Cat. No. I153E-EN-01

SCARA Robots
YRC Series

DeviceNet

USER´S MANUAL

OMRON

Copyright

Introduction

Thank you for purchasing the DeviceNet compatible module. This DeviceNet compatible module is an option module that allows the OMRON robot controller YRC to be connected as a DeviceNet system slave module.

The robot controller explained in this manual refers to the YRC robot controller.
This manual describes the flow of operations from wiring the DeviceNet compatible module to programming, and includes setting examples.

Refer to the respective product manuals for details on other devices such as connecting the master module and sequence programming.

Refer to the controller user's manual and programming manual supplied with the OMRON robot controller for details on operating the robot controller and on the robot program.

● NOTE
The master module explained in this manual is based on the OMRON CJ1 series. If the explanations differ from other brands, refer to the manual for the product being used.

Disclaimers

CHANGE IN SPECIFICATIONS
Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS
Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA
Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS
The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions (Always read before starting use)

Always read this manual, the robot controller user's 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 user's 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. ADDITIONALLY, THERE MAY BE SEVERE PROPERTY DAMAGE.

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
Explains the key point in the operation in a simple and clear manner.

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.

DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).

[Precautions for design]

WARNING

• REFER TO THE DEVICENET SYSTEM MASTER MODULE USER'S MANUAL AND THIS MANUAL FOR DETAILS ON THE STATE OF THE DEVICENET SYSTEM AND ROBOT CONTROLLER WHEN A COMMUNICATION ERROR OCCURS WITH THE DEVICENET 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.
• THE SAFETY CONNECTOR OF THE ROBOT CONTROLLER HAS AN EMERGENCY STOP TERMINAL TO TRIGGER EMERGENCY STOP. USING THIS TERMINAL, PREPARE A PHYSICAL INTERLOCK CIRCUIT SO THAT THE SYSTEM INCLUDING THE ROBOT CONTROLLER WILL WORK SAFETY.

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.
• INSTALL THE DEVICENET COMPATIBLE MODULE INTO THE ROBOT CONTROLLER, AND SECURELY FIX WITH SCREWS.
• NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS OR ELECTRONIC PARTS OTHER THAN THE ROTARY SWITCH ON THE DEVICENET COMPATIBLE MODULE.
• NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS OR ELECTRIC PARTS INSIDE THE CONTROLLER.
• 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 DEVICENET 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 DEVICENET 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 DEVICENET COMPATIBLE MODULE. FAILURE TO SHUT OFF ALL PHASES COULD LEAD TO ROBOT CONTROLLER TROUBLE OR MALFUNCTIONING.
- WHEN USING THE ROBOT CONTROLLER WITH THE DEVICENET 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.

CAUTION

THE DEVICENET SYSTEM MAY NOT FUNCTION PROPERLY IF THE MASTER MODULE AND ROBOT CONTROLLER POWER ARE TURNED ON SIMULTANEOUSLY. ALWAYS TURN THE ROBOT CONTROLLER POWER ON AFTER TURNING ON THE POWER FOR THE MASTER MODULE ON.

[Precautions for disposal]

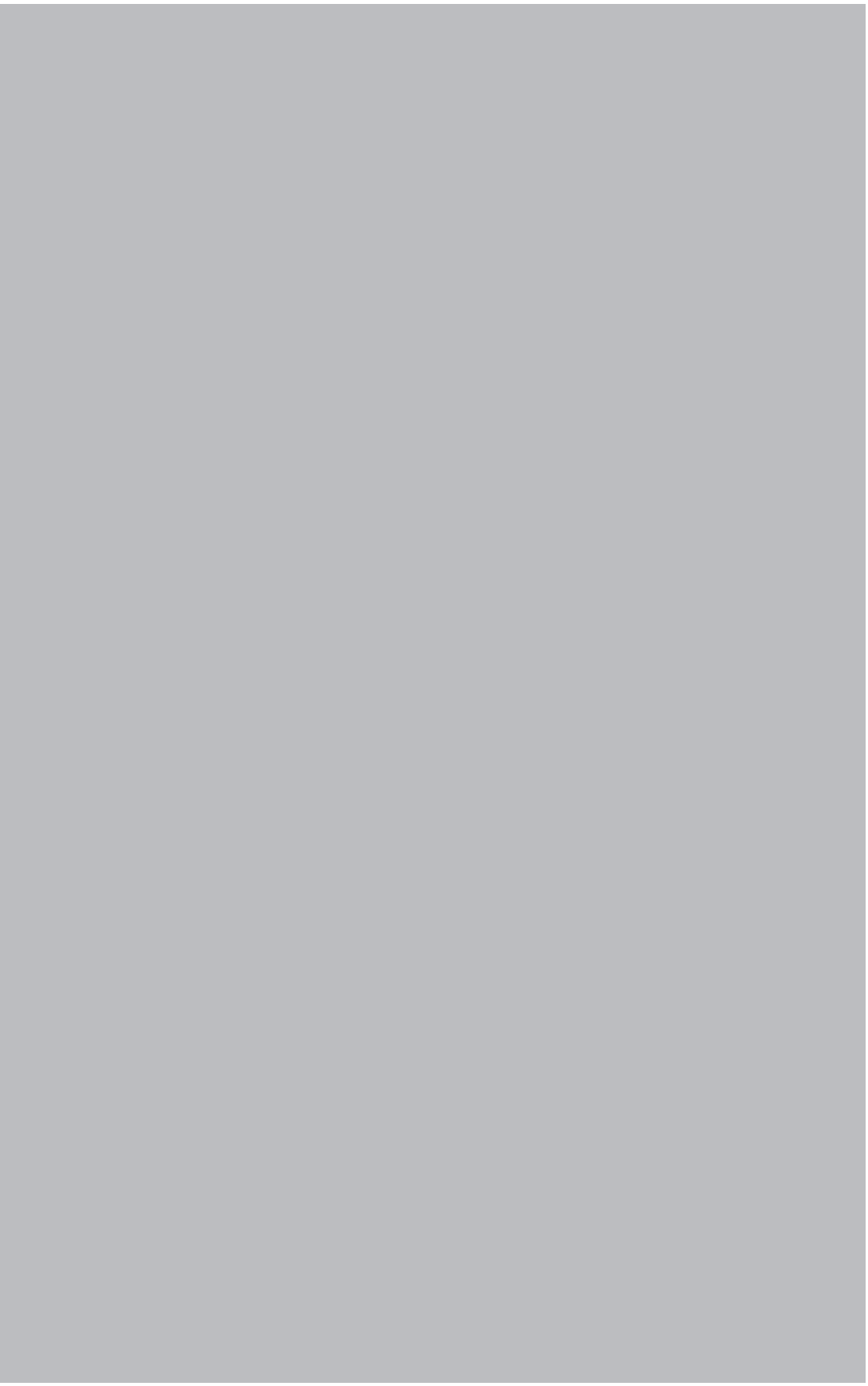
CAUTION

DISPOSE OF THIS PRODUCT AS INDUSTRIAL WASTE.

General Contents

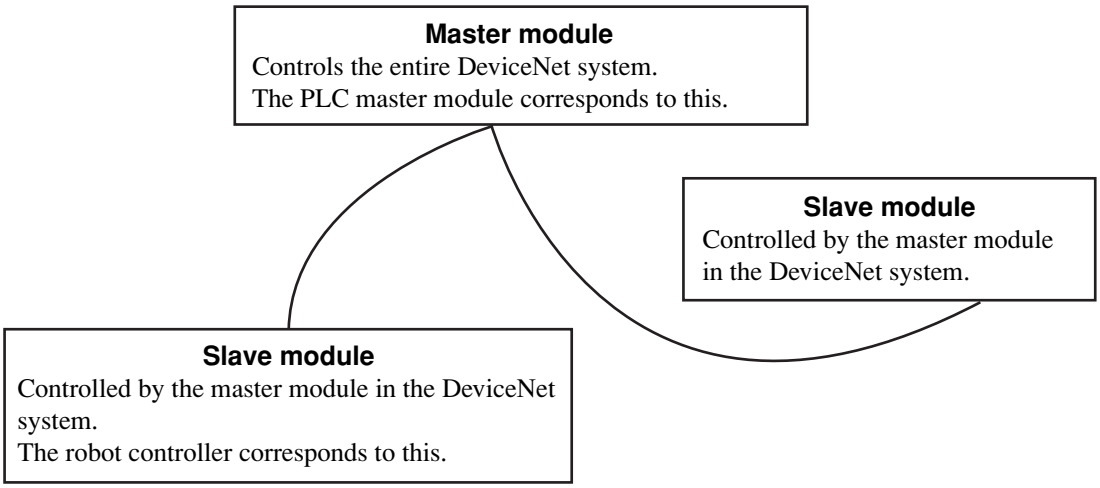
Chapter 1 OUTLINE

Contents



1. Features

The DeviceNet system is a system used to connect the robot controller or scattered input/output modules, etc., with dedicated cables, and to control these modules from the master module.
The DeviceNet system allows wiring to be reduced.



DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).

NOTE

The dedicated input of STD.DIO connector provided on the YRC controllers will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled.

[Wiring saving]

One dedicated cable (5-wire) is used to connect the robot controller and PLC. This allows the entire system wiring to be reduced.

[Emulated serialization on parallel DIO]

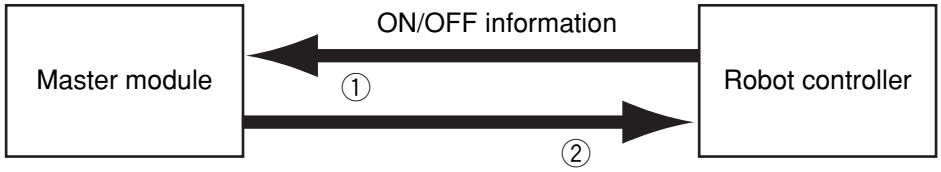
By making the robot controller's internal settings without using a robot program, the various I/O devices, such as the sensors and relays mounted on the robot controller's parallel I/O can be controlled from the PLC as if they were DeviceNet system I/O devices.

CAUTION

AN EMERGENCY STOP TERMINAL FOR HARDWIRE IS PROVIDED IN SAFETY CONNECTOR ON THE ROBOT CONTROLLER.
IN THE YRC CONTROLLER, WHEN THE DEVICENET SYSTEM IS USED WHILE STD. DIO IS NOT USED (EXTERNAL DC 24V POWER SUPPLY IS NOT USED), THE BOARD CONDITION (EXTERNAL 24V MONITOR CONTROL) OF SYSTEM PARAMETERS MUST BE SET INVALID. IF IT IS LEFT VALID, THE STD. DIO INTERLOCK SIGNAL IS ENABLED CAUSING AN ERROR IN THE ROBOT OPERATION COMMANDS.

2. Mechanism

The mechanism of communication is explained in this section to provide an understanding of how the robot controller and master module operate via the DeviceNet system.



1- The robot controller's ON/OFF information is sent to the master module via the network (DeviceNet system cable).

2- The master module's ON/OFF information is sent to the robot controller via the network (DeviceNet system cable).

* **The robot controller monitors the ON/OFF information at a 10ms cycle.**

* **The ON/OFF information consists of two words each of dedicated I/O words, 14 words each of general-purpose I/O words as word information, and 16 points each of dedicated I/O points, 96 points each of general-purpose I/O points as bit information. However, when the number of channels that the DeviceNet compatible module occupies is set to "Small" (2CH each of I/O) by option board parameter, bit information consists 16 points each of dedicated I/O points and 16 points each of general-purpose I/O points, so that word information cannot be handled.**

NOTE

The number of channels that the DeviceNet compatible module occupies can be set to either "Large" (24CH each of I/O) or "Small" (2CH each of I/O) by option board parameter.

If the following is executed with the robot program in the robot controller, the bit information will be sent to the master module via the DeviceNet system by 1.

SO (20)=1

Conversely, if the following is executed with the robot program, the bit information received from the master module via the DeviceNet system will be monitored by 2, and the robot controller will wait for the ON information.

WAIT SI (20)=1

If the following is executed with the robot program in the robot controller, the word information will be sent to the master module via the DeviceNet system by 1.

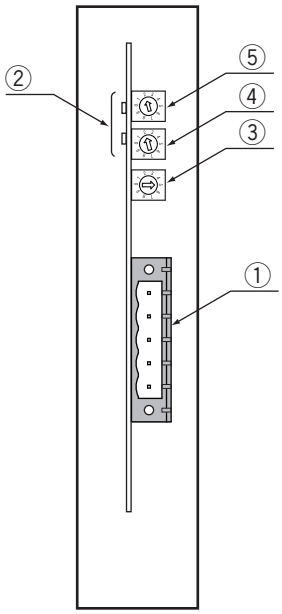
SOW (2)= 256

Conversely, if the following is executed with the robot program, the word information received from the master module via the DeviceNet system will be substituted in integer variable A% by 2.

A% = SIW (3)

3. Names of each part on the DeviceNet compatible module

The part names of the DeviceNet compatible module installed in the robot controller are described in this section. The DeviceNet compatible module is installed into an optional slot in the robot controller.



Front of the unit

1- DeviceNet system cable terminals
These terminals are used to connect the DeviceNet system cable. Each of the five terminals has a meaning, so do not make miswiring. These terminals are "V-" (Black), "CAN L" (Blue), "SHIELD "(-), "CAN H" (White) and "V+" (Red) from the top.

2- Transmission monitor LED
The status in the DeviceNet system is indicated with ON, OFF and flickering status of two LEDs. These terminals are "MS"and "NS" from the top.

3- MAC ID setting switch (LSB: 1st digit)
This is the rotary switch for setting the robot controller MAC ID in the DeviceNet system. The 1st digit of the MAC ID is set with this switch.

4- MAC ID setting switch (MSB: 2nd digit)
This is the rotary switch for setting the robot controller MAC ID in the DeviceNet system. The 2nd digit of the MAC ID is set with this switch.

5- Communication speed switch (BPS)
This is the rotary switch for setting the DeviceNet system's communication speed.

4. Assignment of DeviceNet compatible I/O

The table below shows the correspondence of the robot controller's serial I/O to the I/O data (channel) on the DeviceNet. The number of channels assigned to the DeviceNet compatible module can be set to either 24 channels each or 2 channels each of I/O by robot controller parameter.

● **Using Input 24CH / Output 24CH**

Serial output (Robot controller → Master module)				Serial input (Master module → Robot controller)			
Robot controller		Master module		Robot controller		Master module	
Port No.		Channel No.		Port No.		Channel No.	
	SOW(0)*1	(mCH)			SIW(0)*1	(nCH)	
	SOW(1)*1	(m+1CH)			SIW(1)*1	(n+1CH)	
SOD(2)	SOW(2)	(m+2CH)		SID(2)	SIW(2)	(n+2CH)	
	SOW(3)	(m+3CH)			SIW(3)	(n+3CH)	
SOD(4)	SOW(4)	(m+4CH)		SID(4)	SIW(4)	(n+4CH)	
	SOW(5)	(m+5CH)			SIW(5)	(n+5CH)	
SOD(6)	SOW(6)	(m+6CH)		SID(6)	SIW(6)	(n+6CH)	
	SOW(7)	(m+7CH)			SIW(7)	(n+7CH)	
SOD(8)	SOW(8)	(m+8CH)		SID(8)	SIW(8)	(n+8CH)	
	SOW(9)	(m+9CH)			SIW(9)	(n+9CH)	
SOD(10)	SOW(10)	(m+10CH)		SID(10)	SIW(10)	(n+10CH)	
	SOW(11)	(m+11CH)			SIW(11)	(n+11CH)	
SOD(12)	SOW(12)	(m+12CH)		SID(12)	SIW(12)	(n+12CH)	
	SOW(13)	(m+13CH)			SIW(13)	(n+13CH)	
SOD(14)	SOW(14)	(m+14CH)		SID(14)	SIW(14)	(n+14CH)	
	SOW(15)	(m+15CH)			SIW(15)	(n+15CH)	
SO0(7 to 0) *2		(m+16CH)	7 to 0	SI0(7 to 0) *2		(n+16CH)	7 to 0
SO1(7 to 0) *2			15 to 8	SI1(7 to 0) *2			15 to 8
SO2(7 to 0)		(m+17CH)	7 to 0	SI2(7 to 0)		(n+17CH)	7 to 0
SO3(7 to 0)			15 to 8	SI3(7 to 0)			15 to 8
SO4(7 to 0)		(m+18CH)	7 to 0	SI4(7 to 0)		(n+18CH)	7 to 0
SO5(7 to 0)			15 to 8	SI5(7 to 0)			15 to 8
SO6(7 to 0)		(m+19CH)	7 to 0	SI6(7 to 0)		(n+19CH)	7 to 0
SO7(7 to 0)			15 to 8	SI7(7 to 0)			15 to 8
SO10(7 to 0)		(m+20CH)	7 to 0	SI10(7 to 0)		(n+20CH)	7 to 0
SO11(7 to 0)			15 to 8	SI11(7 to 0)			15 to 8
SO12(7 to 0)		(m+21CH)	7 to 0	SI12(7 to 0)		(n+21CH)	7 to 0
SO13(7 to 0)			15 to 8	SI13(7 to 0)			15 to 8
SO14(7 to 0)		(m+22CH)	7 to 0	SI14(7 to 0)		(n+22CH)	7 to 0
SO15(7 to 0)			15 to 8	SI15(7 to 0)			15 to 8
Reserved *3		(m+23CH)	15 to 0	Reserved *3		(n+23CH)	15 to 0

m : Input-area head CH number assigned to master module
n : Output-area head CH number assigned to master module

Note)
*1: These are used as a dedicated command and so cannot be used as general-purpose I/O data.
*2: These are used as a dedicated I/O and so cannot be used as general-purpose I/O data.
*3: Reserved area.

● **Using Input 2CH / Output 2CH**

Serial output (Robot controller → Master module)			Serial input (Master module → Robot controller)		
Robot controller	**Master module**		**Robot controller**	**Master module**	
Port No.	**Channel No.**		**Port No.**	**Channel No.**	
SO0(7 to 0) *1	(mCH)	7 to 0	SI0(7 to 0) *1	(nCH)	7 to 0
SO1(7 to 0) *1		15 to 8	SI1(7 to 0) *1		15 to 8
SO2(7 to 0)	(m+1CH)	7 to 0	SI2(7 to 0)	(n+1CH)	7 to 0
SO3(7 to 0)		15 to 8	SI3(7 to 0)		15 to 8

m : Input-area head CH number assigned to master module
n : Output-area head CH number assigned to master module

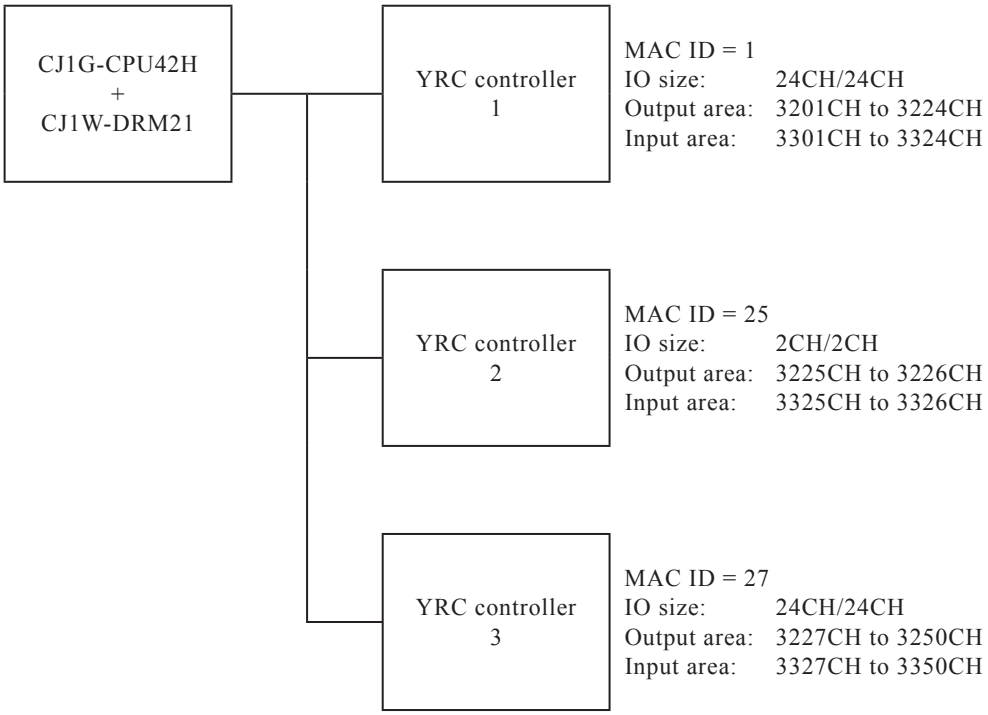
Note)
*1: These are used as a dedicated I/O and so cannot be used as general-purpose I/O data.

NOTE
- Each channel consists of 16-bit data.
- SOn() and SIn() are handled as unsigned 8-bit integer data.
- SOW(n) and SIW(n) are handled as unsigned 16-bit integer data.
- SOD(n) and SID(n) are handled as signed 32-bit integer data.
- The upper and lower words of SOD(n) respectively correspond to SOW(n+1) and SOW(n).
- The upper and lower words of SID(n) respectively correspond to SIW(n+1) and SIW(n).
- The dedicated input of STD.DIO connector provided on the YRC controllers will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled.

The head channel numbers in the input and output areas differ depending on the method of assigning the DeviceNet compatible module to the master module and the MAC ID setting. Refer to the master module and PLC instruction manuals for details.

Example: When fixed assignment is applied to fixed assignment area 1 while using a programmable controller (OMRON CJ1G-CPU42H) and a DeviceNet unit (OMRON CJ1W-DRM21).

Output-area CH (n) = 3200 + MAC ID
Input-area head CH (m) = 3300 + MAC ID

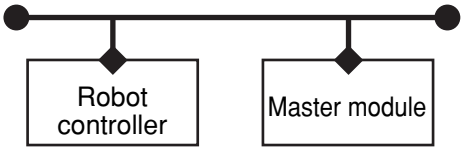


Master module	Controller		
Channel No.	MAC ID	Number of channels	Data
3201 to 3224	1	24	YRC controller 1 serial input
3225 to 3226	25	2	YRC controller 2 serial input
3227 to 3250	27	24	YRC controller 3 serial input
⋮			
3301 to 3324	1	24	YRC controller 1 serial output
3325 to 3326	25	2	YRC controller 2 serial output
3327 to 3350	27	24	YRC controller 3 serial output
⋮			

5. Shift of DeviceNet system connection status and robot controller status

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

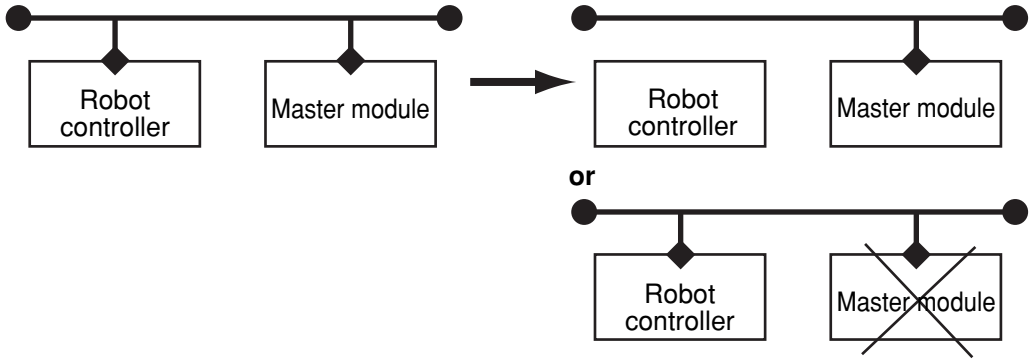
1- Normal state of DeviceNet system connection when robot controller power is turned ON



- Emergency stop/interlock signals in DeviceNet system are valid.
- When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the DeviceNet system.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid.
- When the Board condition (external 24V monitor control) of system parameters is left valid while SAFE mode is enabled, service mode input signal is made valid with DI (02) in SAFETY connector.

* The signals in the DeviceNet system are sent and received.

2- Shift from DeviceNet system normal connection state to DeviceNet system erroneous connection state

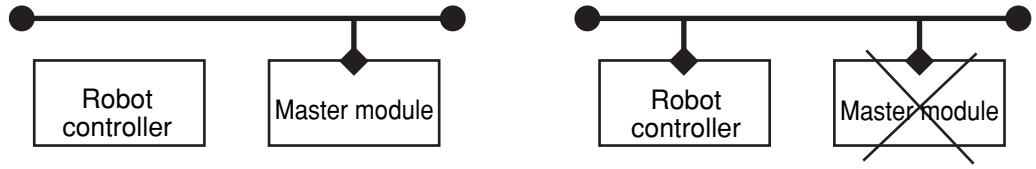


- Emergency stop input turns off with SI (00) in the robot controller.
- Service mode input turns off with SI (02) in the robot controller.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid when the Board condition (external 24V monitor control) of system parameters is left valid.
- When the Board condition (external 24V monitor control) of system parameters is left valid while SAFE mode is enabled, service mode input signal is made valid with DI (02) in SAFETY connector.

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

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

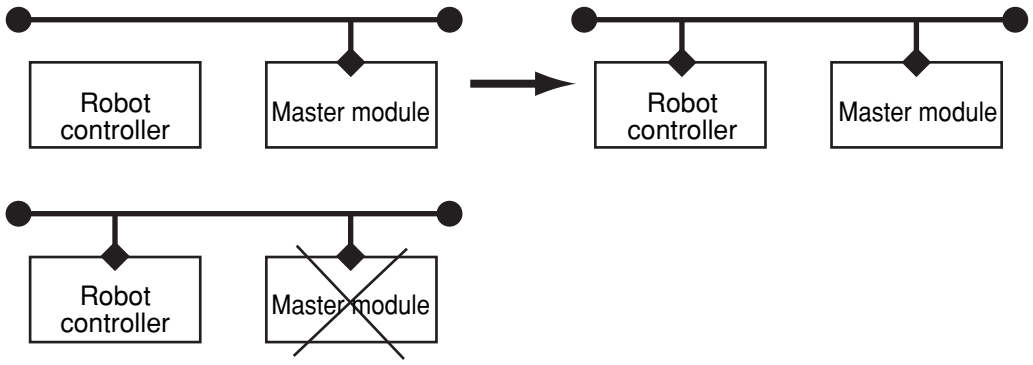
- Connection to DeviceNet system not possible
- Error in master module



- Emergency stop/interlock signals in DeviceNet system are invalid.
- When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the DeviceNet system.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid when the Board condition (external 24V monitor control) of system parameters is left valid.
- When the Board condition (external 24V monitor control) of system parameters is left valid while SAFE mode is enabled, service mode input signal is made valid with DI (02) in SAFETY connector.

* The signals on the DeviceNet system cannot be exchanged.
* The "DeviceNet Link Error" has been added to the error history in the robot controller. (A standby state for up to 10 seconds will occur to check the communication.)
* As opposed to the state given in 2, in this state, the emergency stop state by SI (00) is not attained in the controller, so the robot can be operated from the programming box. (The robot controller can be started independently when setting up the system, etc.)
* Service mode input signal cannot be invalidated with SI (02) when SAFE mode is enabled, so change the service mode parameter setting in SYSTEM > PARAM mode. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.
* When the connection to the DeviceNet system is correctly recovered, the system will automatically return to the DeviceNet system.

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



- DeviceNet system emergency stop/interlock signals change to valid state.
- Emergency stop terminal in SAFETY connector is valid.
- Interlock signal in STD. DIO connector is valid when the Board condition (external 24V monitor control) of system parameters is left valid.
- When the Board condition (external 24V monitor control) of system parameters is left valid while SAFE mode is enabled, service mode input signal is made valid with DI (02) in SAFETY connector.

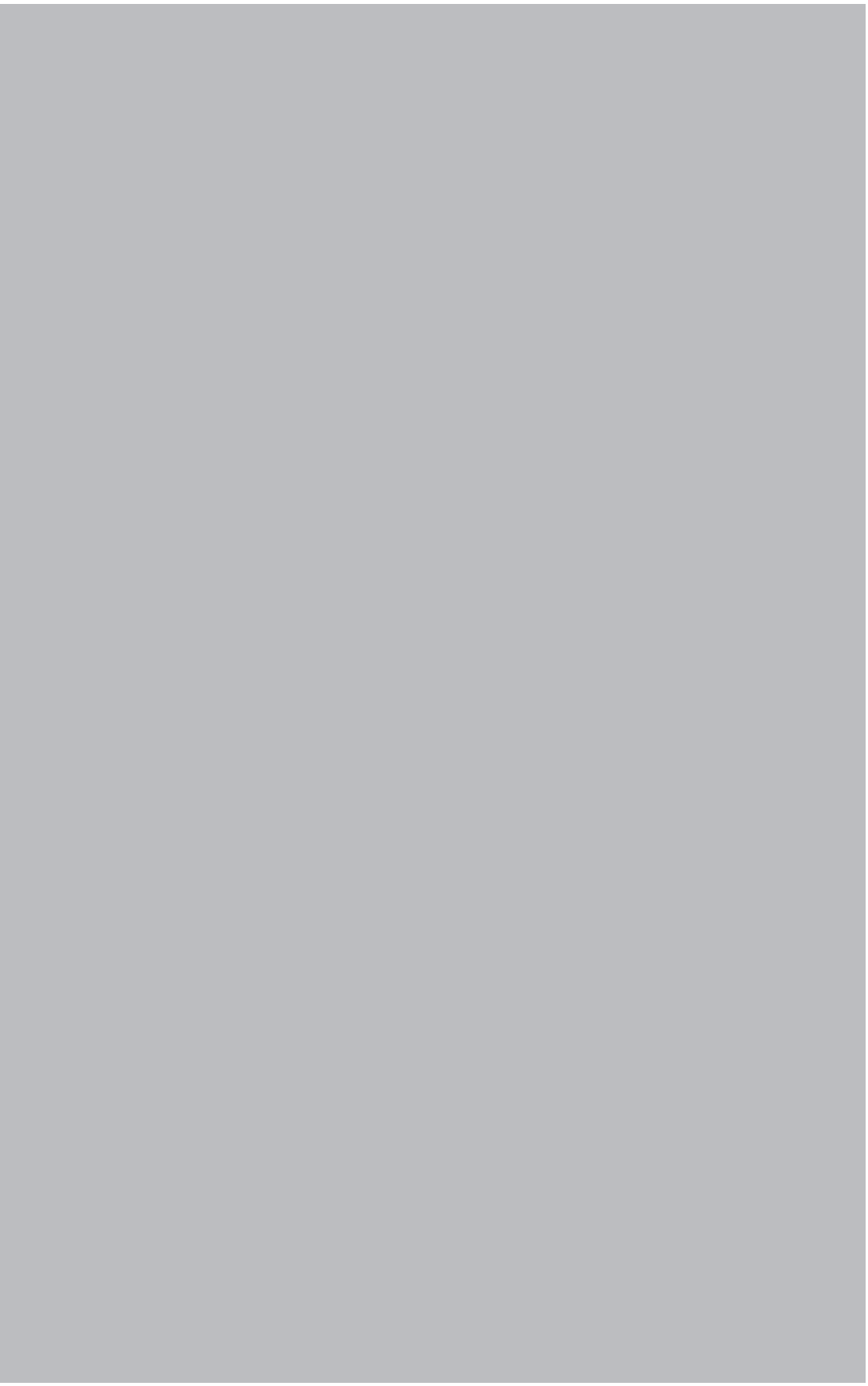
* The signals in the DeviceNet system can be sent and received.

* When service mode parameter setting in SYSTEM > PARAM mode has been changed while SAFE mode is enabled, make the service mode parameter setting again. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.

* The DeviceNet system will return when the DeviceNet system connection is recovered to the normal state.

Chapter 2 CONNECTION

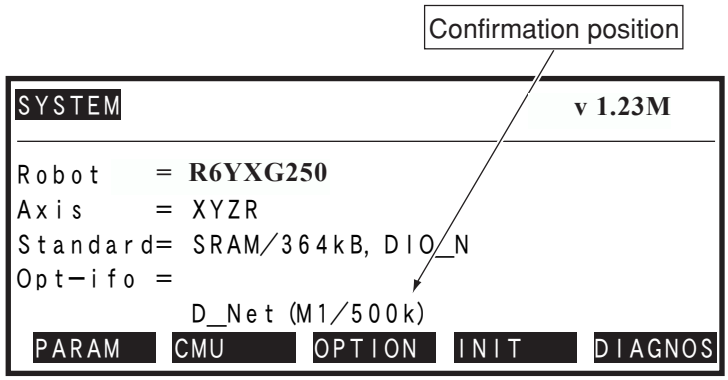
Contents



1. Confirming the DeviceNet compatible module settings

When using the DeviceNet system specification robot controller, the DeviceNet compatible module's MAC ID and communication speed setting can be confirmed from a programming box (PB).

- **When connecting DeviceNet compatible module to existing robot controller**
  → Follow the procedures given in section 2., and change the settings for the DeviceNet system specifications.
- **For DeviceNet system specification robot controller**
  (When robot controller is purchased with DeviceNet compatible module mounted)
  → Follow the procedures given in section 3., and set the MAC ID and communication speed.



[Operation]

1) Press the MODE key on the PB.

2) Press the F 4 (SYSTEM) key on the PB.

3) The display above will appear. The MAC ID and communication speed set for the DeviceNet system will appear in the parentheses following "D_Net" on the screen. The meaning of the above example is shown below.

M1 : MAC ID 1
(Setting range: 0 to 63)
500K : 500Kbps
(Setting speed [unit: bps]: 125K, 250K, 500K)
*** The communication speed must match the master module.**

⚠ CAUTION

IF THE ROBOT CONTROLLER IS NOT CONNECTED TO THE DEVICENET SYSTEM OR IF THERE IS AN ERROR IN THE DEVICENET SYSTEM, THE ERROR "DEVICENET LINK ERROR" WILL APPEAR ON THE PB WHEN THE ROBOT CONTROLLER POWER IS TURNED ON. THE ABOVE SETTINGS CAN BE CONFIRMED EVEN IN THIS STATE.

2. Setting to the DeviceNet system specification controller

When connecting the DeviceNet compatible module to an existing robot controller, the DeviceNet compatible module must be installed in the robot controller. Check the DeviceNet system specifications with the procedure given in section 1.

2.1 Saving the robot controller data

Before installing the DeviceNet compatible module into the robot controller, be sure to save the data stored in the robot controller into an external memory by using VIP software, etc.

2.2 Installing the DeviceNet compatible module

Install the DeviceNet compatible module into the robot controller.
At this point, set the MAC ID and communication speed for the DeviceNet compatible module by referring to the procedures given in "3. Setting the DeviceNet compatible module" in chapter 2.

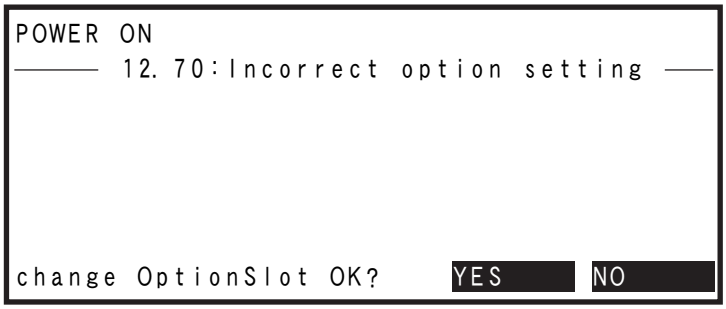
2.3 Response when starting the robot controller

The robot controller will always start up with an "option board setting error" after the DeviceNet compatible module has been installed. Make the following settings as explained below.

[Procedure]

1. Make connections to all input connectors on the front panel of the robot controller.

2. The following type of question will appear on the PB screen, so answer as "YES".



3. If the controller does not operate properly because of a memory error, etc., load the data saved in step 2.1 into the controller. Refer to the controller user's manual for details on loading the data.
   If the robot controller is not correctly connected with the DeviceNet system, the message "DeviceNet Link Error" will appear on the PB.

NOTE
When using support software "VIP" to load data, refer to the VIP user's manual.

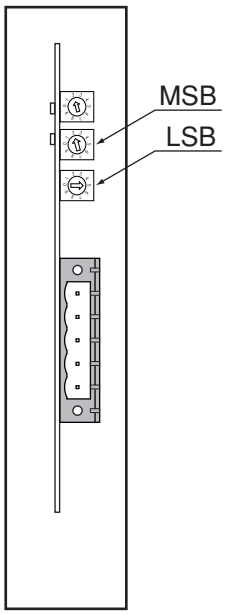
3. Setting the DeviceNet compatible module

To connect the DeviceNet system specification controller to the DeviceNet system, the MAC ID and communication speed must be set with the rotary switch on the DeviceNet compatible module. Carry out the operations explained in section 2.1 to confirm the current MAC ID and communication speed settings.

3.1 Setting the MAC ID

Using the rotary switches MSB and LSB in front of the DeviceNet compatible module, set the MAC ID of the robot controller in the DeviceNet system.

NOTE
The MAC ID for the DeviceNet system can be set in the range of 0 to 63.



Front of the unit

WARNING
WHEN SETTING THE MAC ID, COMPLETELY SHUT OFF THE POWER SUPPLIED TO THE ROBOT CONTROLLER.

[Procedures]

1. Check the MAC ID of the robot controller in the DeviceNet system.
   The MAC ID must be set between 0 and 63.

2. Using a precision flathead screwdriver, set the 2nd digit of the MAC ID on rotary switch MSB.

3. In the same manner, set the 1st digit on rotary switch LSB.

CAUTION

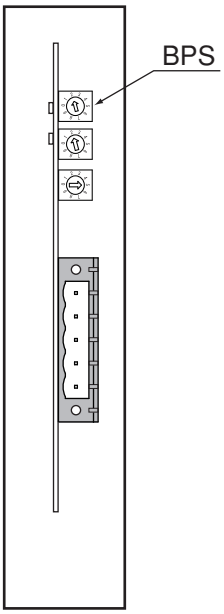
- MAKE SURE THAT THE SETTING IS NOT DUPLICATED WITH OTHER SETTINGS.
- NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS OR ELECTRONIC PARTS OTHER THAN THE ROTARY SWITCH ON THE DEVICENET COMPATIBLE MODULE.
- DO NOT APPLY IMPACT ON THE DEVICENET COMPATIBLE MODULE.
- DO NOT PLACE WATER OR CONDUCTIVE MATTERS, ETC., WHICH COULD CAUSE DAMAGE NEAR THE DEVICENET COMPATIBLE MODULE.
- ACCURATELY SET THE MAC ID
- WHEN SETTING THE BPS, MAKE SURE NOT TO SET THE ROTARY SWITCHES MSB AND LSB BY MISTAKE.

3.2 Setting the communication speed

Using the rotary switch BPS in front of the DeviceNet compatible module, set the communication speed for the robot controller in the DeviceNet system.

NOTE

The communication speed must match the DeviceNet system's master module setting.



Front of the unit

WARNING

WHEN SETTING THE MAC ID, COMPLETELY SHUT OFF THE POWER SUPPLIED TO THE ROBOT CONTROLLER.

[Procedures]

1. Confirm the communication speed for the robot controller in the DeviceNet system.
   The communication speed must be set between 125K and 500Kbps. The correspondence of the communication speed and switch is shown below.

Switch No.	0	1	2	Other than left setting
Communication speed [bps]	125K	250K	500K	Error

2. Using a precision flathead screwdriver, set the switch No. corresponding to the communication speed with rotary switch BPS.

CAUTION

- NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS OR ELECTRONIC PARTS OTHER THAN THE ROTARY SWITCH ON THE DEVICENET COMPATIBLE MODULE.
- DO NOT APPLY IMPACT ON THE DEVICENET COMPATIBLE MODULE.
- DO NOT PLACE WATER OR CONDUCTIVE MATTERS, ETC., WHICH COULD CAUSE DAMAGE NEAR THE DEVICENET COMPATIBLE MODULE.
- ACCURATELY SET THE COMMUNICATION SPEED.
- WHEN SETTING THE MSB AND LSB, MAKE SURE NOT TO SET THE ROTARY SWITCH BPS BY MISTAKE.

4. Noise measures

Two ferrite cores must be mounted on the input power cable when connecting to the DeviceNet system.

4.1 Mounting the ferrite core

Mount two ferrite cores onto the input power cable connected to the input power connector on the front panel of the robot controller.

WARNING
COMPLETELY SHUT OFF THE POWER SUPPLY TO THE INPUT POWER CABLE BEFORE STARTING THIS WORK.

[Procedures]

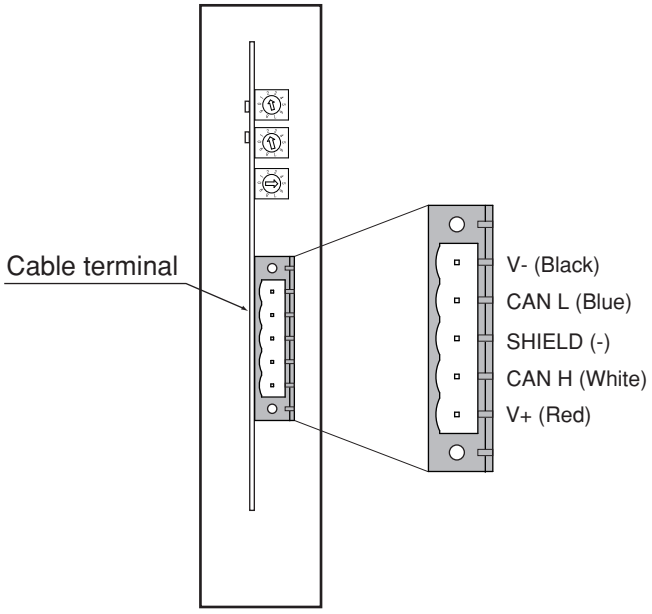
1. Mount the two ferrite cores (supplied) onto the input power cable. The ferrite core should be placed as close to the robot controller body as possible.

2. Fix the mounted ferrite core with an Insulock tie, etc.

CAUTION
SECURELY FIX THE FERRITE CORE. IF THE FERRITE CORE IS NOT MOUNTED, TROUBLE COULD OCCUR WITH THE DEVICENET SYSTEM OPERATIONS.

5. Connecting to the DeviceNet system

The DeviceNet system cable must be connected to the DeviceNet compatible module in order to connect to the DeviceNet system.



Front of the unit

WARNING

BEFORE CONNECTING THE CABLE, COMPLETELY SHUT OFF THE POWER SUPPLIED TO THE ROBOT CONTROLLER.

5.1 Connecting to the cable terminal to the controller

Connect the DeviceNet system cable to the DeviceNet system cable terminal on the DeviceNet compatible module.

[Procedure]

1. Using a flathead screwdriver, completely loosen the two screws on both sides of the DeviceNet system cable terminal, and remove the terminal block section from the DeviceNet compatible module.

   CAUTION

   ALWAYS REMOVE THE TERMINAL BLOCK SECTION BEFORE INSTALLING THE DEVICENET SYSTEM CABLE.

2. Using a flathead screwdriver, securely fix the DeviceNet system cable to the terminal block removed in step 1.
   The name of each terminal on the cable terminal block is shown above.
   * When connecting a terminator, connect it across CAN H-CAN L.
   * A slit to prevent incorrect inverted insertion is provided on the cable terminal block.

CAUTION

- SECURELY INSTALL THE DEVICENET SYSTEM CABLE.
- CAREFULLY CARRY OUT THE WORK TO AVOID APPLYING EXCESSIVE FORCE TO THE DEVICENET CABLE.
- USE A CRIMP TERMINAL TO CRIMP-CONNECT EACH WIRE END OF THE DEVICENET SYSTEM CABLE, SO THAT THE CABLE DOES NOT CAUSE AN OPEN-CIRCUIT FAULT.
- MAKE CONNECTIONS SO THAT THE DEVICENET SYSTEM CABLE IS CORRECTLY WIRED.

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

CAUTION

REFER TO THE MASTER MODULE INSTRUCTION MANUAL FOR DETAILS ON THE DEVICENET SYSTEM CABLE CONNECTION.

5.2 Testing the line from the master module

The master module in the DeviceNet system has a function to test the line to the slave module. Using this function, confirm that the robot controller is accurately recognized as a slave module in the DeviceNet system.
Refer to the master module instruction manual for details.

CAUTION

IF THE LINE TEST RESULTS INDICATE A CORRECT CONNECTION, PLACE THE DEVICENET SYSTEM CABLE INTO A CONDUIT, OR FIX IT WITH A CLAMP.

6. Parameter setting for DeviceNet serial I/O board

The following functions are enabled or disabled by setting the parameters for the DeviceNet serial I/O board.

	Parameter	Meaning
1.	[YRC] Board condition	Enables or disables the DeviceNet compatible module. When set to "VALID" the controller can be connected to the DeviceNet.
2.	Remote cmd / IO cmd (S105)	Enables or disables the functions of remote commands and I/O commands. When set to "VALID" the remote commands and I/O commands can be used. When set to "INVALID" the remote commands and I/O commands cannot be used. This parameter cannot be set to "VALID" simultaneously with parameter 3. When parameter 4 is set to "Small", the remote command cannot be used, although this parameter can be set to "VALID".
3.	Output MSG to SOW(1)	Enables or disables the function that sends an error message code number, which is displayed on the PB, to serial word output SOW(1). When set to "VALID" the error code number will be output to SOW(1). When set to "INVALID" the error code number will not be output to SOW(1). This parameter cannot be set to "VALID" simultaneously with parameter 2. Also, this parameter cannot be set to "VALID" when parameter 4 is set to "Small".
4.	IO size	Selects the number of channels that the DeviceNet compatible module occupies. When set to "Large", 24 channels each are occupied by the input/output. When set to "Small", 2 channels each are occupied by the input/output. This parameter cannot be set to "Small" when parameter 3 is set to "VALID".

NOTE

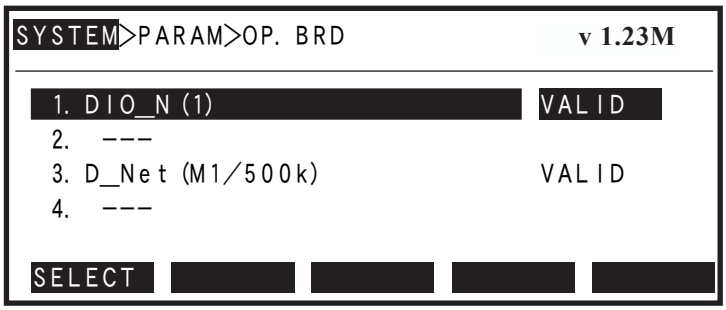
- For remote commands and I/O commands, refer to the separate command reference manual.
- For a description of codes issued from the "Output MSG to SOW(1)" parameter function, refer to "Error message" in this manual.
- When the "remote cmd / I/O cmd" parameter is set to "VALID", the "Output MSG to SOW(1)" parameter function cannot be used. Likewise, when the "Output MSG to SOW(1)" parameter is set to "VALID", the "remote cmd / I/O cmd" parameter function cannot be used.
- When the IO size is set to "Small" (2CH each of input/output), the I/O commands can be used but the remote commands cannot be used. Note that use of the I/O commands is partly limited.
- When the IO size is set to "Small" (2CH each of input/output), the "Output MSG to SOW(1)" parameter function cannot be used.

6.1 Parameter setting for DeviceNet serial I/O board

[Procedure]

1) Press the F 1 (PARAM) key in "SYSTEM" mode to enter "SYSTEM>PARAM" mode.

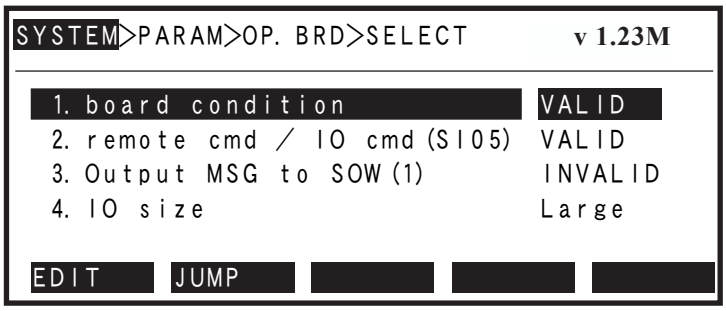
2) Press the F 5 (OP. BRD) key in "SYSTEM>PARAM" mode to enter the option board parameter setting mode.
The option boards installed in the controller are displayed in order on the PB screen.



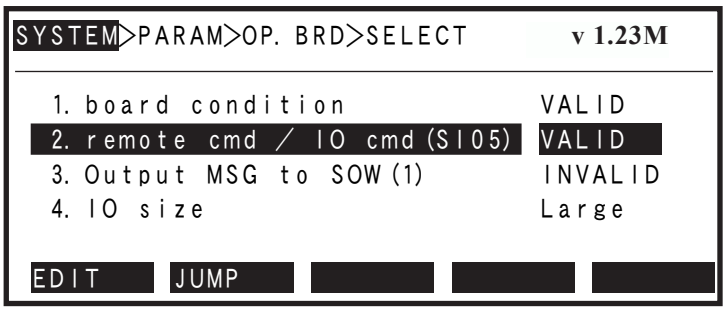
Option boards installed into the option slots are displayed on the PB screen.

Type	Display	Meaning
Option DIO	DIO_N(n)	An option DIO board of NPN specifications is installed. The number in parentheses is an ID number.
	DIO_P(n)	An option DIO board of PNP specifications is installed. The number in parentheses is an ID number.
Serial I/O	CCLnk(n/m)	A CC-Link unit is installed. Letters in parentheses indicate a station number "n" and a communication speed "m".
	D_Net(n/m)	A DeviceNet unit is installed. Letters in parentheses indicate a MAC ID number "n" and communication speed "m".
	Profi(n/m)	A Profibus unit is installed. Letters in parentheses indicate a station address "n" and communication speed "m".
Network	E_Net	An Ethernet unit is installed.
YC-Link	YCLnk(Mn)	A YC-Link unit is installed. Letters in parentheses indicate a station number "n".

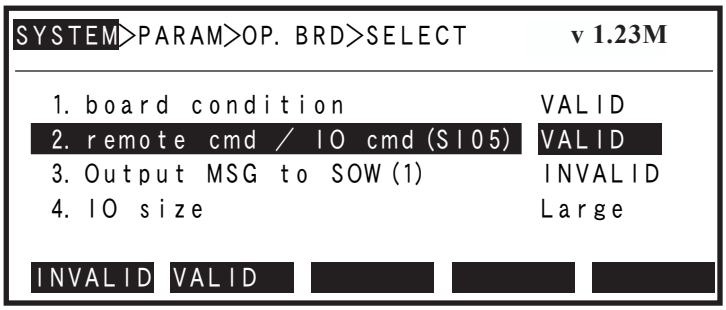
3) In "SYSTEM>PARAM>OP. BRD" mode, select the "D_Net" with the cursor (↑/↓) keys and press the F 1 (SELECT) key.



4) Select the parameter with the cursor (↑/↓) keys.



5) Press the F 1 (EDIT) key.

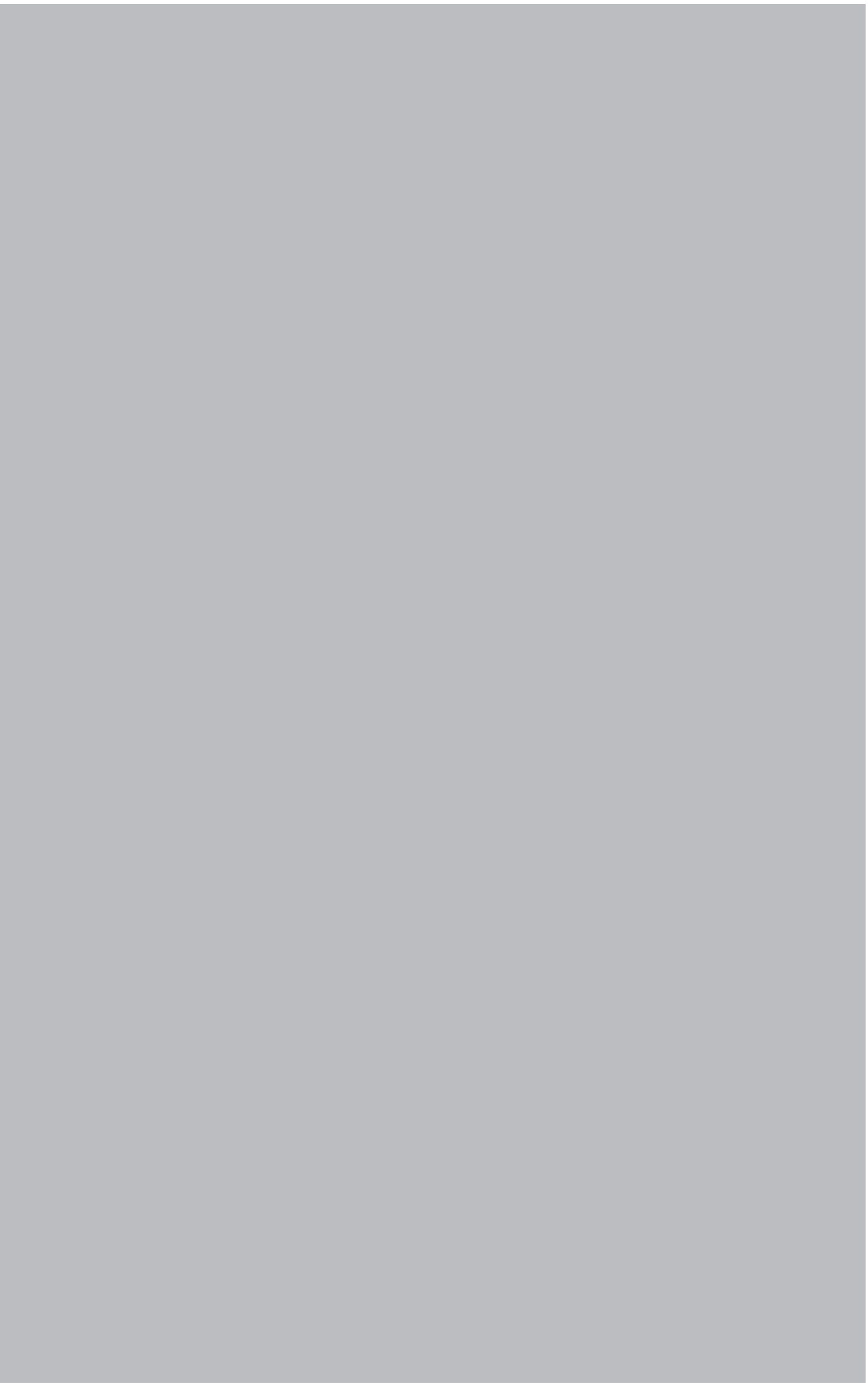


6) Press the F 1 (INVALID) or F 2 (VALID) key.
When setting the IO size parameter, press the F 1 (Large) or F 2 (Small) key.

7) Press the ESC key to quit the edit mode. To continue setting another parameter, use the cursor (↑/↓) keys to select the parameter.

Chapter 3 COMMUNICATION

Contents



1. State when robot controller power is turned ON

The DeviceNet system specification robot controller **always starts operation in servo OFF state when the power turned ON.**

1- When connection to DeviceNet system is correctly established.

The following conditions must be satisfied to correctly connect to the DeviceNet system:

- The DeviceNet system cable must be physically connected
- The MAC ID and communication speed must be correctly set
- The master module is operating normally.

When the robot controller is correctly connected to the DeviceNet system, the normal state will be indicated with the LEDs on the DeviceNet compatible module.

At this time, **the emergency stop signal and interlock signal in the DeviceNet system will be validated, so both signals must be turned ON in the connection process.**

The emergency stop terminal in SAFETY connector is always kept valid. The interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid.

When SAFE mode is enabled, service mode input signal is made valid with SI (02) in the DeviceNet system. The service mode input signal is made valid with DI (02) in SAFETY connector unless the Board condition (external 24V monitor control) of system parameters is set invalid.

2- When connection to DeviceNet system is incorrectly established

The following causes can be considered a correct connection with the DeviceNet system cannot be established:

- The DeviceNet system cable is not physically connected
- The MAC ID or communication speed is set incorrectly
- The master module is not operating correctly

When incorrectly connected to the DeviceNet system, an abnormal state will be indicated with the DeviceNet compatible module's LED. This also occurs when the master module is not operating correctly.

The emergency stop signal and interlock signal in the DeviceNet 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 DeviceNet system.

The emergency stop terminal in SAFETY connector is always kept valid. The interlock signal in STD. DIO connector is valid unless the Board condition (external 24V monitor control) of system parameters is set invalid.

When SAFE mode is enabled, service mode input signal is made valid with DI (02) in SAFETY connector unless the Board condition (external 24V monitor control) of system parameters is set invalid.
Service mode input signal in the DeviceNet system cannot be invalidated when SAFE mode is enabled, so change the service mode setting of system parameters. In this case, take full precautions to prevent improper settings that might lead to a hazardous situation.

* **For meanings of LED display, see Chapter 4 in this manual.**

2. Communication with master module

The method for communicating with the master module by using the robot program when the DeviceNet system is correctly connected is explained in this section.

2.1 Receiving data

The master module's output channel data is read via the serial input ports of the robot controller. The table below shows the correspondence of the master module's output channels and the robot controller's serial input ports. The correspondence of the master module's output channels and the robot controller's serial input ports differs depending on whether the IO size is set to "Large" or "Small" by option board parameter.

● When IO size is set to "Large"

Master module output channel No.	Robot controller serial input port No.		Master module output channel No.	Robot controller serial input port No.
(nCH)		SIW(0)	(n+16CH).07 to 00	SI0(7 to 0)
(n+1CH)		SIW(1)	(n+16CH).15 to 08	SI1(7 to 0)
(n+2CH)	SID(2)	SIW(2)	(n+17CH).07 to 00	SI2(7 to 0)
(n+3CH)		SIW(3)	(n+17CH).15 to 08	SI3(7 to 0)
(n+4CH)	SID(4)	SIW(4)	(n+18CH).07 to 00	SI4(7 to 0)
(n+5CH)		SIW(5)	(n+18CH).15 to 08	SI5(7 to 0)
(n+6CH)	SID(6)	SIW(6)	(n+19CH).07 to 00	SI6(7 to 0)
(n+7CH)		SIW(7)	(n+19CH).15 to 08	SI7(7 to 0)
(n+8CH)	SID(8)	SIW(8)	(n+20CH).07 to 00	SI10(7 to 0)
(n+9CH)		SIW(9)	(n+20CH).15 to 08	SI11(7 to 0)
(n+10CH)	SID(10)	SIW(10)	(n+21CH).07 to 00	SI12(7 to 0)
(n+11CH)		SIW(11)	(n+21CH).15 to 08	SI13(7 to 0)
(n+12CH)	SID(12)	SIW(12)	(n+22CH).07 to 00	SI14(7 to 0)
(n+13CH)		SIW(13)	(n+22CH).15 to 08	SI15(7 to 0)
(n+14CH)	SID(14)	SIW(14)		
(n+15CH)		SIW(15)		

n : Output-area head CH number assigned to master module

● When IO size is set to "Small"

Master module output channel No.	Robot controller serial input port No.
(nCH).07 to 00	SI0(7 to 0)
(nCH).15 to 08	SI1(7 to 0)
(n+1CH).07 to 00	SI2(7 to 0)
(n+1CH).15 to 08	SI3(7 to 0)

n : Output-area head CH number assigned to master module

CAUTION

• ALWAYS REFER TO THE PLC MANUAL AND CHECK THE SETTINGS FOR COMMUNICATION WITH THE MASTER MODULE.

NOTE

The IO size can be set by option board parameter. Refer to section 6 of chapter 2 for more details.

When reading the bit information from the master module output channel No. with the robot controller, write the following command in the robot program in the same manner as the DI input port.

WAIT command

Assignment statement

Example: To wait for (n+17CH)0 to turn ON when the IO size is set to "Large"

WAIT SI (20) = 1..... *The robot program will wait for SI (20) to turn ON.

Example: To read the (n+17CH)0 to (n+17CH)7 data into variable A when the IO size is set to "Large"

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

NOTE

The SI statement in the robot language can be defined from SI0 ( ) to SI27 ( ), but the DeviceNet compatible module accepts from SI0 ( ) to SI15 ( ).

When reading the word information from the master module's output channel No. with the robot controller, write the following command in the robot program.

Assignment statement

Example: To read the (n+2CH) word data into variable B when the IO size is set to "Large"

B = SIW (2)..... *The SIW (2) data will be assigned to variable B as a decimal. If SIW (2) is 01FFh, variable B will be 511.

Example: To read the (n+2CH) and (n+3CH) double word data into variable C when the IO size is set to "Large"

C = SID (2) ..... *The SIW (2) and SIW (3) data will be assigned to variable C as a decimal. If SIW (2) is 0010h and SIW (3) is 0001h, variable C will be 65552.

NOTE

The word data written with SOW (n) has the uncoded little endian format.
The double word data written with SOD (n) has the coded little endian format.

2.2 Transmitting data

The serial output port data of the robot controller is transmitted to the master module's input channel. The table below shows the correspondence of the robot controller's serial output ports and the master module's input channels. The correspondence of the robot controller's serial output ports and the master module's input channels differs depending on whether the IO size is set to "Large" or "Small" by option board parameter.

● When IO size is set to "Large"

Master module input channel No.	Robot controller serial output port No.		Master module input channel No.	Robot controller serial output port No.
(mCH)		SOW(0)	(m+16CH).07 to 00	SO0(7 to 0)
(m+1CH)		SOW(1)	(m+16CH).15 to 08	SO1(7 to 0)
(m+2CH)	SOD(2)	SOW(2)	(m+17CH).07 to 00	SO2(7 to 0)
(m+3CH)		SOW(3)	(m+17CH).15 to 08	SO3(7 to 0)
(m+4CH)	SOD(4)	SOW(4)	(m+18CH).07 to 00	SO4(7 to 0)
(m+5CH)		SOW(5)	(m+18CH).15 to 08	SO5(7 to 0)
(m+6CH)	SOD(6)	SOW(6)	(m+19CH).07 to 00	SO6(7 to 0)
(m+7CH)		SOW(7)	(m+19CH).15 to 08	SO7(7 to 0)
(m+8CH)	SOD(8)	SOW(8)	(m+20CH).07 to 00	SO10(7 to 0)
(m+9CH)		SOW(9)	(m+20CH).15 to 08	SO11(7 to 0)
(m+10CH)	SOD(10)	SOW(10)	(m+21CH).07 to 00	SO12(7 to 0)
(m+11CH)		SOW(11)	(m+21CH).15 to 08	SO13(7 to 0)
(m+12CH)	SOD(12)	SOW(12)	(m+22CH).07 to 00	SO14(7 to 0)
(m+13CH)		SOW(13)	(m+22CH).15 to 08	SO15(7 to 0)
(m+14CH)	SOD(14)	SOW(14)		
(m+15CH)		SOW(15)		

m : Input-area head CH number assigned to master module

● **When IO size is set to "Small"**

Master module intput device No.	Robot controller serial output port No.
(mCH).07 to 00	SO0(7 to 0)
(mCH).15 to 08	SO1(7 to 0)
(m+1CH).07 to 00	SO2(7 to 0)
(m+1CH).15 to 08	SO3(7 to 0)

m : Input-area head CH number assigned to master module

CAUTION

• ALWAYS REFER TO THE PLC MANUAL AND CHECK THE SETTINGS FOR COMMUNICATION WITH THE MASTER MODULE.

NOTE

The IO size can be set by option board parameter. Refer to section 6 of chapter 2 for more details.

When writing the robot controller's bit information into the master module's input channel No., write the following commands in the robot program in the same manner as the DO output port.

SET/RESET command
Assignment statement
OUT command

Example: To turn (m+17CH)0 ON when the IO size is set to "Large"

SET SO (20) or SO (20) = 1.... * SO (20) will turn ON.

Example: To write the variable A data into (m+17CH)0 to (m+17CH)7 when the IO size is set to "Large"

SO2 () = A..... *The variable A data will be converted into a binary and assigned to SO 2(). If variable A is 127, SO2 () will be 7Fh.

NOTE

The SO statement in the robot language can be defined from SO2 ( ) to SO27 ( ), but the DeviceNet compatible module accepts from SO2 ( ) to SO15 ( ).

When writing the robot controller word information into the master module's input channel No., write the following command in the robot program.

Assignment statement

Example: To write 512 into (m+2CH) as word data when the IO size is set to "Large"

SOW (2) = 512 ..... *512 is assigned to SOW (2), and SOW (2) becomes 0200h.

Example: To write 69005 as the double word data into (m+2CH) and (m+3CH) when the IO size is set to "Large"

SOD (2) = 69905 ..... *69905 is assigned to SOD (2), SOW (2) becomes 1111h and SOW (3) becomes 0001h.

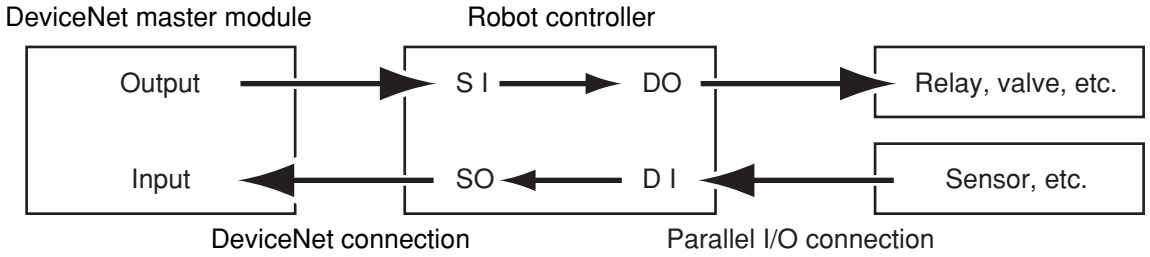
NOTE

The word data written with SOW (n) has the uncoded little endian format.
The double word data written with SOD (n) has the coded little endian format.

3. Direct connection by emulated serialization on parallel DIO

The robot controller's parallel input data can be transferred to the serial output data regardless of the robot program. Likewise, the robot controller's serial input data can be transferred to the parallel output data

By using this function, a sensor or relay connected to the parallel I/O of the robot controller can be used like a device connected to the DeviceNet master module.



NOTE

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

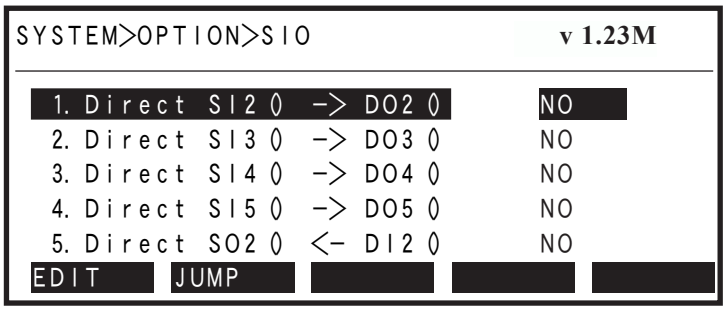
3.1 Emulated serialization setting on parallel DIO

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	
DI2()	SO2()	DO2()	SI2()
DI3()	SO3()	DO3()	SI3()
DI4()	SO4()	DO4()	SI4()
DI5()	SO5()	DO5()	SI5()

[Operation]

1) Press the F 3 (SIO) key in "SYSTEM > OPTION" mode.



Valid keys and submenu functions in this mode are as follows.

Valid keys	Menu	Function
Cursor keys (↑/↓)		Selects SIO parameters.
F1	EDIT	Sets SIO parameters.
F2	JUMP	Jumps to specified SIO parameter.

NOTE

When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

1. Direct connection from SI n ( ) to DO n ( )

Serial port input can be directly connected to parallel port output. The relation of the parallel port and serial port that can be connected is as follows.

Output device such as sensor	
DO port ← SI port	
DO2()	SI2()
DO3()	SI3()
DO4()	SI4()
DO5()	SI5()

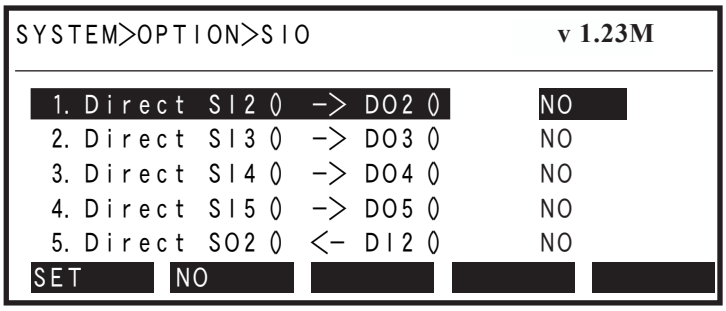
NOTE

When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

[Operation]

1) Select an SI port (from items 1 to 4) in the "SYSTEM > OPTION > SIO" mode.

2) Press the F 1 (EDIT) key.



3) Press the F 1 (SET) key to enable the connection or the F 2 (NO) key to cancel the setting.

4) Press the ESC key to quit setting or select another SI port with the cursor (↑/↓) keys to continue setting.

2. Direct connection from DI n ( ) to SO n ( )

Parallel port input can be directly connected to serial port output. The relation of the parallel port and serial port that can be connected is as follows.

Input device such as valve	
DI port → SO port	
DI2()	SO2()
DI3()	SO3()
DI4()	SO4()
DI5()	SO5()

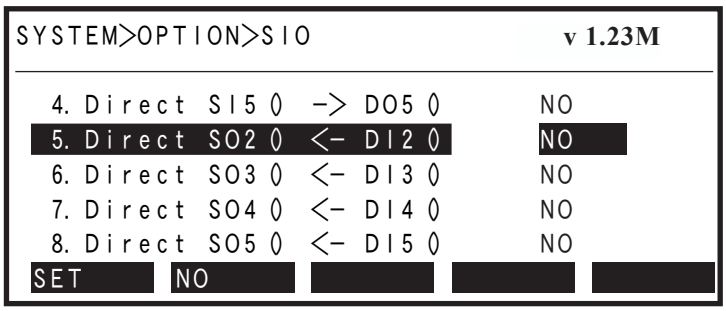
NOTE

When the port specified by SIO is identical with the port used by the program, the output results might be inaccurate.

[Operation]

1) Select a DI port (from items 5 to 8) in the "SYSTEM > OPTION > SIO" mode.

2) Press the F 1 (EDIT) key.



3) Press the F 1 (SET) key to enable the connection or the F 2 (NO) key to cancel the setting.

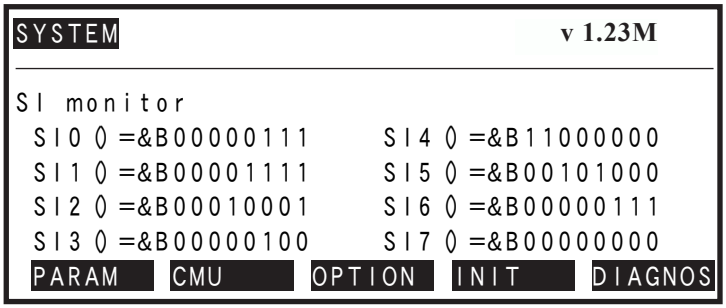
4) Press the ESC key to quit setting or select another DI port with the cursor (↑/↓) keys to continue setting.

4. Referring to communication data

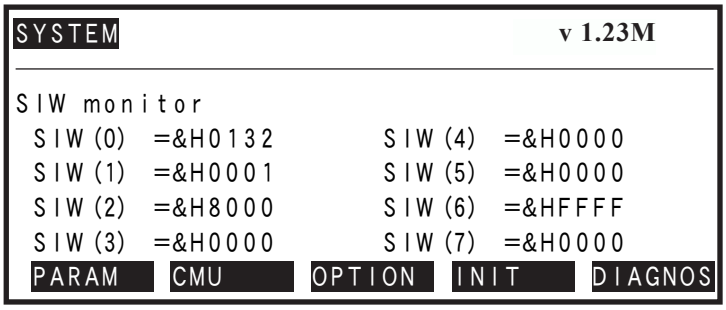
The ON/OFF information exchanged with the master module can be referred to using the programming box (PB). Note that the PB display update interval is longer than the DeviceNet data update interval, so if the ON/OFF interval is short, accurate information may not be displayed.

4.1 Referring to the data from the programming box

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



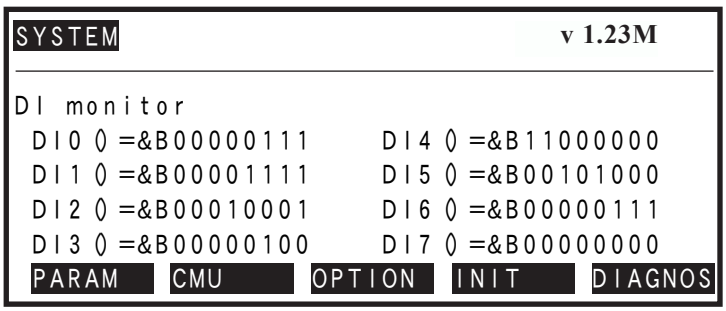
* &Bxxxxxxx corresponds to the 0th bit to 7th bit from right to left.



* &Hxxxx expresses a hexadecimal.

[Operation]

1) Press the DISPLAY key on the PB. A screen like that shown below will appear.



2) Press the DISPLAY key on the PB several times to check the status of SI input ports 0 to 7.

3) Press the DISPLAY key on the PB once more to check the status of SI input ports 10 to 15.

4) Press the DISPLAY key on the PB twice more to check the status of SO input ports 0 to 7.

5) Press the DISPLAY key on the PB once more to check the status of SO input ports 10 to 15.

6) Press the DISPLAY key on the PB twice more to check the status of SIW input ports 0 to 7.

7) Press the DISPLAY key on the PB once more to check the status of SIW input ports 8 to 15.

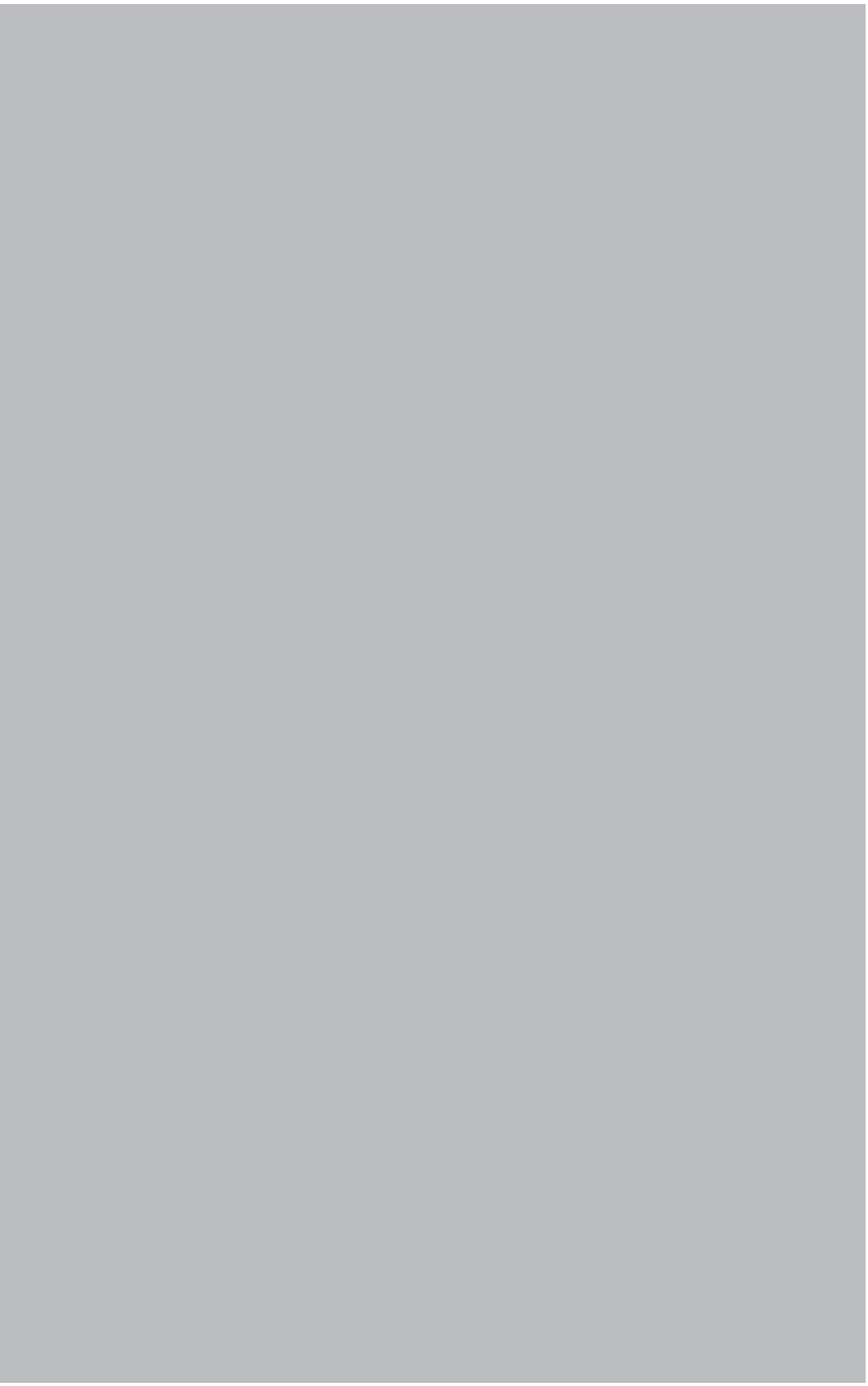
8) Press the DISPLAY key on the PB once more to check the status of SOW output ports 0 to 7.

9) Press the DISPLAY key on the PB once more to check the status of SOW output ports 8 to 15.

10) To stop checking the input/output ports, press the ESC key.

Chapter 4 TROUBLESHOOTING

Contents



1. Items to confirm before starting up DeviceNet system

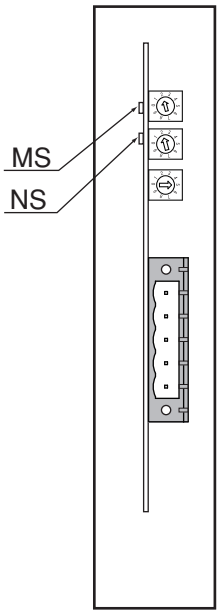
Confirm the following items before starting up the DeviceNet system.

	Confirmation details	Check
1	Is the DeviceNet compatible module accurately connected? (Refer to Chapter 2 section 2 or 3.)	
2	Is the robot controller set to the DeviceNet system specifications? (Refer to Chapter 2 section 1.)	
3	Are the DeviceNet compatible module MAC ID and communication speed correctly set? (Refer to Chapter 2 section 1.)	
4	Is the ferrite core connected to the power input cable to the robot controller? (Refer to Chapter 2 section 4.)	
5	Is the DeviceNet system cable accurately connected to the DeviceNet compatible module? (Refer to Chapter 2 section 5.)	
6	Was the line test from the master module correct? (Refer to the master module instruction manual.)	

NOTE

The dedicated input of STD.DIO connector provided on the YRC controllers will be disabled except for an interlock signal (DI 11). When the Board condition (external 24V monitor control) of system parameters is set invalid, the interlock signal (DI 11) will also be disabled.

2. Meanings of LEDs on DeviceNet compatible module



Front of the unit

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

Name	Color	State	Meaning
MS	–	OFF	Power is not supplied to DeviceNet compatible module.
	Green	ON	DeviceNet compatible module is normal.
	Red	ON	DeviceNet compatible modules hardware error.
		Flicker	Communication setting is illegal. (A non-designated setting was made.)
NS	–	OFF	The communication power is not supplied. Checking the communication settings.
	Green	ON	Normal communication.
		Flicker	Establishing communication.
	Red	ON	Same MAC ID was found in DeviceNet system.
		Flicker	Cannot exchange data due to disconnection, etc.

CAUTION

AFTER THE POWER IS TURNED ON, MS WILL LIGHT IN GREEN AND THEN IN RED, AND NS WILL LIGHT IN GREEN AND THEN IN RED. AFTER THAT, THE LED DISPLAYS SHOWN ON THE RIGHT WILL APPEAR. IF THE POWER IS NOT SUPPLIED TO THE DEVICENET COMPATIBLE MODULE, THE LED WILL REMAIN OFF EVEN AFTER THE POWER IS TURNED ON.

3. Troubleshooting

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

3-1 Robot controller front panel LED confirmation

3-2 Programming box error display confirmation

3-3 DeviceNet compatible module LED confirmation

3-4 Confirmation from master module

3.1 Robot controller front panel LED confirmation

[Confirmation item 1]

<Confirmation details>

- The "PWR" LED is OFF.

<Cause>

- Power is not being supplied to the robot controller.

<Countermeasures>

- Measure the voltage at the AC power input terminal of the power connector with a multimeter and check that the rated voltage is being supplied.

* Refer to the robot controller user's manual for the rated voltage for the robot controller.

[Confirmation item 2]

<Confirmation details>

- The "ERR" LED is ON.

<Cause>

- The robot controller is in emergency stop.
- A major error has occurred in the robot controller.

<Countermeasures>

- Confirm the error message displayed on the programming box.
- Take measures by following the troubleshooting section in the robot controller user's manual.

* Refer to the robot controller user's manual for details on the errors.

3.2 Programming box error display confirmation

[Confirmation item 1]

<Confirmation details>

- "DeviceNet Link Error", "DeviceNet Hardware Error" or "DeviceNet Setting Fault" is displayed on the programming modules.
- An addition has been made to the error history.
- Check the error history with the "SYSTEM> DIAGNOS > HISTORY" mode.

<Cause>

- An error has occurred in the DeviceNet system connection.

<Countermeasures>

- Check whether the DeviceNet system cable is disconnected or incorrectly connected.
- Check that the communication power is supplied.
- Check the MAC ID and communication speed settings for the DeviceNet compatible module.
- Confirm that the master module is operating normally.

[Confirmation items 2]

<Confirmation details>

- "DeviceNet Link Error (Explicit)" is displayed on the programming box.
- An addition has been made to the error history.
- Check the error history with the "SYSTEM> DIAGNOS > HISTORY" mode.

<Cause>

- The DeviceNet compatible module was reset by the Explicit message request (Reset request to Identity Obj) from the master module.

<Countermeasures>

- Refer to the master module's manual.

[Confirmation item 3]

<Confirmation details>

- Check whether an error other than "DeviceNet Link Error" is displayed on the programming box. **In this case, this problem is not related to the DeviceNet system connection. Note, however, the message "DeviceNet Link Error" may not appear on the programming box if multiple errors have occurred simultaneously.**

<Cause>

- An error has occurred in the robot controller.

<Countermeasures>

- Check the error message displayed on the programming box.
- Check the error history using the programming box. Check the error history in the "SYSTEM > DIAGNOS > HISTORY" mode using the programming box.
- Take measures by following the troubleshooting section in the robot controller user's manual.

* Refer to the robot controller user's manual for details on the errors.

3.3 DeviceNet compatible module LED confirmation

[Confirmation item 1]

<Confirmation details>

- The LED display on the DeviceNet compatible module is not "MS: Green" and "NS: Green".

<Cause>

- An error has occurred in the DeviceNet system connection.
- Refer to table in section 2 for the meanings of the LED displays.

<Countermeasures>

- Check whether the DeviceNet system cable is disconnected or incorrectly connected, and whether the terminator is connected and the communication power is supplied.
- Check whether the DeviceNet 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 MAC ID and communication speed settings for the DeviceNet compatible module.
- Confirm that the master module is operating normally.

3.4 Confirmation from master module

[Confirmation item 1]

<Confirmation details>

- Using the master module's line test function, confirm robot controller is correctly connected to the DeviceNet system.

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

[Confirmation item 2]

<Confirmation details>

- Using the master module's line test function, check whether an error has occurred in the robot controller's DeviceNet connection.

<Cause>

- The ferrite core for noise measures is not connected.
- The DeviceNet 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 DeviceNet cable away from noise sources such as the power cable.

4. Error messages relating to DeviceNet

This section describes error messages relating to DeviceNet compatible units. For other messages, refer to robot controller user's manuals. When an error occurs, an error message appears on the message line (2nd line) of the PB screen.

12.1 : Emg.stop on

Code : &H0C01

Meaning/Cause :
a. PB emergency stop button was pressed.
b. Emergency stop terminals on SAFETY connector are open (emergency stop status).
c. PB or terminator is not connected to PB connector.
d. SAFETY connector is not connected.
e. SI(00) is not ON.
f. Error in connection to DeviceNet system.

Action :
1. Release the PB emergency stop button.
2. Close the emergency stop terminals on SAFETY connector.
3. Connect PB or terminator to PB connector.
4. Attach the SAFETY connector.
5. Set SI(00) to ON.
6. Correct the connection to DeviceNet system.

12.2 : Interlock on

Code : &H0C02

Meaning/Cause :
a. Program was executed or moving of axis attempted with interlock signal still input.
b. Interlock signal turned ON during execution of program or axis movement.
c. DC 24V is supplied to STD.DIO connector and DI(11) is not turned ON.
d. SI(11) is not ON.
e. Error in connection to DeviceNet system.

Action :
1. Cancel the interlock signal, and execute program or move axis.
2. Set DI(11) on STD.DIO connector to ON.
3. Set SI(11) to ON.
4. When not using STD.DIO, disable (invalid) the "Watch on STD.DO DC24V" parameter in SYSTEM mode.
5. Correct the connection to DeviceNet system.

12.16 : DeviceNet link error

Code : &H0C10

Meaning/Cause : a. Error in cable for DeviceNet system.
b. Wrong MacID and communication speed setting for DeviceNet system.
c. Power supply for communication is not supplied.
d. Master station sequencer power is turned off, or master station sequencer has stopped operating, is in abnormal operation or at fault.
e. Breakdown in DeviceNet compatible unit.

Action : 1. Check for a broken wire, no connection, miswiring or specifications (cable length) of DeviceNet cable.
2. Check the Mac ID and communication speed setting.
3. Check if the master station sequencer power is supplied.
4. Check if the maser station sequence is operating normally.
5. Replace the DeviceNet compatible unit.

12.17 : DeviceNet hardware error

Code : &H0C11

Meaning/Cause : a. DeviceNet compatible unit is at fault.

Action : 1. Replace the DeviceNet compatible unit.

12.18 : Incorrect DeviceNet setting

Code : &H0C12

Meaning/Cause : a. Wrong MacID and communication speed setting.

Action : 1. Check the MacID and communication speed setting.

12.19 : DeviceNet link error (Explicit)

Code : &H0C13

Meaning/Cause : a. DeviceNet board was reset by an explicit message from a client (request for identity object).

Action :

12.70 : Incorrect option setting

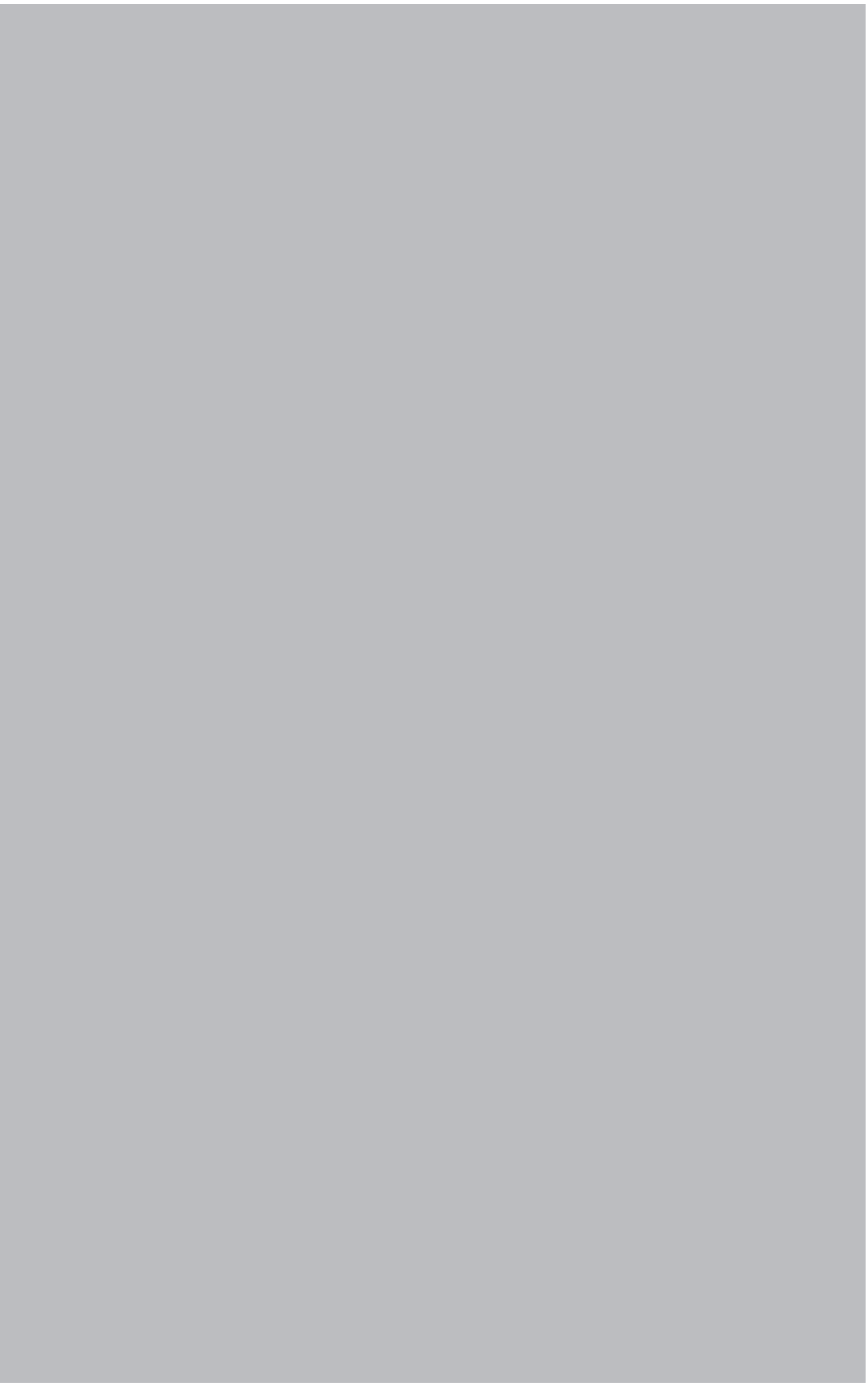
Code : &H0C46

Meaning/Cause : a. Error in DIP switch setting on option unit.
b. Mismatched option units have been installed.
c. Cannot identify the installed option unit.

Action : 1. Check the DIP switch settings on the option unit.
2. Install the correct option units.
3. Replace the option unit.

Chapter 5 SPECIFICATIONS

Contents



1. Profile

CAUTION

• EXPLANATIONS ARE GIVEN BASED ON THE CHANNELS FOR THE OMRON MASTER MODULE. REFER TO THE RESPECTIVE MANUALS WHEN USING OTHER MASTER MODULE BRANDS.

NOTE

The IO size can be set by option board parameter. Refer to section 6 of chapter 2 for more details.

1.1 When IO size is set to "Large"

OMRON robot controller

● Bit input/output

Slave → Master				Master → Slave				
Channel No.	bit	Signal name		Channel No.	bit	Signal name		
(m+16CH)	0	SO(00)	Emergency stop input status output	(n+16CH)	0	SI(00)		Emergency stop input
	1	SO(01)	CPU_OK status output		1	SI(01)		Servo ON input
	2	SO(02)	Servo ON status output		2	SI(02)		Service mode input
	3	SO(03)	Alarm status output		3	SI(03)		Step execution input
	4		Reserved		4			Reserved
	5		Reserved		5	SI(05)		IO command execution trigger input
	6		Reserved		6			Reserved
	7		Reserved		7			Reserved
	8	SO(10)	AUTO mode status output		8	SI(10)		Sequence control input
	9	SO(11)	Return-to-origin complete status output		9	SI(11)		Interlock input
	10	SO(12)	Sequence program execution status output		10	SI(12)		Robot program start input
	11	SO(13)	Robot program execution status output		11	SI(13)		AUTO mode input
	12	SO(14)	Program reset estatus output		12	SI(14)	YRC	Return-to-origin input
	13	SO(15)	Battery alarm output		13	SI(15)		Program reset input
	14	SO(16)	IO command execution judgment output		14	SI(16)		MANUAL mode input
	15	SO(17)	Output durion IO command execution		15	SI(17)	YRC	Absolute reset / Return-to-origin input *1

(continued to next page)

Slave → Master				Master → Slave			
Channel No.	bit	Signal name		Channel No.	bit	Signal name	
(m+17CH)	0 to 7	SO(20) to SO(27)	General-purpose output	(n+17CH)	0 to 7	SI(20) to SI(27)	General-purpose input
	8 to 15	SO(30) to SO(37)	General-purpose output		8 to 15	SI(30) to SI(37)	General-purpose input
(m+18CH)	0 to 7	SO(40) to SO(47)	General-purpose output	(n+18CH)	0 to 7	SI(40) to SI(47)	General-purpose input
	8 to 15	SO(50) to SO(57)	General-purpose output		8 to 15	SI(50) to SI(57)	General-purpose input
(m+19CH)	0 to 7	SO(60) to SO(67)	General-purpose output	(n+19CH)	0 to 7	SI(60) to SI(67)	General-purpose input
	8 to 15	SO(70) to SO(77)	General-purpose output		8 to 15	SI(70) to SI(77)	General-purpose input
(m+20CH)	0 to 7	SO(100) to SO(107)	General-purpose output	(n+20CH)	0 to 7	SI(100) to SI(107)	General-purpose input
	8 to 15	SO(110) to SO(117)	General-purpose output		8 to 15	SI(110) to SI(117)	General-purpose input
(m+21CH)	0 to 7	SO(120) to SO(127)	General-purpose output	(n+21CH)	0 to 7	SI(120) to SI(127)	General-purpose input
	8 to 15	SO(130) to SO(137)	General-purpose output		8 to 15	SI(130) to SI(137)	General-purpose input
(m+22CH)	0 to 7	SO(140) to SO(147)	General-purpose output	(n+22CH)	0 to 7	SI(140) to SI(147)	General-purpose input
	8 to 15	SO(150) to SO(157)	General-purpose output		8 to 15	SI(150) to SI(157)	General-purpose input
(m+23CH)	0 to 15		Reserved	(n+23CH)	0 to 15		Reserved

m : Input-area head CH number assigned to master module
n : Output-area head CH number assigned to master module

*1: Used for "absolute reset" or "absolute reset / return-to-origin" depending on parameter (DI17 mode) setting.

● Word input/output

Slave → Master				Master → Slave			
Channel No.	Signal name			Channel No.	Signal name		
(mCH)		SOW(0)	Dedicated output	(nCH)		SIW(0)	Dedicated input
(m+1CH)		SOW(1)	Dedicated output	(n+1CH)		SIW(1)	Dedicated input
(m+2CH)	SOD(2)	SOW(2)	General-purpose output	(n+2CH)	SID(2)	SIW(2)	General-purpose input
(m+3CH)		SOW(3)	General-purpose output	(n+3CH)		SIW(3)	General-purpose input
(m+4CH)	SOD(4)	SOW(4)	General-purpose output	(n+4CH)	SID(4)	SIW(4)	General-purpose input
(m+5CH)		SOW(5)	General-purpose output	(n+5CH)		SIW(5)	General-purpose input
(m+6CH)	SOD(6)	SOW(6)	General-purpose output	(n+6CH)	SID(6)	SIW(6)	General-purpose input
(m+7CH)		SOW(7)	General-purpose output	(n+7CH)		SIW(7)	General-purpose input
(m+8CH)	SOD(8)	SOW(8)	General-purpose output	(n+8CH)	SID(8)	SIW(8)	General-purpose input
(m+9CH)		SOW(9)	General-purpose output	(n+9CH)		SIW(9)	General-purpose input
(m+10CH)	SOD(10)	SOW(10)	General-purpose output	(n+10CH)	SID(10)	SIW(10)	General-purpose input
(m+11CH)		SOW(11)	General-purpose output	(n+11CH)		SIW(11)	General-purpose input
(m+12CH)	SOD(12)	SOW(12)	General-purpose output	(n+12CH)	SID(12)	SIW(12)	General-purpose input
(m+13CH)		SOW(13)	General-purpose output	(n+13CH)		SIW(13)	General-purpose input
(m+14CH)	SOD(14)	SOW(14)	General-purpose output	(n+14CH)	SID(14)	SIW(14)	General-purpose input
(m+15CH)		SOW(15)	General-purpose output	(n+15CH)		SIW(15)	General-purpose input

m : Input-area head CH number assigned to master module
n : Output-area head CH number assigned to master module

1.2 When IO size is set to "Small"

• Bit input/output

Slave → Master				Master → Slave				
Channel No.	bit	Signal name		Channel No.	bit	Signal name		
(mCH)	0	SO(00)	Emergency stop input status output	(nCH)	0	SI(00)		Emergency stop input
	1	SO(01)	CPU_OK status output		1	SI(01)		Servo ON input
	2	SO(02)	Servo ON status output		2	SI(02)		Service mode input
	3	SO(03)	Alarm status output		3	SI(03)		Step execution input
	4		Reserved		4			Reserved
	5		Reserved		5	SI(05)		IO command execution trigger input
	6		Reserved		6			Reserved
	7		Reserved		7			Reserved
	8	SO(10)	AUTO mode status output		8	SI(10)		Sequence control input
	9	SO(11)	Return-to-origin complete status output		9	SI(11)		Interlock input
	10	SO(12)	Sequence program execution status output		10	SI(12)		Robot program start input
	11	SO(13)	Robot program execution status output		11	SI(13)		AUTO mode input
	12	SO(14)	Program reset status output		12	SI(14)	YRC	Return-to-origin input
	13	SO(15)	Battery alarm output		13	SI(15)		Program reset input
	14	SO(16)	IO command execution judgment output		14	SI(16)		MANUAL mode input
	15	SO(17)	Output during IO command execution		15	SI(17)	YRC	Absolute reset / Return-to-origin input *1
(m+1CH)	0 to 7	SO(20) to SO(27)	General-purpose output	(n+1CH)	0 to 7	SI(20) to SI(27)		General-purpose input
	8 to 15	SO(30) to SO(37)	General-purpose output		8 to 15	SI(30) to SI(37)		General-purpose input

m : Input-area head CH number assigned to master module
n : Output-area head CH number assigned to master module

*1: Used for "absolute reset" or "absolute reset / return-to-origin" depending on parameter (DI17 mode) setting.

2. Details of input/output signals

CAUTION

- EXPLANATIONS ARE GIVEN BASED ON THE CHANNELS FOR THE OMRON MASTER MODULE. REFER TO THE RESPECTIVE MANUALS WHEN USING OTHER MANUFACTURERS' MASTER MODULES.
- THE NUMBER OF OCCUPIED CHANNELS DIFFERS DEPENDING ON THE IO SIZE SETTING (LARGE OR SMALL).

NOTE

The IO size can be set by option board parameter. Refer to section 6 of chapter 2 for more details.

● Bit output

Channel No.		Signal name		Details
Large	Small			
(m+16CH)0	(mCH)0	SO(00)	Emergency stop input status output	Turns ON when robot controller is in emergency stop state.
(m+16CH)1	(mCH)1	SO(01)	CPU_OK status output	Turns ON when robot controller is in normal state.
(m+16CH)2	(mCH)2	SO(02)	Servo ON status output	Turns ON when robot controller motor power is ON.
(m+16CH)3	(mCH)3	SO(03)	Alarm status output	Turns ON when robot controller is in following state: • Serious error occurred in robot controller. • Emergency stop input OFF
(m+16CH)8	(mCH)8	SO(10)	AUTO mode status output	Turns ON when selected mode is AUTO mode. Turns OFF when other mode is selected.
(m+16CH)9	(mCH)9	SO(11)	Return-to-origin complete status output	Turns ON when robot has has completed return-to-origin.
(m+16CH)10	(mCH)10	SO(12)	Sequence program execution status output	Turns ON while sequence program is executed.
(m+16CH)11	(mCH)11	SO(13)	Robot program execution status output	Turns ON while robot program is executed.
(m+16CH)12	(mCH)12	SO(14)	Program reset status output	Turns ON when robot program has been reset. Turns OFF when robot program starts.
(m+16CH)13	(mCH)13	SO(15)	Battery alarm output	Turns ON when system backup battery or absolute battery voltage is low.
(m+16CH)14	(mCH)14	SO(16)	IO command execution judgment output	Turns OFF while executing the IO command. After executing the IO command turns ON if normal, and stays OFF if abnormal.
(m+16CH)15	(mCH)15	SO(17)	Output during IO command execution	Turns ON while executing the IO command.

(continued to next page)

Channel No.		Signal name		Details
Large	Small			
(m+17CH)0 to (m+17CH)7	(m+1CH)0 to (m+1CH)7	SO(20) to SO(27)	General-purpose output	General-purpose output turns ON/OFF when value is assigned to SO port, or SET/RESET command or OUT command is executed.
(m+17CH)8 to (m+17CH)15	(m+1CH)8 to (m+1CH)15	SO(30) to SO(37)	General-purpose output	
to		to	to	
(m+22CH)8 to (m+22CH)15		SO(150) to SO(157)	General-purpose output	

m : Input-area head CH number assigned to master module

NOTE

- When the area check output function is used, the area check outputs can be assigned to the following general-purpose outputs depending I/O size.
- When the IO size is set to "Small", only SO(20) to SO(37) of general-purpose outputs are available.

● Bit input

Channel No.		Signal name		Details
Large	Small			
(n+16CH)0	(nCH)0	SI(00)	Emergency stop input	Turn OFF to trigger emergency stop on controller. Keep turned ON during normal operation.
(n+16CH)1	(nCH)1	SI(01)	Servo ON input	Turn ON to cancel emergency stop and turn ON the robot servo motor. Servo-ON is executed when this input is switched from OFF to ON. Emergency stop input [SI(00)] must have been ON, and emergency stop state in the robot controller (emergency stop terminal of SAFETY connector, etc.) canceled.
(n+16CH)2	(nCH)2	SI(02)	Service mode input	Turn OFF to enter the controller in service mode. Keep turned ON during normal operation. (Effective only when SAFE mode is enabled.) (In SAFE mode enabled, dedicated input might be disabled depending on service mode parameter setting.)
(n+16CH)3	(nCH)3	SI(03)	Step execution input	Turn ON to execute a step in the program during AUTO mode. One line of the program is executed when this input is changed from OFF to ON.

(continued to next page)

Channel No.		Signal name			Details
Large	Small				
(n+16CH)5	(nCH)5	SI(05)		IO command execution trigger input	Turn from OFF to ON to execute IO command. Always turn ON after IO command is set to general-purpose input.
(n+16CH)8	(nCH)8	SI(10)		Sequence control input	Turn ON to execute sequence program in the robot controller. Sequence program is executed when this input is ON.
(n+16CH)9	(nCH)9	SI(11)		Interlock input	Turn OFF to stop execution of robot program. Keep tuned ON to continue program execution.
(n+16CH)10	(nCH)10	SI(12)		Robot program start input	Turn ON to execute robot program. Robot program is executed when this input is switched from OFF to ON. Robot controller must be in AUTO mode.
(n+16CH)11	(nCH)11	SI(13)		AUTO mode input	Turn ON to select AUTO mode. Robot program enters AUTO mode when this input is switched from OFF to ON.
(n+16CH)12	(nCH)12	SI(14)	YRC	Return-to-origin input	Turn ON to perform return-to-origin on incremental type axes or semi-absolute type axes. When this input is switched from OFF to ON, return-to-origin is performed on incremental type axes or absolute search is performed on semi-absolute type axes. This input is for axes whose return-to-origin method is sensor or stroke-end (torque detection) method. Robot controller mode must be in MANUAL mode.
(n+16CH)13	(nCH)13	SI(15)		Program reset input	Turn ON to reset robot program. Program reset is executed when this input is switched from OFF to ON. Robot controller must be in AUTO mode.
(n+16CH)14	(nCH)14	SI(16)		MANUAL mode input	Turn ON to select MANUAL mode. Robot program enters MANUAL mode when this input is switched from OFF to ON.

Channel No.		Signal name			Details
Large	Small				
(n+16CH)15	(nCH)15	SI(17)	YRC	Absolute reset / Return-to-origin input	Used for "absolute reset" or "absolute reset / return-to-origin" depending on parameter (DI17 mode) setting. • When set to "ABS" (absolute reset) Turn ON to perform absolute reset of robot. Absolute reset is performed when this input is switched from OFF to ON, except for axes that use mark method for return-to-origin. Absolute reset cannot be performed by dedicated input if return-to-origin is incomplete on axes that use mark method. Robot controller mode must be in MANUAL mode. • When set to "ABS/ORG" (absolute reset / return-to-origin) When only absolute type axes are used, switching this input from OFF to ON performs absolute reset. When only incremental type and semi-absolute type axes are used, switching this input from OFF to ON performs return-to-origin on the incremental axes and absolute search on the semi-absolute type axes. When absolute type, incremental type and semi-absolute type axes are used, absolute reset is first performed on the absolute axes and then return-to-origin is performed on the incremental type and semi-absolute type axes.
(n+17CH)0 to (n+17CH)7	(n+1CH)0 to (n+1CH)7	SI(20) to SI(27)		General-purpose input	Use ON/OFF of these general-purpose inputs for referencing the SI port value and executing a WAIT command.
(n+17CH)8 to (n+17CH)15	(n+1CH)8 to (n+1CH)15	SI(30) to SI(37)		General-purpose input	
to		to		to	
(n+22CH)8 to (n+22CH)15		—		General-purpose input	

n : Output-area head CH number assigned to master module

NOTE

- When the IO size is set to "Small", only SI(20) to SI(37) of general-purpose inputs are available.
- When the YRC controller is used with a robot whose axis configuration includes absolute type, incremental type and/or semi-absolute type axes, and if SI(17) is used for "absolute reset / return-to-origin", then absolute reset is performed on the absolute reset axis each time return-to-origin is performed on the incremental type and/or semi-absolute type axes. So, if the robot axis configuration includes absolute type, incremental type and/or semi-absolute type axes, we recommend using SI (17) to perform absolute reset and SI(14) to perform return-to-origin.
- Return-to-origin input and absolute reset input can also be executed in AUTO mode by changing the execution level. Refer to the controller user's manual for more details.

● Word input

Channel No.		Name			Details
Large	Small				
(nCH)			SIW(0)	Dedicated input	Used as the remote command area.
(n+1CH)			SIW(1)		Used as the remote command's data area.
(n+2CH)		SID(2)	SIW(2)	General-purpose input	Used to input word or double word data from SIW or SID port. Or, used as remote command's command data area.
(n+3CH)			SIW(3)		
(n+4CH)		SID(4)	SIW(4)		
(n+5CH)			SIW(5)		
(n+6CH)		SID(6)	SIW(6)		
(n+7CH)			SIW(7)		
(n+8CH)		SID(8)	SIW(8)		
(n+9CH)			SIW(9)		
(n+10CH)		SID(10)	SIW(10)		
(n+11CH)			SIW(11)		
(n+12CH)		SID(12)	SIW(12)		
(n+13CH)			SIW(13)		
(n+14CH)		SID(14)	SIW(14)		
(n+15CH)			SIW(15)		

n : Output-area head CH number assigned to master module

CAUTION

WHEN THE IO SIZE IS SET TO "SMALL", WORD INPUT (SID AND SIW) CANNOT BE USED.

● **Word output**

Channel No.		Name			Details
Large	Small				
(mCH)			SOW(0)	Dedicated input	Used as the remote command's status area.
(m+1CH)			SOW(1)		Used as the remote command's error code area.
(m+2CH)		SOD(2)	SOW(2)	General-purpose input	Used to output word or double word data from SOW or SOD port. Or, used as remote command's response area.
(m+3CH)			SOW(3)		
(m+4CH)		SOD(4)	SOW(4)		
(m+5CH)			SOW(5)		
(m+6CH)		SOD(6)	SOW(6)		
(m+7CH)			SOW(7)		
(m+8CH)		SOD(8)	SOW(8)		
(m+9CH)			SOW(9)		
(m+10CH)		SOD(10)	SOW(10)		
(m+11CH)			SOW(11)		
(m+12CH)		SOD(12)	SOW(12)		
(m+13CH)			SOW(13)		
(m+14CH)		SOD(14)	SOW(14)		
(m+15CH)			SOW(15)		

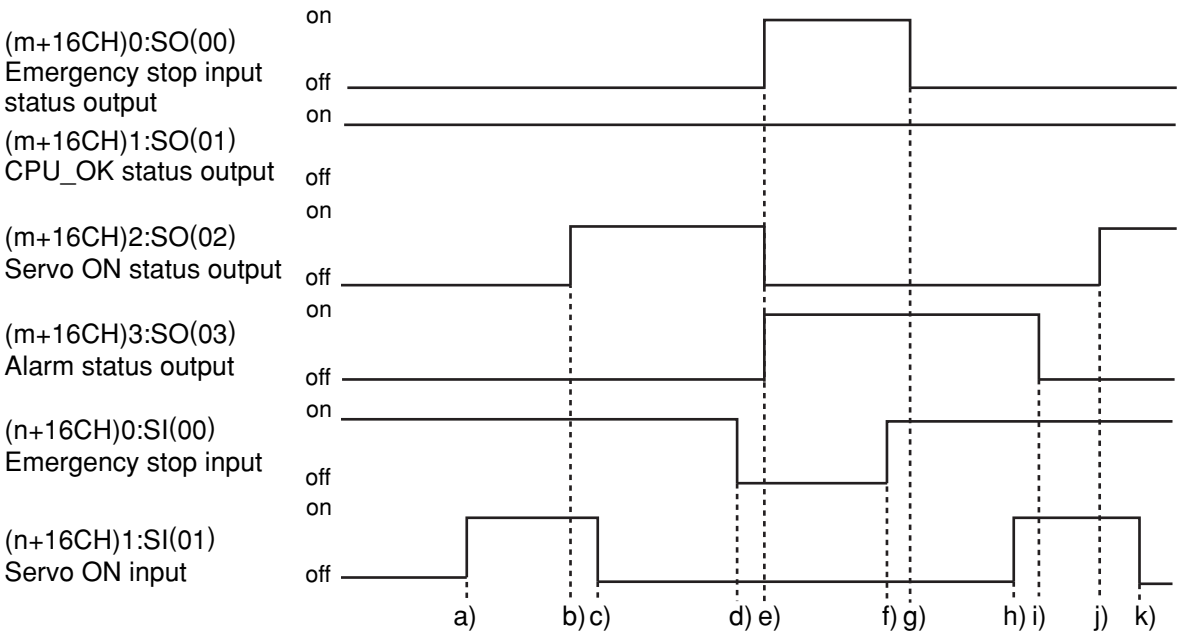
m : Input-area head CH number assigned to master module

CAUTION

WHEN THE IO SIZE IS SET TO "SMALL", WORD OUTPUT (SOD AND SOW) CANNOT BE USED.

3. Dedicated input/output signal timing chart

3.1 Servo ON and emergency stop



CAUTION

- THIS EXPLANATION USES THE CHANNEL NUMBERS WHICH ARE AVAILABLE WHEN THE IO SIZE IS SET TO "LARGE". NOTE THAT THE CHANNEL NUMBERS DIFFER WHEN THE IO SIZE IS SET TO "SMALL".
- PROVIDE AN INTERVAL OF 100MS OR MORE WHEN TURNING THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER ON AND OFF. IF THE INTERVAL IS TOO SHORT, THE DEDICATED INPUT MAY NOT BE RECOGNIZED. (THIS ALSO APPLIES TO THE INTERVAL FOR THE SAME DEDICATED INPUTS OR DIFFERING DEDICATED INPUTS.)
- USE THIS ALSO IF THERE IS A DEDICATED OUTPUT IN RESPECT TO THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER.

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

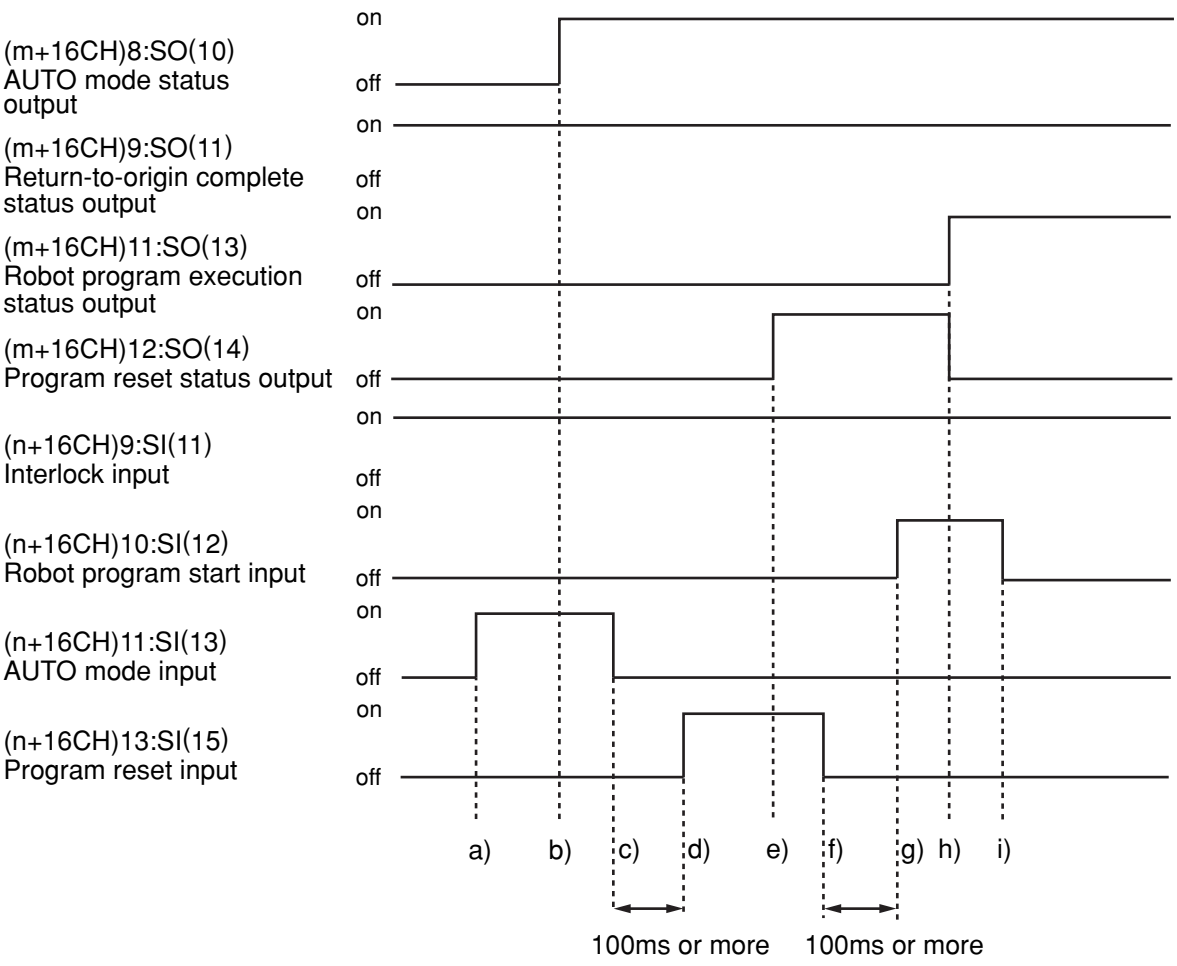
e) Emergency stop input status ON and alarm status output ON are output
Servo ON status output OFF is output

Servo ON process from emergency stop status

f) Emergency stop input ON is input
g) Emergency stop input 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.
* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the DeviceNet system.

3.2 AUTO mode changeover, program reset and program execution



CAUTION

- THIS EXPLANATION USES THE CHANNEL NUMBERS WHICH ARE AVAILABLE WHEN THE IO SIZE IS SET TO "LARGE". NOTE THAT THE CHANNEL NUMBERS DIFFER WHEN THE IO SIZE IS SET TO "SMALL".
- PROVIDE AN INTERVAL OF 100MS OR MORE WHEN TURNING THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER ON AND OFF. IF THE INTERVAL IS TOO SHORT, THE DEDICATED INPUT MAY NOT BE RECOGNIZED. (THIS ALSO APPLIES TO THE INTERVAL FOR THE SAME DEDICATED INPUTS OR DIFFERING DEDICATED INPUTS.)
- USE THIS ALSO IF THERE IS A DEDICATED OUTPUT IN RESPECT TO THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER.

AUTO mode changeover process

a) AUTO mode input ON is input

b) AUTO mode status output ON is output

c) After confirming that the AUTO mode status output is ON, the AUTO 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) Robot program start input ON is input

h) Program reset status output OFF is output
Robot program execution status output ON is output

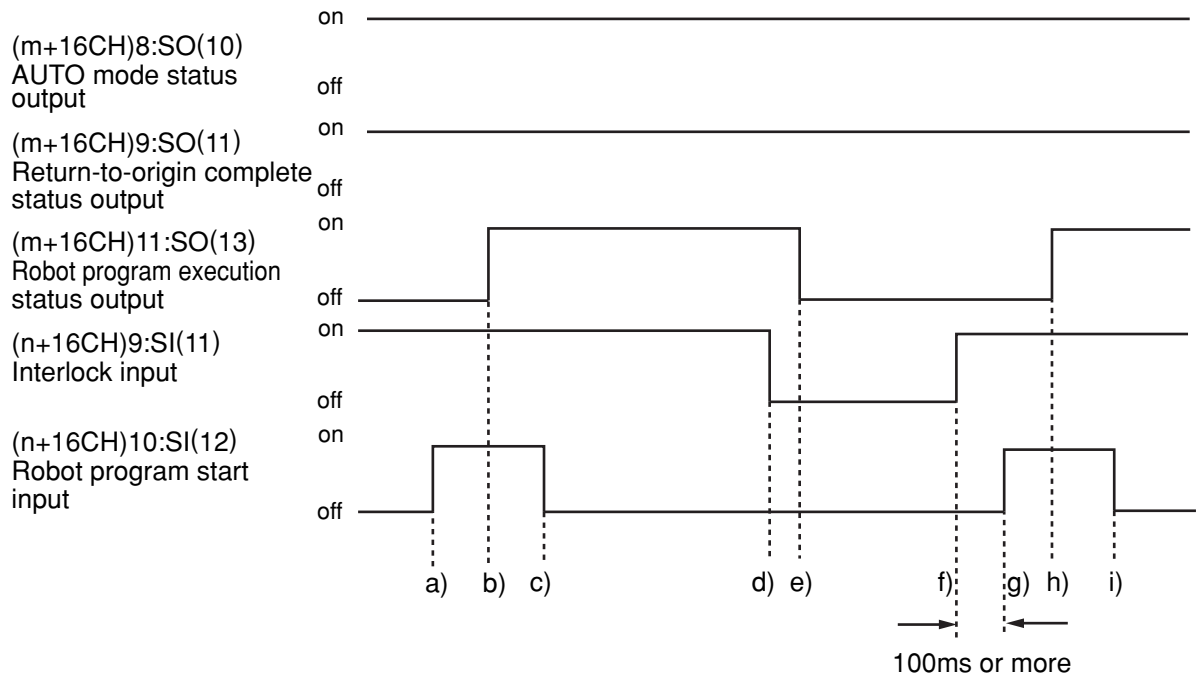
i) After confirming that the robot program execution status output is ON, the robot program start input OFF is input

* The program cannot be executed if the emergency stop input and interlock input are OFF.

* If the return-to-origin complete status output is not ON, execution of the program may not be possible depending on the execution level setting value.

* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the DeviceNet system.

3.3 Stopping with program interlock



CAUTION

- THIS EXPLANATION USES THE CHANNEL NUMBERS WHICH ARE AVAILABLE WHEN THE IO SIZE IS SET TO "LARGE". NOTE THAT THE CHANNEL NUMBERS DIFFER WHEN THE IO SIZE IS SET TO "SMALL".
- PROVIDE AN INTERVAL OF 100MS OR MORE WHEN TURNING THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER ON AND OFF. IF THE INTERVAL IS TOO SHORT, THE DEDICATED INPUT MAY NOT BE RECOGNIZED. (THIS ALSO APPLIES TO THE INTERVAL FOR THE SAME DEDICATED INPUTS OR DIFFERING DEDICATED INPUTS.)
- USE THIS ALSO IF THERE IS A DEDICATED OUTPUT IN RESPECT TO THE DEDICATED INPUT FROM THE MASTER MODULE TO THE CONTROLLER.

Program execution process

a) Robot program 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) Robot program start input ON is input

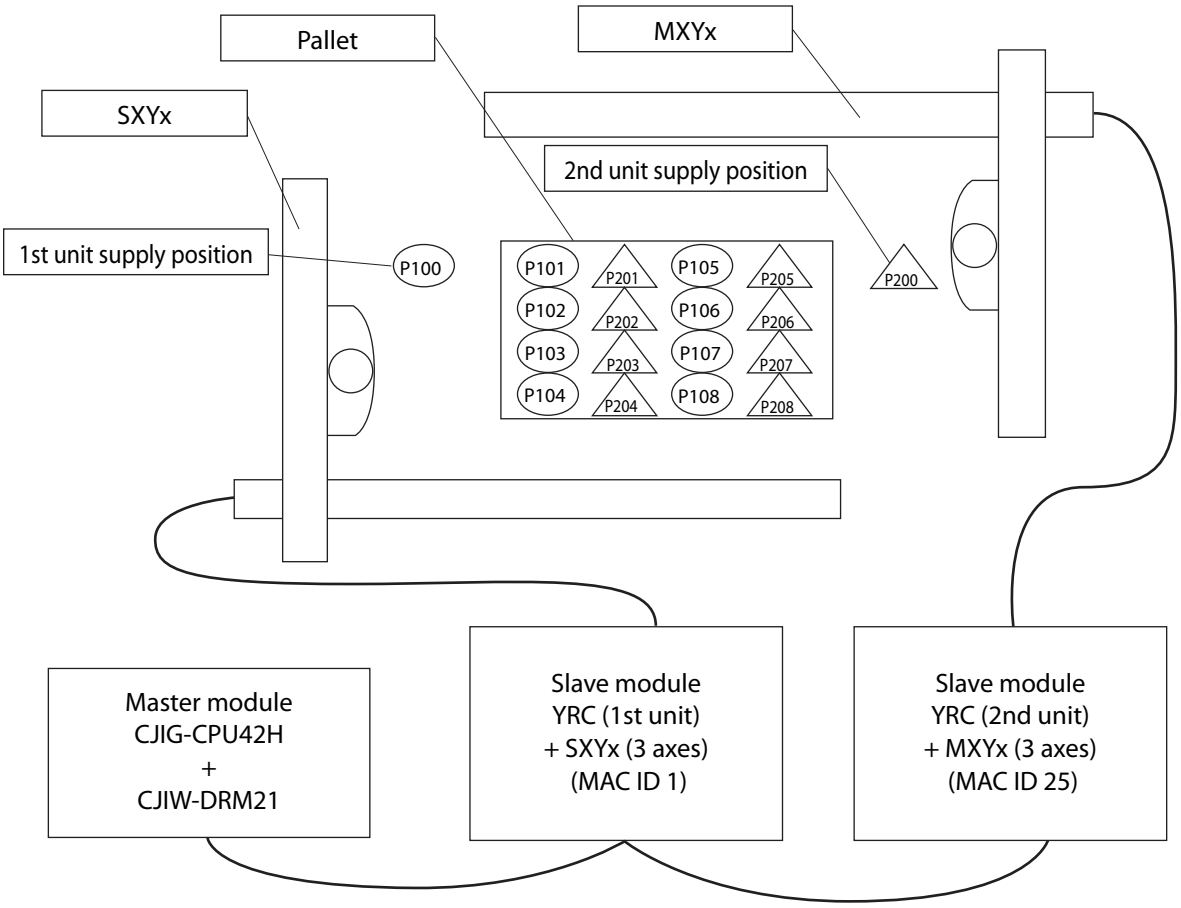
h) Robot program execution status output ON is output

i) After confirming that the robot program execution status output is ON, the start input OFF is input

* The program also stops when emergency stop input OFF is input. At this point, emergency stop input status ON and alarm status output ON are output, and servo ON status output OFF is output. To re-execute the program, servo ON process is required.
* When SAFE mode is enabled, dedicated inputs other than SI (00) and SI (11) might be disabled depending on service mode parameter setting unless service mode input signal is set to ON with SI (02) in the DeviceNet system.

4. Sample program

The YRC Controller is made by YAMAHA.
This example must be considered just as a draft guideline beacuse it uses some information about devices that are not distributed nor supported by OMRON.



[Details of sample]

- Pick & place work is carried out using the PLC and YRC + SXYx (3 axes), YRC+MXYx (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.

CAUTION

EXPLANATIONS ARE GIVEN BASED ON THE CHANNELS FOR THE OMRON MASTER MODULE. REFER TO THE RESPECTIVE MANUALS WHEN USING OTHER MASTER MODULE BRANDS.

[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]

In this example, the first unit MAC ID is designated as "1" and the second unit MAC ID as "25". The PLC output channel is allocated "3200" while the input channel is allocated "3300".

	(1510CH)	0	Unit error
		:	
		15	
	:		
	(1512CH)	0	
		:	
		15	IO data communication status
	:		
MAC ID1	(3201CH)	0	1st unit's SIW(0)
		:	
		15	
	(3202CH)	0	1st unit's SIW(1)
		:	
		15	
	:		
	(3216CH)	0	1st unit's SIW(15)
		:	
		15	
	(3217CH)	0	1st unit's SI(00) : Emergency stop input
		1	1st unit's SI(01) : Servo ON input
		2	1st unit's SI(02) : Service mode input
		3	1st unit's SI(03) :
		4	1st unit's SI(04) :
		5	1st unit's SI(05) : IO command execution trigger input
		6	1st unit's SI(06) :
		7	1st unit's SI(07) :
		8	1st unit's SI(10) : Sequence control input
		9	1st unit's SI(11) : Interlock input
		10	1st unit's SI(12) : Robot program start input
		11	1st unit's SI(13) : AUTO mode input
		12	1st unit's SI(14) :
		13	1st unit's SI(15) : Program reset input
		14	1st unit's SI(16) : MANUAL mode input
		15	1st unit's SI(17) : Absolute reset input
	(3218CH)	0	1st unit's SI(20) : General-purpose input
		1	1st unit's SI(21) : General-purpose input
		2	1st unit's SI(22) : General-purpose input
		3	1st unit's SI(23) : General-purpose input
		4	1st unit's SI(24) : General-purpose input
		5	1st unit's SI(25) : General-purpose input
		6	1st unit's SI(26) : General-purpose input
		7	1st unit's SI(27) : General-purpose input
		8	1st unit's SI(30) : General-purpose input
		9	1st unit's SI(31) : General-purpose input
		10	1st unit's SI(32) : General-purpose input
		11	1st unit's SI(33) : General-purpose input
		12	1st unit's SI(34) : General-purpose input
		13	1st unit's SI(35) : General-purpose input
		14	1st unit's SI(36) : General-purpose input
		15	1st unit's SI(37) : General-purpose input
	:		
	(3223CH)	0	1st unit's SI(140) : General-purpose input
		1	1st unit's SI(141) : General-purpose input
		2	1st unit's SI(142) : General-purpose input
		3	1st unit's SI(143) : General-purpose input
		4	1st unit's SI(144) : General-purpose input
		5	1st unit's SI(145) : General-purpose input
		6	1st unit's SI(146) : General-purpose input
		7	1st unit's SI(147) : General-purpose input
		8	1st unit's SI(150) : General-purpose input
		9	1st unit's SI(151) : General-purpose input
		10	1st unit's SI(152) : General-purpose input
		11	1st unit's SI(153) : General-purpose input
		12	1st unit's SI(154) : General-purpose input
		13	1st unit's SI(155) : General-purpose input
		14	1st unit's SI(156) : General-purpose input
		15	1st unit's SI(157) : General-purpose input
	(3224CH)	0	1st unit reservation area
		:	
		15	

: Word information

: Bit information

MAC ID25				
	(3225CH)	0 : 15	2nd unit's SIW(0)	: Word information
	(3226CH)	0 : 15	2nd unit's SIW(1)	
		:		
	(3240CH)	0 : 15	2nd unit's SIW(15)	
	(3241CH)	0	2nd unit's SI(00) : Emergency stop input	: Bit information
		1	2nd unit's SI(01) : Servo ON input	
		2	2nd unit's SI(02) : Service mode input	
		3	2nd unit's SI(03) :	
		4	2nd unit's SI(04) :	
		5	2nd unit's SI(05) : IO command execution trigger input	
		6	2nd unit's SI(06) :	
		7	2nd unit's SI(07) :	
		8	2nd unit's SI(10) : Sequence control input	
		9	2nd unit's SI(11) : Interlock input	
		10	2nd unit's SI(12) : Robot program start input	
		11	2nd unit's SI(13) : AUTO mode input	
		12	2nd unit's SI(14) :	
		13	2nd unit's SI(15) : Program reset input	
		14	2nd unit's SI(16) : MANUAL mode input	
		15	2nd unit's SI(17) : Absolute reset input	
	(3242CH)	0	2nd unit's SI(20) : General-purpose input	
		1	2nd unit's SI(21) : General-purpose input	
		2	2nd unit's SI(22) : General-purpose input	
		3	2nd unit's SI(23) : General-purpose input	
		4	2nd unit's SI(24) : General-purpose input	
		5	2nd unit's SI(25) : General-purpose input	
		6	2nd unit's SI(26) : General-purpose input	
		7	2nd unit's SI(27) : General-purpose input	
		8	2nd unit's SI(30) : General-purpose input	
		9	2nd unit's SI(31) : General-purpose input	
		10	2nd unit's SI(32) : General-purpose input	
		11	2nd unit's SI(33) : General-purpose input	
		12	2nd unit's SI(34) : General-purpose input	
		13	2nd unit's SI(35) : General-purpose input	
		14	2nd unit's SI(36) : General-purpose input	
		15	2nd unit's SI(37) : General-purpose input	
		:		
	(3247CH)	0	2nd unit's SI(140) : General-purpose input	
		1	2nd unit's SI(141) : General-purpose input	
		2	2nd unit's SI(142) : General-purpose input	
		3	2nd unit's SI(143) : General-purpose input	
		4	2nd unit's SI(144) : General-purpose input	
		5	2nd unit's SI(145) : General-purpose input	
		6	2nd unit's SI(146) : General-purpose input	
		7	2nd unit's SI(147) : General-purpose input	
		8	2nd unit's SI(150) : General-purpose input	
		9	2nd unit's SI(151) : General-purpose input	
		10	2nd unit's SI(152) : General-purpose input	
		11	2nd unit's SI(153) : General-purpose input	
		12	2nd unit's SI(154) : General-purpose input	
		13	2nd unit's SI(155) : General-purpose input	
		14	2nd unit's SI(156) : General-purpose input	
		15	2nd unit's SI(157) : General-purpose input	
	(3248CH)	0 : 15	2nd unit reservation area	

MAC ID1

(3301CH)	0 : 15	1st unit's SOW(0)	: Word information
(3302CH)	0 : 15	1st unit's SOW(1)	
	:		
(3316CH)	0 : 15	1st unit's SOW(15)	
(3317CH)	0	1st unit's SO(00) : Emergency stop input status output	: Bit information
	1	1st unit's SO(01) : CPU_OK status output	
	2	1st unit's SO(02) : Servo ON status output	
	3	1st unit's SO(03) : Alarm status output	
	4	1st unit's SO(04) :	
	5	1st unit's SO(05) :	
	6	1st unit's SO(06) :	
	7	1st unit's SO(07) :	
	8	1st unit's SO(10) : AUTO mode status output	
	9	1st unit's SO(11) : Return-to-origin complete status output	
	10	1st unit's SO(12) : Sequence program execution status output	
	11	1st unit's SO(13) : Robot program execution status output	
	12	1st unit's SO(14) : Program reset status output	
	13	1st unit's SO(15) :	
	14	1st unit's SO(16) : IO command execution judgment output	
	15	1st unit's SO(17) : Output during IO command execution	
(3318CH)	0	1st unit's SO(20) : General-purpose output	
	1	1st unit's SO(21) : General-purpose output	
	2	1st unit's SO(22) : General-purpose output	
	3	1st unit's SO(23) : General-purpose output	
	4	1st unit's SO(24) : General-purpose output	
	5	1st unit's SO(25) : General-purpose output	
	6	1st unit's SO(26) : General-purpose output	
	7	1st unit's SO(27) : General-purpose output	
	8	1st unit's SO(30) : General-purpose output	
	9	1st unit's SO(31) : General-purpose output	
	10	1st unit's SO(32) : General-purpose output	
	11	1st unit's SO(33) : General-purpose output	
	12	1st unit's SO(34) : General-purpose output	
	13	1st unit's SO(35) : General-purpose output	
	14	1st unit's SO(36) : General-purpose output	
	15	1st unit's SO(37) : General-purpose output	
	:		
(3323CH)	0	1st unit's SO(140) : General-purpose output	
	1	1st unit's SO(141) : General-purpose output	
	2	1st unit's SO(142) : General-purpose output	
	3	1st unit's SO(143) : General-purpose output	
	4	1st unit's SO(144) : General-purpose output	
	5	1st unit's SO(145) : General-purpose output	
	6	1st unit's SO(146) : General-purpose output	
	7	1st unit's SO(147) : General-purpose output	
	8	1st unit's SO(150) : General-purpose output	
	9	1st unit's SO(151) : General-purpose output	
	10	1st unit's SO(152) : General-purpose output	
	11	1st unit's SO(153) : General-purpose output	
	12	1st unit's SO(154) : General-purpose output	
	13	1st unit's SO(155) : General-purpose output	
	14	1st unit's SO(156) : General-purpose output	
	15	1st unit's SO(157) : General-purpose output	
(3324CH)	0 : 15	1st unit reservation area	

MAC ID25

(3325CH)	0	2nd unit's SOW(0)	: Word information
	:		
	15		
(3326CH)	0	2nd unit's SOW(1)	
	:		
	15		
	:		
(3340CH)	0	2nd unit's SOW(15)	
	:		
	15		
(3341CH)	0	2nd unit's SO(00) : Emergency stop input status output	: Bit information
	1	2nd unit's SO(01) : CPU_OK status output	
	2	2nd unit's SO(02) : Servo ON status output	
	3	2nd unit's SO(03) : Alarm status output	
	4	2nd unit's SO(04) :	
	5	2nd unit's SO(05) :	
	6	2nd unit's SO(06) :	
	7	2nd unit's SO(07) :	
	8	2nd unit's SO(10) : AUTO mode status output	
	9	2nd unit's SO(11) : Return-to-origin complete status output	
	10	2nd unit's SO(12) : Sequence program execution status output	
	11	2nd unit's SO(13) : Robot program execution status output	
	12	2nd unit's SO(14) : Program reset status output	
	13	2nd unit's SO(15) :	
	14	2nd unit's SO(16) : IO command execution judgment output	
	15	2nd unit's SO(17) : Output during IO command execution	
(3342CH)	0	2nd unit's SO(20) : General-purpose output	
	1	2nd unit's SO(21) : General-purpose output	
	2	2nd unit's SO(22) : General-purpose output	
	3	2nd unit's SO(23) : General-purpose output	
	4	2nd unit's SO(24) : General-purpose output	
	5	2nd unit's SO(25) : General-purpose output	
	6	2nd unit's SO(26) : General-purpose output	
	7	2nd unit's SO(27) : General-purpose output	
	8	2nd unit's SO(30) : General-purpose output	
	9	2nd unit's SO(31) : General-purpose output	
	10	2nd unit's SO(32) : General-purpose output	
	11	2nd unit's SO(33) : General-purpose output	
	12	2nd unit's SO(34) : General-purpose output	
	13	2nd unit's SO(35) : General-purpose output	
	14	2nd unit's SO(36) : General-purpose output	
	15	2nd unit's SO(37) : General-purpose output	
	:		
(3347CH)	0	2nd unit's SO(140) : General-purpose output	
	1	2nd unit's SO(141) : General-purpose output	
	2	2nd unit's SO(142) : General-purpose output	
	3	2nd unit's SO(143) : General-purpose output	
	4	2nd unit's SO(144) : General-purpose output	
	5	2nd unit's SO(145) : General-purpose output	
	6	2nd unit's SO(146) : General-purpose output	
	7	2nd unit's SO(147) : General-purpose output	
	8	2nd unit's SO(150) : General-purpose output	
	9	2nd unit's SO(151) : General-purpose output	
	10	2nd unit's SO(152) : General-purpose output	
	11	2nd unit's SO(153) : General-purpose output	
	12	2nd unit's SO(154) : General-purpose output	
	13	2nd unit's SO(155) : General-purpose output	
	14	2nd unit's SO(156) : General-purpose output	
	15	2nd unit's SO(157) : General-purpose output	
(3348CH)	0	2nd unit reservation area	
	:		
	15		

[Robot program]

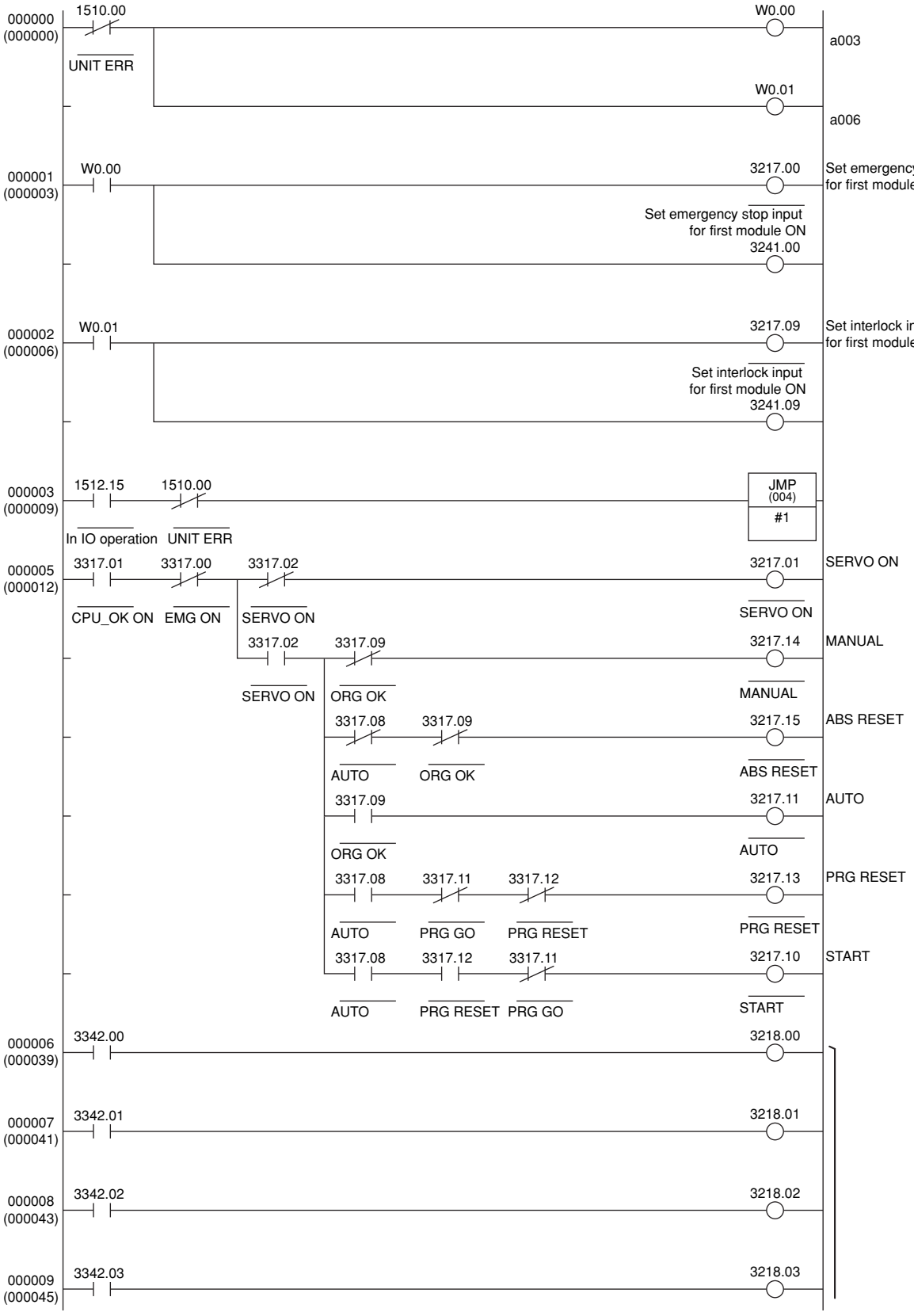
1st unit's YRC

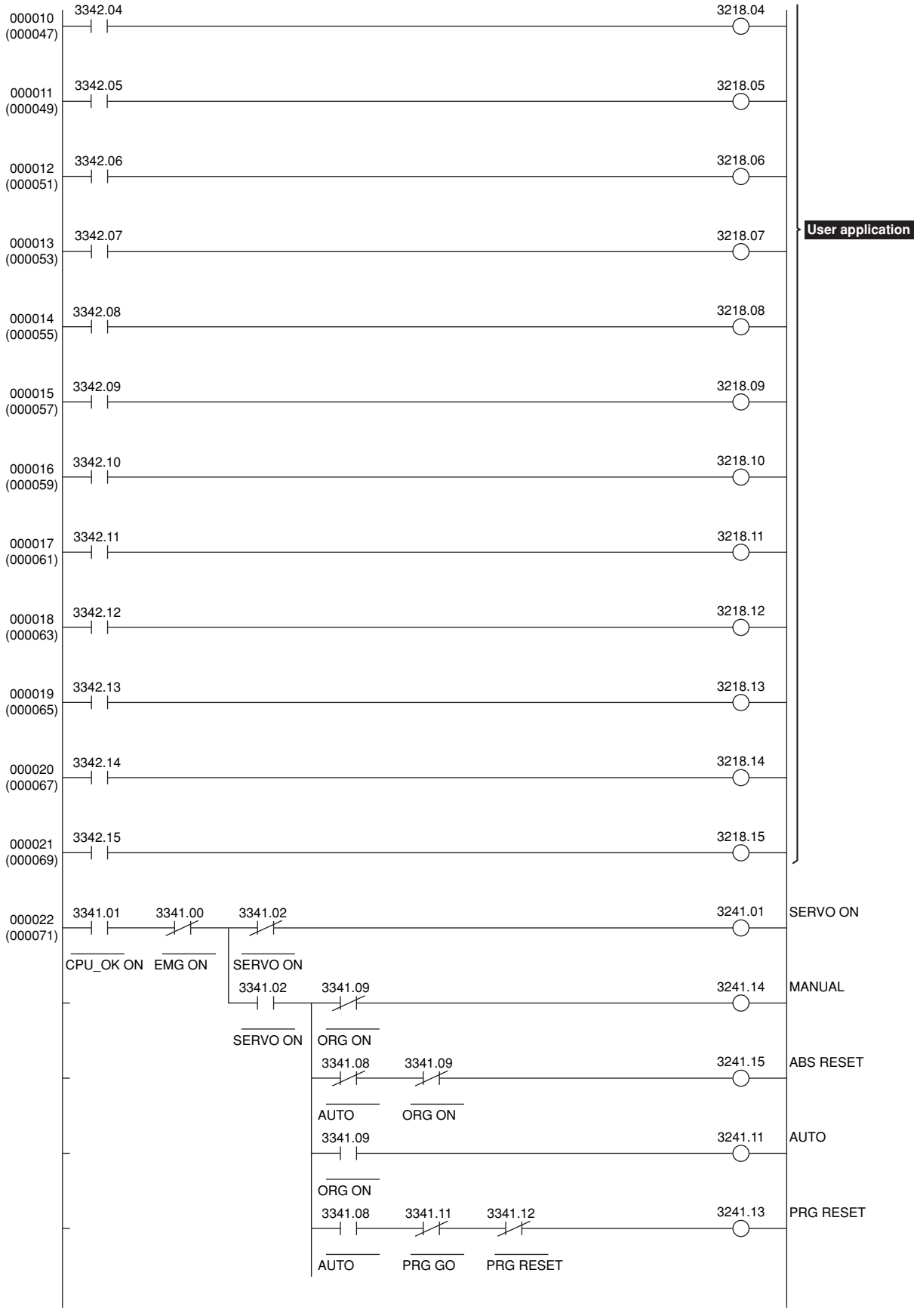
```
 'INIT ROUTINE
    RESET SO2()
    RESET SO4()
    RESET DO4()
    A=101
'MAIN ROUTINE
    MOVE P,P100,Z=0
    GOSUB *PICK
*ST1:
    MOVE P,P[A],Z=0
    GOSUB *PLACE
    MOVE P,P100,Z=0
    SO(41)=1
    WAIT SI(41)=1
    SO(41)=0
    WAIT SI(41)=0
    SO(23,22,21,20)=A-100
    SO(40)=1
    WAIT SI(40)=1
    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
```

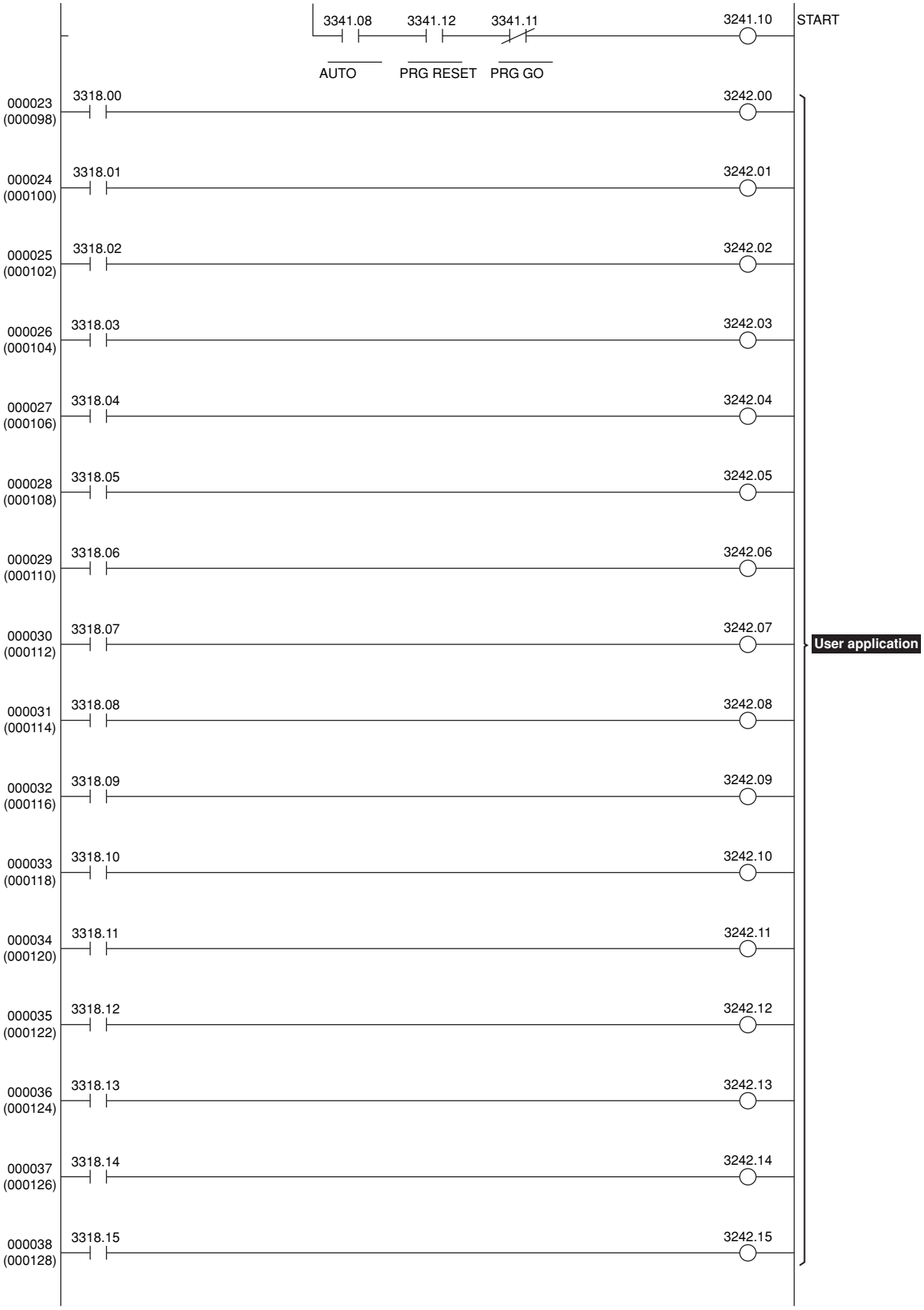
2nd unit's YRC

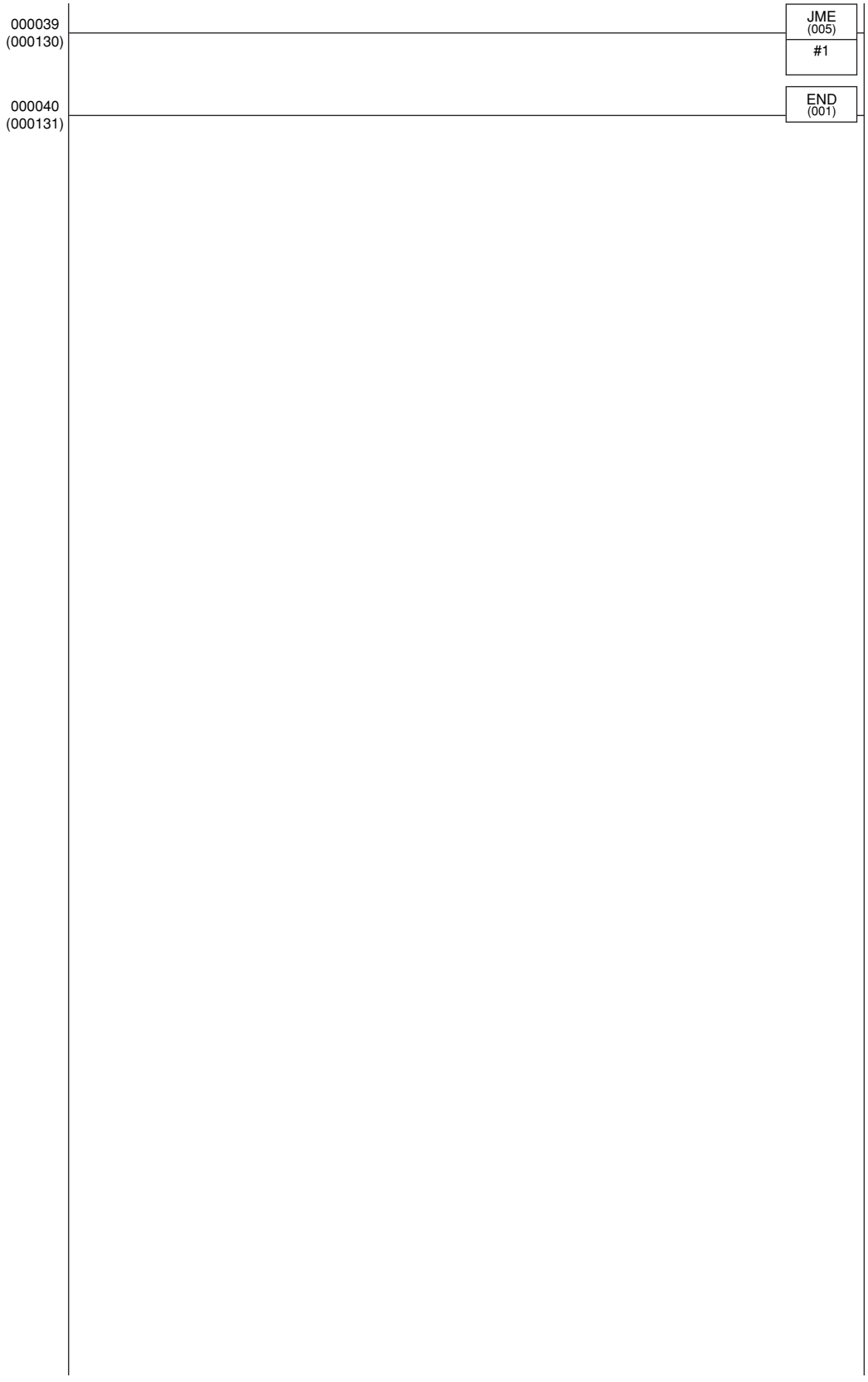
```
'INIT ROUTINE
    RESET SO2()
    RESET SO4()
    RESET DO4()
    B=201
'MAIN ROUTINE
    MOVE P,P200,Z=0
    GOSUB *PICK
*ST2:
    WAIT SI(41)=1
    SO(41)=1
    WAIT SI(41)=0
    SO(41)=0
    WAIT SI(40)=1
    B=SI(23,22,21,20)
    SO(40)=1
    WAIT SI(40)=0
    SO(40)=0
    B=B+200
    MOVE P,P[B],Z=0
    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]


000000
(000000)
1510.00
UNIT ERR
W0.00
a003
W0.01
a006
000001
(000003)
W0.00
3217.00
Set emergency stop input for first module ON
Set emergency stop input for first module ON
3241.00
000002
(000006)
W0.01
3217.09
Set interlock input for first module ON
Set interlock input for first module ON
3241.09
000003
(000009)
1512.15
In IO operation
1510.00
UNIT ERR
JMP
(004)
#1
000005
(000012)
3317.01
CPU_OK ON
3317.00
EMG ON
3317.02
SERVO ON
3217.01
SERVO ON
SERVO ON
3317.02
SERVO ON
3317.09
ORG OK
3217.14
MANUAL
MANUAL
3317.08
AUTO
3317.09
ORG OK
3217.15
ABS RESET
ABS RESET
3317.09
ORG OK
3217.11
AUTO
AUTO
3317.08
AUTO
3317.11
PRG GO
3317.12
PRG RESET
3217.13
PRG RESET
PRG RESET
3317.08
AUTO
3317.12
PRG RESET
3317.11
PRG GO
3217.10
START
START
000006
(000039)
3342.00
3218.00
000007
(000041)
3342.01
3218.01
000008
(000043)
3342.02
3218.02
000009
(000045)
3342.03
3218.03


000010
(000047)
3342.04
3218.04
000011
(000049)
3342.05
3218.05
000012
(000051)
3342.06
3218.06
000013
(000053)
3342.07
3218.07
User application
000014
(000055)
3342.08
3218.08
000015
(000057)
3342.09
3218.09
000016
(000059)
3342.10
3218.10
000017
(000061)
3342.11
3218.11
000018
(000063)
3342.12
3218.12
000019
(000065)
3342.13
3218.13
000020
(000067)
3342.14
3218.14
000021
(000069)
3342.15
3218.15
000022
(000071)
3341.01
3341.00
3341.02
3241.01
SERVO ON
CPU_OK ON
EMG ON
SERVO ON
3341.02
3341.09
3241.14
MANUAL
SERVO ON
ORG ON
3341.08
3341.09
3241.15
ABS RESET
AUTO
ORG ON
3341.09
3241.11
AUTO
ORG ON
3341.08
3341.11
3341.12
3241.13
PRG RESET
AUTO
PRG GO
PRG RESET


3341.08
3341.12
3341.11
3241.10
START
AUTO
PRG RESET
PRG GO
000023 (000098)
3318.00
3242.00
000024 (000100)
3318.01
3242.01
000025 (000102)
3318.02
3242.02
000026 (000104)
3318.03
3242.03
000027 (000106)
3318.04
3242.04
000028 (000108)
3318.05
3242.05
000029 (000110)
3318.06
3242.06
000030 (000112)
3318.07
3242.07
000031 (000114)
3318.08
3242.08
000032 (000116)
3318.09
3242.09
000033 (000118)
3318.10
3242.10
000034 (000120)
3318.11
3242.11
000035 (000122)
3318.12
3242.12
000036 (000124)
3318.13
3242.13
000037 (000126)
3318.14
3242.14
000038 (000128)
3318.15
3242.15
User application


000039
(000130)
JME
(005)
#1
000040
(000131)
END
(001)

5. DeviceNet compatible module specifications

Model / Spec. Item	DeviceNet Unit			
Controller model	YRC robot controller			
Conforms to DeviceNet Specification	Volume 1 Release 2.0 Volume 2 Release 2.0			
Device Profile Name	Generic Device (Device Type Number 0)			
Number of channels used *1)	When IO size is "Large" : Input/output 24 channels each When IO size is "Small" : Input/output 2 channels each			
MAC ID setting	0 to 63 (Set with rotary switch on board)			
Transmission speed setting	500K/250K/125Kbps (Set with rotary switch on board)			
Communication data *2)	Predefined Master/Slave Connection Set : Group Only 2 server Dynamic Connections Supported (UCMM) : No Fragmented Explicit Messaging Implemented : Yes			
DeviceNet I/O points *3) (48 bytes or 4 bytes selectable)	When IO size is "Large"	Input (Total 48 bytes)	byte 0-3 byte 4-31	Dedicated word input : 2 words General purpose word input : 14 words
			byte 32-33 byte 34-47	Dedicated bit input : 16 points General-purpose bit input : 96 points
		Output (Total 48 bytes)	byte 0-3 byte 4-31	Dedicated word input : 2 words General purpose word input : 14 words
			byte 32-33 byte 34-47	Dedicated bit output : 16 points General-purpose bit output : 96 points
	When IO size is "Small"	Input (Total 4 bytes)	byte 0-1 byte 2-3	Dedicated bit input : 16 points General-purpose bit input : 16 points
		Output (Total 4 bytes)	byte 0-1 byte 2-3	Dedicated bit output : 16 points General-purpose bit output : 16 points
Parallel external I/O	The master module and up to four ports can be controlled regardless of the robot program by using the pseudoserialization function.			
Network Topology		Maximum Trunk Distance *4)	Maximum Drop Length	Cumulative Drop Length
	500Kbps	100m	6m or less	39m or less
	250Kbps	250m	6m or less	78m or less
	125Kbps	500m	6m or less	156m or less
Monitor LED	MS (Module Status), NS (Network Status)			

*1) One channel uses 16 bits (2 bytes).
*2) The explicit message function is not supported by the controller.
*3) Controller's I/O update intervals are 10ms at shortest, but actual I/O update intervals change depending on the update time for the master station.
*4) When thick cables are used. Distance will be short if a thin cable is used or thin and thick cables are used.

CAUTION

- FOR THE NAMES AND DESCRIPTION OF WORD AND BIT INPUT/OUTPUT SIGNALS, REFER TO THE TABLES SHOWN IN "1. PROFILE" AND 2. DETAILS OF INPUT/ OUTPUT SIGNALS" IN THIS CHAPTER.
- THE SPECIFICATIONS AND APPEARANCE ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

6. DeviceNet specifications

- **General Device Data**

Conforms to DeviceNet Specification	Volume 1 Release2.0 Volume 2 Release2.0
Vendor Name	YAMAHA MOTOR CO, LTD, OMRON EUROPE, B.V.
Device Profile Name	Generic Device(Device Type Number 0)
Product Code	2
Product Revision	1.1

- **DeviceNet Physical Conformance Data**

Network Power Consumption(Max)	55mA@DC11V
Connector Style	Open-Pluggable
Isolated Physical Layer	Yes
LEDs Supported	Module, Network
MAC ID Setting	Rotary Switch
Default MAC ID	1
Communication Rate Setting	Rotary Switch
Communication Rates Supported	125Kbps, 250Kbps, 500Kbps

- **DeviceNet Communication Data**

Predefined Master/Slave Connection Set	Group 2 Only Server
Dynamic Connections Supported (UCMM)	No
Fragmented Explicit Messaging Implemented	Yes

DeviceNet Required Object Implementation

● Identity Object(0x01)

Object Class

Attributes	None Supported
Services	None Supported

Object Instance

	ID	Description	Get	Set	Value Limit
Attributes	1	Vender	○	×	636
	2	Product type	○	×	0
	3	Product code	○	×	2
	4	Revision	○	×	1.1
	5	Status (bits supported)	○	×	bit0 only
	6	Serial number	○	×	each unit
	7	Product name	○	×	OMRON ROBOT YRC
	8	State	×	×	
	9	Configuration Consistency Value	×	×	
	10	Heartbeat Interval	×	×	
Services	**DeviceNet Services**		**Parameter Options**		
	05H	Reset	none		
	0EH	Get_Attribute_Single	none		

● Message Router Object(0x02)

Object Class

Attributes	None Supported
Services	None Supported

Object Instance

Attributes	None Supported
Services	None Supported

Vendor Specific Additions

No

● **DeviceNet Object (0x03)**

Object Class

Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	Revision	○	×	02H
Services	**DeviceNet Services**		**Parameter Options**		
	0EH	Get_Attribute_Single	none		

Object Instance

Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	MAC ID	○	×	
	2	Baud rate	○	×	
	3	BOI	○	×	00H
	4	Bus-off counter	×	×	
	5	Allocation information	○	×	
	6	MAC ID switch changed	×	×	
	7	Baud rate switch changed	×	×	
	8	MAC ID switch value	×	×	
	9	Baud rate switch value	×	×	
Services	**DeviceNet Services**		**Parameter Options**		
	0EH	Get_Attribute_Single	none		
	4BH	Allocate_Master/Slave_ Connection_Set	none		
	4CH	Release_Master/Slave_ Connection_Set	none		

● **Assembly Object (0x04)**

Object Class

Attributes	None Supported
Services	None Supported

Object Instance

Section	**Description**		**Information**		
	Instance Type		Static I/O Max Instance:1		
Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	Number of Members in List	×	×	
	2	Member List	×	×	
	3	Data	○	×	
Services	**DeviceNet Services**		**Parameter Options**		
	0EH	Get_Attribute_Single	none		

● Connection Object(0x05)

Object Class

Attributes	None Supported
Services	None Supported
Total Active Connections Possible	1

Object Instance 1

Section	**Description**		**Information**		
	Instance Type		Explicit Message Max Instance:1		
	Production Trigger		Cyclic		
	Transport Type		Server		
	Transport Class		3		
Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	State	○	×	
	2	Instance type	○	×	00H
	3	Transport class trigger	○	×	83H
	4	Produced connection ID	○	×	
	5	Consumed connection ID	○	×	
	6	Initial comm. Characteristics	○	×	21H
	7	Produced connection size	○	×	11H
	8	Consumed connection size	○	×	11H
	9	Expected packet rate	○	○	
	12	Watchdog time-out action	○	○	01 or 03
	13	Produced connection path length	○	×	00
	14	Produced connection path	○	×	
	15	Consumed connection path length	○	×	00
	16	Consumed connection path	○	×	
	17	Production inhibit time	○	×	00
Services	**DeviceNet Services**		**Parameter Options**		
	05H	Reset	none		
	0EH	Get_Attribute_Single	none		
	10H	Set_Attribute_Single	none		

Object Instance 2

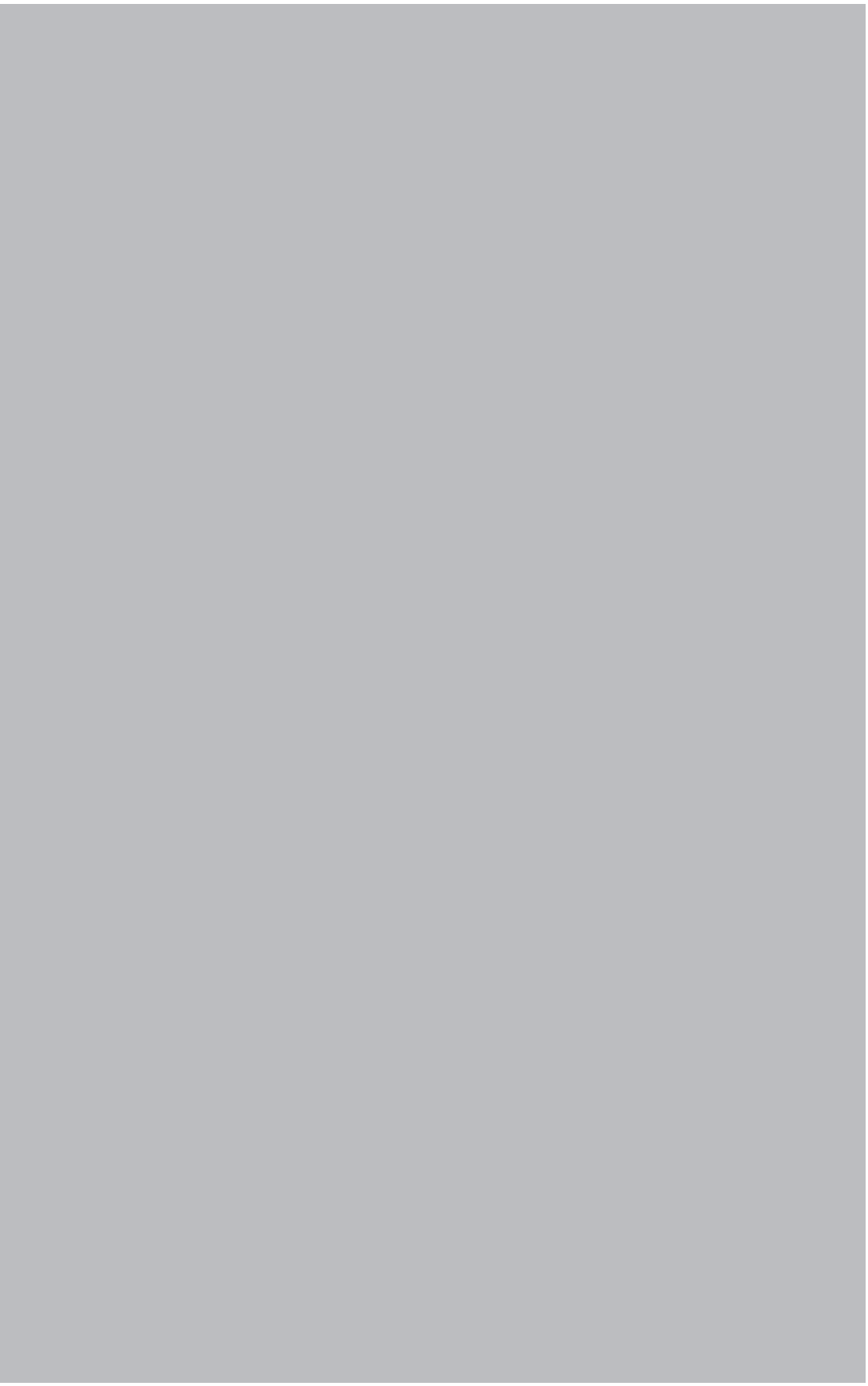
Section	Description		Information		
	Instance Type		Polled I/O Max Instance:1		
	Production Trigger		Cyclic		
	Transport Type		Server		
	Transport Class		2		
Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	State	○	×	
	2	Instance type	○	×	01H
	3	Transport class trigger	○	×	82H
	4	Produced connection ID	○	×	
	5	Consumed connection ID	○	×	
	6	Initial comm. Characteristics	○	×	01H
	7	Produced connection size	○	×	4
	8	Consumed connection size	○	×	4
	9	Expected packet rate	○	○	
	12	Watchdog time-out action	○	×	00
	13	Produced connection path length	○	×	6
	14	Produced connection path	○	×	20_04_24_01_30_03
	15	Consumed connection path length	○	×	6
	16	Consumed connection path	○	×	20_04_24_01_30_03
	17	Production inhibit time	○	×	00
Services	**DeviceNet Services**		**Parameter Options**		
	05H	Reset	none		
	0EH	Get_Attribute_Single	none		
	10H	Set_Attribute_Single	none		

Object Instance 3

Section	Description		Information		
	Instance Type		Bit Strobed I/O Max Instance:1		
	Production Trigger		Cyclic		
	Transport Type		Server		
	Transport Class		2		
Attributes	**ID**	**Description**	**Get**	**Set**	**Value Limit**
	1	State	○	×	
	2	Instance type	○	×	01H
	3	Transport class trigger	○	×	82H
	4	Produced connection ID	○	×	
	5	Consumed connection ID	○	×	
	6	Initial comm. Characteristics	○	×	01H
	7	Produced connection size	○	×	4
	8	Consumed connection size	○	×	8
	9	Expected packet rate	○	○	
	12	Watchdog time-out action	○	×	00
	13	Produced connection path length	○	×	6
	14	Produced connection path	○	×	20_04_24_01_30_03
	15	Consumed connection path length	○	×	6
	16	Consumed connection path	○	×	20_04_24_01_30_03
	17	Production inhibit time	○	×	00
Services	**DeviceNet Services**		**Parameter Options**		
	05H	Reset	none		
	0EH	Get_Attribute_Single	none		
	10H	Set_Attribute_Single	none		

Chapter 6 APPENDIX

Contents



1. Term definition

1. DeviceNet

DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).

2. SAFE mode setting

When the SAFE mode setting is enabled, service mode input is made valid so that safety functions such as operating speed limits in MANUAL mode can be used. The SAFE mode setting is determined at the time of shipping.
The SAFE mode setting is always enabled for controllers compatible with CE marking.

3. SERVICE mode

This mode is valid only when the SAFE mode setting is enabled, and can be controlled by service mode input signals.

4. SAFETY connector

This connector is used to connect emergency stop input and service mode input. Located on the front panel of the robot controller.

5. STD. DIO connector

This connector is used to receive or output dedicated I/O signals and general-purpose I/O signals. Located on the front panel of the robot controller.

6. MAC ID

Identification number assigned to each node in DeviceNet.
Also called the node address.

7. Bit information

Bit information that can be handled by DeviceNet compatible module.

8. Word information

Word information that can be handled by DeviceNet compatible module.

9. Little endian

Method to substitute LSB in low-order address and refer to LSB when handling word information data as double word data.
For example, when the value 00012345h is substituted in SOD (2), 2345h is substituted in SOW (2) of the first word, and 0001h is substituted in SOW (3) of the second word.

2. EDS files

The contents of an EDS file are shown below just for your reference.

When IO size is "Large"

```
$ DeviceNet Configurator Generated Electronic Data Sheet
$

[File]
        DescText    = "YAMAHA ROBOT EDS File";          $ File Description Text
        CreateDate  = 04-19-2002;                       $ File Creation Date
        CreateTime  = 12:00:00;                         $ File Creation Time
        ModDate     = 04-19-2002;                       $ Last Modification Date
        ModTime     = 12:00:00;                         $ Last Modification Time
        Revision    = 1.1;                              $ EDS Revision


[Device]
        VendCode    = 636;                              $ Vendor ID
        VendName    = "YAMAHA MOTOR CO. LTD.";          $ Vendor Name
        ProdType    = 0;                                $ Device Type
        ProdTypeStr = "Generic Device";                 $ Device Type String
        ProdCode    = 2;                                $ Product Code
        MajRev      = 1;                                $ Major Revision
        MinRev      = 1;                                $ Minor Revision
        ProdName    = "YAMAHA ROBOT RCX";               $ Product Name
        Catalog     = "";                               $ Catalog Number


[IO_Info]
        Default     = 0x0001;                           $ Default I/O Type Mask

        PollInfo    = 0x0001,                           $ Compatible I/O Type Mask
                      1,                                $ Default Producing Connection
                      1;                                $ Default Consuming Connection

        Input1      = 48,                               $ Size
                      0,                                $ Number of Significant Bits
                      0x0001,                           $ Compatible I/O Type Mask
                      "",                               $ Name String
                      6,                                $ Connection Path Size
                      "20 04 24 64 30 03",              $ Connection Path
                      "";                               $ Help String

        Output1     = 48,                               $ Size
                      0,                                $ Number of Significant Bits
                      0x0001,                           $ Compatible I/O Type Mask
                      "",                               $ Name String
                      6,                                $ Connection Path Size
                      "20 04 24 65 30 03",              $ Connection Path
                      "";                               $ Help String
```

* EDS files are included on the OMRON manual CD-ROM. Use them as needed.

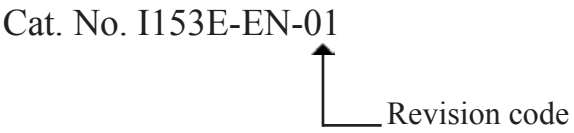
When IO size is "Small"

```
$ DeviceNet Configurator Generated Electronic Data Sheet
$

[File]
        DescText    = "YAMAHA ROBOT EDS File";      $ File Description Text
        CreateDate  = 11-17-2006;                   $ File Creation Date
        CreateTime  = 12:00:00;                     $ File Creation Time
        ModDate     = 11-17-2006;                   $ Last Modification Date
        ModTime     = 12:00:00;                     $ Last Modification Time
        Revision    = 1.0;                          $ EDS Revision


[Device]
        VendCode    = 636;                          $ Vendor ID
        VendName    = "YAMAHA MOTOR CO. LTD.";      $ Vendor Name
        ProdType    = 0;                            $ Device Type
        ProdTypeStr = "Generic Device";             $ Device Type String
        ProdCode    = 4;                            $ Product Code
        MajRev      = 1;                            $ Major Revision
        MinRev      = 1;                            $ Minor Revision
        ProdName    = "YAMAHA ROBOT RCX";           $ Product Name
        Catalog     = "";                           $ Catalog Number


[IO_Info]
        Default     = 0x0001;                       $ Default I/O Type Mask

        PollInfo    = 0x0001,                       $ Compatible I/O Type Mask
                      1,                            $ Default Producing Connection
                      1;                            $ Default Consuming Connection

        Input1      = 4,                            $ Size
                      0,                            $ Number of Significant Bits
                      0x0001,                       $ Compatible I/O Type Mask
                      "",                           $ Name String
                      6,                            $ Connection Path Size
                      "20 04 24 01 30 03",          $ Connection Path
                      "";                           $ Help String

        Output1     = 4,                            $ Size
                      0,                            $ Number of Significant Bits
                      0x0001,                       $ Compatible I/O Type Mask
                      "",                           $ Name String
                      6,                            $ Connection Path Size
                      "20 04 24 01 30 03",          $ Connection Path
                      "";                           $ Help String
```

* EDS files are included on the OMRON manual CD-ROM. Use them as needed.

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous revision.

Revision code	Date	Revised content
01	June 2010	Original production