YAMAHA
YAMAHA MOTOR CO., LTD.

*YAMAHA Robot Controller*

***MRCH/QRCH/QRCX** Series*

# *CC-Link UNIT*

## OWNER'S MANUAL

# Safety Precautions

(Always read before starting use)

Always read this manual, the robot controller instruction manual and programming manual before using this product. Take special care to safety, and correctly handle the product. The cautions given in this manual are related to this product. Refer to the robot controller instruction manual for details on the cautions to be taken with the robot controller system using this product.
* The safety precautions are ranked as "WARNING" and "CAUTION" in this manual.

**⚠WARNING**

**Failure to follow WARNING instructions could result in serious injury or death to the operator or person servicing the product.**

**⚠CAUTION**

**Failure to follow CAUTION instructions may result in injury to the operator or person servicing product, or damage to the product or peripheral equipment.**

Note that some items described as "CAUTION" may lead to serious results depending on the situation. In any case, important information that must be observed is explained. Store this manual where it can be easily referred to, and make sure that it is delivered to the end user.

CC-Link is a registered trademark of Mitsubishi Electric Corporation Co., Ltd.
The CC-Link compatible module provided with a CC-Link label is compatible with CC-Link Ver 1.10.

[Precautions for design]

**⚠WARNING**

- **Refer to the CC-Link system Master Module User's Manual and this manual for details on the state of the CC-Link system and robot controller when a communication error occurs with the CC-Link system, etc. Configure an interlock circuit in the sequence program so that the system, including the robot controller will work safely using the communication status information.**
- **This CC-Link compatible module has an emergency stop terminal to set the robot controller in the emergency stop state. Prepare a physical interlock circuit so that the system, including the robot controller will work safety, using this terminal.**

**⚠CAUTION**

- **The control line and communication cable must not be bound with or placed near the main circuit or power line. Separate these by at least 100mm. Failure to observe this could lead to malfunctions caused by noise.**

[Precautions for installation]

**⚠ WARNING**

- **Always crimp, press-fit or solder the connector wire connections with the maker-designated tool, and securely connect the connector to the module.**
- **Always shut off all phases of the power supply externally before starting installation or wiring work.**
  **Failure to shut off all phases could lead to electric shocks or product damage.**

**⚠ CAUTION**

- **Use the robot controller within the environment specifications given in the manual. Use in an environment outside the environment specification range could lead to electric shocks, fires, malfunctioning, product damage or deterioration.**
- **Mount the CC-Link compatible module on the back of the robot controller, and securely fix with screws.**
- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Never directly touch the conductive sections or electric parts other than the DIP switch on the CPU board.**
- **Accurately connect each connection cable connector to the mounting section. Failure to observe this could lead to malfunctions caused by a connection fault.**

[Precautions for wiring]

**⚠ WARNING**

- **Always shut off all phases of the power supply externally before starting installation or wiring work.**
  **Failure to shut off all phases could lead to electric shocks or product damage.**
- **Always install the terminal covers enclosed with the product before turning ON the power or operating the product after installation or wiring work.**
  **Failure to install the terminal cover could lead to malfunctions.**

**⚠ CAUTION**

- **Tighten the terminal screws within the specified torque range.**
  **A loose terminal screw could lead to short-circuiting or malfunctioning.**
  **If the terminal screw is too tight, short-circuiting or malfunctioning could occur due to screw damage.**
- **Make sure that foreign matter, such as cutting chips or wire scraps, do not enter the robot controller.**
- **The communication cables connected to the CC-Link compatible module must be placed in a conduit or fixed with a clamp.**
  **If the cable is not placed in a conduit or fixed with a clamp, the module or cable could be damaged by the cable shifting, movement or unintentional pulling leading to malfunctioning caused by an improper cable connection.**
- **Do not disconnect the communication cable connected to the CC-Link compatible module by pulling on the cable section.**
  **Loosen the screws on the connector, and then disconnect the cable.**
  **Pulling on the cable fixed with screws could lead to module or cable damage, or malfunctioning caused by an improper cable connection.**

[Precautions for starting and maintenance]

**⚠ WARNING**

- **Do not touch the terminals while the power is ON.**
  **Failure to observe this could lead to malfunctioning.**
- **Always shut off all phases of the power supply externally before cleaning or tightening the terminal screws.**
  **Failure to shut off all phases could lead to electric shocks, product damage or malfunctioning.**
  **A loose screw could lead to dropping, short-circuiting or malfunctioning.**
  **If the screw is too tight, short-circuiting or malfunctioning could occur due to screw damage.**
- **Never disassemble or modify any of the robot controller modules.**
  **Failure to observe this could lead to trouble, malfunctioning, injuries or fires.**
- **Always shut off all phases of the power supply externally before installing or removing the CC-Link compatible module.**
  **Failure to shut off all phases could lead to robot controller trouble or malfunctioning.**
- **When using the robot controller with the CC-Link compatible module mounted, always mount the enclosed ferrite core for noise measures on the power cable as close to the robot controller as possible.**
  **Failure to mount this ferrite core could lead to malfunctioning caused by noise.**

[Precautions for disposal]

**⚠ CAUTION**

- **Dispose of this product as industrial waste.**

Revision history

| Date of revision | Details of revisions |
|---|---|
| June 1999 | First edition |
| March 2001 | Second edition for compliance to V1.10 |

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# Introduction

Thank you for purchasing the CC-Link compatible module. This CC-Link compatible module is an option module that enables connection of the YAMAHA robot controller QRCX/QRCH and MRCH Series as a CC-Link system remote device station.
The CC-Link compatible module with CC-Link label is compatible with CC-Link Ver. 1.10. CC-Link compatible modules without the CC-Link label are compatible with Ver. 1.00.
The robot controller explained in this manual refers to the QRCX/QRCH and MRCH Series.
This manual describes the flow of operations from wiring the CC-Link compatible module to programming, and includes setting examples.

For details on other devices such as connecting the master station PLC and PLC programming, refer to the manual for the respective product.
Refer to the manual enclosed with the YAMAHA controller for details on operating the robot controller and on the robot program.

## MEMO

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**MEMO**

# CHAPTER 1

# Outline

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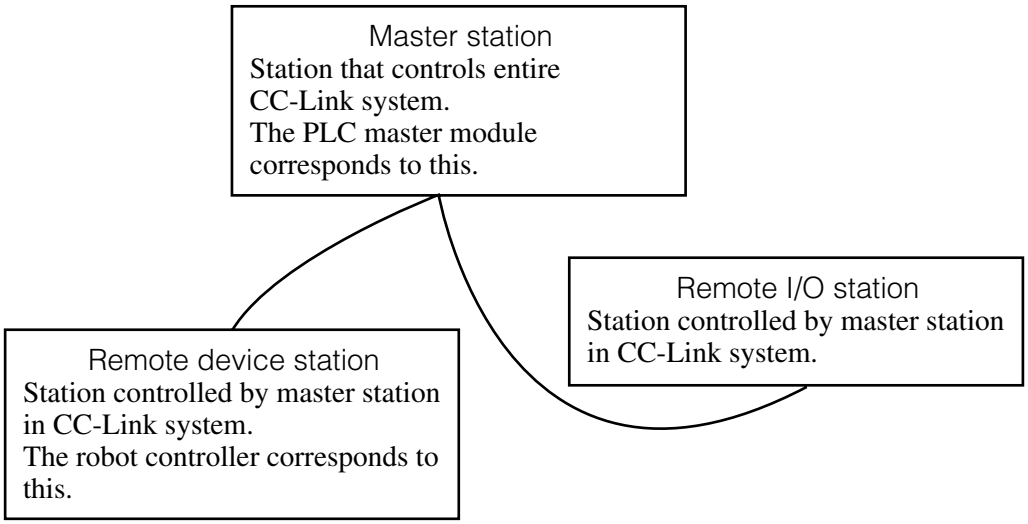
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## MEMO

# 1-1 Features

CC-Link is the abbreviation of Control & Communication Link.
The CC-Link system connects the robot controller and dispersed input/output modules with dedicated cables, and controls these modules from the master station PLC.
The CC-Link system allows wiring to be reduced.



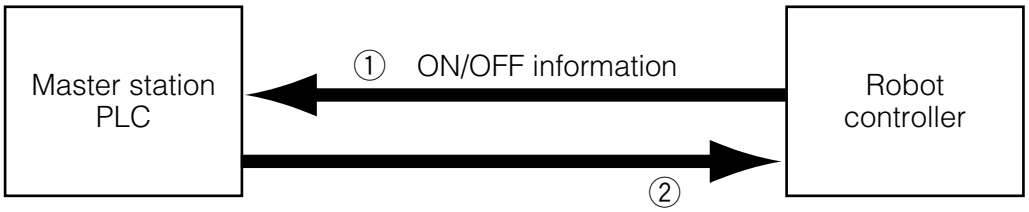

CC-Link is a registered trademark of Mitsubishi Electric Corporation Co., Ltd.
The CC-Link compatible module provided with a CC-Link label is compatible with CC-Link Ver 1.10.

[Wiring saving]
One dedicated cable (4-wire) is used to connect the robot controller and PLC. This allows the entire system wiring to be reduced.
Note that the emergency stop terminal is provided separately.

[Emulated serialization on parallel DIO]
By making the robot controller's internal settings without using a robot program, the various I/O devices, such as the sensors and relays mounted on the robot controller's parallel I/O can be controlled from the PLC as if they were CC-Link system I/O devices.

# 1-2 Mechanism

The mechanism of communication is explained in this section to provide an understanding of how the robot controller and PLC operate via the CC-Link system.




① The robot controller's ON/OFF information is sent to the master station PLC via the network (CC-Link system cable).
② The master station PLC's ON/OFF information is set to the robot controller via the network (CC-Link system cable).

* The robot controller monitors the ON/OFF information at a 10ms cycle.
* The ON/OFF information consists of 16 points each of dedicated I/O points and 96 points each of general-purpose I/O points.

If the following is executed with the robot program in the robot controller, the ON information will be sent to the master station PLC via the CC-Link system by ①.

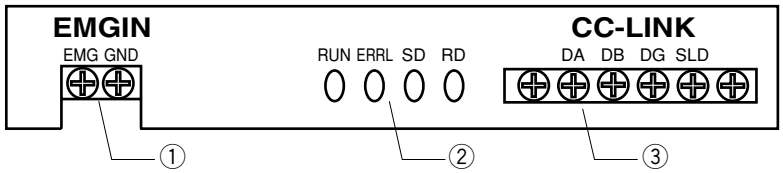
SO (20)=1

Conversely, if the following is executed with the robot program, the ON/OFF information received from the master station via the CC-Link system will be monitored by ②, and the robot controller will wait for the ON information.

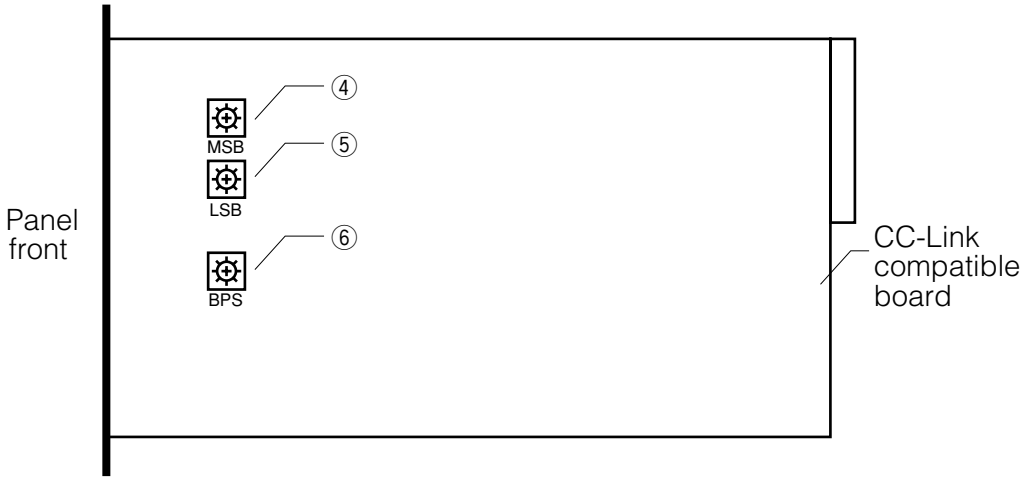
WAIT SI (20)=1

# 1-3 Names of each part on the CC-Link compatible module

The names of each part on the CC-Link compatible module mounted on the robot controller are described in this section. This module is mounted on the top back of the robot controller. The standard I/O module cannot be mounted in this case.




Panel front




Top view of CC-Link module

① Emergency stop terminal
This emergency stop terminal requires physical wiring separate from the emergency stop input on the CC-Link system. This must be short-circuited for the robot controller to operate correctly.
Sequence this terminal with the safety fence, etc., used to protect the worker entering the robot's movement range, and ensure safety for the robot.

② Transmission monitor LED
The status in the CC-Link system is indicated with ON, OFF and flickering status of four LEDs.

③ CC-Link system cable terminal
This terminal is used to connect the CC-Link system cable. Each of the four terminals has a meaning. Make sure not to incorrect wire these.

④ Station No. setting switch (MSB: 10th place)
This is the rotary switch for setting the robot controller station No. in the CC-Link system. The 10th place of the station No. is set with this switch.

⑤ Station No. setting switch (LSB: 1st place)
This is the rotary switch for setting the robot controller station No. in the CC-Link system. The 1st place of the station No. is set with this switch.

⑥ Baud rate switch (BPS)
This is the rotary switch for setting the CC-Link system's communication baud rate.

# 1-4 Assignment of CC-Link compatible I/O

The I/O expressions used in the robot controller's program language and the I/O expressions for the remote device stations differ. The correspondence is shown below.

| Output from robot controller | | Input to robot controller | |
|---|---|---|---|
| Program language | Remote device station | Program language | Remote device station |
| SO0 (7 to 0)*1 | RXn7 to RXn0 | SI0 (7 to 0)*1 | RYn7 to RYn0 |
| SO1 (7 to 0)*1 | RXnF to RXn8 | SI1 (7 to 0)*1 | RYnF to RYn8 |
| SO2 (7 to 0) | RX(n+1)7 to RX(n+1)0 | SI2 (7 to 0) | RY(n+1)7 to RY(n+1)0 |
| SO3 (7 to 0) | RX(n+1)F to RX(n+1)8 | SI3 (7 to 0) | RY(n+1)F to RY(n+1)8 |
| SO4 (7 to 0) | RX(n+2)7 to RX(n+2)0 | SI4 (7 to 0) | RY(n+2)7 to RY(n+2)0 |
| SO5 (7 to 0) | RX(n+2)F to RX(n+2)8 | SI5 (7 to 0) | RY(n+2)F to RY(n+2)8 |
| SO6 (7 to 0) | RX(n+3)7 to RX(n+3)0 | SI6 (7 to 0) | RY(n+3)7 to RY(n+3)0 |
| SO7 (7 to 0) | RX(n+3)F to RX(n+3)8 | SI7 (7 to 0) | RY(n+3)F to RY(n+3)8 |
| SO10 (7 to 0) | RX(n+4)7 to RX(n+4)0 | SI10 (7 to 0) | RY(n+4)7 to RY(n+4)0 |
| SO11 (7 to 0) | RX(n+4)F to RX(n+4)8 | SI11 (7 to 0) | RY(n+4)F to RY(n+4)8 |
| SO12 (7 to 0) | RX(n+5)7 to RX(n+5)0 | SI12 (7 to 0) | RY(n+5)7 to RY(n+5)0 |
| SO13 (7 to 0) | RX(n+5)F to RX(n+5)8 | SI13 (7 to 0) | RY(n+5)F to RY(n+5)8 |
| SO14 (7 to 0) | RX(n+6)7 to RX(n+6)0 | SI14 (7 to 0) | RY(n+6)7 to RY(n+6)0 |
| SO15 (7 to 0) | RX(n+6)F to RX(n+6)8 | SI15 (7 to 0) | RY(n+6)F to RY(n+6)8 |
| —— | RX(n+7)F to RX(n+7)0*2 | —— | RY(n+7)F to RY(n+7)0*2 |
| —— | RWr0 to RWr31*3 | —— | RWw0 to RWw31*3 |

n: Address assigned to master module with station No. setting

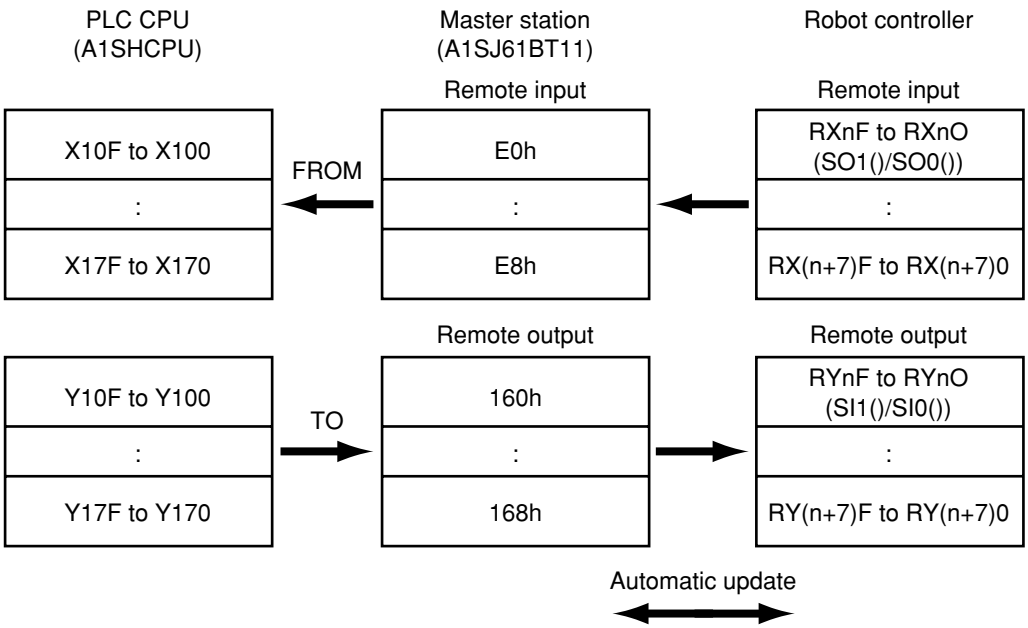
**Caution)**

***1: Has a meaning in the robot controller's internal process as a dedicated input/output. This cannot be used as a general-purpose output in the robot program.**

***2: This area is reserved for the CC-Link system.**

***3: The remote registers are not currently supported.**

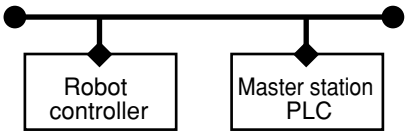
An example of the flow of the I/O information in the robot controller (remote device station) is shown below. The buffer memory in the master station used to store the information, etc., differs according to the PLC type and station No., etc. Refer to the PLC Manual for details.



# 1-5 Shift of CC-Link system connection status and robot controller status

Always start the CC-Link system specification robot controller in the servo OFF state after the power is turned ON.

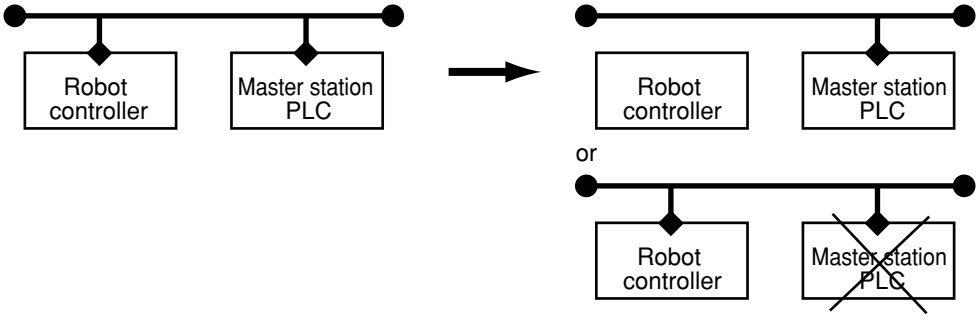
① Normal state of CC-Link system connection when robot controller power is turned ON




- Emergency stop/interlock signal in CC-Link system are valid
- Physical emergency stop signal terminal is valid

* The signals in the CC-Link system are sent and received.
* Always initialize with the master station PLC when connecting to the CC-Link system.

② Shift from CC-Link system normal connection state to CC-Link system erroneous connection state




- Shift to the emergency stop state with SI (OO) in the robot controller
- Physical emergency stop signal terminal is valid

* The signals in the CC-Link system are not sent or received.
* The “CC-Link Communication Error” is added to the error history in the robot controller.
* If the connection to the CC-Link system shifts from the normal state to the erroneous state, the CC-Link system connection must be returned to the normal state.
* The CC-Link system will return when the CC-Link system connection is recovered to the normal state.

③ CC-Link system erroneous connection state due to following factors when robot controller power is turned ON

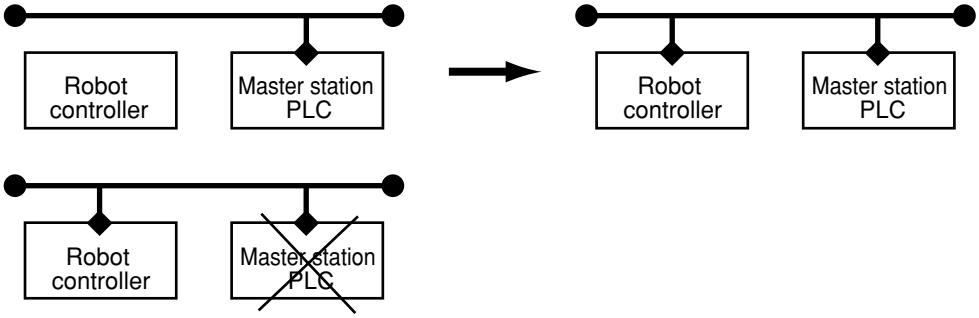
- Connection to CC-Link system not possible
- Error in master station PLC




- Emergency stop/interlock signals in CC-Link system are invalid
- "CC-Link Communication Error" is displayed on the teaching box when the power is turned ON
  (A maximum 2.5-second wait will occur to confirm the communication at this time.)
- Physical emergency stop signal terminal is valid

* The signals on the CC-Link system cannot be exchanged.
* As opposed to the state given in ②, in this state, the emergency stop state by SI (OD) is not attained in the controller, so the robot can be operated from the teaching box. (The robot controller can be started independently when setting up the system, etc.)
* When the connection to the CC-Link system is correctly recovered, the system will automatically return to the CC-Link system.

④ Transmission from CC-Link system erroneous connection state to CC-Link correct connection state when robot controller power is turned ON




- CC-Link system emergency stop/interlock signals change to valid state
- Physical emergency stop signal terminal is valid

* The signals in the CC-Link system can be sent and received.
* When the connection to the CC-Link system shifts to the normal state, the initialization process must be carried out with the master station PLC when connecting to the CC-Link system.
* The CC-Link system will return when the CC-Link system connection is recovered to the normal state.

# CHAPTER 2

# Connection


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2-5 Connecting to the CC-Link system .....2-13

2-5-1 Connecting to the cable terminal to the controller .....2-13
2-5-2 Testing the line from the master station PLC .....2-14

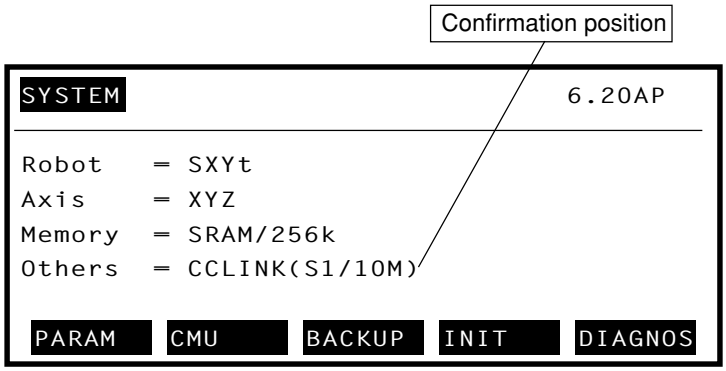
2-6 Connecting the emergency stop terminal .....2-15

## MEMO

# 2-1 Confirming the CC-Link compatible module settings

With the CC-Link system specification robot controller, the CC-Link compatible module station No. and communication speed settings can be confirmed with the teaching box (hereinafter, MPB).

- For CC-Link system specification robot controller
  (When robot controller is purchased with CC-Link compatible module mounted)
  → Follow the procedures given in section 2-2, and set the station No. and communication speed.
- When connecting CC-Link compatible module to existing robot controller
  → Follow the procedures given in section 2-3, and change the settings for the CC-Link system specifications.




[Operation]

1. Press the MPB [MODE] key.
2. Press the MPB [F 5] (system) key.
3. The display above will appear. The station No. and communication baud rate set for the CC-Link system will appear in the parentheses following "CCLINK" on the screen. The meaning of the above example is shown below.
   S1 :Station No. 1
   (Setting range: 1 to 61)
   * Four stations are occupied. Thus, this means that (station No. +3) is occupied.
   10M :10Mbps
   (Setting baud rate [unit: bps]: 156K, 625K, 2.5M, 5M, 10M)
   * The communication baud rate must match the master station setting.

**⚠CAUTION**

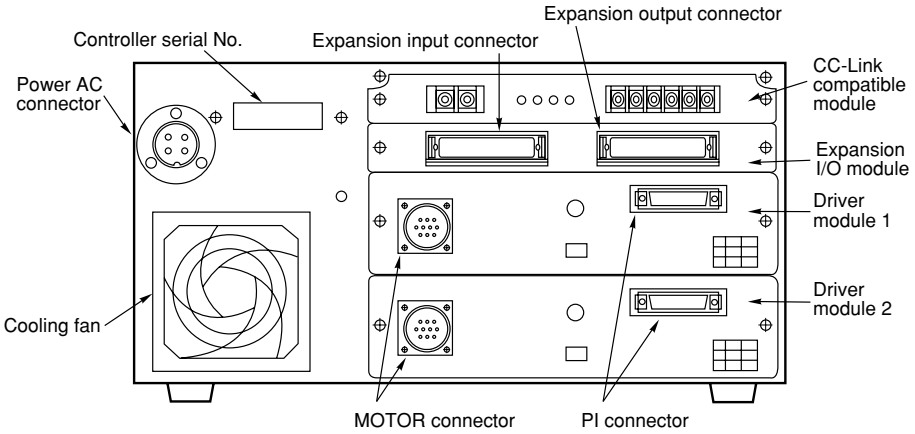
- **If the robot controller is not connected to the CC-Link system or if there is an error in the CC-Link system, the error "CC-Link Communication Error" will appear on the MPB when the robot controller power is turned ON. The above settings can be confirmed even in this state.**

# 2-2 Setting the CC-Link compatible module

To connect the CC-Link system specification controller to the CC-Link system, the station No. and communication baud rate must be set with the rotary switch on the CC-Link compatible module. Confirm the current station No. and communication baud rate with the procedures given in section 2-1.
The operations given in section 2-3. are not required when this section is set.

## 2-2-1 Removing the CC-Link compatible module

Remove the CC-Link compatible module connected at the top back of the robot controller.




Example of back view when CC-Link compatible module is mounted on QRCH

[Procedures]

1. Completely shut off the power input to the robot controller. Disconnect the I/O cable if it is connected.
2. Move the robot controller to a position where work can be carried out on the back side.
3. Using a Phillips head screwdriver, remove the two screws on both sides of the CC-Link compatible module connected at the top back of the robot controller.
4. Pull out the CC-Link compatible module in the direction parallel with the robot controller grounding surface.

**⚠WARNING**

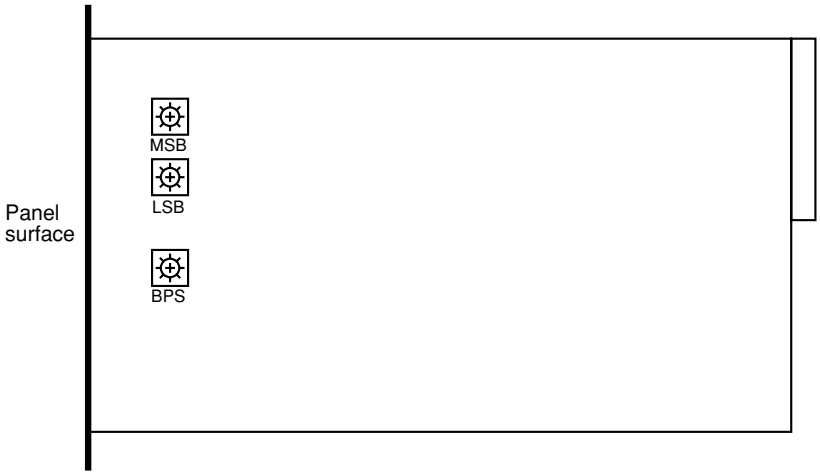
- **Completely shut off the power supplied to the robot controller.**

**⚠CAUTION**

- **Completely shut off the power supplied to the robot controller.**
- **Always disconnect the cables connected to the CC-Link compatible module.**
- **Carefully remove the CC-Link compatible module while taking care not to apply excessive force.**
- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Do not apply impact on the CC-Link compatible module.**
- **Do not place water or conductive matters, etc., which could cause damage near the CC-Link compatible module.**

## 2-2-2 Setting the station No.

Using the rotary switches MSB and LSB on the top of the CC-Link compatible module, set the station No. of the robot controller in the CC-Link system.




Top view of CC-Link compatible module

[Procedures]

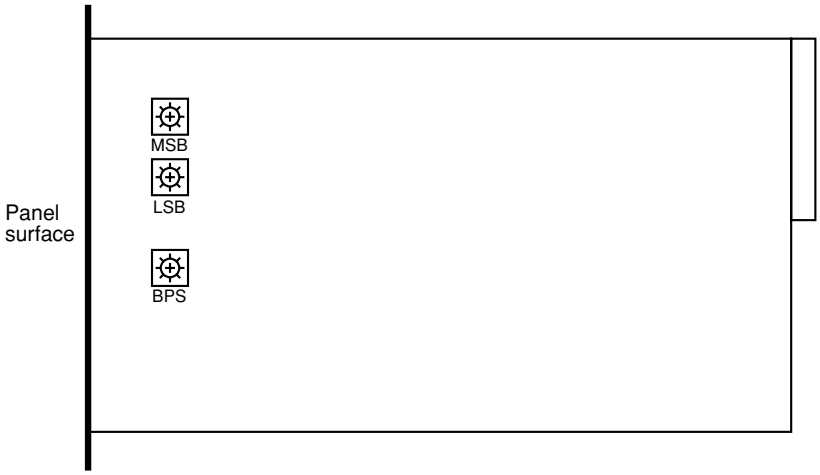
1. Confirm the station No. of the robot controller in the CC-Link system.
   The station No. must be set between 1 and 61.
   * Up to 64 stations can be set as the CC-Link system, but as the CC-Link compatible module occupies four stations, it will occupy (station No. +3). Thus, the above setting range applies.
2. Using a precision Phillips head screwdriver, set the 10th place digit of the station No. with rotary switch MSB.
3. In the same manner, set the 1st place digit with rotary switch LSB.

**⚠CAUTION**

- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Do not apply impact on the CC-Link compatible module.**
- **Do not place water or conductive matters, etc., which could cause damage near the CC-Link compatible module.**
- **Accurately set the station No.**
- **Make sure not to set the rotary switch BPS by mistake.**

## 2-2-3 Setting the communication baud rate

Using the rotary switch BPS on the CC-Link compatible module, set the communication baud rate for the robot controller in the CC-Link system.




Top view of CC-Link compatible module

[Procedures]

1. Confirm the communication baud rate for the robot controller in the CC-Link system. The communication baud rate must be set between 156K and 10Mbps. The correspondence of the communication baud rate and switch is shown below.

| Switch No. | 0 | 1 | 2 | 3 | 4 | Other than left setting |
|---|---|---|---|---|---|---|
| Baud rate [bps] | 156K | 625K | 2.5M | 5M | 10M | Error |

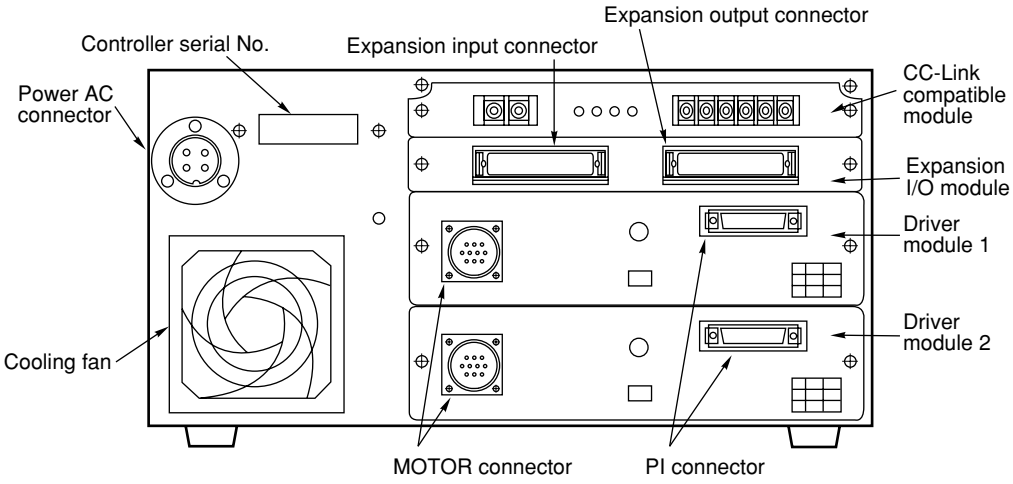
2. Using a precision Phillips head screwdriver, set the switch No. corresponding to the communication baud rate with rotary switch BPS.
   * The communication baud rate must match the CC-Link system's master station setting.

**⚠CAUTION**

- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Do not apply impact on the CC-Link compatible module.**
- **Do not place water or conductive matters, etc., which could cause damage near the CC-Link compatible module.**
- **Accurately set the communication baud rate.**
- **Make sure not to set the rotary switches MSB and LSB by mistake.**

## 2-2-4 Installing the CC-Link compatible module

Install the CC-Link compatible module at the back top position of the robot controller.




Example of back view when CC-Link compatible module is mounted on QRCH

[Procedure]

1. Completely shut off all power input to the robot controller.
2. Move the robot controller to a position where work can be carried out on the back side.
3. If a CC-Link compatible module is connected, remove it with the procedure given in section -1.
4. Set the CC-Link compatible module at the back top position of the robot controller so that it is parallel with the robot controller's grounding surface, and insert it along the rails.
5. Using a Phillips head screwdriver, accurately fix the two screws on both sides of the inserted CC-Link compatible module.
6. Connect the CC-Link communication cable and emergency stop cable.

**⚠ WARNING**

- **Completely shut off the power supplied to the robot controller.**

**⚠ CAUTION**

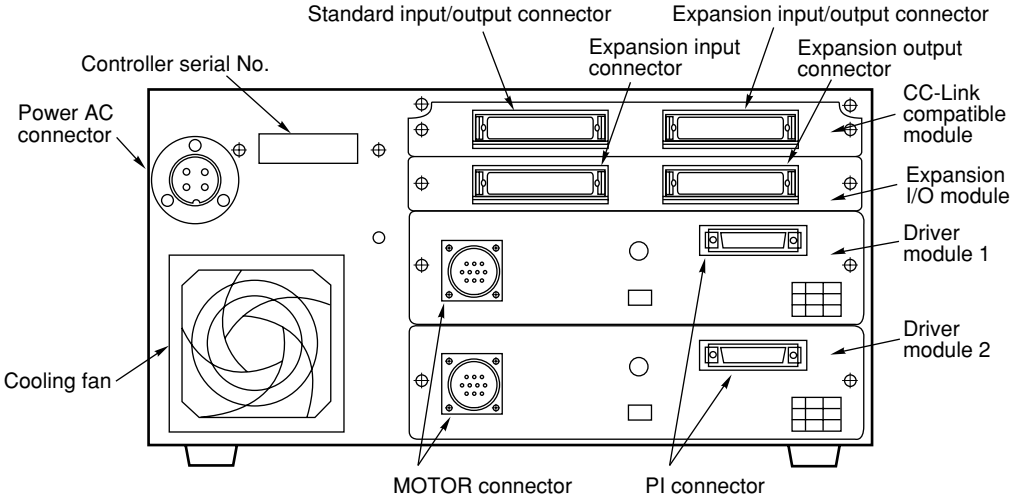
- **Always install the CC-Link compatible module with the connection cables disconnected.**
- **Carefully remove the CC-Link compatible module while taking care not to apply excessive force.**
- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Do not apply impact on the CC-Link compatible module.**
- **Do not place water or conductive matters, etc., which could cause damage near the CC-Link compatible module.**

# 2-3 Setting to the CC-Link system specification controller

When connecting the CC-Link compatible module to an existing robot controller, the CC-Link compatible module must be installed and the DIP switches in the robot controller must be changed. Confirm the CC-Link system specifications with the procedure given in section 2-1.
This section is not required if section 2-2. has been carried out.

## 2-3-1 Removing the standard I/O module

Remove the standard I/O module connected at the back top of the robot controller.




Example of back view when standard I/O module is mounted on QRCH

[Procedures]

1. Completely shut off the power input to the robot controller. Disconnect the I/O cable if it is connected.
2. Move the robot controller to a position where work can be carried out on the back side.
3. Using a Phillips head screwdriver, remove the two screws on both sides of the standard I/O module connected at the top back of the robot controller.
4. Pull out the standard I/O module in the direction parallel with the robot controller grounding surface.

**⚠ WARNING**

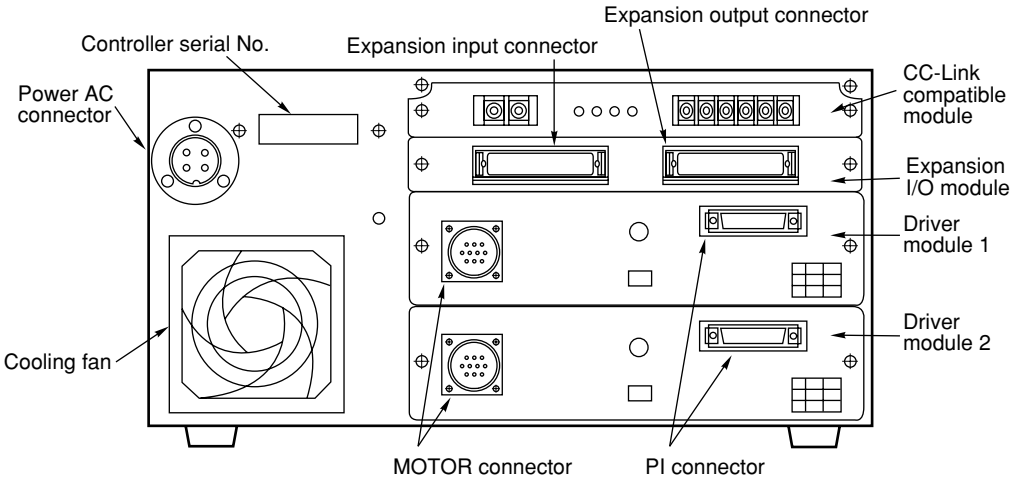
- **Completely shut off the power supplied to the robot controller.**

**⚠ CAUTION**

- **Always disconnect the cables connected to the standard I/O module.**
- **Carefully remove the standard I/O module while taking care not to apply excessive force.**
- **Do not apply impact on the standard I/O module.**
- **Do not place water or conductive matters, etc., which could cause damage near the standard I/O module.**

## 2-3-2 Installing the CC-Link compatible module

Install the CC-Link compatible module at the back top position of the robot controller.




Example of back view when CC-Link compatible module is mounted on QRCH

[Procedure]

1. Completely shut off all power input to the robot controller.
2. Move the robot controller to a position where work can be carried out on the back side.
3. If a standard I/O module is connected, remove it with the procedure given in section -1.
4. Confirm that the CC-Link compatible module station No. and communication baud rate are correctly set. If not set, follow section 2-2-2. and 2-2-3. and set the pertinent information.
5. Set the CC-Link compatible module at the back top position of the robot controller so that it is parallel with the robot controller's grounding surface, and insert it along the rails.
6. Using a Phillips head screwdriver, accurately fix the two screws on both sides of the inserted CC-Link compatible module.
7. Connect the CC-Link communication cable and emergency stop cable.

**⚠WARNING**

- **Completely shut off the power supplied to the robot controller.**

**⚠CAUTION**

- **Always install the CC-Link compatible module with the connection cables disconnected.**
- **Carefully remove the CC-Link compatible module while taking care not to apply excessive force.**
- **Never directly touch the conductive sections or electronic parts other than the rotary switch on the CC-Link compatible module.**
- **Do not apply impact on the CC-Link compatible module.**
- **Do not place water or conductive matters, etc., which could cause damage near the CC-Link compatible module.**

## 2-3-3 Changing the robot controller DIP switch

Change the setting of the DIP switch in the robot controller.
Note that the data such as the programs and points saved in the controller could be damaged at this time, so always save the data into an external memory such as an FDD or by using RS-232-C. Refer to the controller instruction manual for details on saving the data.

**⚠WARNING**

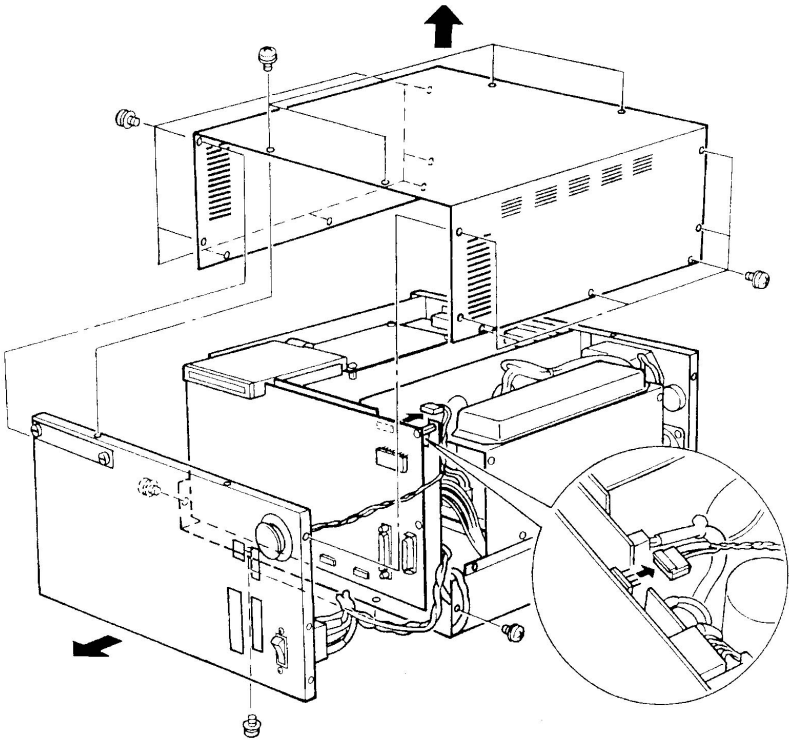
- **Completely shut off the power supplied to the robot controller.**

**⚠CAUTION**

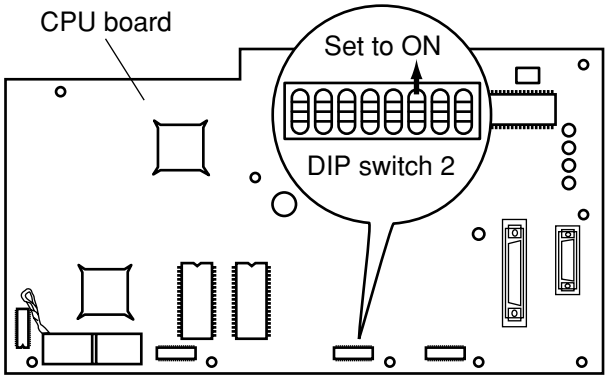
- **Always save the data such as the programs and points saved in the controller into an external memory such as an FDD or by using RS-232-C.**

[Procedures]

1. Save the robot controller data into an external memory.
2. Completely shut off the power input to the robot controller. Always disconnect the input power connector on the back of the robot controller.
3. Move the robot controller to a position where work can be carried out on the back side.
   Using a Phillips head screwdriver, remove the 22 screws fixing the top and side panels of the robot controller. Before completely removing the front panel, remove the power switch fixed with two screws from the front panel, and disconnect the connector connecting the emergency stop button and CPU board.
   The power switch and emergency stop switch are connected to the controller with a cable, so do not apply excessive force on the cable.



4. Set switch 6 of the DIP switch 2 on the CPU board to ON.




5. Fix the power switch with two screws, and connect the connector for the emergency stop button.
   Install the top and front panels to the controller, and securely fix with the 22 screws.
6. Connect the input power connector on the back of the controller, and turn the power ON.
7. The following type of question will appear on the MPB screen, so answer as "YES".

```
POWER
-------------------------------------------

 Warning! Dipswitch is changed
      OLD status is = xxxxH
 If not wanted, power down and reset


 Go on OK?                    YES     NO
```

8. If the controller does not operate properly because of a memory error, etc., load the data saved in step 1. into the controller. Refer to the controller instruction manual for details on loading the data.
   If the robot controller is not correctly connected with the CC-Link system, the message "CC-Link Communication Error" will appear on the MPB.

**⚠CAUTION**

- **Never directly touch the conductive sections or electric parts other than the DIP switch on the CPU board.**
- **Do not apply impact on the CPU board.**
- **Do not place water or conductive matters, etc., which could cause damage near the CPU board.**
- **If the robot controller is not connected to the CC-Link system or if there is an error in the CC-Link system, the error "CC-Link Communication Error" will appear on the MPB when the robot controller power is turned ON.**
- **Always save the data such as the programs and points saved in the controller into an external memory such as an FDD or by using RS-232-C.**

# 2-4 Noise measures

A ferrite core must be mounted on the input power cable when connecting to the CC-Link system.

## 2-4-1 Mounting the ferrite core

Mount the ferrite core onto the input power cable connected to the input power connector on the upper left back of the robot controller.

[Procedures]

1. Mount the enclosed ferrite core onto the input power cable. The ferrite core should be placed as close to the robot controller body as possible.
2. Fix the mounted ferrite core with an Insulock tie, etc.

**⚠ WARNING**

- **Completely shut off the power supply to the input power cable before starting this work.**

**⚠ CAUTION**

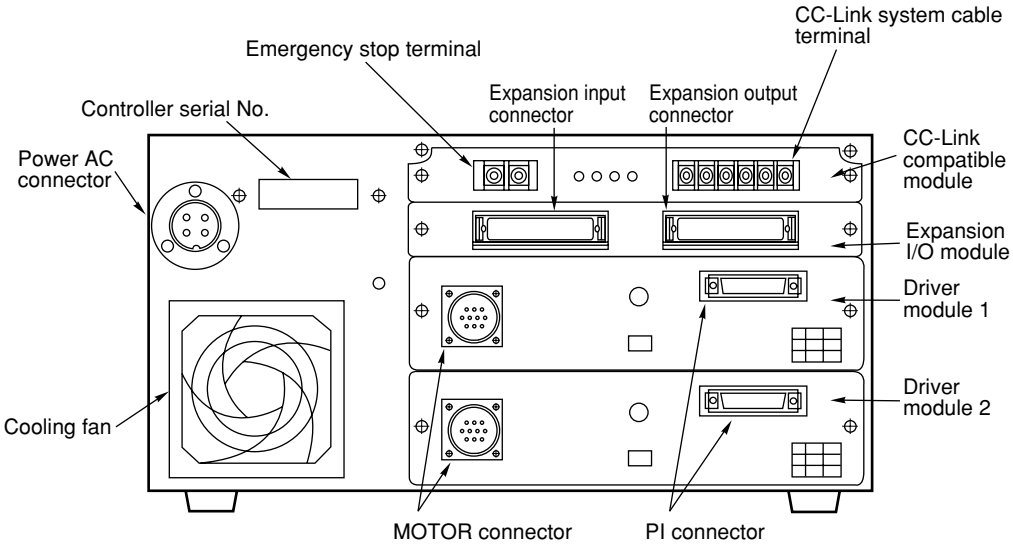
- **Securely fix the ferrite core. If the ferrite core is not mounted, trouble could occur with the CC-Link system operations.**

# 2-5 Connecting to the CC-Link system

The CC-Link system cable must be connected to the CC-Link compatible module in order to connect to the CC-Link system.

## 2-5-1 Connecting to the cable terminal to the controller

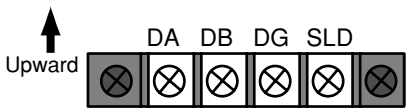
Connect the CC-Link system cable to the C-Link system cable terminal on the right of the CC-Link compatible module.




Example of back view when CC-Link compatible module is mounted on QRCH

[Procedure]

1. Using a Phillips head screwdriver, completely loosen the two screws on both sides of the CC-Link system cable terminal, and remove the terminal block section from the CC-Link compatible module.
2. Using a Phillips head screwdriver, securely fix the CC-Link system cable to the terminal block removed in step 1.
   The names of each terminal on the cable terminal block are shown below.




* When connecting a terminator, connect it across DA-DB.

* A slit to prevent incorrect inverted insertion is provided on the cable terminal block.

3. Connect the cable terminal, into which the CC-Link system cable has been installed, to the CC-Link compatible module terminal block section on the robot controller, and completely fix with the two screws on both sides using a Phillips head screwdriver.

**⚠ WARNING**

- **Completely shut off the power supplied to the robot controller.**

**⚠CAUTION**

- **Always remove the terminal block section when installing the CC-Link system cable.**
- **Securely fix the CC-Link system cable.**
- **Carefully carry out the work to valid applying excessive force on the CC-Link cable.**
- **Treat each end of the C-Link system cable wire with a round terminal or Y terminal so that it will not dislocate.**
- **Carefully carry out the work so that the CC-Link system cable is not incorrectly wired.**
- **Refer to the master station PLC instruction manual for details on the CC-Link system cable connection.**

## 2-5-2 Testing the line from the master station PLC

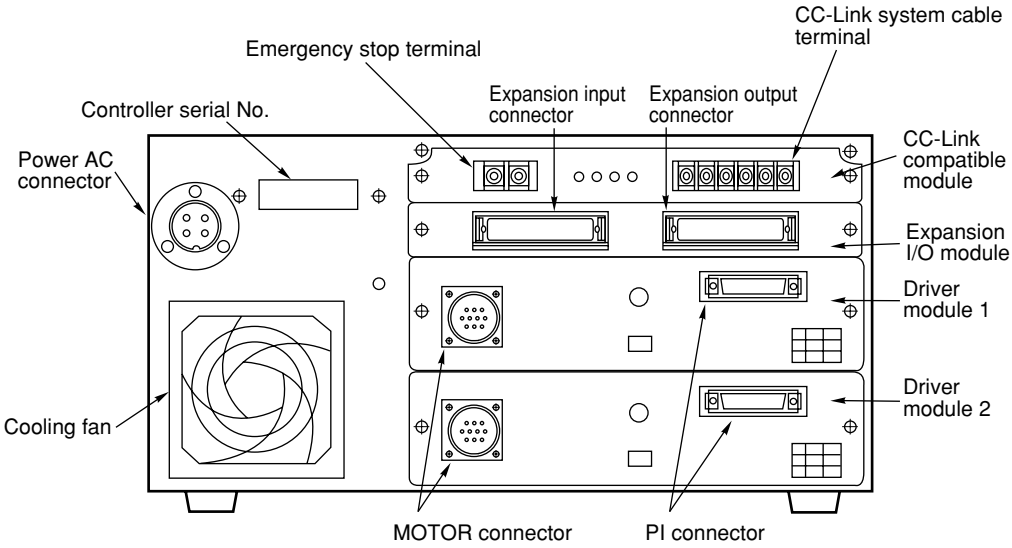
The master station PLC in the CC-Link system has a function to test the line to the remote station. Using this function, confirm that the robot controller is accurately recognized as a remote station in the CC-Link system.
Refer to the master station PLC instruction manual for details.

**⚠CAUTION**

- **If the line test results indicate a correct connection, place the CC-Link system cable into a conduit, or fix it with a clamp.**

# 2-6 Connecting the emergency stop terminal

The CC-Link compatible module has a physical emergency stop terminal in addition to the emergency stop signal in the CC-Link system. Prepare a physical interlock circuit so that the system, including the robot controller will work safely, using this terminal.
The specifications of this emergency stop terminal are the same as the emergency stop input (DI00) for using the internal power supply in the input/output interface listed in the robot controller instruction manual. Refer to the robot controller instruction manual for details.
When operating the robot controller before preparing the interlock circuit, such as when setting up the system, this emergency stop terminal must be short-circuited.




Example of back view when CC-Link compatible module is mounted on QRCH

The emergency stop terminal may be a screw terminal block type or spring terminal block type.

For screw terminal block type:

- Single wire/twisted wire: 0.2 to 1.5mm$^2$ (AWG24 to 16)

**⚠CAUTION**

- **Treat the ends of the wires with a round terminal or Y terminal so that they do not dislocate.**
- **Carefully connect to prevent incorrect wiring.**

For spring terminal block type:

- Single wire/twisted wire: 0.2 to 1.5mm$^2$ (AWG24 to 16)
- Peeled wire length: 10mm
- Use of a bar terminal is possible

When connecting, press the yellow button on the top of the terminal block with a precision screwdriver, etc., and push in the wire material.

**⚠CAUTION**

- **Treat the end of the wires with solder or completely twist so that they do not dislocate.**
- **Carefully connect to prevent incorrect wiring.**

## MEMO

# CHAPTER 3

# Communication


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3-2 Initial process for connecting to CC-Link system .....3-4

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3-5-1 Referring to the data from the teaching box .....3-9

## MEMO

# 3-1 State when robot controller power is turned ON

The CC-Link system specification robot controller always starts operation in servo OFF state when the power turned ON.

① When connection to CC-Link system is correctly established.

The following conditions must be satisfied to correctly connect to the CC-Link system:

- The CC-Link system cable must be physically connected
- The station No. and communication speed must be correctly set
- The master station PLC must be operating correctly

When the robot controller is correctly connected to the CC-Link system, the normal state will be indicated with the LEDs on the CC-Link compatible module.
At this time, the emergency stop signal and interlock signal in the CC-Link system will be valid, so these signals must be turned ON with the initial data process.
The physical emergency stop signal terminal is always valid.

② When connection to CC-Link system is incorrectly established

The following causes can be considered a correct connection with the CC-Link system cannot be established:

- The CC-Link system cable is not physically connected
- The station No. or communication speed is set incorrectly
- The master station PLC is not operating correctly

When the robot controller is incorrectly connected to the CC-Link system, the error state will be indicated with the LEDs on the CC-Link compatible module. Note that if the master station PLC is not operating correctly, nothing will appear on the LEDs.
The emergency stop signal and interlock signal in the CC-Link system are invalid in this case, so the robot controller can be operated independently. However, if the correct state has been established even once after the robot controller power was turned ON, the robot controller's emergency stop state cannot be canceled without correctly connecting to the CC-Link system.
The physical emergency stop signal terminal is always valid.

* Refer to Chapter 4 for details on the LED displays.

# 3-2 Initial process for connecting to CC-Link system

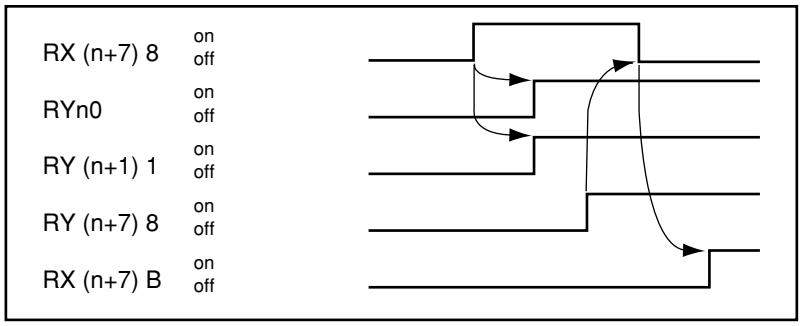
The initial data process must be carried out to correctly connect to the CC-Link system.

## 3-2-1 Initial data process

The initial data process is carried out to confirm that the robot controller is correctly connected to the CC-Link system. Prepare the process on the master station PLC side so that the following type of process is always carried out before data is exchanged.

Initial data process (master station PLC side)

① Confirm that RX(n+7)8 (initial data process request flag) is ON.
② Turn RYn0 (emergency stop input) and RY(n+1)1 (interlock input) ON.
③ Turn RY(n+7)8 (initial data process completion flag) ON.
④ Confirm that RX(n+7)8 (initial data process request flag) is OFF.
⑤ Confirm that RX(n+7)B (remote station Ready) is ON.




The robot controller internal process will automatically start when the power is turned ON and the system is returned from an error state.

**⚠CAUTION**

- **RX(n+7) B (remote station Ready) must always be used on the master station PLC side as the flag to indicate whether the robot controller is operating correctly.**
- **When starting up the system in the emergency stop state using RYn0 (emergency stop input), carry out the initial data process first, and then turn RYn0 (emergency stop input) OFF. The robot controller will start up in the servo OFF state when the power is turned ON.**

# 3-3 Communication with master station PLC

The method for communicating with the master station PLC by using the robot program when the CC-Link system is correctly connected is explained in this section.

## 3-3-1 Receiving data

Data is received by reading the master station PLC output device data with the robot controller's input port.
The correspondence of the master station PLC's output device numbers and robot controller's input port numbers is shown below.

| Master station output device No. | Robot controller input port No. |
|---|---|
| RYn0 to RYn7 | SI(00) to SI(07) |
| RYn8 to RYnF | SI(10) to SI(17) |
| RY(n+1)0 to RY(n+1)7 | SI(20) to SI(27) |
| RY(n+1)8 to RY(n+1)F | SI(30) to SI(37) |
| RY(n+2)0 to RY(n+2)7 | SI(40) to SI(47) |
| RY(n+2)8 to RY(n+2)F | SI(50) to SI(57) |
| RY(n+3)0 to RY(n+3)7 | SI(60) to SI(67) |
| RY(n+3)8 to RY(n+3)F | SI(70) to SI(77) |
| RY(n+4)0 to RY(n+4)7 | SI(100) to SI(107) |
| RY(n+4)8 to RY(n+4)F | SI(110) to SI(117) |
| RY(n+5)0 to RY(n+5)7 | SI(120) to SI(127) |
| RY(n+5)8 to RY(n+5)F | SI(130) to SI(137) |
| RY(n+6)0 to RY(n+6)7 | SI(140) to SI(147) |
| RY(n+6)8 to RY(n+6)F | SI(150) to SI(157) |

n: Address assigned to master module with station No. setting

When reading the bit data from the master station PLC's output device No. with the robot controller, write the following commands in the robot program in the same manner as the DI input port:

WAIT command
Substitute statement

Example : To wait for RY(n+1)0 to turn ON

```
WAIT SI(20) = 1
```

* The robot program will wait for SI(20) to turn ON.

Example : To read the RY(n+1) 0 to RY(n+1)7 data in variable A

```
A = SI2()
```

* The SI2() data will be converted into a decimal and substituted into variable A.
If SI2() is 7Fh, variable A will be 127.

**⚠CAUTION**

- **The SI statement in the robot language uses the same syntax as a DI statement. If the SI statement is not described in the programming manual, refer to the section for the DI statement.**

## 3-3-2 Transmitting data

Data is transmitted by writing the robot controller output port data into the master station PLC's input device.
The correspondence of the master station PLC's input device numbers and robot controller's output port numbers is shown below.

| Master station input device No. | Robot controller output port No. |
|---|---|
| RXn0 to RXn7 | SO(00) to SO(07) |
| RXn8 to RXnF | SO(10) to SO(17) |
| RX(n+1)0 to RX(n+1)7 | SO(20) to SO(27) |
| RX(n+1)8 to RX(n+1)F | SO(30) to SO(37) |
| RX(n+2)0 to RX(n+2)7 | SO(40) to SO(47) |
| RX(n+2)8 to RX(n+2)F | SO(50) to SO(57) |
| RX(n+3)0 to RX(n+3)7 | SO(60) to SO(67) |
| RX(n+3)8 to RX(n+3)F | SO(70) to SO(77) |
| RX(n+4)0 to RX(n+4)7 | SO(100) to SO(107) |
| RX(n+4)8 to RX(n+4)F | SO(110) to SO(117) |
| RX(n+5)0 to RX(n+5)7 | SO(120) to SO(127) |
| RX(n+5)8 to RX(n+5)F | SO(130) to SO(137) |
| RX(n+6)0 to RX(n+6)7 | SO(140) to SO(147) |
| RX(n+6)8 to RX(n+6)F | SO(150) to SO(157) |

n: Address assigned to master module with station No. setting

To write the robot controller's bit data into the master station PLC's input device No., write the following commands in the robot program in the same manner as the DO output port:

SET/RESET command
Substitute statement

Example : To turn RX(n+1)0 ON
SET SO(20) or SO(20) =1
* SO(20) will turn ON.

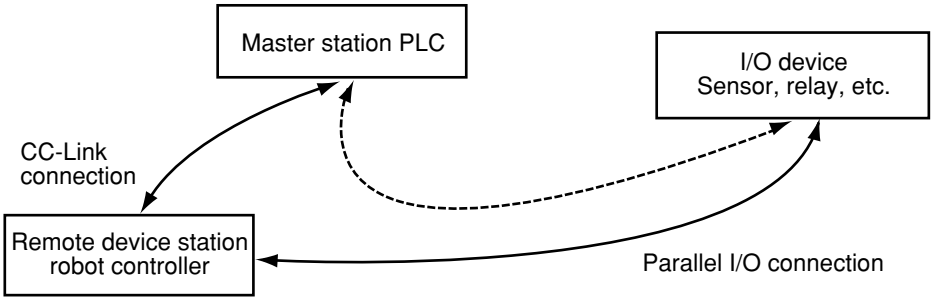
Example : To write variable A data into RX(n+1)0 to RX(n+1)7
SO2() = A
* The variable A data will be converted into a binary and substituted into SO2().
If variable A is 127, 7Fh will be set in SO2().

**⚠CAUTION**

- **The SO statement in the robot language uses the same syntax as a DO statement. If the SO statement is not described in the programming manual, refer to the section for the DO statement.**

# 3-4 Direct connection by emulated serialization on parallel DIO

The master station PLC can exchange ON/OFF information data with the parallel port on the robot controller's expansion I/O module regardless of the robot program. By using this function, I/O devices such as a sensor or relay can be used like a device connected to CC-Link.




When the directly connected and set output port is used with the program, the ON/OFF information may not become the intended value. Do not use the directly connected and set output port with the program.

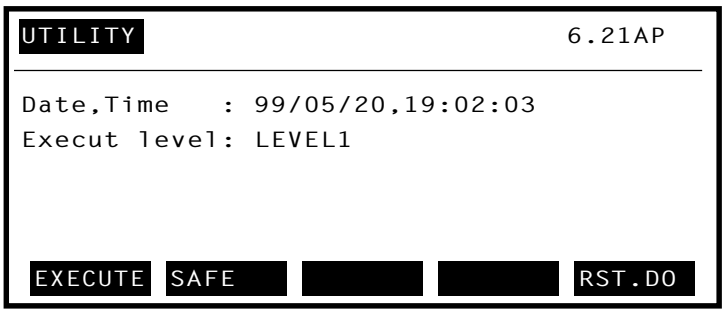
## 3-4-1 Setting from teaching box

The relation of the parallel port and serial port that can be connected is shown below.

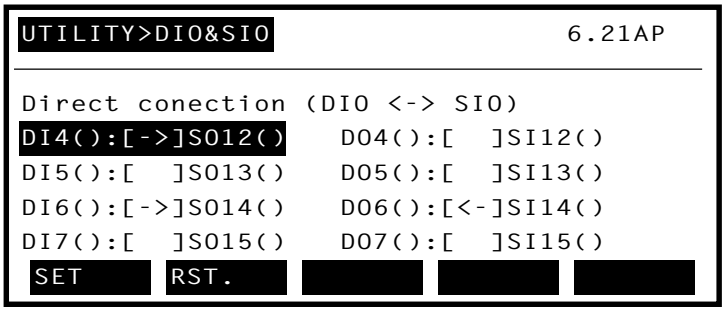
| Input device such as sensor | | Output device such as valve | |
|---|---|---|---|
| DI port → | SO port | DO port ← | SI port |
| DI4() | SO12() | DO4() | SI12() |
| DI5() | SO13() | DO5() | SI13() |
| DI6() | SO14() | DO6() | SI14() |
| DI7() | SO15() | DO7() | SI15() |

[Operation]

1. Press the UTILITY (LOWER + ESC) key on the teaching box (hereinafter, MPB) twice to display the following screen.



2. Next, press the MPB [F 6] ([UPPER]+[F 1]) [DIO&SIO] key. The following screen will appear and settings can be made. The highlight indicates the currently selected port. Select the port using the [→], [←], [↑] and [↓] keys.



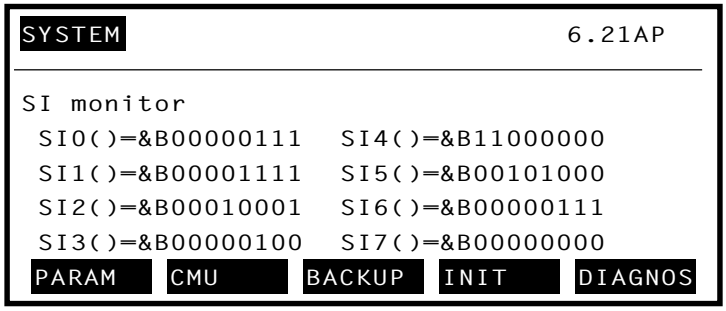

3. To set the selected port as a direct connection, press the [F 1] (set) key. To cancel the setting, press the [F 2] (reset) key.
"->"/"<-" will appear in the brackets for the set port.

# 3-5 Referring to communication data

The ON/OFF information exchanged with the master station PLC can be referred to using the teaching box (hereinafter, MPB).
Note that the MPB display update interval is longer than the CC-Link data update interval, so if the ON/OFF interval is short, accurate information may not be displayed.

## 3-5-1 Referring to the data from the teaching box

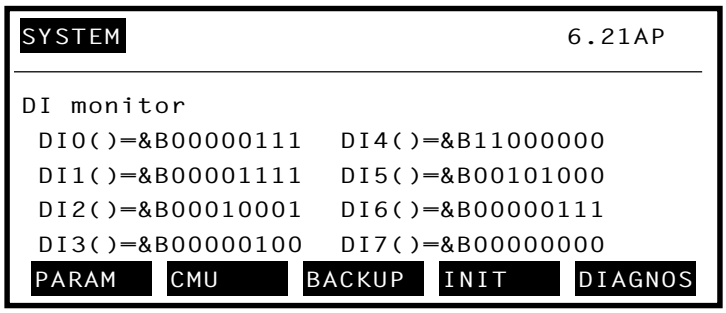
The data exchanged with the master station PLC can be referred to with the MPB. The reference unit is the robot controller input/output port No.




* &Bxxxxxxx corresponds to the 0th bit to 7th bit from right to left.

[Operation]

1. When the DISPLAY key is pressed, the following type of screen will appear.




2. When the MPB DISPLAY key is pressed several times in the same manner as step 1, the statuses of the SI input ports 0 to 7 can be confirmed.
3. If the MPB DISPLAY key is pressed more, the statuses of the SI input ports 10 to 15 can be confirmed.
4. If the MPB DISPLAY key is pressed more, the statuses of the SO input ports 0 to 7 can be confirmed.
5. If the MPB DISPLAY key is pressed more, the statuses of the SO input ports 10 to 15 can be confirmed.
6. To stop confirmation of the input/output ports, press the ESC key.

## MEMO

# CHAPTER 4

# Troubleshooting


4-1 Items to confirm before starting up CC-Link system ..... 4-3

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4-3-4 Confirmation from master station PLC ..... 4-7

## MEMO

# 4-1 Items to confirm before starting up CC-Link system

Confirm the following items before starting up the CC-Link system.

| | Confirmation details | Check |
|---|---|---|
| 1 | Is the CC-Link compatible module accurately connected? (Refer to Chapter 2 section 2-2 or 2-3.) | |
| 2 | Is the robot controller set to the CC-Link system specifications? (Refer to Chapter 2 section 2-1.) | |
| 3 | Are the CC-Link compatible module station No. and communication baud rate correctly set? (Refer to Chapter 2 section 2-1.) | |
| 4 | Is the ferrite core connected to the power input cable to the robot controller? (Refer to Chapter 2 section 2-4.) | |
| 5 | Is the CC-Link system cable accurately connected to the CC-Link compatible module? (Refer to Chapter 2 section 2-5.) | |
| 6 | Was the line test from the master station PLC correct? (Refer to the master station PLC instruction manual.) | |
| 7 | Is the master station PLC set for the 4-station occupying remote device? (Refer to the master station PLC instruction manual.) | |
| 8 | Is the master station PLC exchanging the data for four stations? (The data for four stations must always be exchanged.) | |
| 9 | Has the initial data process been carried out between the master station and robot controller? (Refer the initialization process in Chapter 3 section 3-2.) | |
| 10 | Is the master station PLC judging that the robot controller is correctly functioning using RX(n+7)8 (remote station Ready)? (Refer the samples in Chapter 5 section 5-4.) | |

# 4-2 Meanings of LEDs on CC-Link compatible module

The LEDs on the CC-Link compatible module express the following statuses.
Use these for confirmation when an error occurs.

| RUN | ERRL | SD | RD | Meaning |
|---|---|---|---|---|
| ○ | ◎ | ○ | ○ | Normal communication is taking place, but the CRC error occurs sometimes because of noise. |
| ○ | ◎ | ○ | ○ | The settings have varied from the baud rate and station No. setting made when connected to the CC-Link system. |
| ○ | ◎ | ● | ○ | A CRC error occurred in the received data, and a response cannot be made. |
| ○ | ● | ○ | ○ | Normal communication |
| ○ | ● | ● | ○ | There is no data addressed to the local station. |
| ● | ◎ | ○ | ○ | Polling response is being carried out, but a CRC error occurred in the refresh reception. |
| ● | ◎ | ● | ○ | A CRC error occurred in the data addressed to the local station. |
| ● | ● | ● | ○ | There is no data addressed to the local station or the data addressed to the local station cannot be received because of noise. |
| ● | ● | ● | ○ | Data cannot be received because of a line disconnection.<br>The power for communication has been cut off.<br>An illegal baud rate was set. (It can be spefified but differs from the master station.) |
| ● | ○ | ● | ● | Station No. setting illegal<br>(An illegal station No. was set.) |
| ● | ○ | ● | ○ | Baud rate setting illegal<br>(An illegal baud rate was set.) |
| ● | ● | ◎ | ● | The master station setting does not match the remote device station setting. |
| ● | ● | ● | ● | Communication with the master station was not possible when the power was turned ON.<br>(This also occurs if the controller is not set for CC-Link.) |
| Others | | | | An improbable state |

( ○ : ON, ● : OFF, ◎ : Flicker)

**⚠CAUTION**

- **Even if the LED displays indicate the normal communication state, there may be cases when communication with the master station PLC is not possible unless the initial data process is carried out. Always carry out the initial data process. (Refer to Chapter 3.)**

# 4-3 Troubleshooting

If trouble occurs in the connection with the robot controller while starting up the CC-Link system or during operation, check the following items in listed order.

**4-3-1 Robot controller front panel LED confirmation**
**4-3-2 Teaching box error display confirmation**
**4-3-3 CC-Link compatible module LED confirmation**
**4-3-4 Confirmation from master station PLC**

## 4-3-1 Robot controller front panel LED confirmation

[Confirmation item 1]

<Confirmation details>

- The “POWER” LED is OFF.

<Cause>

- Power is not being supplied to the robot controller.

<Countermeasures>

- Measure the power input terminal on the power connector with a tester, and confirm that the rated power is being supplied.

* Refer to the robot controller instruction manual for the rated current values for the robot controller.

[Confirmation item 2]

<Confirmation details>

- The “CPU_OK” LED is OFF.

<Cause>

- A major error has occurred in the robot controller.

<Countermeasures>

- Confirm the error message displayed on the teaching box.
- Take measures by following the troubleshooting section in the robot controller instruction manual.

* Refer to the robot controller instruction manual for details on the errors.

## 4-3-2 Teaching box error display confirmation

[Confirmation item 1]

<Confirmation details>

- "CC-Link Communication Error" is displayed on the teaching box.

<Cause>

- An error has occurred in the CC-Link system connection.

<Countermeasures>

- Check whether the CC-Link system cable is disconnected or incorrectly connected.
- Check the station No. and communication baud rate settings for the CC-Link compatible module.
- Confirm that the master station PLC is operating.

[Confirmation item 2]

<Confirmation details>

- An error other than "CC-Link Communication Error" is displayed on the teaching box. In this case, this problem is not related to the CC-Link system connection.

<Cause>

- An error has occurred in the robot controller.

<Countermeasures>

- Check the error message displayed on the teaching box.
- Check the error history using the teaching box. Check the error history in the "System > Diagnosis > Error History" mode using the teaching box.
- Take measures by following the troubleshooting section in the robot controller instruction manual.

* Refer to the robot controller instruction manual for details on the errors.

## 4-3-3 CC-Link compatible module LED confirmation

[Confirmation item 1]

<Confirmation details>

- The LED display on the CC-Link compatible module is not “RUN. ERR. SD. RD” = “○●○○”. (○: ON, ●: OFF, ◎: Flicker)

<Cause>

- An error has occurred in the CC-Link system connection. Refer to table in section 4-1 for the meanings of the LED displays.

<Countermeasures>

- Check whether the CC-Link system cable is disconnected or incorrectly connected, and whether the terminator is connected.
- Check whether the CC-Link system cable is laid near the main circuit or power cable, or whether it is bundled with these.
- Check that the ferrite core is connected to the robot controller's power supply cable.
- Check the station No. and communication baud rate settings for the CC-Link compatible module.
- Confirm that the master station PLC is operating.

[Confirmation item 2]

<Confirmation details>

- The LED display on the CC-Link compatible module is “RUN, ERR, SD, RD” = “○●○○”. (○: ON, ●: OFF, ◎: Flicker)

<Cause>

- The initial data process has not been executed when the CC-Link system was connected. Refer to Chapter 3.
- The RX(n+7)B (remote station Ready) signal is not ON.

<Countermeasures>

- Carry out the initial data process when connecting to the CC-Link system.

## 4-3-4 Confirmation from master station PLC

[Confirmation item 1]

<Confirmation details>

- Using the master station PLC's line test function, confirm robot controller is correctly connected to the CC-Link system.

* Refer to the master station PLC instruction manual for details on the line test.

[Confirmation item 2]

<Confirmation details>

- Using the master station PLC's line test function, check whether an error has occurred in the robot controller's CC-Link connection.

<Cause>

- The ferrite core for noise measures is not connected.
- The CC-Link cable is laid near sources of noise such as the power cable.

<Countermeasures>

- Connect the ferrite core for noise measures onto the input power cable.
- Wire the CC-Link cable away from noise sources such as the power cable.

## MEMO

# CHAPTER 5

# Appendix


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## MEMO

# 5-1 Profile

YAMAHA robot controller (4-station occupying)

## Remote input/output

| Remote → Master | | Master → Remote | |
|---|---|---|---|
| Device No. | Signal name | Device No. | Signal name |
| RXn0 | SO (00): Emergency stop input status output | RYn0 | SI (00): Emergency stop input |
| RXn1 | SO (01): CPU_OK status output | RYn1 | SI (01): Servo ON input |
| RXn2 | SO (02): Servo ON status output | RYn2 | System area [for future expansion] |
| RXn3 | SO (03): Alarm status output | RYn3 | |
| RXn4 | System area [for future expansion] | RYn4 | |
| RXn5 | | RYn5 | |
| RXn6 | | RYn6 | |
| RXn7 | | RYn7 | |
| RXn8 | SO (10): Automatic mode status output | RYn8 | SI (10): Sequence control input |
| RXn9 | SO (11): Origin return complete status output | RYn9 | SI (11): Interlock input |
| RXnA | SO (12): Sequence program execution status output | RYnA | SI (12): Start input |
| RXnB | SO (13): Robot program execution status output | RYnB | SI (13): Automatic mode input |
| RXnC | SO (14): Program reset status output | RYnC | SI (14): Origin return input |
| RXnD | System area [for future expansion] | RYnD | SI (15): Program reset input |
| RXnE | | RYnE | SI (16): Manual mode input |
| RXnF | | RYnF | SI (17): Absolute reset input |
| RX(n+1)0 | SO(20) to SO(27): General-purpose output | RY(n+1)0 | SI(20) to SI(27): General-purpose input |
| to | | to | |
| RX(n+1)7 | | RY(n+1)7 | |
| RX(n+1)8 | SO(30) to SO(37): General-purpose output | RY(n+1)8 | SI(30) to SI(37): General-purpose input |
| to | | to | |
| RX(n+1)F | | RY(n+1)F | |
| RX(n+2)0 | SO(40) to SO(47): General-purpose output | RY(n+2)0 | SI(40) to SI(47): General-purpose input |
| to | | to | |
| RX(n+2)7 | | RY(n+2)7 | |
| RX(n+2)8 | SO(50) to SO(57): General-purpose output | RY(n+2)8 | SI(50) to SI(57): General-purpose input |
| to | | to | |
| RX(n+2)F | | RY(n+2)F | |
| RX(n+3)0 | SO(60) to SO(67): General-purpose output | RY(n+3)0 | SI(60) to SI(67): General-purpose input |
| to | | to | |
| RX(n+3)7 | | RY(n+3)7 | |
| RX(n+3)8 | SO(70) to SO(77): General-purpose output | RY(n+3)8 | SI(70) to SI(77): General-purpose input |
| to | | to | |
| RX(n+3)F | | RY(n+3)F | |
| RX(n+4)0 | SO(100) to SO(107): General-purpose output | RY(n+4)0 | SI(100) to SI(107): General-purpose input |
| to | | to | |
| RX(n+4)7 | | RY(n+4)7 | |
| RX(n+4)8 | SO(110) to SO(117): General-purpose output | RY(n+4)8 | SI(110) to SI(117): General-purpose input |
| to | | to | |
| RX(n+4)F | | RY(n+4)F | |
| RX(n+5)0 | SO(120) to SO(127): General-purpose output | RY(n+5)0 | SI(120) to SI(127): General-purpose input |
| to | | to | |
| RX(n+5)7 | | RY(n+5)7 | |
| RX(n+5)8 | SO(130) to SO(137): General-purpose output | RY(n+5)8 | SI(130) to SI(137): General-purpose input |
| to | | to | |
| RX(n+5)F | | RY(n+5)F | |

| Remote → Master | | Master → Remote | |
|---|---|---|---|
| Device No. | Signal name | Device No. | Signal name |
| RX(n+6)0 | SO(140) to SO(147): General-purpose output | RY(n+6)0 | SI(140) to SI(147): General-purpose input |
| to | | to | |
| RX(n+6)7 | | RY(n+6)7 | |
| RX(n+6)8 | SO(150) to SO(157): General-purpose output | RY(n+6)8 | SI(150) to SI(157): General-purpose input |
| to | | to | |
| RX(n+6)F | | RY(n+6)F | |
| RX(n+7)0 | Reserved | RY(n+7)0 | Reserved |
| RX(n+7)1 | | RY(n+7)1 | |
| RX(n+7)2 | | RY(n+7)2 | |
| RX(n+7)3 | | RY(n+7)3 | |
| RX(n+7)4 | | RY(n+7)4 | |
| RX(n+7)5 | | RY(n+7)5 | |
| RX(n+7)6 | | RY(n+7)6 | |
| RX(n+7)7 | | RY(n+7)7 | |
| RX(n+7)8 | Initial data process request flag | RY(n+7)8 | Initial data process complete flag |
| RX(n+7)9 | Not used | RY(n+7)9 | Not used |
| RX(n+7)A | | RY(n+7)A | |
| RX(n+7)B | Remote READY | RY(n+7)B | Reserved |
| RX(n+7)C | Reserved | RY(n+7)C | |
| RX(n+7)D | | RY(n+7)D | |
| RX(n+7)E | (Reserved: QnA) | RY(n+7)E | (Reserved: QnA) |
| RX(n+7)F | | RY(n+7)F | |

n: Address assigned to master module with station No. setting

## Remote registers

| Remote → Master | | | Master → Remote | | |
|---|---|---|---|---|---|
| Address | Details | Default | Address | Details | Default |
| RWrm | Not used | | RWwn | Not used | |
| RWrm+1 | | | RWwn+1 | | |
| RWrm+2 | | | RWwn+2 | | |
| RWrm+3 | | | RWwn+3 | | |
| RWrm+4 | | | RWwn+4 | | |
| RWrm+5 | | | RWwn+5 | | |
| RWrm+6 | | | RWwn+6 | | |
| RWrm+7 | | | RWwn+7 | | |

m, n: Address assigned to master module with station No. setting

# 5-2 Details of remote input/output signals

| Device No. | Signal name | Details |
|---|---|---|
| RXn0 | SO (00): Emergency stop input status output | Turns ON when robot controller is in emergency stop state. |
| RXn1 | SO (01): CPU_OK status output | Turns ON when robot controller is in normal state. |
| RXn2 | SO (02): Servo ON status output | Turns ON when robot's servomotor is ON. |
| RXn3 | SO (03): Alarm status output | Turns ON when robot controller is in following state:<br>• Error state<br>• Emergency stop input OFF |
| RXn8 | SO (10): Automatic mode status output | Turns ON when selected mode is automatic mode.<br>Turns OFF when other mode is selected. |
| RXn9 | SO (11): Origin return complete status output | Turns ON when robot has complete origin return.<br>Remains valid until origin return is started again or power is turned OFF. |
| RXnA | SO (12): Sequence program execution status output | Turns ON while sequence program is executed. |
| RXnB | SO (13): Robot program execution status output | Turns ON while robot program is executed. |
| RXnC | SO (14): Program reset status output | Turns ON when robot program has been reset.<br>Turns OFF when robot program starts. |
| RX(n+1)0<br>to<br>RX(n+1)7 | SO(20) to SO(27): General-purpose output | General-purpose output turns ON/OFF when value is substituted to SO port, or SET/RESET command is executed. |
| to | to | |
| RX(n+6)8<br>to<br>RX(n+6)F | SO(150) to SO(157): General-purpose output | |
| RX(n+7)8 | Initial data process request flag | The initial data process request flag turns ON to request the initial data setting when the power is turned ON, or when returning from a communication error.<br>Turns OFF when initial data process is completed (initial data process complete flag RY(n+7)8 turns ON). |
| RX(n+7)B | Remote READY | Turns ON when initial data setting is completed and READY state is entered when power is turned ON or when returning from communication error. |

n: Address assigned to master module with station No. setting

* SO(01) to SO(14) are equivalent to DO (01) to DO (14) explained in the controller instruction manual.

| Device No. | Signal name | Details |
|---|---|---|
| RYn0 | SI (00): Emergency stop input | Turns OFF when controller enters emergency stop state.<br>Must maintain ON state during normal operation. |
| RYn1 | SI (01): Servo ON input | Turns ON when emergency stop state is canceled, and robot's servomotor turns ON.<br>Servo ON is executed at the change in status from OFF to ON. Note that the following conditions must be satisfied.<br>• RYn0 is ON<br>• Emergency stop switch on front of robot controller is canceled<br>• Emergency stop switch on teaching box is canceled<br>• Emergency stop terminal on CC-Link compatible module is closed |
| RYn8 | SI (10): Sequence control input | Turns ON when the sequence program in the robot controller is being executed.<br>Program is executed when this is ON, and stops when this is OFF. |
| RYn9 | SI (11): Interlock input | Turns OFF when running robot program stops or manual movement is stopped.<br>Must maintain ON state during normal operation. |
| RYnA | SI (12): Start input | Turns ON when selected robot program is being executed.<br>The robot program is executed at the change in status from OFF to ON. |
| RYnB | SI (13): Automatic mode input | Turns ON when the automatic mode is selected.<br>Shifts to the automatic mode at the change in status from OFF to ON. |
| RYnC | SI (14): Origin return input | Turns ON when robot origin return is executed.<br>Origin return is executed at the change in status from OFF to ON. (Valid only for the incremental motor.) |
| RYnD | SI (15): Program reset input | Turns ON when selected robot program is reset.<br>Program is reset at the change in status from OFF to ON. |
| RYnE | SI (16): Manual mode input | Turns ON when the manual mode is selected.<br>Shifts to the manual mode at the change in status from OFF to ON. |
| RYnF | SI (17): Absolute reset input | Turns ON when absolute reset of the robot is executed.<br>Absolute reset is executed at the change in status from OFF to ON. (Valid only for the absolute motor.) |
| RY(n+1)0<br>to<br>RY(n+1)7 | SI(20) to SI(27): General-purpose input | The general-purpose input is turned ON/OFF to refer to the SI port value and to execute the WAIT command. |
| to | to | |
| RY(n+6)8<br>to<br>RY(n+6)F | SI(150) to SI(157): General-purpose input | |
| RY(n+7)8 | Initial data process complete flag | Turns ON after completing the initial data process requested when the power is turned ON or when returning from a communication error or when the initial data process request.<br>With the initial data process, the emergency stop input (RYn0) and interlock input (RYn9) turn ON. |

n: Address assigned to master module with station No. setting

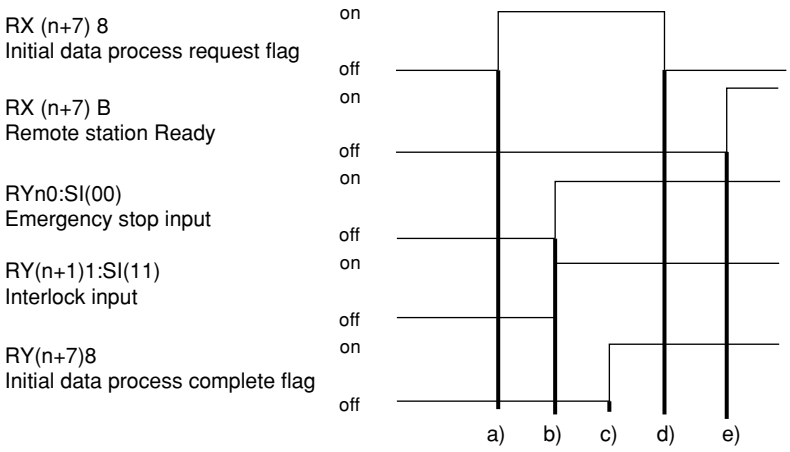
* SI(00) to SI(17) are equivalent to DI(00) to DI(17) explained in the controller instruction manual.

# 5-3 Dedicated input/output signal timing chart

**⚠CAUTION**

- **The dedicated input ON/OFF process from the master station PLC to the controller must be carried out at an interval of 100ms or more. If the interval is too short, the dedicated input may not be recognized. (This also applies to the same dedicated input and differing dedicated input intervals.)**
- **If dedicated outputs are provided for the dedicated inputs from the master station PLC to controller, use them.**

## 5-3-1 Initial data process for CC-Link connection



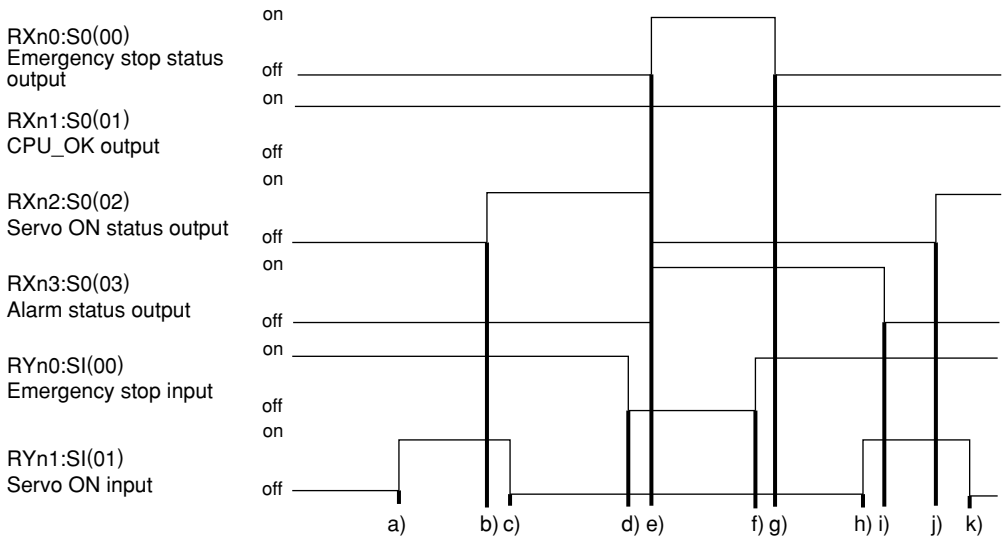

Confirmation of connection with master station PLC at power ON

a) Initial data process request flag ON is output
b) Emergency stop and interlock input ON is input
c) Initial data process complete flag ON is input
d) Initial data process request flag OFF is output
e) Remote station Ready ON is output

Connection with the CC-Link system is completed with this process.

* This process is always required to correctly connect to the CC-Link system.
* To enter the emergency stop state, turn RYn0:SI(00) OFF after the above process is established.
* The servo is OFF when the controller power is turned ON.

## 5-3-2 Servo ON and emergency stop




Initial servo ON process after power ON

a) Servo ON input ON is input
b) If not in the emergency stop state, output servo ON status ON is output
c) After confirming that servo ON status output is ON, servo ON input OFF is input

Shift to emergency stop

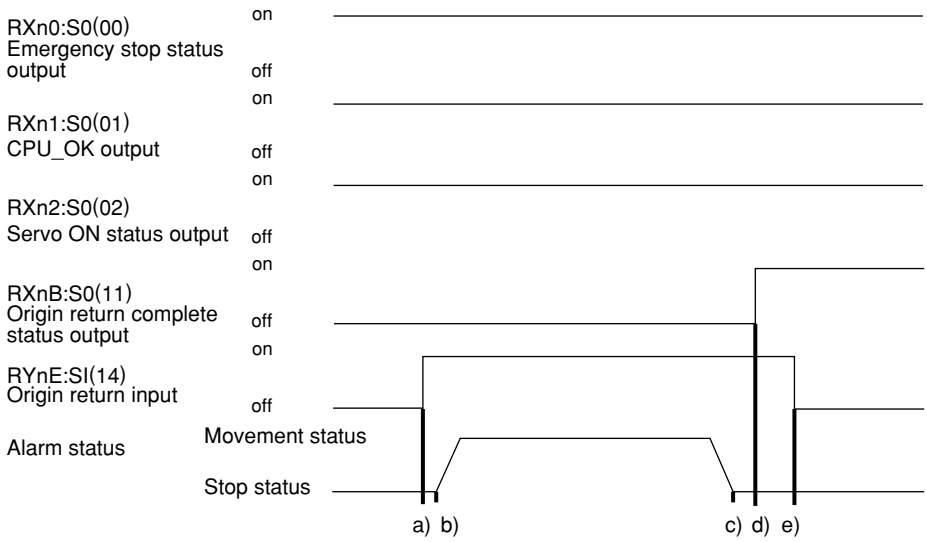
d) Emergency stop input OFF is input
e) Emergency stop status and alarm output ON is output
Servo ON status output OFF is output

Servo ON process from emergency stop status

f) Emergency stop input ON is input
g) Emergency stop status output OFF is output
h) Servo ON input ON is input
i) Alarm status output OFF is output
j) Servo ON status output ON is output
k) After confirming that servo ON status output is ON, servo ON input OFF is input

* The servo is OFF when the controller power is turned ON.

## 5-3-3 Origin return (Valid when incremental motor is connected)

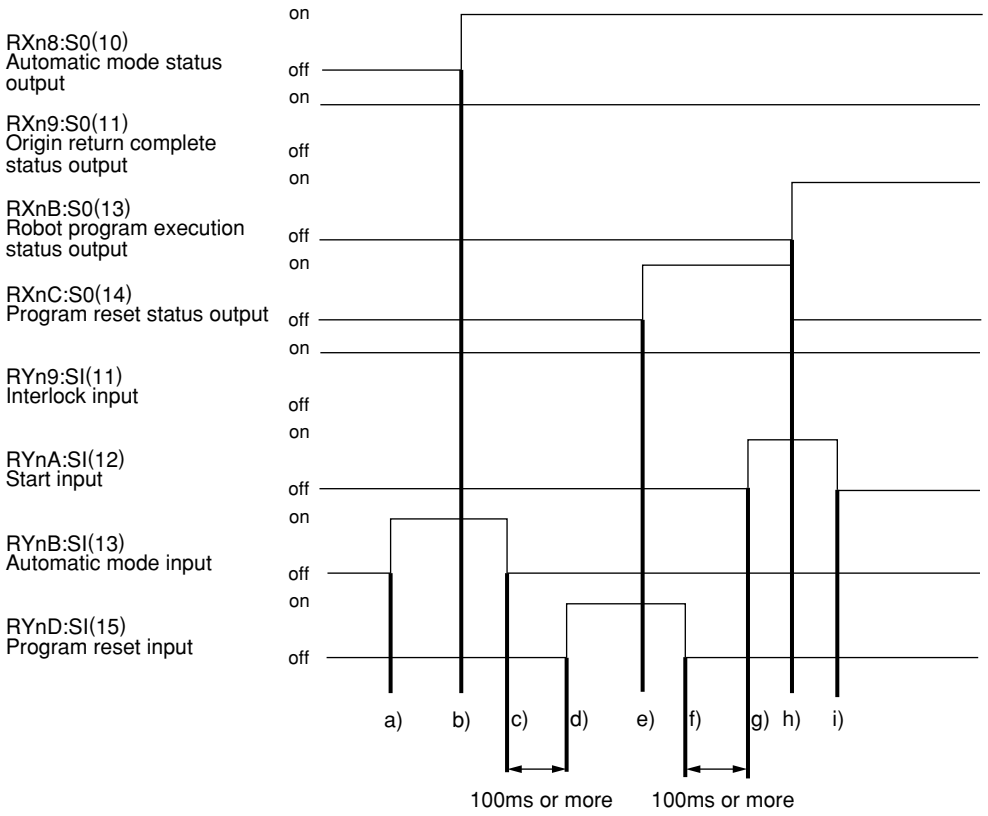



When origin return complete status output is OFF

a) Origin return input ON is input
b), c) Robot arm moves
d) Origin return complete status output ON is output
e) Origin return input OFF is input

* When the origin return complete status output is ON, origin return does not need to be carried out.
* Origin return can be executed only in the servo ON status.
* The origin return complete status output stays ON until origin return is required.
* With the absolute motor specifications, if there is no error in the origin position information when the controller power is turned ON, the origin return complete status output will automatically turn ON.

## 5-3-4 Automatic mode changeover, program reset and program execution




### Automatic mode changeover process

a) Automatic mode input ON is input
b) Automatic mode status output ON is output
c) After confirming that the automatic mode status output is ON, the automatic mode input OFF is input

### Program reset process

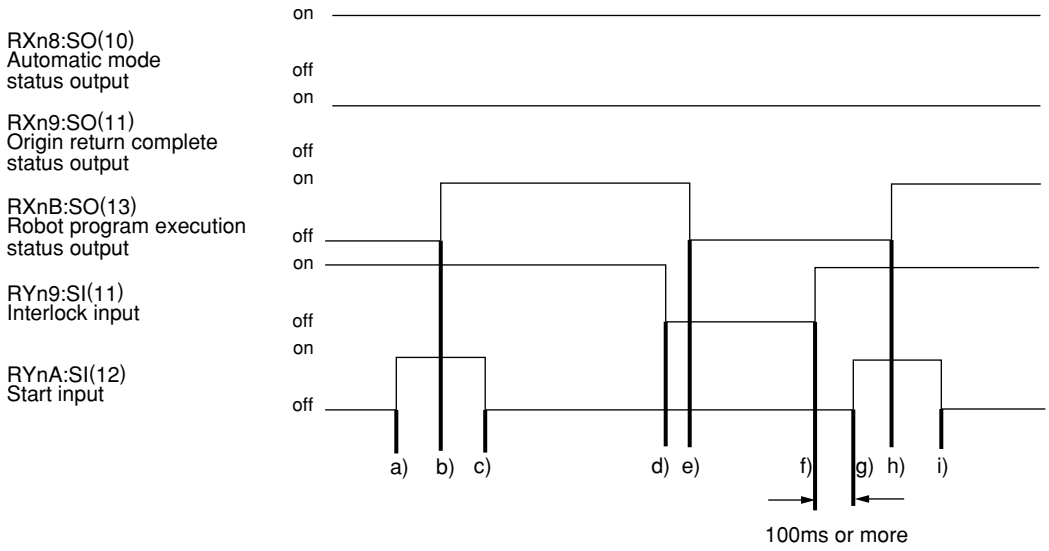
d) Program reset input ON is input
e) Program reset status output ON is output
f) After confirming that the program reset status output is ON, the program reset input OFF is input

### Program execution process

g) Start input ON is input
h) Program reset status output OFF is output
Robot program execution status output ON is output
i) After confirming that the robot program execution status output is ON, the start input OFF is input

* The program cannot be executed if the emergency stop input and interlock input are OFF.
* If the origin return complete status output is not ON, execution of the program may not be possible depending on the execution level setting value.

## 5-3-5 Stopping with program interlock




Program execution process

a) Start input ON is input
b) Robot program execution status output ON is output
c) After confirming that the robot program execution status output is ON, the start input OFF is input

Program stop process using interlock input

d) Interlock input OFF is input
e) Robot program execution status output OFF is output

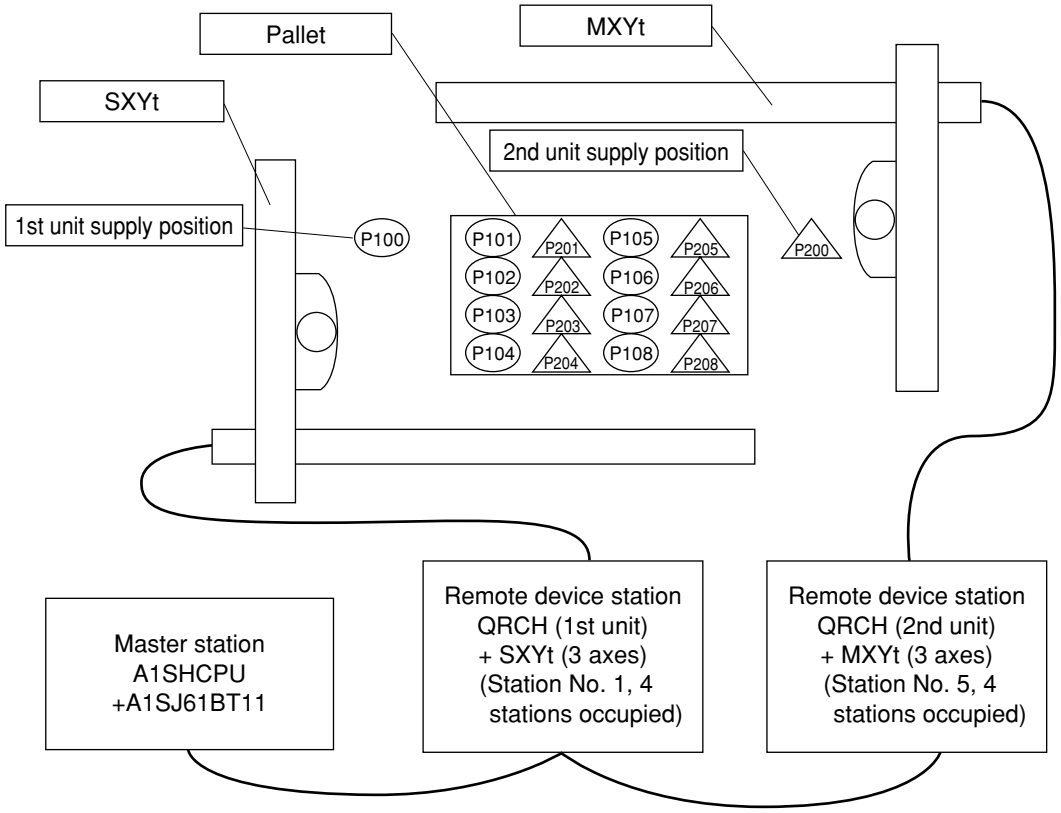
Program execution after stopping program with interlock input

f) Interlock input ON is input
g) Start input ON is input
h) Robot program execution status output ON is output
i) After confirming that the robot program execution status output is ON, the start input OFF is input

* The program will also stop when the emergency stop input OFF is input. In this case, the emergency stop status output and alarm output ON will be output, and the servo ON status output OFF will be output. The servo ON process is required to start the program again.

# 5-4 Sample program

An example for the following type of hardware configuration has been prepared for this section.




[Details of sample]

- Pick & place work is carried out using the PLC and QRCH + SXYt (3 axes), QRCH+MXYt (3 axes).
- The workpieces supplied to each robot are arranged on one pallet.
- The workpiece is supplied at a rate faster than the robot operation.
- The two robots will interfere above the pallet, so data is exchanged to prevent interference.
- When handling the workpiece, the robot moves at a low speed.
- The robot controller directly exchanges the pallet.

* Refer to the robot programming manual for details on the robot program language.
* The PLC circuit is a simple circuit that executes the selected robot program when emergency stop is canceled.

[Robot program data assignment]

* Variables used

| | | |
|---|---|---|
| 1st unit : | A | : Point No. in pallet |
| 2nd unit : | B | : Point No. in pallet |

* Points used

| | | |
|---|---|---|
| 1st unit : | P100 | : Point above workpiece supply |
| | P101 | : 1st point above pallet |
| | : | : |
| | P108 | : 8th point above pallet |
| | P121 | : Z axis position point for workpiece supply |
| | P122 | : Z axis position point on pallet |
| 2nd unit : | P200 | : Point above workpiece supply |
| | P201 | : 1st point above pallet |
| | : | : |
| | P208 | : 8th point above pallet |
| | P221 | : Z axis position point for workpiece supply |
| | P222 | : Z axis position point on pallet |

* Bit data used

| | | |
|---|---|---|
| 1st unit : | SI (40) | : Point No. reception complete input |
| | SI (41) | : Movement complete response standby input |
| | SI (42) | : Movement complete standby input |
| | SO (23) to SO (20) | : Point No. setting output group |
| | SO (40) | : Point No. setting complete output |
| | SO (41) | : Movement complete output |
| | SO (42) | : Movement complete response output |
| | DI (47) | : Pallet change complete input |
| | DO (40) | : Chuck hand open close (0: Close, 1: Open) |
| | DO (47) | : Pallet exchange command output |
| 2nd unit : | SI (23) to SI (20) | : Point No. setting input group |
| | SI (40) | : Point No. transmission complete input |
| | SI (41) | : Movement complete standby input |
| | SI (42) | : Movement complete response standby input |
| | SO (40) | : Point No. setting reception complete output |
| | SO (41) | : Movement complete response output |
| | SO (42) | : Movement complete output |
| | DO (40) | : Chuck hand open/close (0: Close, 1: Open) |

[PLC data assignment]

| | |
|---|---|
| X0 (*1) | : Unit error |
| X1 (*1) | : Local station data link status |
| X6 (*1) | : Data link start normal completion |
| X7 (*1) | : Data link start error completion |
| X0F (*1) | : Unit ready |
| X100 | : 1st unit's SO(00): Emergency stop input status |
| X101 | : 1st unit's SO(01): CPU_OK |
| : | : |
| X17F | : 1st unit reservation |
| X180 | : 2nd unit's SO(00): Emergency stop input status |
| X181 | : 2nd unit's SO(01): CPU_OK |
| : | : |
| X1FF | : 2nd unit reservation |
| Y0 (*1) | : Refresh instruction |
| Y6 (*1) | : Data link start request |
| Y100 | : 1st unit's SI(00): Emergency stop input |
| Y101 | : 1st unit's SI(01): Servo ON input |
| : | : |
| Y17F | : 1st unit reservation |
| Y180 | : 2nd unit's SI(00): Emergency stop input |
| Y181 | : 2nd unit's SI(01): Servo ON input |
| : | : |
| Y1FF | : 2nd unit reservation |
| M0 | : Unit preparation complete flag |
| M1 | : Parameter setting flag |
| M2 | : Data link start flag |
| M4 | : 1st station data link status |
| M8 | : 5th station data link status |
| D0 | : No. of connection units storage device |
| D1 | : 1st unit local station information setting storage device |
| D2 | : 2nd unit local station information setting storage device |
| D10 | : Parameter setting status storage device |

*1: This number is determined by the master module mounting position and the number of occupied input/output points mounted before the module.

[Robot program]

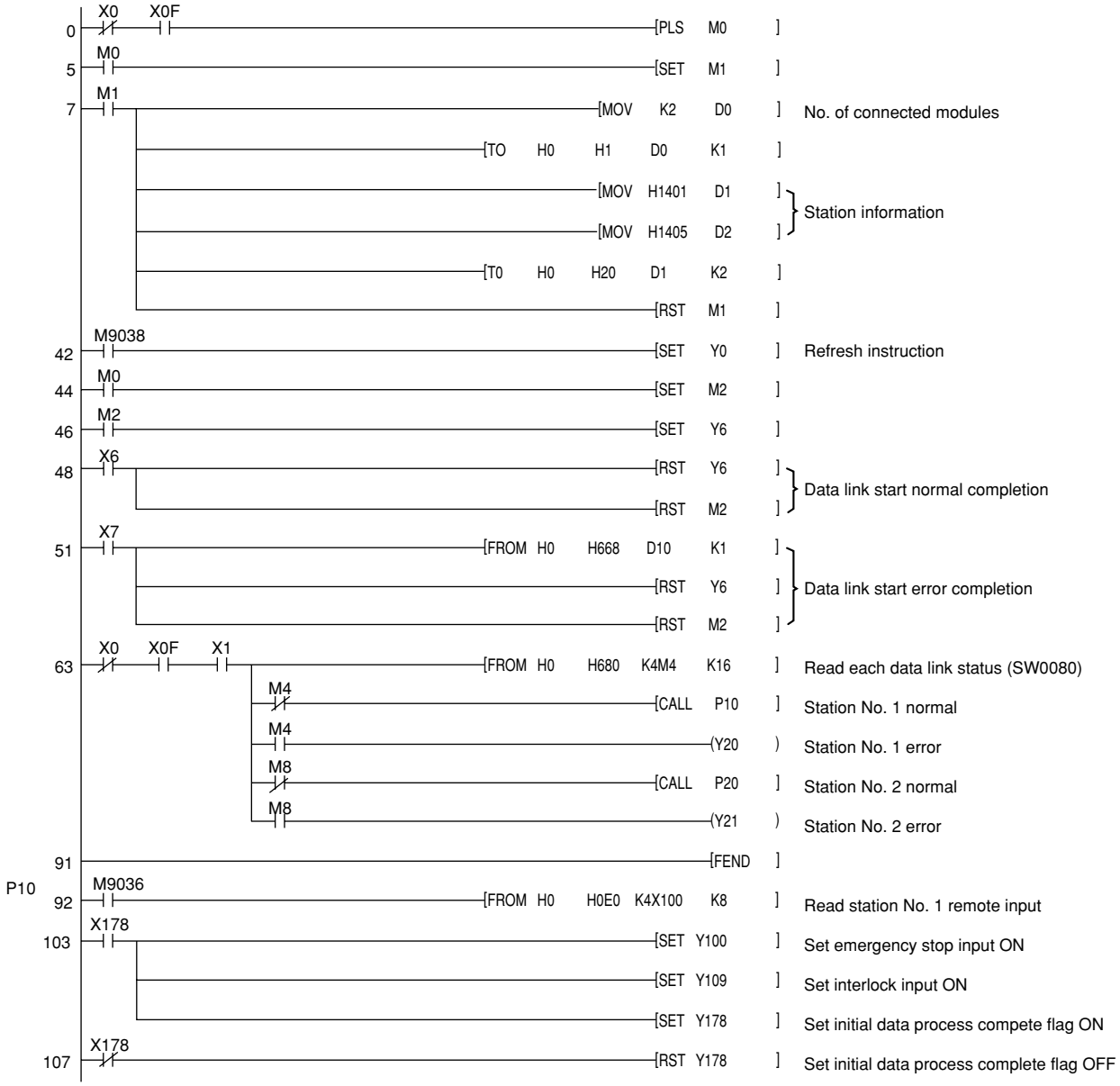
1st unit's QRCH

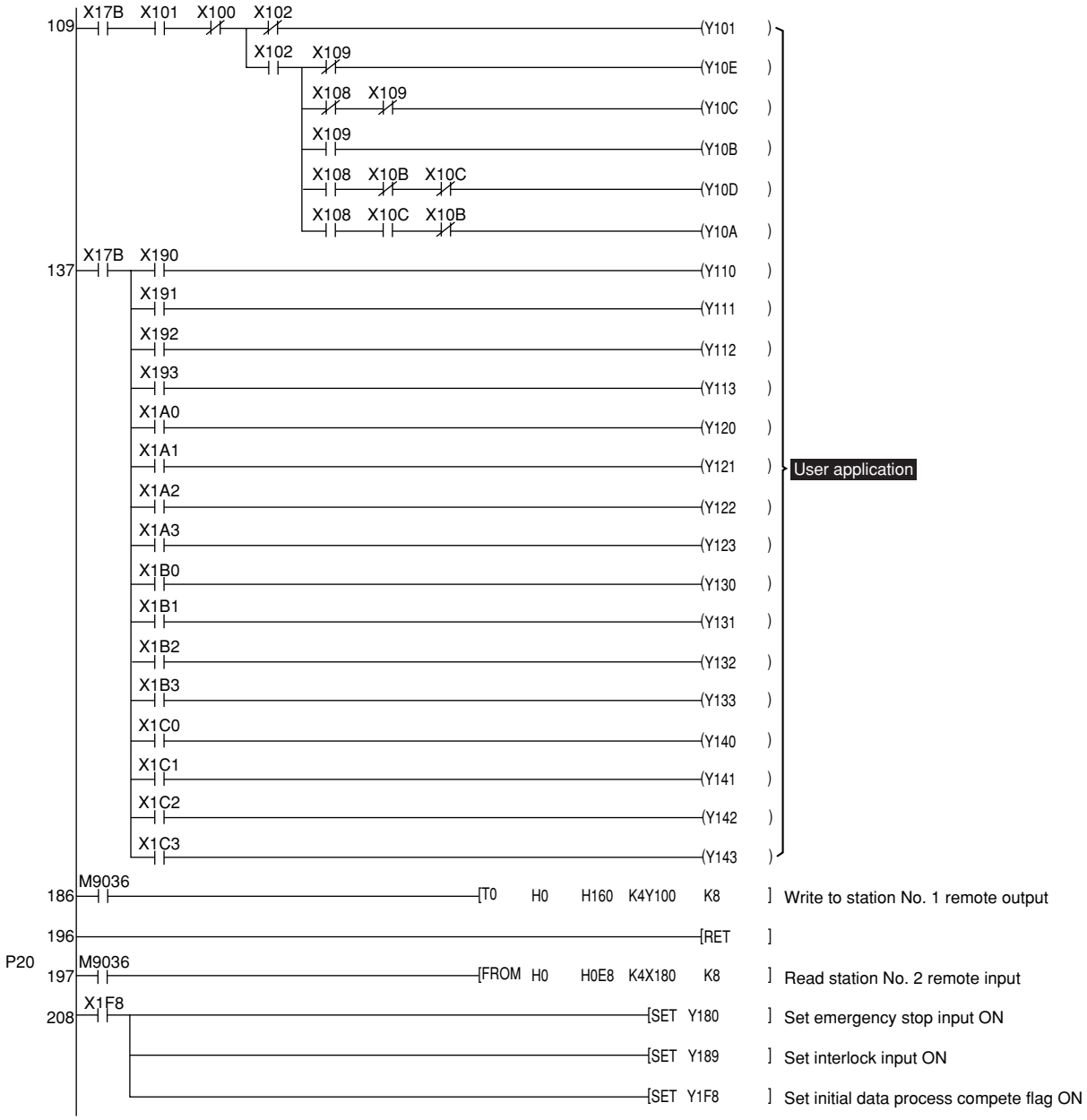
```
'INIT ROUTINE
   RESET SO2()
   RESET SO4()
   RESET DO4()
   A=101
'MAIN ROUTINE
   MOVE P,P100,Z=0
   GOSUB *PICK
*ST1:
   MOVE P,P[A],Z=0
   GOSUB *PLACE
   MOVE P,P100,Z=0
   SO(41)=1
   WAIT SI(41)=1
   SO(41)=0
   WAIT SI(41)=0
   SO(23,22,21,20)=A-100
   SO(40)=1
   WAIT SI(40)=1
   SO(40)=0
   WAIT SI(40)=0
   SO(23,22,21,20)=0
   GOSUB *PICK
   WAIT SI(42)=1
   SO(42)=1
   WAIT SI(42)=0
   SO(42)=0
   A=A+1
   IF A>108 THEN
      A=101
      DO(47)=1
      WAIT DI(47)=1
      DO(47)=0
   ENDIF
   GOTO *ST1
   HALT
'SUB ROUTINE FOR PICK
*PICK:
   DO(40)=1
   DRIVE(3,P121),S=20
   WAIT ARM(3)
   DO(40)=0
   DELAY 500
   RETURN
''SUB ROUTINE FOR PLACE
*PLACE:
   DRIVE(3,P122),S=20
   WAIT ARM(3)
   DO(40)=1
   DELAY 500
   RETURN
```

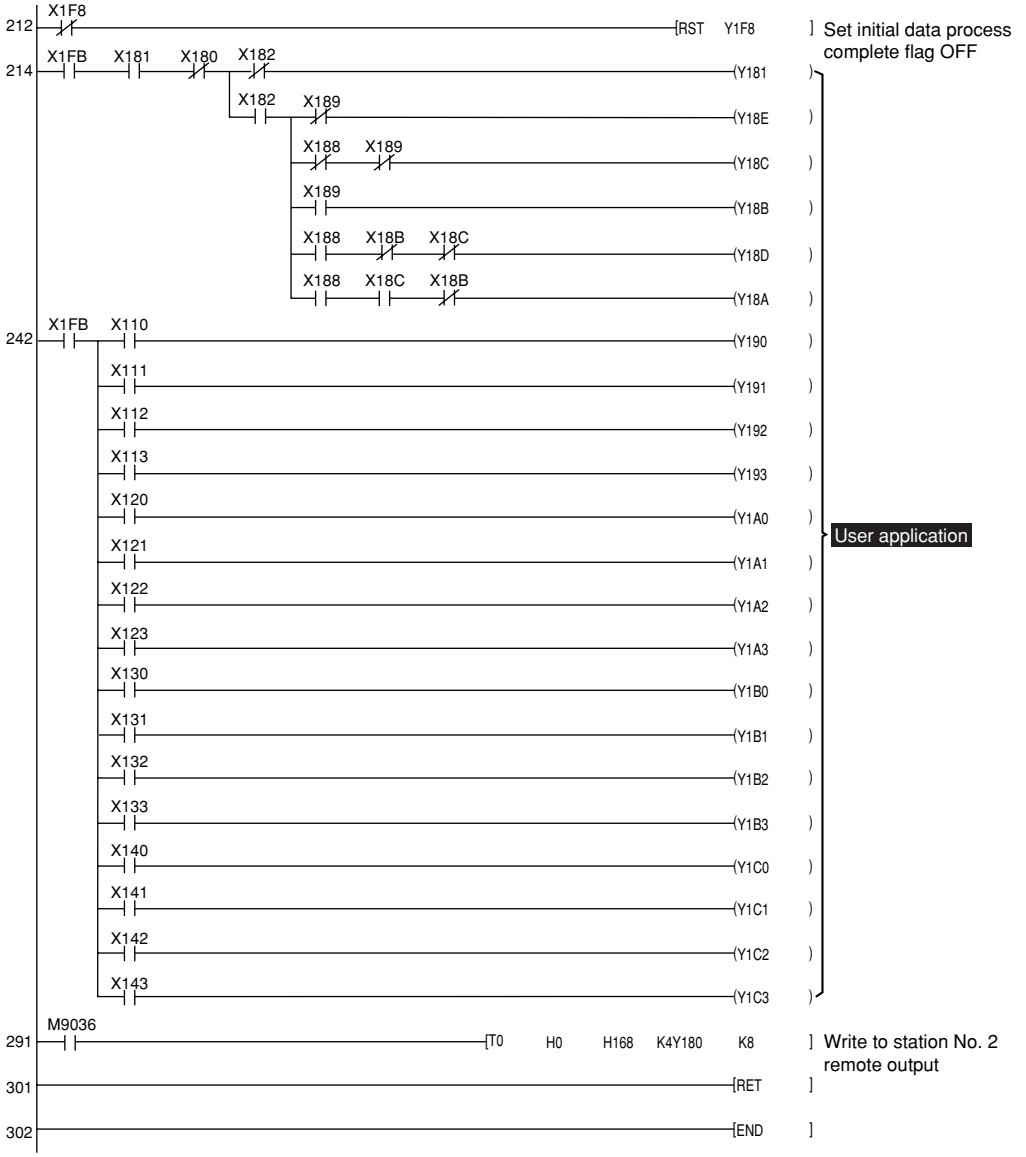
2nd unit's QRCH

```
'INIT ROUTINE
   RESET SO2()
   RESET SO4()
   RESET DO4()
   B=201
'MAIN ROUTINE
   MOVE P,P200,Z=0
   GOSUB *PICK
*ST2:
   WAIT SI(41)=1
   SO(41)=1
   WAIT SI(41)=0
   SO(41)=0
   WAIT SI(40)=1
   B=SI(23,22,21,20)
   SO(40)=1
   WAIT SI(40)=0
   SO(40)=0
   B=B+200
   MOVE P,P[B],Z=0
   GOSUB *PLACE
   MOVE P,P200,Z=0
   SO(42)=1
   WAIT SI(42)=1
   SO(42)=0
   WAIT SI(42)=0
   GOSUB *PICK
   GOTO *ST2
   HALT
'SUB ROUTINE FOR PICK
*PICK:
   DO(40)=1
   DRIVE(3,P221),S=20
   WAIT ARM(3)
   DO(40)=0
   DELAY 500
   RETURN
'SUB ROUTINE FOR PLACE
*PLACE:
   DRIVE(3,P222),S=20
   WAIT ARM(3)
   DO(40)=1
   DELAY 500
   RETURN
```

[PLC program]


X0 X0F [PLS M0]
M0 [SET M1]
M1 [MOV K2 D0] No. of connected modules
[TO H0 H1 D0 K1]
[MOV H1401 D1] Station information
[MOV H1405 D2]
[TO H0 H20 D1 K2]
[RST M1]
M9038 [SET Y0] Refresh instruction
M0 [SET M2]
M2 [SET Y6]
X6 [RST Y6] Data link start normal completion
[RST M2]
X7 [FROM H0 H668 D10 K1] Data link start error completion
[RST Y6]
[RST M2]
X0 X0F X1 [FROM H0 H680 K4M4 K16] Read each data link status (SW0080)
M4 [CALL P10] Station No. 1 normal
M4 (Y20) Station No. 1 error
M8 [CALL P20] Station No. 2 normal
M8 (Y21) Station No. 2 error
[FEND]
P10
M9036 [FROM H0 H0E0 K4X100 K8] Read station No. 1 remote input
X178 [SET Y100] Set emergency stop input ON
[SET Y109] Set interlock input ON
[SET Y178] Set initial data process compete flag ON
X178 [RST Y178] Set initial data process complete flag OFF


109
X17B X101 X100 X102
Y101
X102 X109
Y10E
X108 X109
Y10C
X109
Y10B
X108 X10B X10C
Y10D
X108 X10C X10B
Y10A
137
X17B X190
Y110
X191
Y111
X192
Y112
X193
Y113
X1A0
Y120
X1A1
Y121
User application
X1A2
Y122
X1A3
Y123
X1B0
Y130
X1B1
Y131
X1B2
Y132
X1B3
Y133
X1C0
Y140
X1C1
Y141
X1C2
Y142
X1C3
Y143
186
M9036
T0 H0 H160 K4Y100 K8
Write to station No. 1 remote output
196
RET
P20
197
M9036
FROM H0 H0E8 K4X180 K8
Read station No. 2 remote input
208
X1F8
SET Y180
Set emergency stop input ON
SET Y189
Set interlock input ON
SET Y1F8
Set initial data process compete flag ON


212
X1F8
RST Y1F8
Set initial data process complete flag OFF
214
X1FB X181 X180 X182
Y181
X182 X189
Y18E
X188 X189
Y18C
X189
Y18B
X188 X18B X18C
Y18D
X188 X18C X18B
Y18A
242
X1FB X110
Y190
X111
Y191
X112
Y192
X113
Y193
X120
Y1A0
X121
Y1A1
X122
Y1A2
X123
Y1A3
X130
Y1B0
X131
Y1B1
X132
Y1B2
X133
Y1B3
X140
Y1C0
X141
Y1C1
X142
Y1C2
X143
Y1C3
User application
291
M9036
T0 H0 H168 K4Y180 K8
Write to station No. 2 remote output
301
RET
302
END

# 5-5 CC-Link compatible module specifications

The CC-Link compatible module with the CC-Link label is compatible with CC-Link Ver. 1.10. Limits on the station-to-station cable length, etc., can be eased by using the Ver. 1.10 compatible CC-Link cable. Refer to the master station PLC instruction manual compatible with Ver. 1.10.

| Specification item | CC-Link compatible module |
|---|---|
| Target controller | QRCH/MRCH/QRCX Series controller |
| Remote station type | Remote device station |
| Number of occupied stations | Fixed to four stations |
| Station No. setting | 1 to 61 (rotary switch) |
| Communication speed setting | 10M / 5M / 2.5M / 625K / 156Kbps (rotary switch) |
| Number of CC-Link input/output points *1 | Dedicated input : 10 points<br>Dedicated output : 9 points]<br>General-purpose input : 96 points<br>General-purpose output : 96 points<br>Input register : 16 words (currently not used)<br>Output register : 16 words (currently not used) |
| Monitor LED | RUN, ERRL, SD, RD |

*1) The controller's I/O update interval is 10ms.

Note) The specifications and appearance are subject to change without prior notice.

## MEMO