

Hi4 Function Manual

Fieldbus User's Manual

version 1.2b

2002/03/27



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1 Introduction

1.1 Prerequisite

In order to understand this manual, the followings are prerequisite.

- HR Hi4 Robot controller operation.
- Installation and use of fieldbus network (DeviceNet or Profibus-DP or CC-Link)

1.2 Fieldbus

Fieldbus is an open industrial standard which is utilized to connect PLC(Programmable Logic Controller) to industrial devices (sensors, button, motor driver, O/P interface, and so on) at factory with unit cable

Fieldbus provides intelligent services such as monitoring or remodeling status of whole network from the center and has advantage of transmitting or receiving detail information(setting run mode, sensor error,etc) rather than on/off of sensor or switch.

Fieldbus uses single cable and reduces the cost and time in doing wiring. Easy maintenance is resulted from simplifying wiring through fieldbus. Being different protocol of ethernet characterized with non-deterministic response, Fieldbus characterized with deterministic response for data is generally used in industry where response time is critical

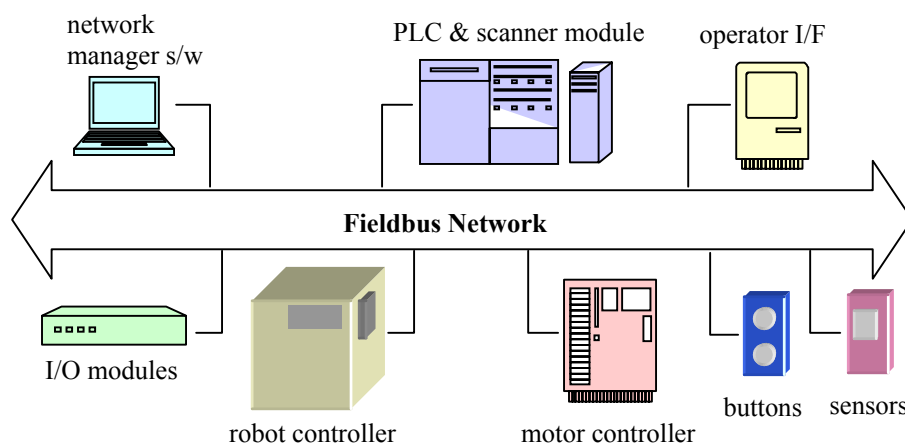


Figure 1-1. Fieldbus Network and Master, Slave Devices

Single fieldbus network can connect single master unit and several slave units. The master unit inspects or manage whole network and transfer the data with slave units. Normally PLC is

master unit and other devices such as sensor, button, and controller are slave units

1.3 Hi4 Robot controller fieldbus function

Hi4 controller is one of slave unit which performs I/O exchange. In order to use fieldbus in Hi4 controller, the fieldbus module matched to the type of fieldbus should be mounted on the BD430(I/O board) of the controller.

Currently, 3 type of fieldbus module (DeviceNet, Profibus-DP and CC-Link) can be mounted on. For DeviceNet or Profibus-DP, the UCS(Universal Communication System)module made by SST company must be equipped. For CC-Link, the BD471 must be equipped.

Functional specification of Hi4 controller field function are following tables (Table1-1 and Table 1-2 and Table 1-3)

Table 1-1. DeviceNet Functional spec.

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

Table 1-2. Fieldbus Functional spec

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

Table 1-3. CC-Link specification

Type	Remote Device
Station Number	4
Input	32byte (256bit) (RWw0~15)
Output	32byte (256bit) (RWr0~15)

1.4 General spec of fieldbus.

Table 1-4 and Table 1-5 and Table 1-6 are respectively general specification of DeviceNet, Profibus-DP, CC-link. For detail information, refer to specification of each fieldbus

Table 1-4 DeviceNet

baudrate	The cable can have :			
	Trunk length	Max drop length	Max node no.	Cumulative drop length
125k bit/s	500 m (1,640 ft)	6m (20 ft)	64ea.	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 1-5 Profibus-DP

Max number of stations	Up to 32 stations per line segment, maximum total of 126.									
Repeater	Can be expanded with up to 4 repeaters									
I/O data per station	Up to 244 input and output bytes data.									
Max # of station per segment without repeater	32									
Max. segment no to be connected	Maximum four repeater between two station (More than 4 in standard can be assisted according to repeater)									
Baudrate (kbit/s)	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Maximum length of segment (m)	1200	1200	1200	1200	1000	400	200	100	100	100

Table 1-6 CC-Link (Ver 1.1 reference, use terminal resistor 110Ω)

Remote station maximum number	64 ea.	
Transmission speed	Station to station cable length	Maximum overall distance
156kbps	20cm or longer	1200m
625kbps		900m
2.5Mbps		400m
5Mbps		160m
10Mbps		100m

1.5 ESD file, GSD file

Each fieldbus units has unique characteristic file to recognize itself. EDS file for Devicenet unit and GSD file is for Profibus. Hi4 controller also has EDS file and GSD file(CC Link does not need characteristic file)

The units connected to network is searched after chracter file is registered in network management software and network browsing is performed. Network management software download these information to fieldbus scanner module of PLC. Once network data is downloaded to scanner module, PLC module activates whole network without help of network management software. Refer to operation manual for PLC scanner module and network management software for further information

2 BD430 and fieldbus module setting

2.1 Setting of DeviceNet, Profibus-DP fieldbus module (UCS)

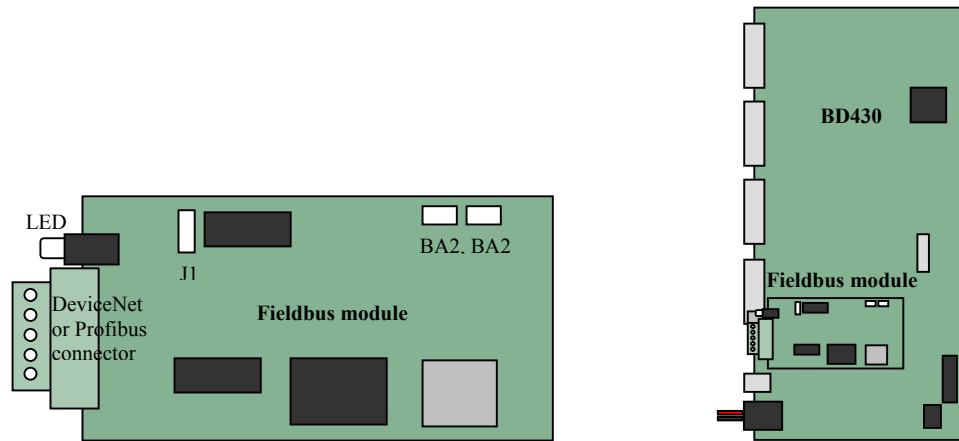


Figure 2-1 Jumper and switch location and BD430 board equipped with UCS
 (※ J1 is available in UCS for DeviceNet)

There are 3 jumpers in fieldbus module .

jumper BA1 and BA2 shall be OPEN shown in Figure 2-2.

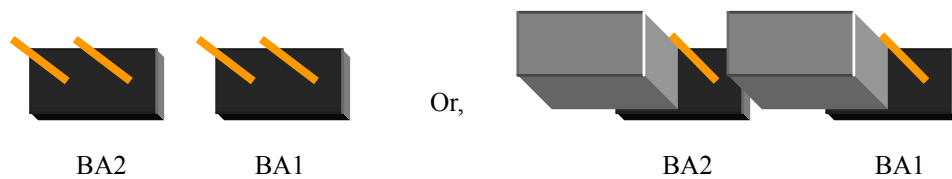


Figure 2-2. OPEN setting for Jumper BA1 and BA2

Jumper J1 is the network power jumper that is only used for DeviceNet. The setting is as follows 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

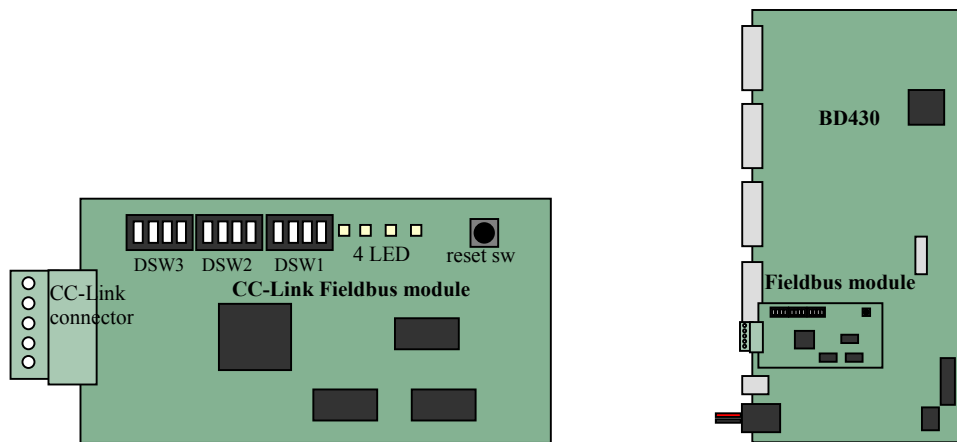


Figure 2-3 Configuration of CC-Link equipped to BD430 and location of jumpers

There are 3 dip switch groups in Fieldbus module, DSW1, DSW2, DSW3
 Each function is as follows shown in Table 2-2.

Table 2-2. Function of CC-Link module dip switch

Switch Name	Switch No.	Contents
DSW1	1	station No setting (Input in 10 unit): × 80
	2	station No setting (Input in 10 unit): × 40
	3	station No setting (Input in 10 unit): × 20
	4	station No setting (Input in 10 unit): × 10
DSW2	1	station No setting (Input in 1 unit): × 8
	2	station No setting (Input in 1 unit): × 4
	3	station No setting (Input in 1 unit): × 2
	4	station No setting (Input in 1 unit): × 1
DSW3	1	baudrate setting: × 8
	2	baudrate setting: × 4
	3	baudrate setting: × 2
	4	baudrate setting: × 1

Station number can be set in range 1~64.

Baudrate can be set as 0~4 in 5 types of number. Speed as to each number is as follows shown in Table 2-3.

Table 2-3. CC-Link Baudrate setting

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

For example, Dip switch is set shown in Figure 2-4 when 2.5 Mbps is needed to be set to the station no.13.

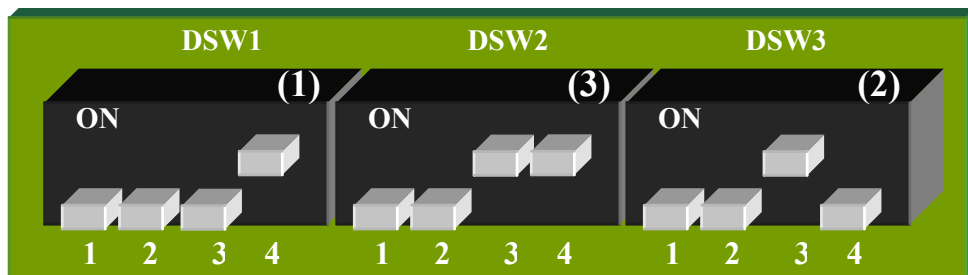


Figure 2-4 Dip switch setting (station no: 13, Baudrate: no. 2 (2.5Mbps))

3 Serial port Setting

If select [PF2](System) – 2: Controller parameter – 2: Serial ports, the following menu is displayed shown in Figure 3-1.

```

15:30:14 * Serial port select * A:0 S:2
 1: Teach Pendant (CNTP)
 2: Serial to I/O Board (CNIO)
 3: Serial port #1 (CNSIO)
 4: Serial port #2 (OPSIO)

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

```

Figure 3-1. Serial port selection menu

After select 2: Serial to I/O Board, press [SET] to display window shown in Figure 3-2.

```

15:30:14 *** Serial to I/O *** A:0 S:2
Baudrate = <...,9600,19200,38400,57600>
Character length = <7,8> bit
Stop bit = <1,2> bit
Parity bit = <Disable,Odd,Even>
Echo = <Disable,Enable>

[SHIFT]+[<-] [->] Key.
>
Complete

```

Figure 3-2. Serial to I/O setting window

With [Up][Down] cursor key and [SHIFT]+[<-][>-] cursor key, set as Figure 3-2 and press [PF5](Complete) key to save.

4 Fieldbus configuration

When select [PF2](System) – 2: Controller parameter – 1: Setting input & output signal – 10: Fieldbus configuration menu, the following is displayed in Figure 4-1.

```
15:30:14 *** Fieldbus Config *** A:0 S:2
1: En/Disable Fieldbus Adapter
2: Select Input Source
3: Assign Input No
4: Assign Output No
5: Set Network Parameter

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

Figure 4-1. Fieldbus setting menu

When fieldbus is set for the first time after format the controller, the following message is displayed as selecting one of 5 entries in menu shown in Figure 4-1.

```
File not exist, Create file? [YES]/[NO]
```

ROBOT.FBU file that stores fieldbus setting is generated as selecting [YES] key and Setting job is proceeded.

4.1 En/Disable Fieldbus

```
15:30:14 * En/Disable Fieldbus * A:0 S:2
Fieldbus Adapter =<Off, On>

[SHIFT]+[<-] [->] to En/Disable
>
Done
```

Figure 4-2. Fieldbus in use

Decide to use fieldbus that must be equipped in fieldbus module in order to use fieldbus. By setting ON, fieldbus function is enabled , and as setting Off, fieldbus function is disabled

※ When Fieldbus module is not mounted on BD430, setting must be Off

If On is selected without fieldbus module on BD430, error will be occurred and whole I/O function is also disabled.

4.2 Network parameter setting

```

15:30:14 Set Network parameter A:0 S:2
Fieldbus Type    = <DeviceNet,Profibus>
Comm. Speed     = <125,250,500>
Node Number     = [10]

[Shift]+[<-] [->] to select fieldbus
>
Previous Next Done
    
```

Communication speed(kbps)and Node number must be set as selecting DeviceNet

```

15:30:14 Set Network parameter A:0 S:2
Fieldbus Type    = <DeviceNet,Profibus>
Comm. Speed     = <----->
Node Number     = [10]

[Shift]+[<-] [->] to select fieldbus
>
Previous Next Done
    
```

Only node number is set as selecting Profibus-DP because communication baudrate follows master setting.

If CC-Link is used, network parameter settings are ignored

4.3 Input source select

```

15:30:14** Select Input Source **A:0 S:2
Select Input Source
0  DI1 - DI8      <- <HWrd, Fbus>
1  DI9 - DI16    <- <HWrd, Fbus>
2  DI17 - DI24   <- <HWrd, Fbus>
3  DI25 - DI32   <- <HWrd, Fbus>
4  DI33 - DI40   <- <HWrd, Fbus>
5  DI41 - DI48   <- <HWrd, Fbus>
6  DI49 - DI56   <- <HWrd, Fbus>
7  DI57 - DI64   <- <HWrd, Fbus>

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[SHIFT]+[<-] [->] to select input src
>
Previous Next Done

```

Figure 4-3. Input source setting menu

Selection, whether Input signal from controller is received by hardwired-contact or by fieldbus, is made in group signal unit

In Figure 4-3, HWrd means HardWired-contact and Fbus means fieldbus

For example, as shown in Figure 4-3, DI1 – DI48 signal is received by hard-wired signal and I signals after DI1-DI48 are received by fieldbus

Select DI signals with Up/Down key and select either of HWrd or Fbus with [SHIFT]+[<-][>] cursor key

Signals from DI1 to DI255 are set in total 4 pages.

Move the pages by use of PF3(Previous) and PF4(Next)Key. After completion of setting, press PF5(Done)key.

4.4 Assigning input signals

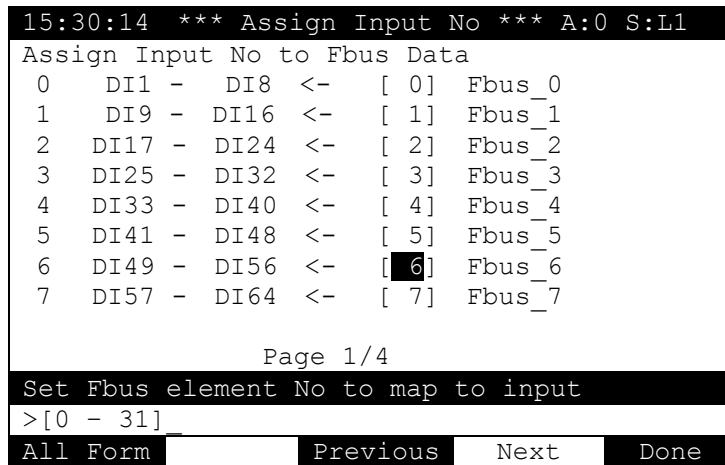


Figure 4-4. Assigning Input signal menu

Input data transmitted to controller through fieldbus is 32 byte in total, namely 32 group signals

Fieldbus group signal can be respectively assigned and transmitted as to DI group signals
 DI group signal to be set to receive input from hard-wired is ignored in input source selection menu

Signals from DI1 to DI255 are set in total 4 pages.
 Move the pages by use of PF3(Previous) and PF4(Next)Key. After completion of setting, press PF5(Done)key.

As pressing PF1(All Initial)key, all pages is set to be default value.

4.5 Assigning output signals

```

15:30:14 *** Assign Output No *** A:0 S:L1
Assign Output No to Fbus Data
0   DO1 - DO8   -> [ 0] Fbus_0
1   DO9 - DO16  -> [ 1] Fbus_1
2   DO17 - DO24 -> [ 2] Fbus_2
3   DO25 - DO32 -> [ 3] Fbus_3
4   DO33 - DO40 -> [ 4] Fbus_4
5   DO41 - DO48 -> [ 5] Fbus_5
6   DO49 - DO56 -> [ 6] Fbus_6
7   DO57 - DO64 -> [ 7] Fbus_7

Page 1/4
Set Fbus element No to map to output
>[0 - 31]
All Form Previous Next Done

```

Figure 4-5. Assigning Output signal menu

DO signals of controller are simultaneously transmitted to both hard-wired contact and fieldbus Selection, whether DO signal from controller is received by hardwired contact or by fieldbus , is made in group signal unit

Signals from DO1 to DO255 are set in total 4 pages.

Move the pages by use of PF3(Previous) and PF4(Next)Key. After completion of setting, press PF5(Done)key.

As pressing PF1(All Initial)key, all pages is set to be default value.

5 Inspection and Troubleshooting

5.1 Error message on controller

Table 5-1 shows troubleshooting method and list of error message which is displayed on teaching

Table 5-1. Error message on controller and troubleshooting

Error message	Troubleshooting
E0023 Fieldbus power is not supplied.	Check 24V power supply for Fieldbus
E0024 Fieldbus network connection error.	Check appropriate cable connection for fieldbus
E0025 Fieldbus IDLE state.	Check that fieldbus function is properly operated only if PLC equipped with fieldbus master(PLC scanner) is in RUN mode.
E0026 Fieldbus adapter response error.	Check proper cable connection between BD430 and main board with RS232C cable Check setting of 2: Serial ports – 2: Serial to I/O board (CNIO). Check power supply for BD430
E0027 Fieldbus module is not detected.	Check Fieldbus module on BD430 board
E0029 Fieldbus setting error.	Check Dip switch setting for fieldbus module

After checking error and clear the problem, double click [RESET] key on Teaching Pendant(T/P) to clear the error.

Retry data transmit again. If problem is not go away, the same error message will displayed again on teaching pendant

※ Fieldbus IDLE is occurred when run/idle bit of PLC is 0 during use of AB PLC

In this case set run/idle bit to 1 to clear the problem.

After clearing the problem, double click RESET key

※ Often IDLE status is happened at the time power on. In this case, all mode switches in PLC must switched to PROG first and to RUN the next to clear the problem. After clearing the problem, double click RESET key.

※If 1747-SDN of AB PLC is used as master, check that firmware version is 4.026 or upgrade version. 1747-SDN of Version 4.015 often results IDLE condition. Contact AB to upgrade.

5.2 Inspection of fieldbus module – DeviceNet, Profibus-DP

Two LEDs are mounted in field module of DeviceNet and Profibus-DP respectively.

As shown in Figure 5-1, LED in left is module status LED and LED at the bottom is Network Specific LED.

In normal status, all two LED are in green light, data transmit can be successfully carried out.

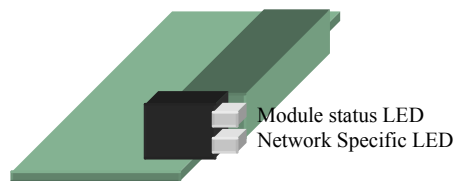


Figure 5-1 LED location of fieldbus module

Table 5-3. Operation of Module status LED

LED State	Field module status
Off	No power or hard/soft reset asserted
Flashing Red	Recoverable configuration fault (Invalid firmware, OEM Data or personality data)
Red	Hardware error or fatal runtime error
Flashing Green	No errors, data exchange interface is not open
Green	No errors, data exchange interface is active
Amber (Red/Green)	Configuration Mode

Table 5-4. Operation of Network Specific LED of fieldbus module for DeviceNet

LED State	Network Status
Off	Network interface offline/No network power
Flashing Red	I/O Connection(s) in timed-out state or other Recoverable Fault
Flashing Green	Device is online, but has no connections
Solid Red	Unrecoverable Fault
Solid Green	Online with established connections
Flashing Green/Red	Device is in Communication Fault state and responding to an Identify Communication Faulted Request

Table 5-5. Operation of Network Specific LED of fieldbus module for Profibus-DP

LED Status	Network Status
Off	Network interface disabled due to CLOSED interface or Client IO_FAULT
Flashing Red	Baud Rate not 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 Inspection of fieldbus module – CC-Link

There are 4 LED which are mounted in CC-Link fieldbus module. Table 6-6 shows the operation status.

Table 5-6. Operation status according to LED of CC-Link fieldbus module

○:ON ●:OFF ◎:BLINK

RUN	ERR	SD	RD	Operation
○	◎	◎	○	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
○	◎	◎	○	Responds 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.

