

Doosan Robot

M0609 | M0617 | M1013 | M1509

Modbus Manual



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Preface

Thank you for choosing this Doosan Robotics product. Before installing the product, please read through this manual and follow the instructions for each installation process provided in this manual. The contents of this manual are current as of the date this manual was written, and product-related information may be modified without prior notification to the user.

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1 Modbus TCP

1.1 Support

1.1.1 Features

The Modbus TCP of Doosan Robotics only supports Master functions, and it can be used for data transmission through I/O expansion or direct connection to other devices.

1.1.2 Signal Type

Type	Access	Size
Discrete Input	Read-only	1bit
Coil	Read-Write	1bit
Input Register	Read-only	16bits
Holding Register	Read-Write	16bits

1.1.3 Function Code

Function Code	Description
1	Read Coils
2	Read Discrete Inputs
3	Read Multiple Holding Registers
4	Read Input Registers
5	Write Single Coil
6	Write Single Holding Register

*DRL (set_modbus_outputs()) is configured to internally call FC5 and FC6 multiple times.

1.1.4 Limitations

Up to five Modbus TCP Slave devices can be connected.

Each device can register up to 50 registers.

The total number of registers cannot exceed 100.

1.2 Network Setting Configuration

1.2.1 Robot Controller IP Configuration

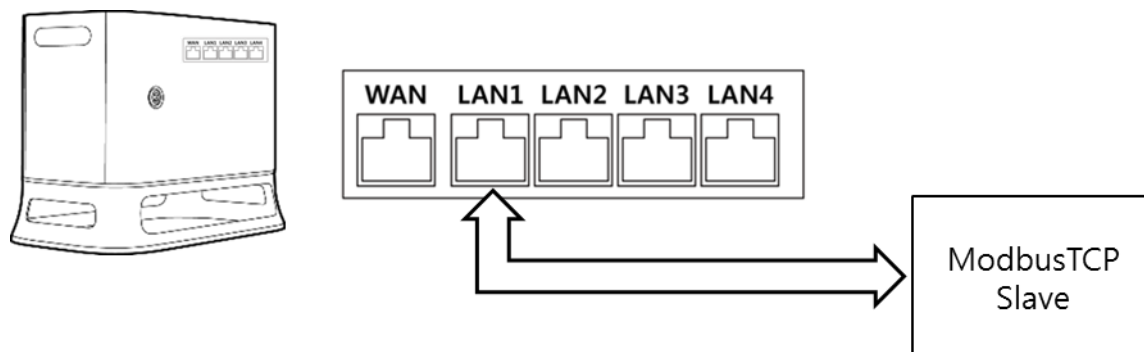
The IP set for the robot controller can be checked through Setting – Network of the TP, and the operator can modify the IP address if necessary.

IP Address	192.168.127.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.137.1

1.2.2 Slave Equipment IP Configuration

The IP address of the Slave equipment can be modified to the same band of the robot controller IP address.

1.3 H/W Connection

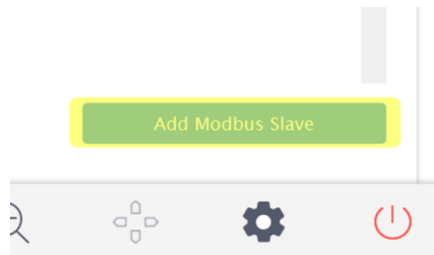


The physical connection is established by connecting one of the LAN ports on the internal router to the Modbus TCP Slave equipment.

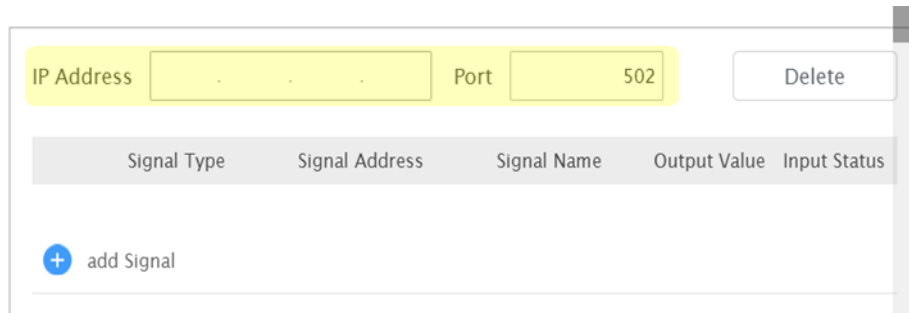
1.4 Modbus Setting

1.4.1 Modbus Slave Registration

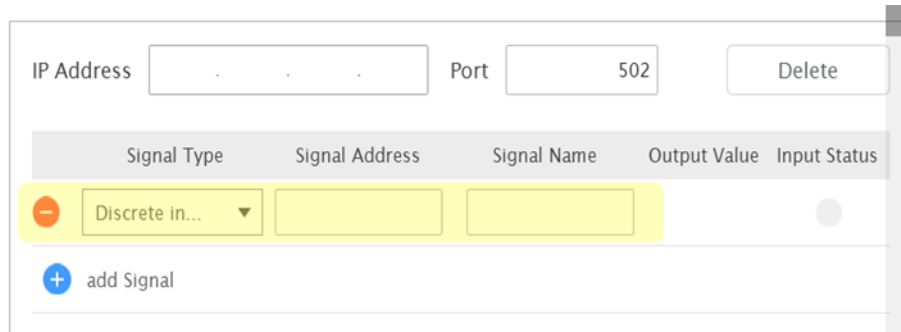
Use the Add Modbus Slave button at Setting – Modbus Slave to register a new device.



Enter the IP address of the Slave device, configure the port (default 502),

A screenshot of a mobile application interface showing the configuration form for a Modbus Slave. The form has two input fields: "IP Address" and "Port". The "Port" field contains the value "502". There is a "Delete" button to the right of the "Port" field. Below the input fields is a table with the following headers: "Signal Type", "Signal Address", "Signal Name", "Output Value", and "Input Status". Below the table is a blue plus icon followed by the text "add Signal".

use Add Signal to configure Signal Type, Signal Address and Signal Name, and click Confirm.

A screenshot of a mobile application interface showing the configuration form for a Modbus Slave. The form has two input fields: "IP Address" and "Port". The "Port" field contains the value "502". There is a "Delete" button to the right of the "Port" field. Below the input fields is a table with the following headers: "Signal Type", "Signal Address", "Signal Name", "Output Value", and "Input Status". A row in the table is highlighted in yellow, showing a red minus icon, a dropdown menu with the text "Discrete in...", an empty "Signal Address" field, and an empty "Signal Name" field. Below the table is a blue plus icon followed by the text "add Signal".

The registered Signal Name can be used to read or write values appropriate for the Signal Type of the corresponding

Signal Address.

2 Using Other Fieldbus / Industrial Ethernet

The Doosan Robotics controller officially supports only the Modbus TCP Master function. Therefore, in order to use another Fieldbus/Industrial Ethernet, it is necessary to convert them using a Gateway.

The Modbus settings are identical, but refer to the Gateway manufacturer's manual for the Gateway settings.

The Gateways tested with Doosan Robotics controller are as follows:

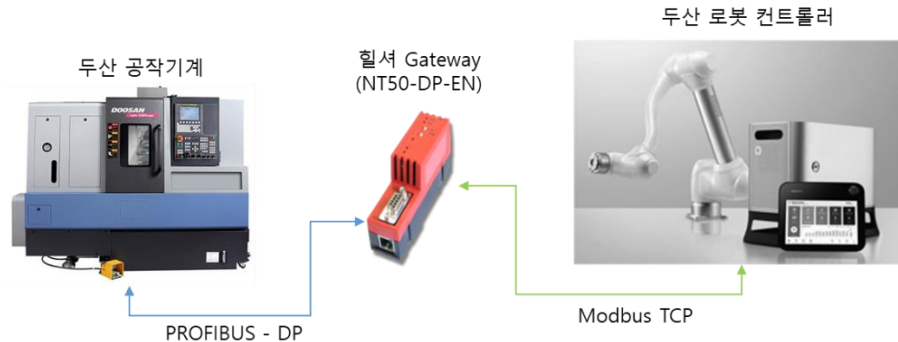
Manufacturer	Model Name	Communication
Anybus	X-Gateway	Modbus TCP Slave – PROFIBUS DP Slave
Hilscher	NT 50-CC-EN	Modbus TCP Slave – CC-Link
Hilscher ¹	NT 50-DP-EN	Modbus TCP Slave – PROFIBUS DP Slave
Hilscher ²	NT 100-RE-EN	Modbus TCP Slave – EtherNet/IP Scanner

¹ Refer to Attachment 1. Doosan Machine Tools and PROFIBUS DP Linking Method

² Refer to Attachment 2. Doosan Machine Tools and EtherNet/IP Linking Method

Attachment 1. Doosan Machine Tools and PROFIBUS DP Linking Method

1. Structure

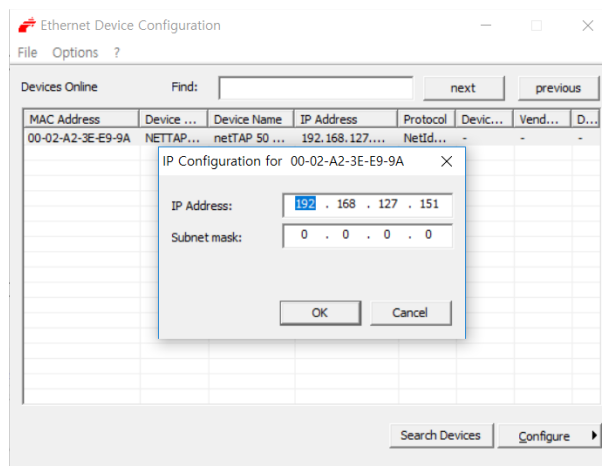


The system structure of Doosan machine tool is as shown above. Doosan machine tool and Hilscher Gateway are connected via Profibus communication, and Hilscher Gateway and Doosan robot controller are connected via Modbus TCP communication. As a result, the Doosan robot controller and Doosan machine tool can communicate through a Gateway.

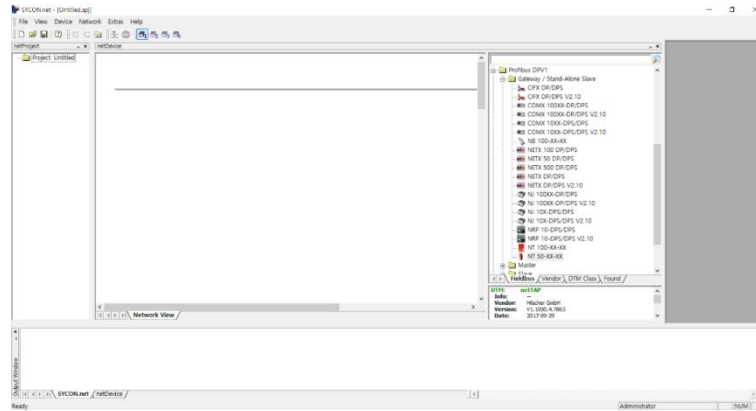
2. Setting

To establish communication between a Doosan machine tool and the Doosan robot controller via Gateway, a GSD file is required.

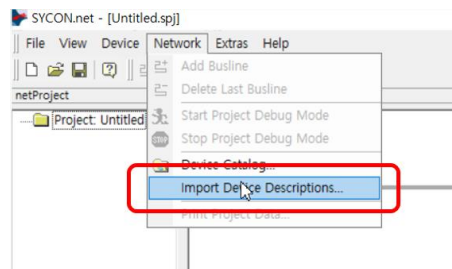
During initial device configuration, use the Hilscher Ethernet Device Configuration Tool to allocate an IP to the Gateway. Click Search Devices to search for connected devices, and use Configure -> Set IP Address to allocate an IP to the Gateway. For demonstration purposes, this example has allocated 192.168.127.151.



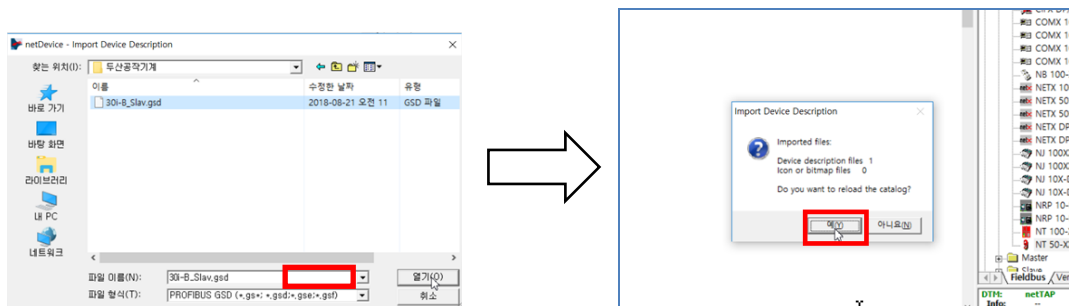
Run Sycon.net to configure the Gateway, and create a new project.



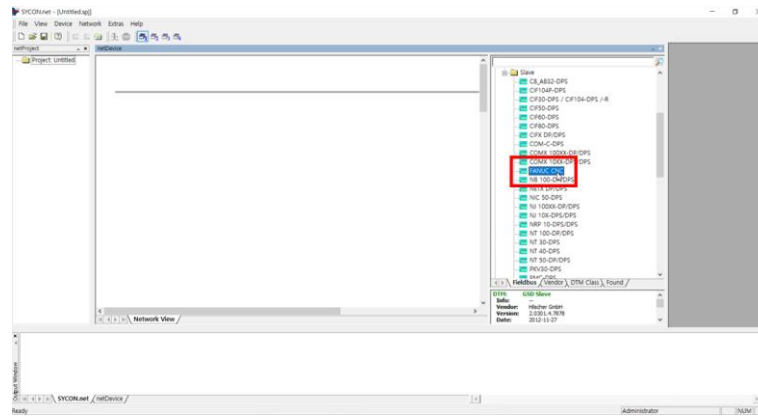
Select Import Device Descriptions from the Network tab on the top to add a new Profibus Slave.



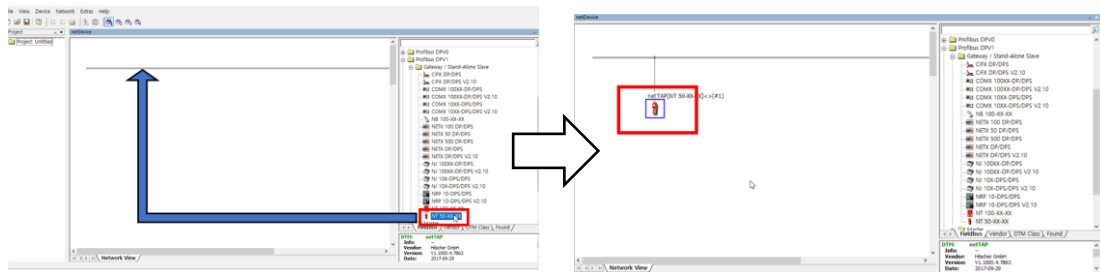
The settings of Doosan machine tool are saved as a GSD file. Go to the folder where the corresponding file is located and then click the Open button to import it.



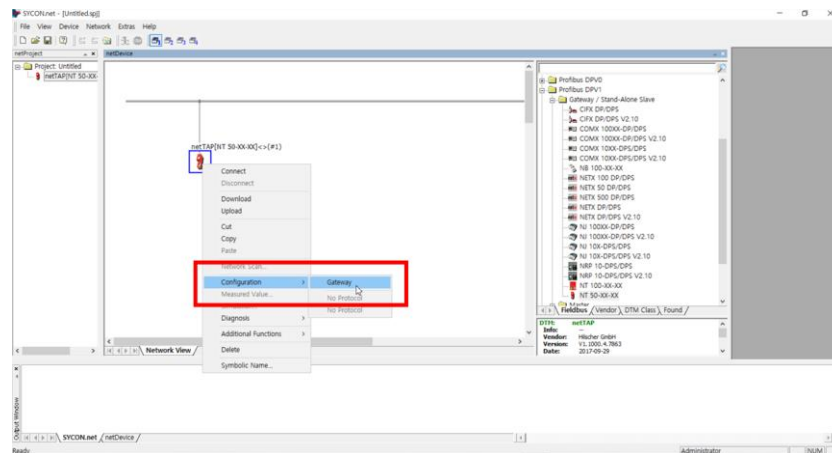
Click ProfibusDPV1 – Slave on the right side of the screen to check whether the FANUC CNC item is added.



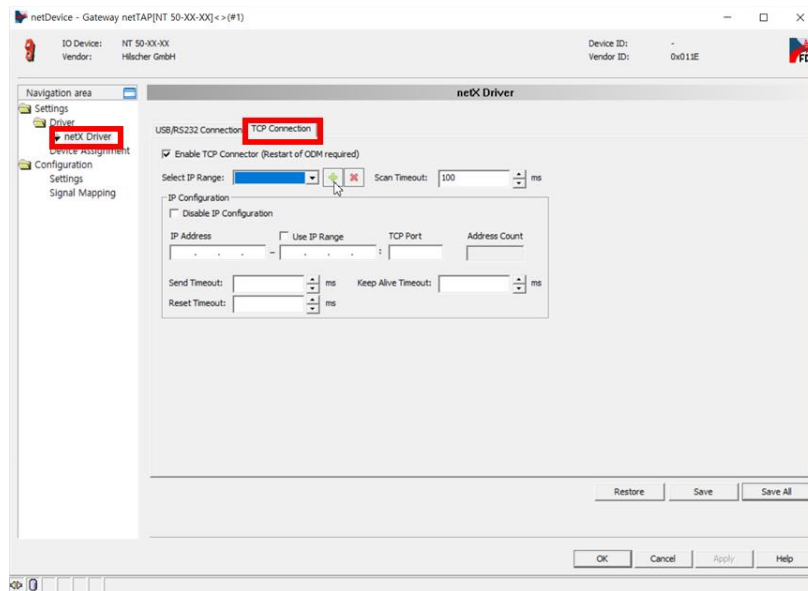
Select NT 50-XX-XX (select according to Gateway type) from the Profibus DPV1 – Gateway / Stand-Alone Slave on the right and drag it to the Workspace on the left to download the image of the Gateway that supports the Profibus protocol.



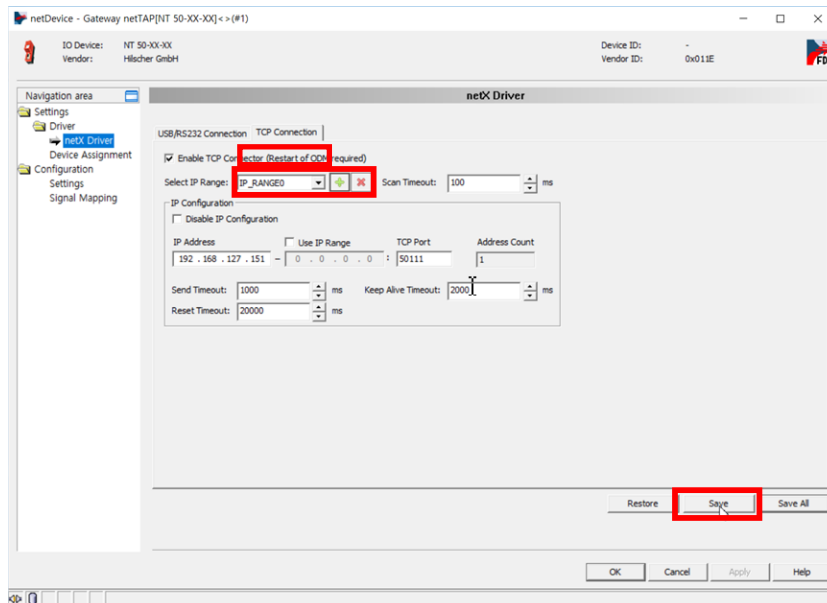
Using the mouse, right-click on the added device and click Configuration -> Gateway to configure the communication protocol of Port x2 and x3.



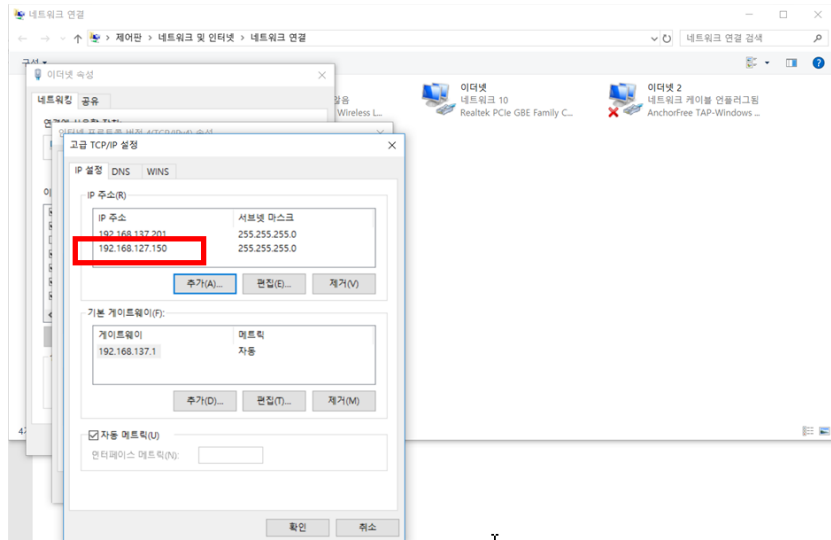
Configure TCP connection. Go to Settings – Driver – netX Driver and click TCP Connection.



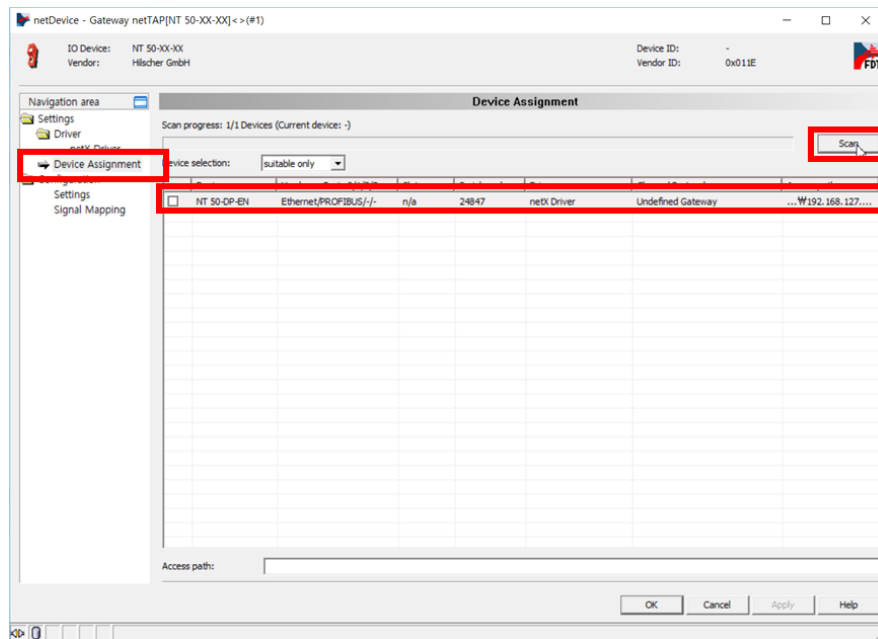
 Click the button to add an IP range. Enter the Gateway IP in IP Address and click the Save button.



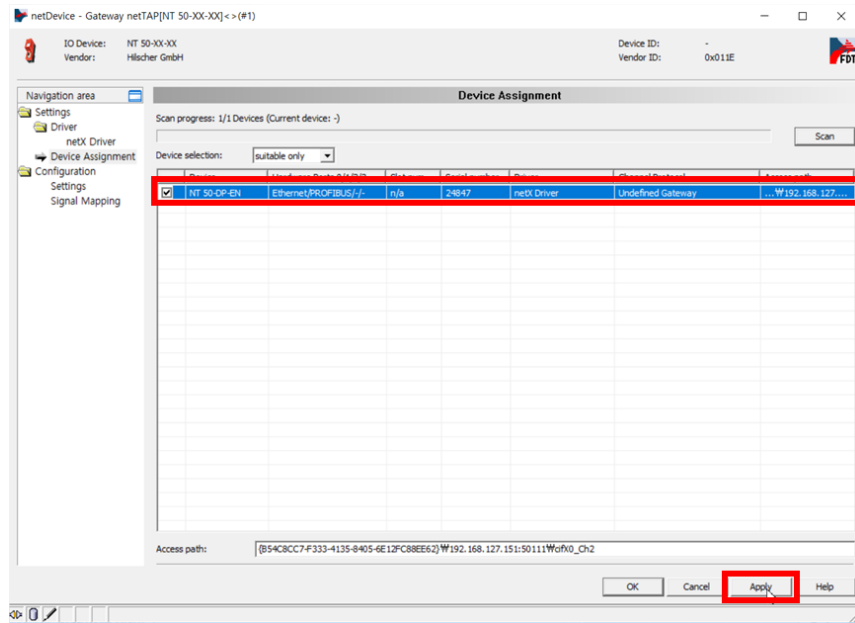
To configure the Gateway through the TCP connection, the IP address of the station with Sycon.net installed must be configured to the same band. Open the Control Panel and add an IP in the same band with the Gateway via Ethernet Properties - TCP/IPV4 – Properties – Advanced - IP Setting – Add. For this demonstration, 192.168.127.50 is added.



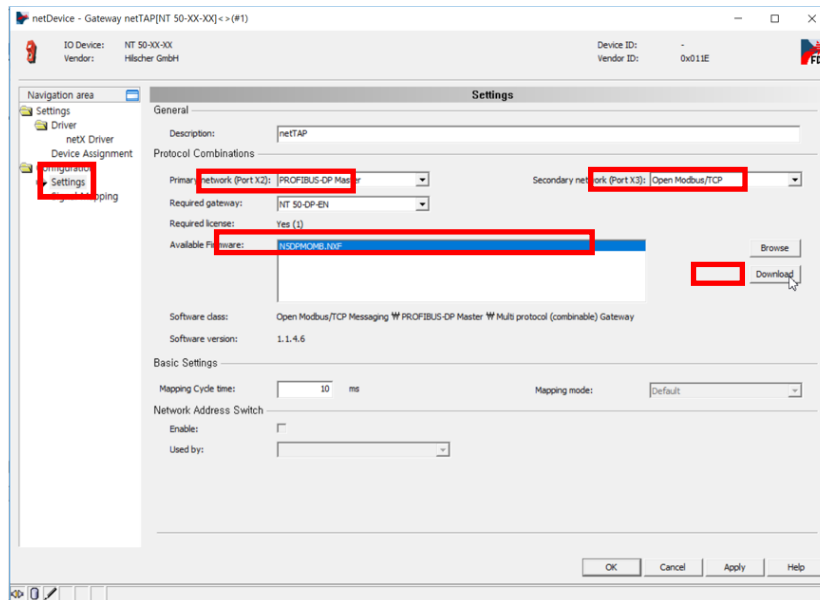
Go to the Device Assignment tab and click the Scan button. The connected Gateway is displayed. If it is not displayed, reboot the PC and try again.



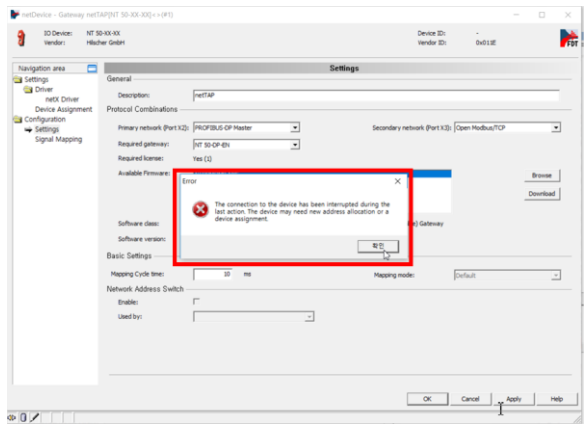
Click the check box of the Gateway and click the Apply button to save the setting.



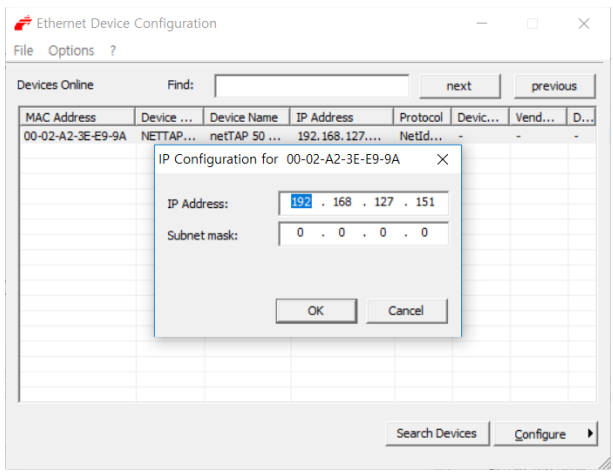
Go to Settings to configure the protocol of the port. Set Port X2 as PROFIBUS-DP Master and Port X3 as Open Modbus/TCP. Then click the available firmware and click the Download button to download the firmware to the Gateway.



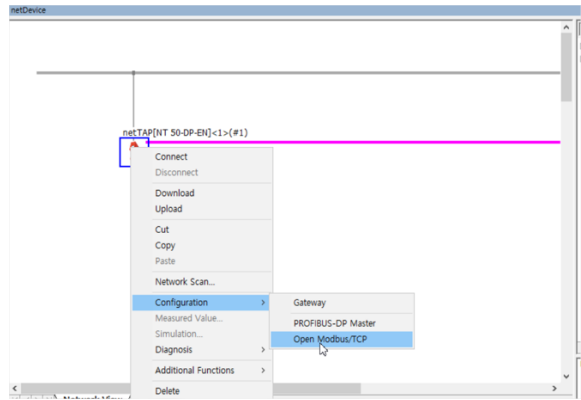
After Gateway Download, an error occurs. This is because the Gateway firmware update initializes the IP information and requires re-configuration. Use the Ethernet Device Configuration Tool to re-allocate the IP address.



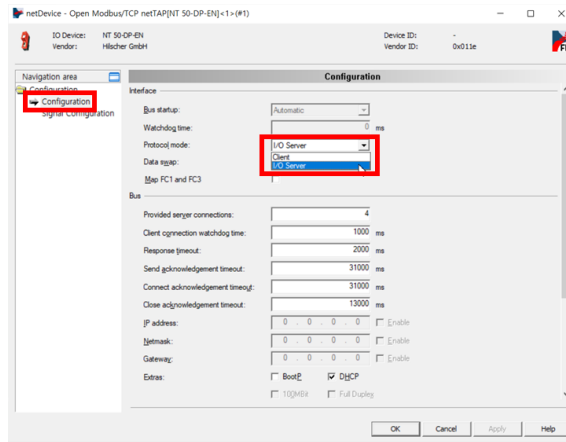
Use the Ethernet Device Configuration Tool to reallocate the IP address.



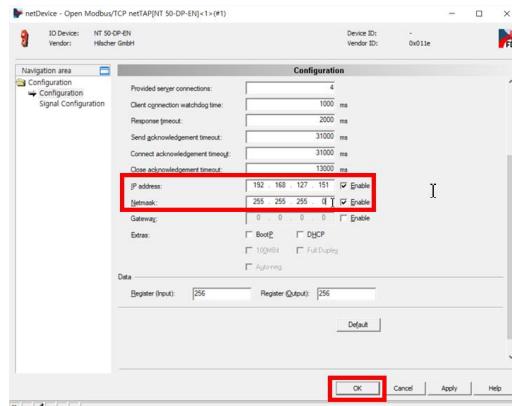
To configure the protocols of each port, right-click the Gateway in Workspace and click Configuration – Open Modbus/TCP.



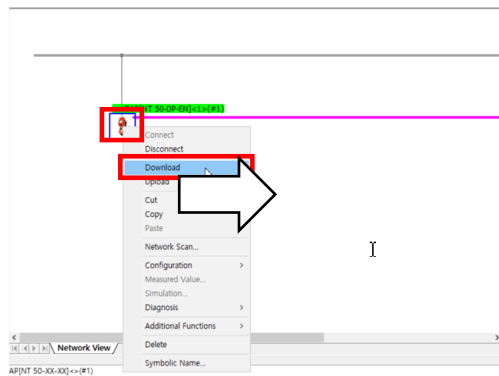
Check the Protocol Mode of the Configuration. If it is set to Client, modify it to I/O Server (in the case of Modbus, the Slave operates as an I/O Server). As the Doosan robot controller is set as Modbus Master (Client), the Gateway should be set as Slave (I/O Server).

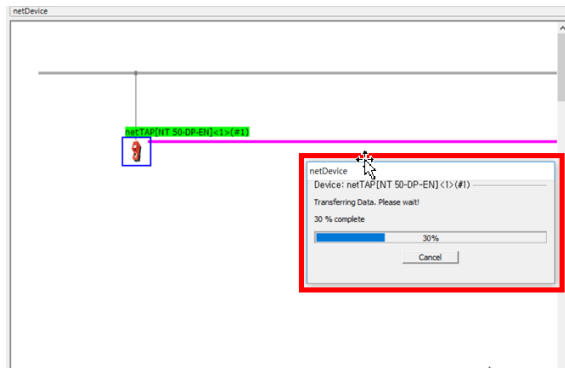


Enter the IP Address and Subnet Mask of the Gateway, and click the OK button.

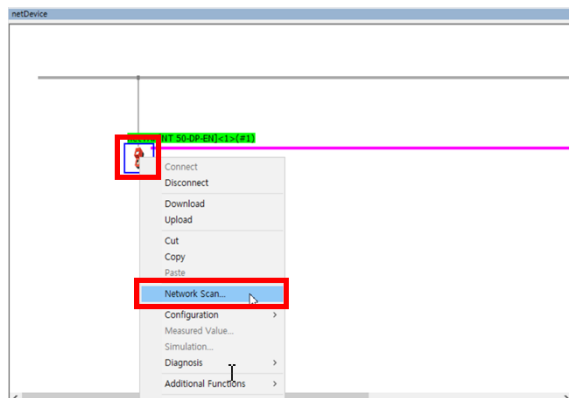


Download the modified settings to the Gateway. Right-click the Workspace Gateway and click Download. Click the “Yes” button in the pop-up window, and the download progress is displayed.

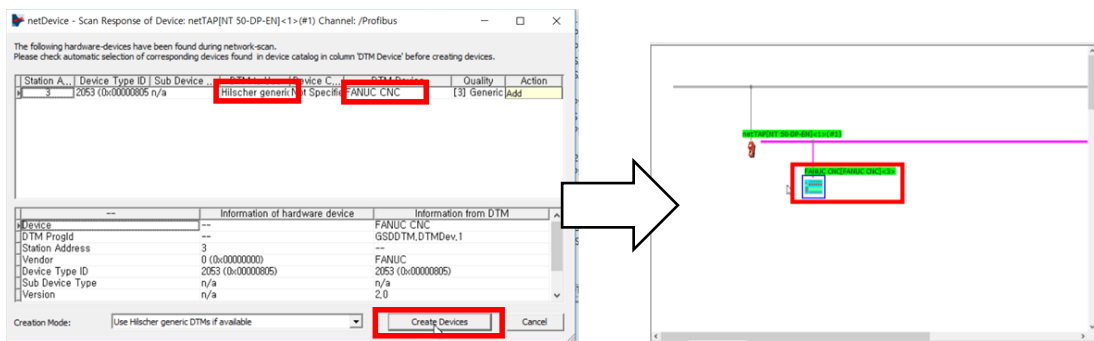




After the download, the Gateway must be linked to the actual device (machine tool). Once the download is complete, right-click the Gateway and click Network Scan.

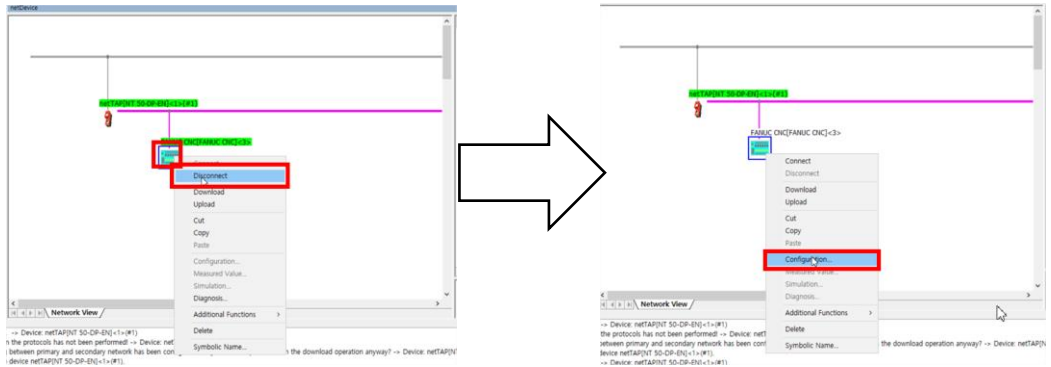


The Gateway and Device connected are displayed. In the case of DTM to Use, a Hilscher Gateway must be registered, and in the case of DTM Device, a FANUC CNC must be registered. Click Create Devices to add the corresponding device to the Workspace Bus.

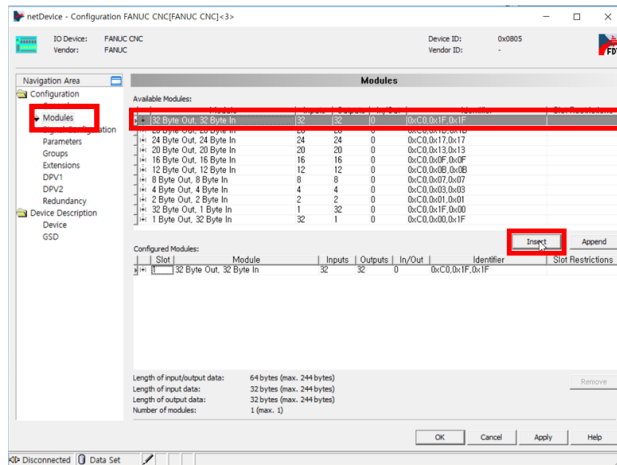


Right-click FANUC CNC Device and click Disconnect to disconnect the connection. When the connection

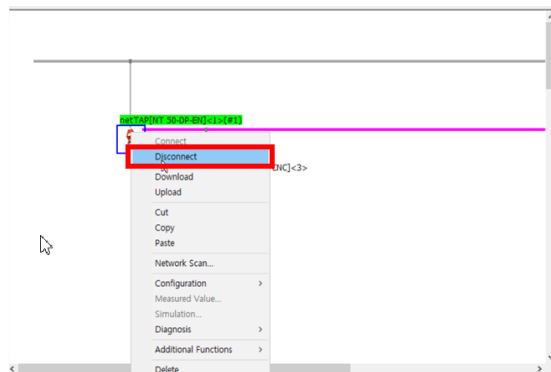
is lost, the Configuration items become available. Click Configuration to configure Signal items.



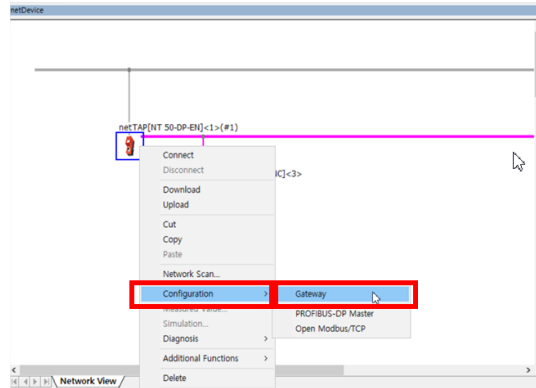
Click Modules to select a Signal Module. Select 32 Byte Out, 32 Byte In Module from the available modules, and click the Insert button to configure the corresponding module. Click the OK button to save the configured settings.



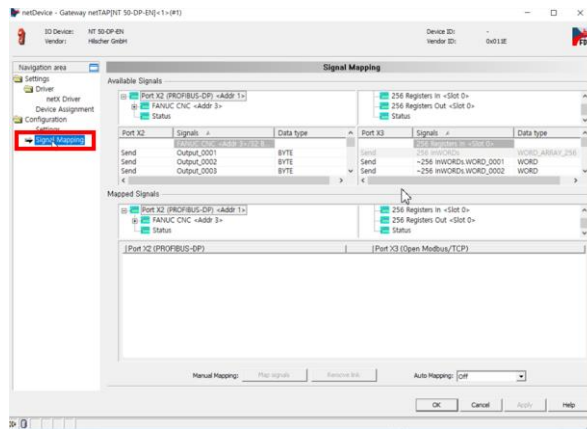
Next, configure the Signal Mapping between Modbus and Profibus. First, right-click the Gateway in Workspace, and then click Disconnect to disconnect the connection.



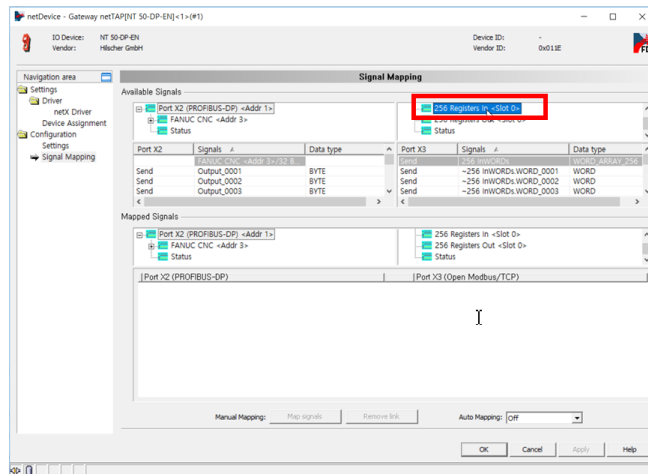
Click Configuration – Gateway.



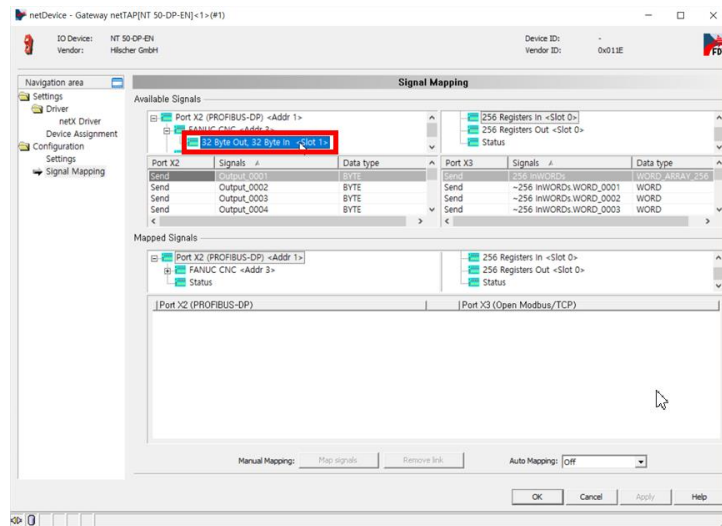
Click the Signal Mapping tab in the Navigation Area on the left.



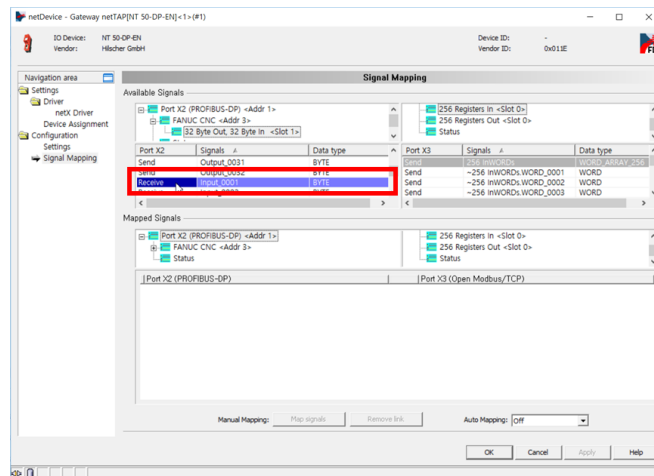
Click 256 Registers in <Slot 0> on the right of Available Signals.



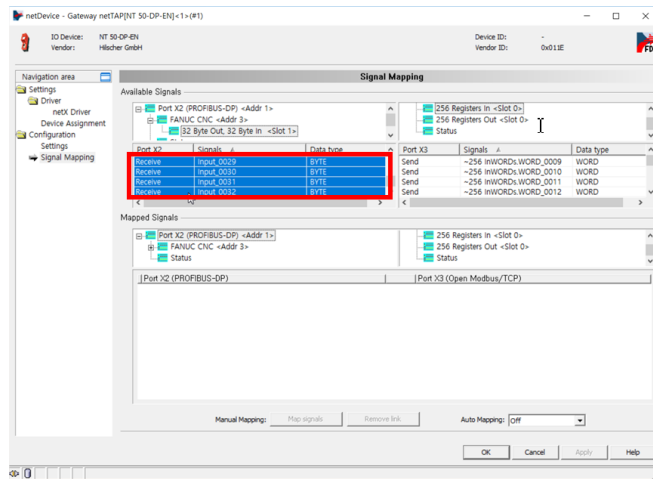
Click 32 Byte Out, 32 Byte In <Slot 1> on the left side of Available Signals.



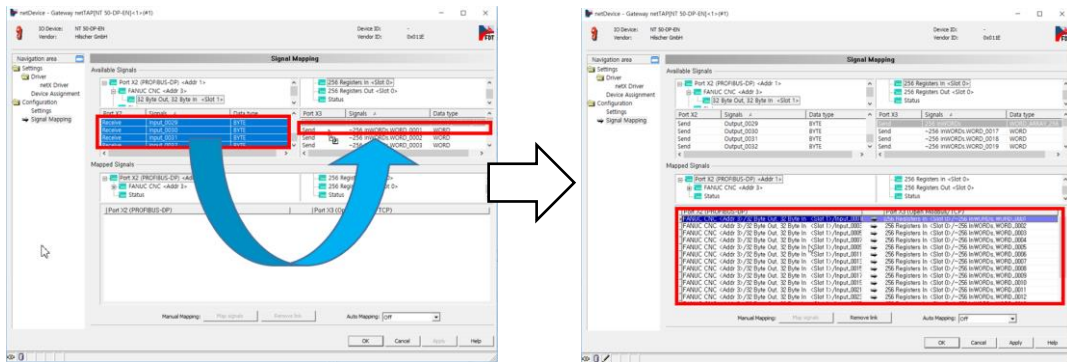
Use the scrollbar to find and select Receive Signal (the value in Port column is Receive).



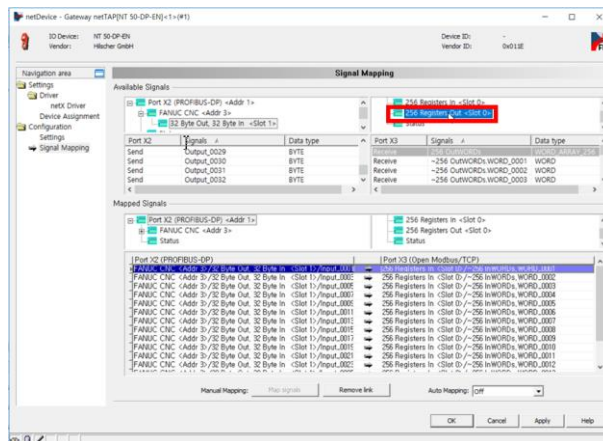
Select all items in Input signal: Input_0001 – Input_0032 of Receive Type.



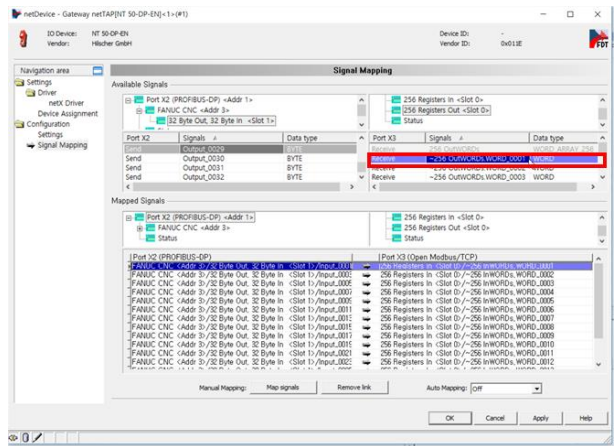
Drag the selected signals (Input_0001 – Input_0002) and drop them in the first Signal on the right. Then check the signals with Mapping.



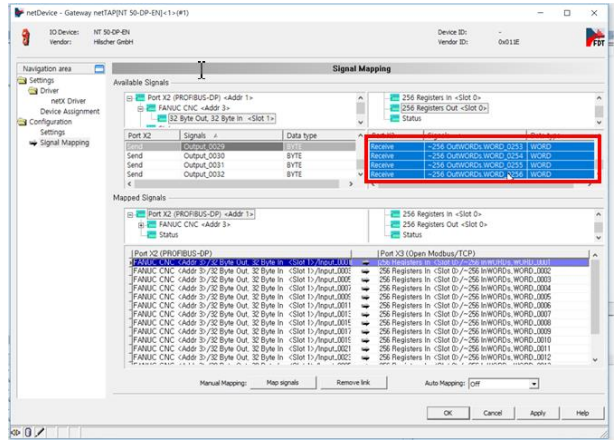
Click 256 Registers Out <Slot 0> on the right of Available Signals.



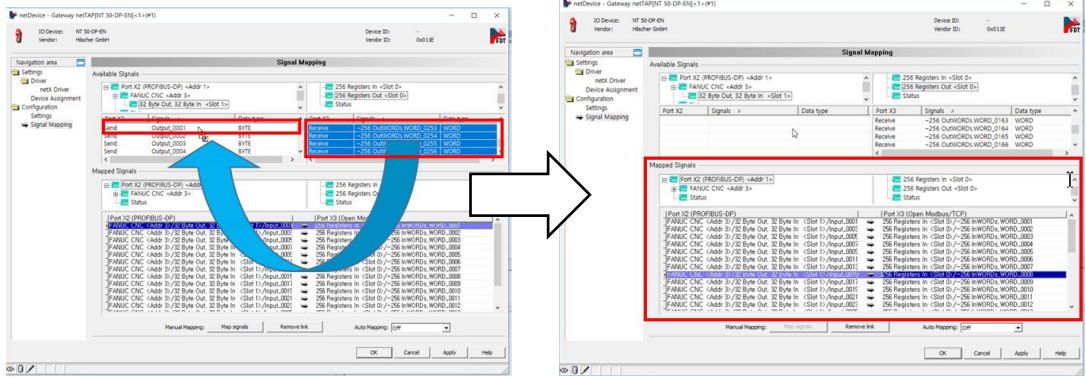
Select Receive Signal (the value in column Port X3 is Receive).



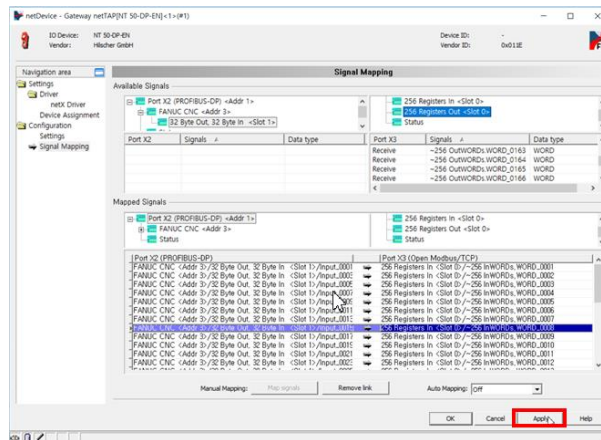
Select all items in signal: ~256 OutWORDS WORD_0001 ~ ~256 OutWORDS WORD_0256 of Receive Type.



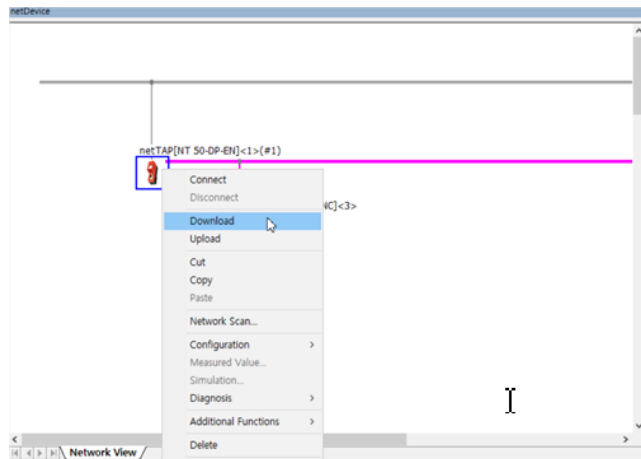
Drag the selected signals and drop them in the first Signal on the right. Then check the signals with Mapping.



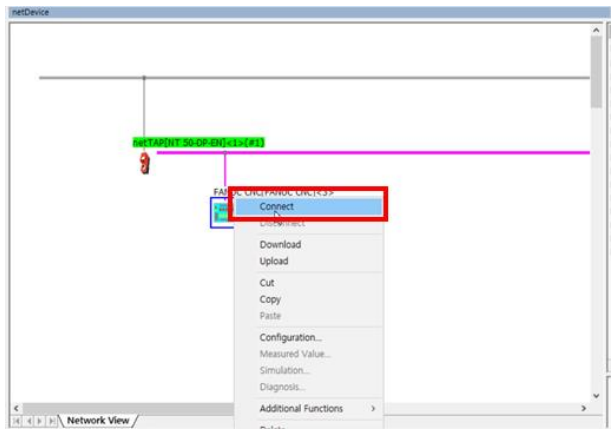
Click the Apply button to apply the settings.



Right-click the Gateway in Workspace, and then click Download to download the modified settings.



Once the download is complete, right-click the FANUC CNC device and click Connect to connect the device with the BUS.



To check the settings, right-click the FANUC CNC device and click Diagnosis.

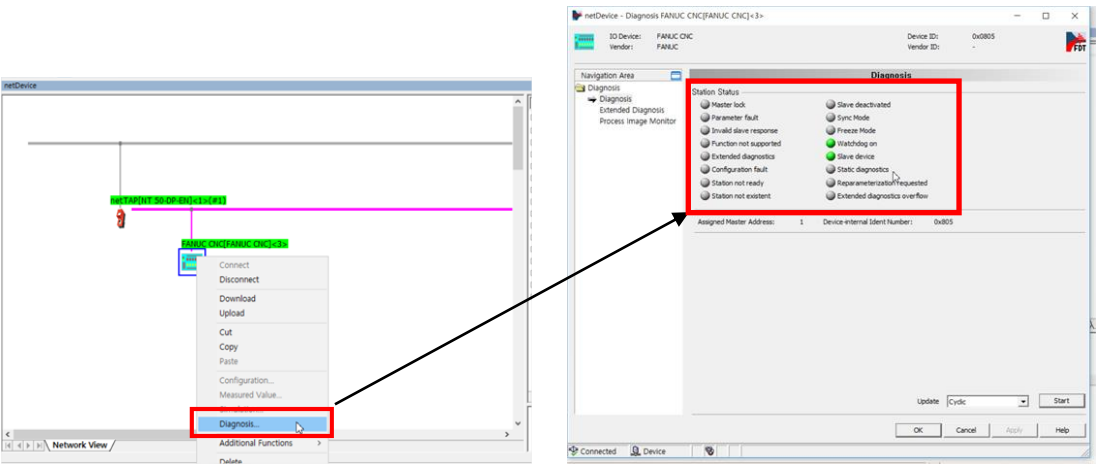
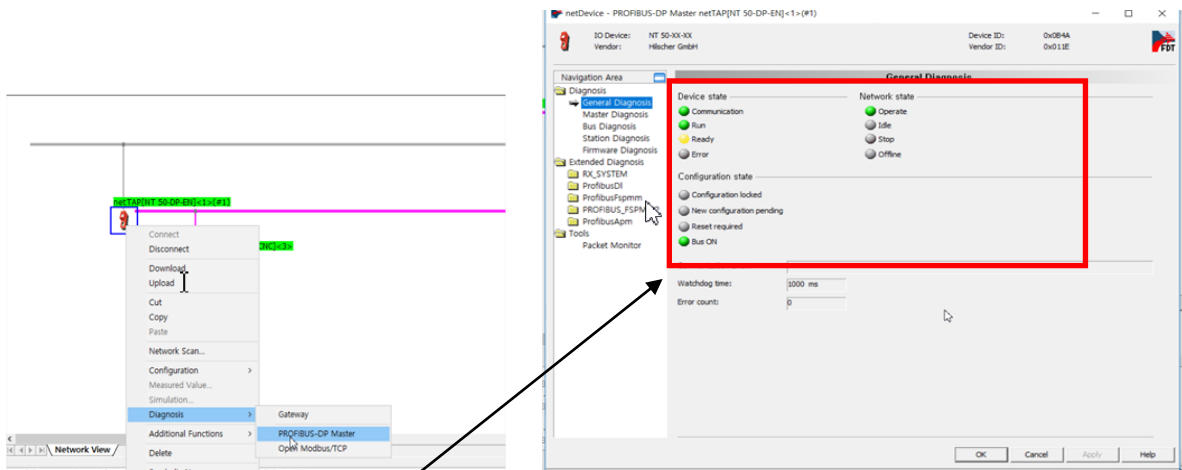


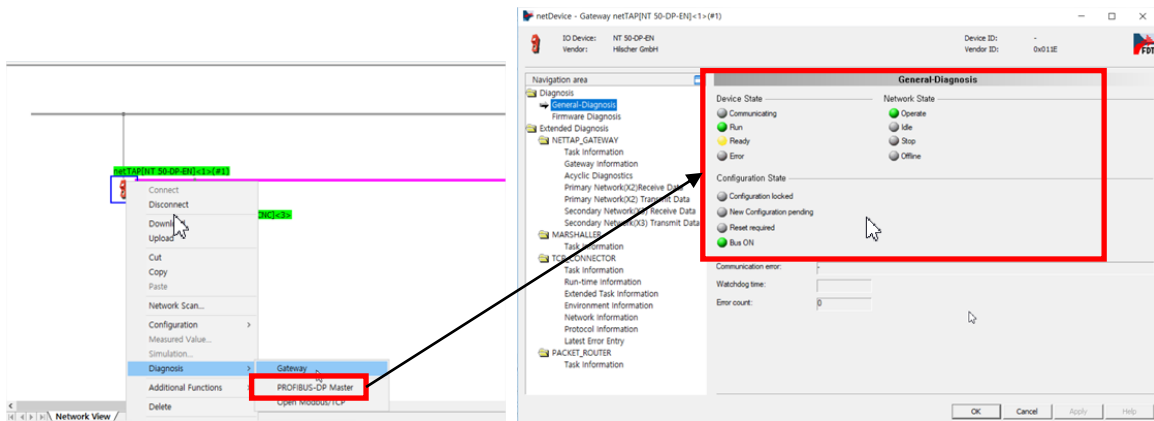
Figure 1 FANUC CNC Diagnosis

To verify the settings, check the Gateway Diagnosis.

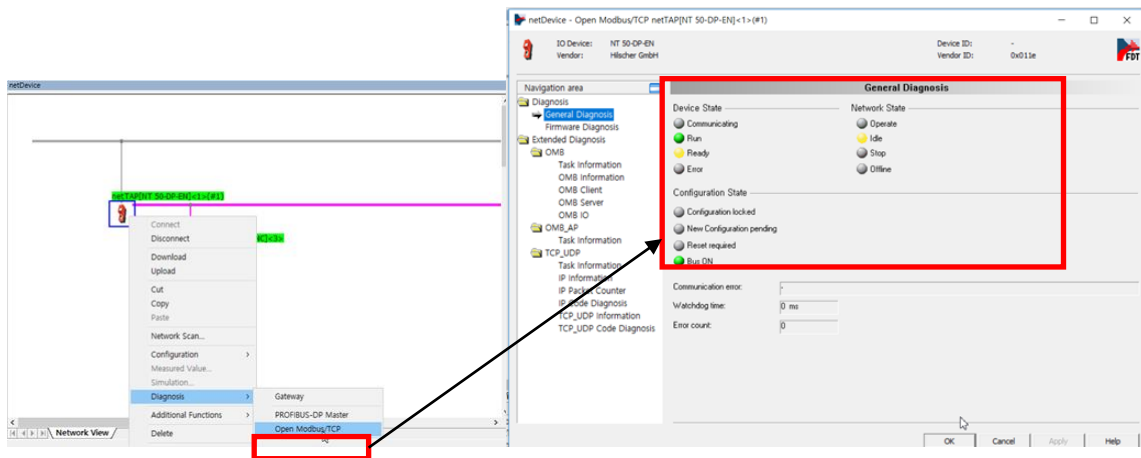
The diagnosis of PROFIBUS-DP Master is as follows:



The diagnosis of Gateway is as follows:



The diagnosis of Open Modbus/TCP is as follows:



Attachment 2. Doosan Machine Tools and EtherNet/IP Linking Method

1. Structure



The overall system for testing is structured as in the figure above. Doosan machine tool is verified using a FANUC 30iB Simulator, and it is operated using an EtherNet/IP Adapter. Therefore, the Gateway firmware is operated using EtherNet/IP Scanner – OpenModbus Slave (I/O Server).

2. Setting

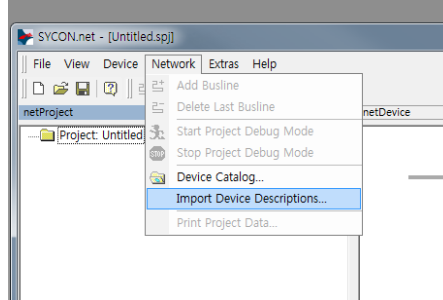
2.1 EtherNet/IP Adapter EDS File

To be able to use an EtherNet/IP Adapter, it is necessary to have an Electronic Data Sheet (EDS) file of the corresponding adapter.

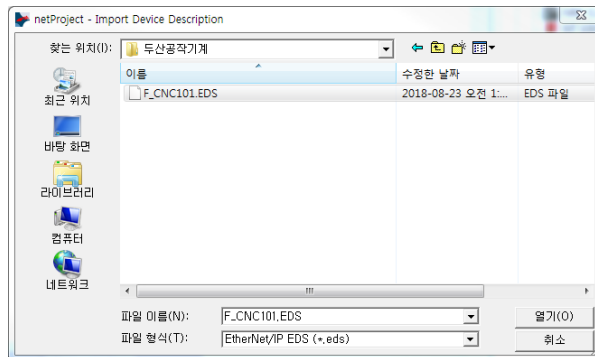
An EDS file is an ASCII file that describes how devices are operated within an EtherNet/IP network. It describes objects that can be used on the device, characteristics and services. It also provides the information necessary for the network tool to recognize the device and information about adapter I/O messages for the scanner.

2.2 Importing EDS file to SYCON.net

Click Network - Import Device Descriptions at the top of SYCON.net.



Select the appropriate file format for the Fieldbus (EtherNet/IP (*.eds)), find the corresponding file and open it.



Newly added devices are displayed on the device list of the corresponding Fieldbus on the right.

The screenshot displays a software interface with a tree view on the left and a details pane on the right. The tree view is organized as follows:

- EtherCAT
- EtherNet/IP
 - Gateway / Stand-Alone Slave
 - Master
 - Slave
 - CIFX RE/EIS V1.1
 - COMX 100XX-RE/EIS V1.1
 - COMX 51XX-RE/EIS V1.1
 - ENIP Generic Adapter
 - ENIP Modular Generic Adapter
 - NB 100-RE/EIS V1.1
 - NETX 100 RE/EIS V1.1
 - NETX 50 RE/EIS V1.1
 - NETX 500 RE/EIS V1.1
 - NETX 51 RE/EIS V1.1
 - NIC 50-RE/EIS V1.1
 - NJ 100XX-RE/EIS V1.1
 - NJ 50X-RE/EIS V1.1
 - NJ 51X-RE/EIS V1.1
 - NRP 51-RE/EIS V1.1
 - NRP 52-RE/EIS V1.1
 - NT 100-RE/EIS V1.1
 - NT 151-RE/EIS V1.1
 - NT 50-EN/EIS V1.1
 - NXIO 100 RE/EIS V1.1
 - NXIO 50 RE/EIS V1.1
 - Series 30I V1.4
- Modbus RTU
- Open Modbus/TCP

The details pane at the bottom shows the following information:

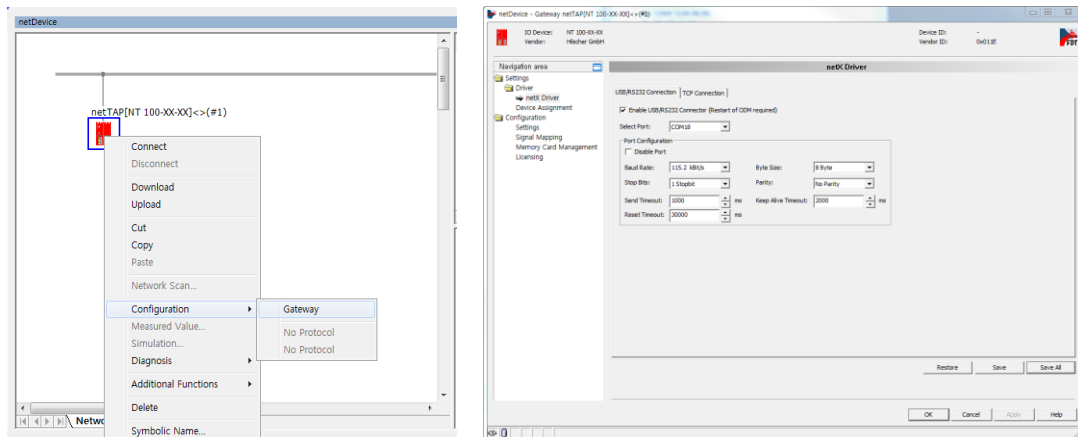
DTM: EtherNet/IP Generic EDS Adapter DTM
Info: --
Vendor: Hilscher GmbH
Version: V1.1000.4.7877
Date: 2012-02-08

Device: Series 30I V1.4
Info: F_GNC101EDS
Vendor: FANUC CORPORATION
Version: V1.4
Date: 2018-08-22

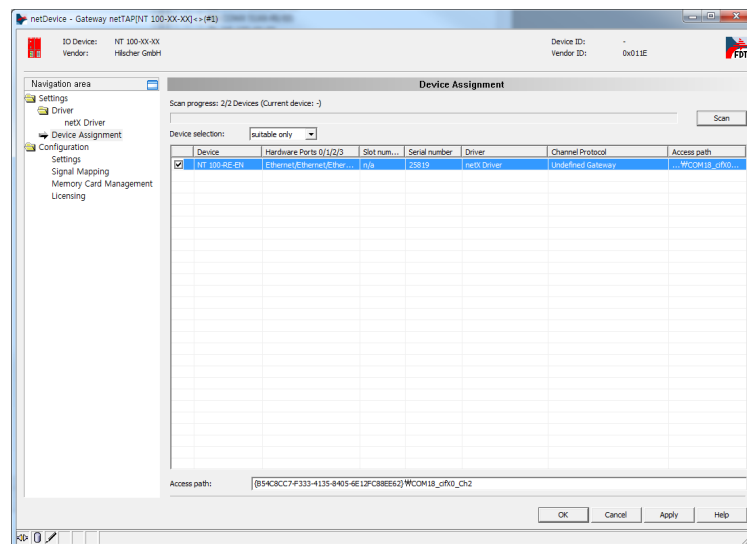
2.3 Gateway Device (NT 100-RE-EN) Configuration

Unlike NT50, NT100 can download settings from a USB, so it does not require the use of the Ethernet Device Configuration Tool used for NT50.

Once the SYCON.net program and USB driver are installed on the workstation PC through Gateway_Solution, add Gateway NT100 using SYCON.net, and the USB Connection information can be checked in Configuration, as shown below.

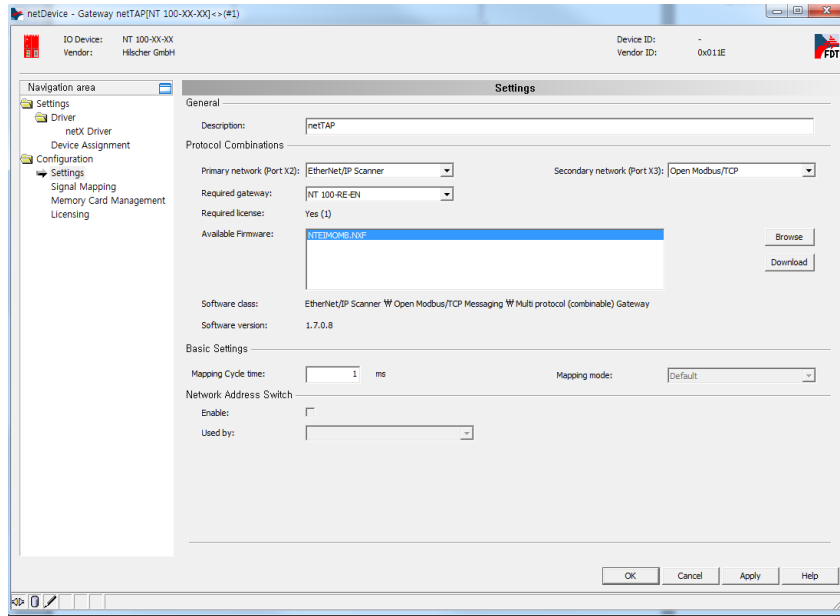


In Gateway-Configuration-Settings-Device Assignment, find connected devices using Scan and click Apply.

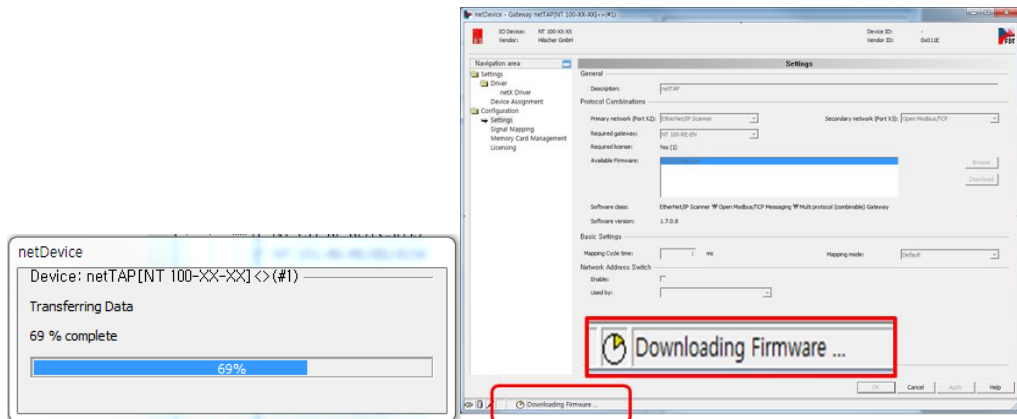


2.3.1 Firmware Download

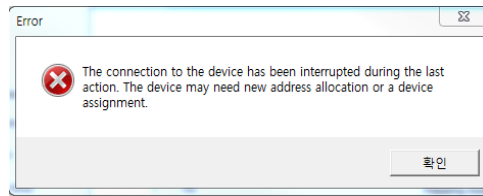
In Gateway-Configuration-Configuration-Settings, select Primary network (EtherNet/IP Scanner) Secondary network (Open Modbus/TCP) to download the Available Firmware (NTEIMOMB.NXF).



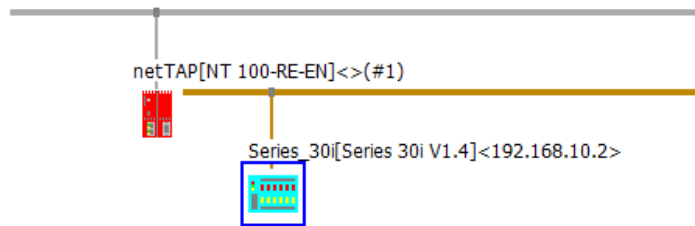
During the download, ignore the progress shown in the message window and wait until the indication at the bottom disappears.



Once the download is complete, an error message is displayed, as shown below. This is because the equipment is initialized after firmware download, which results in Assignment reset. Run Assignment again to resolve the error.

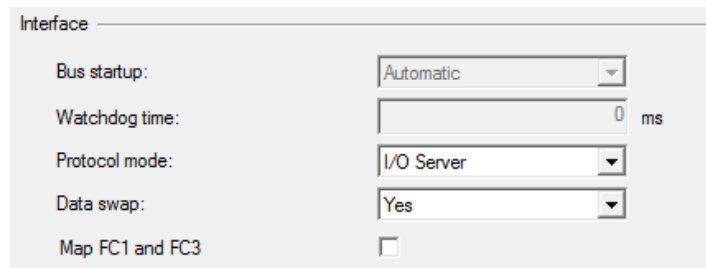


In the case of EtherNet/IP, Gateway-Network Scan is not possible, so select and drag the corresponding EtherNet/IP Slave (Adapter) from the equipment list on the right, and connect it to the Gateway bus.



2.3.2 Modbus Slave Configuration

- In Gateway – Configuration – Open Modbus TCP,
- modify Interface - Protocol mode as I/O Server.



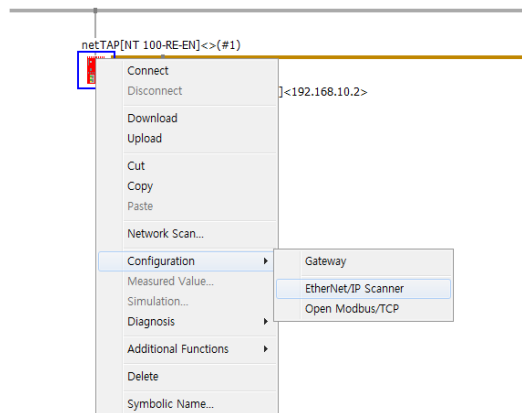
- After disabling DHCP in Bus setting,
- configure the IP Address (192.168.127.x) and Netmask (255.255.255.0).

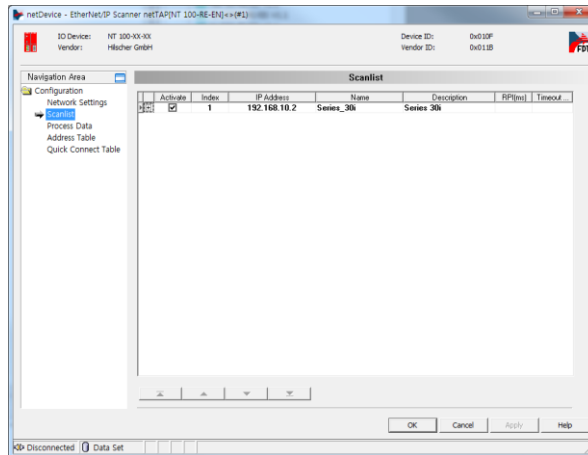
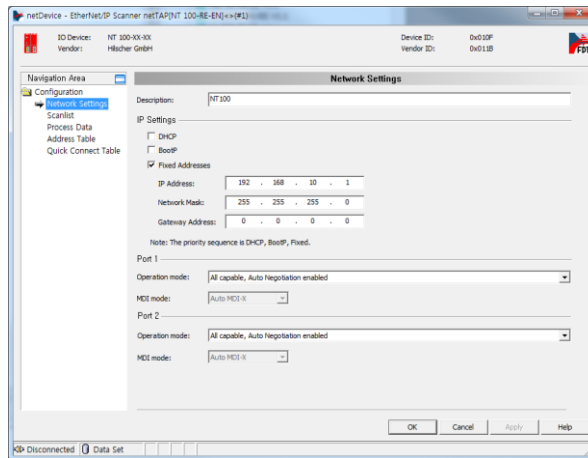
Bus	
Provided server connections:	4
Client connection watchdog time:	1000 ms
Response timeout:	2000 ms
Send acknowledgement timeout:	31000 ms
Connect acknowledgement timeout:	31000 ms
Close acknowledgement timeout:	13000 ms
IP address:	192 . 168 . 127 . 151 <input checked="" type="checkbox"/> Enable
Netmask:	255 . 255 . 255 . 0 <input checked="" type="checkbox"/> Enable
Gateway:	0 . 0 . 0 . 0 <input type="checkbox"/> Enable
Extras:	<input type="checkbox"/> BootP <input type="checkbox"/> DHCP <input type="checkbox"/> 100MBit <input type="checkbox"/> Full Duplex <input type="checkbox"/> Auto-neg.
Data	
Register (Input):	2880
Register (Output):	2880

-The Register size of the Data Setting is automatically configured by the EtherNet/IP, so it is okay to leave it as default.

2.3.3 EtherNet/IP Master (Scanner) Configuration

Set the IP between the Master (Scanner) and Slave (Adapter) to establish EtherNet/IP communication. Go to Gateway-Configuration-EtherNet/IP Scanner and set the Master IP in Network Setting and Slave IP in Scanlist.

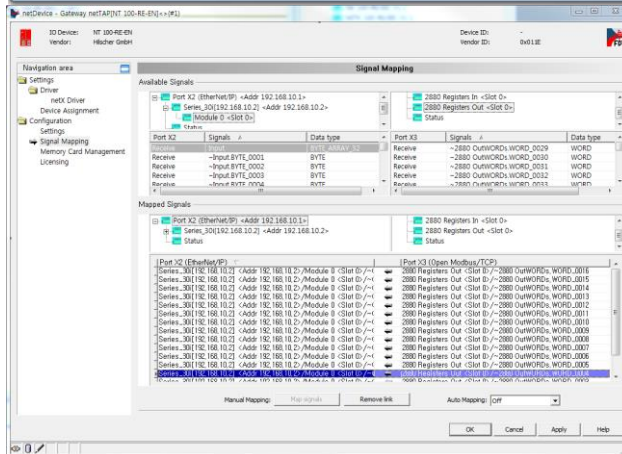
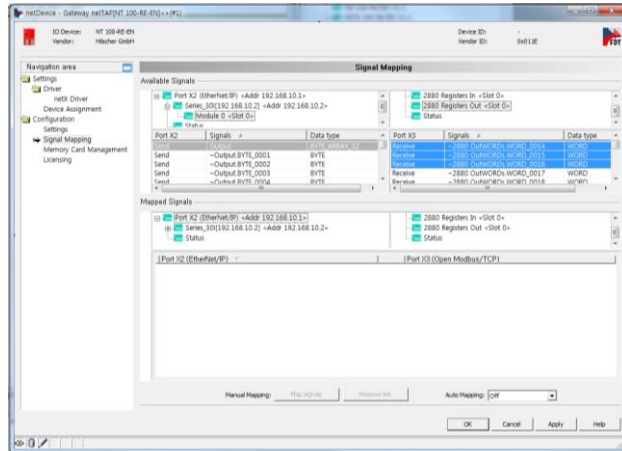




The definition of data transmitted via EtherNet/IP is included in the EDS file, so it cannot be configured individually (32 byte Input/32 byte Output).

2.3.4 Signal Mapping

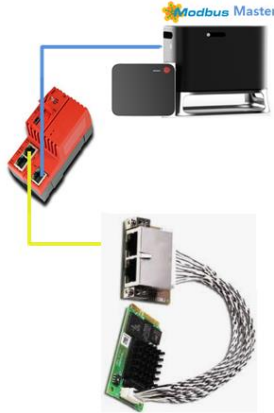
- Right-click Gateway, click Configuration – Gateway
- Configuration on the Left – Signal Mapping
- Select Register Out from the Modbus on the right of Available Signals, then drag Receive WORD 0001~0016 (in Modbus, WORD refers to 2 byte) from the bottom list, and match them to Send 0001 of EtherNet/IP on the left.



- Drag Receive 0001~0032 from EtherNet/IP on the left and match them to Register In Send 0001 of Modbus on the right.

Attachment 3. PROFINET I/O Device Linking Method

1. Structure



The overall system for testing is structured as in the figure above. The Profinet Slave equipment used is the Hilscher cifX 90e card. Gateway firmware is operated using Profinet I/O Controller (Master) – OpenModbus Slave (I/O Server).

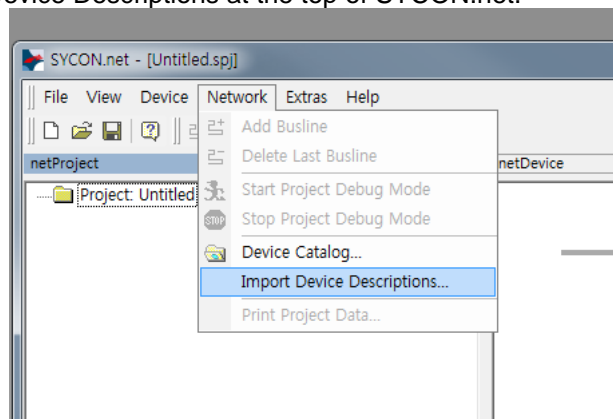
2. Setting

2.1 Profinet I/O Device GSDML File

To be able to use Profinet I/O Device (Slave), it is necessary to have a GSDML (EDS) file of the corresponding Slave.

2.2 Importing GSDML File to SYCON.net

Click Network - Import Device Descriptions at the top of SYCON.net.



Select the appropriate file format for the Fieldbus (PROFINET GSDML (*.xml)), find the

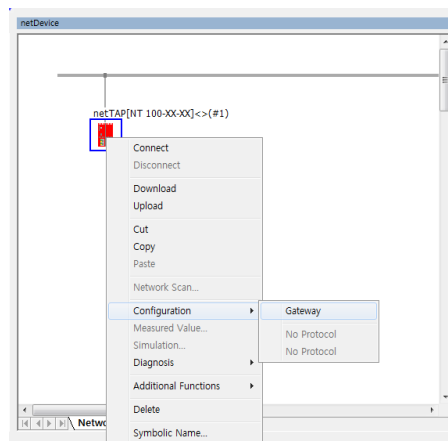
corresponding file and open it. Newly added devices are displayed on the device list of the corresponding Fieldbus on the right.

For this test, a Hilscher device is configured as the default Slave equipment.

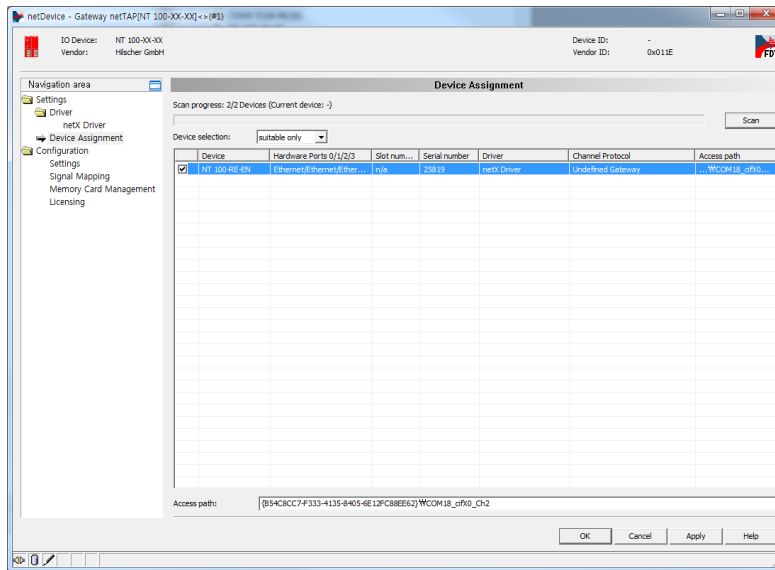
2.3 Gateway Device (NT 100-RE-EN) Configuration

In the case of NT100, settings are downloaded using a USB.

Once the SYCON.net program and USB driver are installed on the workstation PC through Gateway_Solution, add Gateway NT100 using SYCON.net, and select Configuration.

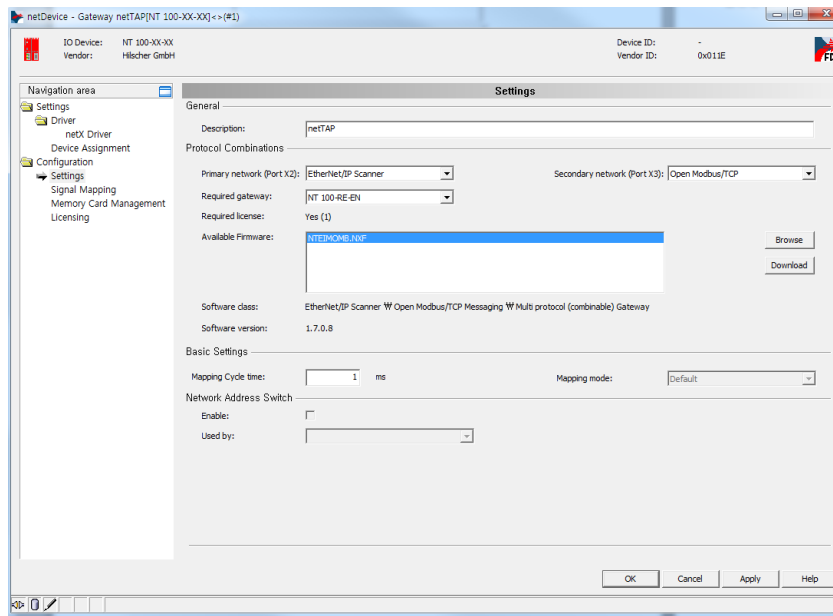


In Gateway-Configuration-Settings-Device Assignment, find connected devices using Scan and click Apply. (equipment must be scanned without a separate setting, and if this fails, the Gateway must undergo Factory Reset)

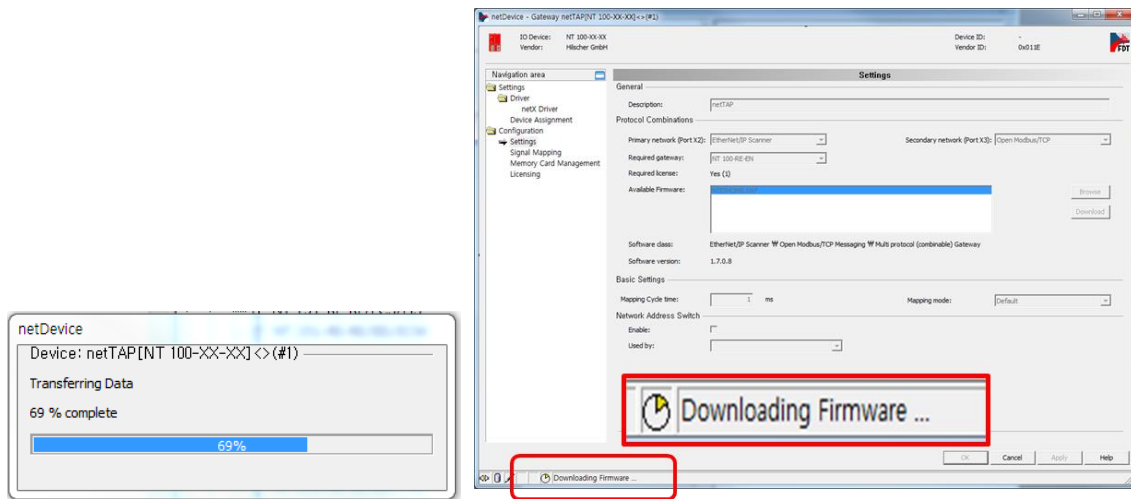


2.3.1 Firmware Download

In Gateway-Configuration-Configuration-Settings, select Primary network (Profinet I/O Controller) Secondary network (Open Modbus/TCP) to download the Available Firmware (NTPNMOMB.NXF).

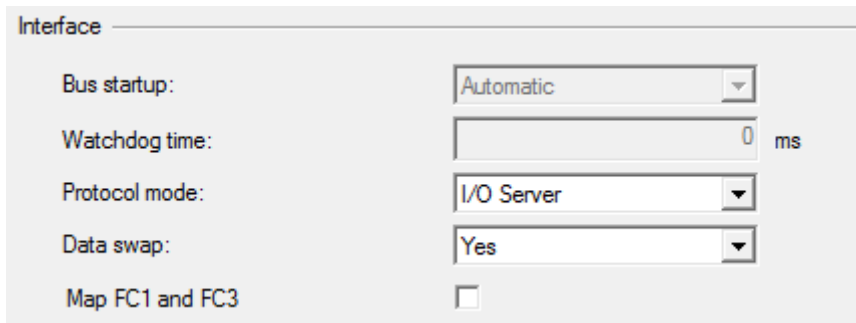


During the download, ignore the progress shown in the message window and wait until the indication at the bottom disappears.



2.3.2 Modbus Slave Configuration

- In Gateway – Configuration – Open Modbus TCP,
- modify Interface - Protocol mode as I/O Server.



- After disabling DHCP in Bus setting,
- configure the IP Address (192.168.127.x) and Netmask (255.255.255.0).

Bus

Provided server connections:

Client connection watchdog time: ms

Response timeout: ms

Send acknowledgement timeout: ms

Connect acknowledgement timeout: ms

Close acknowledgement timeout: ms

IP address: Enable

Netmask: Enable

Gateway: Enable

Extras:

BootP DHCP

100MBit Full Duplex

Auto-neg.

Data

Register (Input): Register (Output):

-The Register size of the Data Setting is automatically configured by Profinet, so it is okay to leave it as default.

2.3.3 Profinet I/O Controller (Master) Configuration

In the case of Profinet, Gateway-Network Scan is not possible, so select and drag the corresponding Profinet I/O Device (Slave) from the equipment list on the right, and connect it to the Gateway bus.

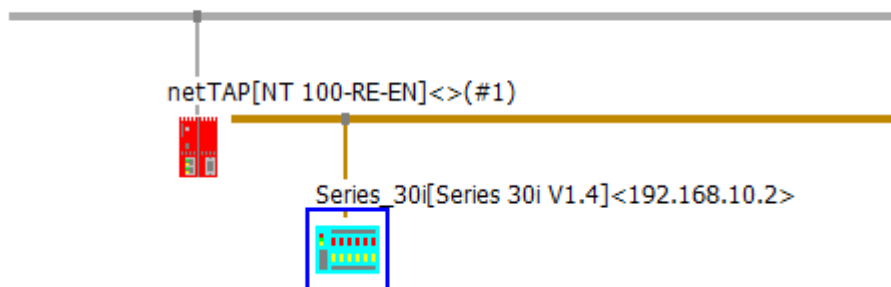


Figure 2 Add Profinet I/O Device (Slave)

Go to Slave - Configuration – Modules and use Add Module to configure In/Out Data.

2.3.4 Signal Mapping

- Right-click Gateway, click Configuration – Gateway
- Configuration on the Left – Signal Mapping
- Perform Auto Mapping with the Auto Mapping function at the bottom.
- Right-click Gateway and click Download to download the settings to the device.

Attachment 4. CC-Link (Mitsubishi PLC) Linking Method

1. Structure

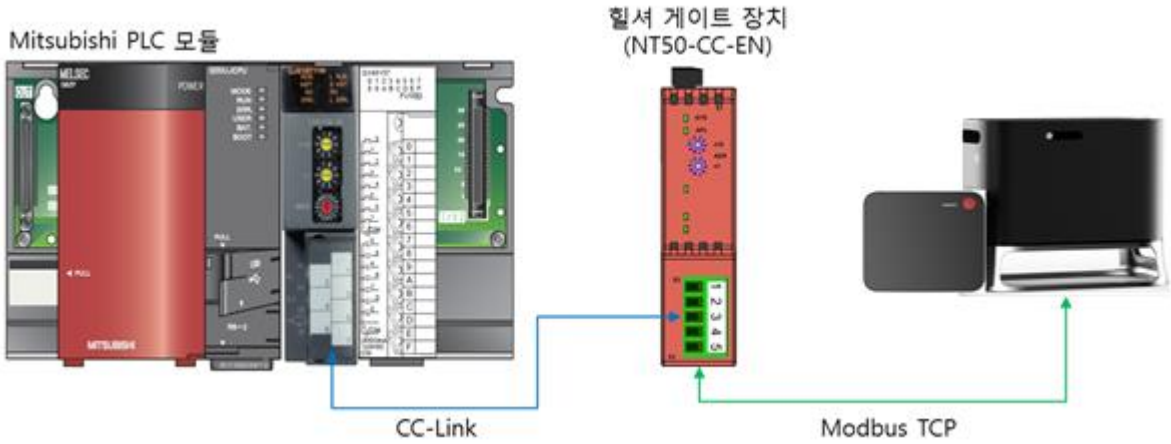


Figure 3 System Configuration

The overall system for testing is structured as in the figure above. The Mitsubishi PLC module and Hilscher Gateway are connected via CC-Link communication, and the Hilscher Gateway and Doosan robot controller are connected via Modbus TCP communication. As a result, the Mitsubishi PLC and Doosan machine tool can communicate with each other through the Gateway.

2. Setting

2.1 Mitsubishi PLC Configuration

2.1.1 CC-Link Communication Configuration

For configuration, configure the setting switches of the CC-Link Master among PCL modules (e.g., QJ61BT11N) as follows:

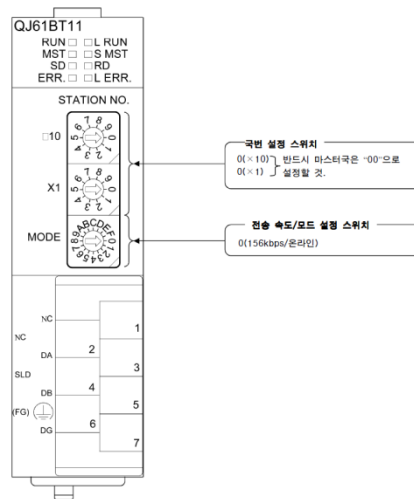


Figure 4 Setting Switch Sample Screen

In the sample setting as shown above, the area code setting switch must be set as 0 for x10 and x1 as CC-Link Master is set. Also, the MODE selection is related to communication speed, so refer to the table below for configuration. For the test, set the MODE as “4” (10 Mbps).

No.	Transmission Speed	Mode
0	156k bps	Online Mode
1	625k bps	
2	2.5M bps	
3	5M bps	
4	10M bps	
5	156k bps	Line Test Mode (Area Code setting switch configured as 0: Line Test 1) (Area Code setting switch configured as 1-64: Line Test 2)
6	625k bps	
7	2.5M bps	
8	5M bps	
9	10M bps	
A	156k bps	Hardware Test Mode
B	625k bps	
C	2.5M bps	
D	5M bps	
E	10M bps	
F		
		Configuration Prohibited

Table 1 Mode Setting Information

2.1.1.1 PLC Parameter Configuration

To build and download the PLC SW image, create, build and download GX Works2 software. GX Works software is a unified development tool consisting of GX Configurator, GX Developer and GX Simulator programs. First, execute the GX Works2 program and select New project. Then, select the properties of the new project and push the OK button as follows.

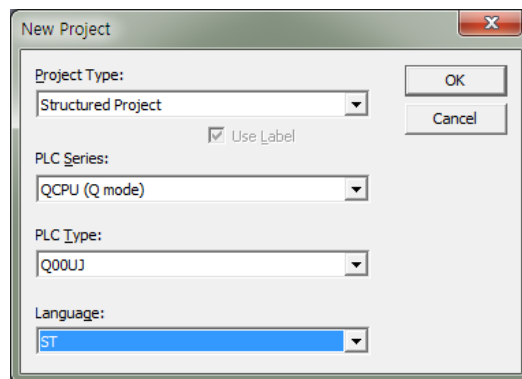


Figure 5 New Project Input Screen

When Parameter - PLC Parameter item is displayed on the Project Tab on the left, a popup window is displayed as follows. Enter parameters according to each item, referring to the following figures:

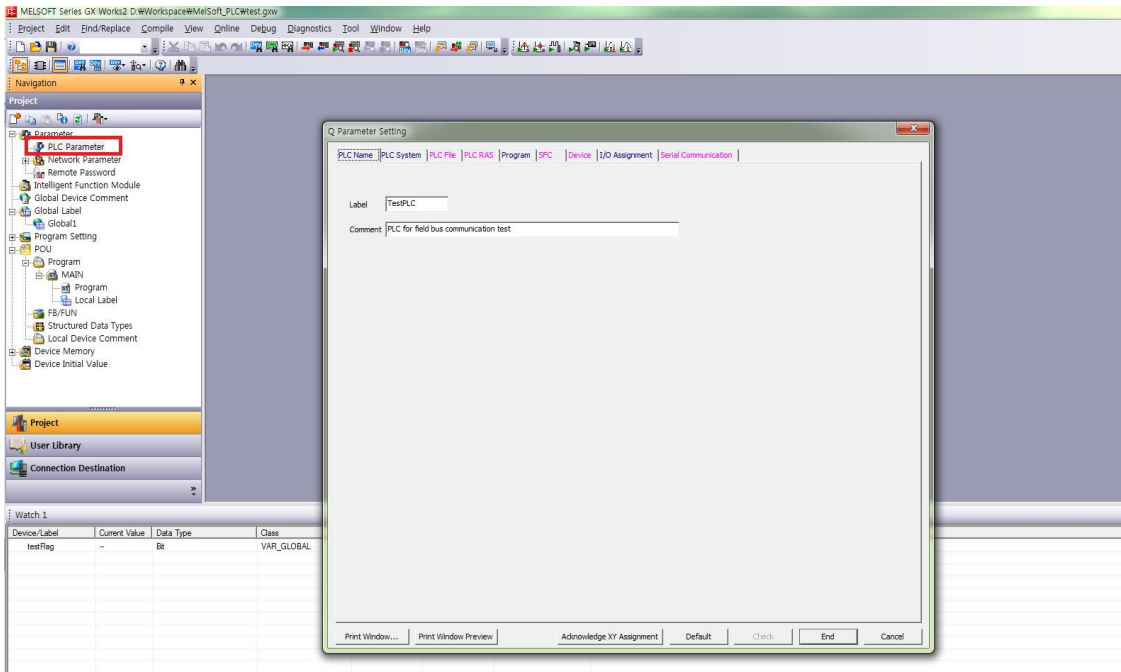


Figure 6 PLC Parameter Select Screen

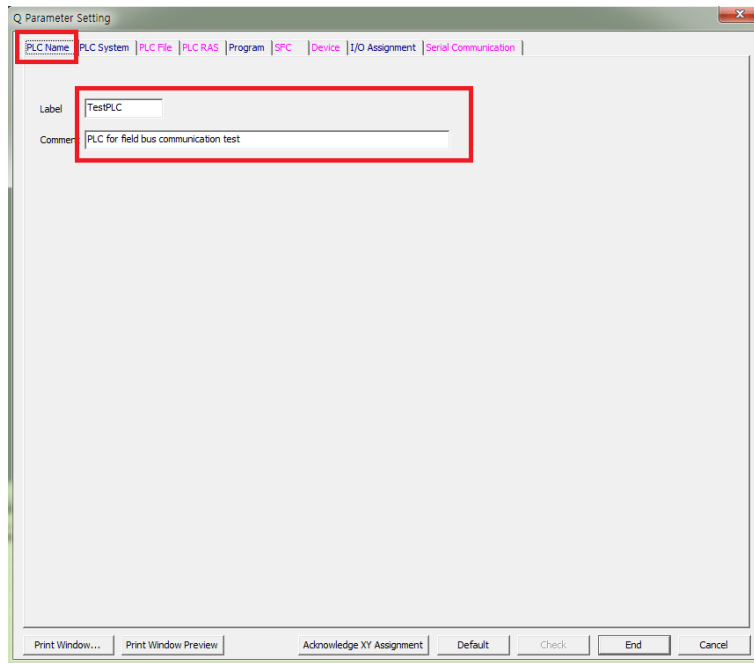


Figure 7 PLC Name Input Screen

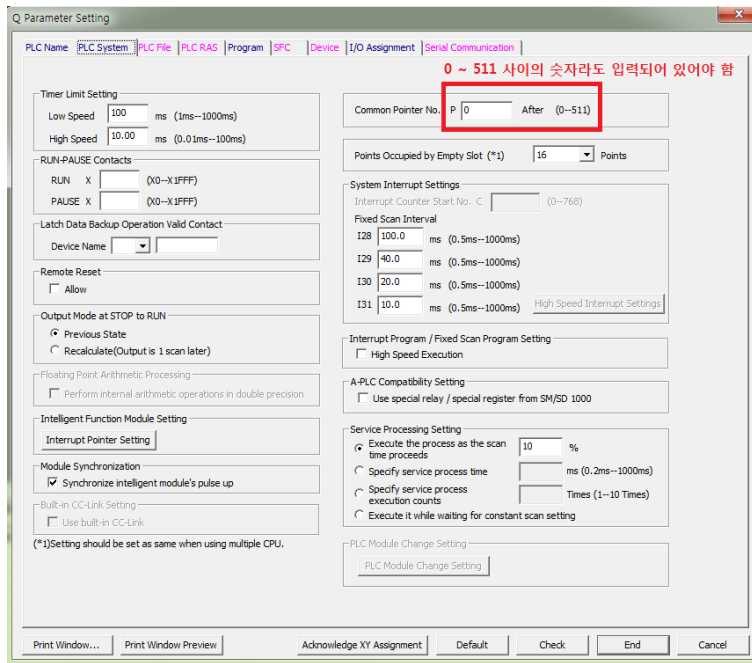


Figure 8 PLC System Input Screen

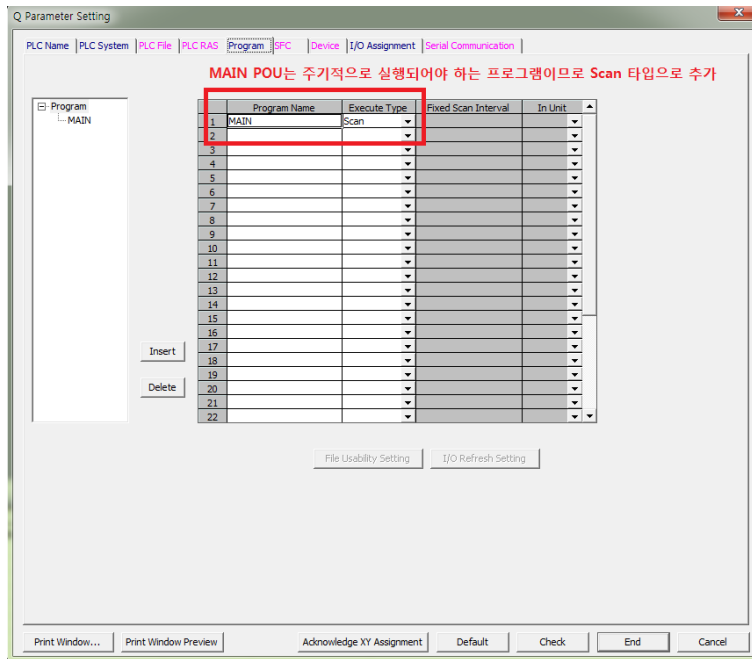


Figure 9 Program Input Screen

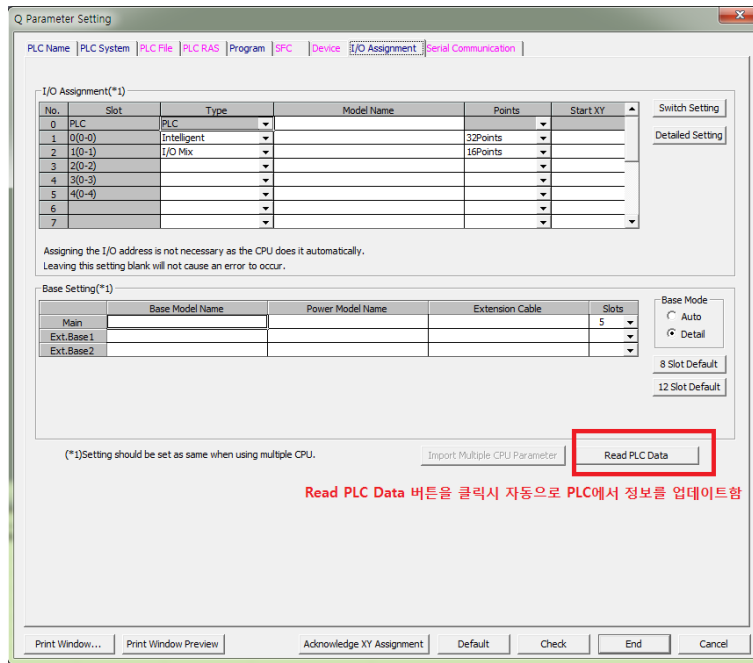


Figure 10 I/O Assignment Input Screen

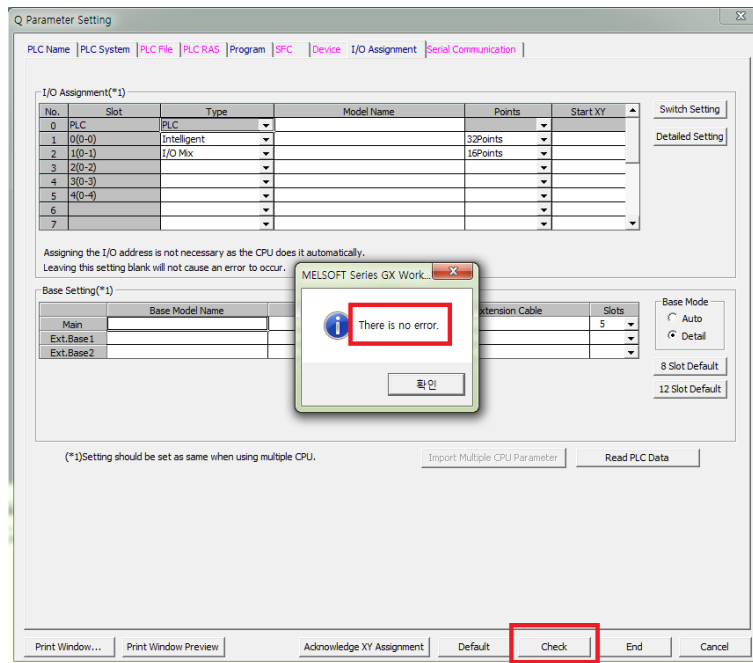


Figure 11 Final Result Check Screen

Once parameters are entered as in the figures above, press the Check button on the bottom to check

whether Errors occurred, then press the End button to enter the configured information. If an error window is displayed after Check is pressed, check related configuration information, eliminate error conditions and then press the End button to properly apply the configuration.

After PLC Parameter configuration is complete, Network Parameter information must be configured. In this example, the system uses CC-Link, so select Network Parameter – CC-Link. Enter parameters in the CC-Link configuration referring to the figure and table below and click the Station Information button.

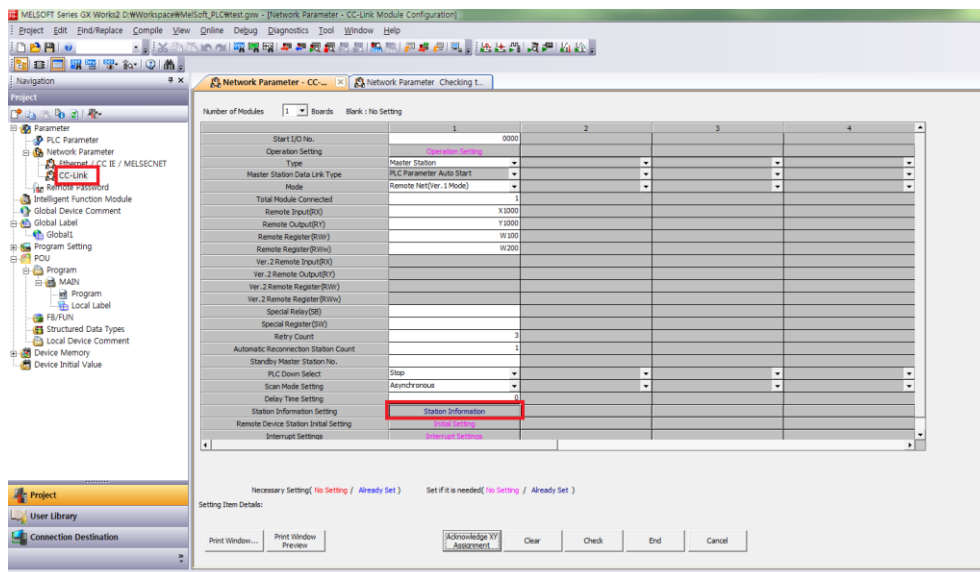


Figure 12 CC-Link Communication Configuration Screen

Item	Details
Type	Master Station
Mode	Remote Net (Ver.1 Mode)
Total Module	1
Remote Input (RX)	X1000
Remote Output (RY)	Y1000
Remote Register (RWr)	W100
Remote Register (RWw)	W200

Table 2 CC-Link Communication Configuration Description

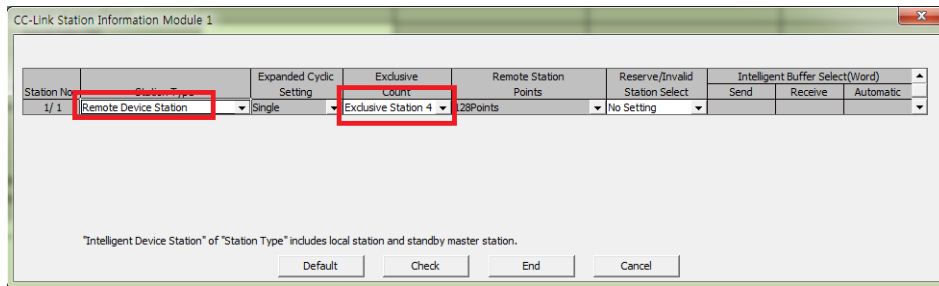


Figure 13 Station Information Information Input Screen

When the Station Information screen is displayed, enter Remote Device Station and Exclusive Station 4 information, press the Check button to check whether there are errors, and press the End button to complete the configuration. Press the Check button at CC-Link configuration screen to check whether there are errors, and press the End button to complete the configuration.

2.1.1.2 ST Language Program Creation

Since the ST language support option is selected when a project is created, it is possible to use ST language when creating PLC software. The next section describes how to create a program that sets the input value of the Input device as the output value of the Output device.

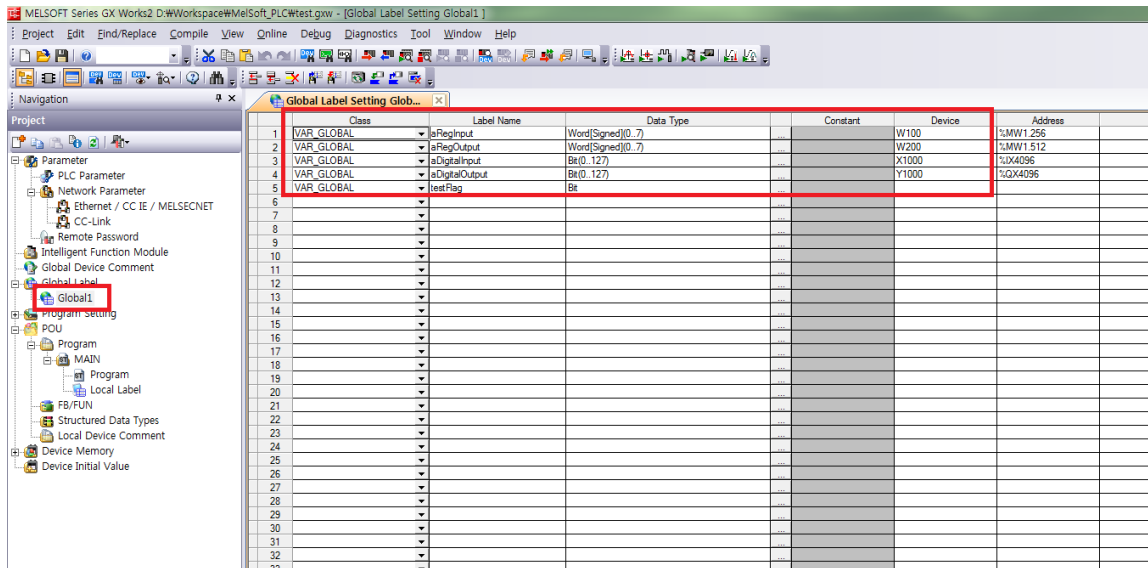


Figure 14 Global Variable Input Screen

Register Global variables as in the figure above to use the I/O of the device connected via CC-Link communication. Variable registration information is in the following table:

Class	Label Name	Data Type	Device	Description
VAR_GLOBAL	aRegInput	Word(Signed)(0..7)	W100	Register Input
VAR_GLOBAL	aRegOutput	Word(Signed)(0..7)	W200	Register Output
VAR_GLOBAL	aDigitalInput	Bit(0..127)	X1000	Digital Input
VAR_GLOBAL	aDigitalOutput	Bit(0..127)	Y1000	Digital Output
VAR_GLOBAL	testFlag	Bit		Test Purpose
VAR	count	Word(Signed)		Local Variable

Figure 15 Variable Input Information

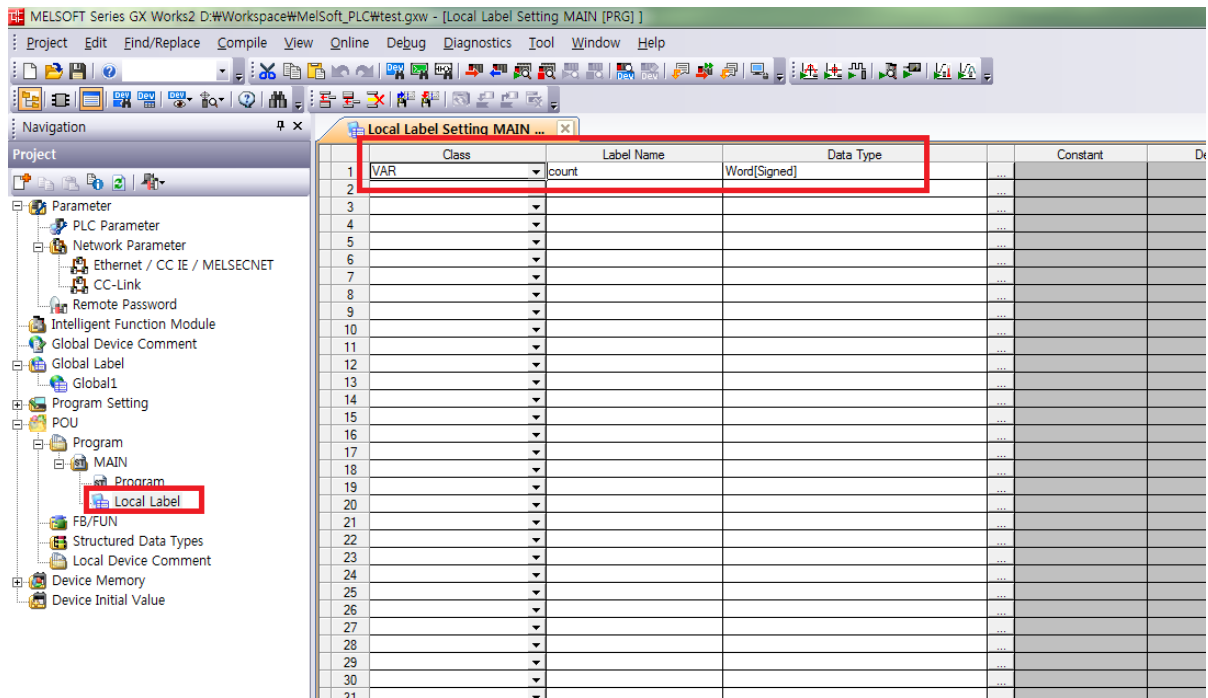


Figure 16 Local Variable Input Screen

When the Global variable registration is complete, select the POU – Program – MAIN – Local Label item as in the figure above to register the Local variable to use in the program. In this example, the count variable is registered to execute the For loop syntax.

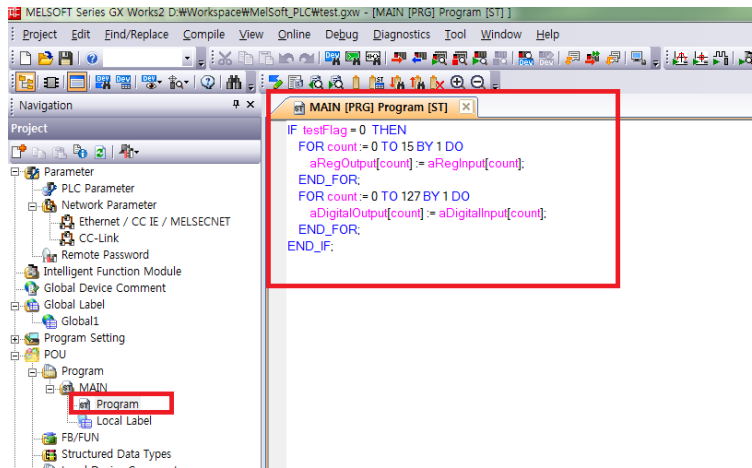


Figure 17 MAIN POU Program Input Screen

Select POU – Program – MAIN – Program item and enter the motion of the MAIN program to execute. Inputs made in the figure above assign the aRegInpu variable as aRegisterOutput variable and the aDigitalInpu variable as the aDigitalOutput variable when testFlag is 0. Since the MAIN program is registered as a Scan type during PLC Parameter configuration, the MAIN POU program automatically restarts periodically even without specific inputs.

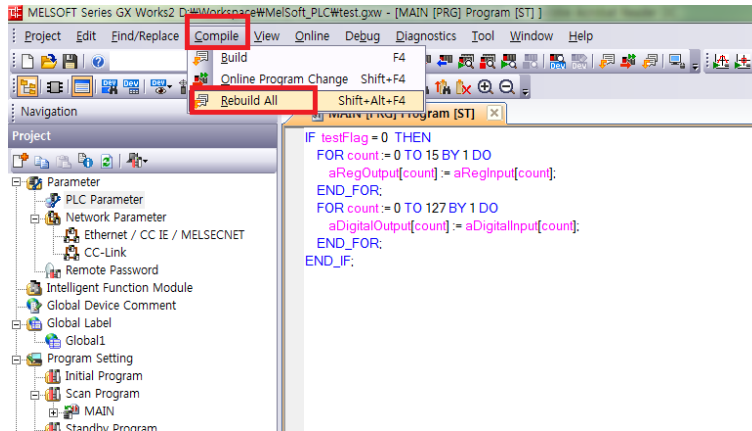


Figure 18 Compile Menu Selection Screen

When program creation is complete, select Compile - Rebuild All items and execute the entire project build for program building. If there are no errors, no error message is displayed and the build is complete. When the program is properly built, select the Online - Write to PLC menu as in the figure below to Download.

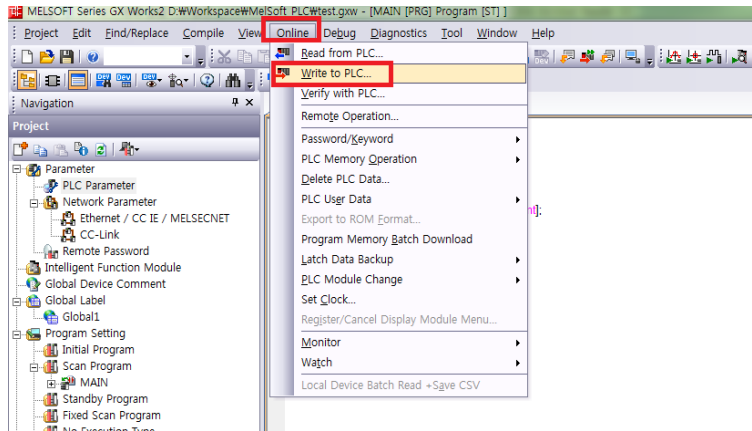


Figure 19 Write to PLC Menu Selection Screen

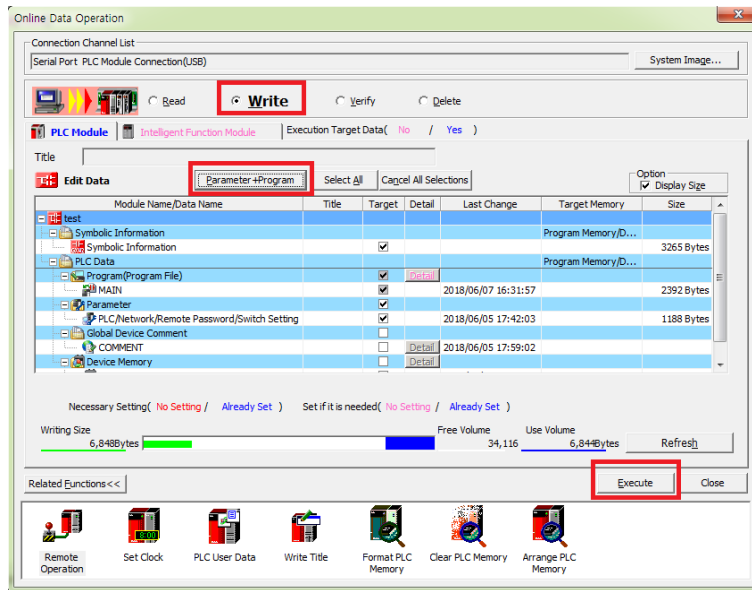


Figure 20 Write to PLC Popup Screen

When a popup is displayed as in the figure above, select the Parameter+Program item to designate the item to Download and click the Execute button to Download it to the PLC. After completing the process described above, CC-Link communication is established and the PLC is configured to periodically execute the test program that allocates the input value as the output value.

2.1.2 Hilscher Gateway Device (NT 50-CC-EN) Configuration

During initial device configuration, use the Ethernet Device Configuration tool to allocate an IP address to a Gateway device. In this example, 192.168.137.123 is used.

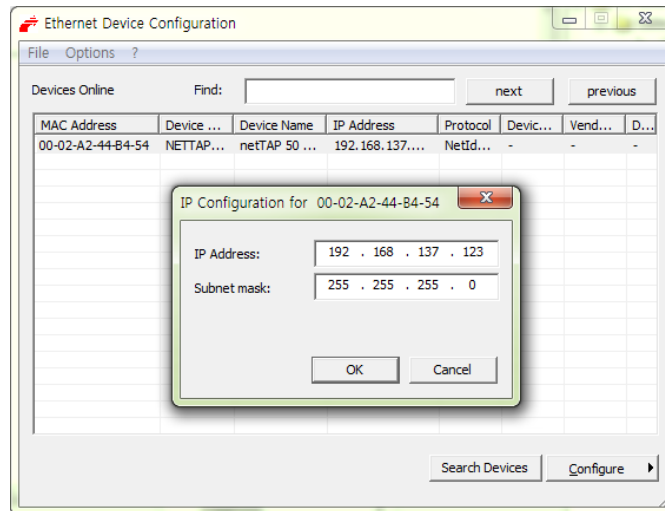


Figure 21 Ethernet Device Configuration Tool Configuration Screen

Execute the SYSCON program to download the Gateway device image and create a new project to add an NT-50-CC-EN device supporting the CC-Link protocol.

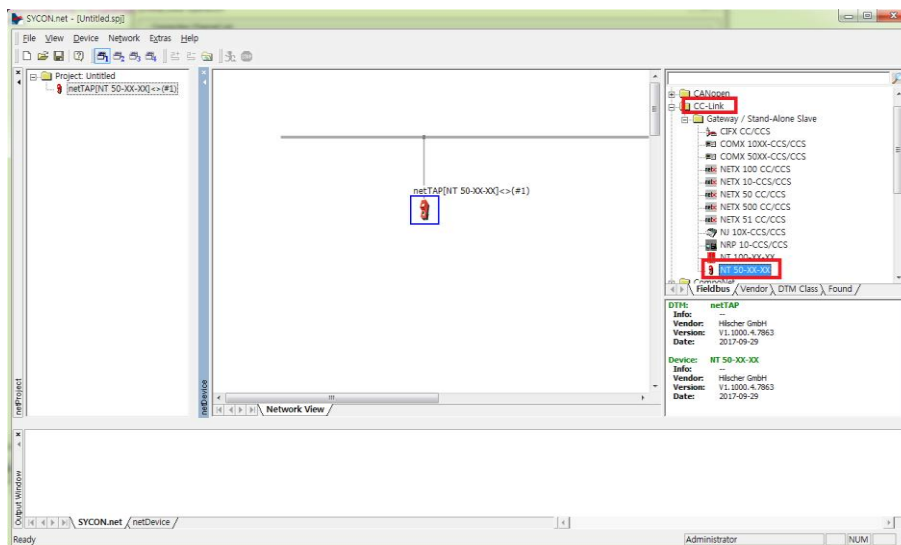


Figure 22 Add Gateway Screen

Using the mouse, right-click on the added device and click → Configuration → Gateway to configure the communication protocol of Port x2 and x3.

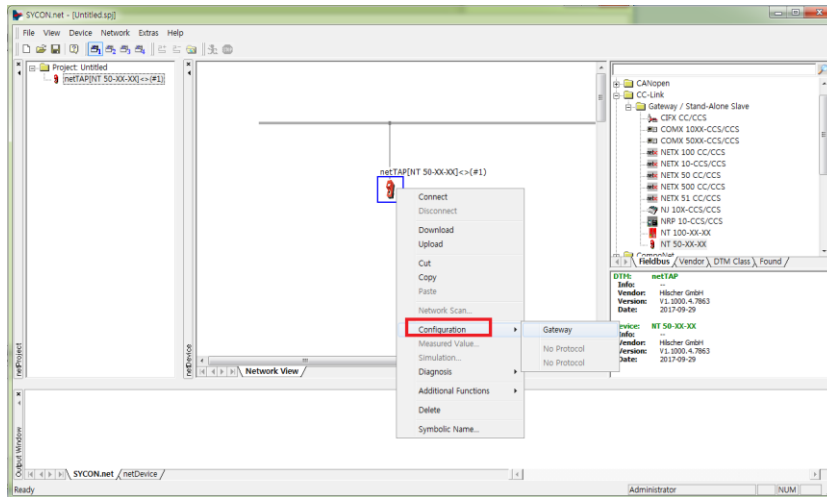


Figure 23 Gateway Configuration Screen

Select CC-Link Slave for Port x2 and select Open Modbus TCP for Port x3, and then select Download.

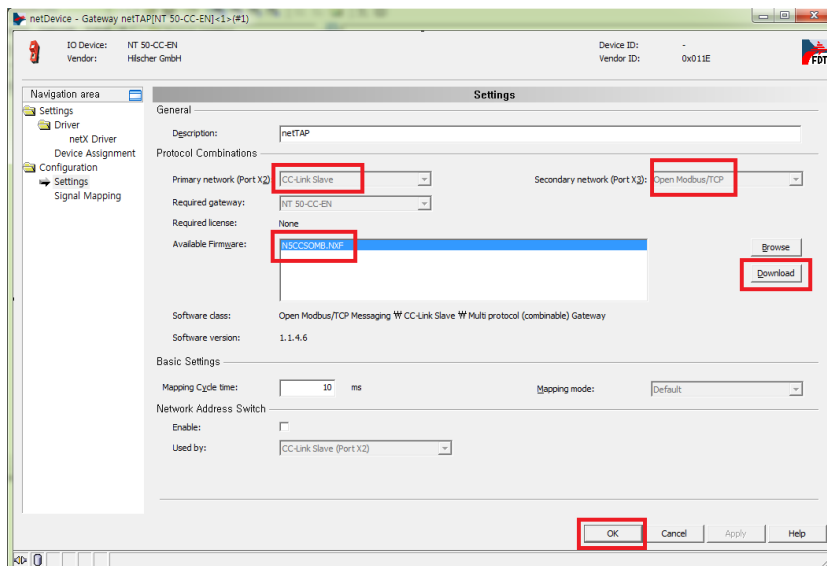


Figure 24 Gateway Configuration Popup Menu Screen

After Gateway Download is complete, keep in mind that you must repeat the process of assigning an IP address using the Ethernet Device Configuration tool as in the early stage of the process. This is because the Gateway firmware update initializes the IP information and requires reconfiguration.

The following section describes how to configure Port x2 and x3 individually according to each protocol. Using the mouse, right-click on the added Gateway device and click → Configuration → CC-Link Slave or Open Modbus/TCP to configure the protocol to connect to.

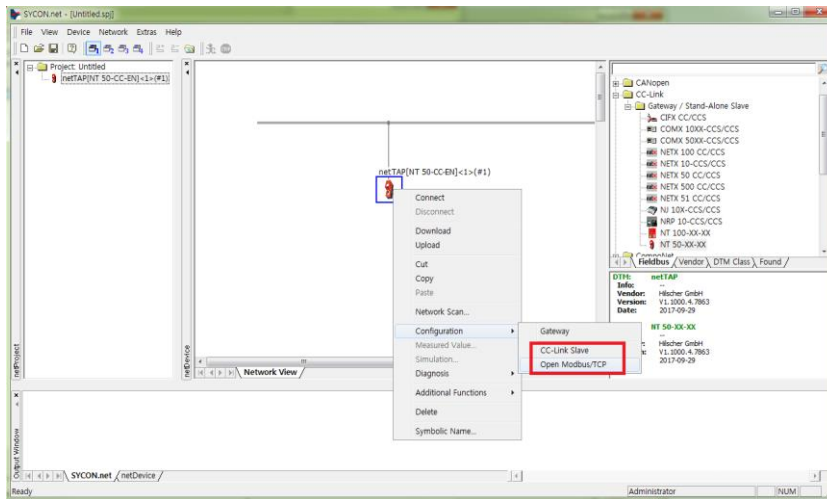


Figure 25 Protocol Configuration Menu Screen for Port 1 and 2

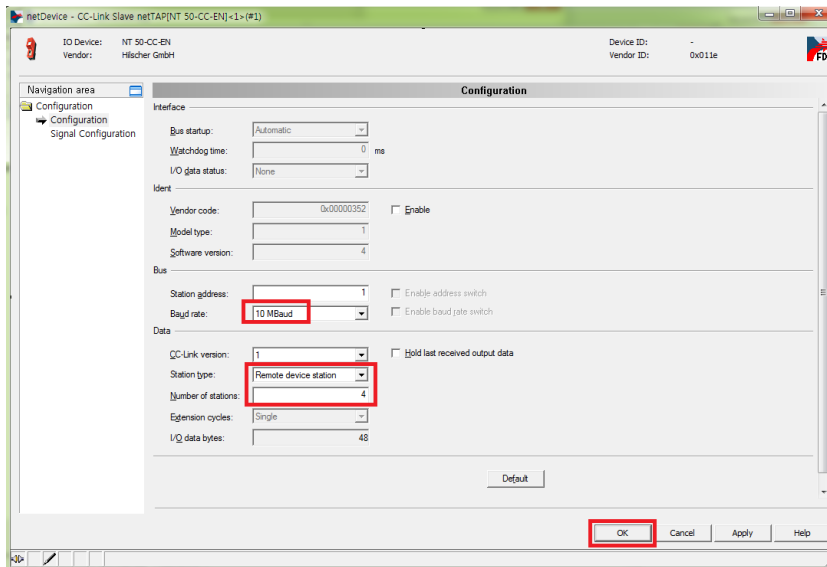


Figure 26 CC-Link Protocol Configuration Screen

First, configure the CC-Link Slave protocol of Port X2 as in the figure above. Set the communication speed to 10 Mbps as in the PLC configuration, station type to Remote device station, Number of stations to four and click OK to complete the configuration.

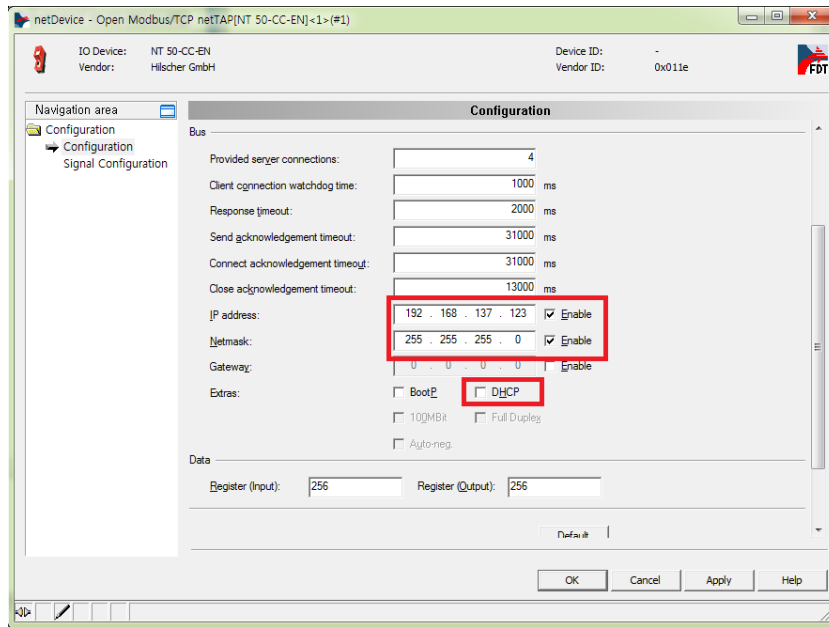


Figure 27 Modbus TCP Protocol Configuration Screen

Then configure the Open Modbus/TCP protocol for Port x3. Deselect the DHCP option as in the figure above and enter the allocated IP information. In this example, the IP address 192.168.138.123 is used.

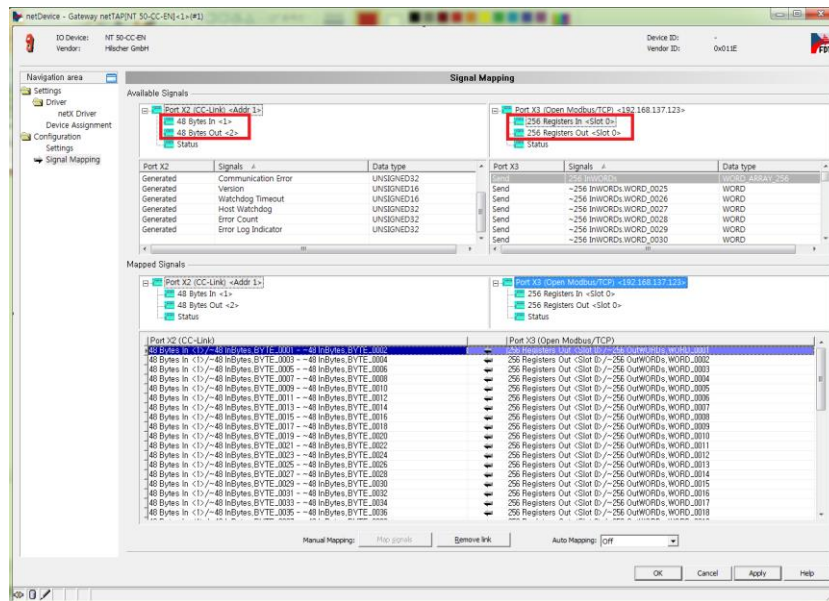


Figure 28 Gateway Signal Mapping Configuration Screen

After protocol configuration of Port x2 and x3 are complete, data must be connected to the x2 and x3 communication in order for the Gateway device to perform its role. Using the mouse, right-click on the added device and click the → Configuration → Gateway menu to Open the Gateway configuration

popup.

Then select Signal Mapping from the tab on the right to Open the data connection screen of Port x2 and x3. In the figure above, Port x2 is able to use 48 Bytes of data as In/Out and Port x3 is able to use 256 Words of data as In/Out. Because the data size of Port x3 is larger than Port x2, data must be connected manually as the automatic allocation function is unavailable. In the figure above, 48 Bytes of data of Port x2 are connected to 24 Words of data of Port x3.

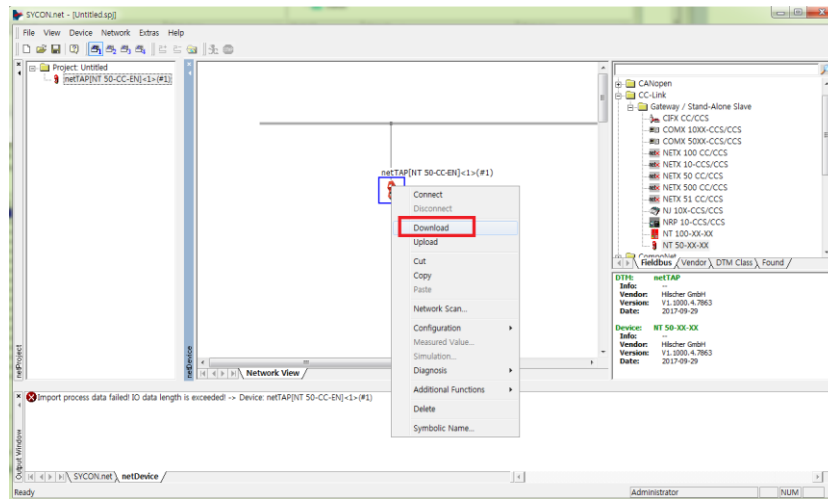


Figure 29 Download Menu Screen

After completing the processes above, execute Download as in the figure above to apply the changes.

2.1.3 Test Procedure

- ✓ After completing the configuration processes above without errors, the CC-Link Slave device and Modbus TCP communication are configured as follows:

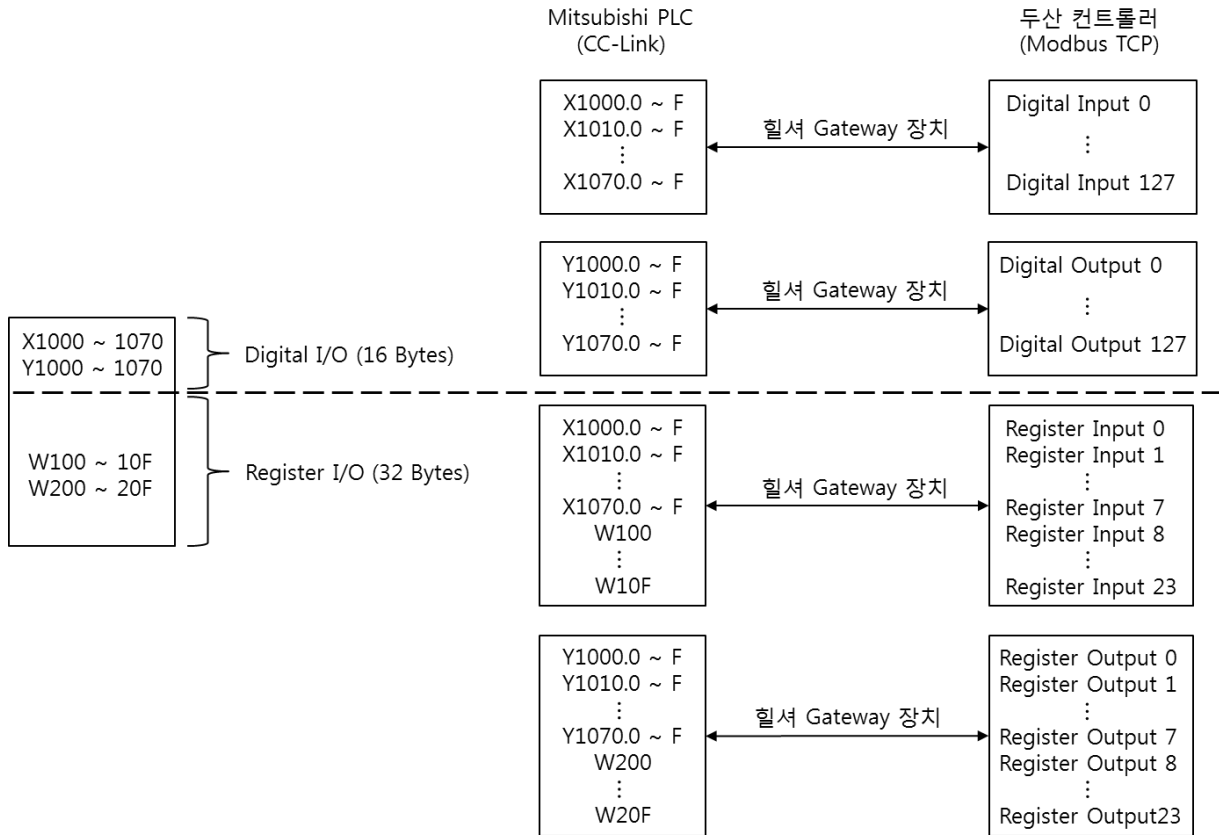


Figure 30 Modbus TCP and CC-Link Communication

Modbus TCP	PLC Address	Size
Digital Input	X1000 ~ X1070	128 Bits
Digital Output	Y1000 ~ Y1070	128 Bits
Register Input	X1000 ~ X1070, W100 ~ W10F	24 Words
Register Output	Y1000 ~ Y1070, W200 ~ W20F	24 Words

Table 3 Modbus TCP and CC-Link Communication Connection Data Table

- ✓ The overall I/O data supported are the same as the description above, but in the test, a simple example is created to check whether I/O control is performed properly by adding some I/Os.
- ✓ Add registers in the TP program as in the following table:

Name	Type	IP address	Index
mDi0 ~ 7	Digital Input	192.168.137.123	0 ~ 7
mDo0 ~ 7	Digital Output	192.168.137.123	0 ~ 7
mRi0	Register Input	192.168.137.123	8
mRo0	Register Output	192.168.137.123	8

Table 4 Modbus Register Registration Table

- ✓ Use Task Writer to program the following:

```

set_modbus_output("mDo0",ON)

wait_modbus_input("mDi0",ON)

set_modbus_output("mDo1",ON)

wait_modbus_input("mDi1",ON)

set_modbus_output("mDo0",OFF)

wait_modbus_input("mDi0",OFF)

set_modbus_output("mDo1",OFF)

```

- /
- ✓ Execute the Task to check its results.



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