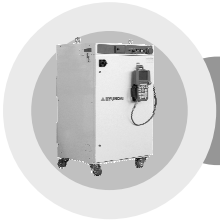
WARNING

THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi4aFB071001FMEN3



Hi4a Controller Function Manual

Fieldbus

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

Printed in Korea - Oct. 2007. 3rd Edition

Contents

List of Figures

List of Tables

1 Introduction

1.1. Prior knowledge

To better understand this manual, you should have the knowledge of below topics.

- Operating method of Hi4a robot controller.
- Installation and utilization method of Fieldbus network (DeviceNet, Profibus-DP or CC-link)

1.2. About Fieldbus

- Fieldbus is an open industry standard to operate devices such as sensor, button, motor driver, operating interface etc. using a single communication cable and PLC (Programmable Logic Controller).
- Fieldbus provides intelligent service such as central monitoring or reconfiguring the network status and has an advantage of communicating a more detailed information (operating mode setting, sensor error etc.) besides just ON/OFF like a sensor or switch.
- Because the fieldbus uses a signal cable, it reduces time and cost for wiring and simplifies wiring for easier maintenance. Also unlike a protocol with non-deterministic response, such as Ethernet, fieldbus ensures the data response speed and therefore satisfies the critical time characteristics important for industrial use.

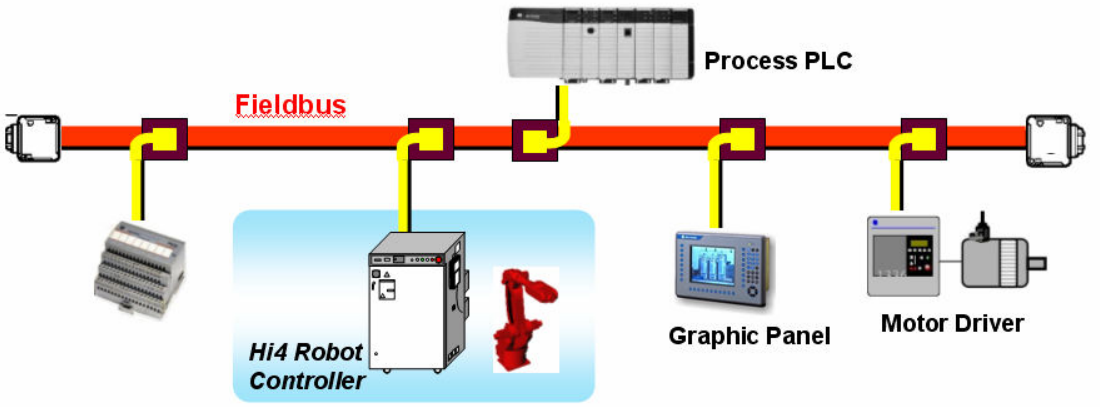


Figure 1.1 Fieldbus network and master/slave devices

- 1 master device and several slave devices are connected to 1 fieldbus network. The master device searches/manages the whole network while the slave devices exchange data. In general, PLC is the master device and other devices such as sensor, button , controller etc. are slave devices.

1.3. 2 methods of Hi4a robot controller fieldbus function

Hi4a controller supports 2 types of fieldbus function as shown in Table 1-1.

Table 1-1 2 methods of Hi4a robot controller fieldbus function and characteristics

	BD430 I/O board	BD420 multi-communication board
Mounted module	One of the following two 1) UCS module from SST 2) BD471 CC-Link slave module	COM module from Hilscher
The number of module that can be mounted	1	1 ~4
Support function	Slave	Both master and slave can be supported at the same time
Support protocol	DeviceNET Profibus -DP CC-Link	DeviceNET Profibus-DP Interbus (to be supported)
Connection with main board	RS-232C	BD400 mother board bus
Fieldbus input of robot language	Input from DI area set with input source as fieldbus Ex: WAIT DI5	Input from F1~F4 object DI Ex: WAIT F2.DI5
Fieldbus output of robot language	DO output is to both hard-wired and fieldbus. Ex: DO12=1	Output to F1~F4 object DO Ex: F4.DO12=1
Fieldbus input of PLC	Input from X relays set with input source as fieldbus	Input from F1~F4 object X
Fieldbus input of PLC	Y output is to both hard-wired and fieldbus.	Output to F1~F4 object Y

You can choose from the 2 methods. This manual only explains the fieldbus function using the BD430 I/O board.

1.4. Hi4a robot controller fieldbus function

Hi4a controller is one of the fieldbus slave device that can execute I/O exchange. To use the fieldbus function in Hi4a controller, proper fieldbus module must be mounted on the BD430 I/O board.

Currently you can install one of the 3 types (DeviceNET, Profibus-DP and CC-Link). When using the DeviceNet and Profibus-DP, UCS module of SST is mounted and when using the CC-Link, BD471 board is mounted.

Hi4a controller fieldbus function specifications are as shown in Table 1-2, 1-3 and 1-4.

Table 1-2 DeviceNet function specification for Hi4a controller

Vendor ID	505 (= 0x1F9 hex)
Device Type	0 (Generic Device)
I/O connection	Polled
Input	32byte (256bit)
Output	32byte (256bit)

Table 1-3 Profibus-DP function specification for Hi4a controller

PNO Id	0870
Input	32byte (256bit)
Output	32byte (256bit)

Table 1-4 CC-Link function specification for Hi4a controller

Type	Remote Device
Maximum number of station	4
Input	32byte (256bit) (RWw0~15)
Output	32byte (256bit) (RWr0~15)

1.5. Basic specification of fieldbus

Table 1-5, 1-6 and 1-7 shows the basic specification of DeviceNet, Profibus-DP and CC-Link.

Table 1-5 Basic specification of DeviceNet

Transmission rate	The cable can have :			
	Trunk length	Max drop length	Maximum number of node	Cumulative drop length
125k bit/s	500 m (1,640 ft)	6m (20 ft)	64 nodes	156 m (512 ft)
250k bit/s	250 m (820 ft)			78 m (256 ft)
500k bit/s	100 m (328 ft)			39 m (128 ft)

Table 1-6 Basic specification of Profibus-DP

Maximum number of stations	Up to 32 stations per line segment and maximum of total 126 stations.									
Repeater	Can be expanded to maximum of 4									
I/O data per station	244 input, output byte									
Maximum number of connected segments	Maximum of 4 repeater between two stations (More than 4 repeaters supported depending on the repeater)									
Transmission rate(kbit/s)	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Maximum segment length (m)	1200	1200	1200	1200	1000	400	200	100	100	100

Table 1-7 Basic specification of CC-Link (ver 1.1 standard, use terminal resistance 110Ω)

Maximum number of remote stations	**64 stations**	
Transmission speed	**Cable distance between stations**	**Maximum total cable distance**
156kbps	20cm or more	1200m
625kbps		900m
2.5Mbps		400m
5Mbps		160m
10Mbps		100m

1.6. ESD file and GSD file

Each fieldbus device has a unique characteristics file to identify itself.
For DeviceNet, it is the EDS file and for Profibus device, it is the GSD file. Hi4a controller also has EDS file and GSD file. (CC-Link does not uses a characteristics file.)

If you register the characteristics file to the network management S/W and execute network browsing, devices connected to the fieldbus network are searched. The network management S/W downloads this information to the PLC fieldbus scanner module, i.e. master. Once the network information is downloaded to the scanner module, PLC scanner module operates the whole network without the help of network management S/W.

For more details of this procedure, please refer to the product manual for PLC and for S/W for setting the network.

2

BD430 and Fieldbus Module Setting

2.1. Fieldbus module setting for DeviceNet and Profibus-DP

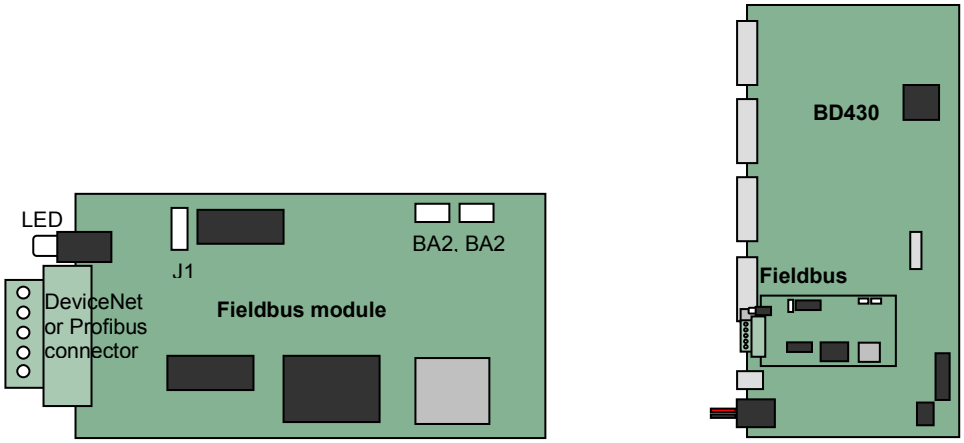


Figure 2.1 Shape of BD430 and location of jumpers with fieldbus module mounted
(* J1 only exists in UCS for DeviceNet)

There are 3 jumpers in the fieldbus module.
Jumpers BA1 and BA2 must be open as shown in Figure 22.

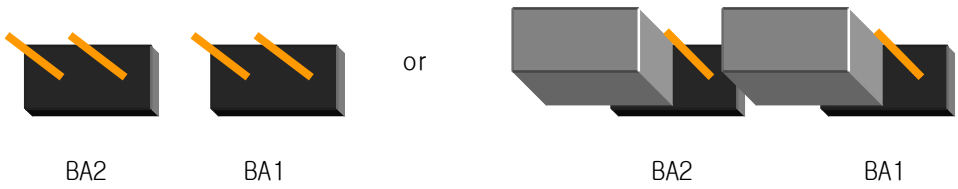


Figure 2.2 Set jumpers BA1 and BA2 as OPEN

Jumper J1 is the network power jumper and is only on UCS for DeviceNet. The setting is as shown in Table 2-1.

Table 2-1 Network power jumper –DeviceNet

Jumper	Network power
1-2 SHORT	Internal (3-wire, non-powered CAN networks)
2-3 SHORT	External (5-wire, powered CAN networks)

2.2. BD471 CC-Link fieldbus module setting

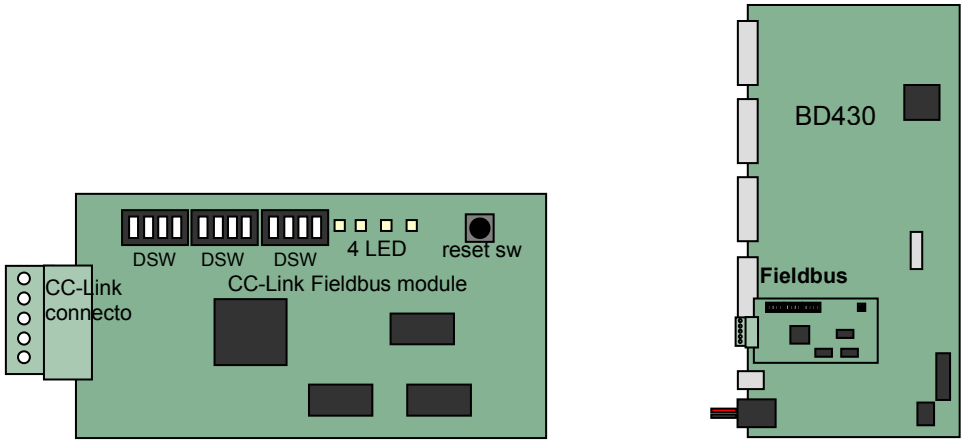


Figure 2.3 Shape of BD430 and location of jumpers with CC-Link module mounted

There are 3 dip switch groups (DSW1, DSW2 and DSW3) in the fieldbus module.
Each function is shown in Table 2-2.

Table 2-2 CC-Link module dip switch function

Switch name	Switch no.	Description
DSW1	1	Station no. setting (enter in units of 10): × 80
	2	Station no. setting (enter in units of 10): × 40
	3	Station no. setting (enter in units of 10): × 20
	4	Station no. setting (enter in units of 10): × 10
DSW2	1	Station no. setting (enter in units of 1): × 8
	2	Station no. setting (enter in units of 1): × 4
	3	Station no. setting (enter in units of 1): × 2
	4	Station no. setting (enter in units of 1): × 1
DSW3	1	Baud rate setting: × 8
	2	Baud rate setting: × 4
	3	Baud rate setting: × 2
	4	Baud rate setting: × 1

The station number can be set within the range of 1~64.
Baud rate is set to one number from the range of 0~4. The speed for each number is as shown in Table 2-3.

Table 2-3 CC-Link speed setting

Dip switch setting (binary)	Speed
0 (0000)	156kbps
1 (0001)	625kbps
2 (0010)	2.5Mbps
3 (0011)	5Mbps
4 (0100)	10Mbps

For example, if you want to set the speed of 2.5Mbps at station number 13, the dip switch should be set as shown in Figure 2.4.

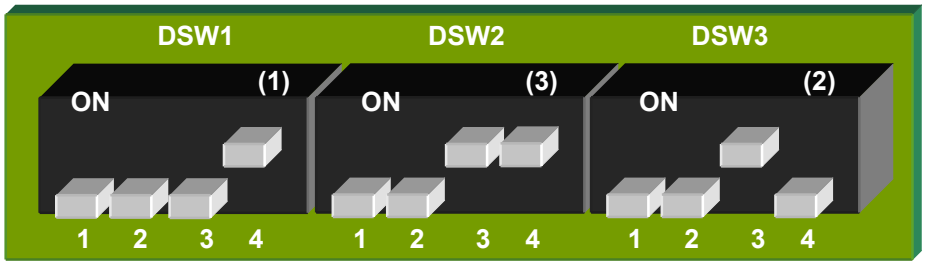


Figure 2.4 Example of dip switch setting (Station no.: 13, speed: 2)

And, you can set the number of staions with two jumpers, JP1, JP2.

Table 2-4 CC-Link the number of stations setting

JP1	JP2	The number of stations
Open	**Open**	1
Short	**Open**	2
Open	**Short**	3
Short	**Short**	4

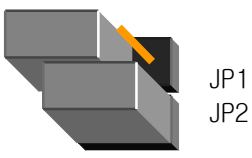
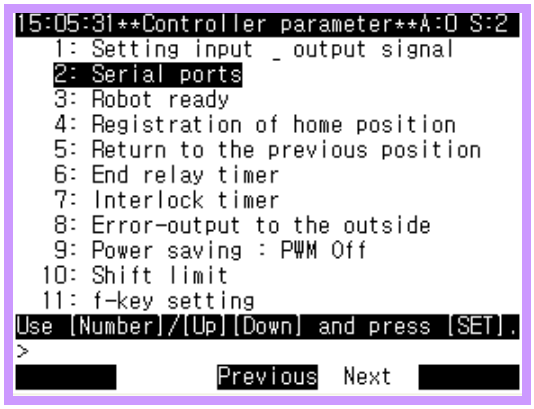


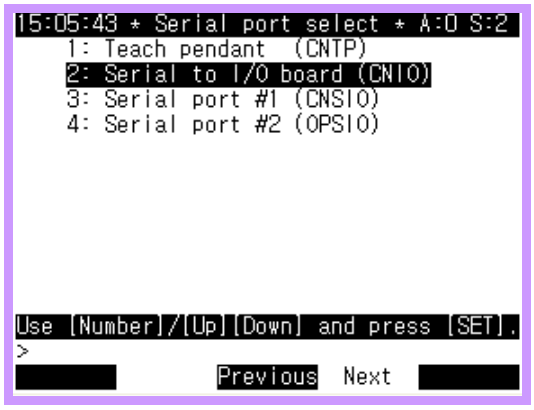
Figure 2.5 Example of the munber of stations setting (The number of stations : 3)

3
Serial Port Setting

(1) Select 『[PF2]: System』 → 『2: Controller parameter』 → 『2: Serial ports』.



(2) Select 『2: Serial to I/O board (CNIO)』.

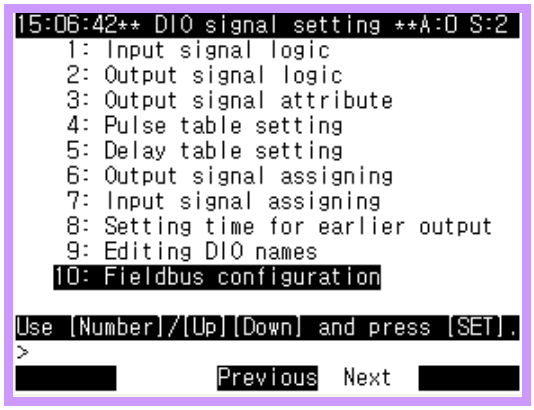


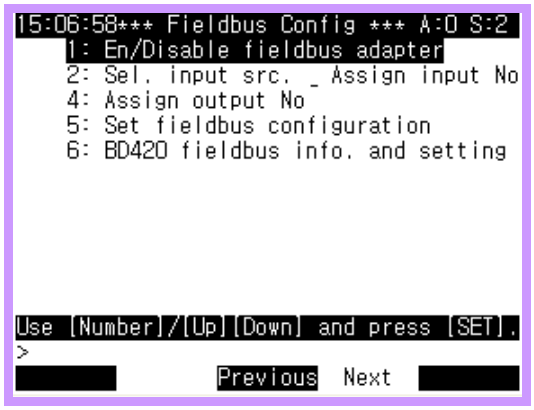
(3) After finishing the setting using the top/down arrow key and [SHIFT]+left/right cursor key, press the 『[PF5]: Complete』 key to save the changes.

4

Input Source Selection and Signal

(1) Select 『[PF2]: System』 → 『2: Controller parameter』 → 『1: Setting input & output signal』 → 『10: Fieldbus configuration』.





(2) If this is the first time setting the fieldbus after formatting the controller, select one of the menu items and you will see the following message.

(3) Press the [YES] key and the ROBOT.FBU file is created to save the fieldbus setting, and it switches to the setting process.

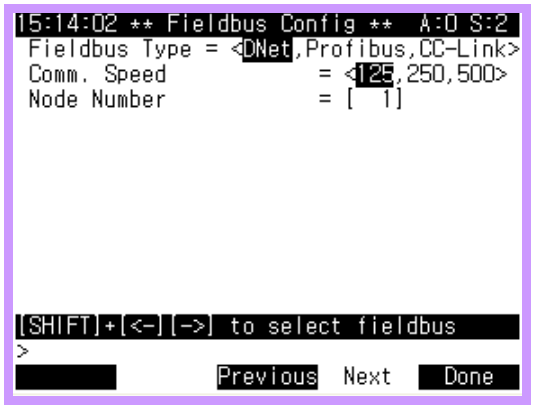
4.1. En/Disable fieldbus adapter

This decides whether to install and use the fieldbus. If this is set to On, the fieldbus function is operated and if not, it will not operate.

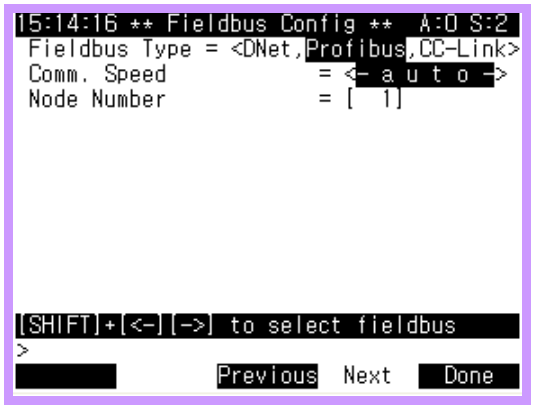
- **If you did not mount the fieldbus module on BD430, you must set this to Off. If you didn't mount the fieldbus module and set it as On, an error will be generated and the whole I/O function will not operate.**

4.2. Fieldbus configuration

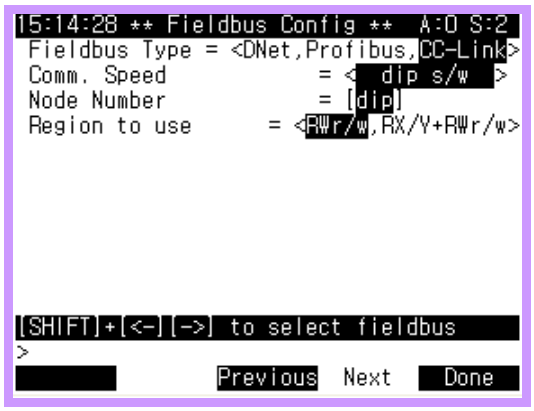
(1) If you selected the DeviceNet, set the communication speed and node number.



(2) If you selected Profibus-DP, the communication speed follows the master's setting and you only set the node number.



(3) If you selected CC-Link, the communication speed and node number follows the BD471 board dip switch setting. For the meaning of region to use, please refer to the next section.



4.3. CC-Link setting

4.3.1. I/O usable area

The usable I/O area and the corresponding Hi4a area according to the number of station of BD430, is as follows in Table 4-1, 4-2, 4-3 and 4-4. The bold lettered one shows the usable area.

Table 4-1 I/O usable area of CC-Link (1 station)

RWr/RWw mode		**RX/RY+RWr/RWw mode**	
RX/Y00-1F	-	**RX/Y00-1F**	**FBus_0~3**
RX/Y20-3F	-	RX/Y20-3F	FBus_4~7
RX/Y40-5F	-	RX/Y40-5F	FBus_8~11
RX/Y60-7F	-	RX/Y60-7F	FBus_12~15
RWr/w0-1	**FBus_0~3**	**RWr/w0-1**	**FBus_16~19**
RWr/w2-3	**FBus_4~7**	**RWr/w2-3**	**FBus_20~23**
RWr/w4-5	FBus_8~11	RWr/w4-5	FBus_24~27
RWr/w6-7	FBus_12~15	RWr/w6-7	FBus_28~31
RWr/w8-9	FBus_16~19	RWr/w8-9	-
RWr/w10-11	FBus_20~23	RWr/w10-11	-
RWr/w12-13	FBus_24~27	RWr/w12-13	-
RWr/w14-15	FBus_28~31	RWr/w14-15	-

Table 4-2 I/O usable area of CC-Link (2 stations)

RWr/RWw mode		**RX/RY+RWr/RWw mode**	
RX/Y00-1F	-	**RX/Y00-1F**	**FBus_0~3**
RX/Y20-3F	-	**RX/Y20-3F**	**FBus_4~7**
RX/Y40-5F	-	RX/Y40-5F	FBus_8~11
RX/Y60-7F	-	RX/Y60-7F	FBus_12~15
RWr/w0-1	**FBus_0~3**	**RWr/w0-1**	**FBus_16~19**
RWr/w2-3	**FBus_4~7**	**RWr/w2-3**	**FBus_20~23**
RWr/w4-5	**FBus_8~11**	**RWr/w4-5**	**FBus_24~27**
RWr/w6-7	**FBus_12~15**	**RWr/w6-7**	**FBus_28~31**
RWr/w8-9	FBus_16~19	RWr/w8-9	-
RWr/w10-11	FBus_20~23	RWr/w10-11	-
RWr/w12-13	FBus_24~27	RWr/w12-13	-
RWr/w14-15	FBus_28~31	RWr/w14-15	-

Table 4-3 I/O usable area of CC-Link (3 stations)

RWr/RWw mode		**RX/RY+RWr/RWw mode**	
RX/Y00-1F	-	**RX/Y00-1F**	**FBus_0~3**
RX/Y20-3F	-	**RX/Y20-3F**	**FBus_4~7**
RX/Y40-5F	-	**RX/Y40-5F**	**FBus_8~11**
RX/Y60-7F	-	RX/Y60-7F	FBus_12~15
RWr/w0-1	**FBus_0~3**	**RWr/w0-1**	**FBus_16~19**
RWr/w2-3	**FBus_4~7**	**RWr/w2-3**	**FBus_20~23**
RWr/w4-5	**FBus_8~11**	**RWr/w4-5**	**FBus_24~27**
RWr/w6-7	**FBus_12~15**	**RWr/w6-7**	**FBus_28~31**
RWr/w8-9	**FBus_16~19**	RWr/w8-9	-
RWr/w10-11	**FBus_20~23**	RWr/w10-11	-
RWr/w12-13	FBus_24~27	RWr/w12-13	-
RWr/w14-15	FBus_28~31	RWr/w14-15	-

Table 4-4 I/O usable area of CC-Link (4 stations)

RWr/RWw mode		RX/RY+RWr/RWw mode	
RX/Y00-1F	-	**RX/Y00-1F**	**FBus_0~3**
RX/Y20-3F	-	**RX/Y20-3F**	**FBus_4~7**
RX/Y40-5F	-	**RX/Y40-5F**	**FBus_8~11**
RX/Y60-7F	-	**RX/Y60-7F**	**FBus_12~15**
RWr/w0-1	**FBus_0~3**	**RWr/w0-1**	**FBus_16~19**
RWr/w2-3	**FBus_4~7**	**RWr/w2-3**	**FBus_20~23**
RWr/w4-5	**FBus_8~11**	**RWr/w4-5**	**FBus_24~27**
RWr/w6-7	**FBus_12~15**	**RWr/w6-7**	**FBus_28~31**
RWr/w8-9	**FBus_16~19**	RWr/w8-9	-
RWr/w10-11	**FBus_20~23**	RWr/w10-11	-
RWr/w12-13	**FBus_24~27**	RWr/w12-13	-
RWr/w14-15	**FBus_28~31**	RWr/w14-15	-

4.3.2. CC-Link system area

When using the RX/RY + RWr/RWw mode, the last 2 byte of the usable RX/RY area must not be used because it is a system area.

Table 4-5 shows the system area. In this, “reserved area” is currently usable but can be used for a different purpose in the future version of CC-Link protocol.

Using the “reserved” area can cause malfunctioning due to lack of compatibility. Therefore please limit the use of this area.

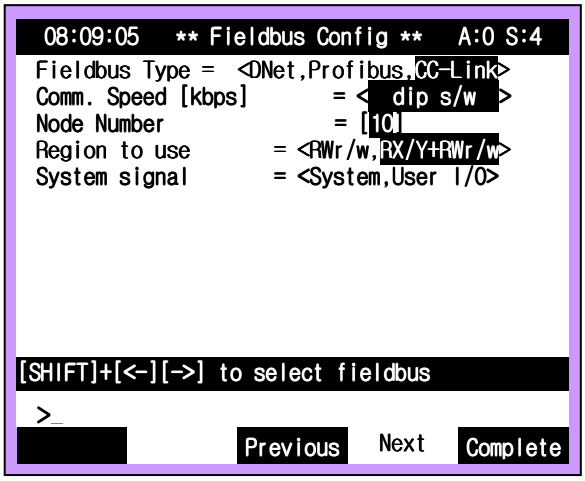
Table 4-5 CC-Link system area

<table>
<tr><th>Link input</th><th>Signal name</th><th>Link output</th><th colspan="2">Signal name</th></tr>
<tr><td>RXn0</td><td rowspan="8">Reserved</td><td>RYn0</td><td colspan="2" rowspan="8">Reserved</td></tr>
<tr><td>RXn1</td><td>RYn1</td></tr>
<tr><td>RXn2</td><td>RYn2</td></tr>
<tr><td>RXn3</td><td>RYn3</td></tr>
<tr><td>RXn4</td><td>RYn4</td></tr>
<tr><td>RXn5</td><td>RYn5</td></tr>
<tr><td>RXn6</td><td>RYn6</td></tr>
<tr><td>RXn7</td><td>RYn7</td></tr>
<tr><td>RXn8</td><td>Initial data process request flag</td><td>RYn8</td><td colspan="2">Initial process complete flag</td></tr>
<tr><td>RXn9</td><td>Initial data setting complete flag</td><td>RYn9</td><td colspan="2">Initial setting request flag</td></tr>
<tr><td>RXnA</td><td>Error status flag</td><td>RYnA</td><td colspan="2">Error set request flag</td></tr>
<tr><td>RXnB</td><td>Remote station ready</td><td>RYnB</td><td colspan="2" rowspan="3">Reserved</td></tr>
<tr><td>RXnC</td><td rowspan="2">Reserved</td><td>RYnC</td></tr>
<tr><td>RXnD</td><td>RYnD</td></tr>
<tr><td>RXnE</td><td rowspan="2">Defined by OS</td><td>RYnE</td><td colspan="2" rowspan="2">Defined by OS</td></tr>
<tr><td>RXnF</td><td>RYnF</td></tr>
<tr><td colspan="2"></td><td rowspan="4">The number of station</td><td>1</td><td>n=1</td></tr>
<tr><td colspan="2"></td><td>2</td><td>n=3</td></tr>
<tr><td colspan="2"></td><td>3</td><td>n=5</td></tr>
<tr><td colspan="2"></td><td>4</td><td>n=7</td></tr>
</table>

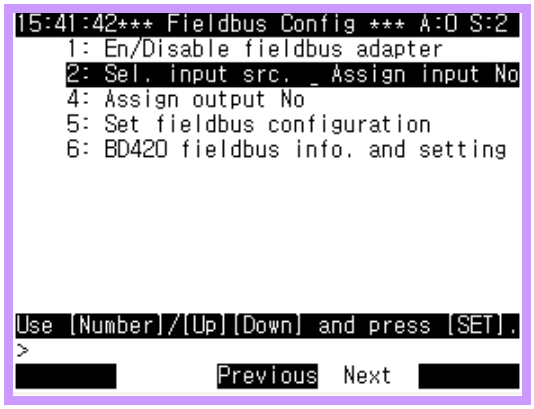
Because RXn8~RXnB and RYn8~RYnA is used as proprietary handshake for CC-Link communication, it cannot be used as a general I/O. If you have to use this area inevitably, you must stop the handshake operation of this area of Hi4a robot controller. For this, set the system signal option as shown in Figure 4-6.

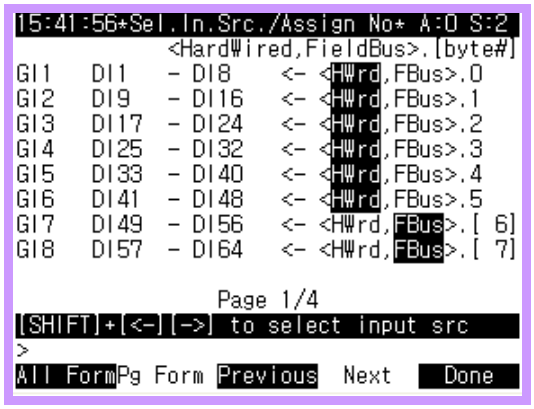
But please refrain from doing this because this usage method does not satisfy the CC-Link standard.

If, PLC side is using the handshake of RXn8~RXnB and RYn8~RYnA, you must set the system signal to “System”.



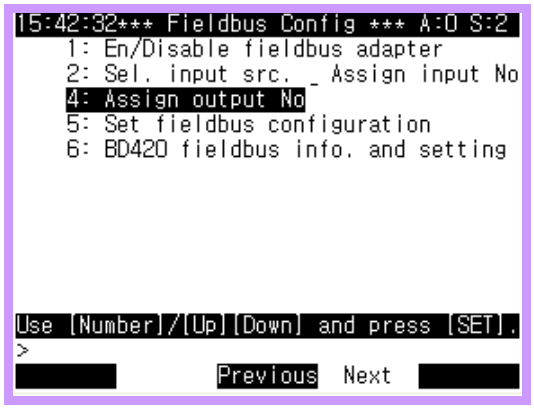
4.4. Input source selection and input signal allocation

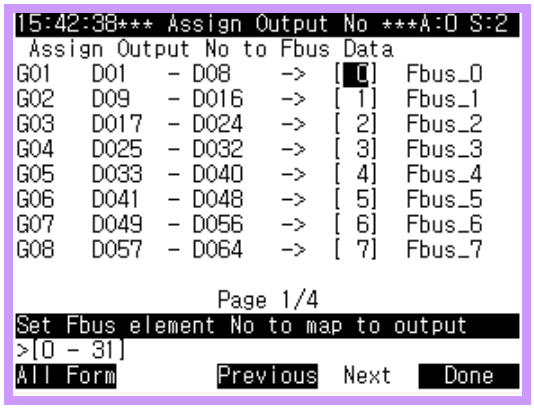




- Select in group signal unit whether to receive the input signal of the controller from the hard-wired contact point or from the fieldbus.
- HWrd refers to the hard-wired contact point and, Fbus refers to the fieldbus.
- For example, in the above setting, DI1 – DI48 receives from hard-wired contact point and the rest on receives the DI signal from the fieldbus.
- Select the DI signal group using the top/down cursor key and select one of HWrd or Fbus using the [Shift]+left/right cursor key.
- If you selected the Fbus, set the number on which DI group signal to receive the fieldbus group signal.
- The setting from DI1 to DI255 is done over a total of 4 pages. You can move between the pages using the 『[PF3]: Previous』 and 『[PF4]: Next』 key. Press the 『[PF5]: Done』 key when the setting is done.
- Press the PF1 (All Form) key to set all the pages to HWrd or Fbus. Press the PF2 (Pg Form) key to set current page to HWrd or Fbus.

4.5. Output signal allocation





- The DO signal of the controller is sent out to both hard-wired contact point and the fieldbus at the same time.
- The data sent out from the fieldbus is total of 32 bytes, i.e. 32 group signals. You can set the fieldbus group signal to send the DO group signal.
- The setting from DO1 to DO256 is done over a total of 4 pages. You can move between the pages using the 『[PF3]: Previous』 and 『[PF4]: Next』 key. Press the 『[PF5]: Complete』 key when the setting is done.
- Press the 『[PF1]: All Form』 key to return all the settings to the initial value.

5

Status Check and Troubleshooting

5.1. Controller error message

Table 5-1 lists the warning messages to be displayed in the controller teach pendant and handling methods, during fieldbus use.

Table 5-1 Controller warning message and handling method

Warning message	Handling method
W0010 Fieldbus power is not supplied	Check if the 24V power is supplied throughout the whole fieldbus.
W0011 Fieldbus network connection error	Check if the fieldbus cable is properly installed and if it has any connection error.
W0012 Fieldbus IDLE state	Fieldbus function can only be used when the PLC with fieldbus master (PLC scanner) is in run mode.
W0013 UCS module is not detected	Check if the fieldbus module is mounted on BD430.
W0014 Fieldbus setting error.	Check if the dip switch of fieldbus module is correctly set.

After checking the warning, if the problem has been resolved, double click the [RESET] key of controller T/P to cancel the error condition and retry the data exchange. If the problem is not resolved, the same error message will show up. Because the Hi4a controller periodically retries the normal communication, if the problem has been resolved, the fieldbus communication can be automatically reconnected.

- **If you are using the AB PLC, fieldbus IDLE occurs even if the PLC run/idle bit is set to 0. In this case, set the run/idle bit to 1 to cancel it. After canceling, double click on the RESET of teach pendant.**
- **When turning on the power, it some times turns idle. When this happens, switch all PLC mode switch to PROG and then re-switch to RUN to cancel the idle condition. After canceling it, double click the RESET of teach pendant.**
- **If you are using the 1747-SDN of AB PLC as the master, check if the firmware version is 4.026 or higher. 1747-SDN of version 4.015 sometimes causes the idling. If the version is too old, request an upgrade to AB.**

5.2. Fieldbus module status check - DeviceNet, Profibus-DP

The fieldbus module of DeviceNet and Profibus-DP has 2 LED installed. The top LED is the module status LED and the bottom LED is the network-specific LED as shown in Figure 5.1.

When both LEDs are on in green color, it means that the module is normally executing data exchange.

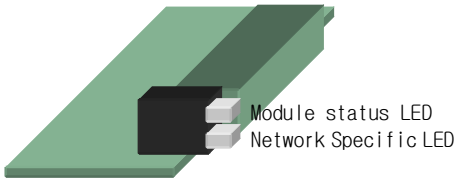


Figure 5.1 Fieldbus module LED location

Table 5-2 Module status LED operation

LED status	Fieldbus module status
Off	No power.
Flashing Red	Recoverable configuration fault (invalid firmware, OEM data, or personality data)
Solid Red	Hardware error
Flashing Green	No error. Client interface is not open.
Solid Green	No error. Client interface is active.
Amber (Red/Green)	Configuration mode.

Table 5-3 Network-specific LED operation of fieldbus module for DeviceNet

LED status	Network status
Off	Network interface offline/no network power
Flashing Red	I/O connection in timeout-out state or other recoverable fault
Solid Red	Device is online, but has no connections
Flashing Green	Unrecoverable fault
Solid Green	Online with established connections
Red/Green blinking	Device is in Communication Faulted state and responding to an Identify Communication Faulted Request

Table 5-4 Network-specific LED operation of fieldbus module for Profibus-DP

LED status	Fieldbus module status
Off	Network interface disabled due to CLOSED interface or Client IO_FAULT
Flashing Red	Baud Rate note detected, Not Configured or Configuration Error with Master
Solid Red	Network offline, no bus, no baud rate.
Green/Red Flash	Online, network clear mode.
Solid Green	Online, data exchange mode.

5.3. Fieldbus module status check (CC-Link)

There are 4 LEDs installed on CC-Link fieldbus module.

Table 5-5 Operating status of CC-Link fieldbus module according to LED

○ : ON ● : OFF ⦿ : Blinking

RUN	ERR	SD	RD	Operating status
○	⦿	⦿	○	Communicating normally, but CRC errors have often been detected due to noise.
○	⦿0.4s	⦿	○	The baud rate or station number setting has been changed from the settings at the reset cancellation.
○	⦿	●	○	Unable to respond because the received data caused a CRC error.
○	●	⦿	○	Normal communication
○	●	●	○	No data for the host.
○	⦿	⦿	○	Reponds to polling signal, but the refresh reception caused a CRC error.
●	⦿	●	○	Data for the host caused a CRC error.
●	●	⦿	○	Link startup has not been conducted.
●	●	●	○	Either no data for the host or unable to receive the data for host due to noise.
●	●	●	●	Unable to receive due to wire breakage, etc. Power off or hardware being set.
●	○	●	○,●	Baud rate and/or station number setting error.

6

Fieldbus Function Utilization

6.1. DeviceNet

6.1.1. Introduction

PLC product from Allen-Bradley, has the function to exchange I/O through DeviceNet. This document explains the method of configuring the communication between Hi4a robot controller and DeviceNet based on SLC of Allen-Bradley or SDN-1747 scanner module.

6.1.2. Configuration

If you are installing the DeviceNet network, changing the setting or doing monitoring, you must connect the PC to the PLC and DeviceNet as shown in Figure 6.1. And this PC must have MS Windows 95/98/NT OS and software from Rockwell Software installed as shown in Table 6-1.

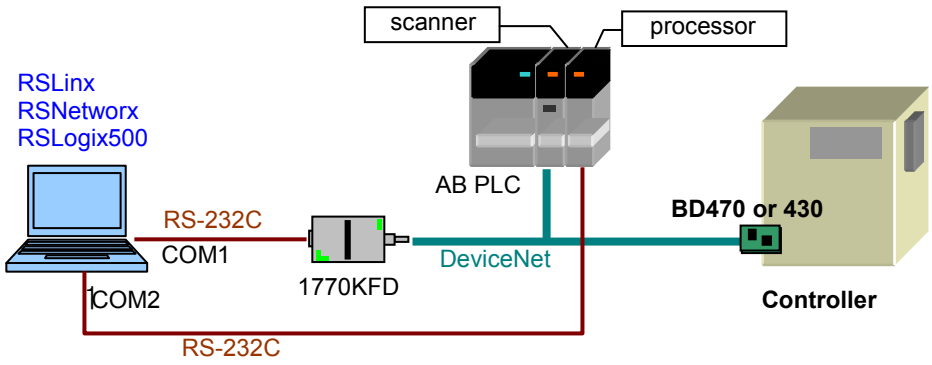


Figure 6.1 Composition for DeviceNet setting and monitoring

Table 6-1 Software used for setting and monitoring DeviceNet

S/W name	Role
RSLinx	This provides the connectivity to DeviceNet and AB PLC for the application from AB or Rockwell Software operated in PC.
RSNetworx	This monitors the DeviceNet network status or configures the DeviceNet devices.
RSLogix500	Creates a ladder diagram and download to PLC. Or remote control PLC and monitors the file status and operating status including I/O.

1770KFD is the hardware product from AB that enables connection from PC to DeviceNet via RS-232C.

This document explains rough procedure of network installation and setting. For more details of each S/W, please refer to the manual provided by Rockwell Software.

6.1.3. RSLinx

Execute RSLinx. If this is the first time you are executing this, you must set the driver.
Select the Configure Drivers… from the menu item.

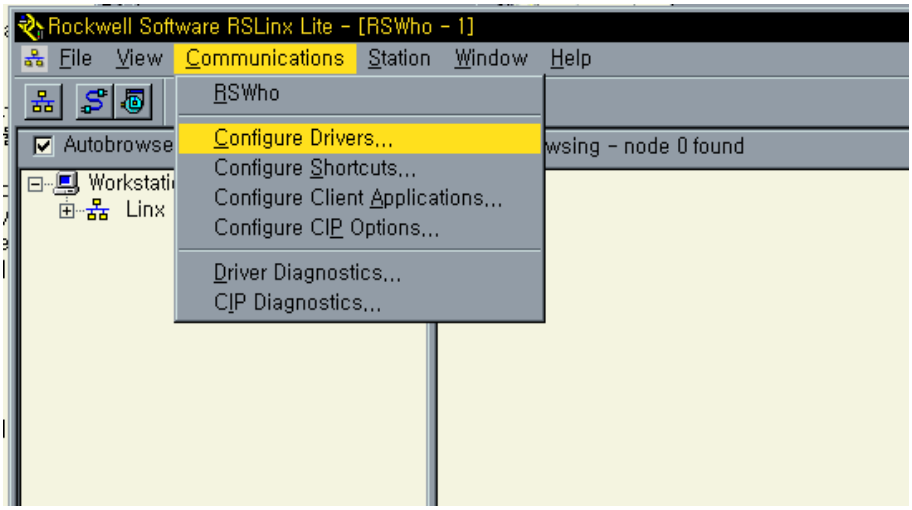


Figure 6.2 Configure drivers… Selection

You will see the “Configure drivers” dialog box.

6.1.3.1. DeviceNet driver setting

(1) First you must ensure connectivity to the DeviceNet. Select the DeviceNet Driver from the Available Driver Types.

(2) Press the Add New… button and open the DeviceNet Driver Selection window.

(3) Select Allen-Bradley 1770-KFD and press Select.

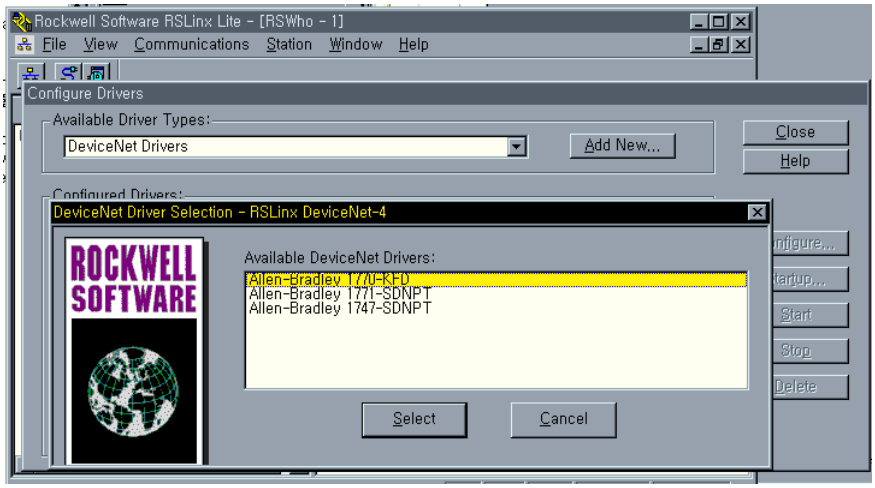


Figure 6.3 1770-KFD registration

(4) The 1770-KFD Driver Configuration window is shown as in Figure 6.4.

(5) Select the right setting for Serial Port Setup and DeviceNet Port Setup, and press OK key.

(6) At this time, the Data Rate of DeviceNet Port Setup must be the same as the PLC DeviceNet scanner speed. (For the 1747-SDN scanner, the version and speed are displayed by the 7 segment display when the power is turned on.)

(7) Node Address is the node number of 1770-KFD itself.

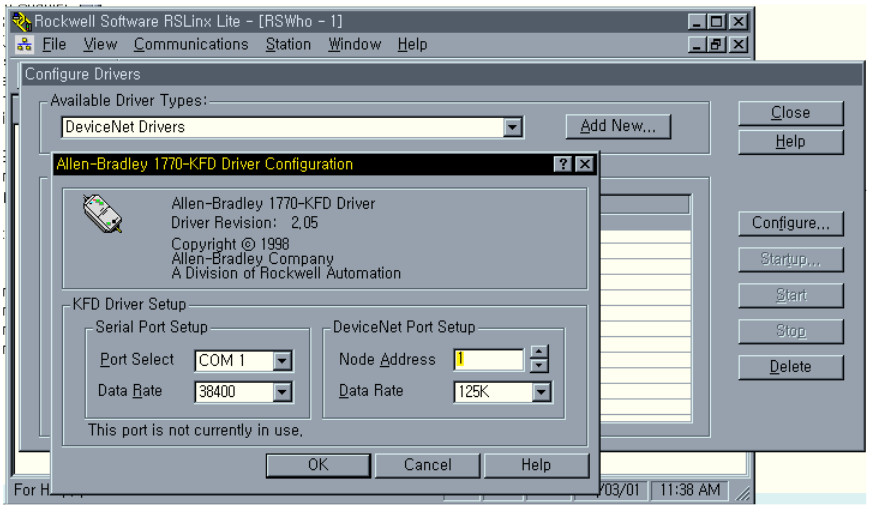


Figure 6.4 1770-KFD Driver Configuration

Reference : How to change the fieldbus baud rate of 1747-SDN

① Execute RSNetworx with RSLinx open.
② First you must initialize the internal memory of the scanner. Select SDN from RSNetworx to download, which will delete all scanner setting.
③ Select Tools - Node Commissioning menu of RSNetworx.
④ Press Browse and select 1770KFD to browse. When you see SDN, select SDN and press OK.
⑤ Set the node number and speed, then press Apply. It is successfully done if you see no error and the message below saying that the setting is done.
⑥ If you turn off the power and then turn it back on, the initial version and node number will be displayed in 7-segment. Check if they are changed.
⑦ Now you must set the speed of 1770KFD to this speed. Select Communications - Configure Drivers menu in RSLinx and delete the 1770KFD driver. Then re-add the driver. At this time, the newly changed baud rate will be applied.

6.1.3.2. DF1 driver setting

(1) Set the DF1 communication device in the same method. This is to connect the PC and the SLC.

(2) Select the RS-232 DF1 Devices from the Available Driver Types in Configure Drivers window. Press the Add New…button to see the DF1 Communications Device window as shown in Figure 6.5.

(3) After selecting the type of device to connect from Device (for example SLC) and select the RS-232C port to connect from Comm (COM1 or COM2). If you press the Auto-Configure button, the rest of the communication setting is done automatically.

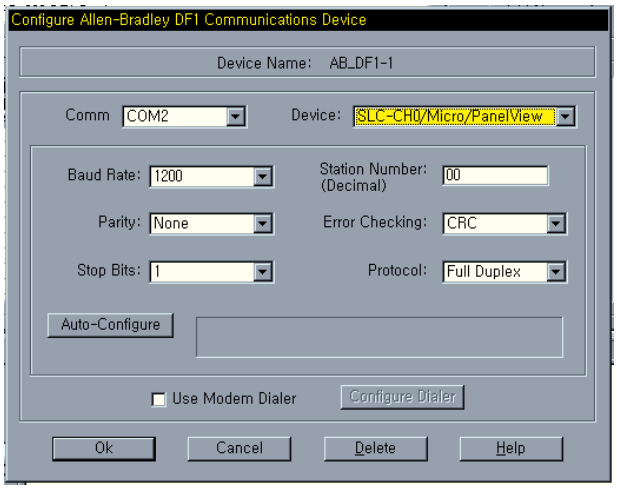


Figure 6.5 DF1 Communication device setting

(4) If you select these two drivers successfully, you will see the following window in Figure 6.6.

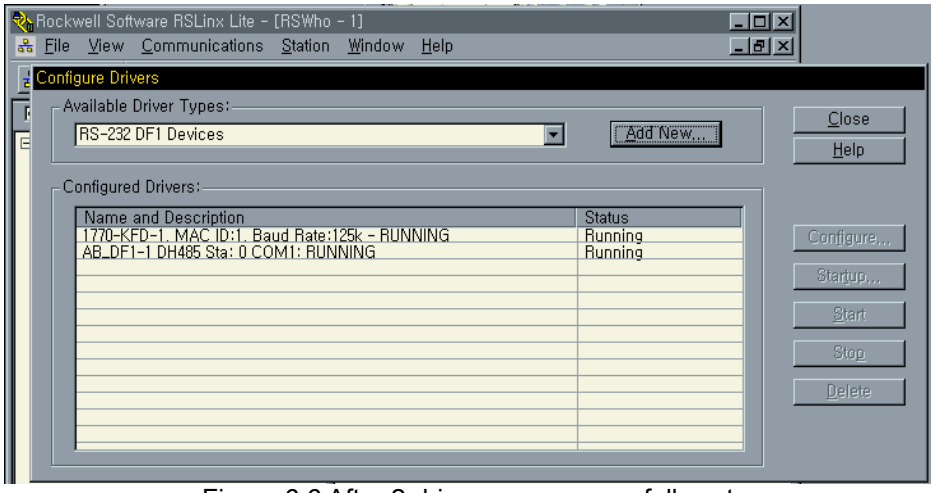


Figure 6.6 After 2 drivers are successfully set

(5) If the Autobrowse check box is checked and RSLinx will repeatedly execute the network browsing.

(6) Select 1770-KFD, DeviceNet from the left tree view of Figure 6.7 and you will see the devices connected to the DeviceNet on the right window.

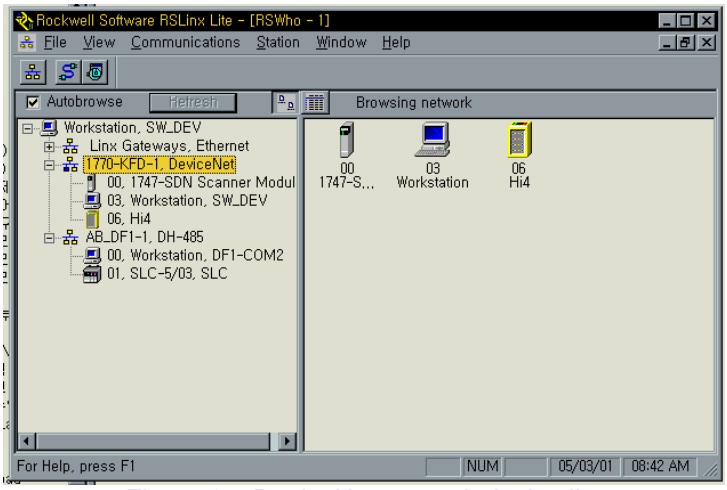


Figure 6.7 DeviceNet network device list

(7) Even though the Hi4a robot controller is shown in icon as node number 6 in Figure 6.7, if the EDS file of Hi4a robot controller is not registered to the computer, it will indicate that the node number 6 has an unknown device.

(8) Select AB-DF, DH-485 from the left tree view of Figure 6.8 and you will see the devices connected to the DF1 network on the right window.

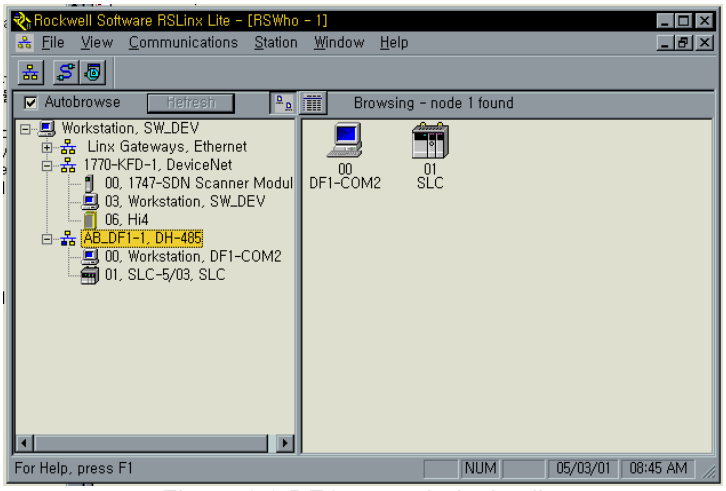


Figure 6.8 DF1 network device list

6.1.3.3. Complete

Now the driver setting in RSLinx is complete. To use RSNetworx or RSLogix500, do not close the RSLinx.

6.1.4. RSNetworx

6.1.4.1. EDS creation and registration

(1) If this is the first time after installing RSNetworx, you must register the EDS of Hi4a robot controller. Select EDS Wizard… menu item from Figure 6.9.

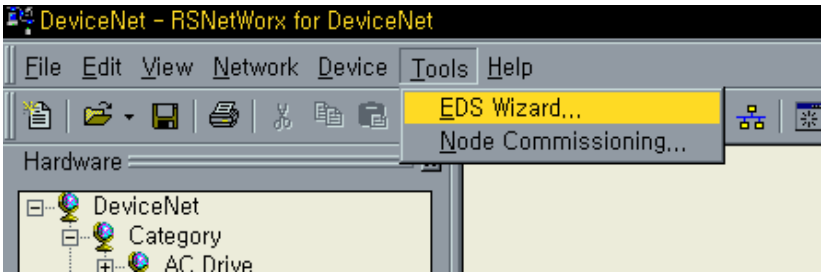


Figure 6.9 EDS Wizard… Menu item selection

(2) The EDS Installation Wizard window opens as shown in Figure 6.10. Select the Create an EDS Stub radio button and press Next>.

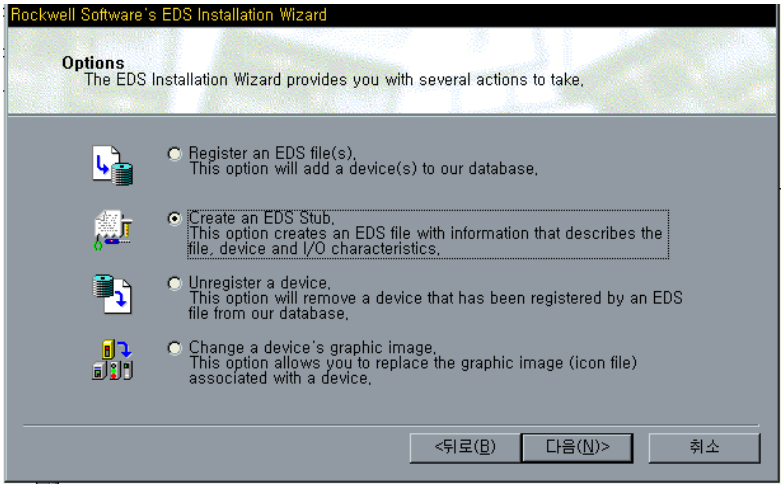


Figure 6.10 EDS Installation Wizard

(3) Enter the DeviceNet ID information of fieldbus adapter for Hi4a robot controller as shown in Figure 6.11 and press Next>.

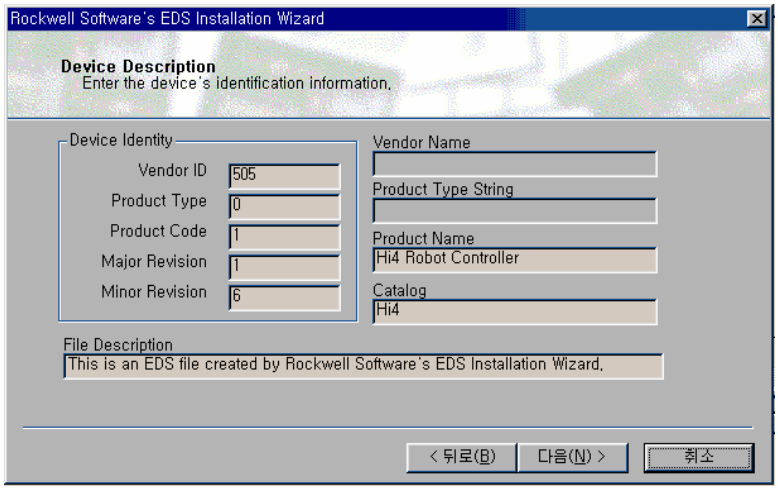


Figure 6.11 DeviceNet ID information entry for fieldbus adapter for Hi4a robot controller{

(4) Check the Enabled of Polled and enter the I/O by 32 bytes and press the Next> button.

(5) When the EDS Installation Wizard is complete, now the RSNetworx can identify the Hi4a robot controller as DeviceNet slave device.

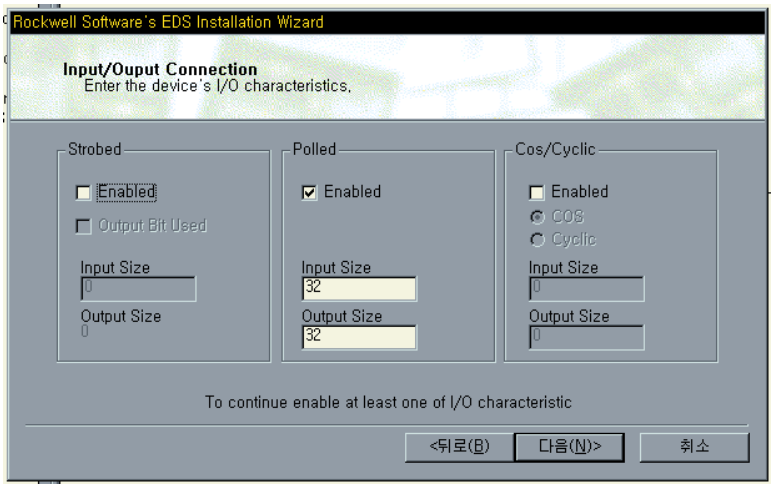


Figure 6.12 Setting I/O characteristics in polling method

※ When preparing and registering the EDS file with EDS Installation Wizard, if you mistakenly enter the wrong data, you must remove the incorrect EDS file with unregister function and retry.

6.1.4.2. Network browse

(1) Press the Online button and Browse button, and you will see the Browse for Network window as shown in Figure 6.13. Select the 1770-KFD, DeviceNet and press the OK button.

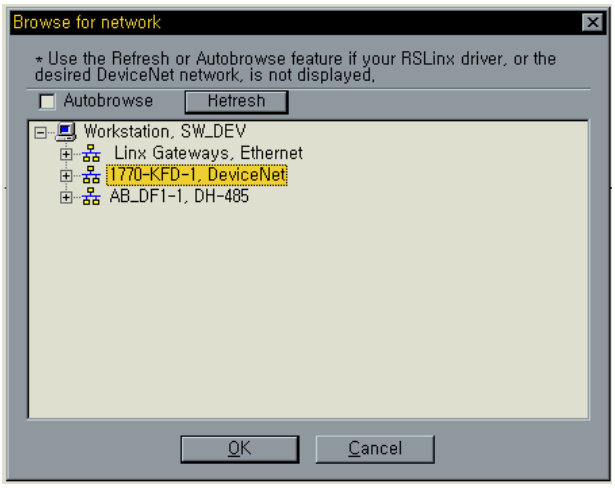


Figure 6.13 Browse for network window

(2) RSLinx will start browsing, and in result the icon of devices forming the network as shown in Figure 6.14.

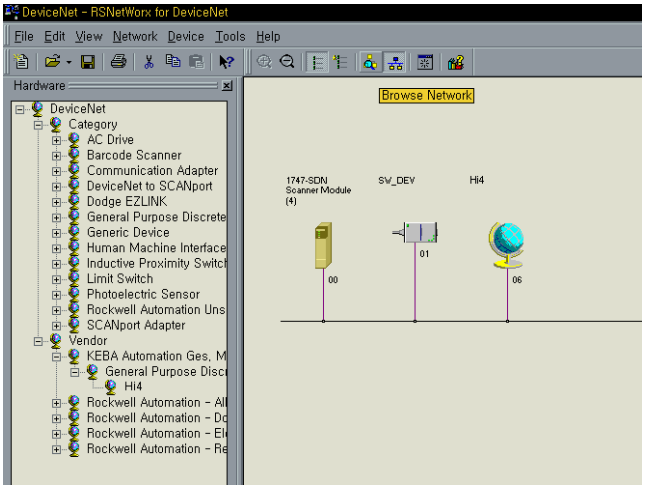


Figure 6.14 Network browsing result

6.1.4.3. 1747-SDN setting and download

(1) Double click the 1747-SDN Scanner Module icon on the right screen and the 1747-SDN Scanner Module window opens.

(2) Select the Scanlist tab and scanner will select the slaves to execute the scanning as shown in Figure 6.15. From the devices on the left, move the device to scanning including the Hi4a robot controller to the right scanlist using the arrow button.

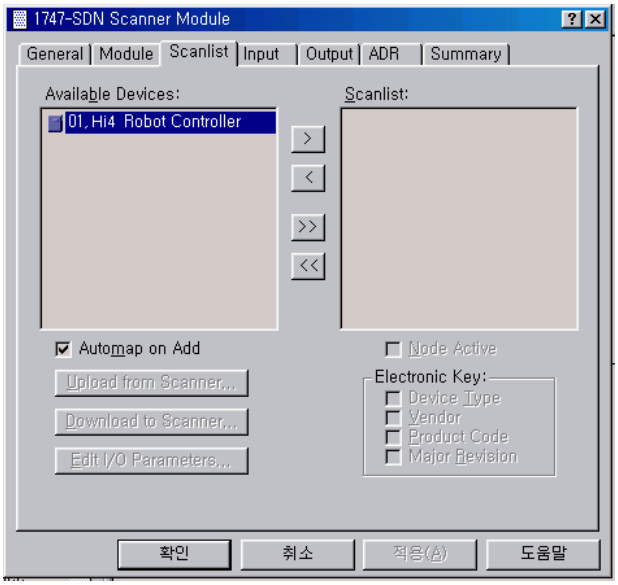


Figure 6.15 Scanner scanlist

(3) When selecting the input or output tab, you will select whether to download or upload. If you select to upload, the page to set the input or output of 1747-SDN will open as shown in Figure 6.16. This setting shows how the input/output of the Hi4a robot controller is mapped to the I file and O file of 1747-SDN. Keep this setting unless you have a specific reason to change.

(4) Press the OK button to download as shown in Figure 6.17, and transmit this information to 1747-SDN. After downloading this information, 1747-SDN will operate the DeviceNet network.

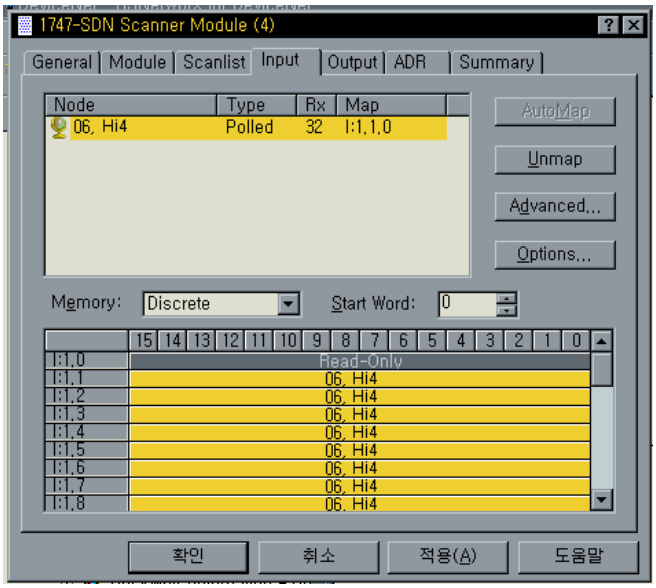


Figure 6.16 1747-SDN input setting tab

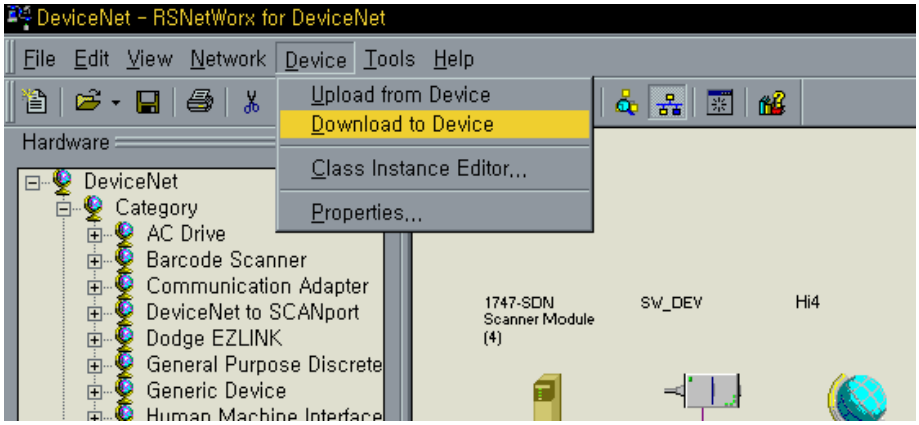


Figure 6.17 Download to 1747-SDN scanner module

6.1.4.4. Complete

(1) This completes the 1747-SDN scanner module setting. Now, 1747-SDN scanner module which is the DeviceNet master device, controls the whole DeviceNet network when the power is connected, and exchanges information with the slave devices within the network including the Hi4a robot controller.

(2) Now, RSNetworx is not needed unless you want to change the network setting (Adding or remove slave device, change data mapping). RSLinx and RSLogix are also only used for specific settings such as preparing and downloading ladder diagram, PLC monitoring etc. In other words, in PLC RUN mode, the PC or 1770KFD does not have to be connected.

※ Caution

- When using the SLC500 which is an AB PLC, the fieldbus idling can occur if the PLC run/idle bit is 0. You can resolve this issue by setting the PLC run/idle bit to 1. After resetting, you must double click on RESET of Teach Pendant.

6.2. Profibus-DP

6.2.1. Introduction

(1) PLC product from Siemens, has the function to exchange I/O through Profibus. This document explains the method of configuring the communication between Hi4a series robot controller and Profibus-DP based on S7-300 CPU module (including built-in Profibus master) of Siemens.

(2) If you are installing the Profibus network, changing the setting or doing monitoring, you must connect the PC to the PLC and DeviceNet as shown in Figure 6.18. And this PC must have MS Windows 95/98/NT OS and step 7 software from Siemens installed.

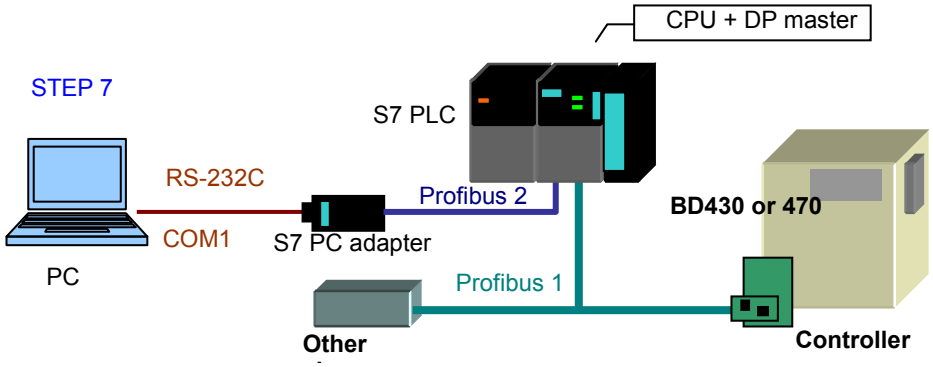


Figure 6.18 Composition for Profibus-DP setting and monitoring

(3) S7 PC adapter is the hardware product of Siemens that enables the PC to connect to Profibus-DP via RS-232C.

(4) This document explains rough procedure of network installation and setting. For more details of PLC and STEP7 S/W, please refer to the manual provided by Siemens.

6.2.2. Project creation

(1) Run the STEP 7 Simatic Manager. Close the initial Wizard window by pressing Cancel.

(2) Select File – New menu. If you see the window shown in Figure 6.19, enter the project name and press OK.

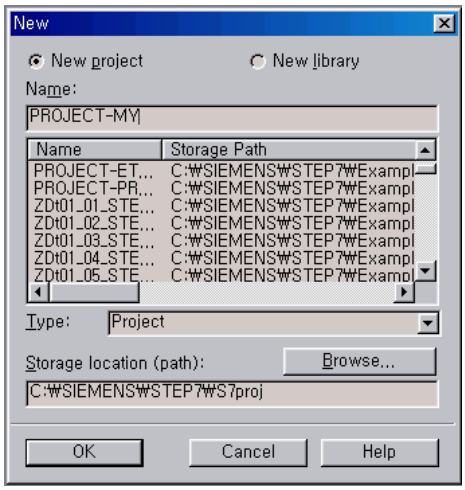


Figure 6.19 Project creation

(3) Select SIMATIC 300 Station from Insert – Station menu. If you see the window shown in Figure 6.20, double click on the hardware of SIMATIC 300. The HW Config program will run.

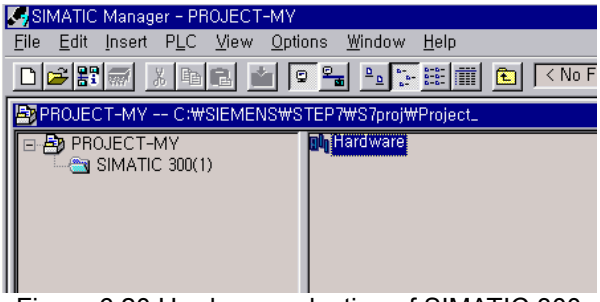


Figure 6.20 Hardware selection of SIMATIC 300

6.2.3. Rail slot configuration of HW config

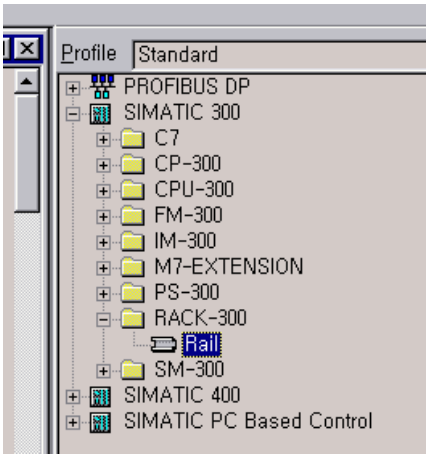


Figure 6.21 Catalog

(1) There is a catalog, as shown in Figure 6.21, within the HW Config program. Open SIMATIC 300 and then RACK-300, and then double click on Rail.

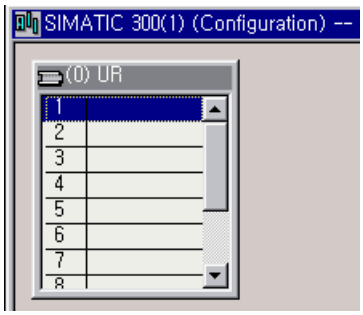


Figure 6.22 SIMATIC 300 Rail

(2) The rail window will open as shown in Figure 6.22. This is the window to set which device to install to each rail slot on which PLC modules are installed. The example would be power module for slot 1, CPU for slot 2 and 16 point input module for slot 4.

(3) First, with slot 1 highlighted as shown in Figure 6.22, find the right power module from the catalog to set the power module.

(4) Select slot 2 and double click on the right CPU name to see the following window shown in Figure 6.23 to set the Profibus-DP with internal CPU.

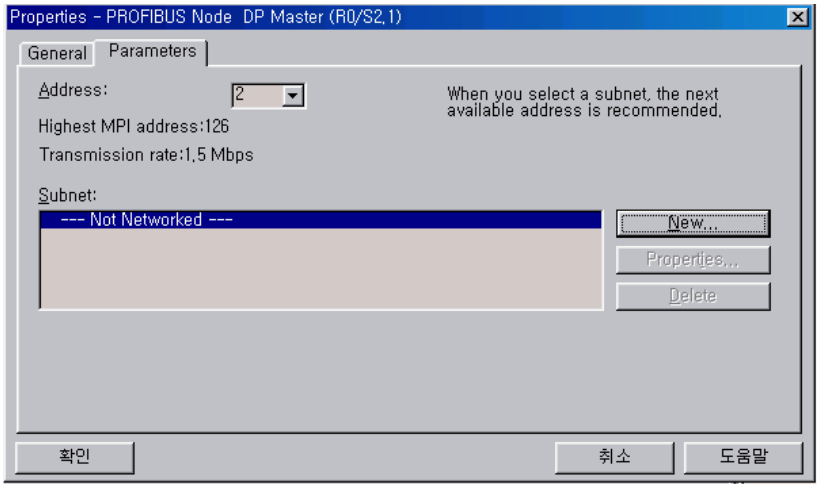


Figure 6.23 PROFIBUS-DP Master setting window

(5) After selecting the address for master, press the New button to see the various parameter setting window. Make necessary changes and press OK. Generally the parameters are ok to be kept as default value. Now, you will see the created network name and speed in Subnet list.

(6) Keep slot 3 unoccupied for expansion I/O. Select slot 4 and find the right input module from the catalog.

(7) If you have reached the window in Figure 6.24, it is done normally.

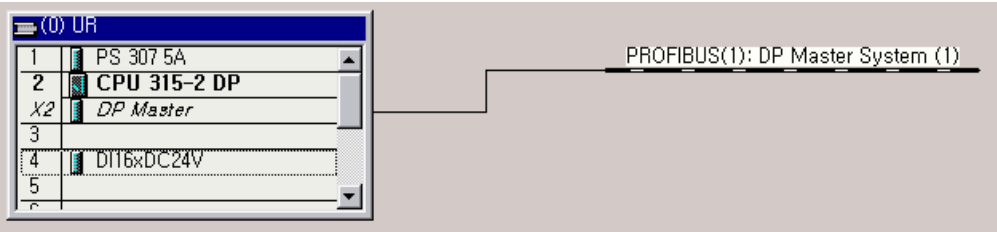


Figure 6.24 Slot configuration complete

6.2.4. GSD file installation

(1) Now you must set the slave with GSD file of Hi4a robot control, which is basically not included in the STEP 7 software. Therefore you must first install the GSD file.

(2) Select Options – Install New *.GSE Files… menu and you will see the file selection window. Find and select the. Hhi_0870.gsd file, and press the Open button to install the file. (* BD420 : Hil_7501.gsd)

(3) Also, you have to install the image file displaying the Hi4a robot controller. Select the Options – Install New *.GSE Files… menu in the same way.

(4) When the file selection window opens, select the Bitmap Files (.bmp) for the file type and find/select the hhi_hi_n.bmp file. Press the Open button to install the file.

(5) Now, open Additional Field Devices – General – Hi4 RobotController from the catalog and you will see the following in Figure 6.25.

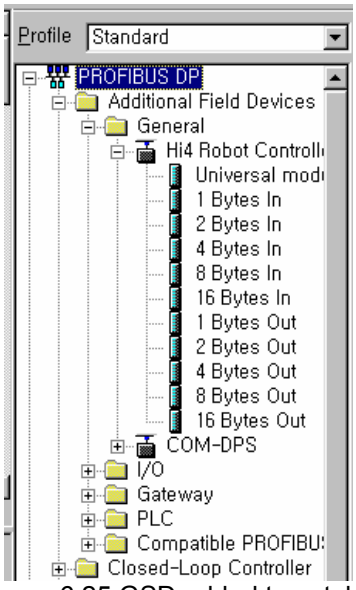


Figure 6.25 GSD added to catalog

(6) Hi4a robot controller can have a total of 32 bytes of input and 32 bytes of output. You can see the various input and output modules in catalog of Figure 6.25 for various combinations.

6.2.5. Adding and setting slave device to Hi4a robot controller

(1) First click the Profibus network symbol shown in Figure 6.26 and double click on the HiRobotController folder in the catalog. You will see the address entry window.

Figure 6.26 PROFIBUS network symbol

(2) Enter an appropriate node number and press OK, and the slave device of Hi4a robot controller will be added to the network as shown in Figure 6.27.

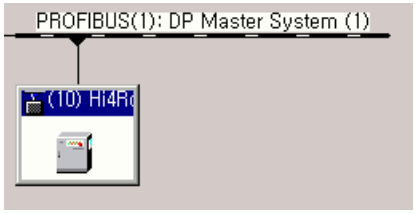


Figure 6.27 Slave device of Hi4a robot controller be added to the networtk

(3) You can add slave devices to the network using this method.
If you double click on the Hi4a robot controller device icon, you can set the necessary properties such as name or node number etc.

(4) The UCS card installed on the Hi4a robot controller is set to the input/output size appropriate for the user's work usage. You can make a module list according to the UCS card by selecting a combination of input and output module from the catalog in Figure 6.25.
(To change the I/O size of UCS card, you need an extra equipment. Please consult with your Hi4a robot controller supplier.)

(5) We will use the USC card that uses 32 bytes each for input and output as an example.
When the Hi4a robot controller icon is selected, you will see module table in the bottom of the program. First select slot 0 and double click on 16 Bytes In from the catalog and add the module. In the same way, add 2 input modules and 2 output modules in slot 0, 1, 2 and 3 to reach Figure 6.28.

(10) Hi4 Robot Controller

S...	Module ...	Order Number	I Addre...	Q Addre...	Comment
0	31	16 Bytes In	2...17		
1	31	16 Bytes In	18...33		
2	47	16 Bytes Out		0...15	
3	47	16 Bytes Out		16...31	
4					

Figure 6.28 Module setting (Input 32 byte, output 32 byte)

(6) These are mapped to an appropriate location in each PLC I address or Q address. In this example, the reason the I address starts from 2 and not from 0 is because 16 point input module of rail slot 4 is already occupying byte 0 and 1. (You can check this by clicking on slot 4 in the rail window.)

(7) If you double click on the address item, you can change the address to the wanted location. But two modules must not be overlapped.

(8) Figure 6.29 shows an example when using the Hi4a robot controller as a device with input of 10 bytes and output of 5 bytes. Please note that the In and Out in refers to the input and output of PLC in the figure. (Do not confuse input and output of Hi4a robot controller.) In other words, 1 Bytes In of line 1 is the first output byte of Hi4a robot controller.

(4) Hi4RobotControlle

S...	Module ...	Order Number	I Addre...	Q Addre...	Comment
0	8DI	1 Bytes In	0		
1	32DI	4 Bytes In	1...4		
2	16DO	2 Bytes Out		0...1	
3	39	8 Bytes Out		2...9	
4					

Figure 6.29 Module setting (Input 10 bytes, output 5 bytes)

※ If this module setting is different from the UCS setting, a network error will be occured.

(9) Now, click on Station – Save and Compile menu and save/compile the setting to complete the process. Also when you click on PLC – Download menu, the hardware setting is downloaded to PLC.

6.2.6. PLC ladder preparation

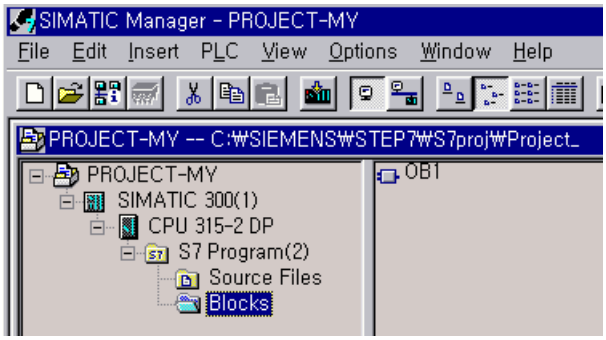


Figure 6.30 OB1

(1) Return to SIMATIC Manager program and open S7 Program – Blocks to double click on OB1. OB1 is the main program of S7 PLC.

(2) When the setting window opens, select the wanted type of program from STL/LAD/FBD and press OK. When STL/LAD/FBD program is executed, prepare the PLC program and download to PLC. For more details please refer to the STEP 7 manual.

6.2.7. Complete

(1) This completes the module setting. Profibus master device controls the whole Profibus network when the power is connected, and exchanges information with the slave devices within the network including the Hi4a robot controller.

(2) Now, HW Config software is not needed unless you want to change the network setting (Adding or remove slave device, change data mapping). In other words, in PLC RUN mode, the PC or PC adapter does not have to be connected.

6.3. CC-Link

6.3.1. Introduction

(1) PLC product from Mitsubishi has the function to exchange I/O through CC-LINK. This document explains the method of configuring the communication between Hi4a series robot controller and CC-Link based on A2SH CPU CPU module and A1SJ61BT11 master module of Mitsubishi.

(2) If you are installing the CC-LINK network, changing the setting or doing monitoring, you must connect the PC to the PLC as shown in Figure 6.31. And this PC must have MS Windows 95/98/NT OS and GPP software for Windows from Mitsubishi installed.

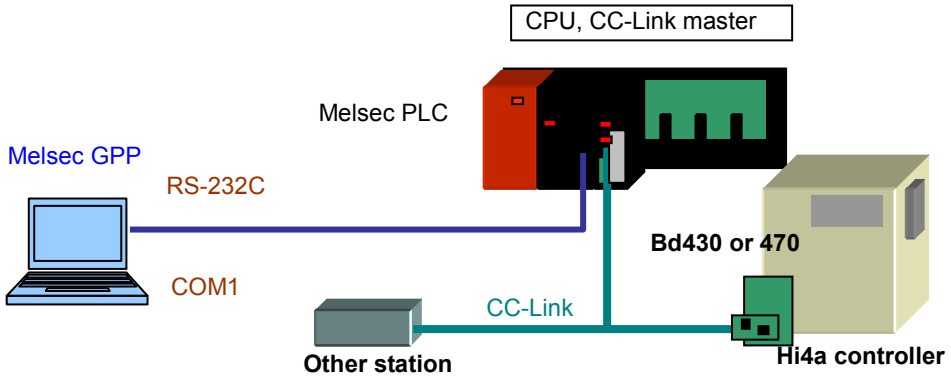


Figure 6.31 Composition for CC-Link setting and monitoring

(3) RS-232C cable must be provided from Mitsubishi or wired to the Melsec PLC specification.

(4) This document explains rough procedure of network installation and setting. For more details of PLC and GPP S/W, please refer to the manual provided by Mitsubishi.

6.3.2. CC-Link parameter setting

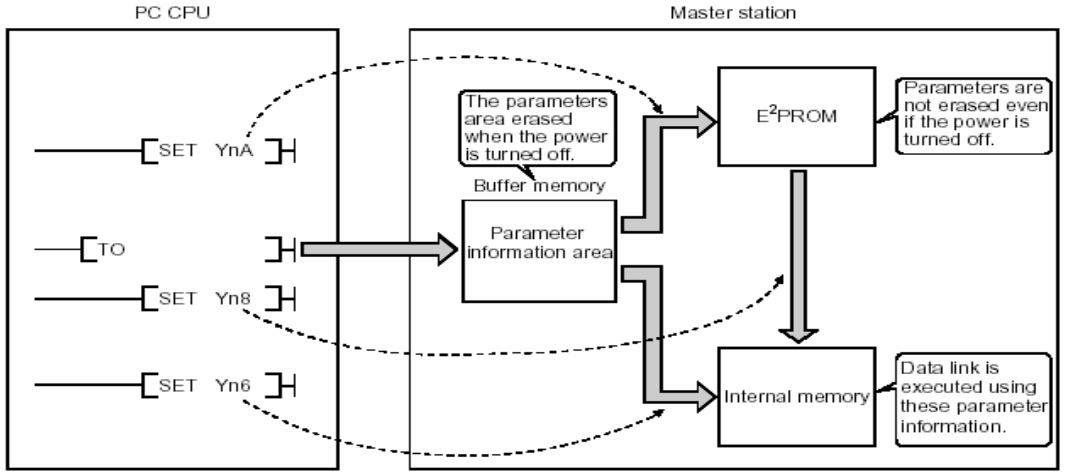


Figure 6.32 CC-Link parameter setting

(1) For the A1SJ61BT11 master module, the parameters for participating stations must be set in the internal memory during CC-Link operation.

(2) Prepare and run a ladder setting the buffer memory and copying [SET Yn6] the content to the internal memory, and then test the CC-Link operation.

(3) When the operation is normal, prepare a ladder to copy [SET YnA] the buffer memory setting to E2PROM and run this ladder to execute E2PROM recording.

(4) Prepare a ladder to copy [SET Yn8] the E2PROM content to the internal memory when turning the power ON, and include it in the work ladder.

(5) Unlike the buffer memory or the internal memory, E2PROM content is saved even when the PLC power is off. Therefore this is an appropriate location to save the CC-Link setting information. But because there is a life span limitation of repeated writing, operation testing process is done with the copying from buffer memory to internal memory rather than using E2PROM. When testing is done and the communication is normally in process, record the setting information to E2PROM and leave only the ladder for operation 3). Now whenever the power is turned on, PLC will open the setting information from E2PROM to the internal memory.

(6) (n in Yn6, Yn8, YnA etc, refers to the first address of the module. This is decided by which I/O slot the master module is inserted and by the area size of I/O module. For example, if the first address of the module is 40 hex, it will become Y46, Y48, Y4A.)

6.3.2.1. Parameter setting items

Table 6-2 Parameter setting items

<table>
<tr><th>Setting item</th><th>Description</th><th>Buffer memory address</th></tr>
<tr><td>The number of units connected</td><td>The number of remote and local stations connected to master station (including reserved stations)
Default : 64 units
Setting range : 1~64 units</td><td>1H</td></tr>
<tr><td>The number of retries</td><td>The number of retries in case of communication error
Default : 3 times
Setting range : 1~7 times</td><td>2H</td></tr>
<tr><td>The number of auto recovery units</td><td>The number of remote and location stations that can be recovered with 1 link scan
Default : 1 unit
Setting range: 1~10 units</td><td>3H</td></tr>
<tr><td>Operating specification when CPU is down</td><td>Data link condition setting for master station CPU error
Default : 0 (Stop)
Setting range : 0(Stop) 1(Continue)</td><td>6H</td></tr>
<tr><td>Specification of reserved station</td><td>Reserved station setting
Default : 0 (No setting)
Setting range : Set the corresponding bit of station number to 1</td><td>10H ~ 13H</td></tr>
<tr><td>Specification of disabled station</td><td>Disabled station setting
Default : 0 (No setting)
Setting range : Set the corresponding bit of station number to 1</td><td>14H ~ 17H</td></tr>
<tr><td>Station information</td><td>Setting connected remote and local station type
Default : 0101H ~ 0140H
Setting range : As below.
<table><tr><td>b15 ~ b12</td><td>b11 ~ b8</td><td>b7 ~ b0</td></tr><tr><td>Station. type</td><td>The number of occupied stations</td><td>Station number</td></tr></table>0: Remote I/O 1~4 1~64
1: Remote device
2: Intelligent device</td><td>20H(station no. 1) ~ 5FH(station no. 64)</td></tr>
</table>

6.3.2.2. Example of parameter setting

(1) Assume that you are connecting a Hi4a robot controller and a remote device that occupies 2 stations to CC-Link.

(2) Station 1 is allocated to Hi4a robot controller and station 5 to the other device. Assume that the first address of the module is 40H.

(3) First, with the ladder as shown in Figure 6.34, save the parameter setting to the buffer.

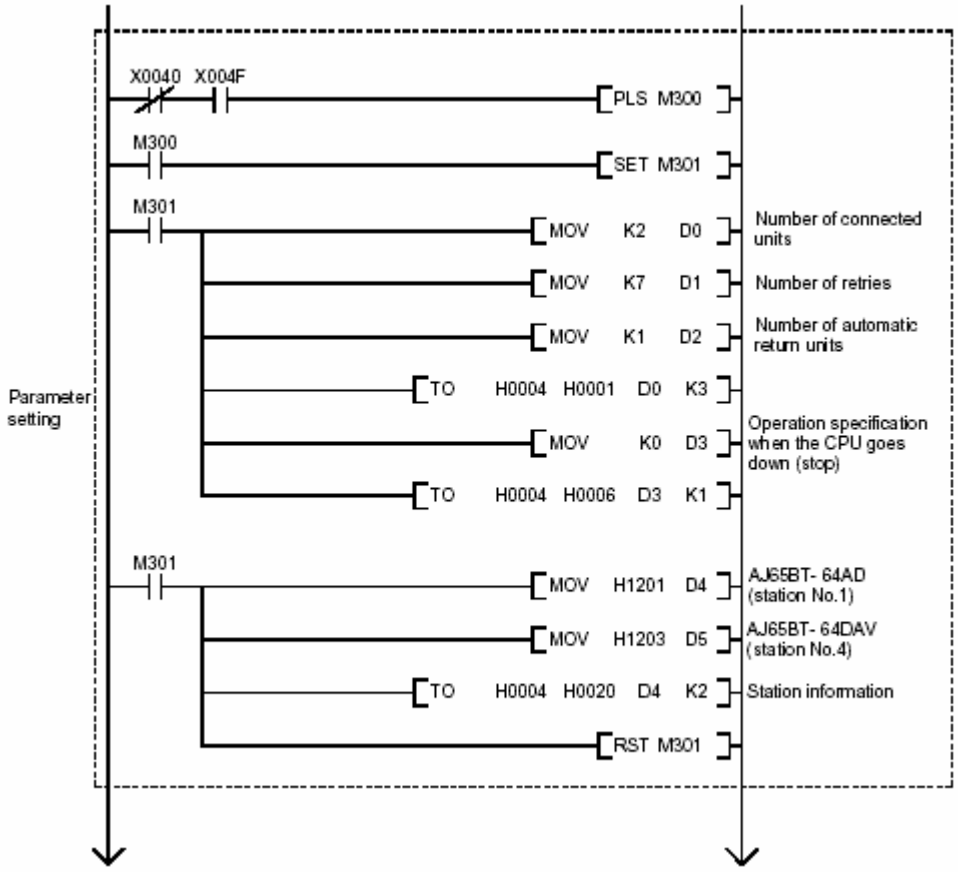


Figure 6.33 Parameter setting in buffer memory

(4) Test the operation after copying the setting in the buffer memory to the internal memory using the ladder as shown in Figure 6.35. If there is a problem with the operation, check the setting, fix the root cause and repeat the testing.

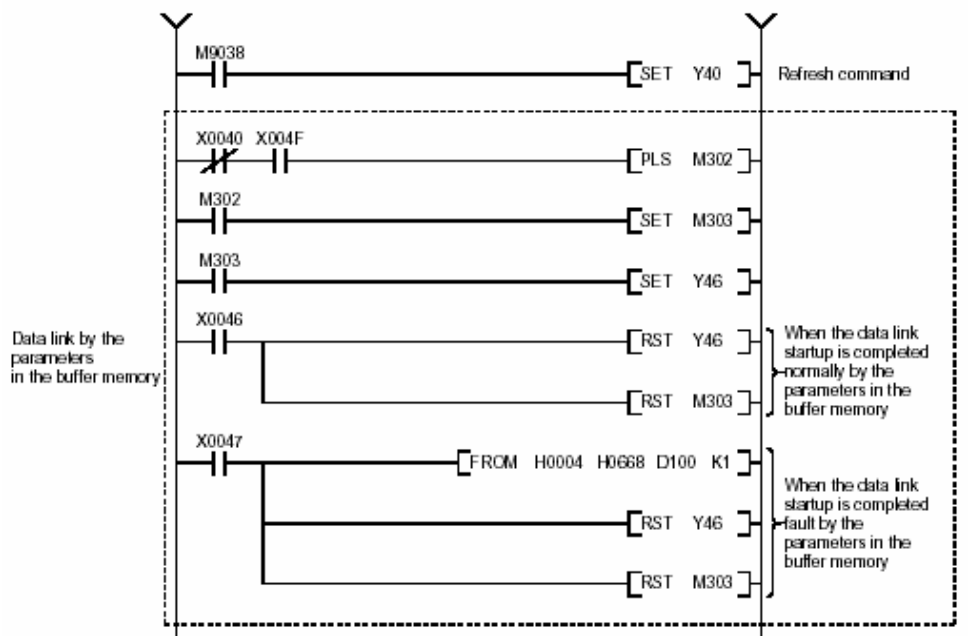


Figure 6.34 Copying setting in buffer memory to internal memory

(5) Copy the setting from buffer memory to E2PROM using the ladder as shown in Figure 6.36.

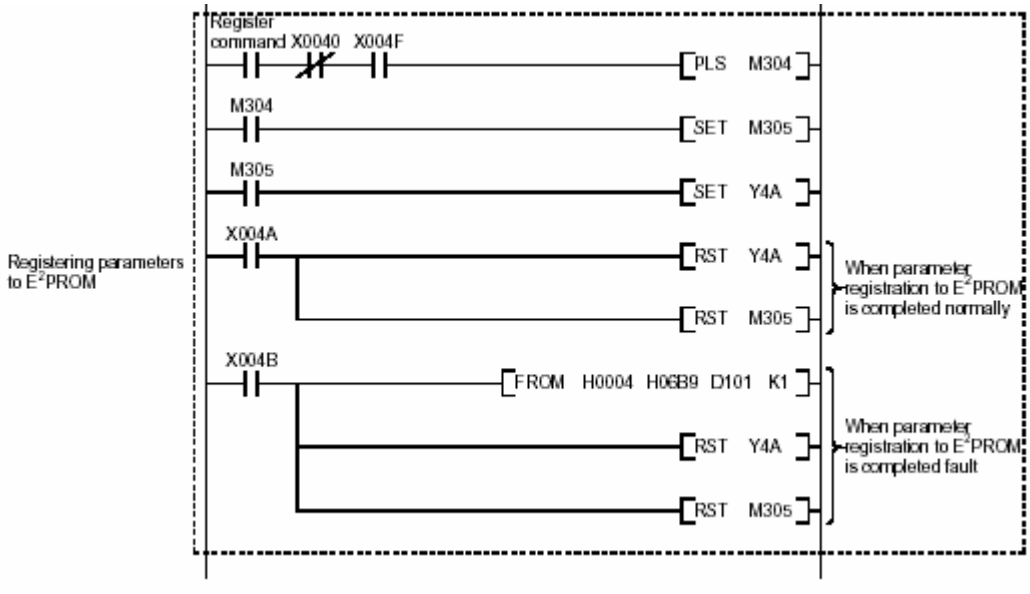


Figure 6.35 Copying setting of buffer memory to E2PROM

(6) If you ran the ladder up to Figure 6.36, now general PLC operation will pull the setting information from E2PROM to the internal memory as shown in Figure 6.37. Only the ladder process has to be done every time the PLC is On.

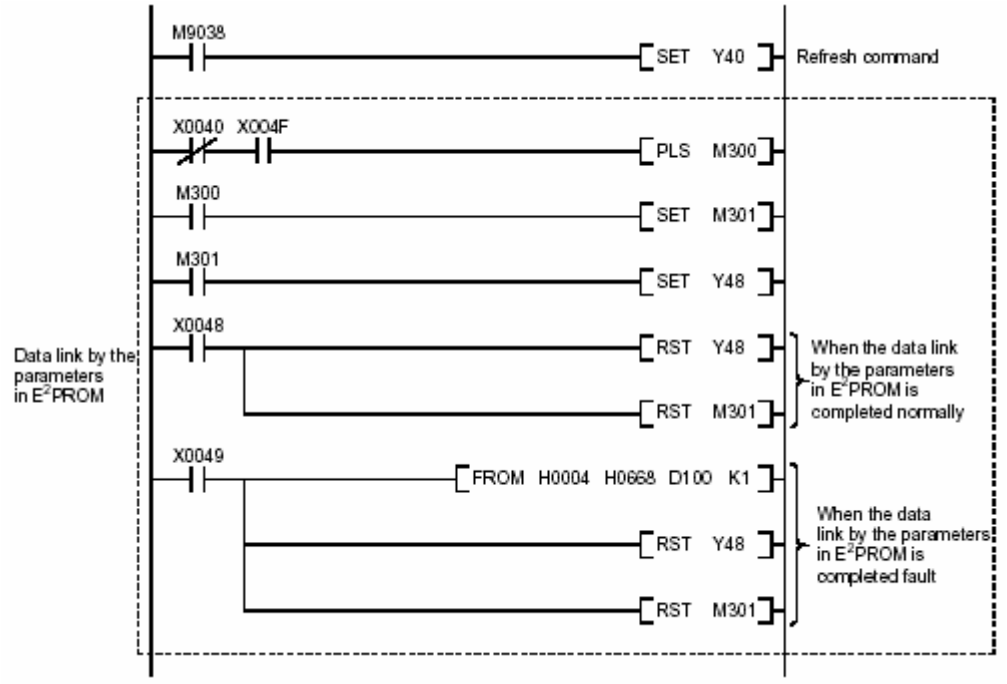


Figure 6.36 Copying the setting from E2PROM to internal memory

6.3.3. Data mapping

(1) If all the settings are correctly done, the output data (RWr) of remote stations are transmitted to the area starting from 1E0H of master buffer memory, as shown in Figure 6.38. The data in the area starting with buffer memory of 1E0H are transmitted to input data (RWw) of remote stations

(2) For the AnA-family CPU of Mitsubishi, the ladder must be composed in order that the I/O data of buffer memory are exchanged with the wanted content of relay area by the ladder command, as shown in Figure 6.39.

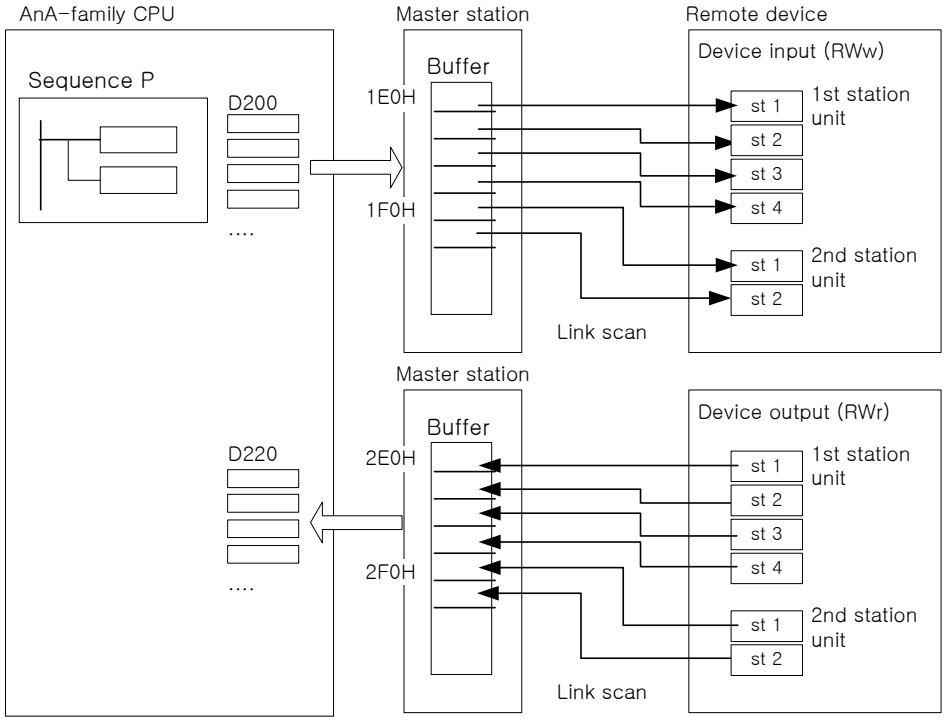


Figure 6.37 Exchange between remote register RWw, RWr and relay

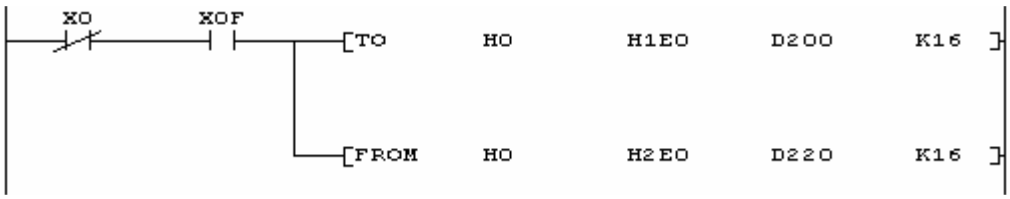


Figure 6.38 Example command for exchange between buffer memory data and relay data

6.3.4. Complete

(1) This completes the module setting. CC-Link master device controls the whole CC-Link network when the power is connected, and exchanges information with the slave devices within the network including the Hi4a robot controller.

(2) Now, GPP software is not needed unless you want to change the network setting (Adding or remove slave device, change data mapping). In other words, in PLC RUN mode, the PC does not have to be connected.

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

- **Head Office**
  Tel. 82-52-202-7901 / Fax. 82-52-202-7900
  1, Jeonha-dong, Dong-gu, Ulsan, Korea

- **A/S Center**
  Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- **Seoul Office**
  Tel.82-2-746-4711 / Fax. 82-2-746-4720
  140-2, Gye-dong, Jongno-gu, Seoul, Korea

- **Ansan Office**
  Tel.82-31-409-4945 / Fax.82-31-409-4946
  1431-2, Sa-dong, Sangnok-gu, Ansan-si, Gyeonggi-do, Korea

- **Cheonan Office**
  Tel.82-41-576-4294 / Fax.82-41-576-4296
  355-15, Daga-dong, Cheonan-si, Chungcheongnam-do, Korea

- **Daegu Office**
  Tel.82-53-746-6232 / Fax.82-53-746-6231
  223-5, Beomeo 2-dong, Suseong-gu, Daegu, Korea

- **Gwangju Office**
  Tel. 82-62-363-5272 / Fax. 82-62-363-5273
  415-2, Nongseong-dong, Seo-gu, Gwangju, Korea

- **본사**
  Tel. 052-202-7901 / Fax. 052-202-7900
  울산광역시 동구 전하동 1 번지

- **A/S 센터**
  Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- **서울 사무소**
  Tel. 02-746-4711 / Fax. 02-746-4720
  서울특별시 종로구 계동 140-2 번지

- **안산 사무소**
  Tel. 031-409-4959 / Fax. 031-409-4946
  경기도 안산시 상록구 사동 1431-2 번지

- **천안 사무소**
  Tel. 041-576-4294 / Fax. 041-576-4296
  충남 천안시 다가동 355-15 번지

- **대구 사무소**
  Tel. 053-746-6232 / Fax. 053-746-6231
  대구광역시 수성구 범어 2 동 223-5 번지

- **광주 사무소**
  Tel. 062-363-5272 / Fax. 062-363-5273
  광주광역시 서구 농성동 415-2 번지