote I/O station transmission delay time

Xt : Remote I/O station → Master station transmission delay time

} CC-Link transmission delay time

For Master station → Remote I/O station transmission delay time (Yt), Remote I/O station → Master station transmission delay time, refer to the Operation Manuals for the CC-Link master unit and PLC to be mounted.




(Note) When communication error is caused due to a problem on the transmission path, communication retry (retry times = 3) occurs and a longer SIO link cycle time (Mt) than normal may occur.

## 7.2 Communication signal and operation timing

### (1) Controller preparation completion (PWR)

This is turned ON when the controller becomes controllable after power is turned on.

■ Function

This is turned ON when the controller has been normally initialized and becomes controllable after power is turned on regardless of the status of the alarm and status of the servo.
This is ON if the controller is controllable even when it is in an alarm status.
This synchronizes with the LED (Green) of RDY on the front of the controller.

### (2) Emergency stop (EMGS)

This is turned ON when the controller is in emergency stop status.

■ Function

This is turned ON when any alarm for the controller occurs, or there occurs an emergency stop status by emergency stop circuit (refer to 4.3.1), or motor drive power is in shut-off status. This is turned OFF when the emergency stop status is released.

### (3) Alarm (ALM)

This signal is turned ON when the protecting circuit (function) for the controller detects any abnormality.

■ Function

This signal is turned ON when the protecting circuit (circuit) detects an abnormality and operates.
This can be turned OFF when the cause of the alarm is released and the reset (RES) signal is turned ON. (Except for alarm on cold start level)
When any alarm is detected, the LED (Red) of ALM on the front of the controller is lit. When in normal status, this is unlit.
In ERC2, the LED on the upper part of the motor unit is lit in red. It is lit in green with the servo on.

### (4) Reset (RES)

This signal has two functions, one of which is alarm reset for the controller, and the other is to cancel remaining movement amount during pause.

■ Function

[1] Alarm signal can be reset by turning ON this signal after eliminating cause of the alarm during occurrence of alarm. (Except for alarm on cold start level)
[2] Remaining movement amount can be canceled by turning ON this signal during pause.

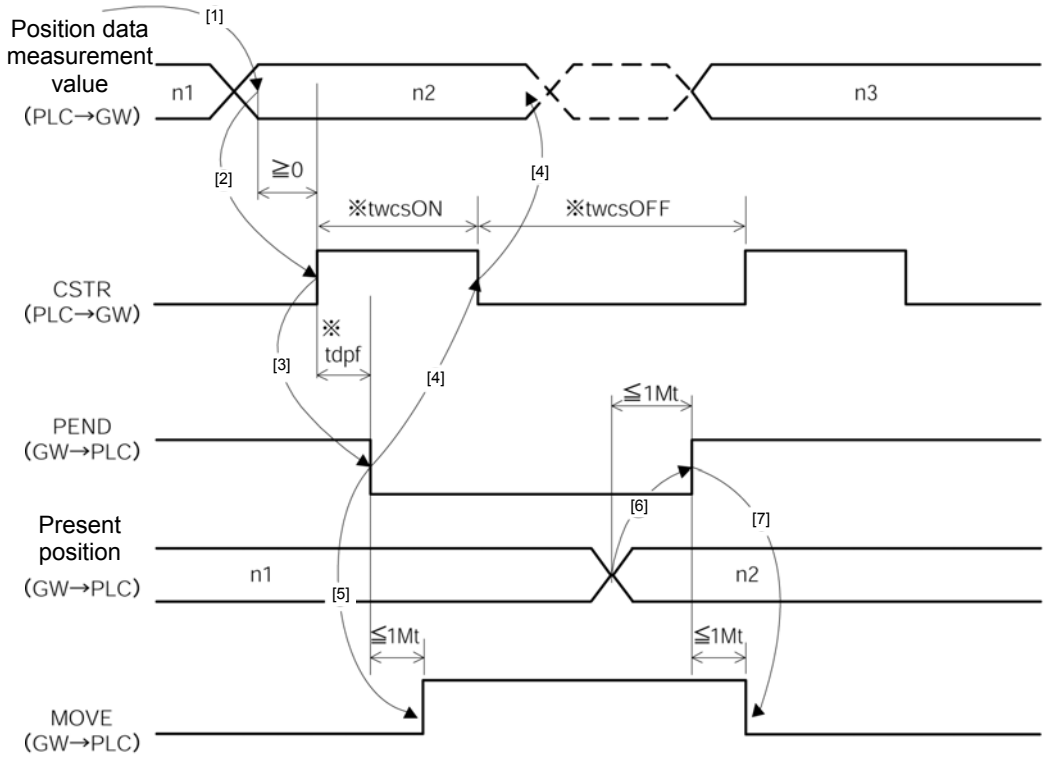
## (5) Direct numeric value designated operation (Position data, present position data, CSTR, PEND, MOVE, acceleration and deceleration data, speed data)

This is a function to operate the robo-cylinder by directly writing position data, acceleration and deceleration data, speed data onto the link register on the PLC without using the position table for the controller.
Position data designated operation is an effective function when position data limit designated mode (maximum number of controlled axes, 14 axes), or positioning data designated mode (maximum number of controlled axes, 7 axes), simple direct value/position No. designated mode (maximum number of controlled axes, 16 axes) is selected.
And, acceleration and deceleration data and speed data designation are effective functions only when positioning data designated mode (maximum number of controlled axes, 7 axes) is selected.

■ Function

a. Position data designated operation
This is an effective function when the position data limit designated mode or positioning data designated mode is selected.

[1] Set target position data onto position data designated register.
[2] Turn ON the CSTR (Start) at the same time as [1] or after that (≥0).
Normally, turn ON the CSTR in a state that the PEND (positioning completion) is ON, or the MOVE (on-moving signal) is OFF.
The target position data is transmitted to the controller at ON edge of the CSTR (at signal startup).
[3] The PEND is turned OFF after the CSTR is ON, and after tdpf.
[4] Turn OFF the CSTR by turning OFF the PEND or turning ON the MOVE (on-moving).
Do not change the target position data until the CSTR is turned OFF.
[5] The MOVE is turned ON at the same time when the PEND is turned OFF or within 1Mt after that.
[6] The present position data is always updated. The PEND is turned OFF when the CSTR is OFF and remaining movement amount is in a range of the parameter No.10 “Positioning width (in-position) initial value” for the controller and at the same time when the present position is updated or within 1Mt after that.
Therefore, check reading of stop position data after positioning is completed in some proper time (remaining movement amount moving time) after the PEND is turned ON.
Further, the present position data slightly changes due to vibration, etc., even during stop, therefore, take it into account when handling the position data.
[7] The MOVE is turned OFF at the same time when the PEND is turned ON or within 1Mt after that.
[8] It is possible to change the target position data during movement.
To change the target position during movement, turn ON the CSTR after changing the target position data (>PLC scan time).
In this case, keep the CSTR ON for tdpf or longer. And take an interval time of 1Mt or longer until turning ON the next CSTR after turning OFF the CSTR.




※Yt+2Mt+Xt≦tdpf≦Yt+2Mt+Xt+7 (msec)
twcsON ≧1Mt
twcsOFF ≧1Mt

## b. Acceleration and deceleration, speed data designation

This is an effective function when the positioning data designated mode is selected.

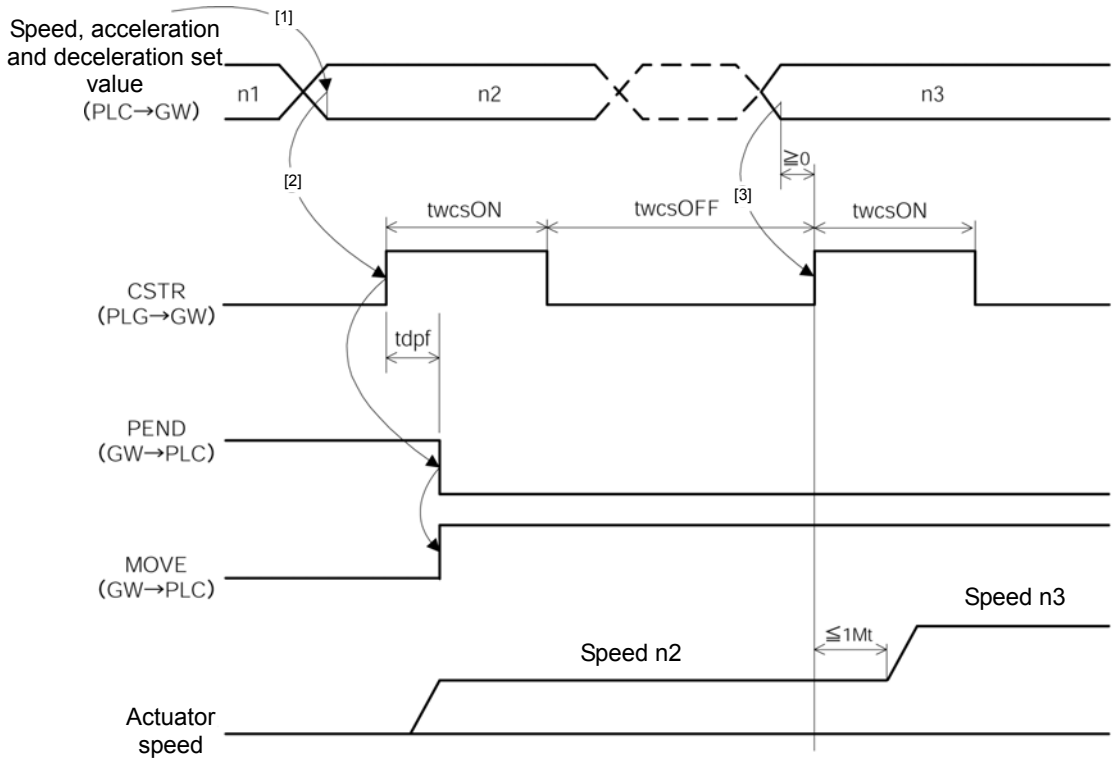
[1] Set the acceleration and deceleration, and speed data designation to each designated register at the same time when setting the target position data in a. or before setting it.
Note that setting of parameter No.9 “Acceleration and deceleration initial value” is not applied unless the acceleration and deceleration is set. And, stop status is kept when speed is not set or is set to “0.” Alarm does not occur.

[2] It is transmitted together with the target position data at ON edge of the CSTR (start) (at startup of signal).

[3] It is possible to change the acceleration and deceleration and speed data during movement.
To change the acceleration and deceleration or speed during movement, turn ON the CSTR after changing the acceleration and deceleration and speed data.
In this case, keep the CSTR ON for tdpf or longer. And take an interval time of 1Mt or longer until turning ON the next CSTR after turning OFF the CSTR.
When changing the speed by changing the setting to “0” during movement, it decelerates and stops. Alarm does not occur.

**⚠ CAUTION**

1. It is necessary to set the target position data even when changing only the acceleration and deceleration/speed data during movement.
2. It is necessary to set the acceleration and deceleration/speed data even when changing only the target position during movement.




twcsON≧1Mt
twcsOFF≧1Mt

## (6) Positioning data designated mode push operation (Position data, acceleration and deceleration data, speed data, current limit value, positioning width, present position data, DIR, PUSH, CSTR, PEND, MOVE)

This is a function to operate to push the actuator by directly writing position data, acceleration and deceleration data, speed data, current limit value and positioning width onto the link register on the PLC without using the position table for the controller.
This is an effective function when push operation mode (maximum number of controlled axes, 3 axes) is selected in positioning data designated mode.

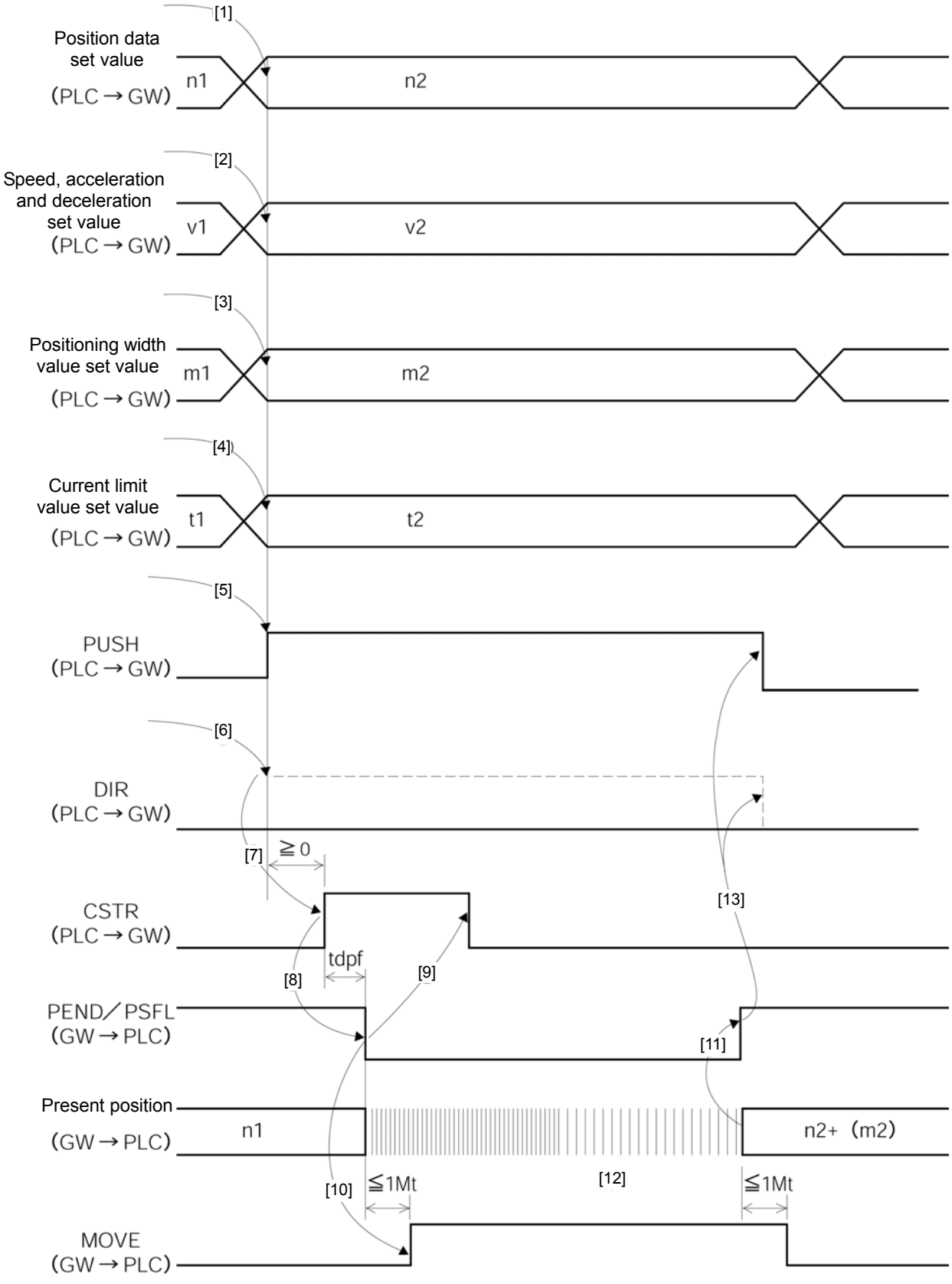
■ Function

[1] Set push a start position data to the position data designated register.
[2] Set a speed up to the push start position to the speed designated register, and set the acceleration and deceleration at the time to the acceleration and deceleration register. Note that setting of the parameter No.9 “Acceleration and deceleration initial value” is not applied unless the acceleration and deceleration is set.
[3] Set a push operation moving amount (maximum push amount) to the positioning width designated register. (*)
[4] Set a current limit value for setting push force to the current limit value register.
[5] Turn ON the PUSH (push operation mode designation) signal.
[6] Select a push direction with the DIR (push direction designation) signal.
Push operation is performed in home return reverse direction with the DIR signal ON, and in home return direction with the DIR signal OFF.
[7] Turn ON the CSTR(start) after that (≥0)
Turn ON the CSTR in a status that the PEND (Positioning completed) or the MOVE (on-moving) signal is OFF.
Data set in [1] to [4] is transmitted to the controller at the ON edge (at startup of signal).
[8] The PEND is turned OFF after the CSTR is turned ON, and after tdpf.
[9] Turn OFF the CSTR by turning OFF the PEND or turning ON the MOVE signal.
[10] The MOVE is turned ON at the same time when the PEND is turned OFF or within 1Mt after that.
[11] The PEND is turned ON when the CSTR is OFF and current from the motor reaches the current limit value set in [4]. (Push completed)
The PSFL (push outside) signal is turned ON unless the current from the motor reaches the current limit value set in [4] even if the positioning width set in [3] is reached.
In this case, the PEND is not turned ON. (Push outside)
[12] The present position data is always updated.
[13] Turn OFF the PUSH and DIR by turning ON the PEND or turning ON the PSFL.

◎ Normal positioning in push operation enable mode

Normal positioning in push operation enable mode is operated with the signal in [5] OFF. Setting in [4] is also unnecessary. The PEND is turned ON when the CSTR is OFF and remaining movement amount set in [3] enters a positioning width designated data range. The others are the same as those in the “7.2(5) Direct numeric value designated operation.”

* Note that setting of the parameter No.10 “Positioning width initial value” unless the positioning width designated data is set.




※ Yt+2Mt+Xt ≦ tdpf ≦ Yt+2Mt+Xt+7（msec）

## (7) Position No. designated operation (Command position No., completion position No., CSTR, PEND, MOVE)

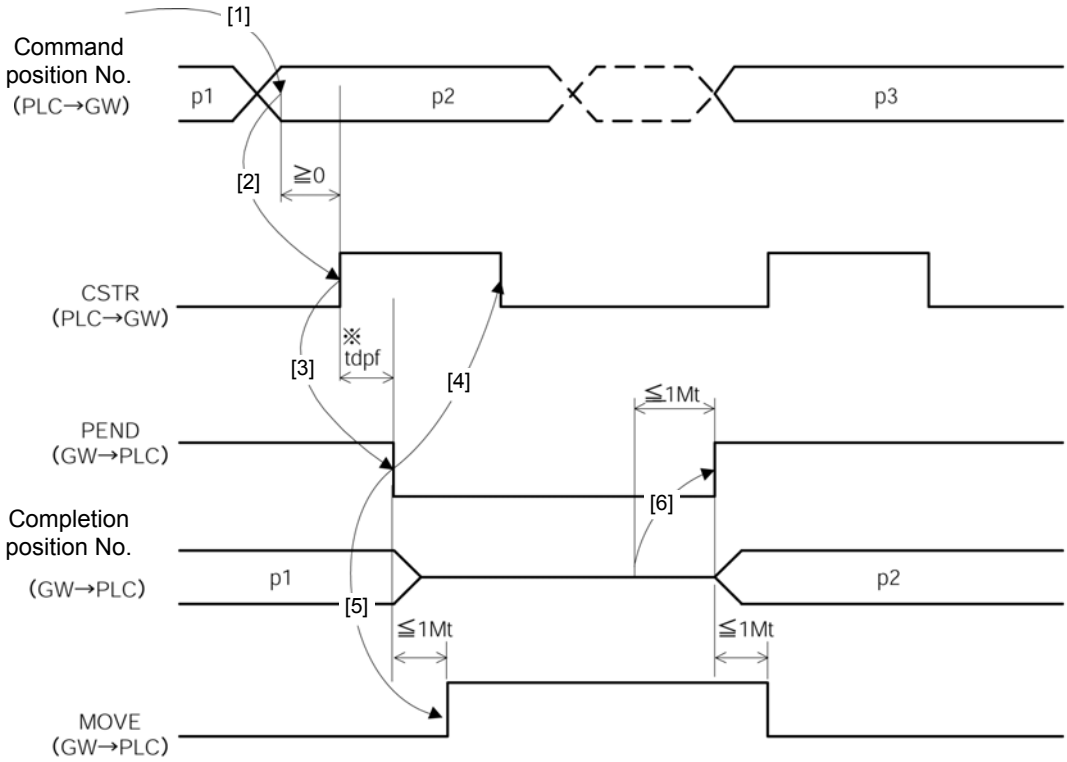
This is an effective function when the position No. designated operation mode is selected.

■ Function

Enter position data into the position table of the controller in advance, and designate a position No. with the link register on the PLC to operate.

Push operation, speed change operation during movement and pitch feed by relative coordinate designation are the same as those in the case to operate with the PIO (I/O cable), therefore, refer to the Operation Manuals for PCON, ACON, SCON and ERC2.

[1] Set a position No. to the command position No. register.
[2] Turn ON the CSTR (start) after that (≥0).
[3] The PEND (positioning completed) is turned OFF after the CSTR is turned ON, and after tdpf.
[4] Turn OFF the CSTR by turning OFF the PEND or turning ON the MOVE (on-moving).
[5] The MOVE is turned ON at the same time when the PEND is turned OFF or within 1Mt after that.
[6] The completion position No. and PEND are outputted when the CSTR is OFF and the remaining movement amount is within a range of the parameter No.10 “Positioning width (in-position) initial value” for the controller.
Therefore, check reading of completion position No. after positioning is completed in some proper time (remaining movement) after the PEND is turned ON.




※Yt+2Mt+Xt≦tdpf≦Yt+2Mt+Xt+7（msec）

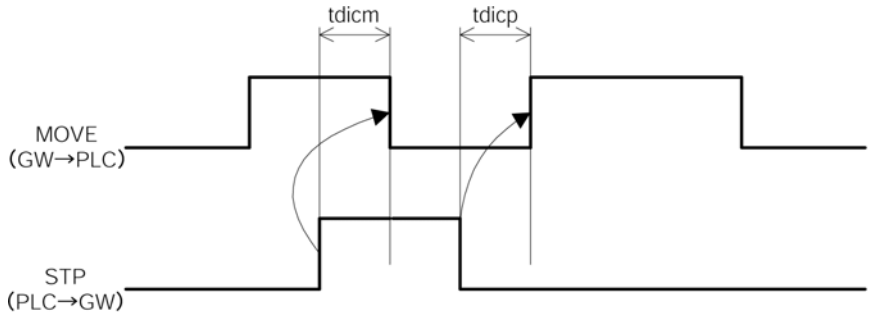
## (8) Pause (STP, MOVE)

This is a function to perform pause during movement of axis.

■ Function

Axis movement can be stopped and restarted by the STP (pause) signal. Axis movement stops while the STP signal is ON.

A relationship between the STP signal and MOVE (on-moving) signal is as follows.




tdicm≦Depends on acceleration and deceleration.

tdicp≦Yt+2Mt+Xt+6 (msec)

## (9) Servo on (SON, SV)

This is a signal to put the motor into an operable status.

When the servo is turned on, the LED (green) for SV on the front of the controller is lit. In ERC2, the LED on the upper part of the motor unit is lit in green.

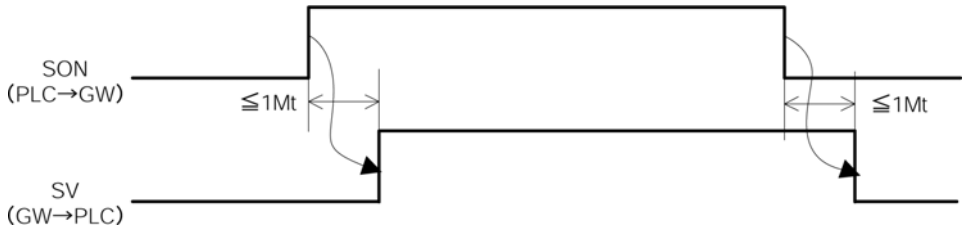
The SV (operation preparation completion) signal synchronizes with this LED indication.

■ Function

Servo ON/OFF for the controller is enabled by the SON (servo on) signal.

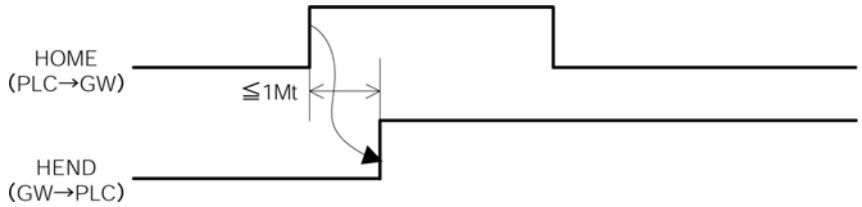
While the SON signal is ON, the controller is in the servo on status and can be operated.

A relationship between the SON signal and SV signal is as follows.



## (10) Home return (HOME, HEND)

Home return is executed at ON edge (at startup of signal) of HOME (Home return).
When home return is completed, the HEND (Home return) signal is turned ON.
Turn OFF the HOME signal when the HEND signal is turned ON. Home return by the HOME signal is also effective after home return is completed.




**⚠ CAUTION**

1. The position No. designated mode executes positioning after only the first one home return after power is turned on is performed when positioning to a position is commanded without performing home return when power is turned on.
2. Note that there occurs an alarm of “Error code 83 ALARM HOME ABS (absolute position moving command in home return non-completion status) in cases other than the position No. designated mode.

## (11) Zone (ZONE1, ZONE2)

In the case of the position No. designated mode, zone signals at two points can be outputted during movement in an arbitrary region set as a parameter.
ZONE 1 (Zone 1) signal is turned ON in a region set to the parameter No.1 (zone boundary 1 + side) and No.2 (zone boundary 1 - side).
ZONE 2 (Zone 2) signal is turned ON in a region set to the parameter No.23 (zone boundary 2 + side) and No.24 (zone boundary 2 - side).

**⚠ CAUTION**

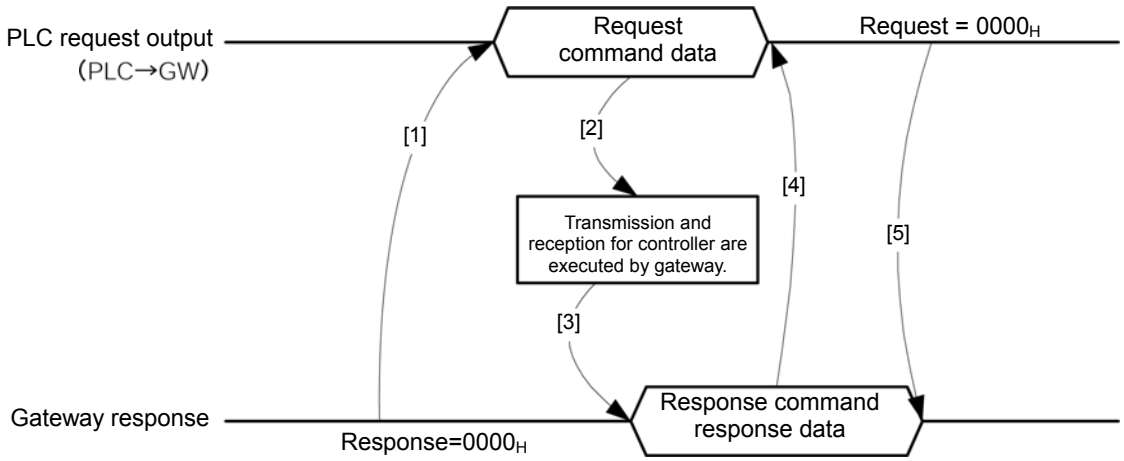
1. This signal supports the position No. designated mode only.
2. Use this signal in a status that home return is completed (HEND signal is ON).
   If the HEND (home return completed) signal is ON, this signal is also effective even in the servo off status or emergency stop status.

MEMO

## 7.3 Command transmission and reception

The diagram below shows a timing chart for command transmission and reception.
The gateway analyzes the request command and responds at every time when control and status data exchange for all axes which are always performed are ended.
The PLC and gateway unit execute the following.

[1] The PLC application confirms zero of the response command, then sets the necessary request command and data.
[2] The gateway detects that the request command became other than zero, then transmits the request data to the applicable axis.
[3] The gateway receives a response from the applicable axis, then outputs the response result.
[4] The PLC application confirms the response result, then clears the request command.
[5] The gateway confirms that the request command is cleared, then clears the response command and waits for the next command.
When using continuously, repeat [1] to [5].



MEMO

# 8. System build-up

It is necessary to set as follows in order to make the controller communicate with the CC-Link Master (PLC) and controller through the gateway unit.

[1] Controller setting for SIO communication (Modbus communication) between the gateway unit and controller

[2] Setting of PLC side and gateway unit for CC-Link communication between the PLC and gateway unit

## 8.1. Communication setting for controller

It is necessary to set as follows in order to make the controller communicate with the gateway unit.

(1) Set so as not to duplicate axis No.
Note that a range of settable axis No. depends on the operation mode of the gateway unit.

(2) Parameter setting

[1] Set the parameter No. 16 “SIO communication speed” to “230400” (230.4 kbps).
SIO communication cannot be performed in a setting other than 230.4 kbps.

[2] Set the parameter No. 17 “Slave station transmitter activation minimum delay time” to “5” or less.
When attempting to execute the communication cycle at the fastest speed, set it to “0.”

## 8.2. CC-Link communication setting

It is necessary to set as follows in order to make the gateway communicate with master station.
As for this setting, a gateway unit must accord with the master station.

○: ON ×: OFF

| Item | Setting of gateway unit | | | | Setting of PLC master | | |
|---|---|---|---|---|---|---|---|
| Communication speed | Baud rate setting switch | | | | Number of exclusive stations | | |
| Station No. | Station No. setting switch | | | | Expanded cyclic setting | | |
| Station type | Remote device station only | | | | Remote device station | | |
| Number of exclusive stations/Mode | Mode setting SW1 | | | | Number of exclusive stations | Expanded cyclic setting | |
| | 4 | 3 | 2 | 1 | | | |
| | × | × | × | × | 4 | 1 time | Position data limit designated mode (14 axes) |
| | × | × | ○ | × | 4 | 1 time | Position No. designated mode (14 axes) |
| | × | ○ | × | × | 4 | 1 time | Normal positioning mode (7 axes) |
| | × | ○ | ○ | × | 4 | 1 time | Push operating mode (3 axes) |
| | ○ | × | × | ○ | 3 | 2 times (example) | Simple direct value/Position No. designated mode Small |
| | × | ○ | × | ○ | 3 | 4 times (example) | Simple direct value/Position No. designated mode Middle |
| | × | × | × | ○ | 2 | 8 times (example) | Simple direct value/Position No. designated mode Large |

The master station should set the following in addition to the above.

[1] Head address of remote input (RX)
[2] Head address of remote output (RY)
[3] Head address of remote input register (RWr)
[4] Head address of remote output (RWw)

* For setting of the master station, refer to the Operation Manuals for the master station and the PLC to be mounted.

For an example of the CC-Link setting in GX Developer V8, refer to the 9.5.2 (2).

Number of exclusive stations, expanded cyclic setting and size of data area are as shown in the table below.

| CC-Link version | | Ver. 1 | Ver. 2 | | |
|---|---|---|---|---|---|
| Direct value designation | | ○ | × | × | × |
| POS designation | | ○ | × | × | × |
| Direct value/speed/acceleration and deceleration designation | | ○ | × | × | × |
| Direct value/speed/acceleration and deceleration/positioning width/push % | | ○ | × | × | × |
| Simple direct value/Position No. designation Small | | × | ○ | × | × |
| Simple direct value/Position No. designation Middle | | × | × | ○ | × |
| Simple direct value/Position No. designation Large | | × | × | × | ○ |
| Number of exclusive stations | | 4 | 3 | 3 | 2 |
| Expanded cyclic setting | | - | 2 | 4 | 8 |
| Size | Bit data (byte) | 16 | 20 | 40 | 48 |
| | Word data (byte) | 32 | 48 | 96 | 128 |

## 8.3. Master PLC address assignment

The basic concept of address assignment (memory map) for the CC-Link master PLC has been explained in 5.2. This section explains a case when the gateway unit is a remote station. If the gateway unit is a remote device station (remote station which handles bit information and word information), the number of exclusive stations depends on the operation mode.

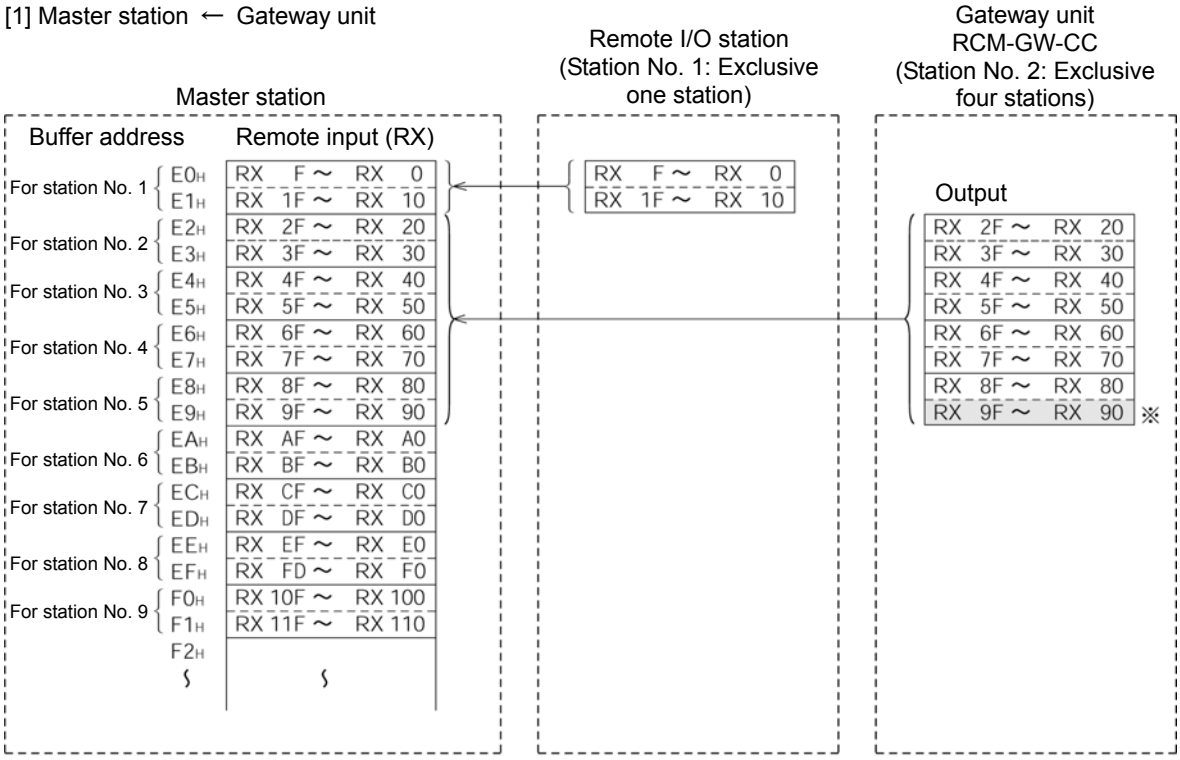
| Operation mode | | Input and output region | | Number of exclusive stations | Number of controlled axes |
|---|---|---|---|---|---|
| | | Remote I/O | Remote register | | |
| Position data limit designation | | 8 word | 16 word | 4 | 14 |
| Position No. designation | | 8 word | 16 word | 4 | 14 |
| Normal position data designation | | 8 word | 16 word | 4 | 7 |
| Push operation data designation | | 8 word | 16 word | 4 | 3 |
| Simple direct value/Position No. designation | Small | 10 word | 24 word | * Depends on setting | 16 max. |
| | Middle | 20 word | 48 word | * Depends on setting | 16 max. |
| | Large | 24 word | 64 word | * Depends on setting | 16 max. |

* Number of links per one CC-Link remote station is 32 points (two words) for remote input and output, and four points (four words) respectively for remote register, then a maximum 64 stations per one system can be linked.
  Number of links per one station can be expanded by the expanded cyclic setting.

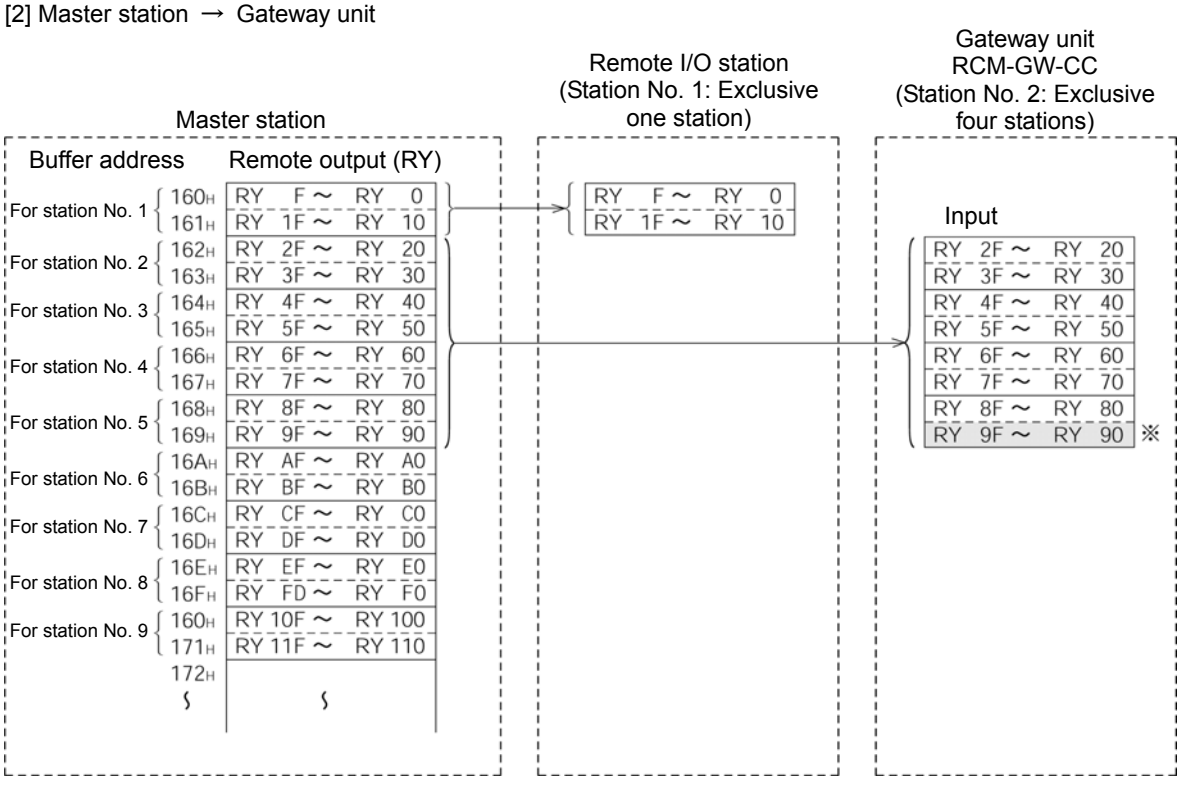
The following shows an example that a remote I/O exclusive one station is set to the station No.1 and gateway unit is set to the station No.2.

## (1) Remote I/O

[1] Master station ← Gateway unit



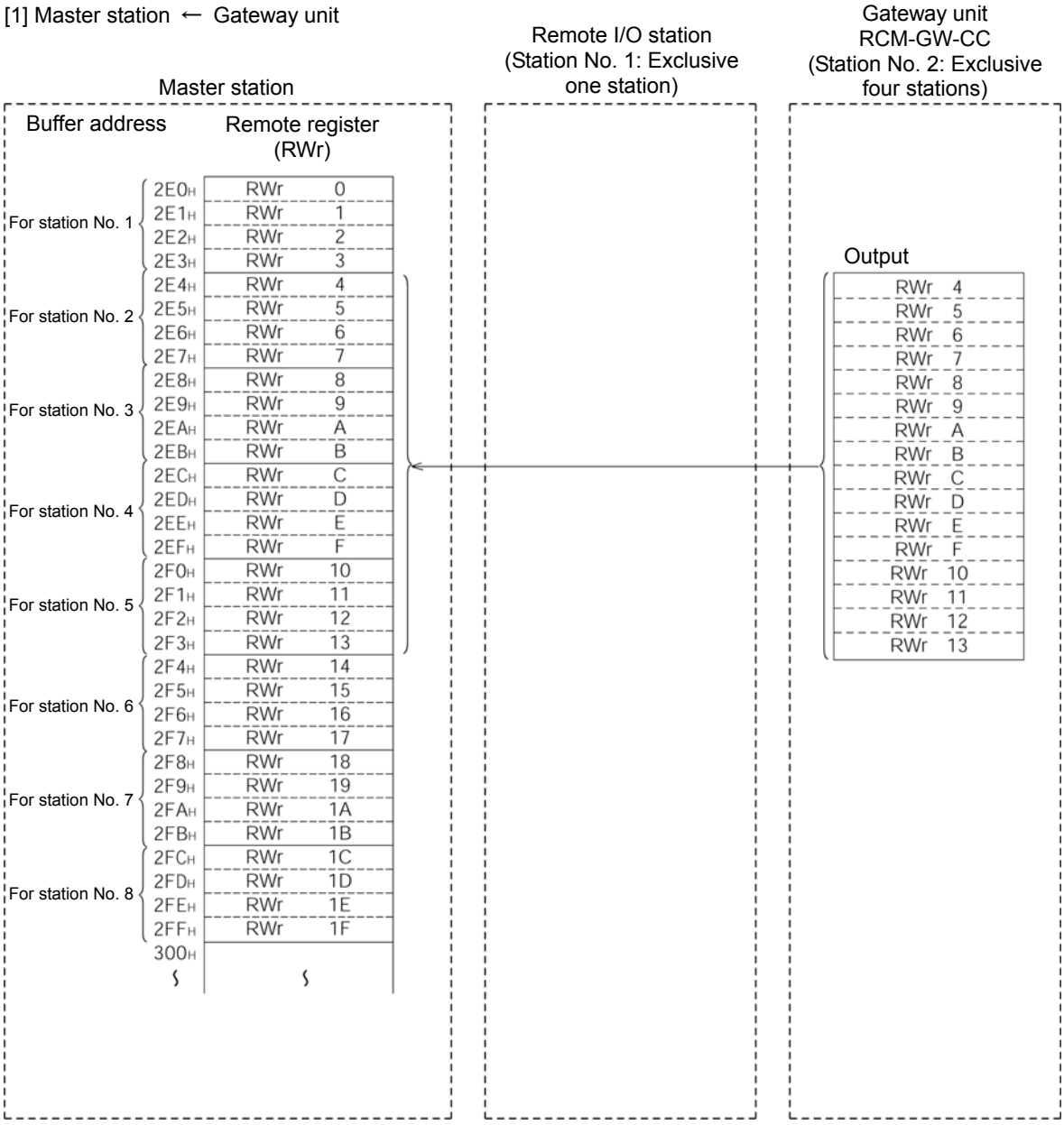

[2] Master station → Gateway unit



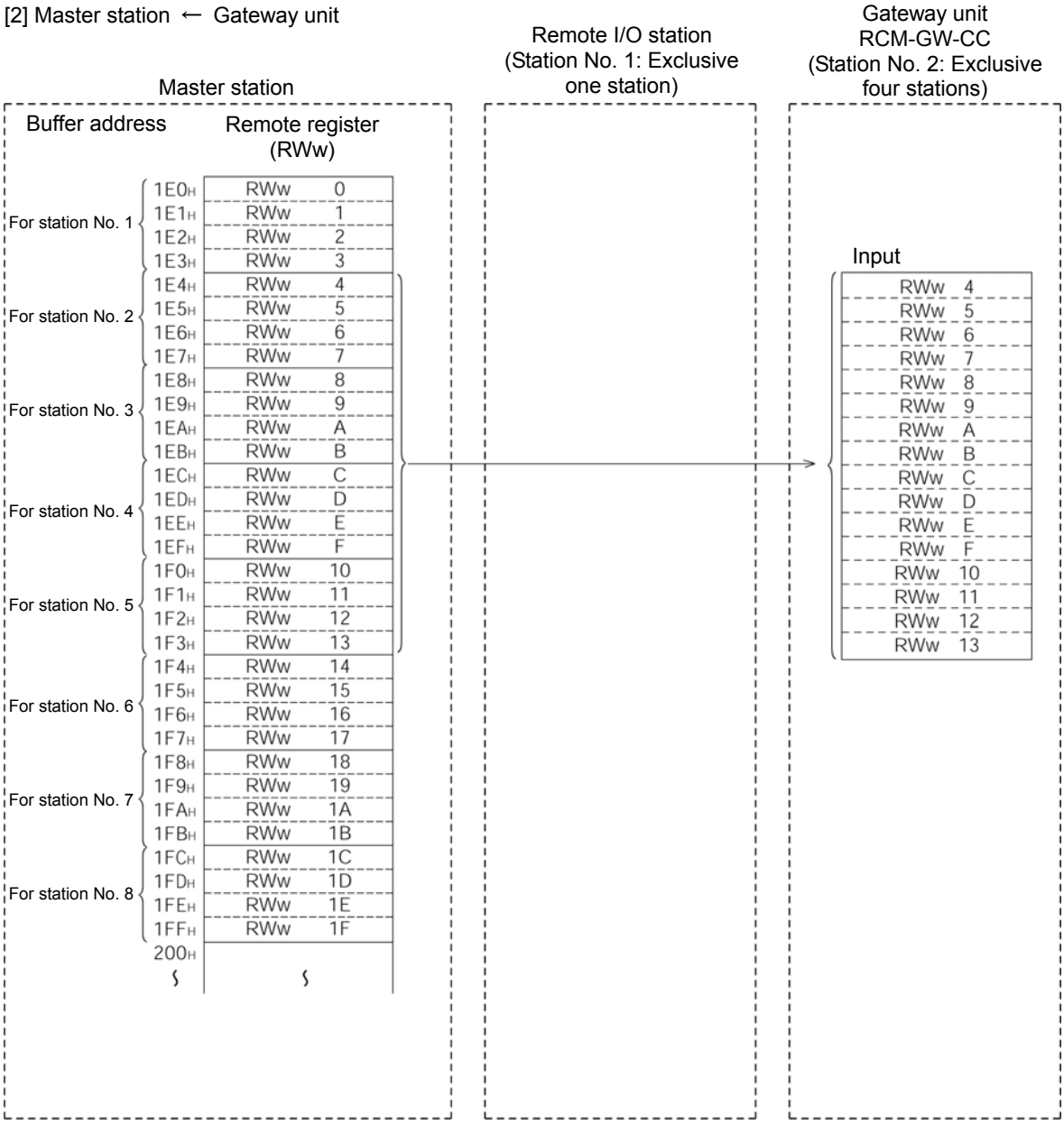

* Not used for the system area.

## (2) Remote register

[1] Master station ← Gateway unit



[2] Master station ← Gateway unit



## 8.4. CSP file

When using GX Configurator –CC (Mitsubishi Electric), download the following CSP file from our website.

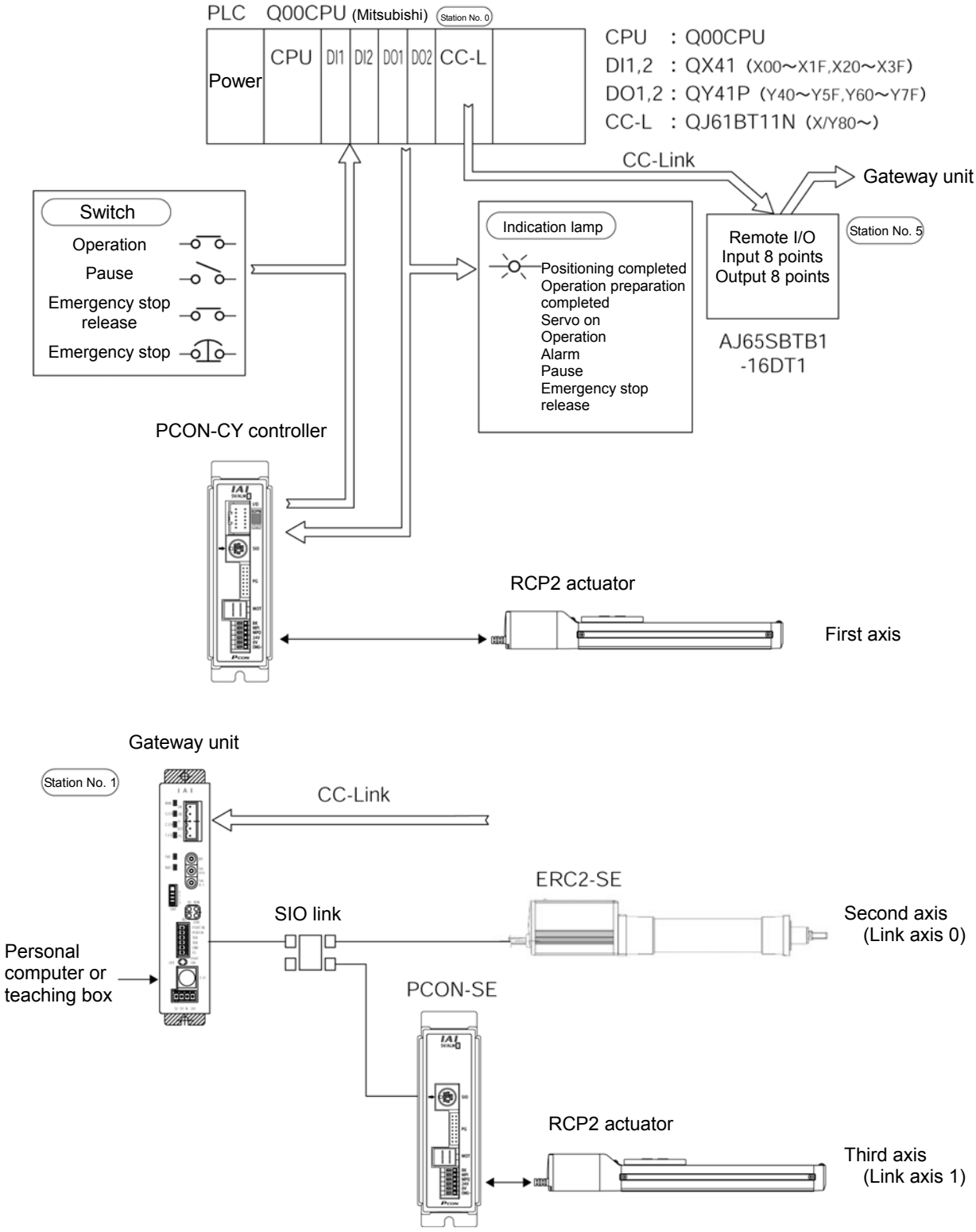
Website http://www.iai-robot.co.jp

To download it, open the “File for field network setting” from the “Download & Support” menu on the website to select the CSP file.

For how to set the remote station (CC-Link gateway unit) to the master station, refer to the Operation Manuals for the master station, PLC to be mounted and peripheral equipment.

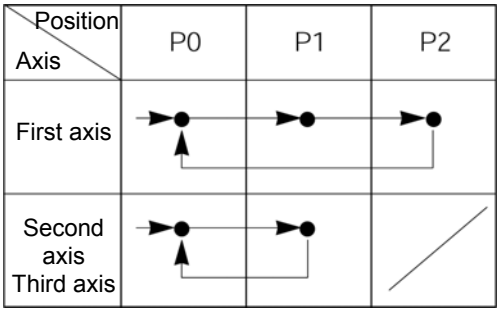
# 9. CC-Link operation case

## 9.1 Outline of configuration



## 9.2 Actuator operating pattern

Prepare position tables for all of the three axes, and designate position No. from the PLC to operate.




## 9.3 Various settings on SIO link side

### (1) Setting of SIO link

[1] Connect personal computer (supporting software) or teaching box to the gateway unit and turn ON the port switch.
(Note) Perform SIO link only on axis to be set. In other words, connect only axis to be set to the four-way junction. Connect and disconnect the connector sequentially for every setting.
[2] Start the personal computer supporting software.
[3] Click the “Set (S)” → “Controller setting.”
[4] Click the “Axis No. assignment (N).”
[5] Axis No. assignment table appears, then set No.
[6] Click the “OK,” then “ESC.”
[7] Connect and disconnect the SIO link cable to set the next axis No.
[8] When ended, finally connect all axes to the SIO link.

### (2) Setting of SIO communication speed

Set parameters for the SIO communication speed subsequently from the status of (1).
[1] Restart the personal computer supporting software, then SIO link axis information (0 and 1 at this time), and confirm them.
[2] Click the “Parameter (P)” → “Edit (E).”
[3] Select the axis 0 → click the [ > ] → click the [ OK ].
[4] Parameter screen appears, then set the No. 16 SIO communication speed to 230400 (230.4kbps), transmit it to the controller and close with [ × ].
[5] Select the axis 1 at [2] to [4] to execute.

### (3) Creation of position table

Start from the personal computer software initial screen subsequently from (2).

[1] Click the [Position (T)] → [Edit/Teach (E)].
[2] Select the axis 0 → click the [ > ] → click the [ OK ].
[3] Position data edit screen for the axis 0 appears, then enter the data.
[4] Transmit the data to the controller, and exit the edit screen with [ × ].
[5] Select the axis 1 at [1] to [4] to execute.
[6] Exit the personal computer supporting software.
[7] Disconnect the personal computer cable from the gateway unit, and turn OFF the port switch.

**⚠ CAUTION**

After connecting the personal computer (supporting software) or the teaching box to the gateway unit and performing various settings for the SIO link axis and creation of position table, be sure to set the MANU operation mode to the <Monitor mode 2> to exit.
Otherwise, the controller will not be started from the PLC.
For details, refer to the Operation Manual for the personal computer supporting software or the teaching box.

## 9.4 Setting of gateway unit

### (1) Mode setting for gateway unit

As operation is performed in the position No. designated mode, set the mode setting switch (SW1) as follows.

1: OFF 2: ON 3: OFF 4: OFF

### (2) Setting of node address and communication speed for gateway unit

Station No. =1

Communication speed = 625kbps

Since the setting is as above, set the DIP switch as follows.

Station No.

SA × 10 :0

SA × 1 : 1

Baud rate BR: 1

## 9.5 Setting on CC-Link master side

For settings on the master side, there are hardware settings and parameters setting to build a network.

### 9.5.1 Hardware setting

Station No. setting is as follows in this operational example.

| Station No. 0 | Station No. 1 | Station No. 2 | Station No. 3 | Station No. 4 | Station No. 5 |
|---|---|---|---|---|---|
| Master unit QJ61BT11N | Gateway unit (Position No. designated mode, Exclusive four stations) | | | | Remote I/O AJ65SBTB1-16 DT1 |

### (1) Station No. setting for master unit Station No. 00

### (2) Communication speed and mode setting

As the communication speed is set to 625kbps in the online mode, set the rotary SW to 1.

* After setting in (1) and (2), turn ON and OFF the power, or reset the CPU.
  For details, refer to the Operation Manual for the PLC.
* For the remote I/O (AJ65STTB1), also set the station No. to 5 and communication speed to 625kbps.

## 9.5.2 Parameter setting

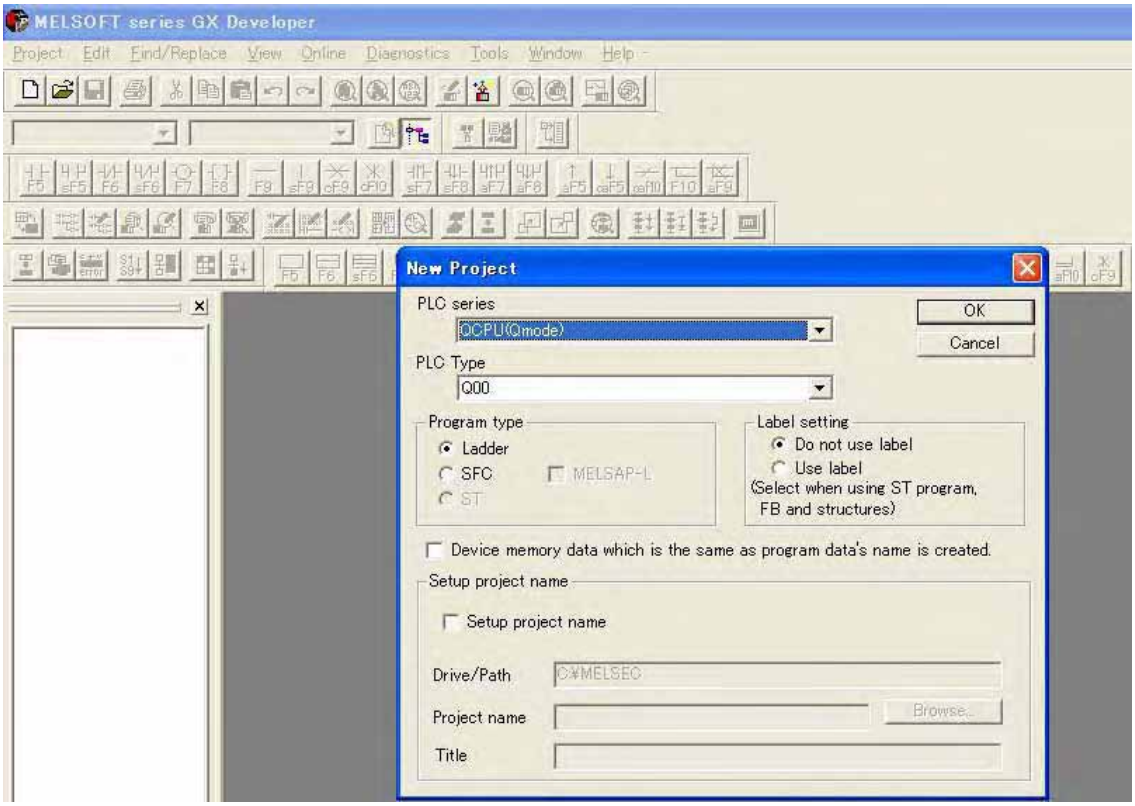
In order to make the CC-Link operate, it is necessary to set network parameters and automatic refresh parameters. Set them by GX-Developer, and write into the parameter area for the PLC-CPU.

- Network parameters
  These parameters are set to the master station, and there is a CC-Link connected unit number, communication retry times and station information, etc.
- Automatic refresh parameters
  These parameters are for automatically refreshing master station buffer memory (such as RX/RY) and PLC-CPU device (such as X/Y/M/D), and set to the CPU.

The following shows how to set and a setting example. For details, refer to the Operation Manual for the PLC.

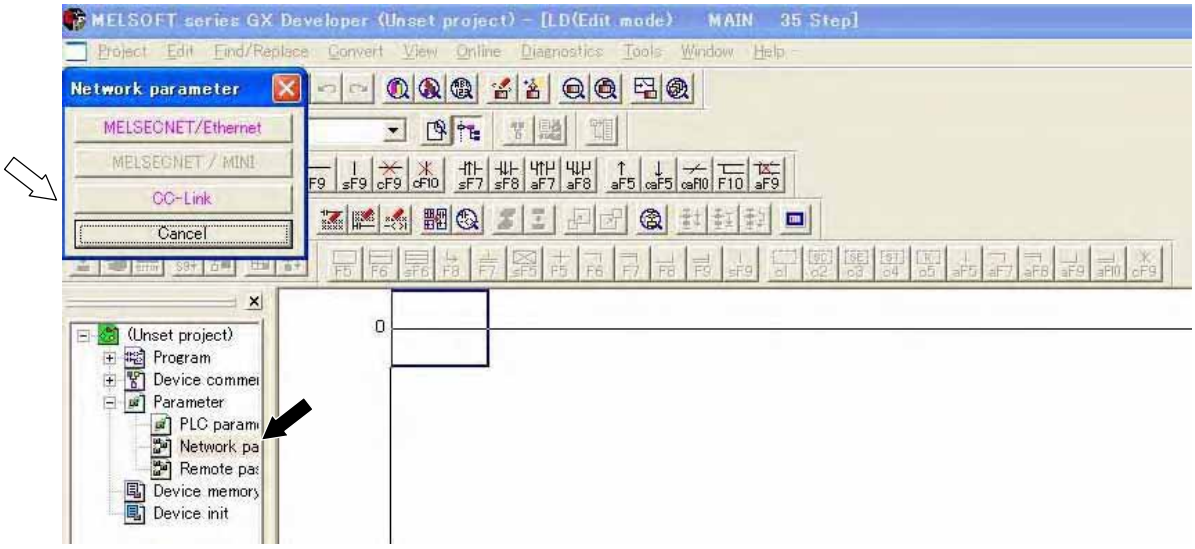
### (1) Starting GX-Developer

Start the GX-Developer, and click the [Project]→[New project], then the following screen appears.
Set the PC series to QCPU (Q mode), and the PC type to Q00, then click the OK button.

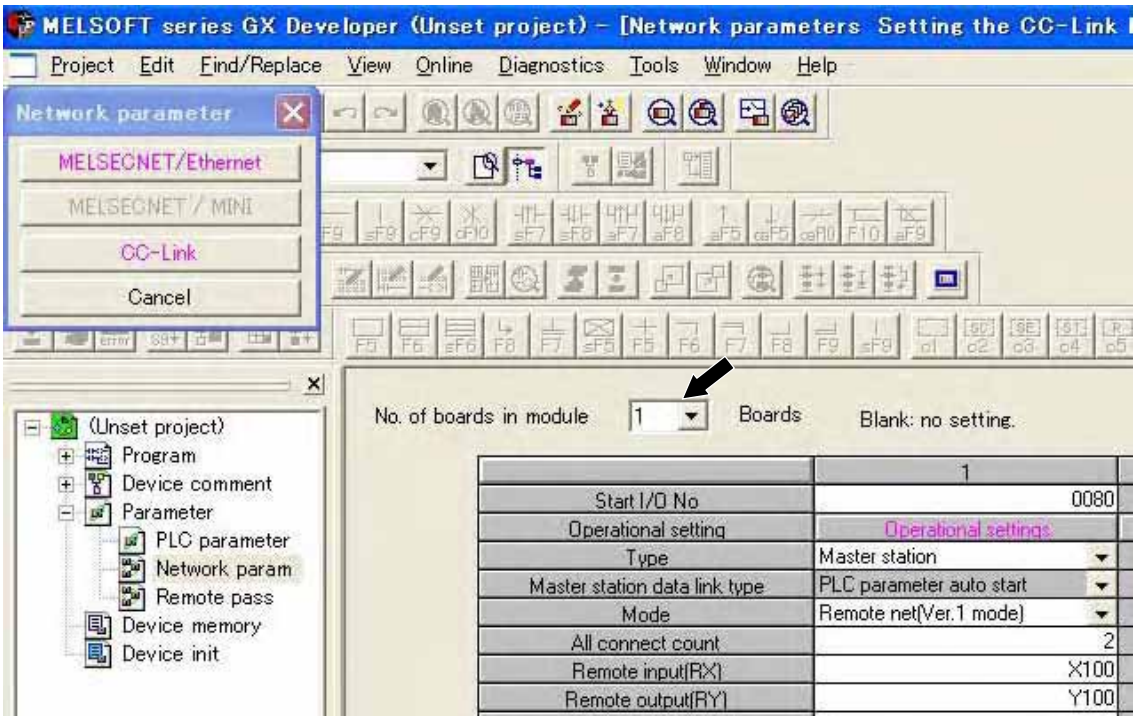


## (2) Parameter setting

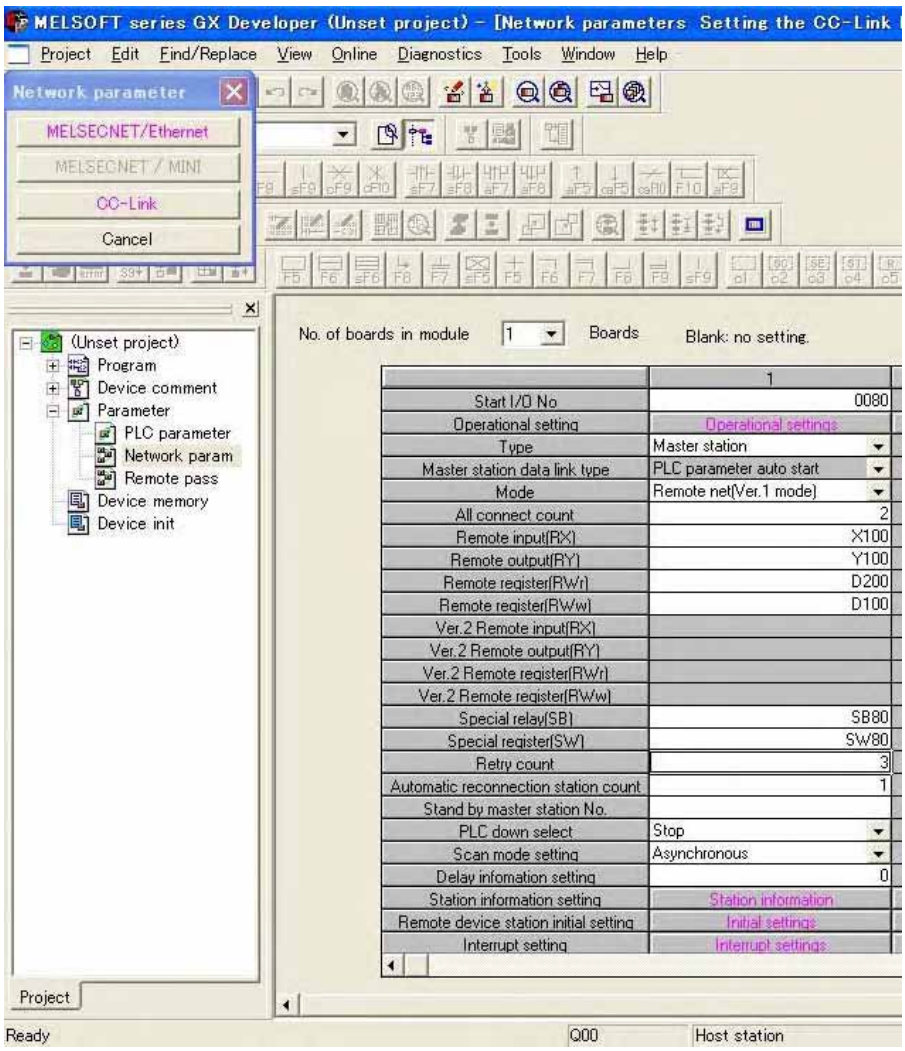
[1] Double-click the [Network param] from the project data list, and network parameter select dialog box appears, then click the CC-Link button.




[2] Network parameter setting screen for CC-Link appears, then set the unit sheet number to one. (Master station is one sheet in this operational example.)



[3] Set parameters as shown below from now. Mode setting should be “Remote net [Ver. 1 mode].”

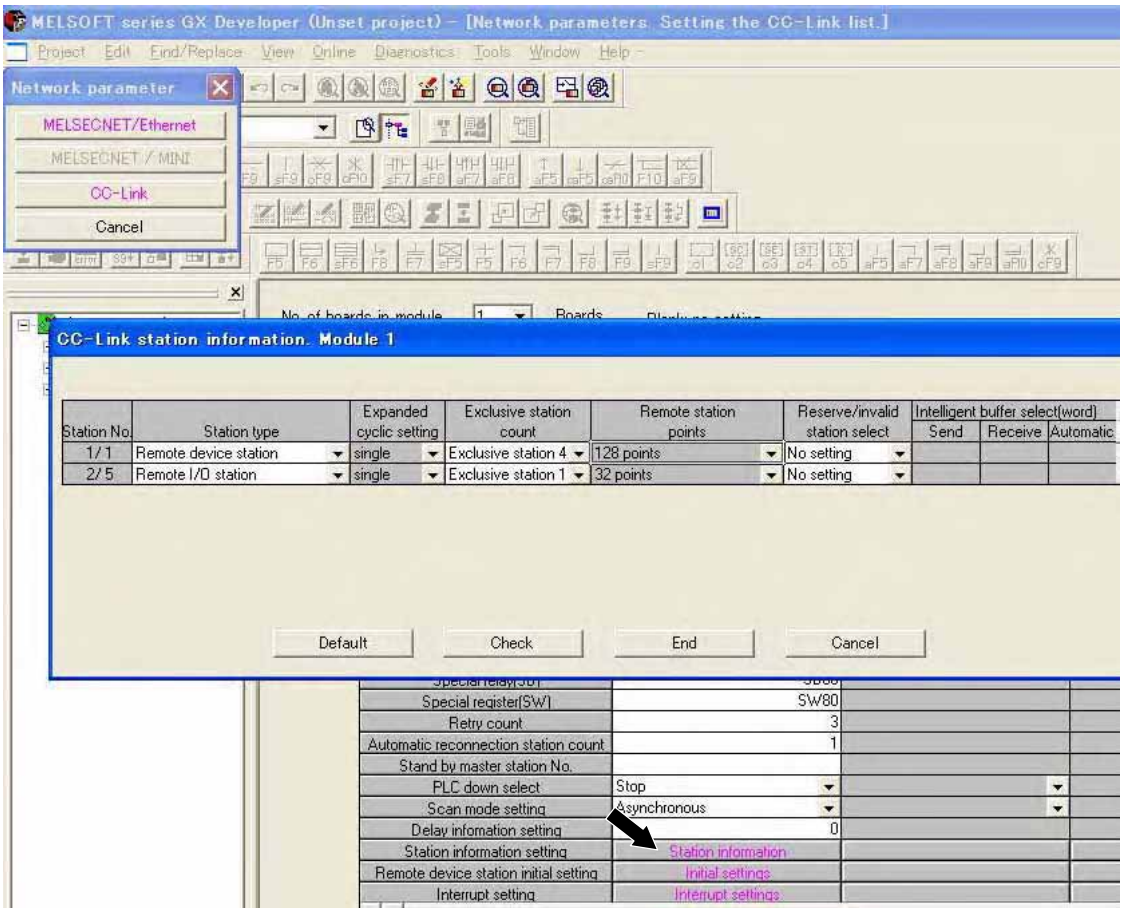



Parameters different from initial setting are as follows.

- “Start I/O No” ····· I/O address of master unit, 0080
- “All connect account” ···· Number of remote stations, 2
- “Remote input (RX) Refresh device” ····· X100
- Remote output (RY) ····· Y100
- Remote register (RWr) ····· D200
- Remote register (RWr) ····· D100
- Special relay (SB) ····· SB80
- Special register (SW) ····· SW80

Install master station buffer memory to an internal device of the PLC-CPU.

[4] Click the Station information button to display the station information unit 1 edit screen, and set the remote station as follows, then click the End button at the lower part of the screen.



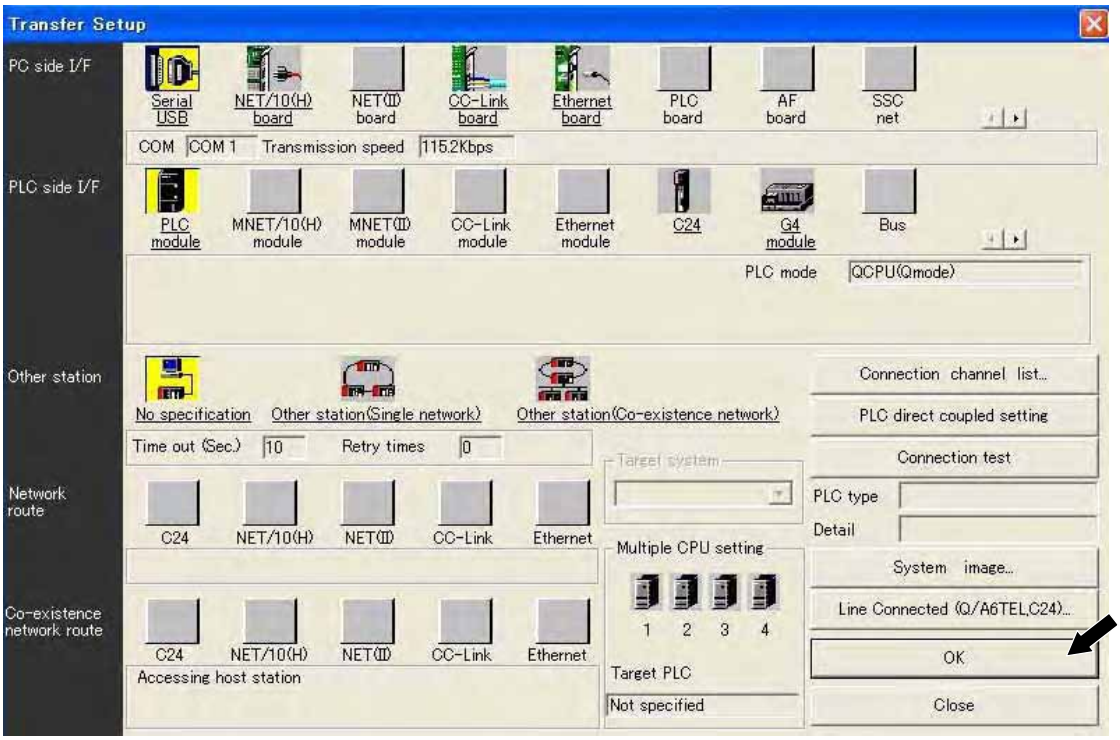

- The station No. 1 is the gateway unit and is used in the position No. designated mode, therefore, it becomes the remote device station exclusively four stations.
- The station No. 5 is remote I/O (AJ65SBTB1), and is a remote I/O station exclusively for one station.

[5] Save the project.

## (3) Writing parameters

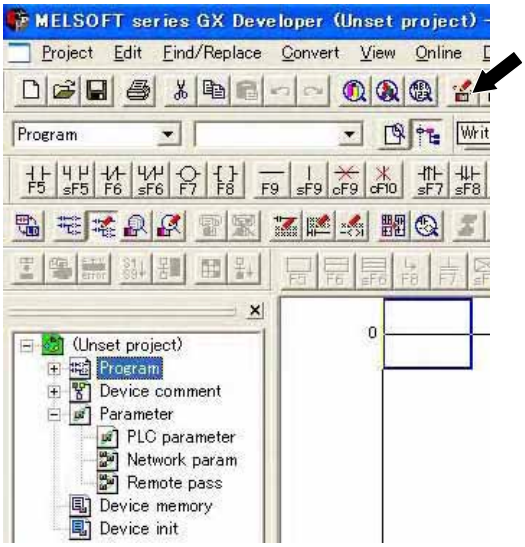
Write parameters set in (2) into the PLC.

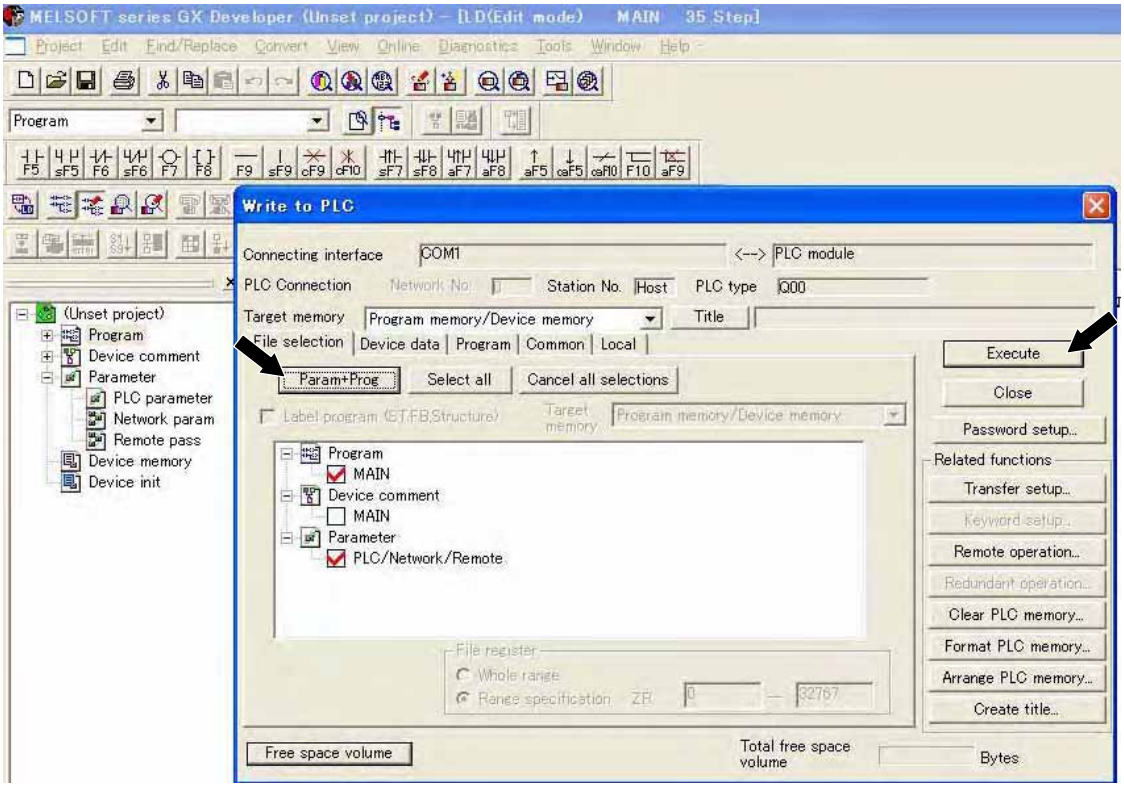
[1] Transfer setup
Click the [Online (O)]→[Transfer setup (C)] menu, then the following transfer setup designated screen appears.




I/F PC side: Serial USB
I/F PLC side: PLC module
Other station: No specification
Check the above setting, and click OK.

[2] Writing
Click write to PLC tab to display the following PLC write screen.

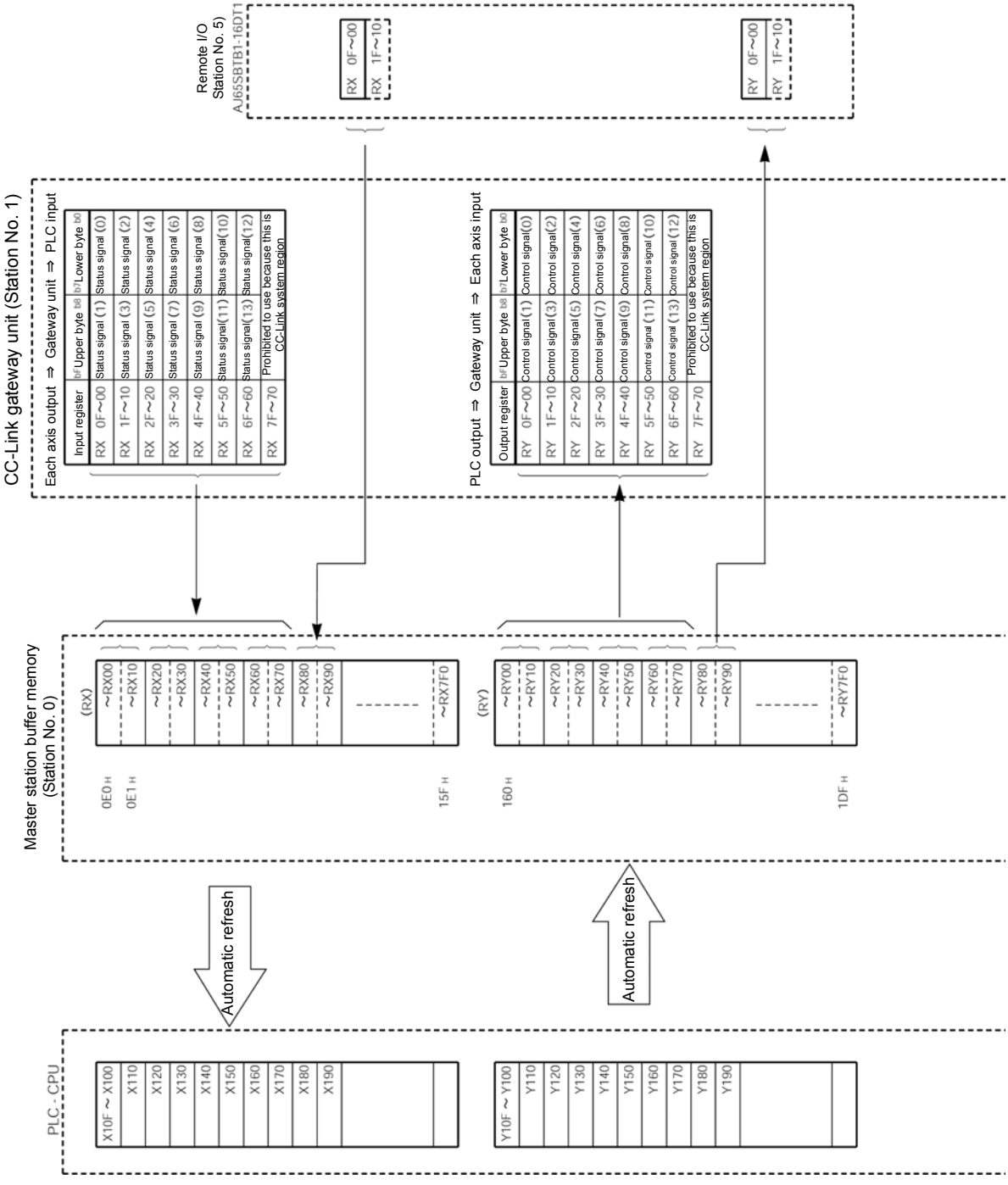


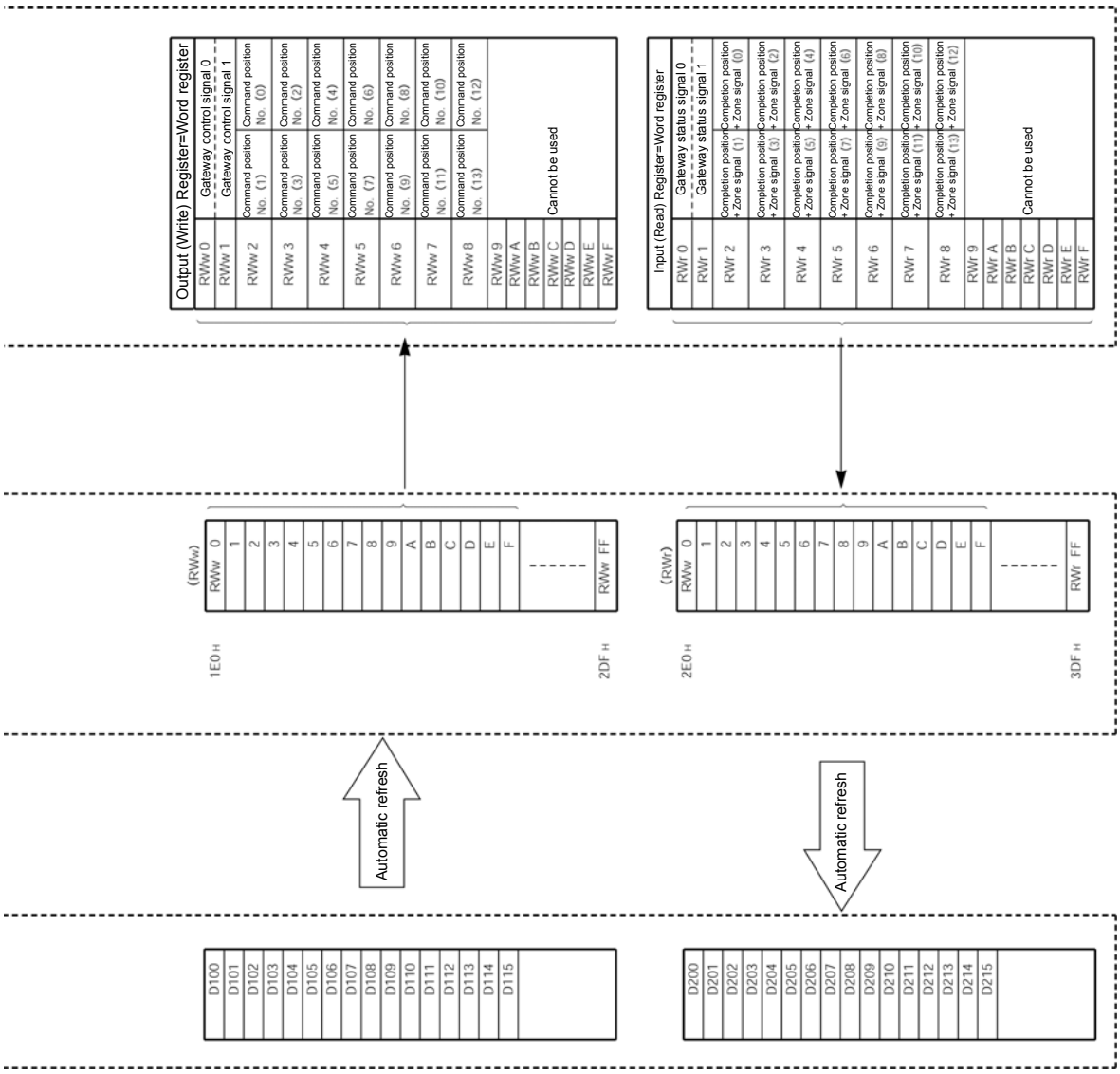




Click [Param+Prog] button on the PLC write screen, and select the “MAIN” for program and the “PC/Network” for parameter.
Click [Execute] button, then write is performed, and when it is completed, dialog box for confirmation appears. Click [OK] → [Close], and then write is completed.

[3] PLC-CPU reset
Parameters become effective by resetting the CPU for the PLC.

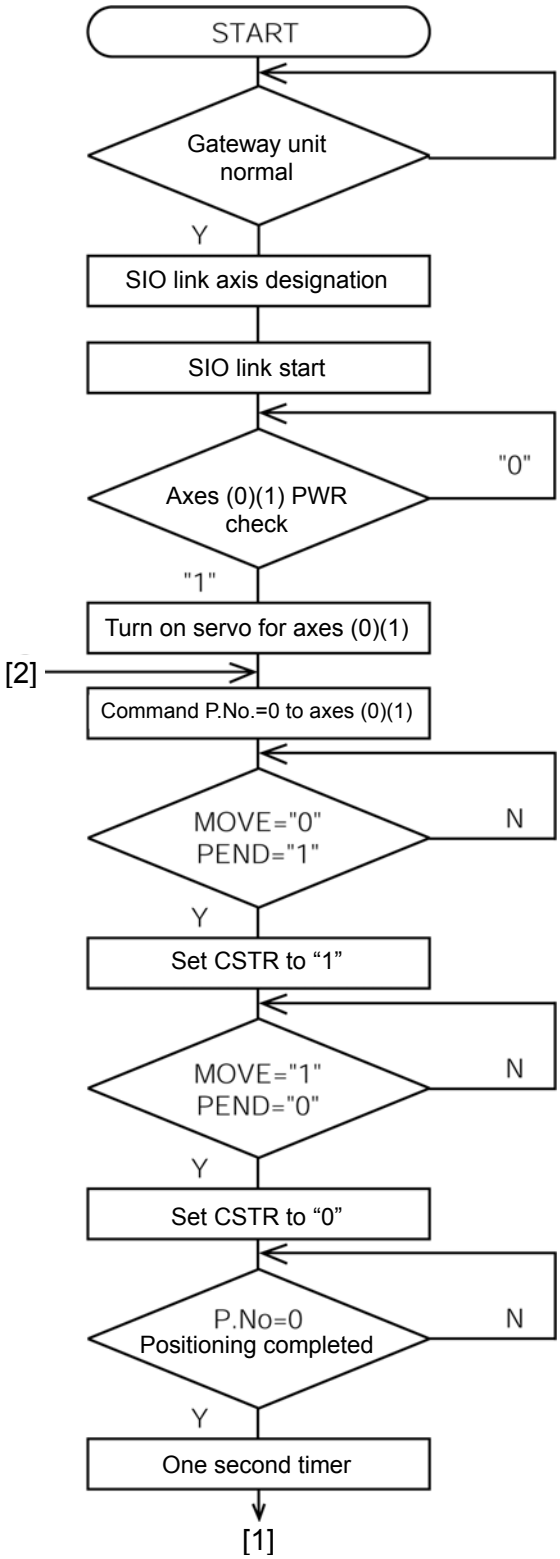
## 9.6 Address Correlation Diagram

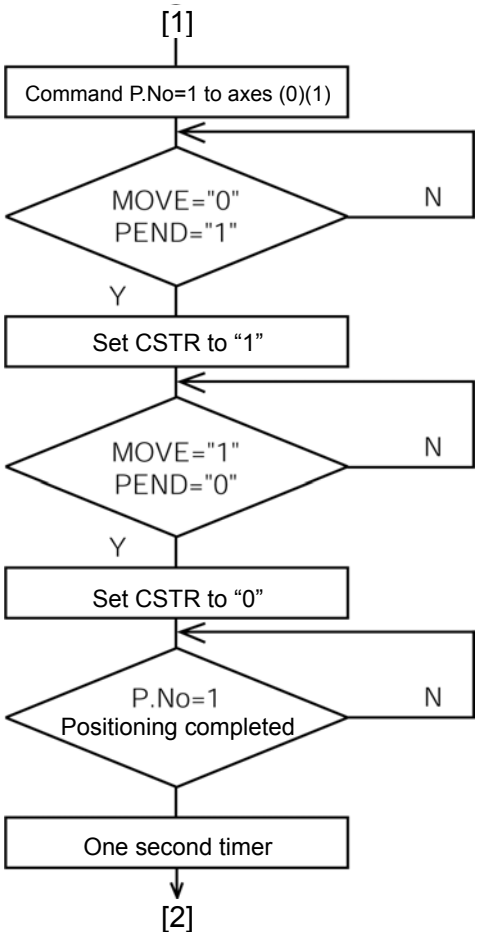



Output (Write) Register=Word register
RWw 0 Gateway control signal 0
RWw 1 Gateway control signal 1
RWw 2 Command position No. (1) Command position No. (0)
RWw 3 Command position No. (3) Command position No. (2)
RWw 4 Command position No. (5) Command position No. (4)
RWw 5 Command position No. (7) Command position No. (6)
RWw 6 Command position No. (9) Command position No. (8)
RWw 7 Command position No. (11) Command position No. (10)
RWw 8 Command position No. (13) Command position No. (12)
RWw 9 RWw A RWw B RWw C RWw D RWw E RWw F Cannot be used
Input (Read) Register=Word register
RWr 0 Gateway status signal 0
RWr 1 Gateway status signal 1
RWr 2 Completion position + Zone signal (1) Completion position + Zone signal (0)
RWr 3 Completion position + Zone signal (3) Completion position + Zone signal (2)
RWr 4 Completion position + Zone signal (5) Completion position + Zone signal (4)
RWr 5 Completion position + Zone signal (7) Completion position + Zone signal (6)
RWr 6 Completion position + Zone signal (9) Completion position + Zone signal (8)
RWr 7 Completion position + Zone signal (11) Completion position + Zone signal (10)
RWr 8 Completion position + Zone signal (13) Completion position + Zone signal (12)
RWr 9 RWr A RWr B RWr C RWr D RWr E RWr F Cannot be used
(RWw)
RWw 0 1 2 3 4 5 6 7 8 9 A B C D E F RWw FF
1E0H
2DFH
(RWr)
RWw 0 1 2 3 4 5 6 7 8 9 A B C D E F RWr FF
2E0H
3DFH
Automatic refresh
Automatic refresh
D100 D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113 D114 D115
D200 D201 D202 D203 D204 D205 D206 D207 D208 D209 D210 D211 D212 D213 D214 D215

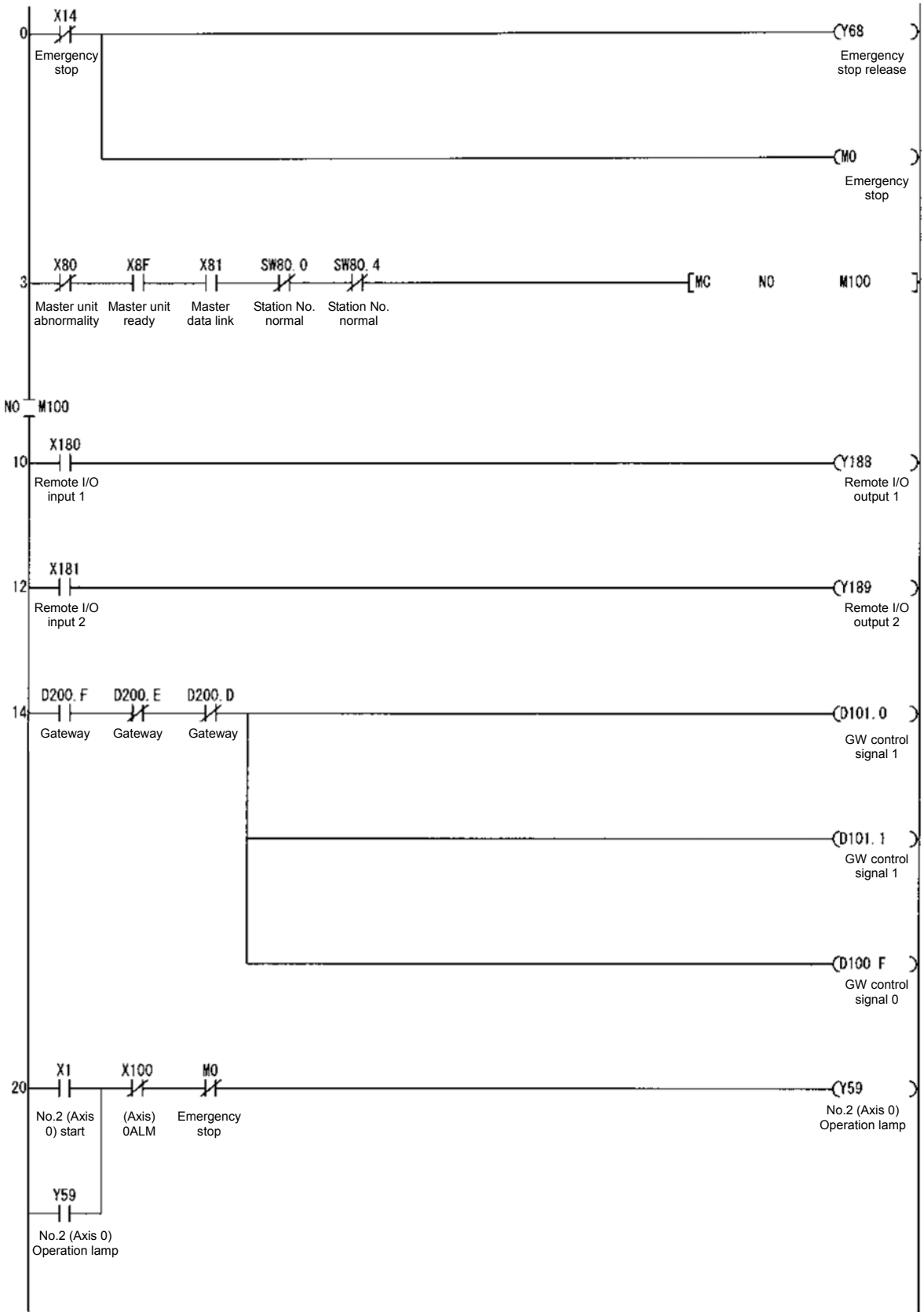
## 9.7 Ladder Sequence Flowchart

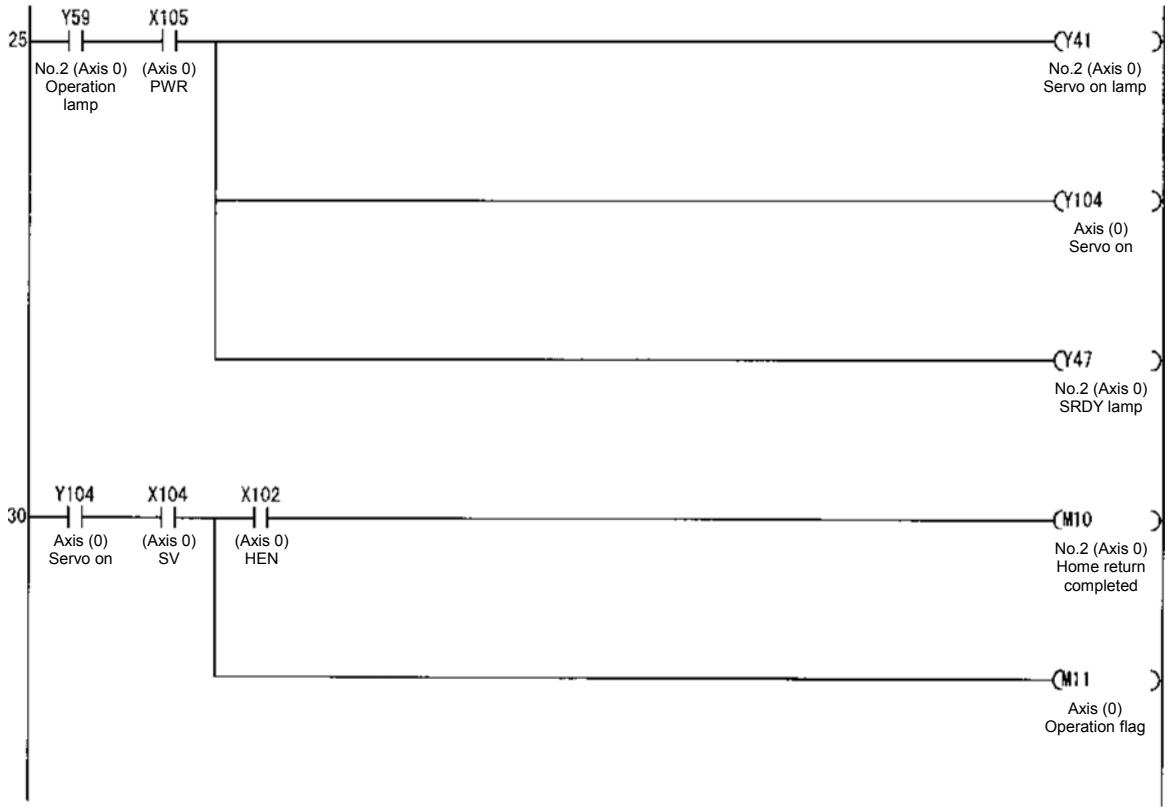
Operation flowchart for the second axis (axis 0) and third axis (axis 1) which are DeviceNet slave axes is as follows. Insides of parentheses are SIO link axis Nos.

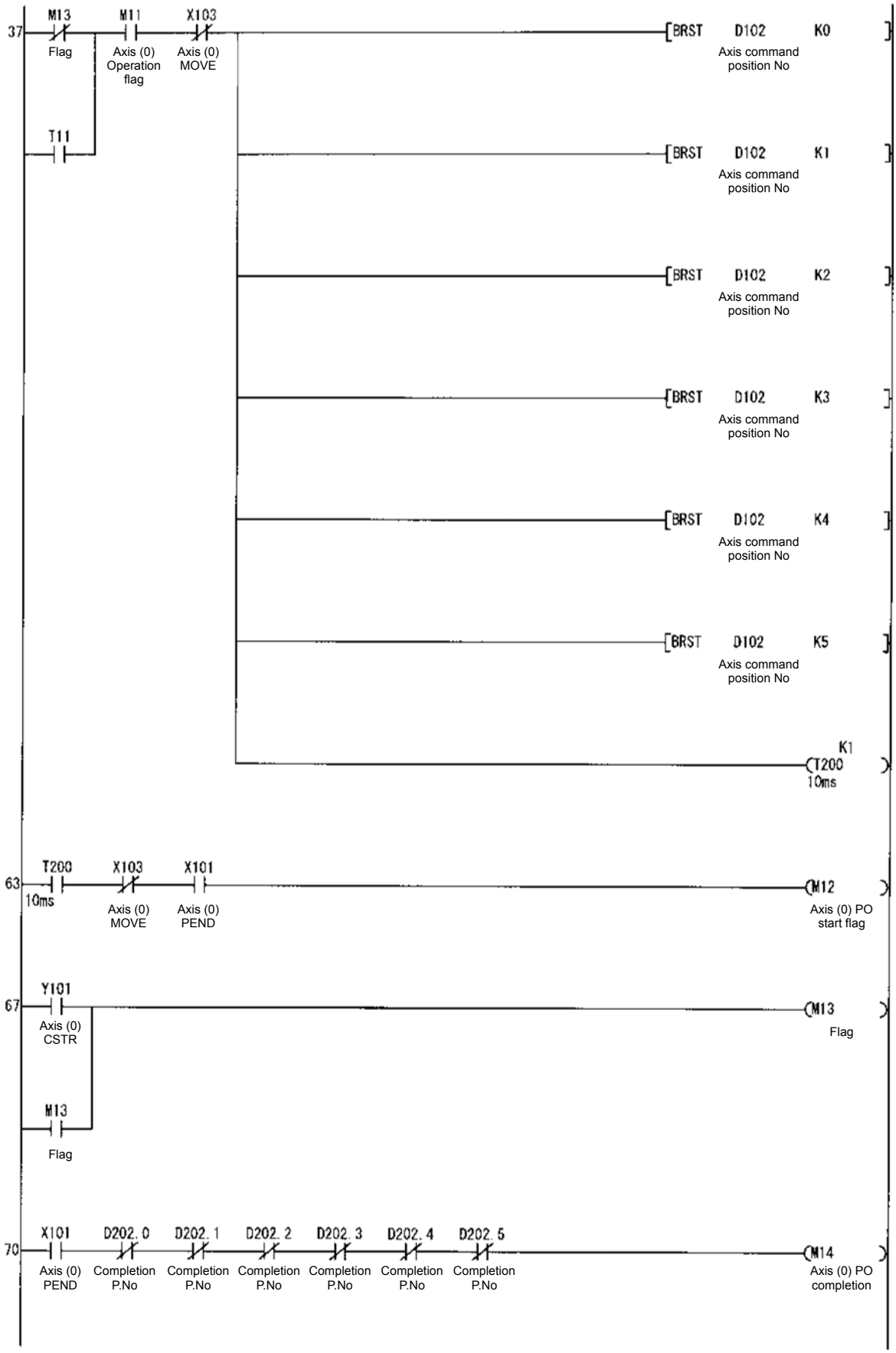


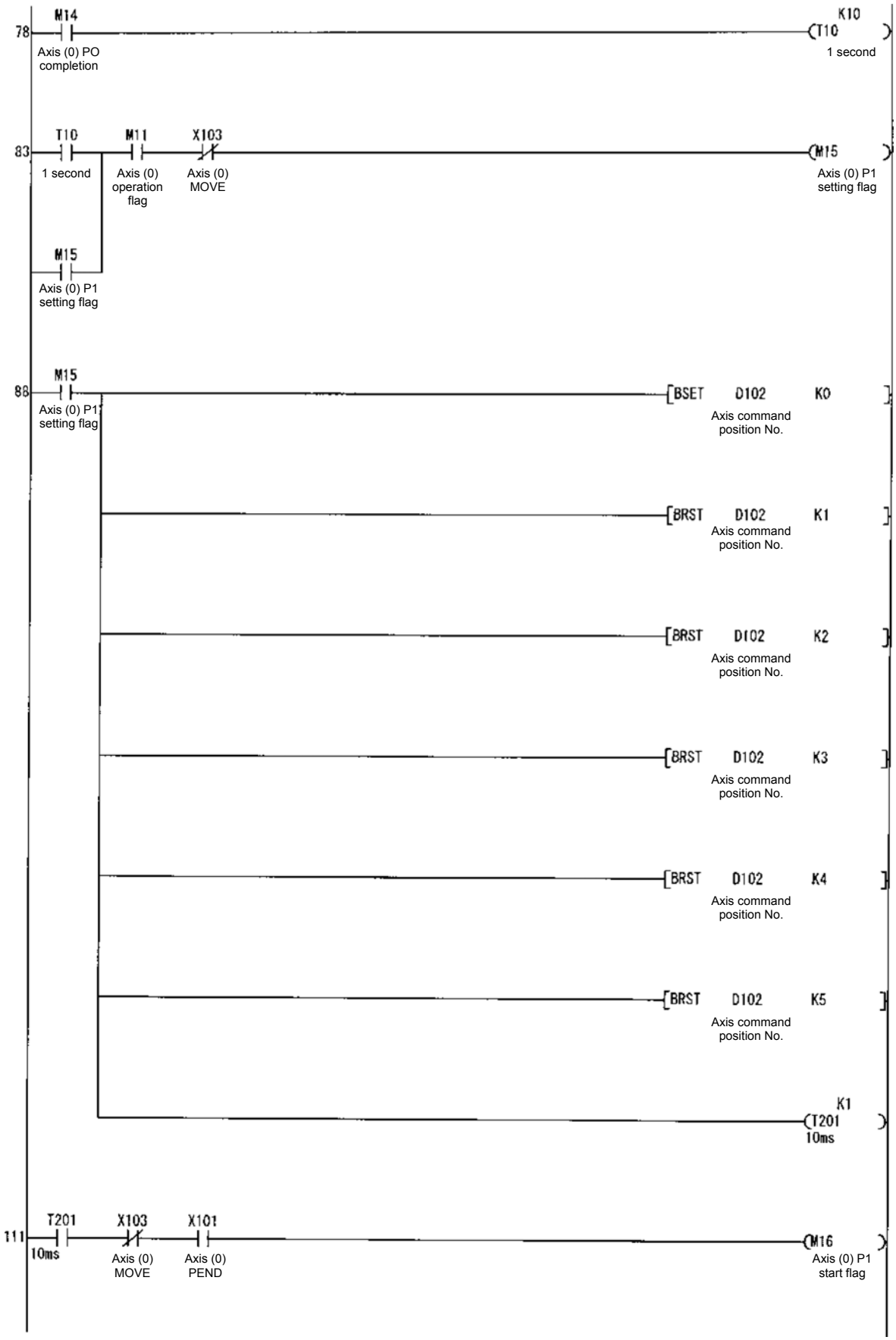

[1]
Command P.No=1 to axes (0)(1)
MOVE="0"
PEND="1"
N
Y
Set CSTR to “1”
MOVE="1"
PEND="0"
N
Y
Set CSTR to “0”
P.No=1
Positioning completed
N
One second timer
[2]

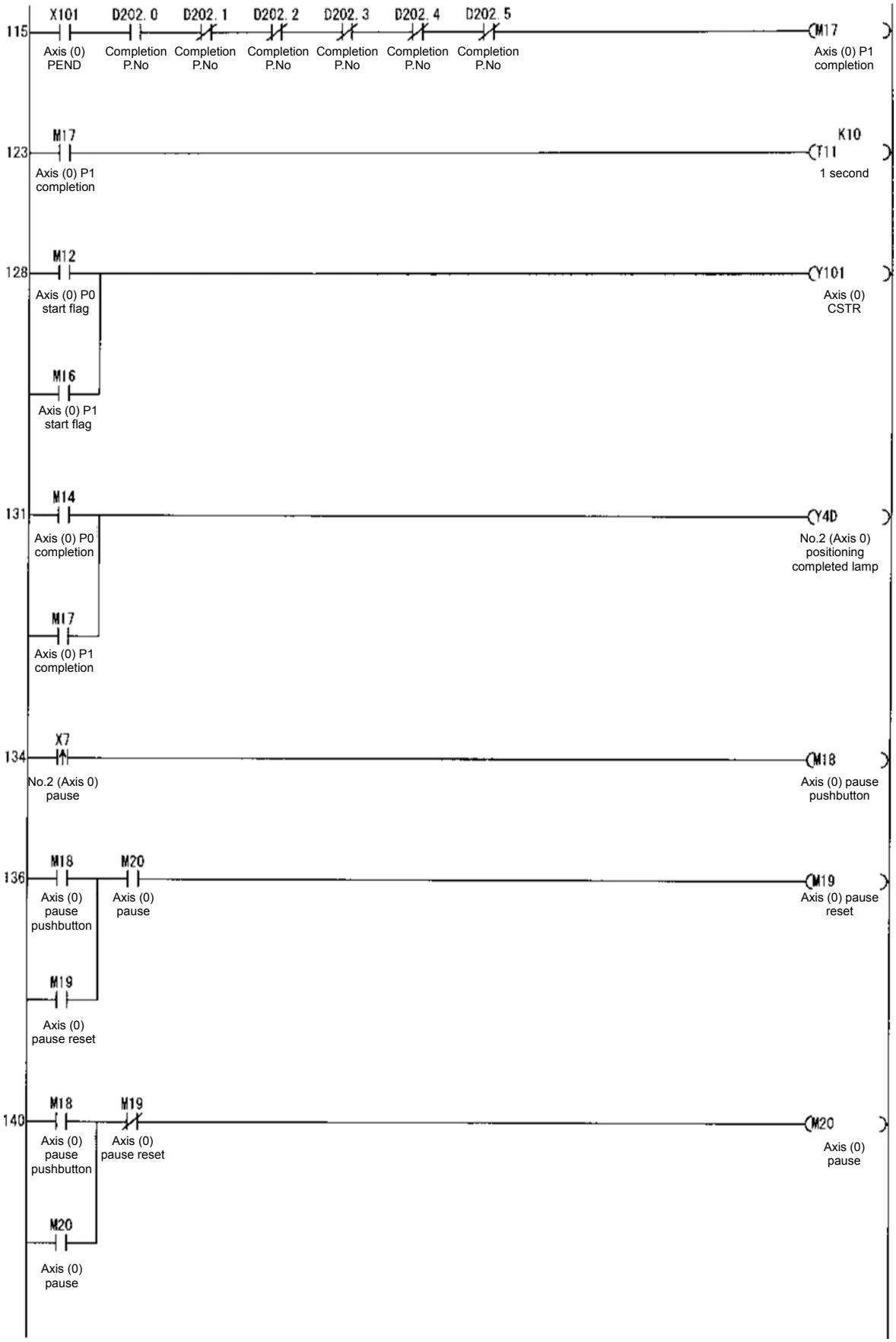
## 9.8 Ladder Sequence

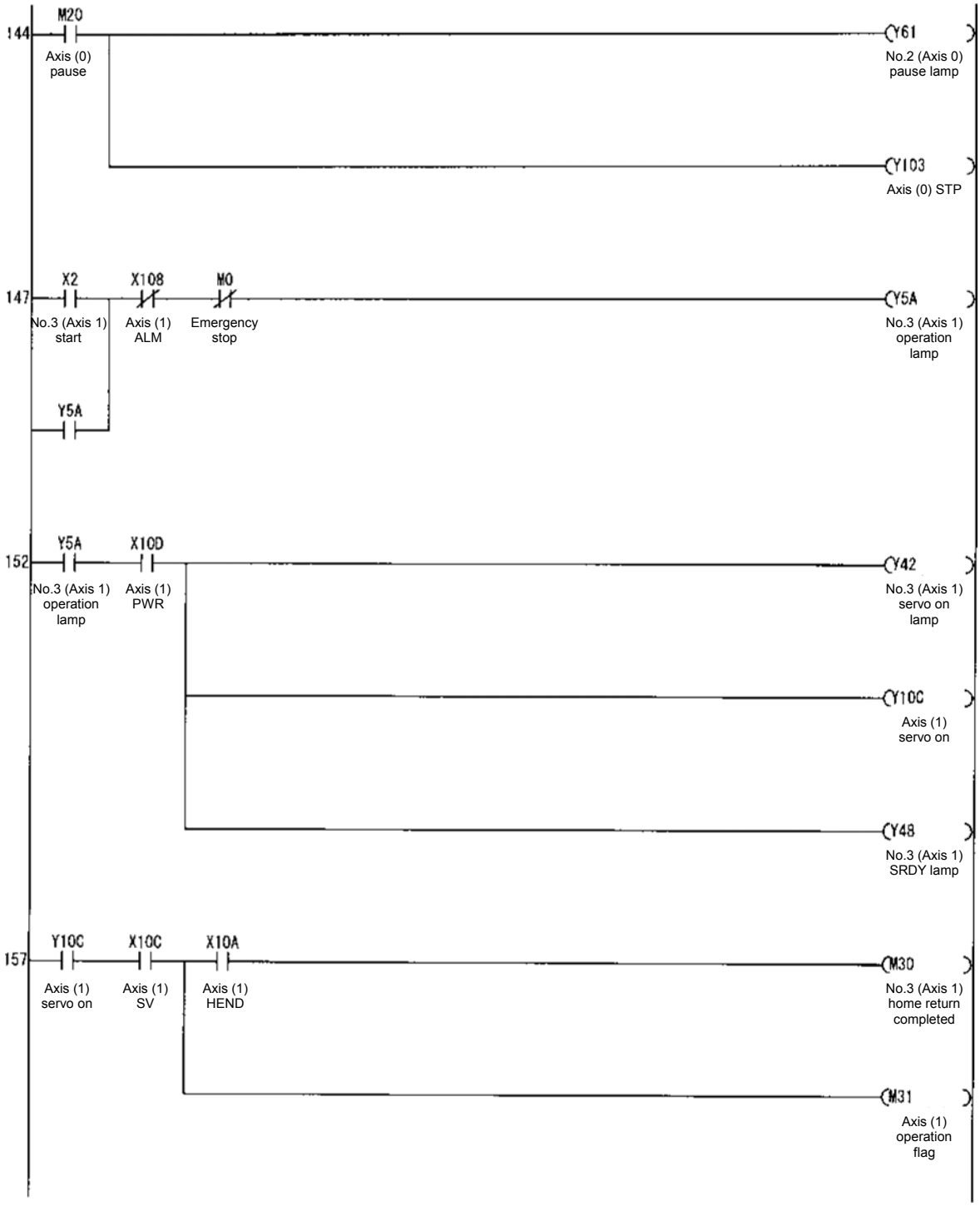


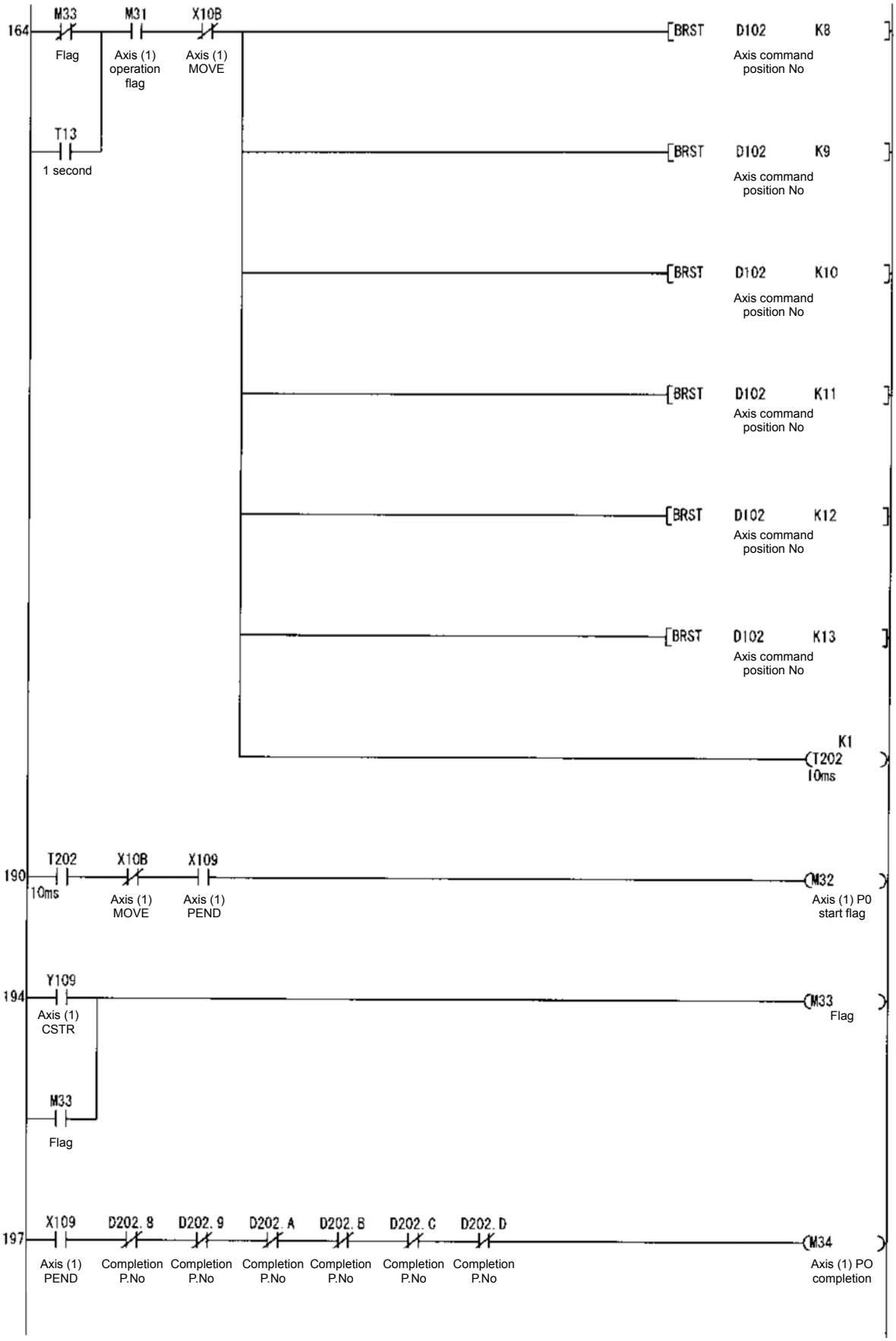

25
Y59
No.2 (Axis 0) Operation lamp
X105
(Axis 0) PWR
Y41
No.2 (Axis 0) Servo on lamp
Y104
Axis (0) Servo on
Y47
No.2 (Axis 0) SRDY lamp
30
Y104
Axis (0) Servo on
X104
(Axis 0) SV
X102
(Axis 0) HEN
M10
No.2 (Axis 0) Home return completed
M11
Axis (0) Operation flag

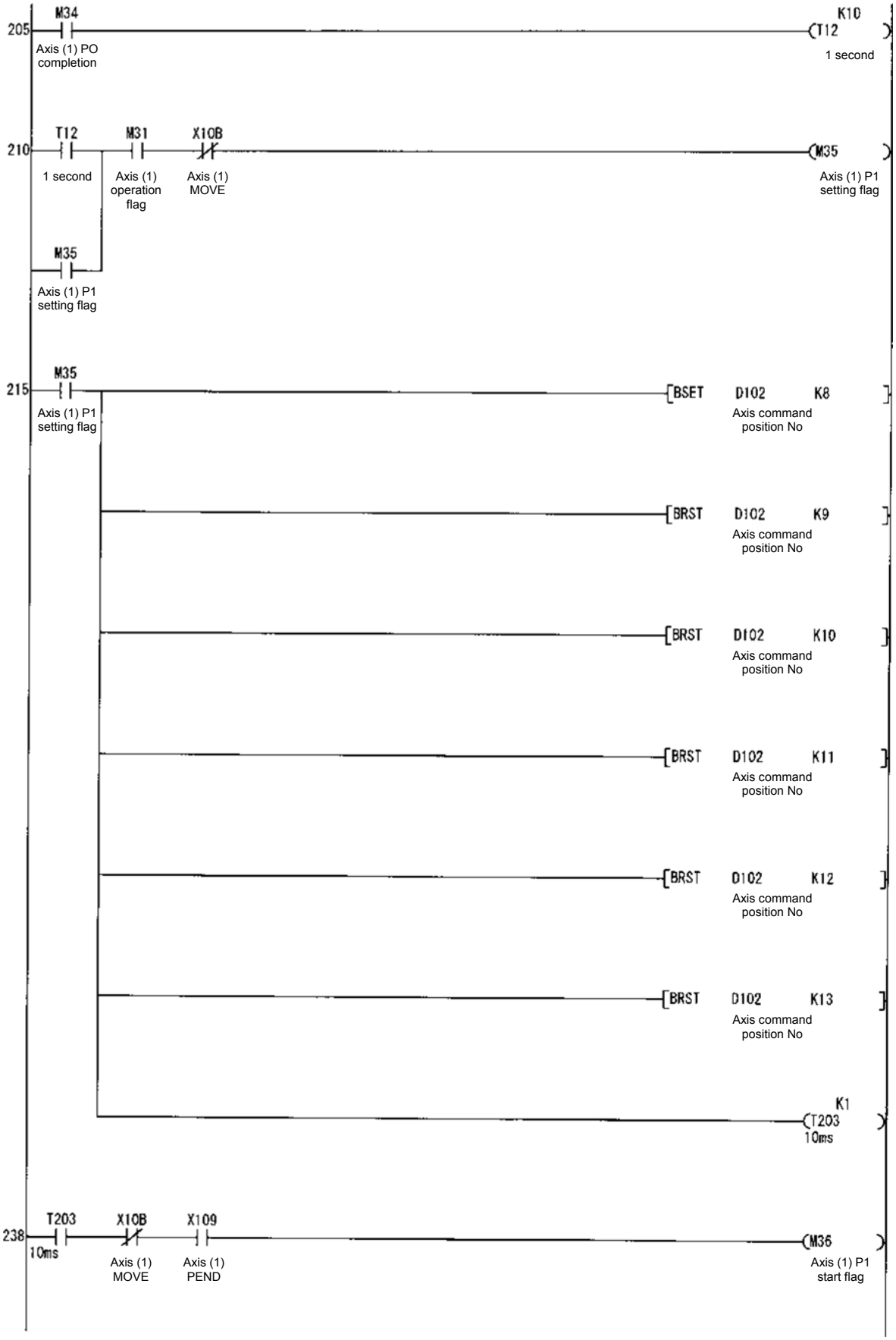

37
M13
Flag
M11
Axis (0) Operation flag
X103
Axis (0) MOVE
T11
BRST D102 K0
Axis command position No
BRST D102 K1
Axis command position No
BRST D102 K2
Axis command position No
BRST D102 K3
Axis command position No
BRST D102 K4
Axis command position No
BRST D102 K5
Axis command position No
K1
T200
10ms
63
T200
10ms
X103
Axis (0) MOVE
X101
Axis (0) PEND
M12
Axis (0) PO start flag
67
Y101
Axis (0) CSTR
M13
Flag
M13
Flag
70
X101
Axis (0) PEND
D202.0
Completion P.No
D202.1
Completion P.No
D202.2
Completion P.No
D202.3
Completion P.No
D202.4
Completion P.No
D202.5
Completion P.No
M14
Axis (0) PO completion

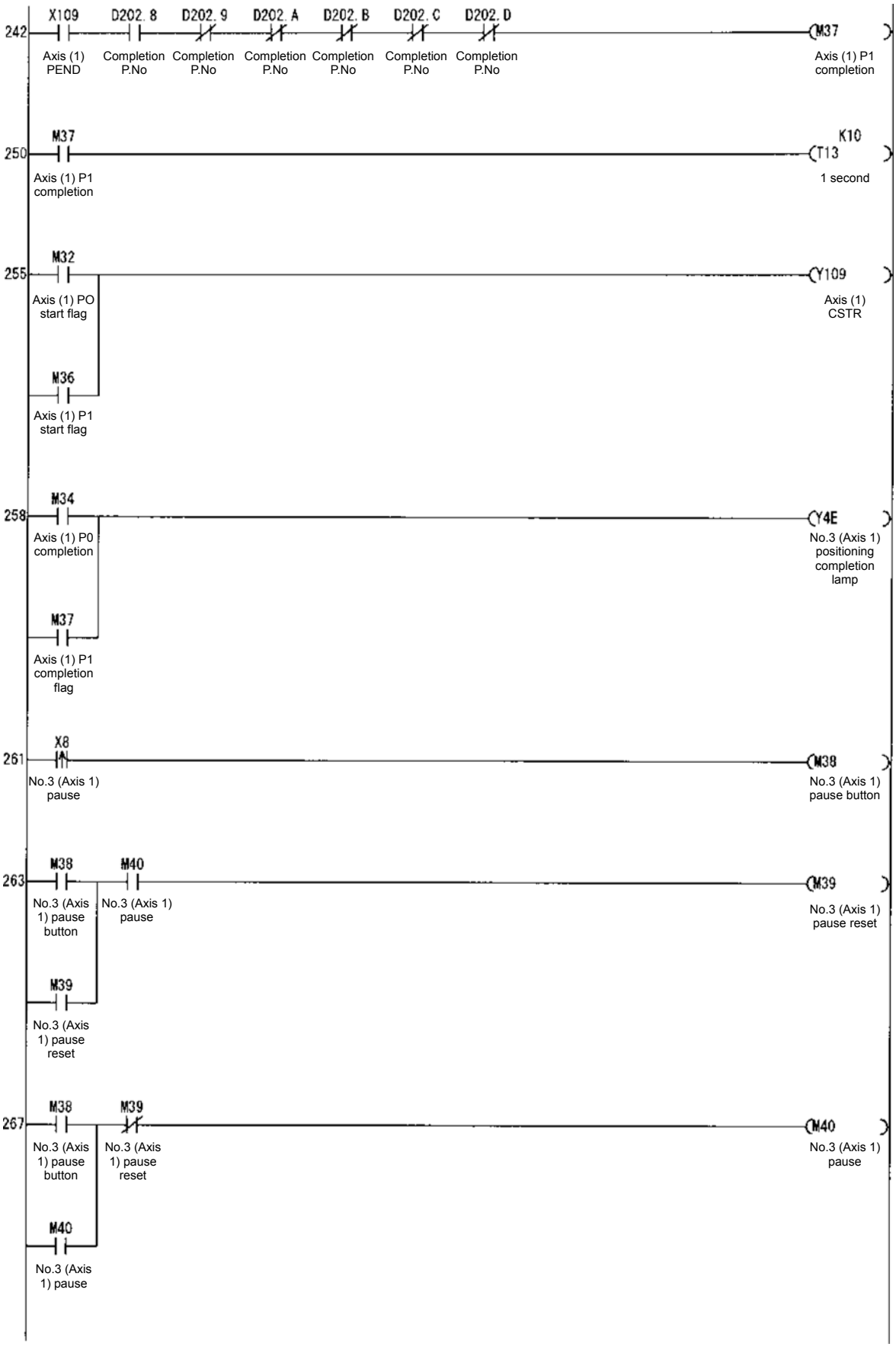

78
M14
Axis (0) PO completion
K10
T10
1 second
83
T10
1 second
M11
Axis (0) operation flag
X103
Axis (0) MOVE
M15
Axis (0) P1 setting flag
M15
Axis (0) P1 setting flag
88
M15
Axis (0) P1 setting flag
BSET D102 K0
Axis command position No.
BRST D102 K1
Axis command position No.
BRST D102 K2
Axis command position No.
BRST D102 K3
Axis command position No.
BRST D102 K4
Axis command position No.
BRST D102 K5
Axis command position No.
K1
T201
10ms
111
T201
10ms
X103
Axis (0) MOVE
X101
Axis (0) PEND
M16
Axis (0) P1 start flag

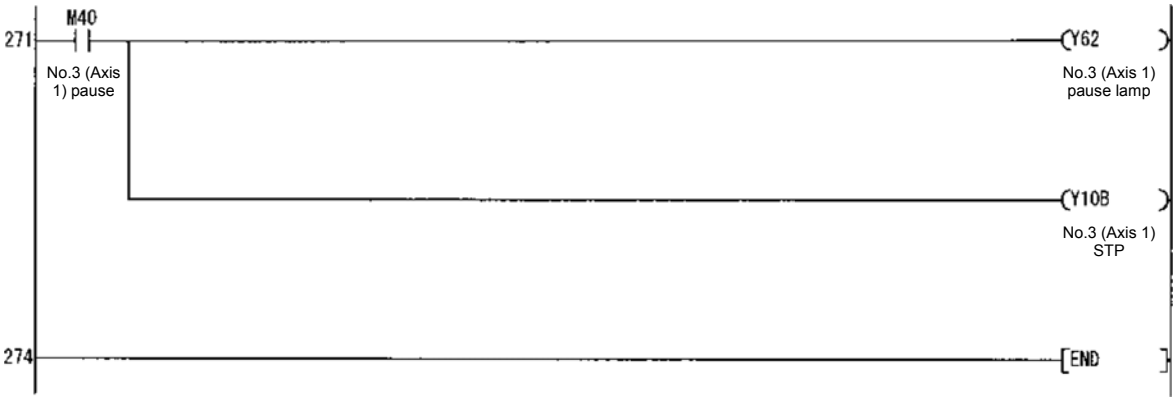

115
X101
Axis (0) PEND
D202.0
Completion P.No
D202.1
Completion P.No
D202.2
Completion P.No
D202.3
Completion P.No
D202.4
Completion P.No
D202.5
Completion P.No
M17
Axis (0) P1 completion
123
M17
Axis (0) P1 completion
K10
T11
1 second
128
M12
Axis (0) P0 start flag
Y101
Axis (0) CSTR
M16
Axis (0) P1 start flag
131
M14
Axis (0) P0 completion
Y4D
No.2 (Axis 0) positioning completed lamp
M17
Axis (0) P1 completion
134
X7
No.2 (Axis 0) pause
M18
Axis (0) pause pushbutton
136
M18
Axis (0) pause pushbutton
M20
Axis (0) pause
M19
Axis (0) pause reset
M19
Axis (0) pause reset
140
M18
Axis (0) pause pushbutton
M19
Axis (0) pause reset
M20
Axis (0) pause
M20
Axis (0) pause


144
M20
Axis (0) pause
Y61
No.2 (Axis 0) pause lamp
Y103
Axis (0) STP
147
X2
No.3 (Axis 1) start
X108
Axis (1) ALM
M0
Emergency stop
Y5A
No.3 (Axis 1) operation lamp
Y5A
152
Y5A
No.3 (Axis 1) operation lamp
X10D
Axis (1) PWR
Y42
No.3 (Axis 1) servo on lamp
Y10C
Axis (1) servo on
Y48
No.3 (Axis 1) SRDY lamp
157
Y10C
Axis (1) servo on
X10C
Axis (1) SV
X10A
Axis (1) HEND
M30
No.3 (Axis 1) home return completed
M31
Axis (1) operation flag


164
M33
Flag
M31
Axis (1) operation flag
X10B
Axis (1) MOVE
T13
1 second
BRST D102 K8
Axis command position No
BRST D102 K9
Axis command position No
BRST D102 K10
Axis command position No
BRST D102 K11
Axis command position No
BRST D102 K12
Axis command position No
BRST D102 K13
Axis command position No
K1
T202
10ms
190
T202
10ms
X10B
Axis (1) MOVE
X109
Axis (1) PEND
M32
Axis (1) P0 start flag
194
Y109
Axis (1) CSTR
M33
Flag
M33
Flag
197
X109
Axis (1) PEND
D202.8
Completion P.No
D202.9
Completion P.No
D202.A
Completion P.No
D202.B
Completion P.No
D202.C
Completion P.No
D202.D
Completion P.No
M34
Axis (1) PO completion


205
M34
Axis (1) PO completion
K10
T12
1 second
210
T12
1 second
M31
Axis (1) operation flag
X10B
Axis (1) MOVE
M35
Axis (1) P1 setting flag
M35
Axis (1) P1 setting flag
215
M35
Axis (1) P1 setting flag
BSET D102 K8
Axis command position No
BRST D102 K9
Axis command position No
BRST D102 K10
Axis command position No
BRST D102 K11
Axis command position No
BRST D102 K12
Axis command position No
BRST D102 K13
Axis command position No
K1
T203
10ms
238
T203
10ms
X10B
Axis (1) MOVE
X109
Axis (1) PEND
M36
Axis (1) P1 start flag


242
X109
Axis (1) PEND
D202. 8
Completion P.No
D202. 9
Completion P.No
D202. A
Completion P.No
D202. B
Completion P.No
D202. C
Completion P.No
D202. D
Completion P.No
M37
Axis (1) P1 completion
250
M37
Axis (1) P1 completion
K10
T13
1 second
255
M32
Axis (1) PO start flag
M36
Axis (1) P1 start flag
Y109
Axis (1) CSTR
258
M34
Axis (1) P0 completion
M37
Axis (1) P1 completion flag
Y4E
No.3 (Axis 1) positioning completion lamp
261
X8
No.3 (Axis 1) pause
M38
No.3 (Axis 1) pause button
263
M38
No.3 (Axis 1) pause button
M40
No.3 (Axis 1) pause
M39
No.3 (Axis 1) pause reset
M39
No.3 (Axis 1) pause reset
267
M38
No.3 (Axis 1) pause button
M39
No.3 (Axis 1) pause reset
M40
No.3 (Axis 1) pause
M40
No.3 (Axis 1) pause


271
M40
No.3 (Axis 1) pause
Y62
No.3 (Axis 1) pause lamp
Y10B
No.3 (Axis 1) STP
274
END

# 10. Troubleshooting

## 10.1 Action to Be Taken upon Occurrence of Trouble

Upon occurrence of a problem, take an appropriate action according to the procedure below in order to ensure speedy recovery and prevent recurrence of the problem.

a. Check the status of various LED indications for gateway unit.
   [1] Gateway unit status indication LED (RUN, G.ER, C.ER, T.ER)
   [2] SIO communication status (TxD, RxD)
   [3] CC-Link communication status (RUN, ERR, RD, SD)
b. Presence/absence of abnormality in host controller (PLC, master station)
c. Presence/absence of abnormality in controller
d. Check the power voltage of the gateway unit.
e. Check the cables for connection error, disconnection and pinching.
   Before performing a continuity check, turn off the power and disconnect the cables.
f. Check the noise elimination measures (grounding, installation of surge killer, etc).
g. Check the operation by the teaching box or personal computer software.
   Connect the teaching box or the personal computer software to the gateway and operate each axis to check the operation and presence/absence of alarm.
h. Check the input and output signals between the PLC and the controller.
   [1] Check the PLC side by the monitor function of the personal computer software GX Developer (Mitsubishi Electric).
   [2] Check the controller by the personal computer software or status monitor of the teaching box.
   [3] In the previous checks, check that there is no discrepancy between [1] and [2].
i. Review the events leading to the occurrence of a problem, as well as the operating condition at the time of occurrence.
j. Analyzes the cause occurrence
k. Take action

Please check items a. through i. before contacting IAI.

## 10.2 Troubleshooting

Statuses of failures are classified into the following three types.

a. Abnormality of gateway unit
b. Abnormality of SIO communication
c. Abnormality of CC-Link

### 10.2.1 Abnormality of gateway unit

There occurs a control abnormality of the gateway unit if the RUN (Green) on the gateway status indication LED is unlit or G.ER (Red) is lit in a state that the determined power is supplied.

★ Check the power voltage of the gateway unit. If the determined power is supplied, once turn OFF the power and turn on again. If the RUN (Green) is unlit or G.ER (Red) is lit even in that case, contact IAI.

### 10.2.2 Abnormality of SIO communication

When the SIO communication is abnormal, the T.ER (Red) on the gateway status indication LED is lit. Further, communication status can also be checked by the TxD (Green) and RxD (Green) on the LED.
For details, refer to the item of [2] SIO communication status LED in “2.3 Name and function of each part.”

★ Check the following contents.
[1] Check if wiring for the communication line is correctly connected.
[2] Check if CFG13 - 0 (link connecting axis selection) is correctly performed. For details, refer to the input and output signal list in the “6.1 Gateway control signal.”
[3] Check if GND (ground=0V) levels of the power of the robo-cylinder controller and gateway unit are on the same line. Particularly, when the levels are connected by link, pay attention to whether all GND (ground) are common.
[4] Check if the terminal resistors are correctly connected, and resistance values are correct.
[5] Check if the power line which becomes a noise source is not wired near wiring of the SIO communication line.

### 10.2.3 Abnormality of CC-Link communication

When the CC-Link communication is abnormal, C.ER (Red) on the gateway status indication LED is lit.
Further, details of communication status can be checked by RUN (Green), ERR (Red), SD (Green) and RD (Green) on the CC-Link communication status LED. When any abnormality occurs, check the operation status with the status indication list on the next page.

★ Check the communication status LED, and check the following depending on each status.
[1] Check if wiring for the communication line is correctly connected.
[2] Check if the gateway unit is correctly set to the PLC (master station) as a remote device of four stations. (Note that this is not remote I/O.)
[3] Check that address settings for remote I/O and remote input and output are not duplicated.
[4] Check if the terminal resistors are correctly connected, and resistance values are correct.
[5] Check if the power line which becomes a noise source is not wired near wiring of the SIO communication line.

## CC-Link communication status indication list

○: Lit ●: Unlit ◎: Flashing

| RUN (Green) | ERR (Red) | SD (Green) | RD (Green) | Operation |
|---|---|---|---|---|
| ○ | ◎ | ◎ | ○ | Communication is normally performed, however, CRC(*) error frequently occurs due to noise. |
| ○ | 0.4s◎ | ◎ | ○ | Baud rate or station No. has changed from baud rate for reset release or station No. setting. |
| ○ | ◎ | ◎ | ● | (Impossible status) |
| ○ | ◎ | ● | ○ | Received data became CRC(*) error, and cannot respond. |
| ○ | ◎ | ● | ● | (Impossible status) |
| ○ | ● | ◎ | ○ | Normal communication |
| ○ | ● | ◎ | ● | (Impossible status) |
| ○ | ● | ● | ○ | No data is transmitted to local station. |
| ○ | ● | ● | ● | (Impossible status) |
| ● | ◎ | ◎ | ○ | Polling response is performed, but refresh reception is CRC(*) error. |
| ● | ◎ | ◎ | ● | (Impossible status) |
| ● | ◎ | ● | ○ | Data to local station is CRC(*) error |
| ● | ◎ | ● | ● | (Impossible status) |
| ● | ● | ◎ | ○ | Not link-started. |
| ● | ● | ◎ | ● | (Impossible status) |
| ● | ● | ● | ○ | There is no data to local station, or reception for local station is impossible due to noise. |
| ● | ● | ● | ● | Data cannot be received due to disconnection. Power is shut off or H/W is being set. |
| ● | ○ | ● | ○ | Invalid baud rate, invalid station No. setting |
| ● | ○ | ● | ● | Invalid baud rate, invalid station No. setting |
| ● | ● | ● | ● | Power is shut off, or remote station power part is in fault. |

*CRC: Cyclic Redundancy Check
Data error detecting method which is mostly used for synchronizing transmission

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IAI
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