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WARNING

INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED INSTALLATION PERSONNEL AND MUST CONFORM TO ALL NATIONAL AND LOCAL CODES

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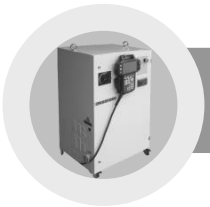

Hi5a Controller Function Manual

BD525 DeviceNet Master, Slave

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1 Overview

1.1. Prior knowledge

The users should have the following knowledge to understand this manual well.

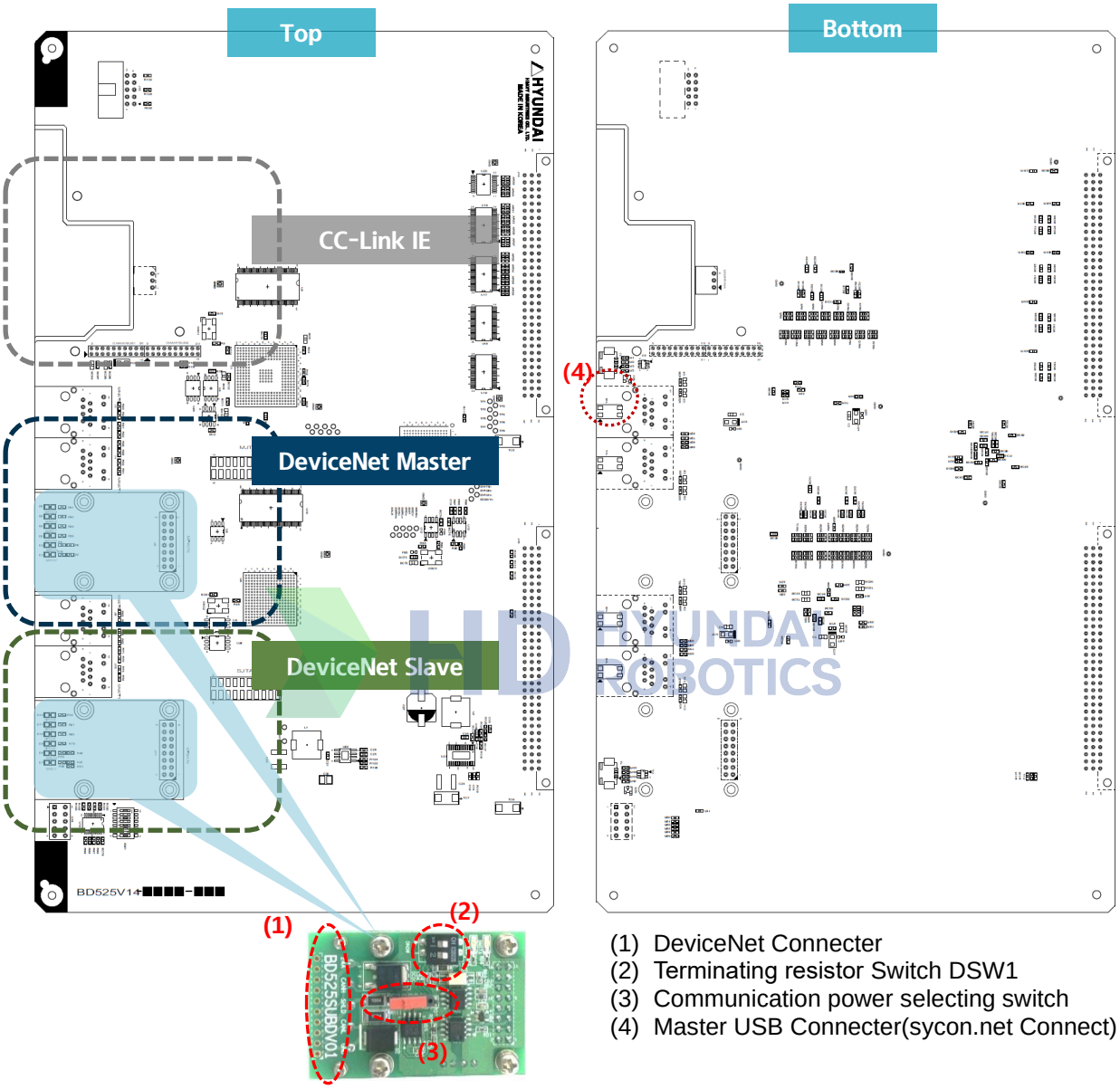
- Method to use the Hi5a robot controller
- How to use the embedded PLC of the Hi5a robot controller
- How to install and utilize the DeviceNet network

※ The master and the slave of the BD525 DeviceNet can be supported in the Hi5a controller main software of **V40.12-00** or higher.

1.2. Reference materials

- DTM for Hilscher DeviceNet Master Devices
- Generic Slave DTM for DeviceNet Slave Devices
- netDevice and netProject

1.3. Appearance of the BD525 board



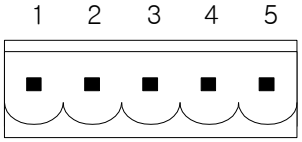
(1) DeviceNet Connecter
(2) Terminating resistor Switch DSW1
(3) Communication power selecting switch
(4) Master USB Connecter(sycon.net Connect)

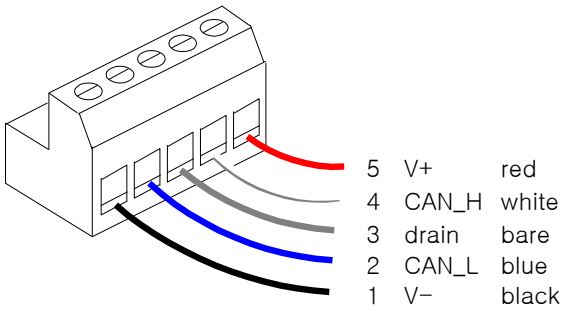
Figure 1.1 BD525 communication board

As the BD525 multi-protocol communication board can support industrial communication of up to three channels, including a CC-Link IE Field slave, a fieldbus or real-time Ethernet master, and a slave, at the same time. The board will be supplied after being assembled to include necessary channels.

To use the master and the slave of the BD525 DeviceNet, the sub-board (BD525SUBD) for the DeviceNet access should be mounted in piggyback form.

(1) DeviceNet Connecter





Male connector of the BD525 board side Female connector of the cable side

Figure 1.2 Connection of the BD525 DeviceNet cable

(2) Terminating resistor Switch DSW1

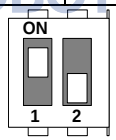
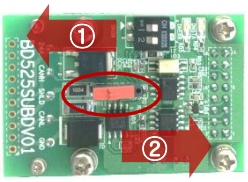
Pin number		**1**	2
Setting	**OFF**	Terminating resistor **OFF**	Not in use
	ON	Terminating resistor **ON**	Not in use
Appearance of the switch			

Table 1-1 BD525SUBD Terminal resistor setting switch

(3) Communication power selection switch JP1

Always place JP1 in position ①, as shown in the following figure, and supply communication power (24VDC) from the outside. **JP1 can be removed from the board without pre-notification.**



① Position ( ):Use of external power for communication (default)
② Position ( ):Use of internal power for communication

Figure 1.3 BD525SUBD Communication power selection switch

(4) Master USB Connecter(Sycon.net Connect)

For setting the network of the master of the BD525 DeviceNet, the Sycon.net software will be used. The set configuration information will be downloaded through the USB port. The master USB connector will be used for the USB connection between the PC with Sycon.net installed and the BD525 board.

1.4. BD525 DeviceNet Master specification

Communication method	Bit Strobe COS(Change Of State) Cyclic Poll
Communication speed	125Kbps, 250Kbps, 500Kbps
Maximum count of slaves to be connected	63
Communication cable	DeviceNet Standard cable
Maximum size of input data	120 Bytes
Maximum size of output data	120 Bytes
Mapping of input and output data	FB1

Table 1-2 BD525 DeviceNet Master specification

1.5. BD525 DeviceNet Slave specification

Communication method	Bit Strobe COS(Change Of State) Cyclic Poll
Communication speed	125Kbps, 250Kbps, 500Kbps
Node number	0~63
Communication cable	DeviceNet Standard cable
Maximum size of input data	120 Bytes
Maximum size of output data	120 Bytes
Mapping of input and output data	FB3

Table 1-3 BD525 DeviceNet Slave specification

1.6. DeviceNet Specification for connection

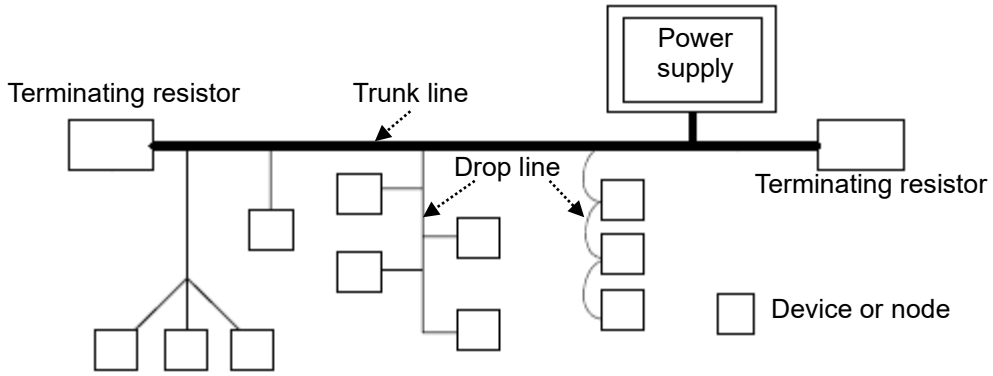


Figure 1.4 DeviceNet Configuration of the network

(1) Terminating resistor

- If a termination resistor embedded in the BD525SUBD board is to be used (DSW1 Pin1 On), do not install an additional external termination resistor.

Figure 1.5 BD525SUBD Terminating resistor

- If a termination resistor embedded in the BD525SUBD board is not to be used (DSW Pin1 Off), install a resistor of 121 Ω (1%, 1/4 W), as shown in the following figure.

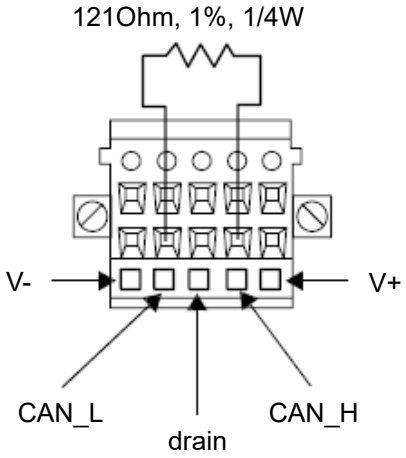


Figure 1.6 Installation of an external termination resistor

(2) Maximum length of the trunk line of each type

Communication speed	Flat cable	Thick cable	Mid cable	Thin cable
125k bit/s	420m	500m	300m	100m
250k bit/s	200m	250m	250m	100m
500k bit/s	75m	100m	100m	100m

Table 1-4 Length of the trunk line of the DeviceNet

(3) Length of the drop line

Communication speed	Cumulative drop line length
125k bit/s	156m
250k bit/s	78m
500k bit/s	39m

Table 1-5 DeviceNet Length of the drop line

(4) Ground

- Ground the **V conductor, shield, and drain lines at one location** to prevent ground loops. If possible, **ground at a physical central location** of the network to maximize the ground effects and minimize the effects of the external noise.
- When more than two power supplies are to be used, **V+ should be cut off between the power supplies.**

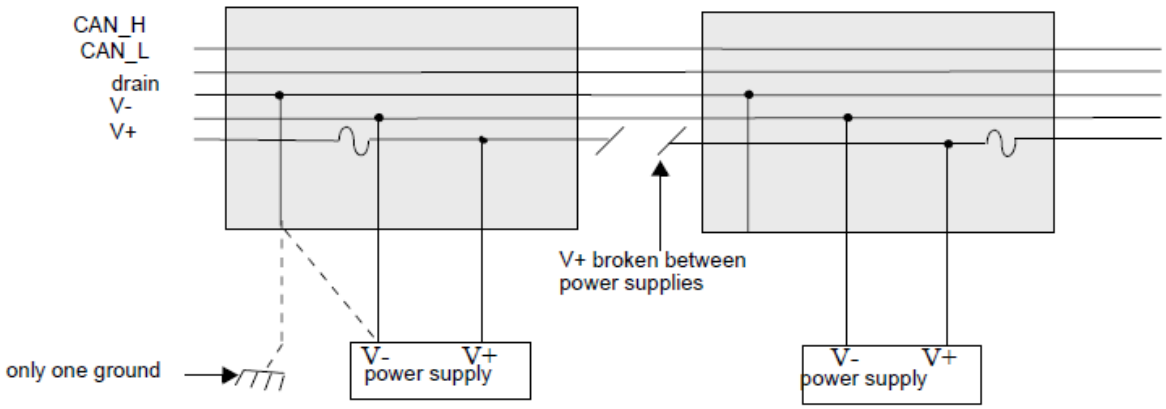


Figure 1.7 DeviceNet Installation

1.7. BD525 EDS File

The BD525 DeviceNet EDS file can be downloaded from the website provided below.
Click **"FieldbusConfig"** on the website, and download and decompress the file. After that, you can use the EDS file in the BD525 DeviceNet EDS folder.

- Korean : https://www.hyundai-robotics.com:5008/customer/customer4_view.html?no=89
- English : https://www.hyundai-robotics.com:5008/english/customer/customer4_view.html?no=89
- Chinese: https://www.hyundai-robotics.com:5008/chinese/customer/customer4_view.html?no=89

1.8. Sycon.net Installation

The network setting software for the master of the BD525 DeviceNet is Sycon.net. Click **"Sycon.net"** on the website, and download and decompress the file. After that, you need to install Sycon.net and the USB driver.

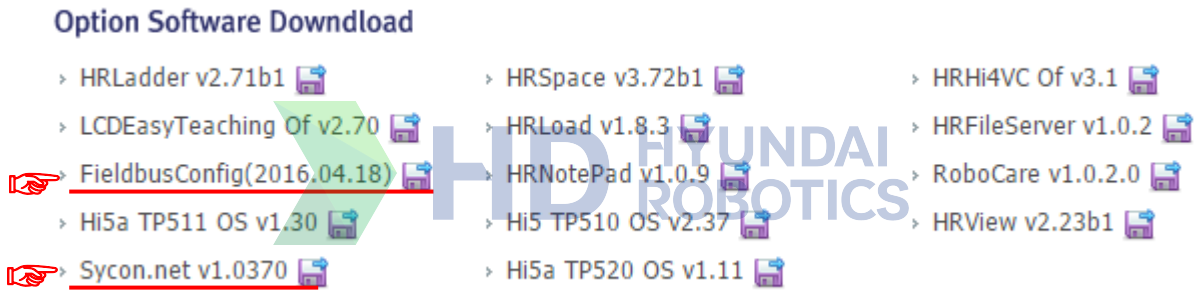


Figure 1.8 Downloading of the EDS file and Sycon.net

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BD525 DeviceNet Master

2.1. BD525 DeviceNet Master setting

To set the network of the master of the BD525 DeviceNet, execute according to the following procedures. Sycon.net and the USB driver must be installed first before setting the DeviceNet network.

(1) Install the EDS file of the slave unit that needs to be installed to the master of the BD525 DeviceNet.

- Execute Network > Import Device Description

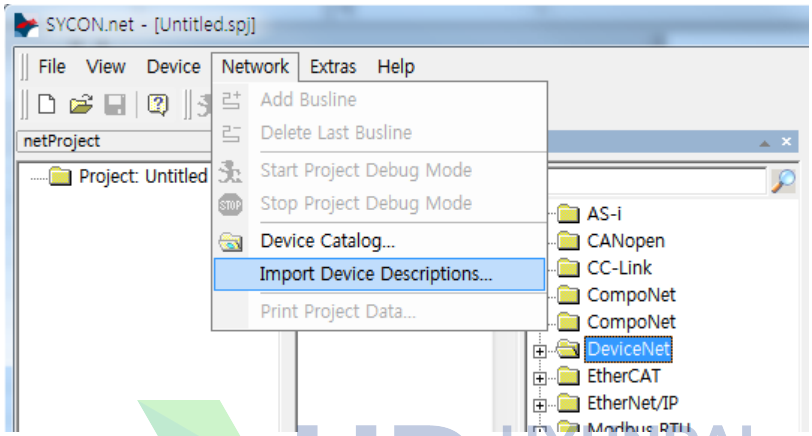

Figure 2.1 Sycon.net Import Device Description Menu

- In the **Import Device Description** dialog box, select "DeviceNet EDS" as the file type. After that, select the EDS file of the system that needs to be installed, and click the Open button.

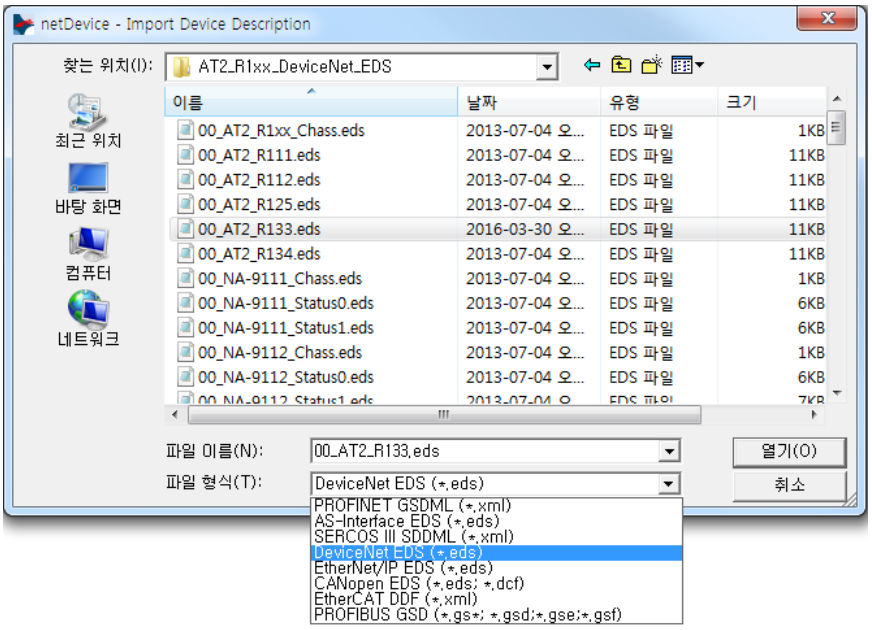

Figure 2.2 Installation of the Sycon.net EDS file

(2) Configuration of the DeviceNet network (insertion of the master and the slave)

- In the Device Catalog window, drag and drop "NETX 100 DN/DNM" into the bus line of the DeviceNet window.

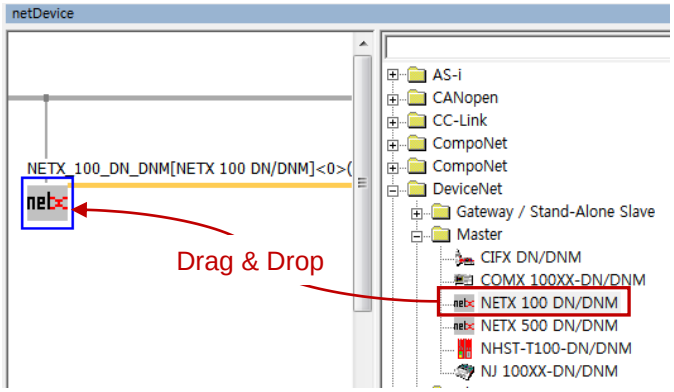

Figure 2.3 Insertion of the master

- In the Device Catalog window, drag and drop the slave units, which are to be connected, into the bus line. (This stage can be skipped when it is required to search the slaves connected to the master by scanning the network. Refer to (5) Slave Search.)

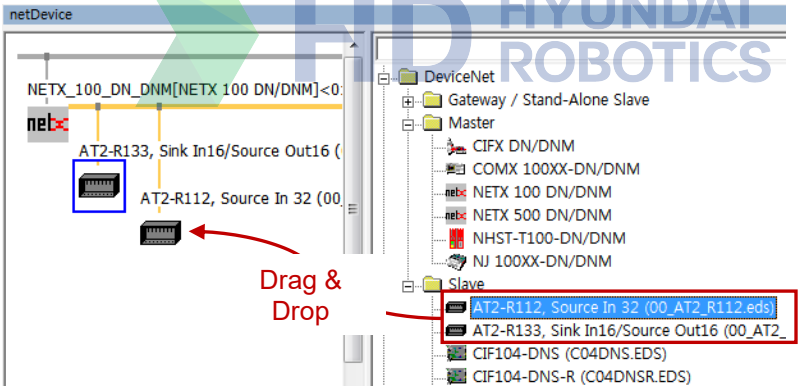

Figure 2.4 Insertion of the slaves

(3) USB-based connection between the BD525 board and Sycon.net

Connect the PC, in which Sycon.net is installed, and the BD525 board using a USB cable. If the USB driver is normally installed, you can see NETX 100 in Devices and Printer (in case of Windows 7).

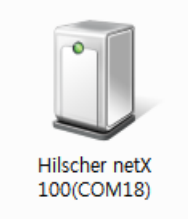

Figure 2.5 USB Device

(4) Setting of the master connection driver

Open the DTM setting dialog box by double-clicking the master (NETX 100 DN/DNM) icon, and execute the following in sequence.

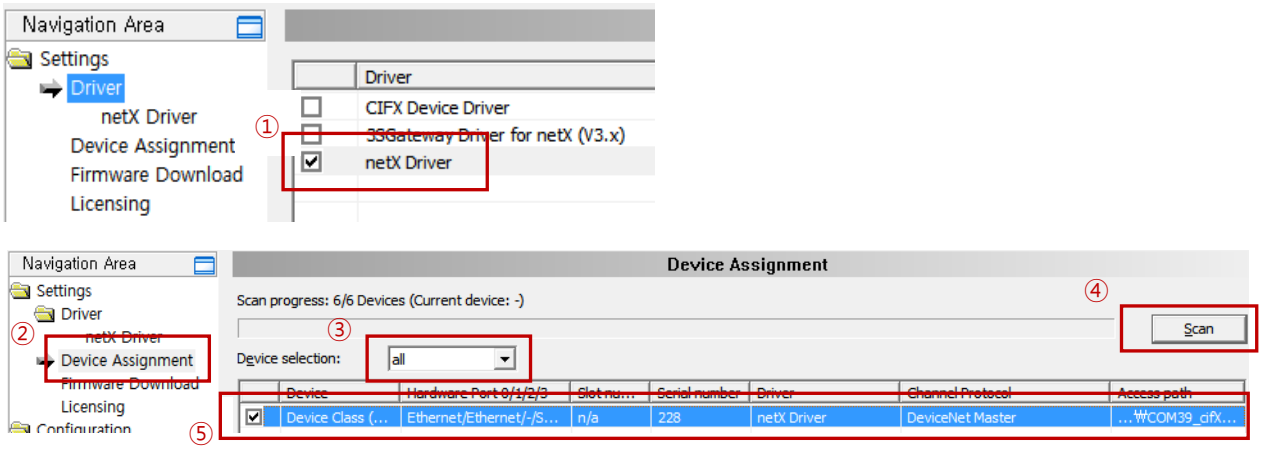

Figure 2.6 Setting of the master USB driver

① In Navigation Area, select **Setting > Driver**. Then, check the check box of the **NETX Driver** in the list of drivers on the left before clicking the Apply button.

② In Navigation Area, select **Setting > Device Assignment**.

③ In the Device Assignment screen on the right, change the **Device Selection** to **"All".**

④ Click the **Scan** button.

⑤ In the list of devices, check the check box of the **DeviceNet master** unit, and click the **Apply** button.

(5) Searching of a slave (Skip this stage when a slave was added manually in Stage (2).)

- Right-click the Master icon, and select the Connect menu.

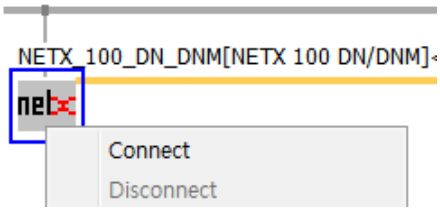

Figure 2.7 USB communication connection

- When the USB connection is normal, the Master icon will turn green.

- Right-click the Master icon, and select the **Network Scan** menu.

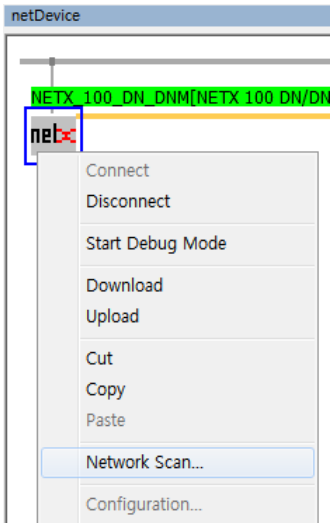

Figure 2.8 Scanning of the network

- Of the searched slave nodes, change the Action of the devices that need to be added to the DeviceNet network to "Add," and click the Create Devices button.
  - Action ➔ Add : Adding a new node
  - Action ➔ Skip: No additional nodes.
  - Action ➔ Replace: Changing to the searched node

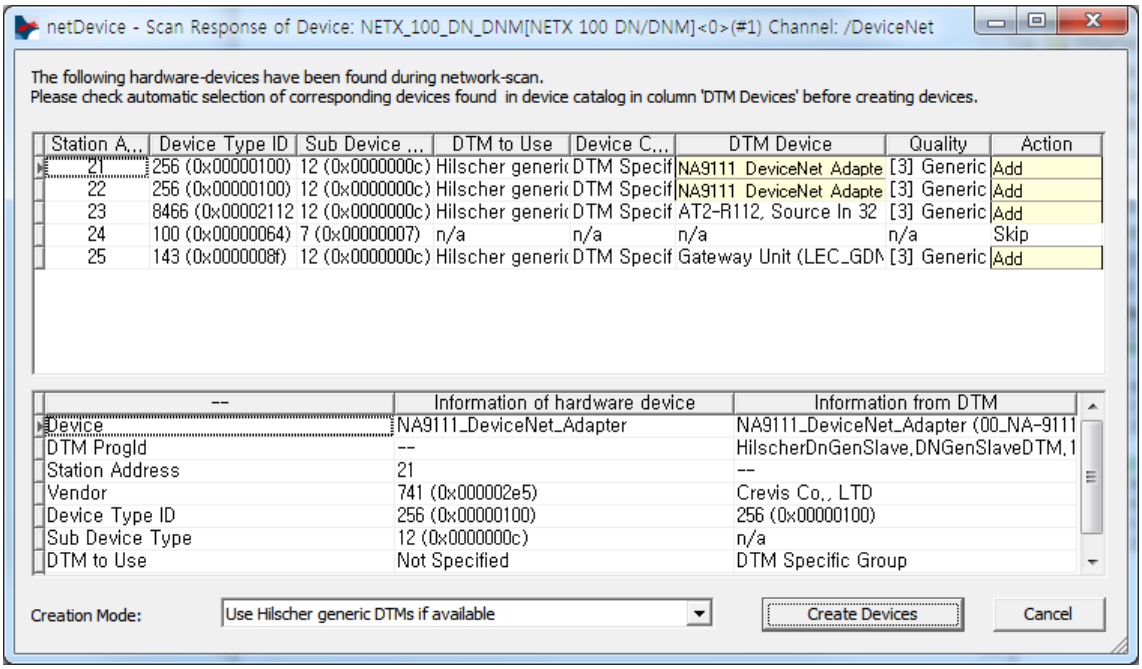

Figure 2.9 Dialog box for the network scanning result

- In the dialog box asking whether to override the existing module setting, if you click the Y button, the relevant node will be added.

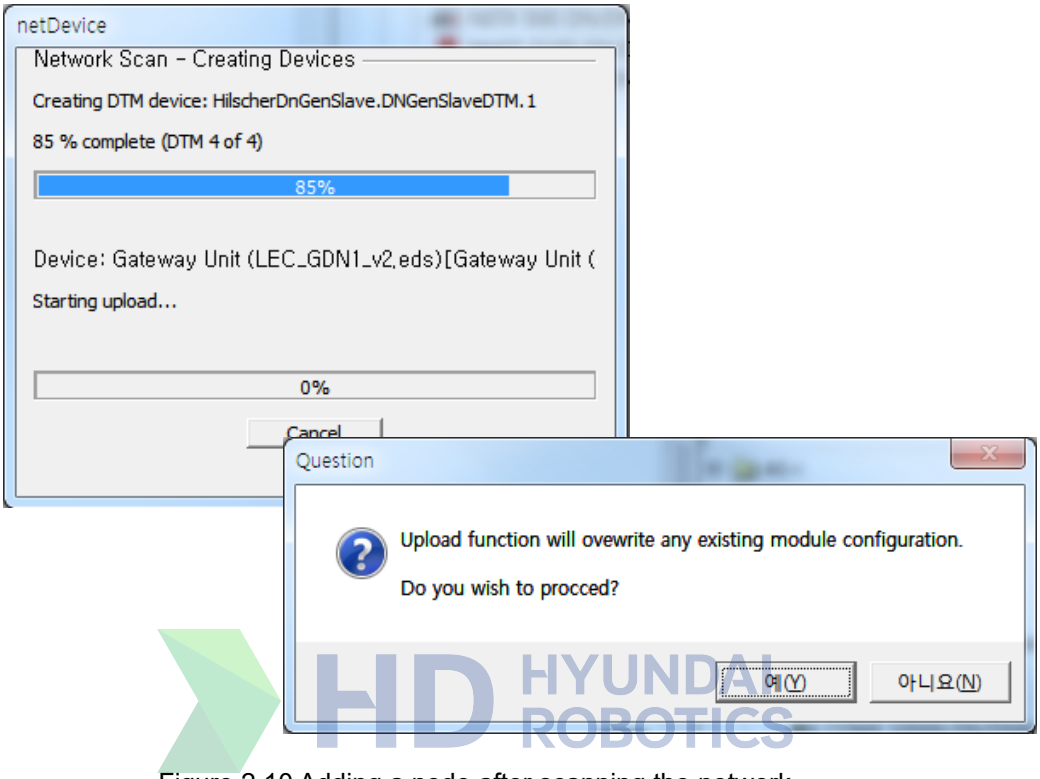

Figure 2.10 Adding a node after scanning the network

(6) Setting of the slaves

- To be set when it is required to change the settings of the slaves searched through the Network Scan function or to configure the DeviceNet network manually
- Double-click the Slave icon to open the setting dialog box.
- In Configuration of Navigation Area, select Connection, and select a method to connect the DeviceNet.

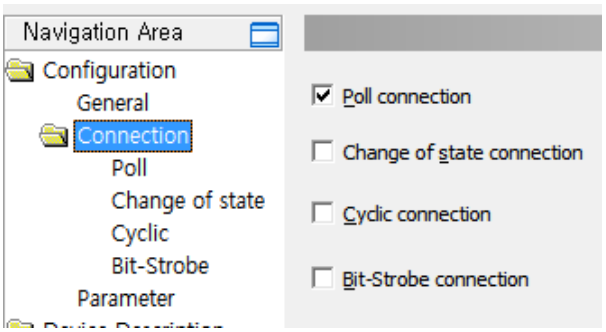

Figure 2.11 Setting of the method to connect the slave of the DeviceNet

- In Configuration of Navigation Area, set the sizes of the input and output data, as well as the items related to the cycle of communication, for the set connection method.

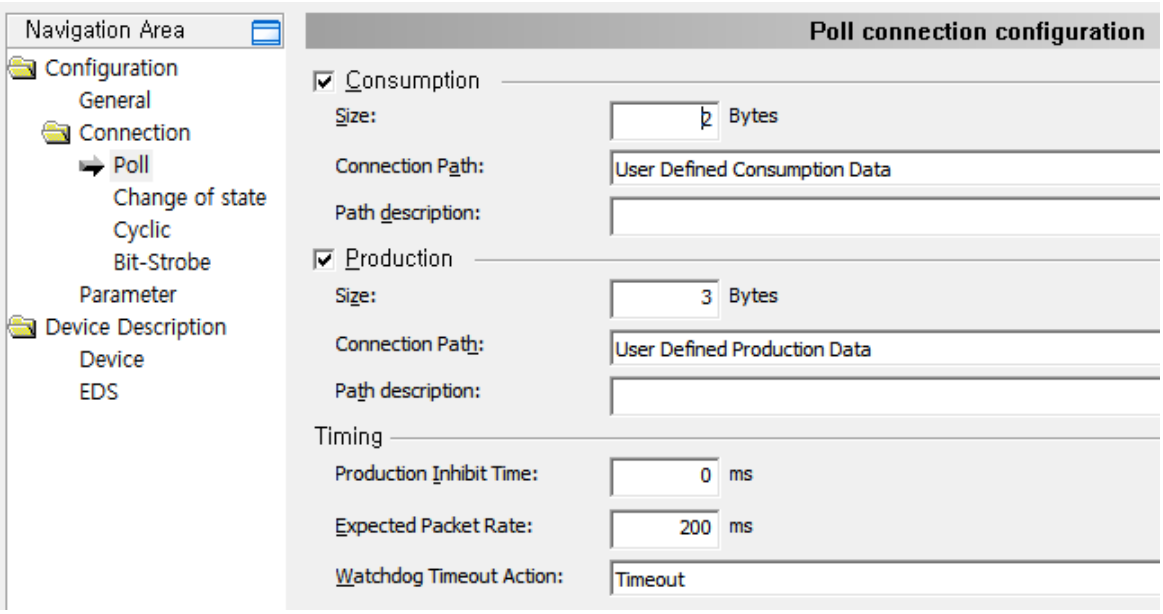

Figure 2.12 Setting of the connection of the slaves

※ Refer to the **Generic Slave DTM for the DeviceNet Slave Devices** manual for details related to the setting of the slaves.

(7) Setting of the master

- Open the Settings dialog box by double-clicking the Master icon..

- BUS parameters, such as the MAC ID, communication speed, and options for handling errors, can be set by selecting **Configuration > BUS Parameters** Navigation Area.

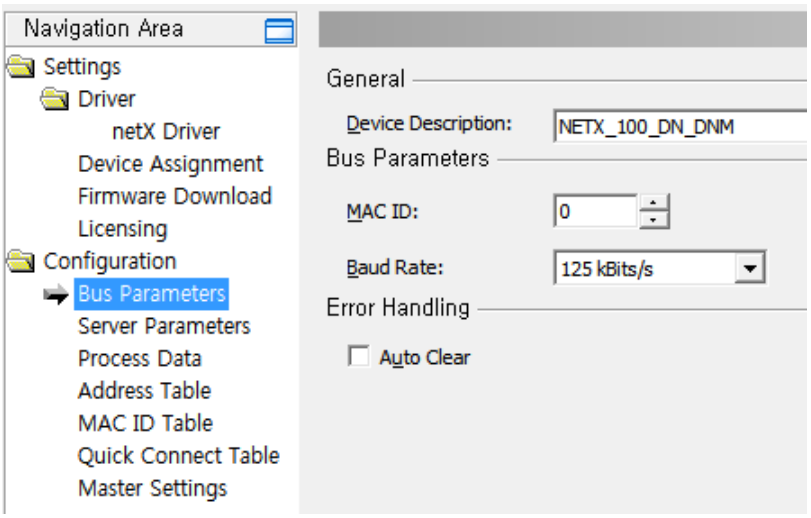

Figure 2.13 Setting of the master

Bus Parameter		Description
MAC ID		This is the address of the master of the DeviceNet. (Allowable scope: 0~63)
Baud Rate		This is the communication speed of the master of the DeviceNet. (Allowable scope: 125Kbps, 250Kbps, 500Kbps)
Auto Clear	Check	If there is a communication error with any of the slaves, the operation of the master will shift from the Operate mode to the Clear mode, cutting off communication with all the slaves. It is required to reset to recover this state (either to reset or use the power of the controller . ON➔ OFF ➔ ON).
	Deactivation	Even when there is a communication error with any of the slaves, the operation of the master will stay in the Operate mode, maintaining communication with the connected slaves and the ones that have a communication problem.

Table 2-1 DeviceNet Master BUS Parameter

- **The BD525 DeviceNet master can play the roles of the master and the server (slave) at the same time.** To the use the function as a DeviceNet server, select **Configuration > Server Parameters** in Navigation Area, and select the I/O Connection information.

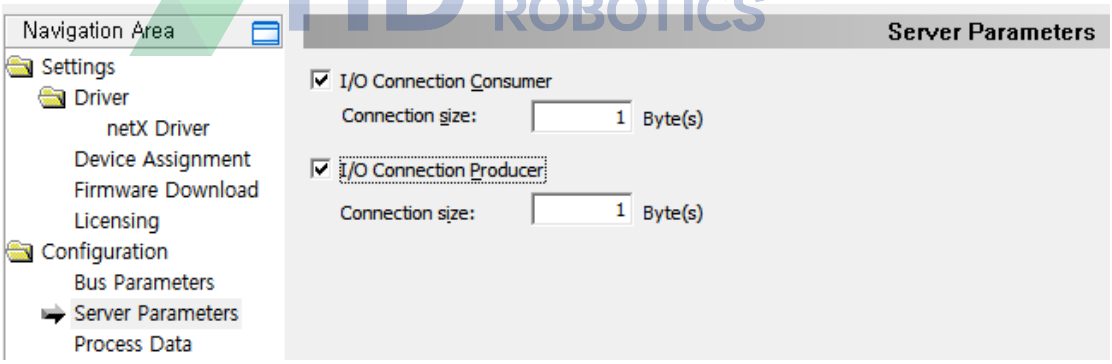

Figure 2.14 Setting of the master server parameter

- I/O Connection Consumer: Check the check box of the use, and input the size of the output data (consume connection size) as a slave by taking another master as reference. (0~255)
- I/O Connection Producer: Check the check box of the use, and input the size of the output data (consume connection size) as a slave by taking another master as reference. (0~255)

- The option to start communication can be selected by selecting the master of the Navigation Area **Settings** dialog box.

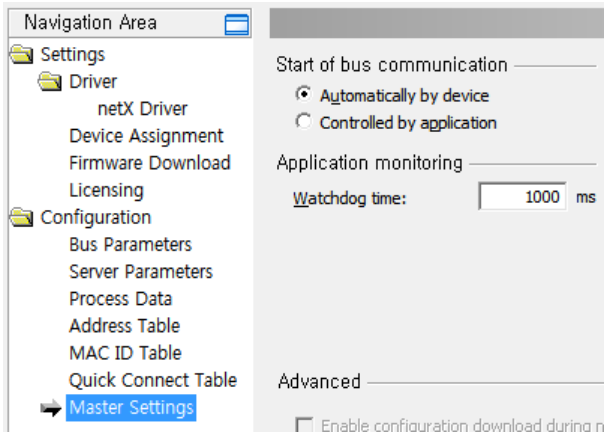

Figure 2.15 Master settings

Start of bus communication	Description
Automactically by device	Communication will start automatically when the initialization of the BD525 DeviceNet is completed.
Controlled by application	The main software of the controller performs controlling to start communication. **When this option is set, the Network Scan function cannot be used.**

Table 2-2 Option of starting communication

- The MAC ID Table, Process Data, Quick Connect Table, and others can be set. Refer to the **DTM of the DeviceNet Master Devices** manual for more details.

(8) Download

- When all settings are completed, connect by right-clicking the Master icon, and select Download.

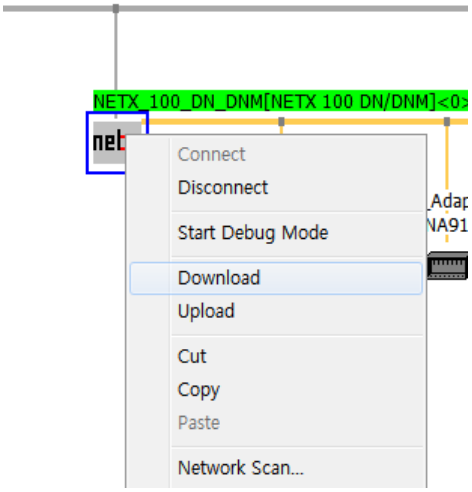

Figure 2.16 Setting of the master download

(9) Setting of the master of the BD525 DeviceNet of the robot controller

- Execute "[F2]: System" → "2: Control parameter" → "2: Input and output signals setting" → "15: BD525 fieldbus setting and diagnosis."

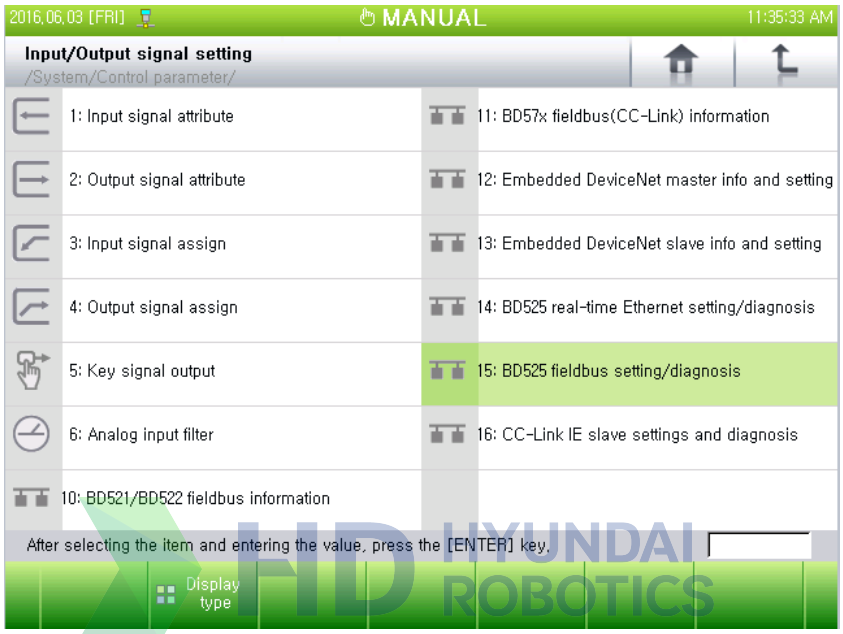

Figure 2.17 Menu of the BD525 fieldbus setting and diagnosis

- When there is an error with the sizes of the input and output data or with the communication, select the option of input handling, and click "[F6]: Apply" or "[F7]: Complete" button.

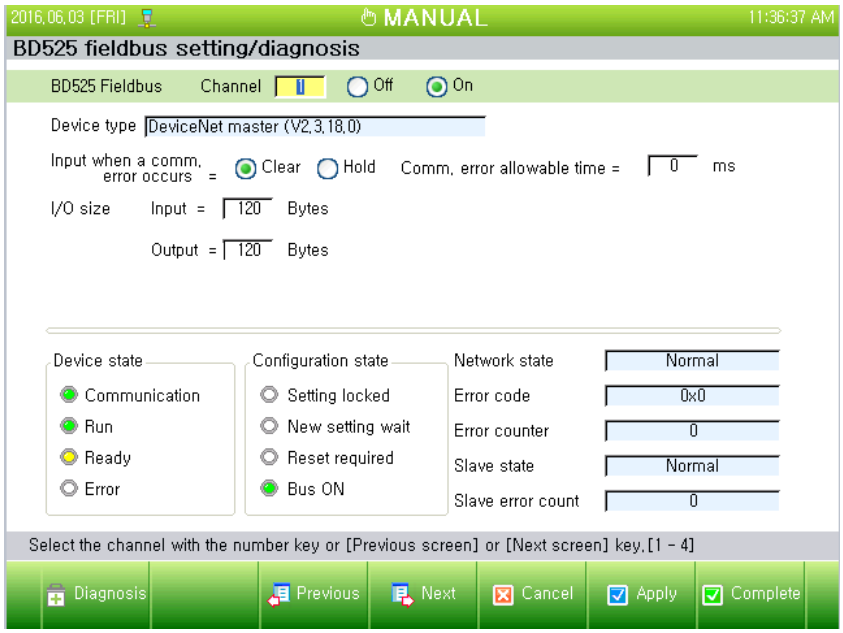

Figure 2.18 Setting and diagnosis of the BD525 fieldbus master

2.2. BD525 DeviceNet Diagnosis of the master

(1) Execute "[F2]: System" → "2: Control parameter" → "2: Input and output signals setting" → "15: BD525 fieldbus setting and diagnosis."

(2) Select "[F1]: Diagnosis." The communication status of the DeviceNet slave units can be checked.

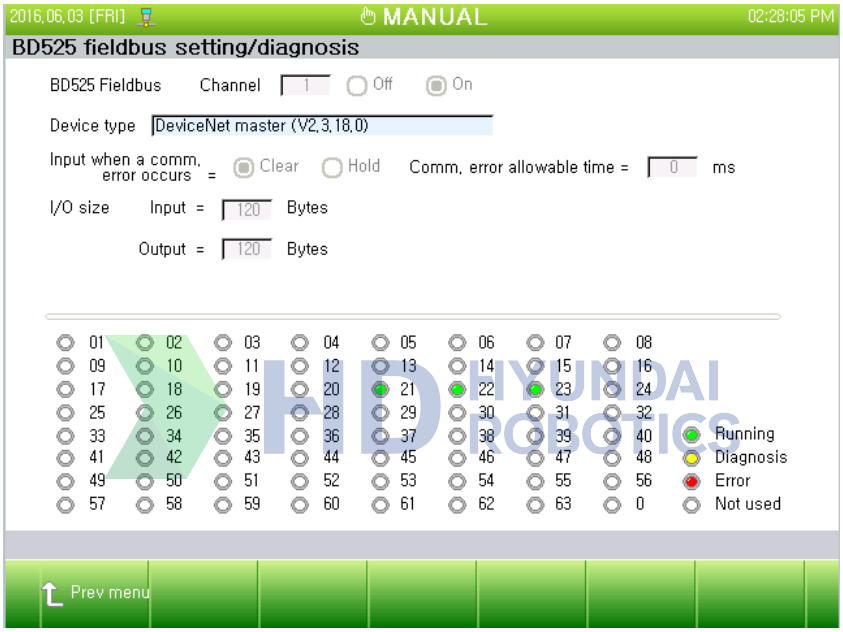

Figure 2.19 Diagnosis of the BD525 fieldbus master

2.3. Option of skipping the error/warning related to the communication of the robot controller

The robot controller can skip the error/warning of the BD525 DeviceNet through a special register (SP20) of the PLC embedded in the robot controller.

Special register	Value	Explanation
SP20	0(Off)	Activation of the error/warning related to communication (default)
	1(On)	Skipping the error/warning related to communication

Table 2-3 Embedded PLC SP20

2.4. BD525 status information of the PLC embedded in the robot controller

Relay	Explanation	Others
SW330	BD525 Master: Status of the devices *1)	
SW331	BD525 Master: Count of the set slaves	0~65535
SW332 ~ SW339	BD525 Master: List of the set slaves	List of bits
SW340	BD525 Master: Status of communication (lower 8bit)*2) BD525 Master: Status of the slaves (upper 8Bit)*3)	
SW341	BD525 Master: Count of the active slaves	0~65535
SW342 ~ SW349	BD525 Master: List of the active slaves	List of bits
SW350	BD525 Master: Accumulated count of communication errors	0~65535
SW351	BD525 Master: Count of the Error slaves	0~65535
SW352 ~ SW359	BD525 Master: List of the Error slaves	List of bits

Table 2-4 Embedded PLC SW Memory

*1) BD525 Master: Status of the devices
Bit 0: 1=Ready
Bit 1: 1=Running
Bit 2: 1=Bus On
Bit 3: 1=Configuration locked
Bit 4: 1=New Configuration
Bit 5: 1=Restart required
Bit 6: 1=Restart required Enable
Bit 7~31: Reserved

*2) BD525 Master: Status of communication
0=Unknown, 1=NOT Configured, 2=STOP, 3=IDLE, 4=OPERATE

*3) BD525 Master: Status of the slaves
0=UNDEFINED, 1=OK(No Fault), 2=FAILED(Errors with one or more slaves)

2.5. BD525 DeviceNet Master IO Monitoring

Execute according to the following procedures to monitor the I/O data of the BD525 DeviceNet.

(1) Select "[F1]: Service" → "1: Monitoring" → "3: Fieldbus signal."

(2) For inputting, select "1: FB1 fieldbus input," and for outputting, select "2: FB1 fieldbus output."

(3) The I/O of the BD525 DeviceNet master can be monitored.

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BD525 DeviceNet Slave

3.1. BD525 DeviceNet Slave Setting

To use a slave of the BD525 DeviceNet, it is required to set the bus parameter of the robot controller.

(1) Execute "[F2]: System" → "2: Control parameter" → "2: Input and output signals setting" → "15: BD525 fieldbus setting and diagnosis."

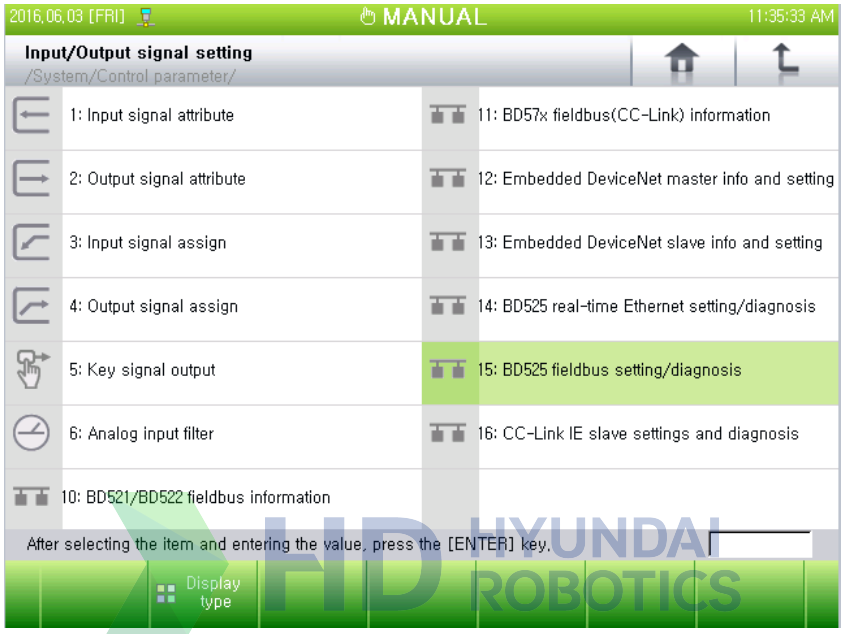

Figure 3.1 Menu of the BD525 fieldbus setting and diagnosis

(2) Channel #3 is for the DeviceNet slaves.
Input "3" in the channel input box, and press "Enter" or use the "[F3]: Previous" or "[F4]: Next" button to move to channel #3.

(3) Set the information, such as the use, station number, input following a communication error, I/O size, and communication speed, and press "[F6]: Apply" or "[F7]: Complete."

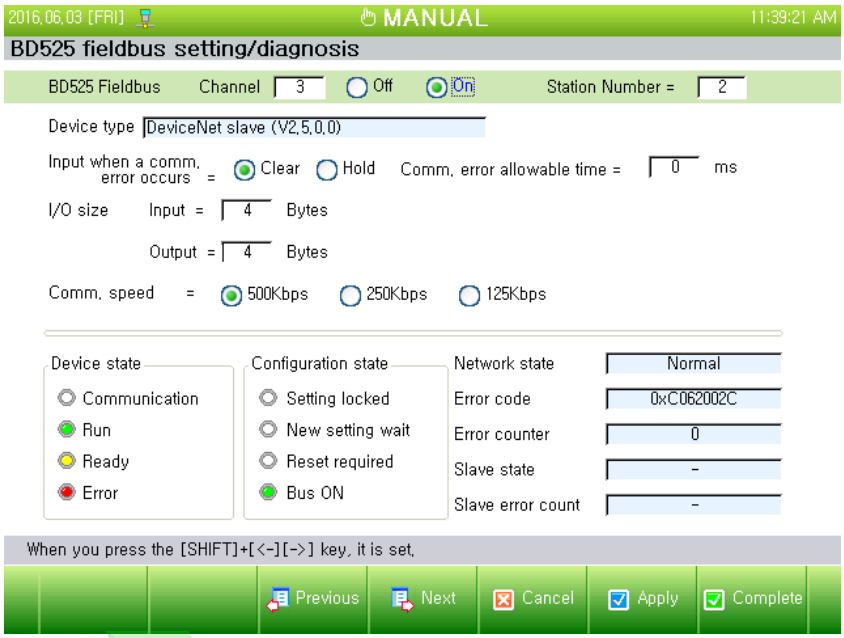

Figure 3.2 Screen for setting the BD525 DeviceNet slaves.

- Use
  - Set it as "On" to use the communication with a DeviceNet slave.
- Input following a communication error
  - This is an option for handling the input data (FB3.X) when there is a communication error. When it is set as "Clear," all the data will be cleared to 0 when a communication error occurs. If it is set as "Hold," the last effective value will be maintained when a communication error occurs.
- Station number
  - The effective range of the DeviceNet MAC ID is 0–63.
- Time allowed for a communication error
  - Within the set time, a communication error will not generate an error/warning message. (0~65535 ms)
- I/O size
  - Input: Set the size of the input data (FB3.Y) by taking the master as reference (0–120).
  - Output: Set the size of the output data (FB3.X) by taking the master as reference (0–120).
- Communication speed
  - Set the speed to match the communication speed of the master.

Once the setting is changed, you should click the "[F6]: Apply" or "[F7]: Complete" button to reflect/save the change into the controller. In addition, if the setting is changed while the use is set as "On," the changed condition will be reflected after the device is reset or the controller is rebooted.

3.2. Option of skipping the error/warning related to the communication of the robot controller.

The robot controller can skip the error/warning of the BD525 DeviceNet through a special register (SP21) of the PLC embedded in the robot controller.

Special register	Value	Explanation
SP21	0(Off)	Activation of the error/warning related to communication (default value)
	1(On)	Activation of the error/warning related to communication

Table 3-1 Embedded PLC SP21

3.3. Monitoring of the I/O of the BD525 DeviceNet slave

To monitor the I/O of the BD525 DeviceNet slave, execute according to the following procedures.

(1) Select "[F1]: Service" → "1: Monitoring" → "3: Fieldbus signal."

(2) For inputting, select "5: FB3 fieldbus input," and for outputting, select "6: FB3 fieldbus output."

(3) The I/O of the BD525 DeviceNet slave can be monitored.

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