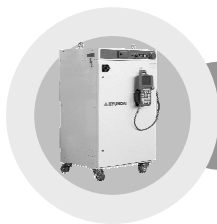**WARNING**

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

Hi4a Controller Function Manual

BD420 Munlticommunication Board

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1
Overview

1.1. Getting Started

To understand this document requires below knowledge.

- How to use Hi4a Robot Controller
- How to install and use Fieldbus network
  (DeviceNet, Profibus-DP, Interbus)

1.2. About Fieldbus

Fieldbus is open industry standard to operate equipments such as sensor, button, motor driver, and control interface in a factory connecting PLC(Programmable Logic Controller) with single cable.

Fieldbus offers intelligent service such as monitoring or restructuring total network state in the center. For example, not only simple on and off about sensor or switch but it also has benefit to share more detailed information (operation mode setup, sensor failure etc.)

Fieldbus saves time and cost for wiring because of using single cable, and the more wiring configuration is simple the more maintenance is competitive. Also, it satisfies industry usage which Time-critical characteristic is important because data response speed is secured that is different from protocol of non-deterministic response characteristic same as Ethernet.
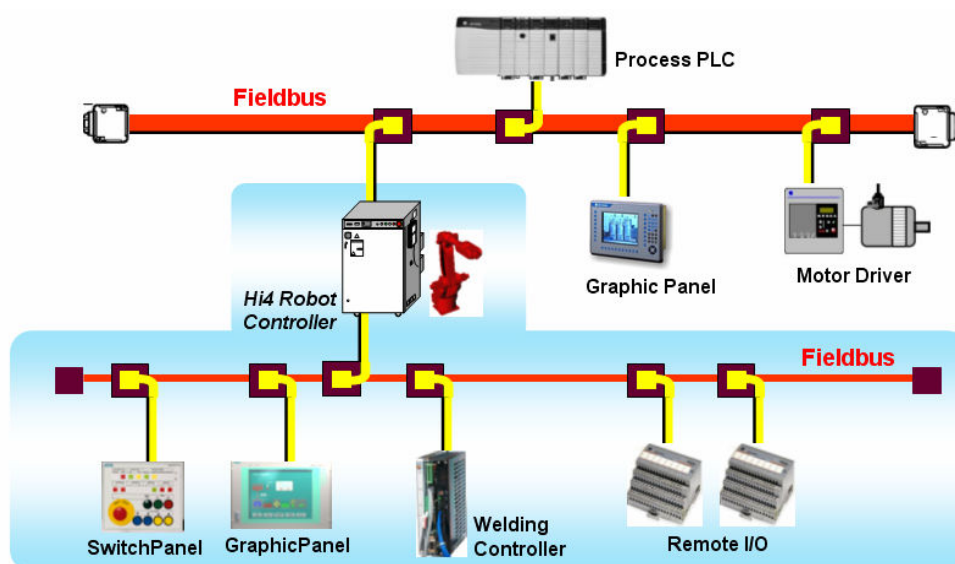
Figure 1.1 Fieldbus Network and Master, Slave Devices

1 unit of Fieldbus Network is connected on 1 unit of master device and several slave devices. Master device searches and manages total network and exchange data with slave devices. Generally, PLC is the master device, and slave devices are the others such as sensor, button, and controller etc.

1.3. Two Methods of Hi4a Robot Controller Fieldbus Function

Hi4a controller supports Fieldbus function by 2 methods as below.

Table 1-1 Two Methods and Characteristics of Hi4a Controller Fieldbus Function

	BD430 I/O Board	BD420 Multicommunication Board
Mounting Module	One of below two, 1) SST UCS Module 2) BD471 CC-Link Slave Module	Hilscher COM Module
Module Qty mounting available	1 unit	1 to 4 units
Support Function	Slave	Both Master and Slave at the same time
Support Protocol	DeviceNet/Profibus-DP/CC-Link	DeviceNet/Profibus -DP/Interbus(scheduled)
Connecting mainboard	RS-232C	Bus of BD400 Motherboard
How to use Fieldbus Input of Robot Language	Input it from DI area setting up input source as Fieldbus. Ex: WAIT DI5	Input it from DI of F1~F4 object Ex: WAIT F2.DI5
How to use Fieldbus Output of Robot Language	DO Output is outputted at the same time to both Hard-wired and Fieldbus. Ex: DO12=1	Output it to DO of F1~F4 object Ex: F4.DO12=1
How to use Fieldbus Input of Embedded PLC	Input it from X relays setting up input source as Fieldbus.	Input it from X of F1~F4 object
How to use Fieldbus Output of Embedded PLC	Y Output is outputted at the same time to both Hard-wired and Fieldbus.	Output it to Y of F1~F4 object

Choose one of two methods to use. This manual guides Fieldbus function using BD420 Multicommunication Board only.

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2

Basic
Specification of
Fieldbus

These are basic specifications of DeviceNet, Profibus-DP and Interbus. Please refer to each Fieldbus Manuals for further information.

2.1. Basic Specification of DeviceNet

Table 2-1 Basic Specification of DeviceNet

Transfer Rate	The cable can have :			
	Trunk Length	Max drop Length	Max node Qty	Cumulative drop length
125k bit/s	500 m (1,640 ft)			156 m (512 ft)
250k bit/s	250 m (820 ft)	6m (20 ft)	64 units	78 m (256 ft)
500k bit/s	100 m (328 ft)			39 m (128 ft)
Terminating Resistance	121Ω, 1% metal film, 1/4 Watt			
Electric Potential Difference between V+ and V-	24 Volt			


```
5  V+      red
4  CAN_H   white
3  drain   bare
2  CAN_L   blue
1  V-      blakc
```

Female   Male
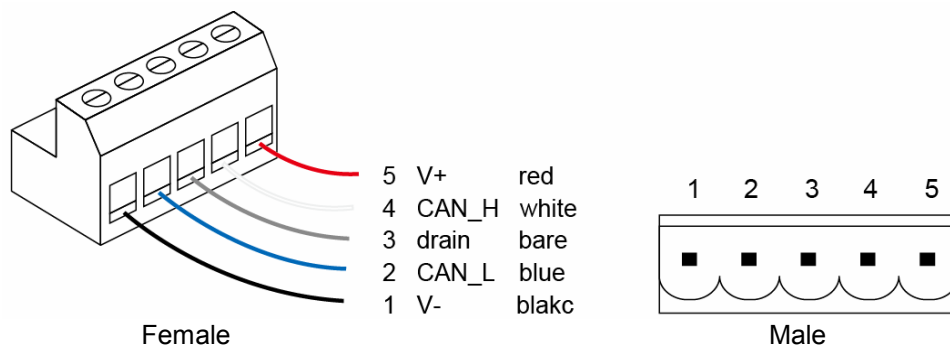
Figure 2.1 Open Connector Pinout of DeviceNet

2.2. Basic Specification of Profibus -DP

Table 2-2 Basic Specification of Profibus -DP

Max Station Qty	Up to 32 Stations per line segment, Max 126 units									
Repeater	Extend it up to Max 4 units									
Input & Output Data per Station	244 input, output byte									
Max Qty of connected segment	Repeaters of Max 4 units between two stations (Depending on repeater, support it over 4 units standard)									
Transfer Rate (kbit/s)	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Max segment Length (m)	1200	1200	1200	1200	1000	400	200	100	100	100

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2.3. Basic Specification of Interbus
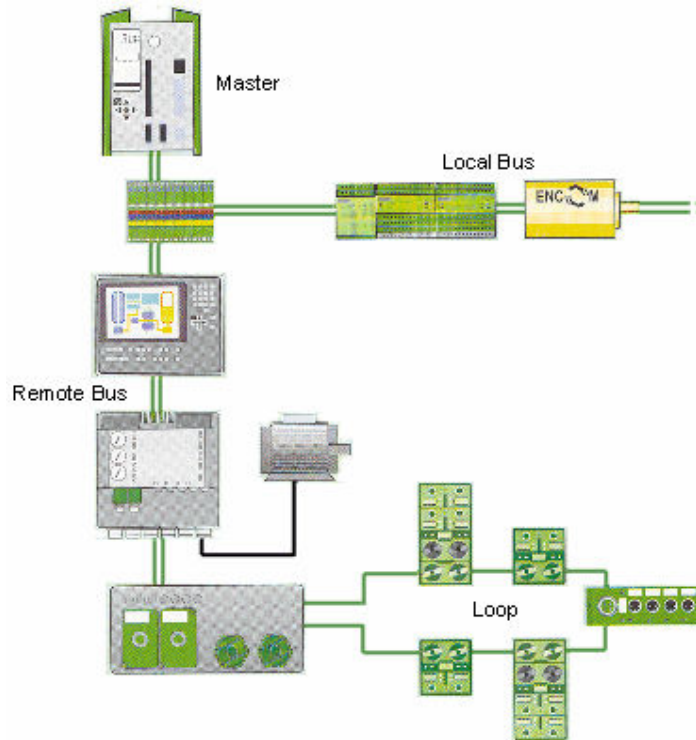
Figure 2.2 Configuration of Interbus

Table 2-3 Basic Specification of Interbus Remotebus

Max Node Qty	512
Network Max Level Qty	16
Max I/O Score	4096 points (512byte)
Transfer Rate	500 kbps
Max Bus Length between two Remote Bus	400m (1312.336 ft.)
Max Total Bus Length	13km (8.078 mi.)
Topology	Active Ring

2-5

Table 2-4 Basic Specification of Interbus Loop

Max Node Qty	63
Max Bus Length between two Remote Bus	20m (65.617 ft.)
Max Total Bus Length	200m (656.168 ft.)
Current	1.8A
Power and Communication connected by single cable	

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2.4. ESD File, GSD File

Each Fieldbus has inherent characteristic file to recognize itself. In case of DeviceNet and Interbus device, it is EDS file (however, format is different), and in case of Profibus-DP device, it is GSD file. Also, Hi4a Controller has EDS file and GSD file.

Registering characteristic file on network file S/W and performing network browsing, the devices connected on network are searched. Network management S/W downloads this information to Fieldbus Scanner Module-Master. Once network information is downloaded to scanner module, PLC Scanner Module can operate total network without network management S/W help.

Please refer to PLC Product and S/W Product Manual to setup Network for detailed method of this procedure.

3

Module Mounting on BD420 and H/W Setup

3.1. Mounting of Fieldbus Module
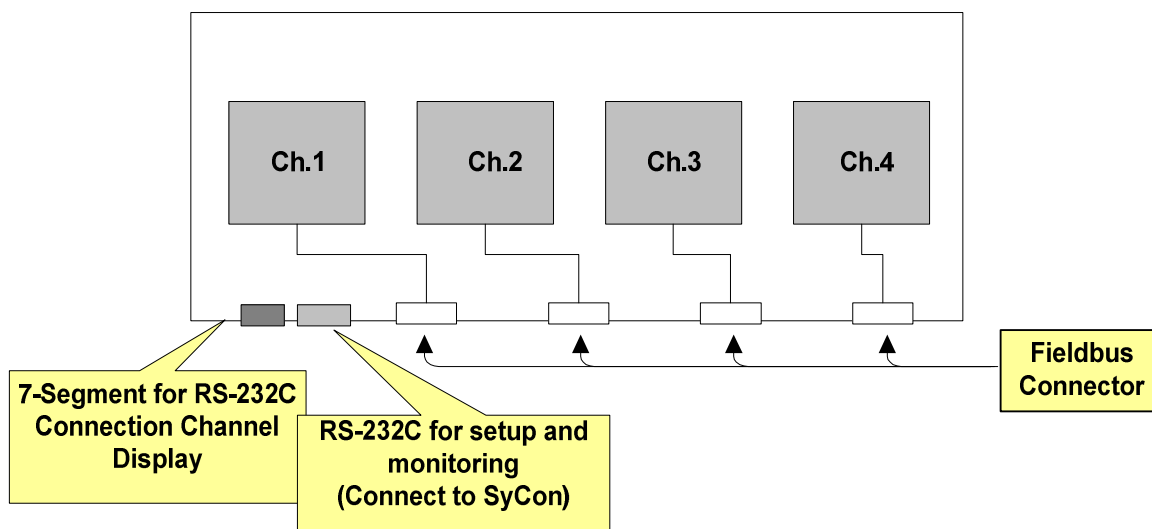
Figure 3.1 Four Channels to mount Fieldbus module

The numbers of DeviceNet, Profibus-DP, Interbus are respectively BD421, BD422, BD423. And the common designation of them is BD420.
Fieldbus module can be mounted up to 4 units on BD420. Each position is Channel 1, 2, 3 and 4. (Standard type BD420 can mount up to 2 units. In case that 4 channels are needed, we supply 4 channel type BD420.)
Module mounting is not needed to be done in order, however, notice which channel is mounted. Because this channel number is used when performing Fieldbus input/output at robot operation program or Embedded PLC Ladder

RS-232C and 7-segment for setup and monitoring will be explained in Fieldbus Master Setup.

3.2. Dip Switch of BD420

BD420 Board has lots of dip switches. These dip switches are set up depending on factories followed by Fieldbus type of module mounting on each channel. Therefore, please do not change setup without maintenance staff help.

4

Fieldbus Information and Setup

4.1. Fieldbus Menu and Setup File

Fieldbus module requires setting up network parameter before use.

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

```
00:00:14 *** System setting *** A:0 S:8
1: User parameter
2: Controller parameter
3: Machine parameter
4: Application parameter
5: Initialize
6: Automatic constant setting




Use [Number]/[Up][Down] and press [SET].
>
            Previous  Next
```

```
00:00:20**Controller parameter**A:0 S:8
1: Setting input _ output signal
2: Serial ports
3: Robot ready
4: Registration of home position
5: Return to the previous position
6: End relay timer
7: Interlock timer
8: Error-output to the outside
9: Power saving : PWM Off
10: Shift limit
11: f-key setting
Use [Number]/[Up][Down] and press [SET].
>
            Previous  Next
```

```
00:00:28** DIO signal setting **A:0 S:8
1: Input signal logic
2: Output signal logic
3: Output signal attribute
4: Pulse table setting
5: Delay table setting
6: Output signal assigning
7: Input signal assigning
8: Setting time for earlier output
9: Editing DIO names
10: Fieldbus configuration

Use [Number]/[Up][Down] and press [SET].
>
            Previous  Next
```

```
00:00:36*** Fieldbus Config *** A:0 S:8
1: En/Disable fieldbus adapter
2: Sel. input src. _ Assign input No
4: Assign output No
5: Set fieldbus configuration
6: BD420 fieldbus info. and setting





Use [Number]/[Up][Down] and press [SET].
>
            Previous  Next
```

(2) Select 『6: BD420 fieldbus info. and setting 』

```
00:01:13*** Fieldbus Config *** A:0 S:8
1: En/Disable fieldbus adapter
2: Sel. input src. _ Assign input No
4: Assign output No
5: Set fieldbus configuration
6: BD420 fieldbus info. and setting






Use [Number]/[Up][Down] and press [SET].
>
            Previous  Next
```

(3) Pressing [YES] key, ROBOT.FB2 storing Fieldbus Setup is created and it leads to Setup operation.

4.2. BD420 Fieldbus Information and Setup

```
00:09:51 *** BD420 Fieldbus *** A:0 S:8
BD420  Fieldbus        Ch:[ 1] <Off,On>
Dev.name:[Not Mounted                  ]
state : [              ]
----------------------------------------




Press [PF3], [PF4], [ESC] or [R..]
>
RS232I/F          Previous  Next    Done
```

This screen consists of four pages and each pages corresponds each channels. It is possible to change channel with 『[PF3]: Previous』 and 『[PF4]: Next』 key.

- ■ Ch   : Display selected channel number.
- ■ <Off,On>   : Select Fieldbus Module of related channel to perform or not.
- ■ Dev.name   : Display name of mounted module at related module.
- ■ State   : Display module performs network action normally.
- ■ Err.addr.   :
  In case of Fieldbus Master Module, display the address (node No. etc.) when founding slave causing a problem in network.

Below dotted line is displayed diversely followed by Fieldbus Protocol type as Fieldbus Parameter. In case of Fieldbus Slave Module, set up parameter, press "[PF5]: Done" button. And then set point is saved in Fieldbus Setup File- ROBOT.FB2.

Saved set point is applied to Fieldbus Module whenever turning on controller. If parameter is set up properly fitting in network state, Fieldbus Action is performed when turning on controller.

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5

How to set up Fieldbus Master

5.1. Fieldbus Master

Using it mounting Fieldbus Master Module at BD420, Hi4a Controller manages Fieldbus Network for itself shown as Figure 5.1. In case of using Embedded PLC, Hi4a Controller can control unit sequence connected by Fieldbus.
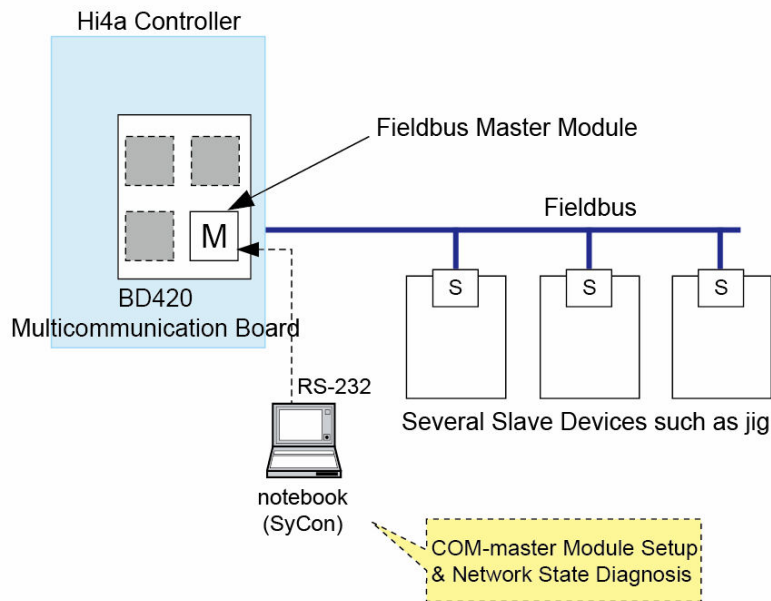
Figure 5.1 Fieldbus Network Self-Management

Master Module uses SyCon S/W for Window made by Hilscher that is different from slave done by parameter setup as Teachpendant. Setting information is downloaded to Fieldbus Master Module through RS-232C and it is recorded on Flash ROM in module. Therefore, setup using SyCon is performed only when configuring or changing network newly.

5.2. RS-232C Cable Structure to connect SyCon

Figure 5.2 RS-232C Cable Structure to connect Sycon

RS-232C Cable between PC and Hilscher COM Module should be wiring same as Figure 5.2.

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5.3. Channel Selection of RS-232C to connect SyCon

SyCon can communicate Fieldbus Module of only 1 unit through RS-232C Cable. Therefore, it is necessary to connect RS-232C Port of BD420 to Channel mounting Fieldbus Module to set up before performing SyCon.

Let's suppose that connect SyCon to Fieldbus Module connected to Channel 3.

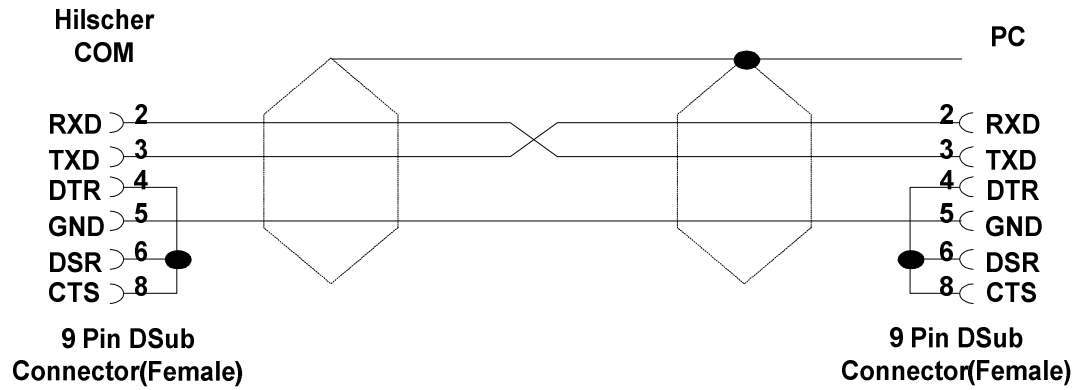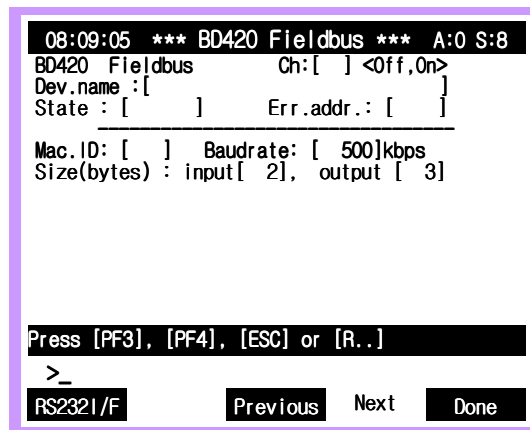(1)　Select 『[PF2]: System』 → 『2: Controller Parameter』 → 『1: Setting input & output signal』 → 『10: Fieldbus configuration』 → 『6: BD420 fieldbus info. and setting』

```
08:09:05 *** BD420 Fieldbus *** A:0 S:8
BD420 Fieldbus        Ch:[  ] <Off,On>
Dev.name :[                              ]
State : [       ]      Err.addr.: [     ]
————————————————————————————
Mac.ID: [   ]   Baudrate: [  500]kbps
Size(bytes) : input[  2],  output [  3]




Press [PF3], [PF4], [ESC] or [R..]
  >_
 RS232I/F          Previous   Next    Done
```

(2)　Press 『[PF4]: Next』 twice and move to No. 3 channel screen.

(3)　Pressing 『[PF1]: RS232I/F』 button in this state, RS-232C port is connected to currently selected channel, that is No.3 channel.

(4)　7-segment mounting BD420 board side shows channel No. connecting RS-232C currently. This is used for confirmation.

5.4. How to set up master using SyCon
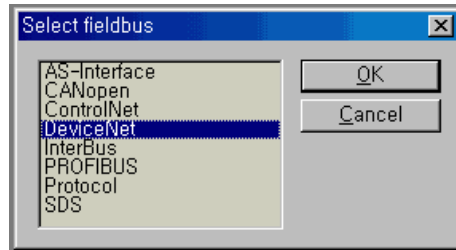

Figure 5.3 Select Fieldbus Type

After performing SyCon S/W, select 『File – New』 menu to configure network newly. When the Dialog Box is shown as Figure 5.3, select Fieldbus type you want. (DeviceNet or PROFIBUS)

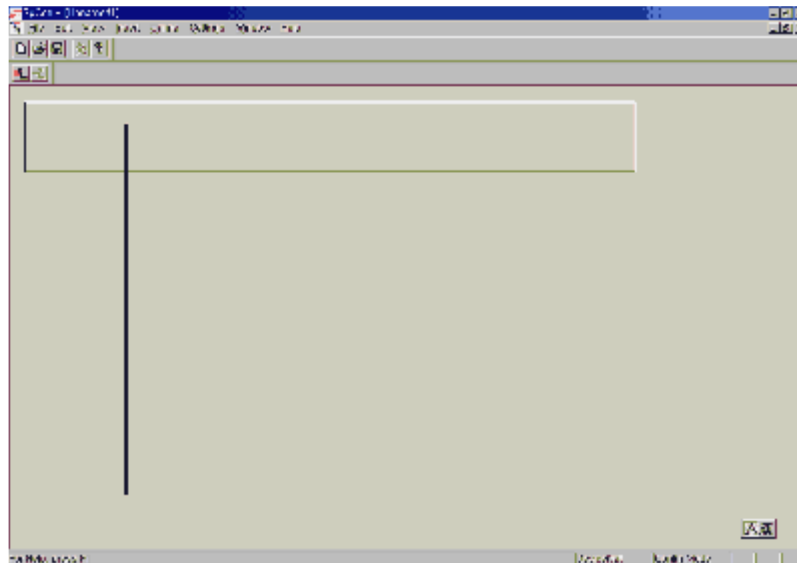Clicking OK button, the state is same as Figure 5.4.

Figure 5.4 Project Initial State of SyCon

Figure 5.5 Master Insertion Button

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Firstly, set up master. Clicking 「Insert Master」 button of Figure 5.5, Dialog Box same as Figure 5.6 appears.
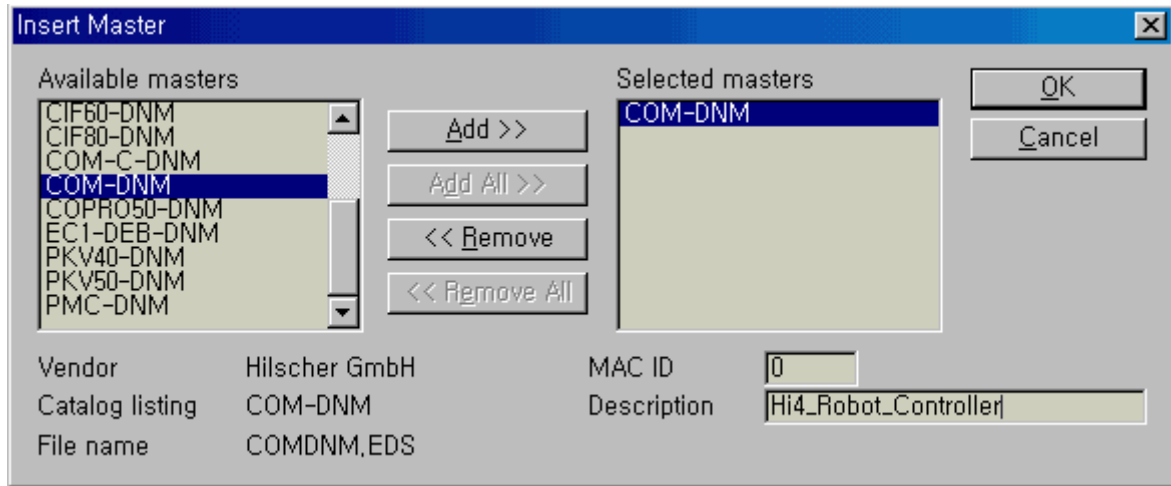
Figure 5.6 Master Insertion Dialog Box (Example of DeviceNet)

On the left list, select Master Module Name of network mounted on BD420 and then move it right side with Add button. Module Names per each Protocol are same as Table 5-1.

Table 5-1 Module Name per each Protocol

Protocol	Module Name
DeviceNet	COM-DNM
Profibus-DP	COM-DPM

After setting up MAC ID (Usually 0) of Master, attach Explanation (Space is not allowed.) on Description. Clicking OK button, the state is same as Figure 5.7.
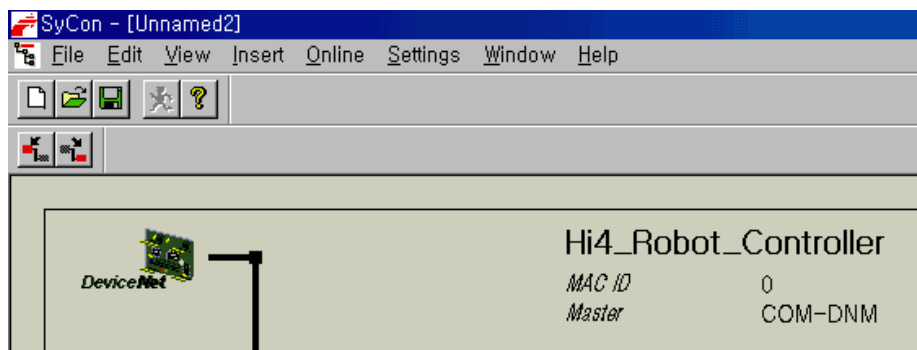
Figure 5.7 Master is inputted state (Example of DeviceNet)

Double-clicking Master Figure of the screen for Master Setup, the result is same as below,

(1) In case of DeviceNet   : The dialog is shown as Figure 5.9.
(2) In case of Profibus –DP   : The dialog is shown as Figure 5.8.

[In case of Profibus -DP]

Clicking 『DP Master Settings …』 button, the dialog of Figure 5.9 appears.
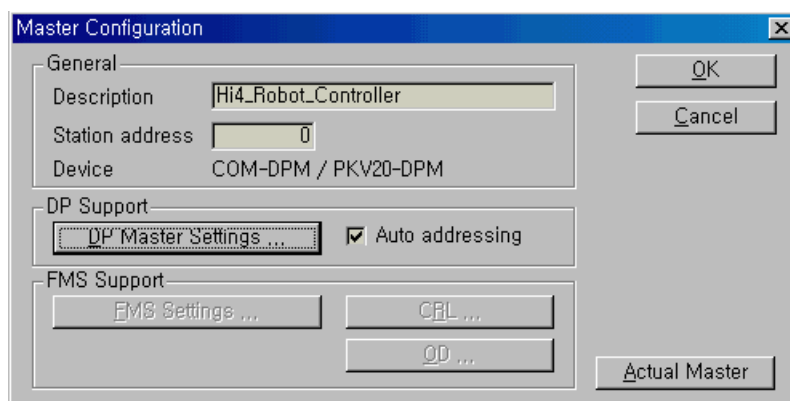
Figure 5.8 Profibus-DP Master Configuration Dialog Box

[In case of DeviceNet]

On the Dialog Box of Figure 5.9, click [OK] after completing settings same as Figure 5.9.
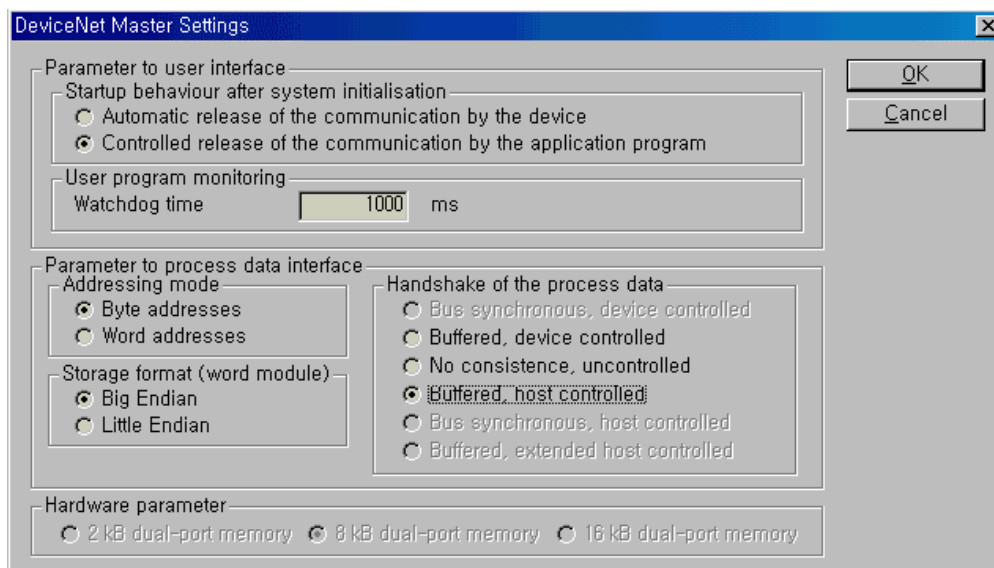
Figure 5.9 DeviceNet Master Settings Dialog Box

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Clicking 『Settings – Bus Parameters』 Menu Item, the Dialog Box same as Figure 5.10 or Figure 5.11 appears.
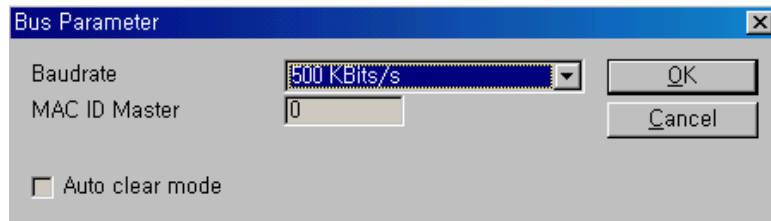
Figure 5.10 Bus Parameter Dialog Box (In case of DeviceNet)
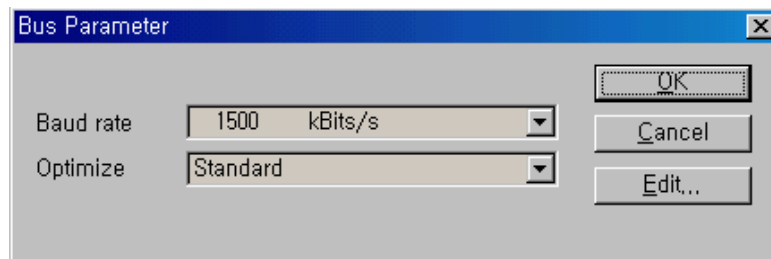
Figure 5.11 Bus Parameter Dialog Box (In case of Profibus -DP)

After setting up Baudrate fitting in Network Speed of Fieldbus, click [OK] button.

■ In case of DeviceNet : The speed of Master in network and all Slaves should be same.

■ In case of Profibus-DP : Slaves in network follow the speed of Master automatically.
Set up Standard for Optimize of Figure 5.11.

5.5. Registering EDS, GSD File

Characteristic File of related Slaves is necessary so that Fieldbus Master recognizes Slaves properly.
All Characteristic File of Slaves to use should be registered on SyCon.
Name of Characteristic File per Protocol is same as Table 5-2.

Table 5-2 Name of Characteristic File per Protocol

| Protocol	Name of Characteristic File
DeviceNet	EDS
Profibus-DP	GSD

On SyCon, select File – Copy EDS (or Copy GSD) Menu Item.
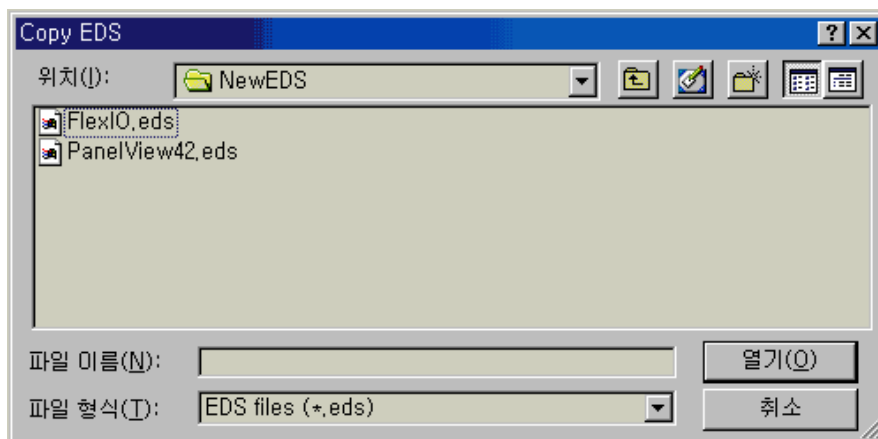
Figure 5.12 Copy EDS Dialog Box (In case of DeviceNet)

Here, explain Registration Process on the basis of the case of DeviceNet. And the processes of other Protocol cases are same.

On the Dialog Box same as Figure 5.12, move EDS (or GSD) File to saved directory, select EDS (or GSD), click Open button. And then the related file is registered as SyCon.
(Clicking while Pressing Ctrl key, it is possible to select several items at the same time.)
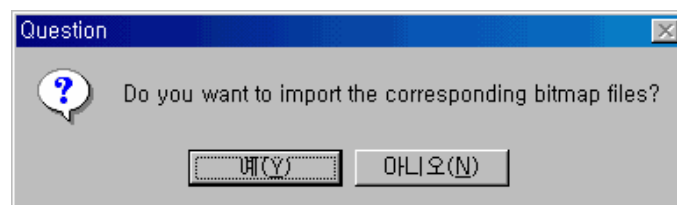
Figure 5.13 Registering corresponded bitmap file

Then, Question Window asks registering corresponded bitmap file same as Figure 5.13. If bitmap file is ready, click Yes (Y) and if it is not, click No (N). Please refer to Note 5-1 or Note 5-2 for How to prepare bitmap file.

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Note 5-1 : How to prepare bitmap file for EDS

Three bitmap files should be ready to express three states of Setting, Action, and Diagnosis per Slave devices. Bitmap is type of 70x40 pixels and 16 colors (4 bit).
Supposing EDS File Name to register is PhoSens.eds, names of three bitmap files should be followed as below. And locate it at the directory same as EDS File to register.
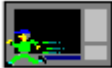
(1) Setting : PhoSens_s.dib	
(2) Action : PhoSens_r.dib	
(3) Diagnosis : PhoSens_d.dib	

Note 5-2 : How to prepare bitmap file for GSD

Three bitmap files should be ready to express three states of Setting, Action, and Diagnosis per Slave devices. Bitmap is type of 70x40 pixels and 16 colors (4 bit).

Opening GSD File to register, items designating bitmap name on next position just after Implementation_Type item should be existed as below,

```
…
Implementation_Type = "SPC3"
Bitmap_Device = "GP_run"
Bitmap_Diag    = "GP_dia"
Bitmap_SF      = "GP_sf"
…
```

Correspond names of three bitmap files with these items and locate it at the directory same as GSD File to register.

(1) Setting : GP_sf.dib	
(2) Action : GP_run.dib	
(3) Diagnosis : GP_dia.dib	

5.6. Manual Settings of Slave Devices

To set up slave devices connected on network, two methods of manual and auto are available. Firstly, explain manual setting.

Figure 5.14 Insert Device Tool Bar Button

Pressing the Insert Device button same as Figure 5.14, and then click the part below Master of network figure with cursor.
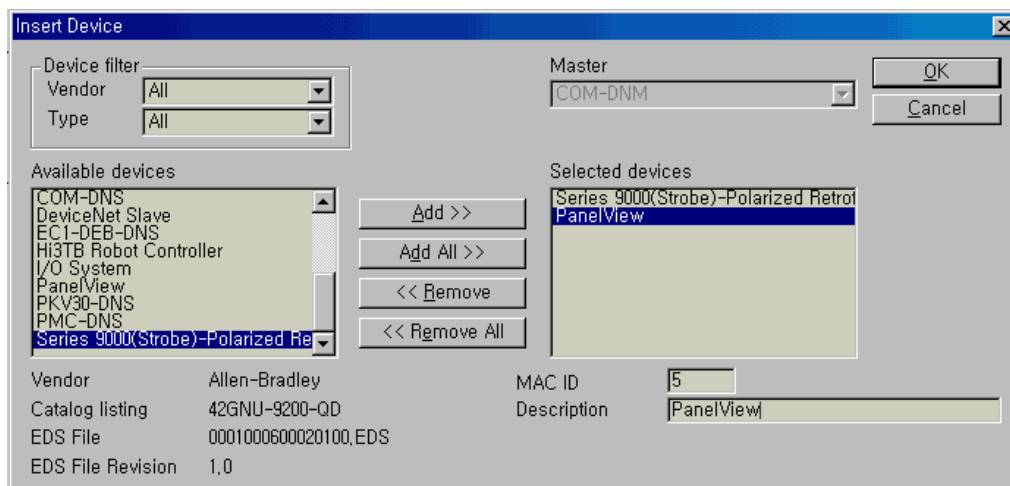
Figure 5.15 Insert Device Dialog Box (In case of DeviceNet)

The Dialog Box same as Figure 5.15 appears. Viewing the left list, you can find Slave names of registered EDS (or GSD). Click the Slave you want and click [Add >>] button. And then, it is registered on the right list.

While clicking Slave device on the right list, input MAC ID below and write explanation on Description.

After completing the right list, finish it clicking [OK] button.
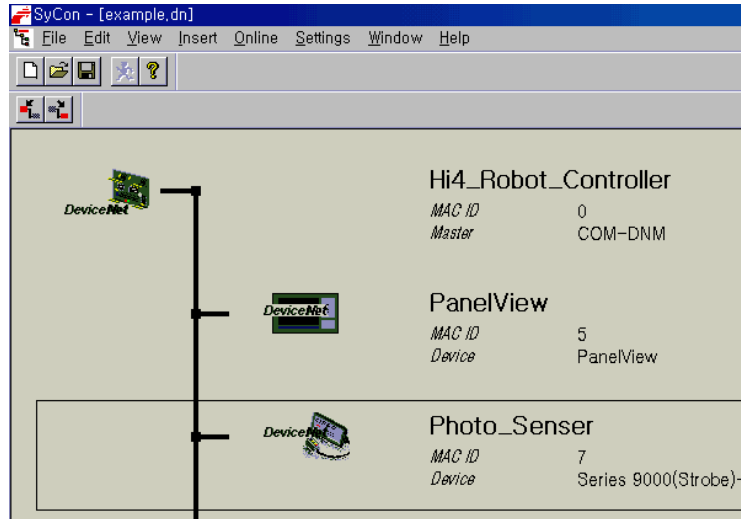
Figure 5.16 View registered Slaves (In case of DeviceNet)

Now it will be same as Figure 5.16. It requires settings for Parameter and I/O Mapping about each Slave. Double-clicking the Slave you want, the dialog same as Figure 5.17 appears.

Figure 5.17 Device Configuration Dialog Box (In case of DeviceNet)

Perform required Parameter Editing. Two list boxes at the bottom are for I/O Mapping.

For example, if PanelView is the device having input of 2 byte and output of 3 byte (At the Master's viewpoint), double-click each input and output once of BYTE_ARRAY on list box at the top and register them on list box at the bottom and then type 2 and 3 clicking each values of I Len. and O Len. with mouse.

In case of other Protocol, settings are similar.

It is important mapping is done which location of Master. If you turn it on checking 『Settings – Auto

Addressing⌟ Menu Items, mapping, which is done one by one followed by registration order, is applied automatically. This application is done when downloading total settings by Master Module. If you turn Auto Addressing Function off, you should set up I Addr. and O Addr. values properly of list box at the bottom.

5.7. Auto Settings of Slave Devices by Auto Network Scan Function

If all Slave devices are already connected on Fieldbus Network, you can use simple Auto Settings.
Firstly, perform Settings of Master and Bus Parameter Settings on new project.
Now, Select 『Online – Auto Network Scan』 Menu Item.

If communication is connected, Dialog Box same as Figure 5.18 appears instantly. If different type of Dialog Box appears, refer to 『Note 5-3 : Connecting communication』
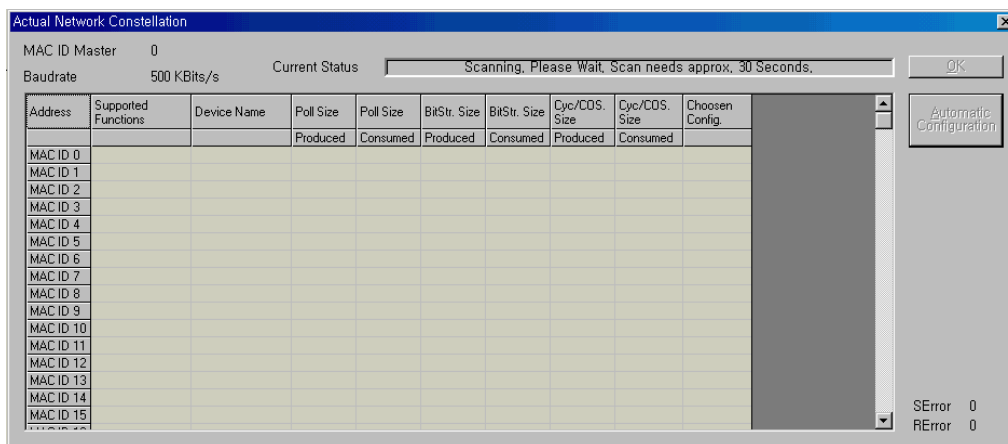
Figure 5.18 Actual Network Constellation Dialog Box – On scanning

Please wait for 30 seconds while network scan is on. Completing scan successfully, the state is same as Figure 5.19. This example is supposed that devices called PanelView and UCS-EV2 are connected on network as each device is set by MAC ID 5 and 6.
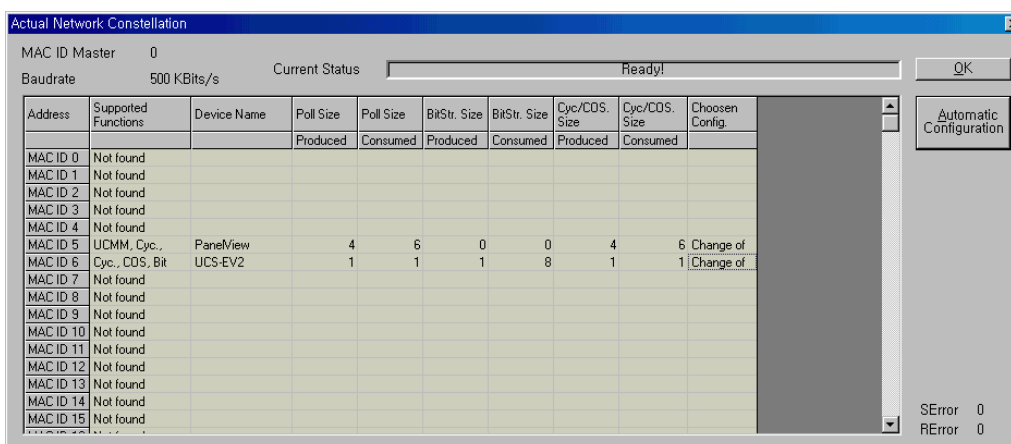
Figure 5.19 Actual Network Constellation Dialog Box – Scan Completed

Double-clicking item of Chosen Config. column of this list, you can change communication method. If the result is satisfied, you can reflect scanned contents to project by clicking [Automatic Configuration].

Closing Dialog Box clicking [OK] button, you can view the result reflected project same as Figure 5.20.

5-15
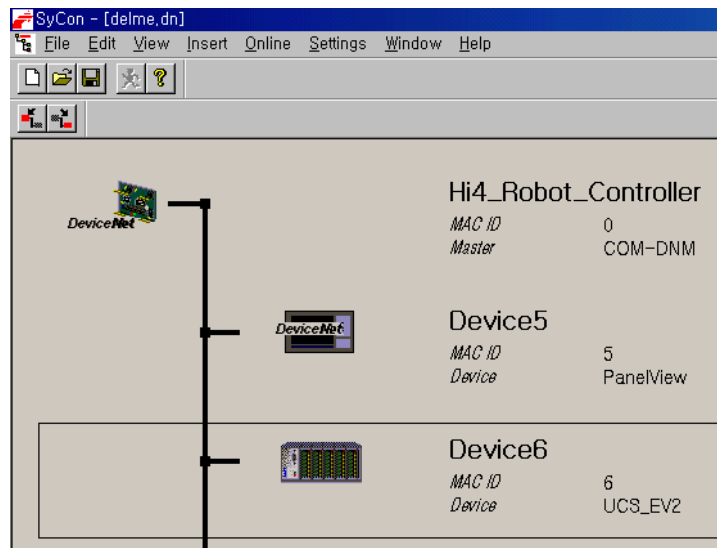
Figure 5.20 The result reflecting scanned contents (In case of DeviceNet)

If you want to control the settings about each Slaves, double-click Slave Figure you want just like Manual Settings.

Note 5-3 : Connecting communication

If communication is not connected, Dialog Box same as Figure 5.21 appears.
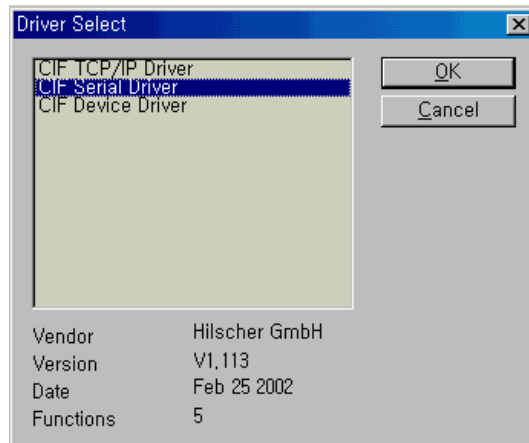
Figure 5.21 Driver Select Dialog Box

Select CIF Serial Driver on List Box and select OK. And then Dialog Box same as Figure 5.22 appears.
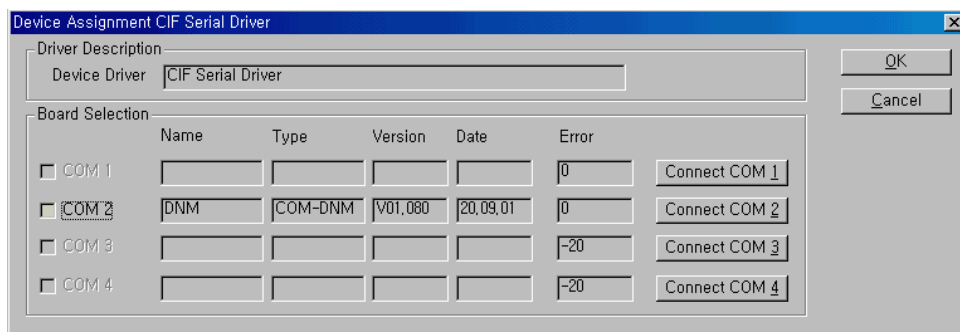
Figure 5.22 Device Assignment CIF Serial Driver

Confirm No. of RS-232C COM Port of PC connecting Master Module and click corresponding [Connect COM ?] button. If it is connected normally, left Check Box is active appearing name of module and version etc. instantly. If it is not same as above, it is not connected properly.
Check cable wiring, connection state, type of Master Module, or power supply etc.
Also in case other project window is appeared or it is already connected on other channels of BD420, it is not connected properly. In this case, save the project and finish SyCon and then try it after performing it again.

If you connect it successfully, press [OK] button after checking by clicking Check Box.

5.8. Downloading

Completing all Settings, download Total Network Settings by Master Module. Firstly, after selecting it by clicking Figure of Master Module, select 『Online – Download』Menu Item. If communication is connected, Message same as Figure 5.23 appears. Here, clicking [Yes(Y)], download same as Figure 5.24 is performed.
If different type of Dialog Box appears, refer to 『Note 5-3 : Connecting communication 』
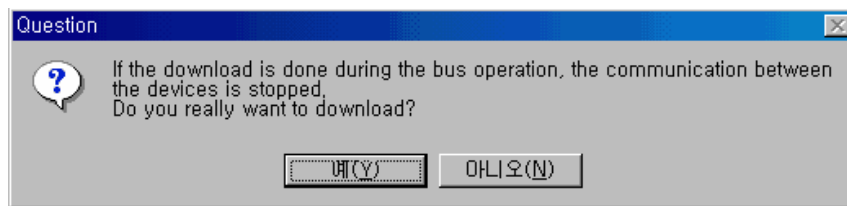
Figure 5.23 Question for Fieldbus Action Stop
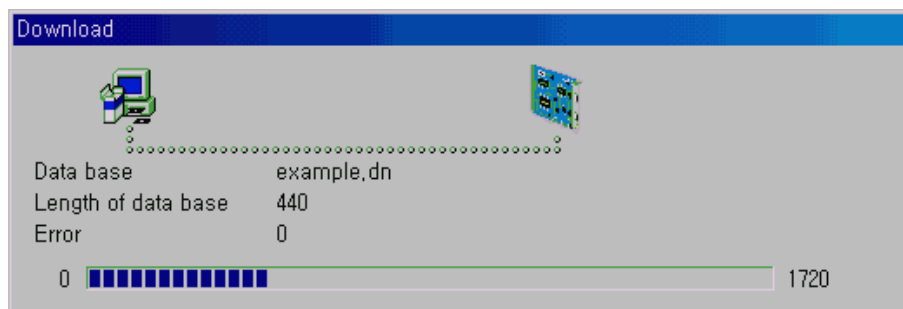
Figure 5.24 Downloading

Completing download, turn Hi4a off and on. Confirm Fieldbus is working normally. In case all Fieldbus Actions are normal, you can remove RS-232C cable. (Remove it when Hi4a Controller is off.)

6
Access of Fieldbus I/O

6.1. Using in Robot Language

Only when Embedded PLC is off, Access from Robot Language is possible..
Four Channels of BD420 correspond to each FB1, FB2, FB3, and FB4 object in Robot Language.
Each Channel Objects have DI Input of 256 points and DO Output of 256 points. (Hi4a Controller over mv10.07-26 has each DI Input and DO Output of 960 points.)

- Expression of DO Output   : FB{Channel No.}.DO{Single Signal No.}
- Expression of DI Input   : FB{Channel No.}.DI{Single Signal No.}
- Expression of GO Output   : FB{Channel No.}.GO{Group Signal No.}
- Expression of GI Input   : FB{Channel No.}.GI{ Group Signal No.}

Table 6-1 Example of Fieldbus I/O Access

Type	Command Language	Explanation
Output	FB2.DO17=1	17th Single Signal Output ON of BD420 2nd Channel
	FB1.GO2=255	Output 255 at 2nd Group Signal Output of BD420 1st Channel.
	FB3.DO[128]=0	128th Single Signal Output ON of BD420 3rd Channel
	FOR V1%=1 TO 10 FB [4].GO[V1%+20]=&HF0 NEXT	Output F0hex 21st to 30th Group Signal Output of BD420 4th Channel.
Input	WAIT FB2.DI1	Wait until 1st Single Signal Input of BD420 2nd Channel is ON.
	IF FB3.GI2=9 THEN 99	In case 2nd Group Signal Input of BD420 3rd Channel is 9, it is branched off as 99 Line No.

	FOR V1%=1 TO 4
	IF FB [V1%].DI64=1 THEN
	STOP
	ENDIF
	NEXT
		In case one of DI64 of BD420 1st to 4th Channel is 1, Robot is stopped.

	IF DI12<>FB1.DI20 THEN
	STOP
	ENDIF
		In case 12th Single Signal Input of BD430 differs from 20th Single Signal Input of BD420 1st Channel, it is stopped.

While Embedded PLC is on, FBn.DI and FBn.DO do not perform any duty.

6.2. Using in Embedded PLC

While Embedded PLC is on, Access from Robot Language is cut off. It is connected by Relay of Embedded PLC only.

Four Channels of BD420 correspond to each FB1, FB2, FB3, and FB4 channel object in Embedded PLC. Each Channel Objects have X Input of 256 points and Y Output of 256 points. (Hi4a Controller over mv10.07-26 has each X Input and Y Output of 960 points.)

Table 6-2 shows Expression of FB Channel Object Relay.

Table 6-2 Example of Fieldbus I/O Access

Data Size	Direction	Relay Name	Grammar
Bit	Input	X	FB{Channel No.}.X{Single Signal No.}
	Output	Y	FB{Channel No.}.Y{Single Signal No.}
Byte	Input	XB	FB{Channel No.}.XB{Byte No.}
	Output	YB	FB{Channel No.}.YB{Byte No.}
Word	Input	XW	FB{Channel No.}.XW{Word No.}
	Output	YW	FB{Channel No.}.YW{Word No.}

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Figure 6.1 shows I/O Configuration while Embedded PLC is on. To output signal to BD420 or input signal from BD420 in Robot Language, it is connected by Ladder Logic of Embedded PLC.
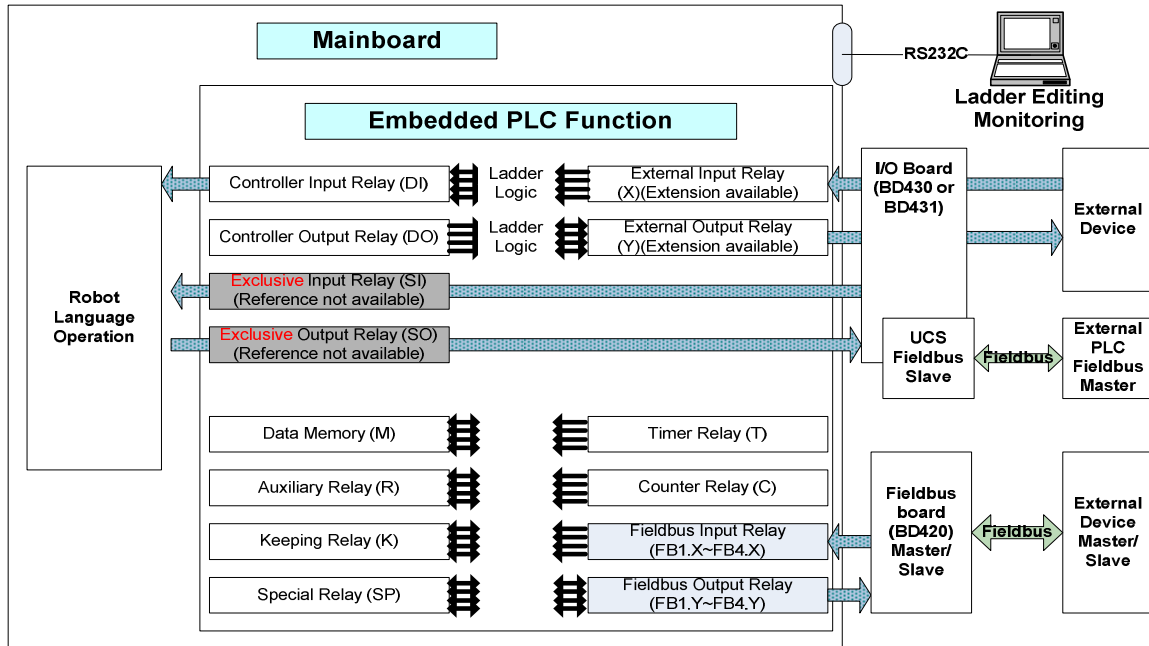
Figure 6.1 I/O Configuration while Embedded PLC is on

Figure 6.2 showed the example of connection as below. It connects each four words for Input and Output.

(1) Mapping DOW13 ~ DOW16 (Byte mark is GO25 ~ GO32) Output of Robot Language as FB2.YW1 ~ FB2.YW4 Output of Fieldbus.

(2) Mapping FB2.XW1 ~ FB2.XW4 Input of Fieldbus as DIW13 ~ DIW16 (Byte mark is GI25 ~ GI32) Input of Robot Language.
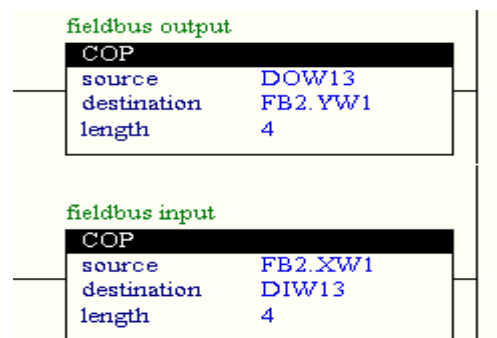
Figure 6.2 Example of Embedded PLC Ladder mapping Input and Output of Robot Language to Fieldbus.

7

**Fieldbus
Diagnosis**

7.1. Diagnosis function

When the master module is selected, [PF2: Check!] button is displayed.

```
08:09:05   *** BD420 Fieldbus ***   A:0 S:8
BD420 Fieldbus      Ch:[ 3]    <Off,On>
Dev.name:[COM-Profibus-DP Master       ]
state   : [Error   ]
       ──────────────────────────────────




Press [PF3], [PF4], [ESC] or [R..]
 >_
RS232I/F  Check!  Previous   Next      Done
```

When [PF2: Check!] button is pressed, the Diagnosis screen is displayed as shown at the below figure.
The number of bus errors (BusErrCnt) and the number of timeouts (TimeOutCnt) detected by the master are displayed, and the node number of the slave causing the error, the error code and the error source (Src; Source) are also displayed. The English description about the current error code is displayed at the below, of which the first sentence shows the cause and the second one shows the counter measures.

```
08:09:05   *** BD420 Fieldbus ***   A:0 S:8
BD420 FB[3]        State[error       ]
COM-DPM
       ──────────────────────────────────
BusErrCnt[     0]      TimeOutCnt[      0]
Err.Node[   5] Err.Code[ 17] Src[slave ]
No response of the station
check bus cable, check bus address of s
lave



Press [ESC] or [R..]
 >_
Glob.Bit Slv.Tabl             End
```

When [PF1: Glob.Bit] is pressed at the Diagnosis screen, the Global Bit screen is displayed.

```
08:09:05    *** BD420 Fieldbus ***    A:0 S:8
BD420 FB[3]           State[error      ]
COM-DPM
rsvd TOUT NRDY EVE  FAT  NEXC ACLR CTRL
─────────────────────────────────────

rsvd : reserved




Press [PF3],[PF4],[ESC] or [R..]
  >_
                   Previous  Next    End
```

The 3~4 characters acronyms displayed on the screen are the global bits representing the communication status of the master module. The highlighted bits are turned on while the normal bits are turned off.
One of the bits blinks, which does not mean the bit status, but shows that the help cursor is located at the related bit. The help cursor shows the meaning of each bit, which can be moved by [Shift + arrow] keys. The meaning of the bit (blinking bit) where the help cursor is located is displayed at the bottom in English.
(The structure of the global bit depends on the protocol. The above example is for the floppy bus master.)

When [PF2: Slv tbl] is pressed at the Diagnosis screen, the Slave table screen is displayed.

```
08:09:05    *** BD420 Fieldbus ***    A:0 S:8
BD420 FB[3]           State[Error      ]
COM-DPM          Slave No. to diag. [  0]
<Configured dev,Activated dev,Diag.dev>
─────────────────────────────────────
000 001 002 003 004 005 006 007 008 009
010 011 012 013 014 015 016 017 018 019
020 021 022 023 024 025 026 027 028 029
030 031 032 033 034 035 036 037 038 039
040 041 042 043 044 045 046 047 048 049
050 051 052 053 054 055 056 057 058 059
060 061 062 063 064 065 066 067 068 069
Input slave #, ress [PF1] to diagnose
  >[1 - 127]_
Slv.Diag         Previous  Next    End
```

When the slave node number table exceeds one page, the page can be scrolled by pressing [PF3: Previous] or [PF4: Next].

The display mode can be changed by using [Shift + Left/Right arrow] key.

Table 7-1 Example of Field bus I/O access

Display mode	Description
Set device	The node numbers of the slave registered at the master by using the SyCon are highlighted.
Activated device	The node numbers of the slave normally communicating with the master are highlighted.
Diagnosis information device	The node numbers of the slave having the diagnostic information are highlighted.

The diagnostic information means the history of errors such as the field bus error at a specific slave device.

The master can get the diagnostic information from the slave and display it. For example, if the slave at the No. 8 node is highlighted showing that it has the diagnostic information as shown at the below figure, the slave diagnosis screen can be displayed by entering '8' into 'Slave number to diagnose' field and pressing [PF1: Slv.Diag].


```
08:09:05    *** BD420 Fieldbus ***    A:0 S:8
BD420 FB[3]           State[Error       ]
COM-DPM           Slave No. to diag. [  8]
<Configured dev,Activated dev,Diag.dev>
_____
000 001 002 003 004 005 006 007 008 009
010 011 012 013 014 015 016 017 018 019
020 021 022 023 024 025 026 027 028 029
030 031 032 033 034 035 036 037 038 039
040 041 042 043 044 045 046 047 048 049
050 051 052 053 054 055 056 057 058 059
060 061 062 063 064 065 066 067 068 069
Input slave #, ress [PF1] to diagnose
 >[1 - 127]8_
Slv.Diag        Previous   Next      End
```

The Slave Diagnosis screen is shown at the below figure. More than one slave status bit are displayed at the top of the screen. Just like the global bit, the highlighted bit means the On status while the blinking bit means the one selected by the help cursor. The meaning of the highlighted bit can be displayed by moving the help cursor with [Shift + arrow] key.
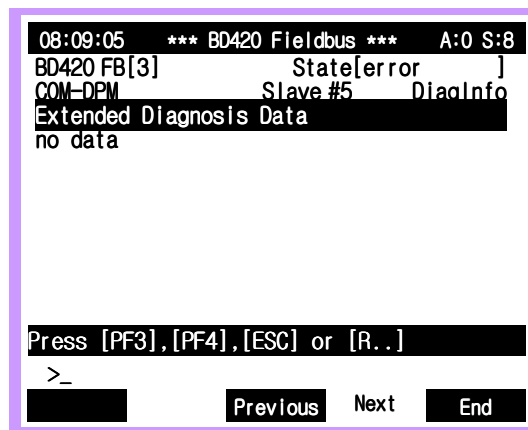
```
08:09:05    *** BD420 Fieldbus ***    A:0 S:8
BD420 FB[3]            State[Error      ]
COM-DPM             Slave #5     DiagInfo
MsLk PrmF InRs NtSp ExDg CnfF NtRd NtRs
NtPj Rsvd Sync Frez WdOn ExOv StDg PrRq
————————————————————————————————
WdOn: watchdog activated


————————————————————————————————
MasterAddr:0            IdentNumber:0x7500

Press [PF3],[PF4],[ESC] or [R..]
  >_
            Previous   Next     End
```
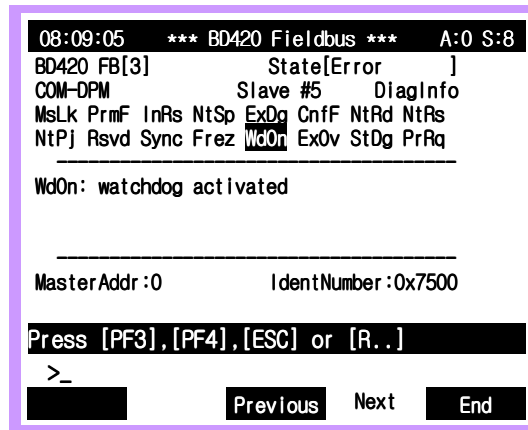
The master address (|MasterAddr) for the slave and the identification number of the slave (IdentNumber) are displayed at the bottom of the screen.
 (The screen structure depends on the protocol. The above example is for the floppy bus master.)

When [PF4: Next] is pressed, the Extended Diagnosis Data is displayed as shown at the below figure.

```
08:09:05    *** BD420 Fieldbus ***    A:0 S:8
BD420 FB[3]            State[error      ]
COM-DPM             Slave #5     DiagInfo
Extended Diagnosis Data
no data





Press [PF3],[PF4],[ESC] or [R..]
  >_
            Previous   Next     End
```

The Extended Diagnosis Data does not mean the information defined as standard specification at the field bus, but the unique information of the product defiend for each slave product (for example, measured value error of sensor, remote I/O device failure, etc.). The Extended Diagnosis Data is displayed without any interpretation as received as hexdecimal data string. For its meaning, see the manual of the related slave product.

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7.2. Controller Error Message

Figure 7-2 shows list and troubleshooting of Error Message displayed on Teachpendant while using Fieldbus.

Table 7-2 Controller Error Message and Troubleshooting

Error Message	Troubleshooting
W0013 Fieldbus Module is not detected.	Check BD420 mounted and Fieldbus Module mounted on BD420.
W0015 Fieldbus Communication Error.	Check Fieldbus Network and Parameter Settings of Module.

After checking errors and solving problems, try to connect Fieldbus by turning Controller off and on.

7.3. Inspecting state with BD420 LED

Six LEDs are mounted on each channel at BD420. Left four LEDs have different duties depending on Fieldbus Protocol.
Above all, the meaning of right two LEDs is same as Table 7-3 regardless of Protocol.

Table 7-3 State and Meaning of common LED

Name	Color	State	Meaning
RDY	Yellow	On ☀	Ready
		Blinking ☉	Bootstrap Loader Active
		Off ●	Hardware or System Error
RUN	Green	On ☀	Communication Running
		Blinking ☉	Parameter Error
		Off ●	Communication Stopped

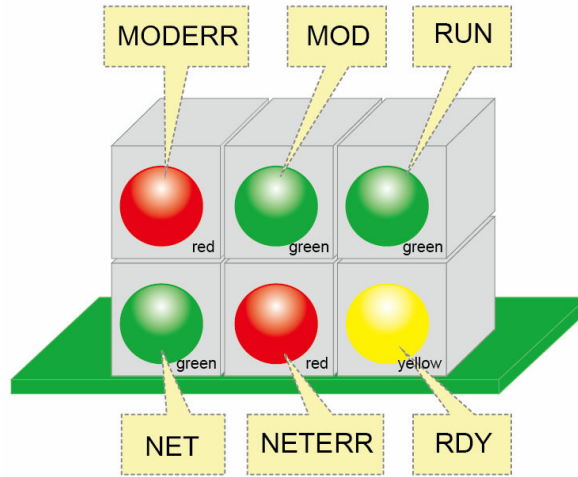From Figure 7.1 to Figure 7.3, and Table 7-4 to Table 7-6, shows LED names per each Fieldbus Protocol and explanation.

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Figure 7.1 LED DeviceNet Master and Slave Module

Table 7-4 LED State and Meaning of DeviceNet Master and Slave Module.

Name	Color	State	Meaning
NET	Green	On ☀	Online, Link OK
		Blinking ☉	Online, Not Connected
		Off ●	Refer to NETERR
NETERR	Red	On ☀	Critical Link Failure
		Blinking ☉	Connection Timeout
		Off ●	Refer to NET
MOD	Green	On	Normal Operation
		Blinking ☉	Configuration Failure
		Off ●	Refer to MODERR
MODERR	Red	On	Unrecoverable Fault
		Blinking ☉	Minor Fault
		Off ●	Refer to MOD

※ In case NET and NETERR are all off, it might be the problem of DeviceNet Power (24V) Supply
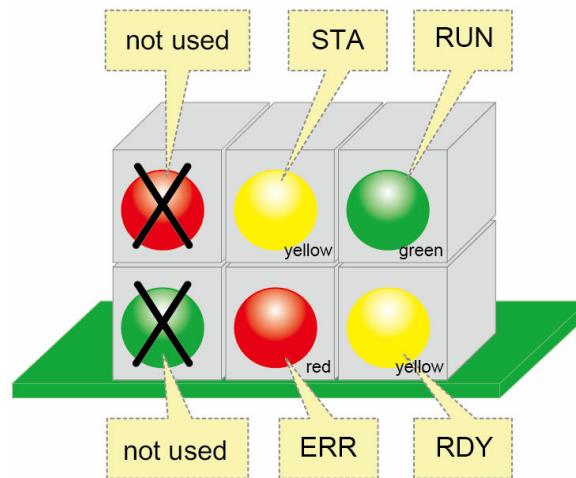
Figure 7.2 LED of Profibus -DP Master, Slave and Interbus Master Module

Table 7-5 LED State and Meaning of Profibus -DP Master, Slave and Interbus Master Module

Name	Color	State	Meaning
STA	Yellow	On ☀	DP Master : hold token DP Slave : Data exchanged Interbus : data telegrams active
		Off ●	Master : no hold token Slave : no data exchange Interbus : no data telegrams active
MODERR	Red	On ☀	Error on Communication Line
		Off ●	No Error on Communication Line

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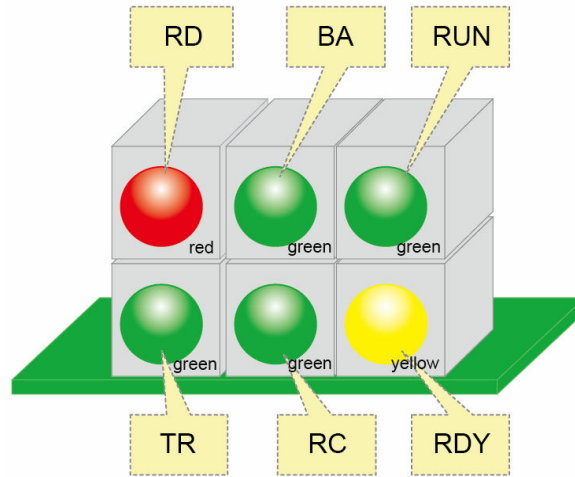
Figure 7.3 LED of Interbus Slave Module

Table 7-6 LED State and Meaning of Interbus Slave Module

Name	Color	State	Meaning
RC	Green	On ☀	Remotebus Cable check OK
		Off ●	No connection to previous Slave
BA	Green	On ☀	Data Message Active
		Off ●	No Data Messages Active
TR	Green	On ☀	PCP Data Transmission
		Off ●	No PCP Data Transmission
RD	Red	On ☀	Remotebus OUT Interface Disabled
		Off ●	Remotebus OUT Interface Enables

7.4. Fieldbus related Output Signal Assignment

You can set specific hard-wired output signal come to be ON when a fieldbus fault occurred.

(1) Select 『[PF2]: System』 → 『2: Controller parameter』 → 『1: Setting input & output signal』 → 『6: Output signal assigning』 .

(2) Search for "Fieldbus trouble" item with 『[PF3]: Previous』 and 『[PF4]: Next』 key.

(3) Set the DO signal number you want, and store it with 『[PF5]: Complete』 key.

```
02:57:12** DO Sig assignment ** A:0 S:8
Servo gun output method(Wd-On)=    [   0]
Frequency count ACK           =    [   0]
Palletize count ACK           =    [   0]
Freq/Palletize count error    =    [   0]
Count output Bit   = B01[   0] B02[   0]
                     B03[   0] B04[   0]
                     B05[   0] B06[   0]
                     B07[   0] B08[   0]
                     B09[   0] B10[   0]
Robot lock status(Enable=ON)=      [   0]
Fieldbus trouble             =     [   0]
Select and Enter number. Press [SET]
>[0 - 256]
All FormOne FormPrevious  Next  Complete
```

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