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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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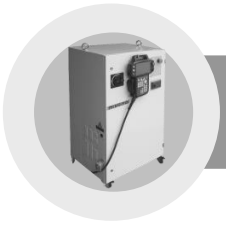
Hi5aEC230621FMEN2



Hi5a Controller Function Manual

BD525 EtherCAT

Printed in Korea - Jun. 2023. 2nd Edition

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1 Overview

1. Overview

1.1. Prior knowledge

Understanding this manual requires the following knowledge.

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

1.2. Reference materials

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

1.3. Appearance of the BD525 board

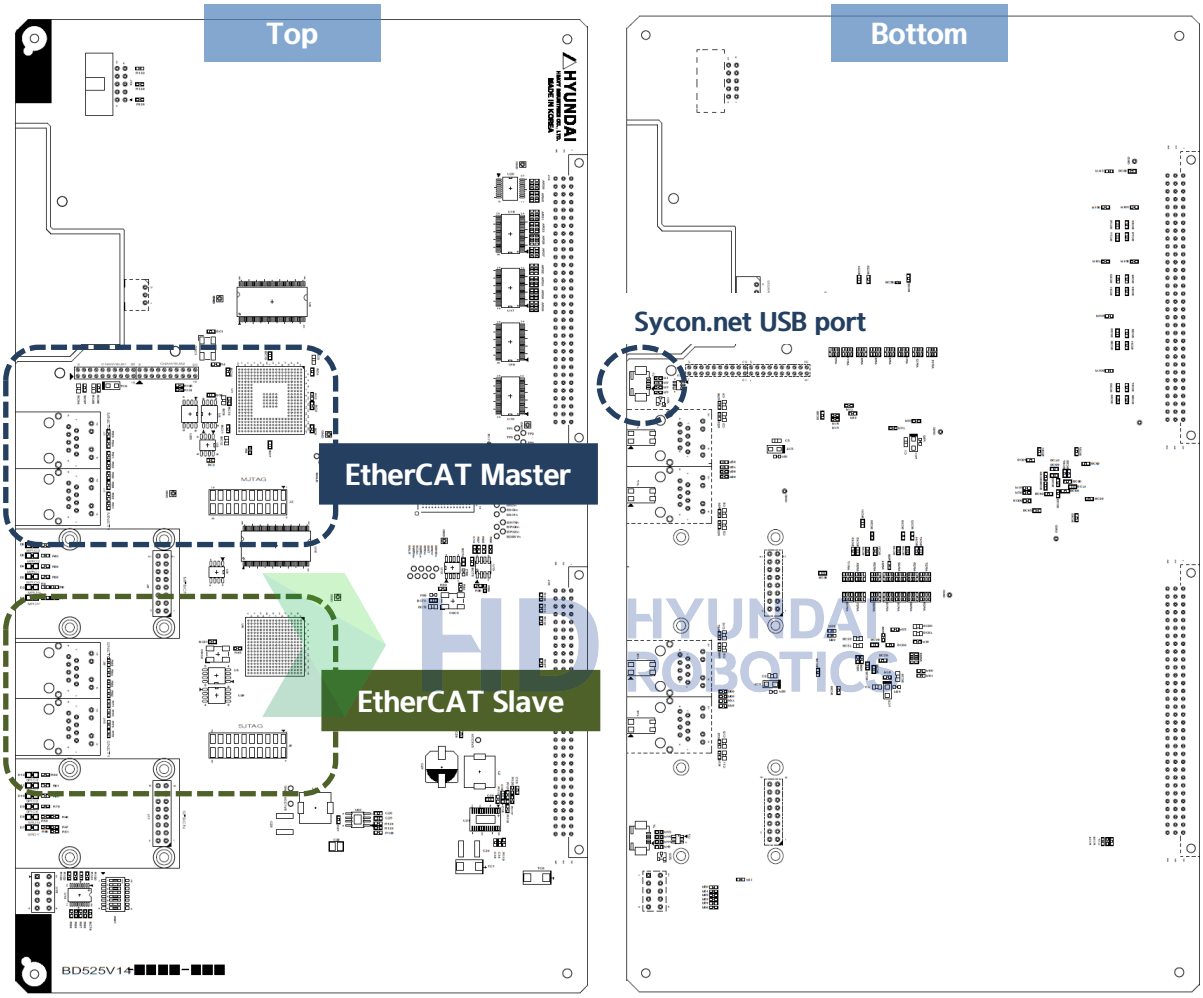

Figure 1.1 BD525 communication board

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.

BD525 has 2 RJ45 connectors for EtherCAT Master and Slave communications with a USB connector in the back to access the EtherCAT master setting software, Sycon.net.

1.4. BD525 EtherCAT Master specification

Communication speed	100Mbps Full Duplex
Maximum count of slaves to be connected	388
Minimum communication cycle	250 us
Maximum size of input data	120 Bytes
Maximum size of output data	120 Bytes
Input and output data mapping	FB1

Table 1-1 BD525 EtherCAT Master specification

1.5. BD525 EtherCAT Slave specification

Communication speed	100Mbps Full Duplex
Maximum size of input data	120 Bytes
Maximum size of output data	120 Bytes
Input and output data mapping	FB3

Table 1-2 BD525 EtherCAT Slave specification

1.6. BD525 EtherCAT Slave ESI File

The BD525 EtherCAT Slave ESI 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 ESI file in the BD525 EtherCAT Slave ESI folder.

- http://www.hyundai-robotics.com/www/product/product6.html

1.7. Sycon.net Installation

The network setting software for the master of the BD525 EtherCAT 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.

제품명	설명	File (down load)
FieldbusConfig	Device description files for fieldbus configuration(EDS, GSD, GSDML, CSP, ESI)	FieldbusConfig(2016.04.18)
Hi5 TP510	The operating system of Hi5 teach pendant TP510	Hi5 TP510 OS v2.37
Hi5a TP511	The operating system of Hi5a teach pendant TP511	Hi5a TP511 OS v1.32
Hi5a TP520 OS	The operating system of Hi5a teach pendant TP520	Hi5a TP520 OS v1.15
HRFileConv	Convert Hi4 job program to Hi5 job program.	HRFileConv v1.00b1
HRFileServer	Remote file server for PC responding HI5 LOADF/SAVEF statement	HRFileServer v1.0.2
HRHi4VC	Virtual robot controller oprating in PC, useful for robot operation trainning Controller	HRHi4VC Of v3.1
HRLadder	Up/Down load, editing software of PLC program between PC & Robot Controller	HRLadder v2.73b1
HRLoad	Check whether it is overweight or not, based on the weight of the additive load, the center of mass, the moment of inertia.	HRLoad v1.8.4.2
HRNotePad	Text editor for JOB file supports syntax coloring and source folding.	HRNotePad v1.0.9

제품명	설명	File (down load)
HRpal	Hyundai Robot SafeSpace configuration utility	HRpal v2.0.0
HRpalware	Hi5a applet which can create palletizing loading pattern and job program	HRpalware v1.0.0
HRSafeSpace	Hyundai Robot SafeSpace configuration utility	HRSafeSpace v1.1.3
HRSpace	3D Simulation, Off-line Programming, Virtual Hi5 robot Controller	HRSpace v3.75b1
HRView	File transfering software between PC & Robot Controller	HRView v2.23b1
LCDEasyTeaching	Command Execution, Teaching, Copy / Shift of Teaching data	LCDEasyTeaching Of v2.70
RoboCare	Hi5/Hi5a applet for Hyundai Robot mechanism check-out support	RoboCare v1.0.2.0
Sycon.net	Configuration software for BD525 fieldbus master	Sycon.net v1.0400

Figure 1.2 Downloading of the ESI file and Sycon.net

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2 BD525 EtherCAT Master

2.1. BD525 EtherCAT Master setting

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

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

- Execute **Network > Import Device Description**

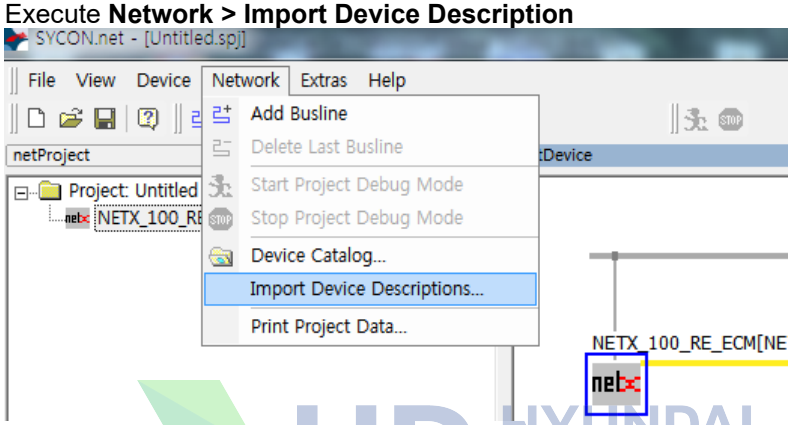

Figure 2.1 Sycon.net Import Device Description Menu

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

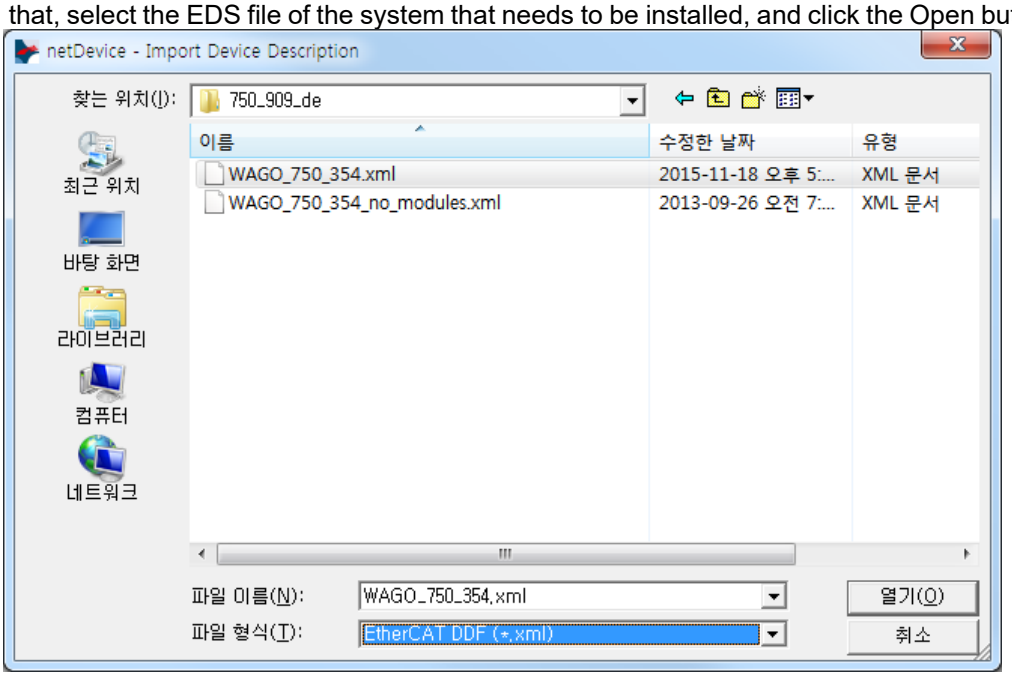

Figure 2.2 Installation of the Sycon.net ESI file

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

- In the Device Catalog window, drag and drop "**NETX 100 RE/ECM**" into the bus line of the netDevice window.

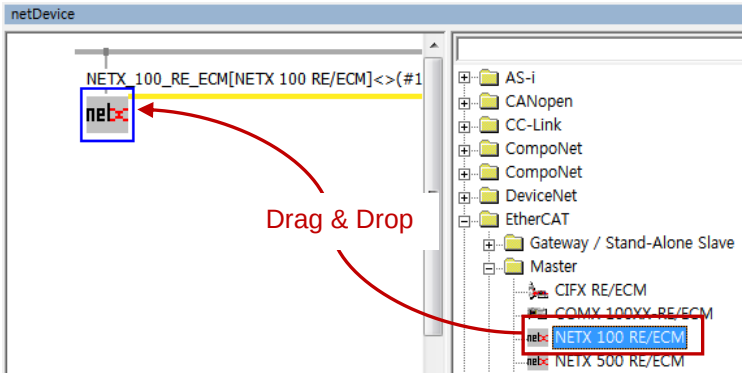

Figure 2.3 Insertion of the master

- 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.)

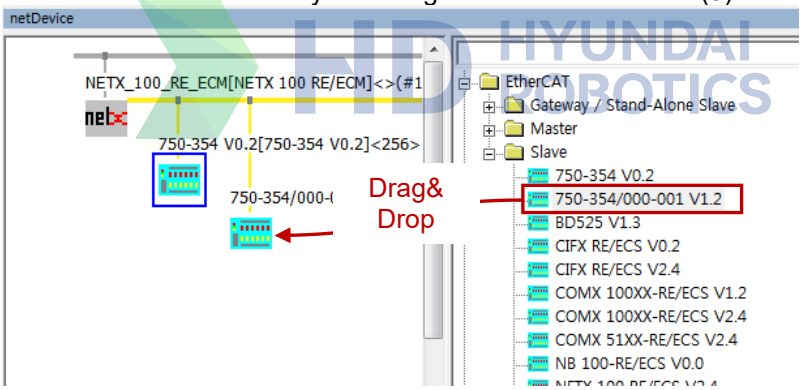

Figure 2.4 Insertion of the slaves

(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).

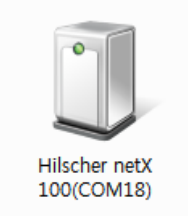

Figure 2.5 USB Device

(4) Setting of the master connection driver

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

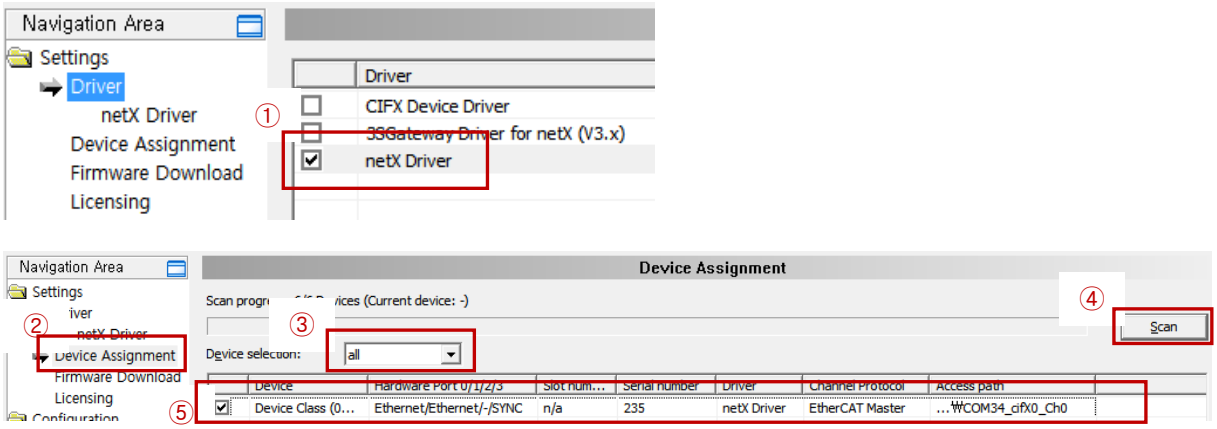

Figure 2.6 Setting of the master USB driver

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 **EtherCAT 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.

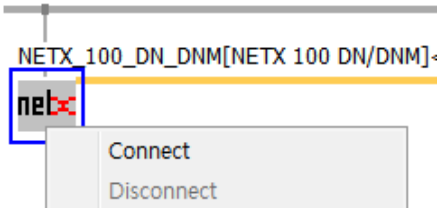

Figure 2.7 USB communication connection

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

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

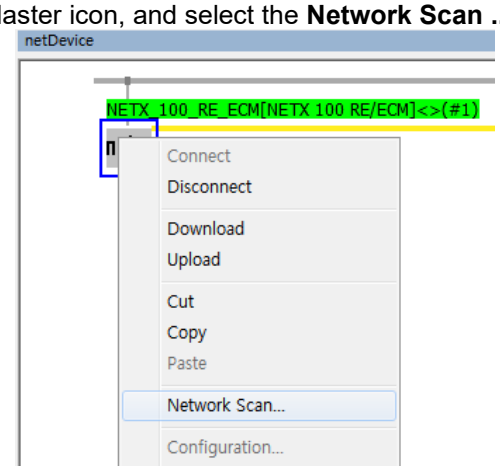

Figure 2.8 Scanning of the network

- Of the searched slave nodes, change the Action of the devices that need to be added to the EtherCAT 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

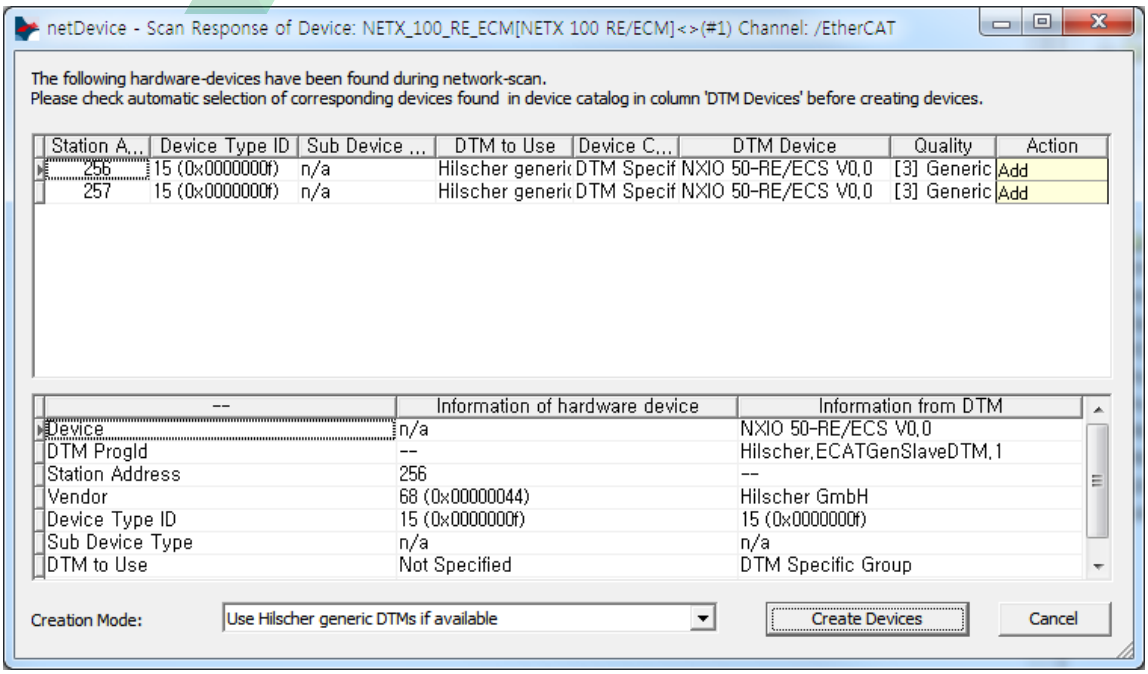

Figure 2.9 Dialog box for the network scanning result

(6) Setting of the slaves

- To change the slave settings, double-click the Slave icon to open the setting dialog box.
- Change the slave settings including Process Data, and then click the Apply button.

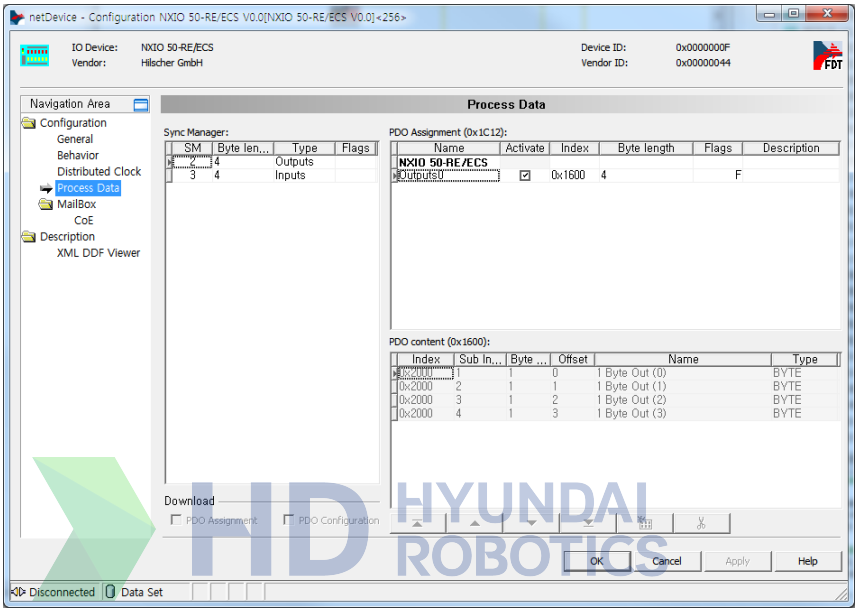

Figure 2.10 Setting of the slaves

(7) Setting of the master.

- In the off-line state, double-click the Master icon to open the setting dialog box.
  (In the online state, right-click it and then select the Disconnect menu to change to the off-line mode.)

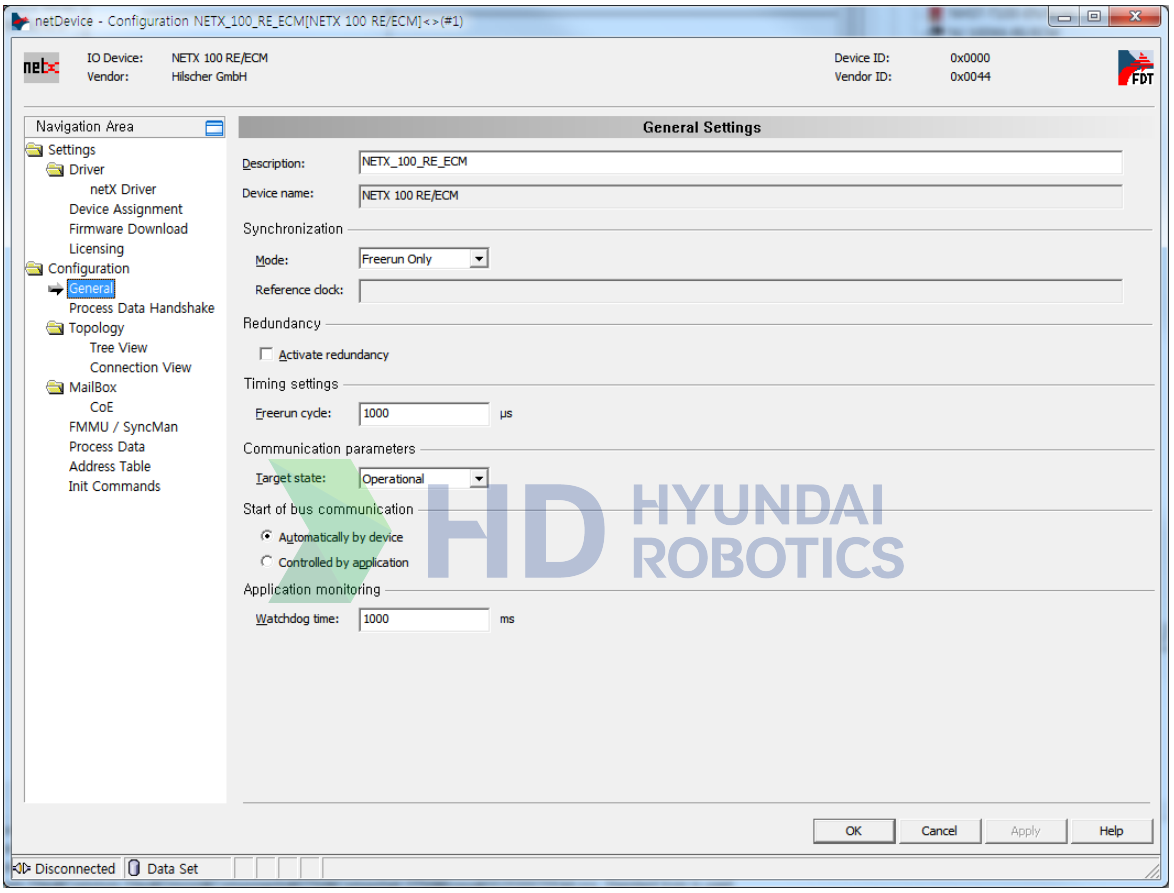

Figure 2.11 Setting of the master

(8) Download

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

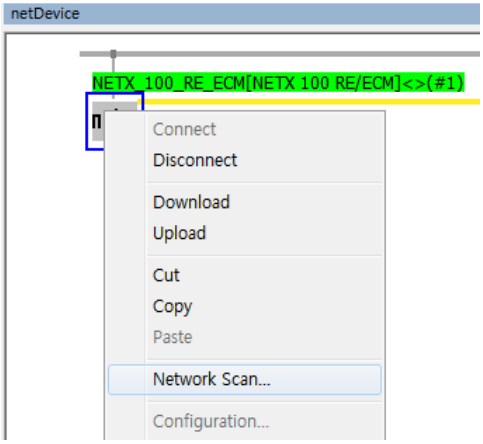

Figure 2.12 Setting of the master download

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

- Execute 『[F2]: System』 → 『2: Control parameter』 → 『2: Input/Output signal setting』 → 『14: BD525 Real-time Ethernet setting and diagnosis』.

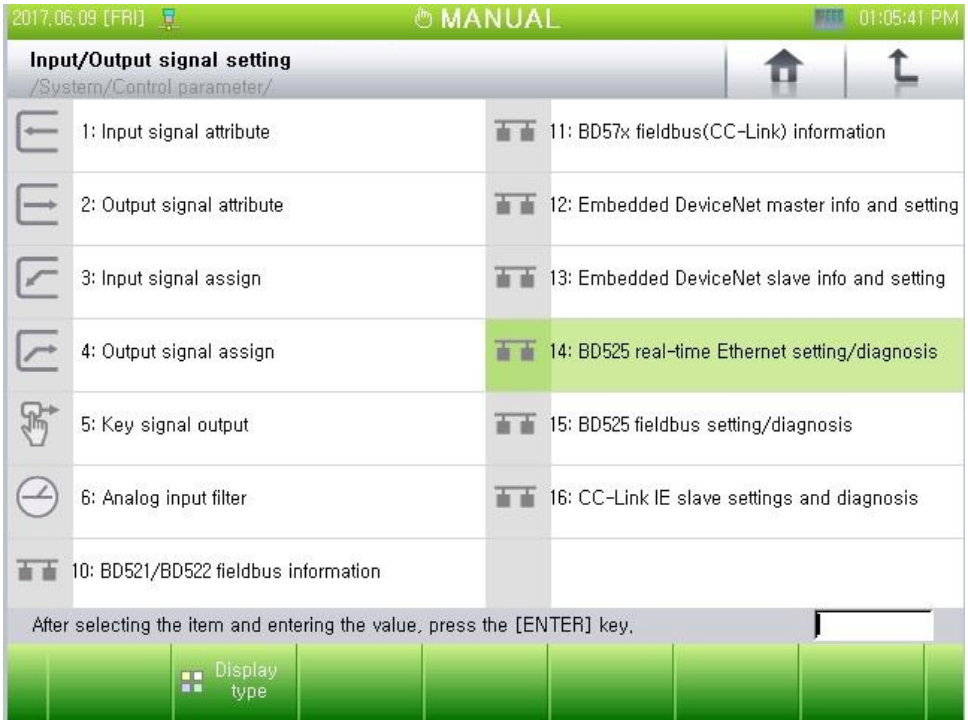

Figure 2.13 Menu of the BD525 Real-time Ethernet setting and diagnosis

- 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.

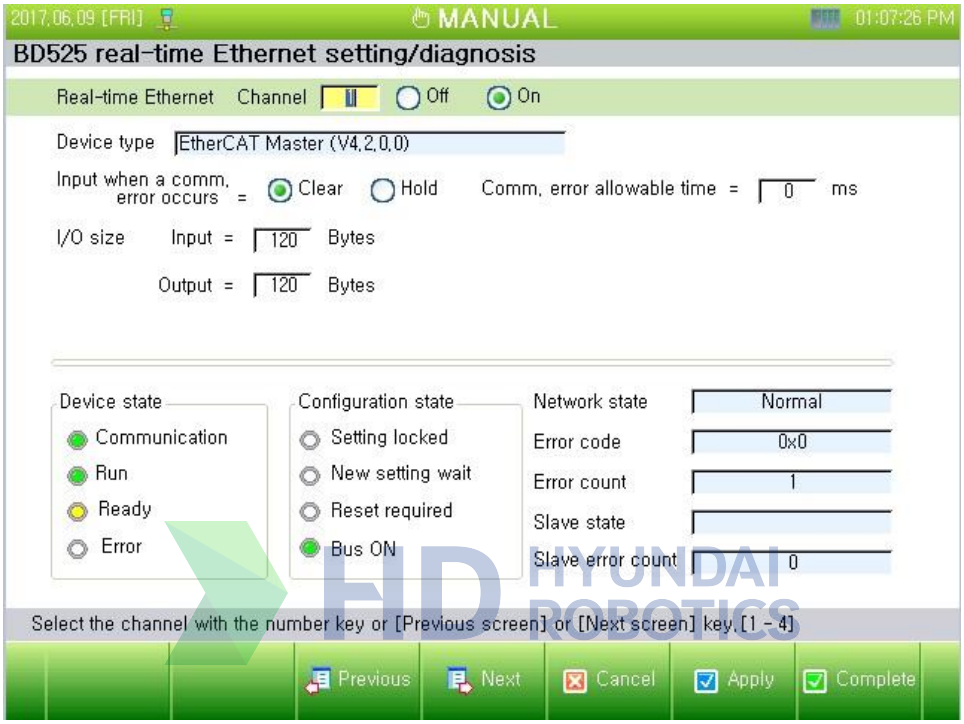

Figure 2.14 Setting and diagnosis of the BD525 Real-time Ethernet

2.2. 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 EtherCAT 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 2-1 Embedded PLC SP20

2.3. 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: Communication state(lower 8bit)*2) BD525 Master: Slave state(upper 8Bit)*3)	

*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 : Communication state
0=Unknown, 1=NOT Configured, 2=STOP, 3=IDLE, 4=OPERATE

*3) BD525 Master : Slave state
0=UNDEFINED, 1=OK(No Fault), 2=FAILED(One or more Slave errors)

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 2-2 Embedded PLC SW Memory

2.4. BD525 EtherCAT Master IO Monitoring

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

(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 EtherCAT master can be monitored.

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BD525 EtherCAT Slave

3.1. BD525 EtherCAT Slave setting

Execute according to the following procedures to use the slave of the BD525 EtherCAT.

(1) Select 『[F2]: System』 → 『2: Control parameter』 → 『2: Input/Output signal setting 』 → 『14: BD525 real-time Ethernet setting and diagnosis 』.

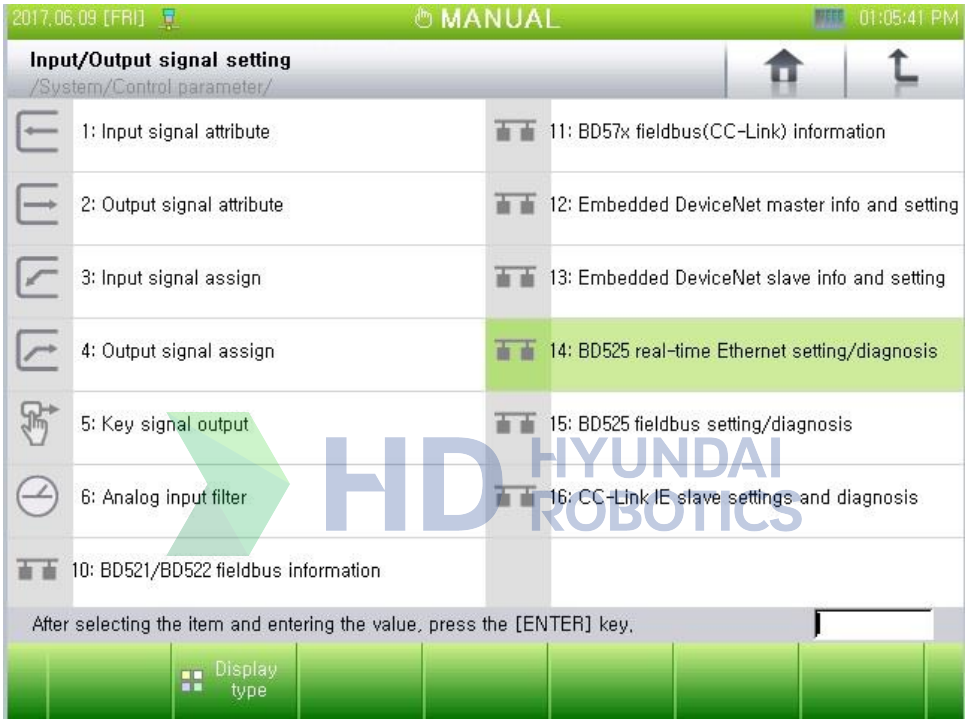

Figure 3.1 Menu of the BD525 Real time Ethernet setting and diagnosis

(2) Channel #3 is for the EtherCAT 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.

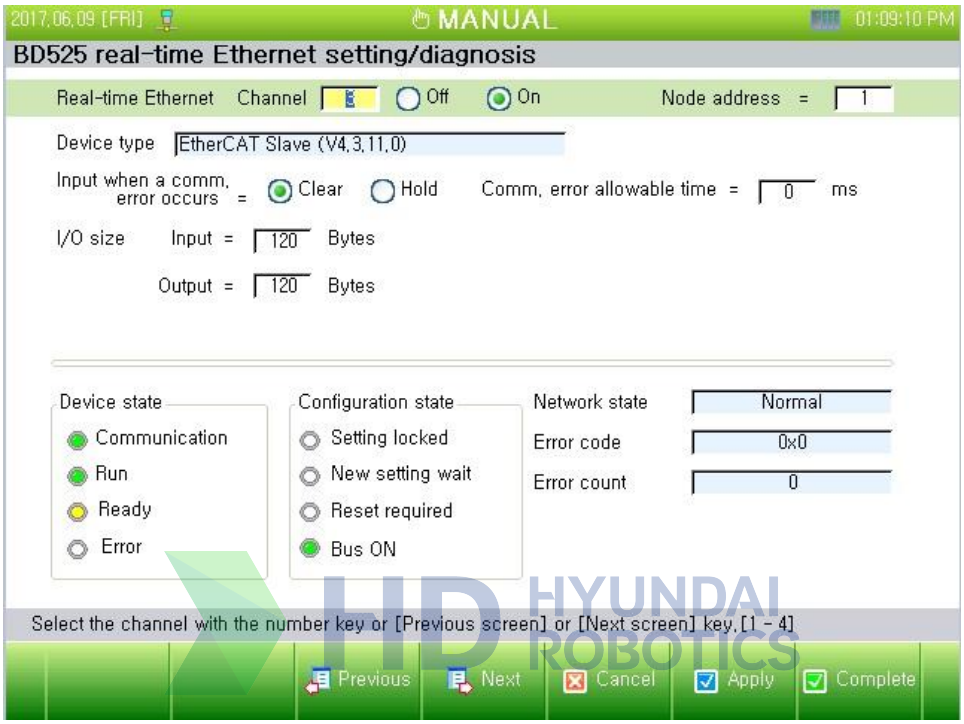

Figure 3.2 BD525 Real time Ethernet setting and diagnosis

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

- 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.
- Node address: Effective range is 1 to 65535 for the unique Ids of Slave node.
- 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).

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 EtherCAT 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)	Skip of the error/warning related to communication

Table 3-1 Embedded PLC SP21

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

To monitor the I/O of the BD525 EtherCAT 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 EtherCAT slave can be monitored.

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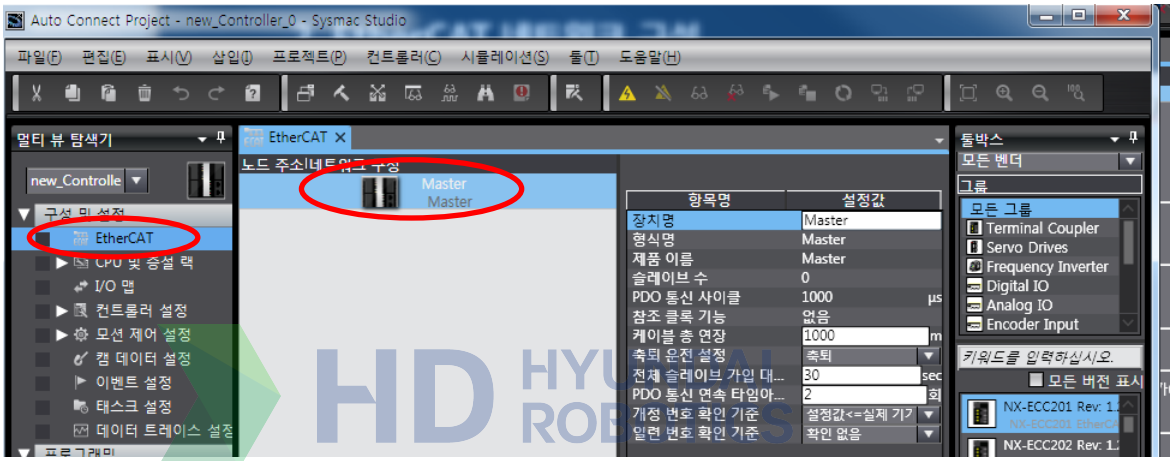
3.4. Example of OMRON PLC connection

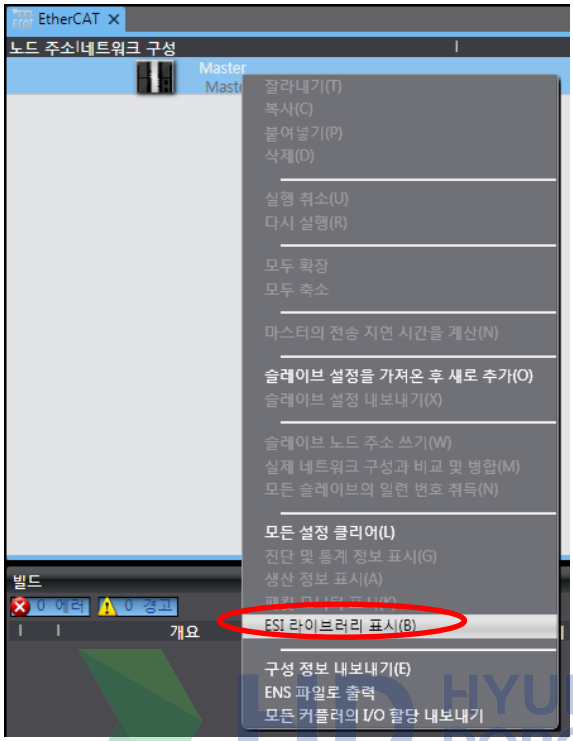
Here is an example of setting Sysmac Studio to establish communication between OMRON PLC and BD525 EtherCAT Slave.

(1) Installation of BD525 EtherCAT Slave ESI file

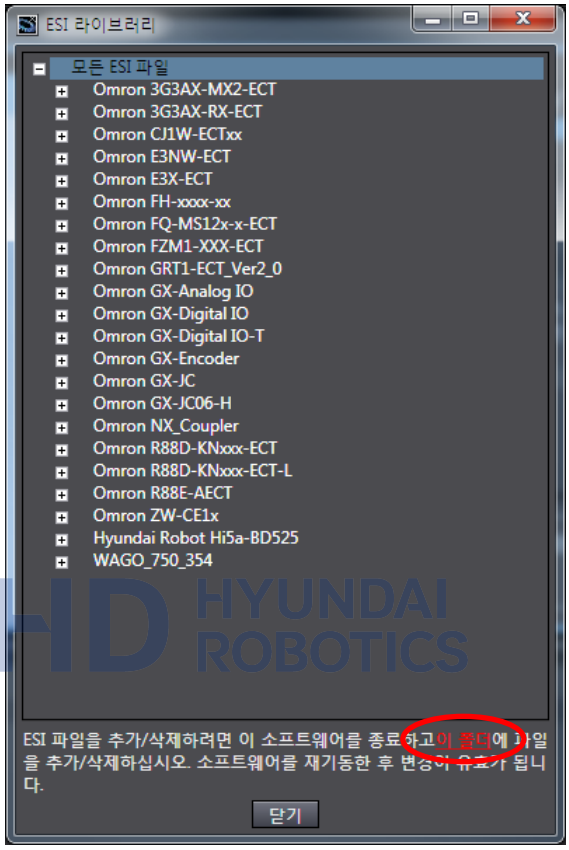
① Double-click **EtherCAT** under configuration and setting of Sysmac Studio Multi-View Explorer to display EtherCAT Master in the Edit Pane.

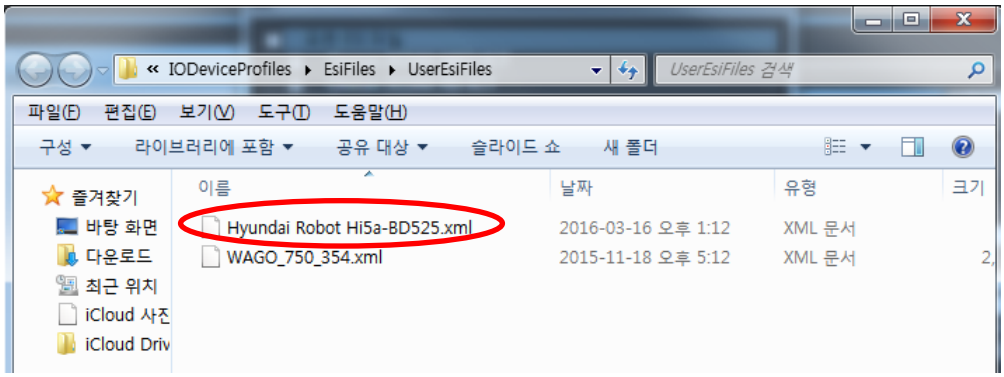


② Right-click the EtherCAT Master in the Edit Pane to execute the **ESI Library Display** menu.


EtherCAT
노드 주소/네트워크 구성
Master
잘라내기(T)
복사(C)
붙여넣기(P)
삭제(D)
실행 취소(U)
다시 실행(R)
모두 확장
모두 축소
마스터의 전송 지연 시간을 계산(N)
슬레이브 설정을 가져온 후 새로 추가(O)
슬레이브 설정 내보내기(X)
슬레이브 노드 주소 쓰기(W)
실제 네트워크 구성과 비교 및 병합(M)
모든 슬레이브의 일련 번호 취득(N)
모든 설정 클리어(L)
진단 및 통계 정보 표시(G)
생산 정보 표시(A)
ESI 라이브러리 표시(B)
구성 정보 내보내기(E)
ENS 파일로 출력
모든 커플러의 I/O 할당 내보내기
빌드
0 에러
0 경고
개요

Click this folder at the bottom of ESI Library dialog box; then, copy the Hi5a Controller ESI file to the open folder.

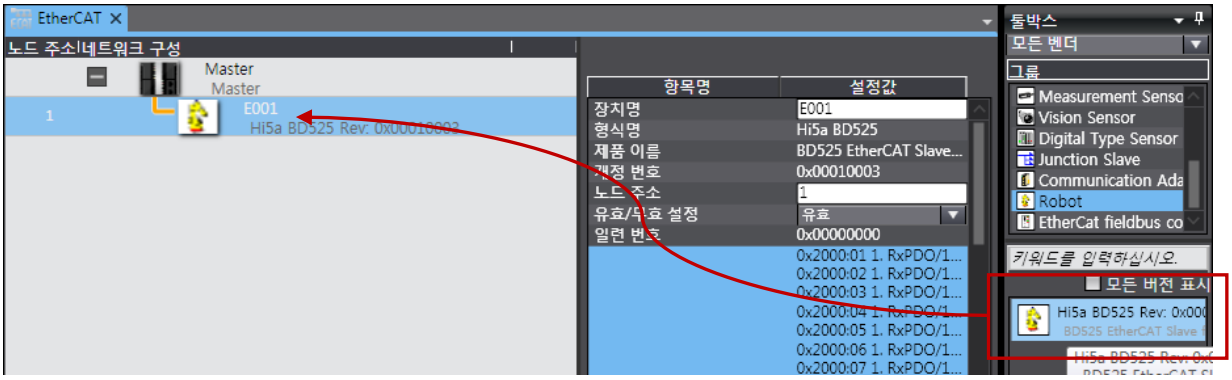




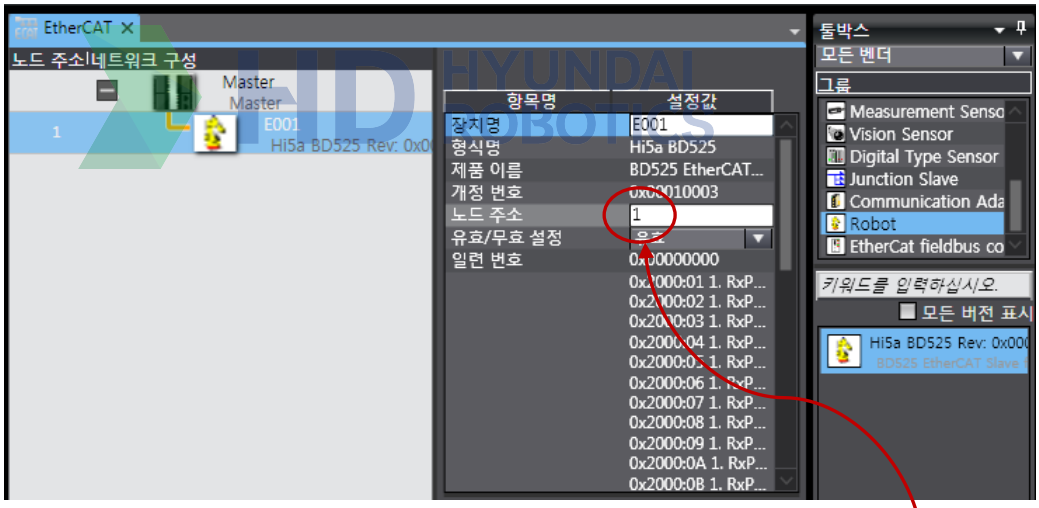
③ Restart the Sysmac Studio.

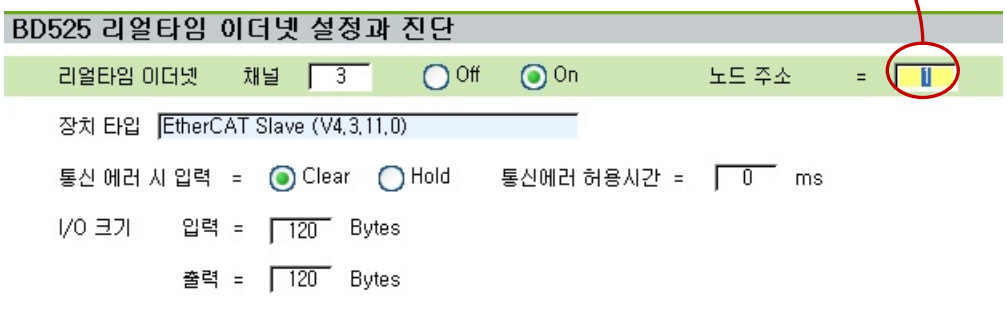
Configuration of the EtherCAT network

① In the Slave list of the toolbox, drag and drop Hi5a BD525 to connect it to the Master. Select Robot in the toolbox group to find Hi5a BD525 Slave.

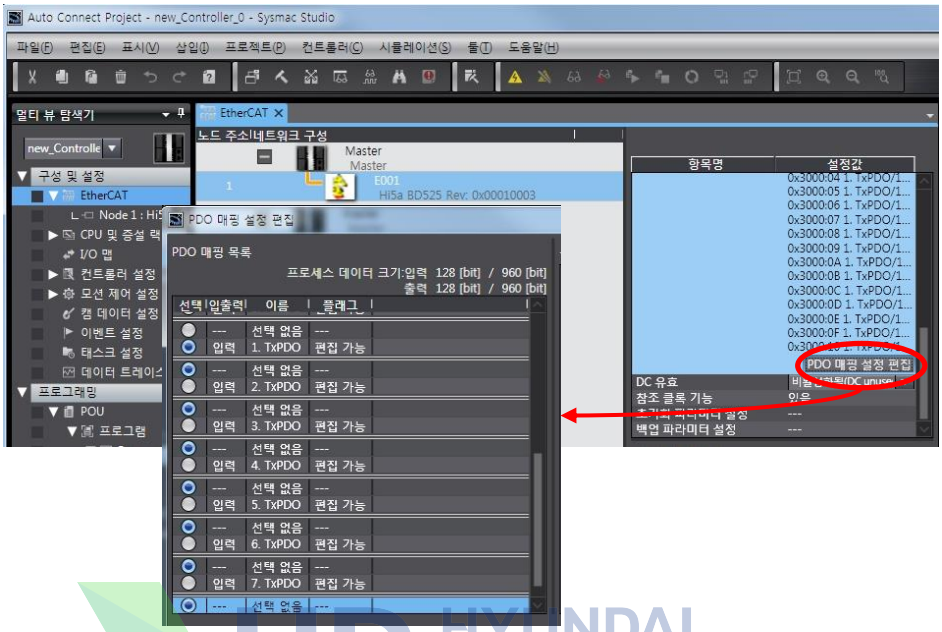


② Set the same node address as that for Hi5a Controller.





③ Set PDO mapping according to the IO size in Hi5a Controller.



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Ulsan: Room 201-5, Automotive and Shipbuilding Engineering Hall, Maegoksaneop-ro 21, Buk-gu, Ulsan-si
Middle Region: Song-gok-gil 161, Yeomchi-eup, Asan-si, Chungcheongnam-do
Gwangju: Room 101, Building B, Pyeongdongsandan-ro 170-3, Gwangsan-gu, Gwangju-si
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