How to Use the TIA Portal to Set a Siemens PLC and the MGate 5111

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Contents

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About Moxa

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1 Application Description

The **TIA Portal** is **Siemens's** new software platform to configure and program **S7-300/400/1200/1500** PLCs. This technical note demonstrates how to configure the **Siemens S7-300** to connect with the **MGate 5111** in **TIA Portal** V14.

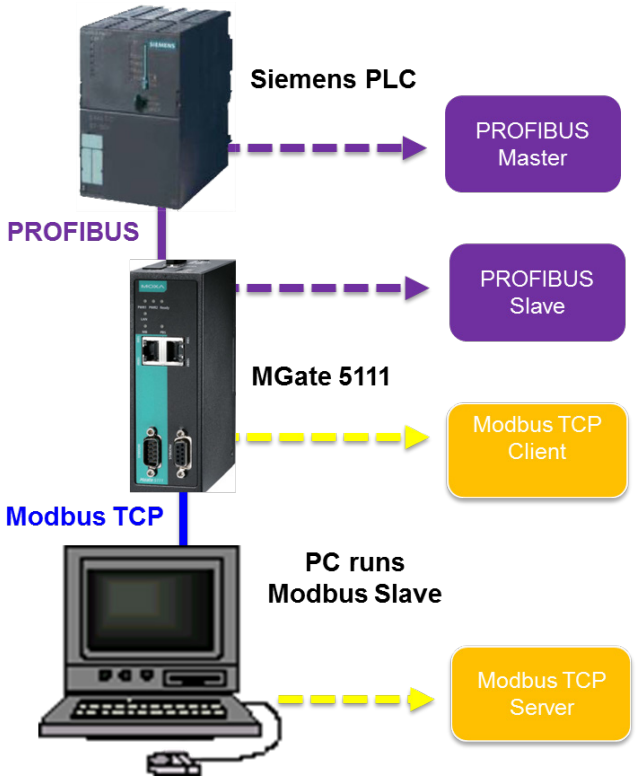
The **MGate 5111** supports a variety of maintenance functions, such as **Protocol Diagnostics**, **Traffic Monitoring**, **Status Monitoring,** and **Fault Protection**. The **Status Monitoring** function notifies a PLC/DCS/SCADA system when a Modbus device gets disconnected or does not respond. If a command has run successfully, the status bit's value will be 1. If a command has failed, the status bit's value will be 0. In this case, the master device will be aware of the failure status of the slave device. When a PROFIBUS cable gets disconnected, the **Fault Protection** function executes actions on end devices identified by a pre-defined value set by the user.

This technical note demonstrates how PROFIBUS Master (**Siemens** PLC) get these Modbus command statuses by receiving **Input Status module** values, as well as how the **Fault Protection** function works. We also demonstrate how **Protocol Diagnostics** and **Traffic Monitoring** make troubleshooting easy.

2 System Topology

This technical note demonstrates how to exchange data between a PROFIBUS master and six Modbus TCP slaves. The Modbus TCP slave IDs 1-3 use Modbus Read command and show the **Status Monitoring** function. The Modbus TCP slave IDs 4-6 use Modbus Write command and show the **Fault Protection** function.

We use the **Siemens S7-300** as the PROFIBUS Master to connect the **MGate 5111**'s PROFIBUS port. On a PC, we run a **Modbus Slave** tool to simulate Modbus TCP slaves that the **MGate 5111** will connect to the PC's TCP 502 to poll slaves.



3 Required Equipment and Components

A. TIA Portal

As a registered **Siemens**'s customer you can download the trial software for **TIA Portal** V14 and test it for 21 days.

Version: V14

Download Website:
https://support.industry.siemens.com/cs/document/109740158/simatic-step-7-(tia-portal)-v14-trial-download?dti=0&lc=en-WW

B. Modbus Slave

Modbus Slave is a popular Modbus slave simulator to test and debug your modbus devices. Supports Modbus RTU/ASCII and Modbus TCP/IP.

Version: V6+

Download Website: http://www.modbustools.com/download.html

C. MGate 5111 Firmware

Version: V.1.0

Download Website: http://www.moxa.com

D. MGate 5111's GSD File

The **GSD** (General Station Description) file is an electronic device datasheet or device data base file that identifies the PROFIBUS IO device. This file can be installed into a PROFIBUS Engineering tool, e.g., TIA Portal so that the PROFIBUS Engineering tool can configure this PROFIBUS IO Device.

Version: V.1.0 or higher

Download Website: http://www.moxa.com

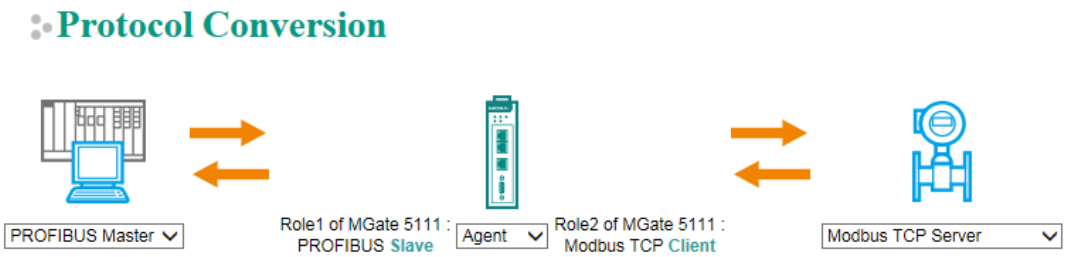
Note: For wiring, please refer to the MGate 5111 User's Manual

4 MGate 5111 Setting

For details, please refer to the MGate 5111 user's manual that you can download from www.moxa.com

A. Protocol Conversion

Login to the **MGate 5111**'s Web Console. Set **Protocol Conversion**: Role 1 as PROFIBUS Slave and Role 2 as TCP Client.



B. Configure Modbus Commands

Under **Modbus TCP settings**, set **Max. retry** as 0. The default value is 3. Changing this value to 0 is in order to quickly demonstrate the detection that the TCP command has failed.

Then add below Function Code 03 commands to poll Slave ID1- ID3's register 0, and add Function Code 06 commands to write Slave ID4-ID6's register 0.

Role: Client

Client Settings

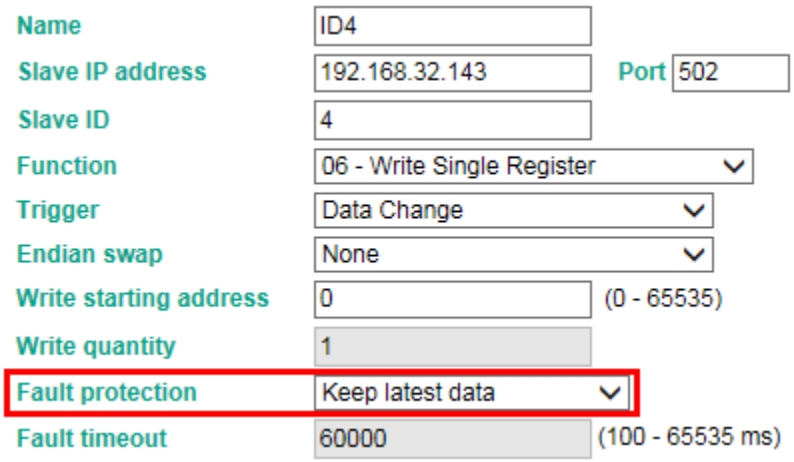
Initial delay	0	(0 - 30000 ms)
Max. retry	0	(0 - 5)
Response timeout	1000	(10 - 120000 ms)

Modbus Commands

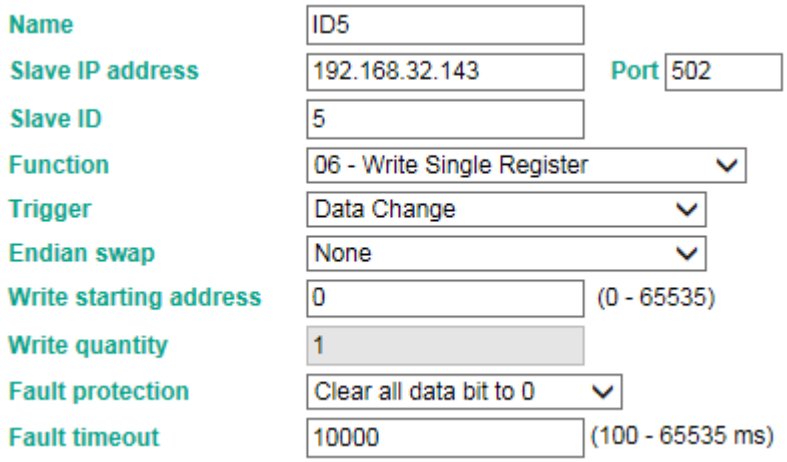
Add | Edit | Clone | Delete | Move

Index	Name	Slave IP Address	Slave ID	Function	Address / Quantity	Trigger	Poll Interval	Endian Swap
1	ID1	192.168.32.143 : 502	1	3	Read address 0, Quantity 1	Cyclic	1000	None
2	ID2	192.168.32.143 : 502	2	3	Read address 0, Quantity 1	Cyclic	1000	None
3	ID3	192.168.32.143 : 502	3	3	Read address 0, Quantity 1	Cyclic	1000	None
4	ID4	192.168.32.143 : 502	4	6	Write address 0, Quantity 1	Data Change	N/A	None
5	ID5	192.168.32.143 : 502	5	6	Write address 0, Quantity 1	Data Change	N/A	None
6	ID6	192.168.32.143 : 502	6	6	Write address 0, Quantity 1	Data Change	N/A	None

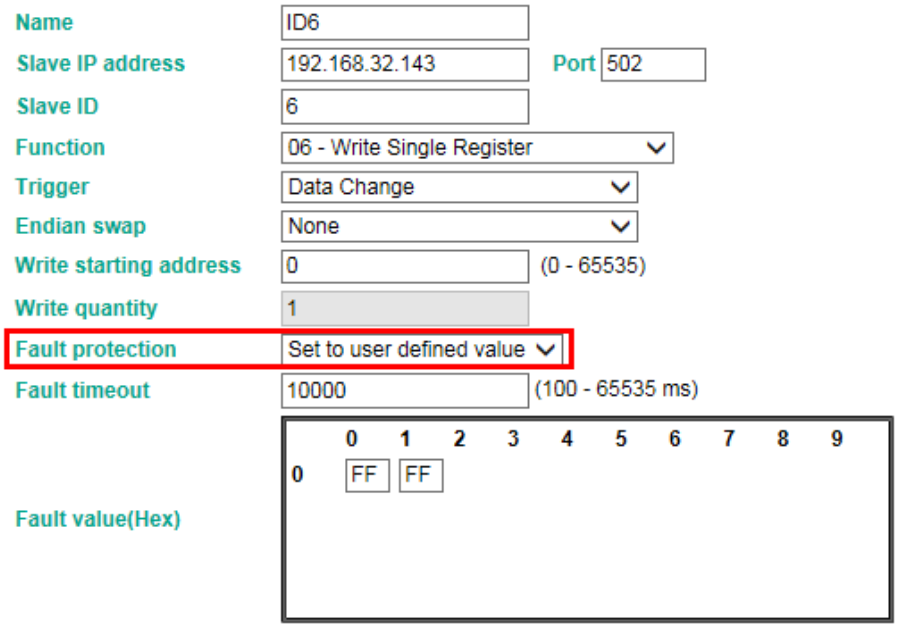
Keep ID4's **Fault Protection** command as **Keep latest data**.



For ID5 **Fault Protection** command, choose **Clear all data bit to 0** and set **Fault timeout** as 10000 ms.

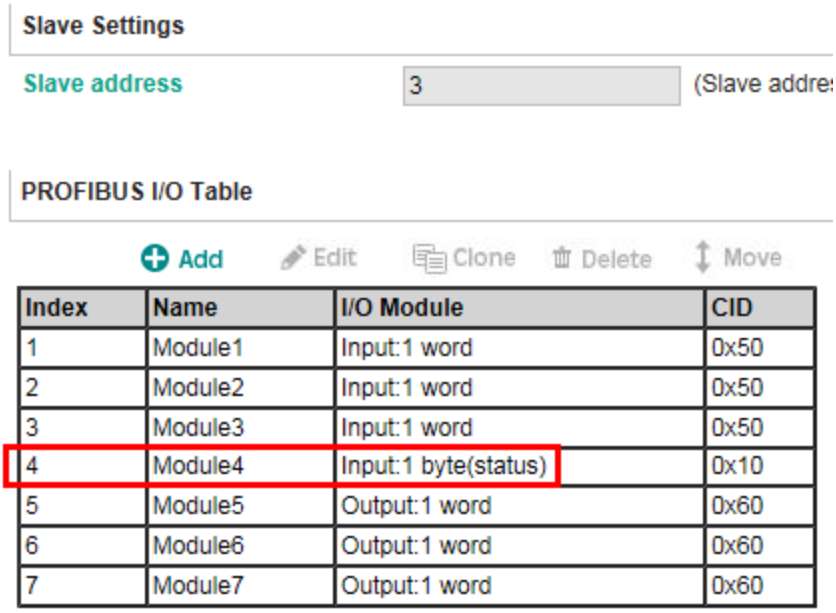


For ID6 **Fault Protection** command, choose **Set to user defined value** and set **Fault value** as 0xFF 0xFF. **Fault timeout** is set as 10000 ms.



C. Configure PROFIBUS Module

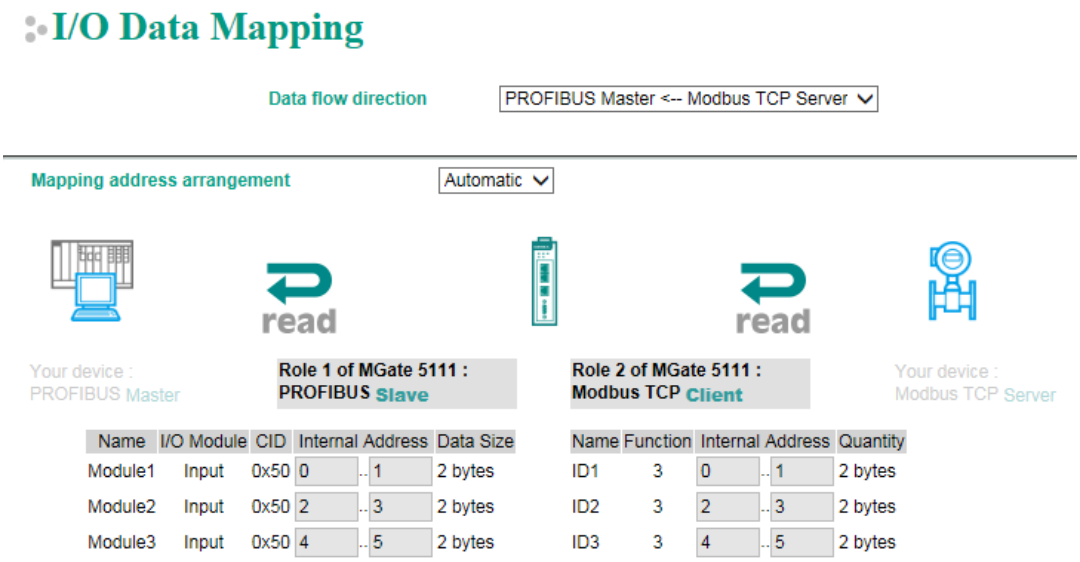
Add **Input Module 1 words** to Slot 1-3 to map the register values of Modbus Slave ID 1-3. Add **Input Status Module** to store the Modbus TCP command status on Slot 4. Add **Output: 1 word** modules to slots 5-7 to write the value on the registers of Modbus Slave IDs 4~6.



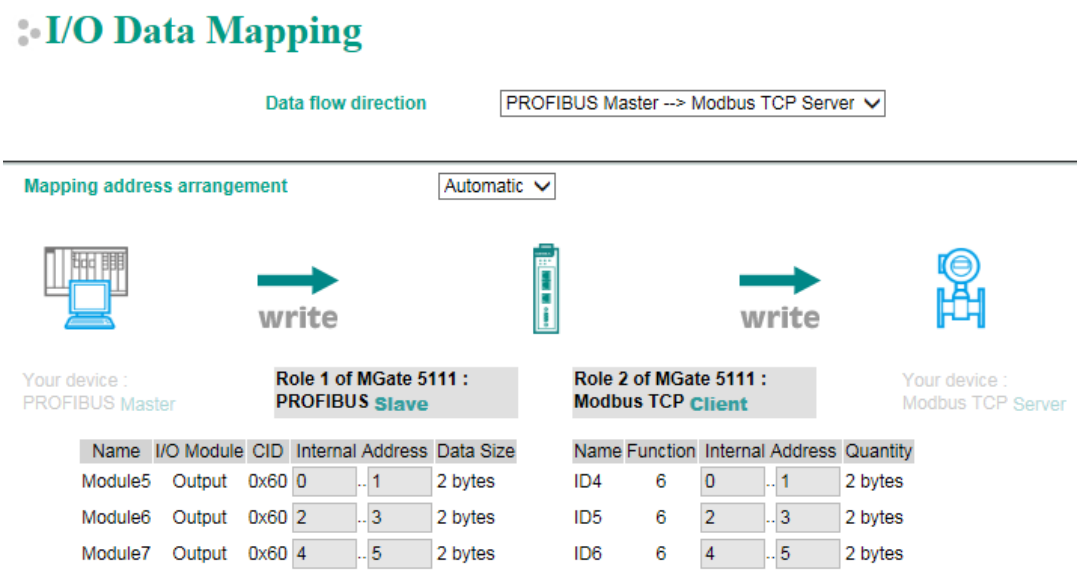
Index	Name	I/O Module	CID
1	Module1	Input:1 word	0x50
2	Module2	Input:1 word	0x50
3	Module3	Input:1 word	0x50
4	Module4	Input:1 byte(status)	0x10
5	Module5	Output:1 word	0x60
6	Module6	Output:1 word	0x60
7	Module7	Output:1 word	0x60

D. I/O Data Mapping

Let the MGate auto map the data on both sides of the MGate's IO Internal Memory. Modbus read commands fit PROFIBUS Module 1-3 as below. Take note that the **input status module** is not included in MGate's IO Internal Memory.

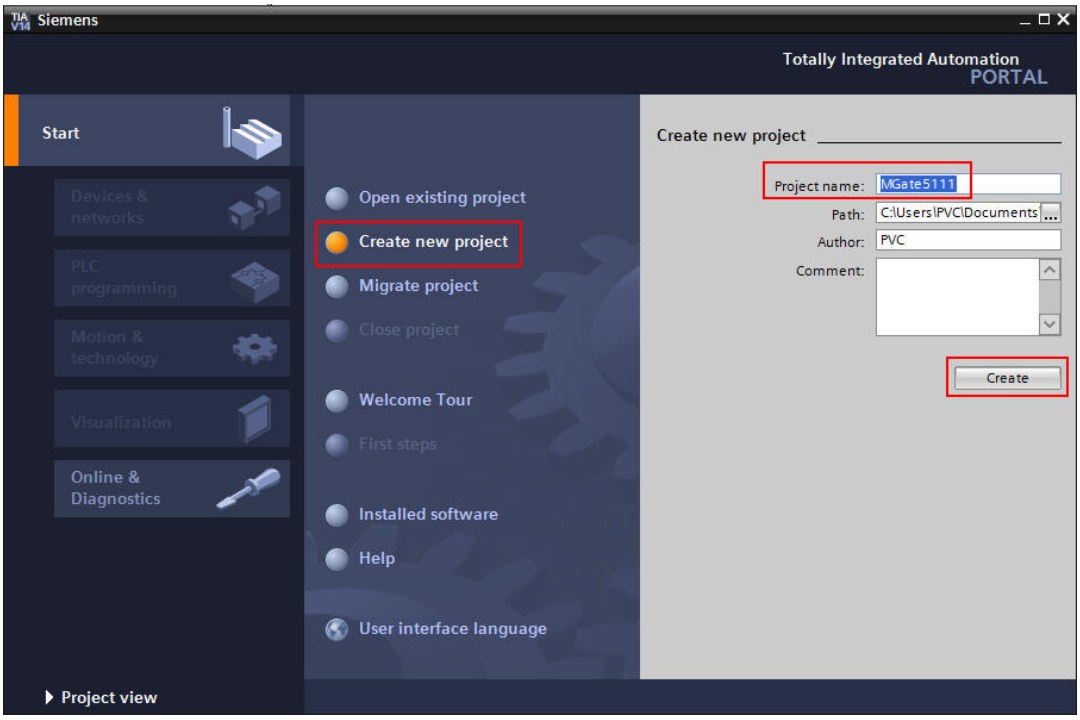


On the other data flow, we can see PROFIBUS Modules 5-7 fit ID4 and ID5's Modbus write commands as follows:

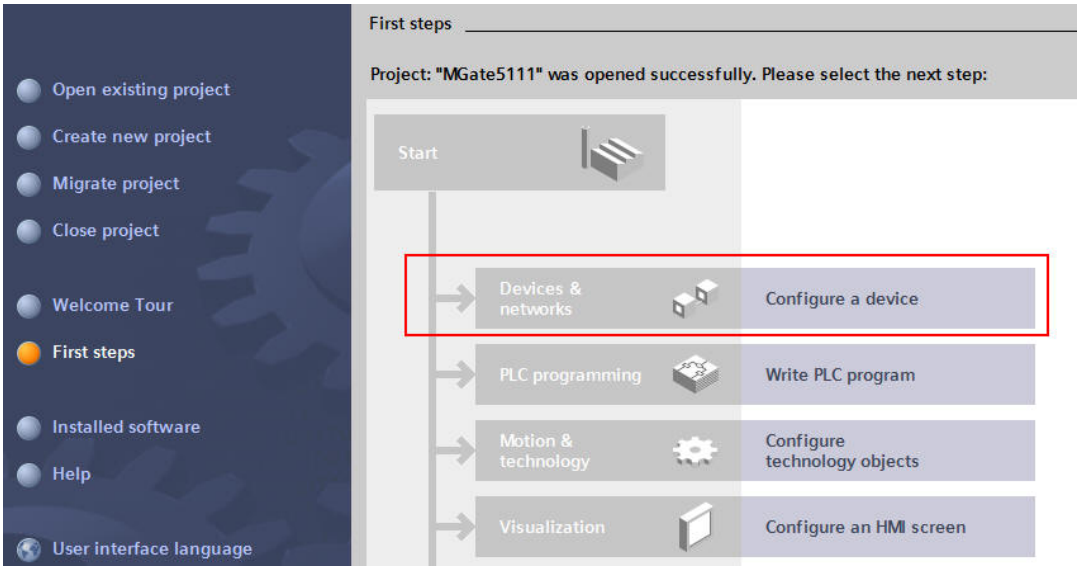


5 Siemens PLC Setting

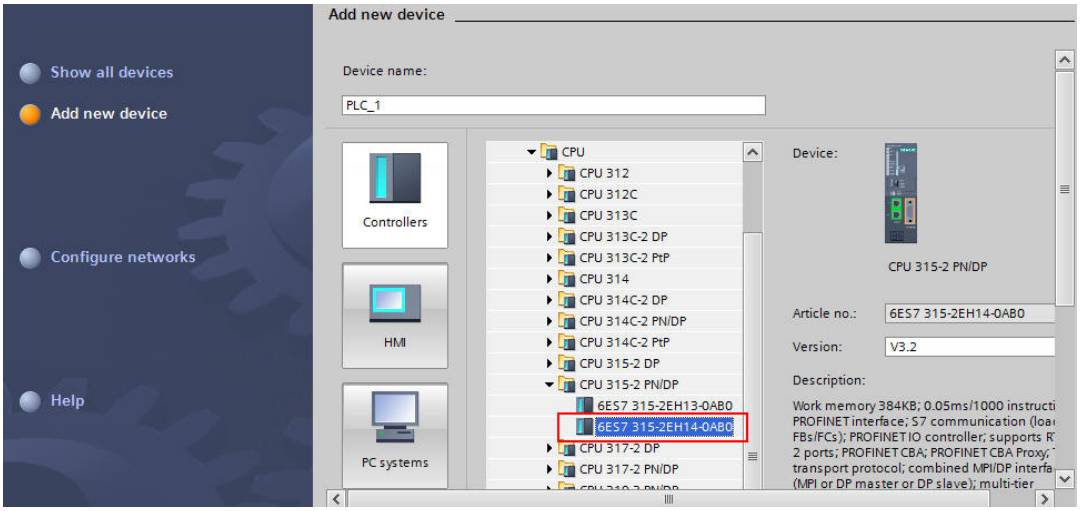
(1) Create a new project.



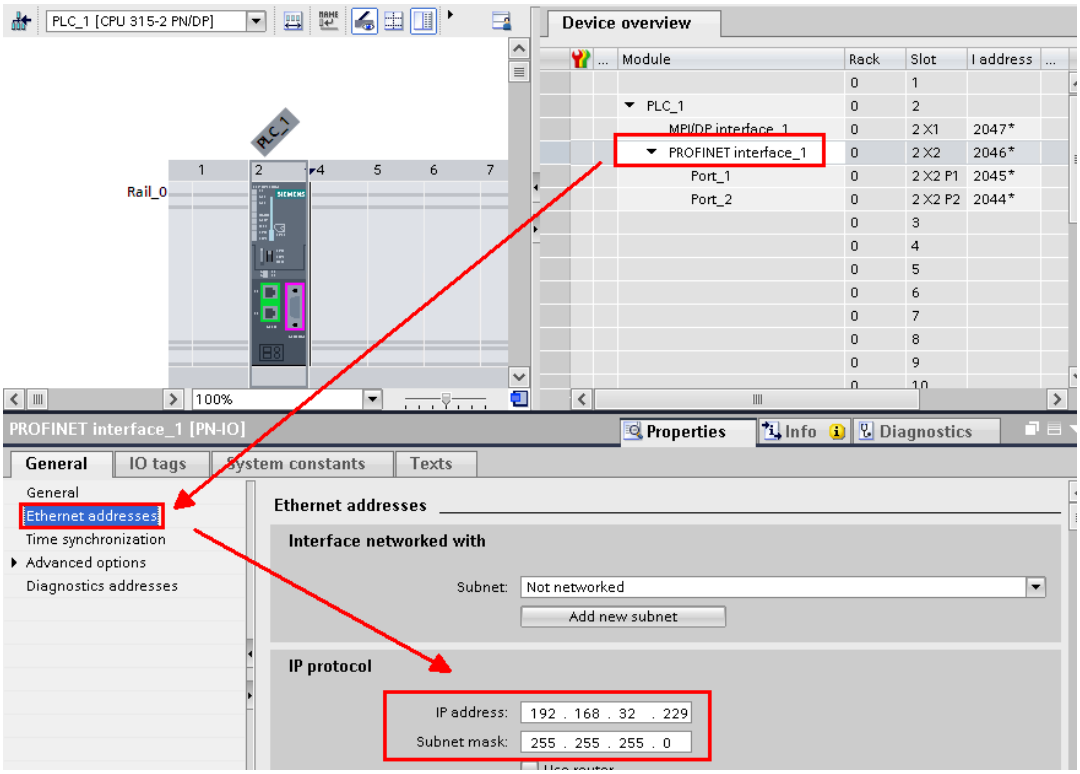
(2) Once the new project has been created successfully, click **Configure a device** to add the PLC.



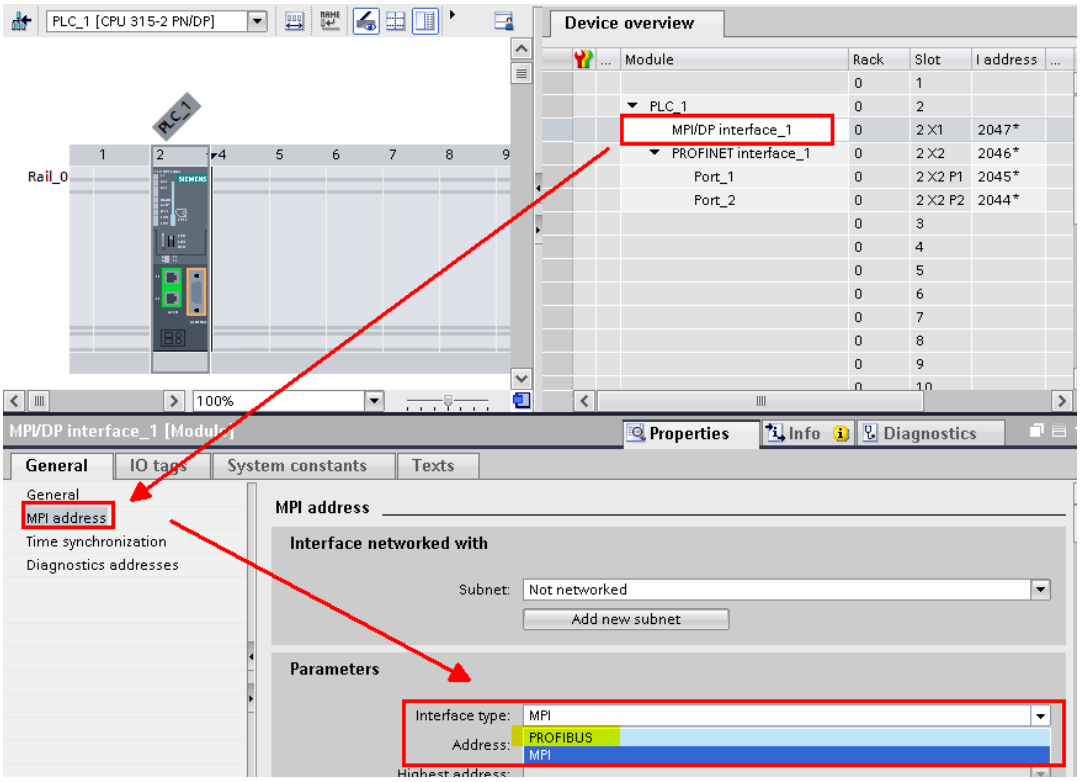
To add the actual PLC's CPU model, select it from **Controllers → CPU** as below:



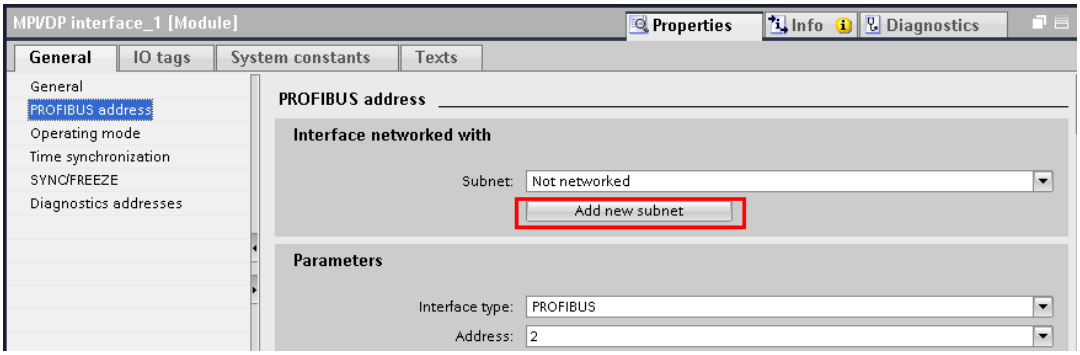
(3) Click PLC's **PROFINET interface** to set its **IP Address**.



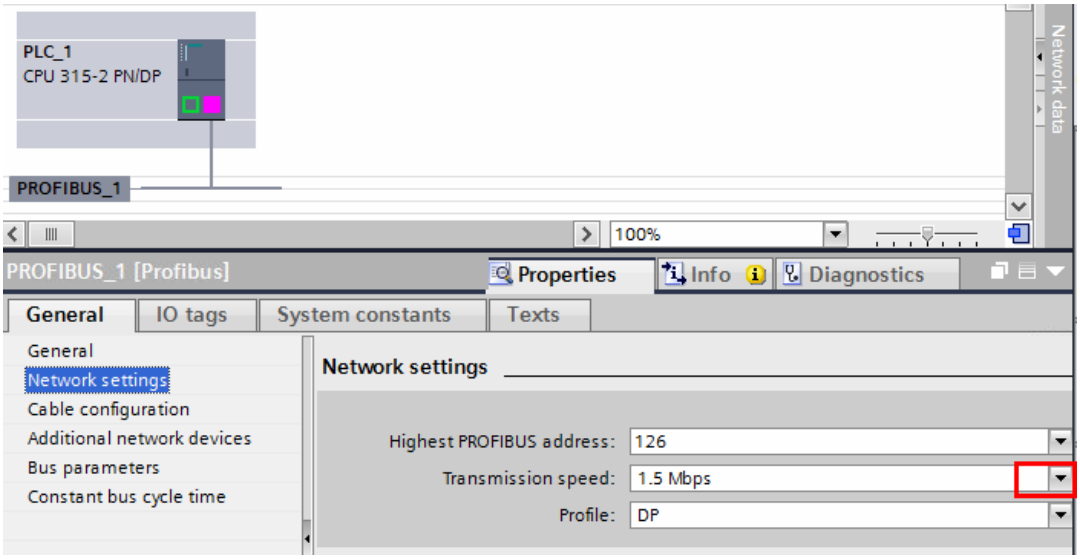
(4) Click PLC's **MPI/DP interface** to set **Interface Type** as PROFIBUS.



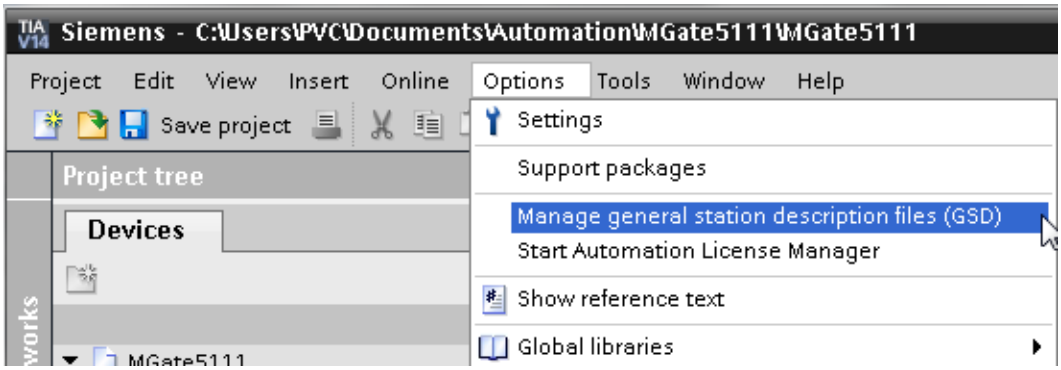
Click **Add new subnet** to add a PROFIBUS subnet.



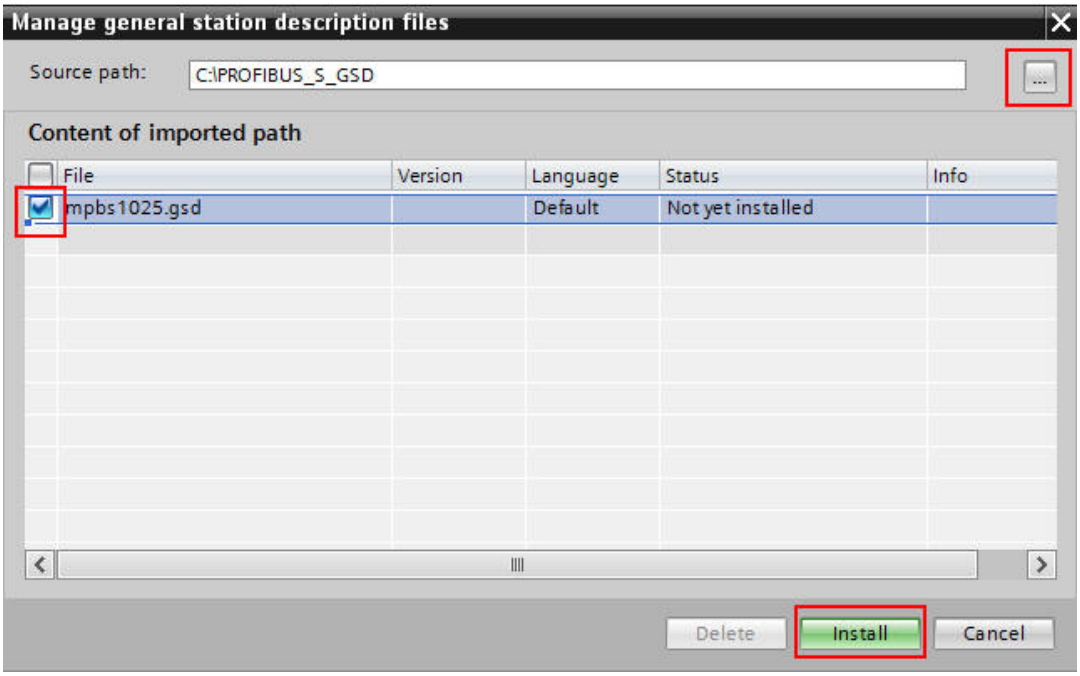
Then a **PROFIBUS_1** subnet is created. You can modify the PROFIBUS baudrate by modifying **Transmission Speed**



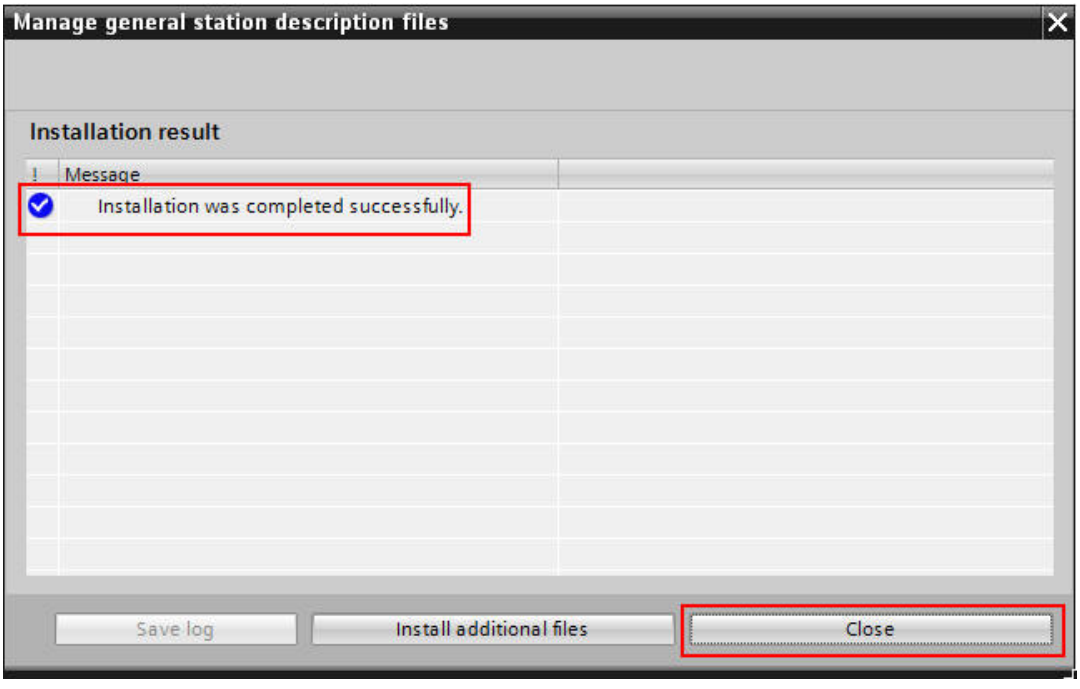
(5) Click **Options → Manage general station description** to install the **MGate 5111**'s GSD file.



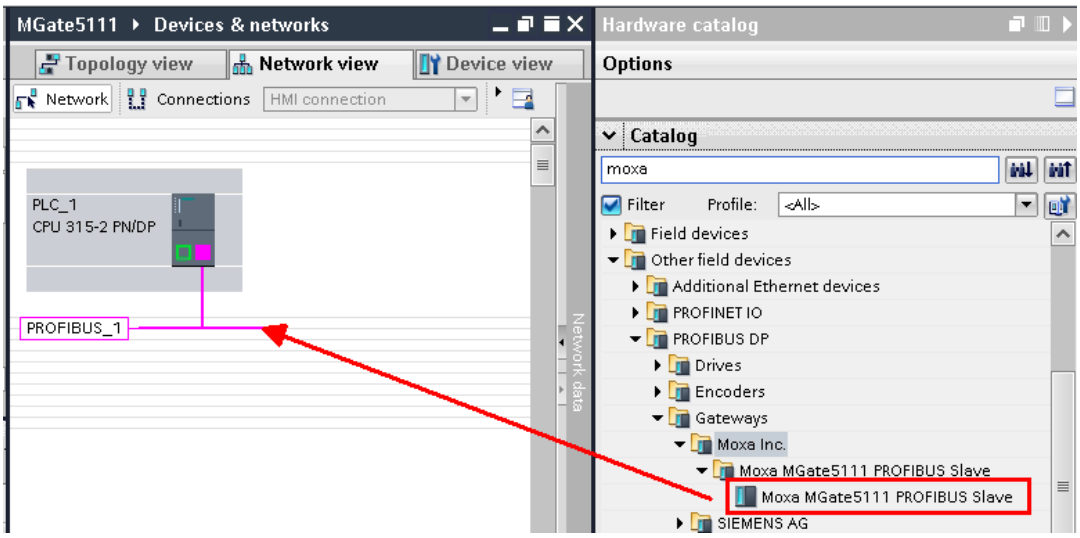
Select the **MGate 5111**'s GSD file then click **Install**.



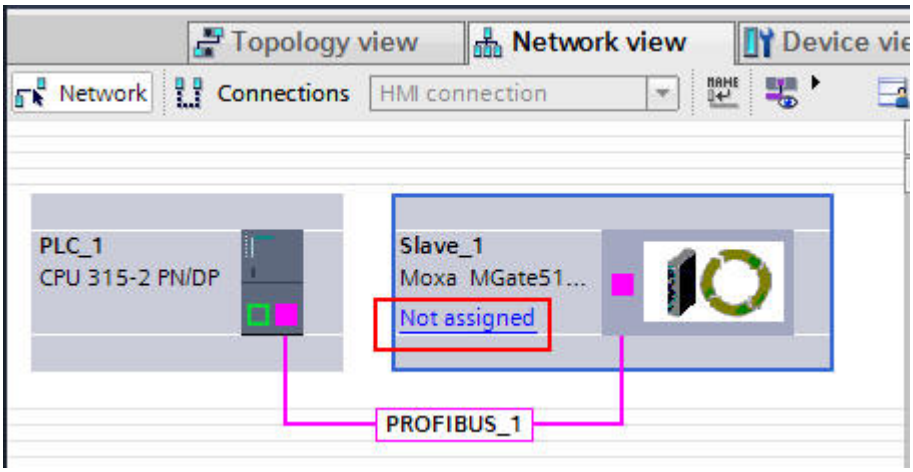
Make sure the installation is a success.



(6) In the **Hardware catalog** window, we can filter "moxa" to search the **MGate 5111**. Choose the **MGate 5111** device icon, then drag and drop to **PROFIBUS_1** subnet.

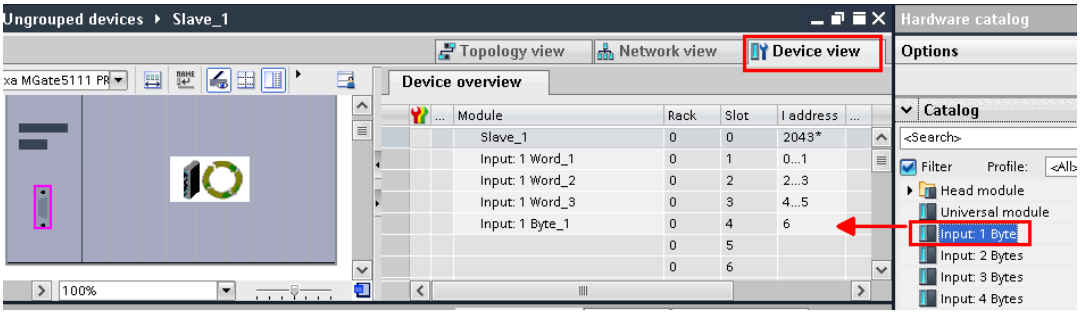


(7) Click **Not assigned** to assign the **MGate 5111** to **PLC_1**.

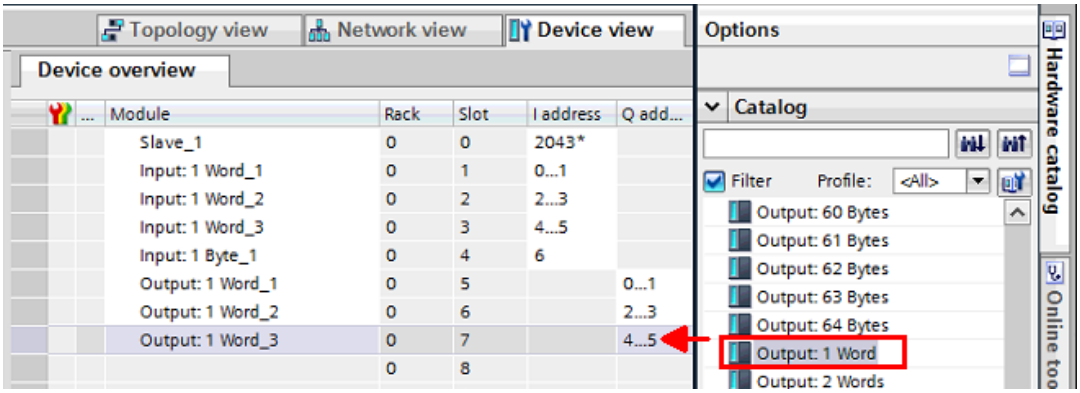


Then the **MGate 5111** is set into **PLC_1**'s DP Master System.

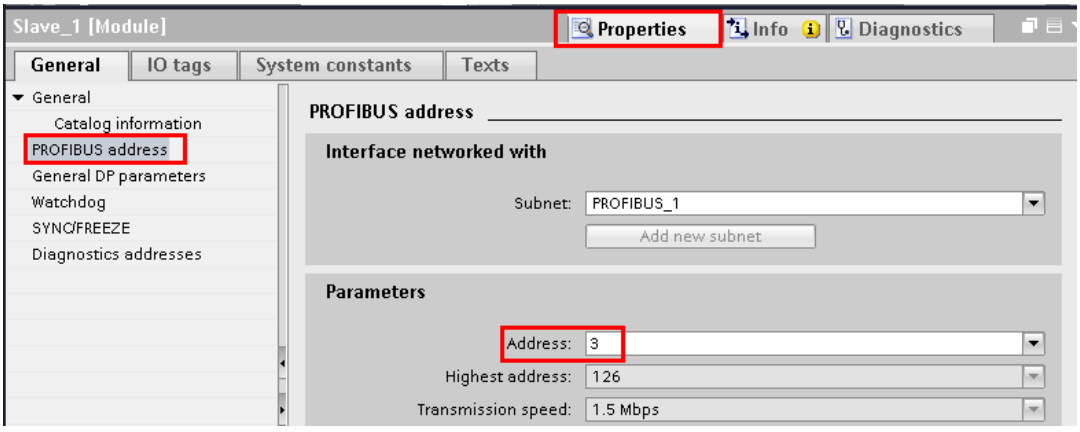
(8) In the **MGate 5111**'s **Device view**, drag and drop **Input 1 Word** to Slot 1-3 and **Input 1 Byte** to Slot 4. Assign their **I address** to 0-6.



Drag and drop **Output 1 Word** to Slot 5-7. Assign their **Q address** to 0-5.

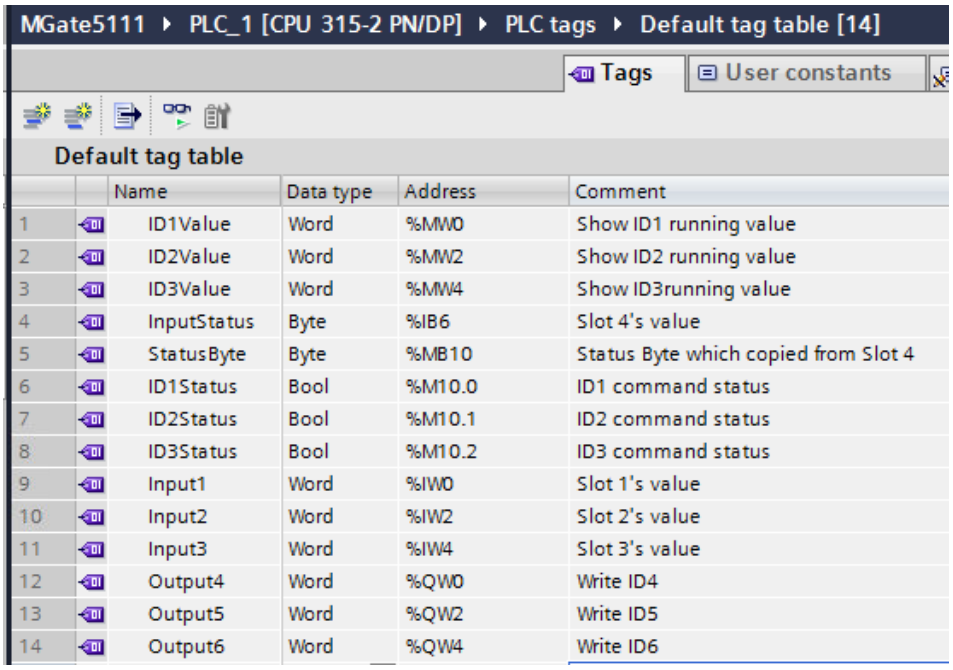


(9) Under the **MGate 5111**'s **Properties**, set its PROFIBUS address as its actual address, which is set by hardware's rotary switch.



(10) We want to get Modbus ID1-ID3's register value and make sure the Modbus commands' responses are valid. If a Modbus command's response is invalid or times out, the register value will show a specific value. In this demonstration, we will use a program to set this value as 0xFFFF. We will show details later.

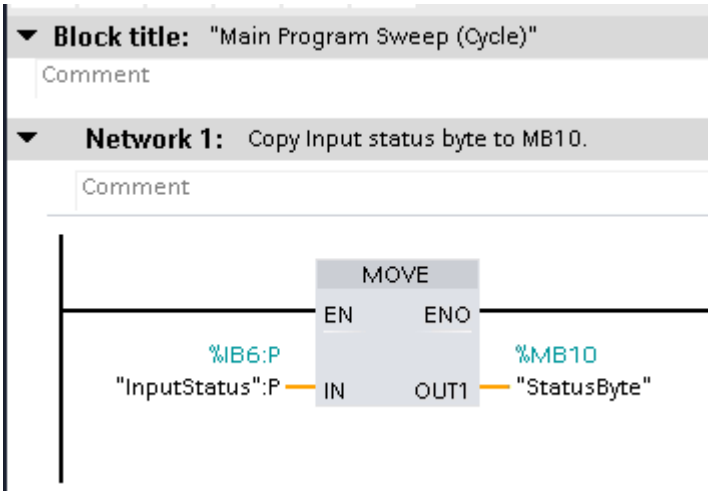
We created the following tags:

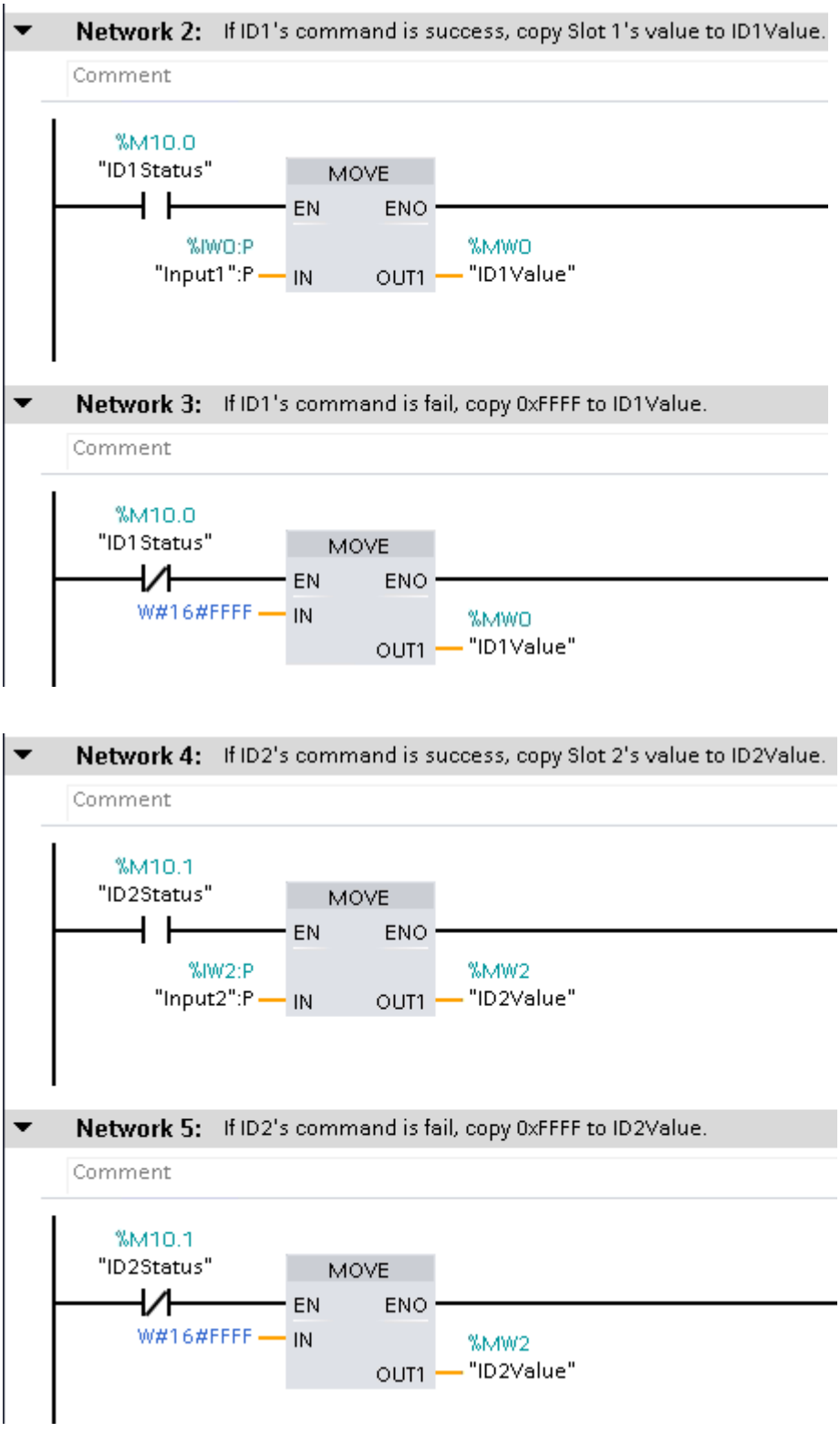


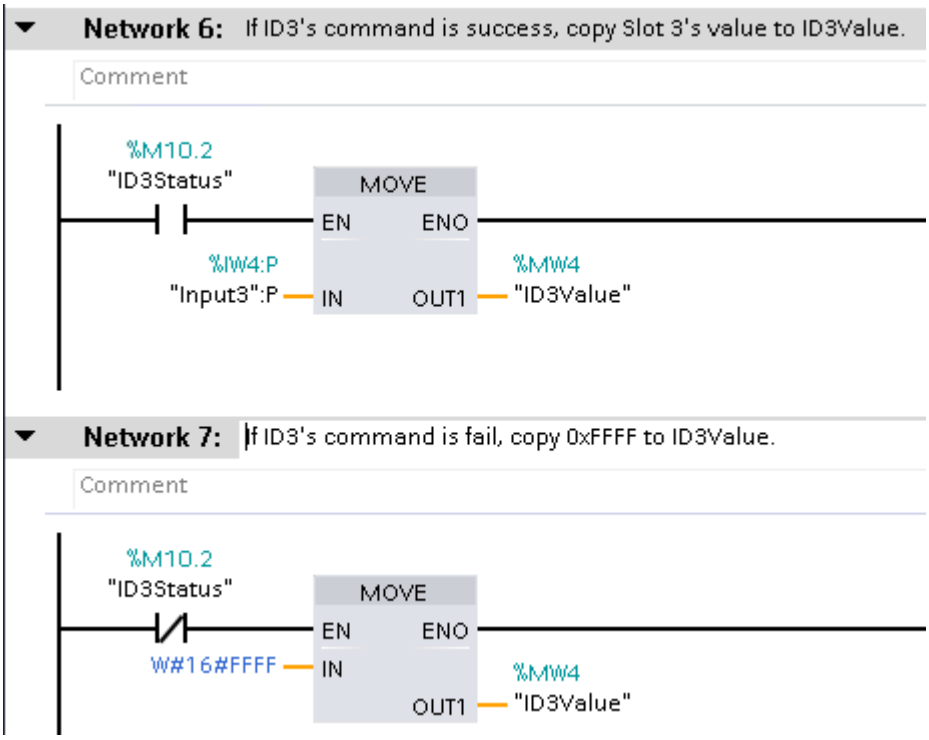
	Name	Data type	Address	Comment
1	ID1Value	Word	%MW0	Show ID1 running value
2	ID2Value	Word	%MW2	Show ID2 running value
3	ID3Value	Word	%MW4	Show ID3running value
4	InputStatus	Byte	%IB6	Slot 4's value
5	StatusByte	Byte	%MB10	Status Byte which copied from Slot 4
6	ID1Status	Bool	%M10.0	ID1 command status
7	ID2Status	Bool	%M10.1	ID2 command status
8	ID3Status	Bool	%M10.2	ID3 command status
9	Input1	Word	%IW0	Slot 1's value
10	Input2	Word	%IW2	Slot 2's value
11	Input3	Word	%IW4	Slot 3's value
12	Output4	Word	%QW0	Write ID4
13	Output5	Word	%QW2	Write ID5
14	Output6	Word	%QW4	Write ID6

Click **Main [OB1]** to edit program.

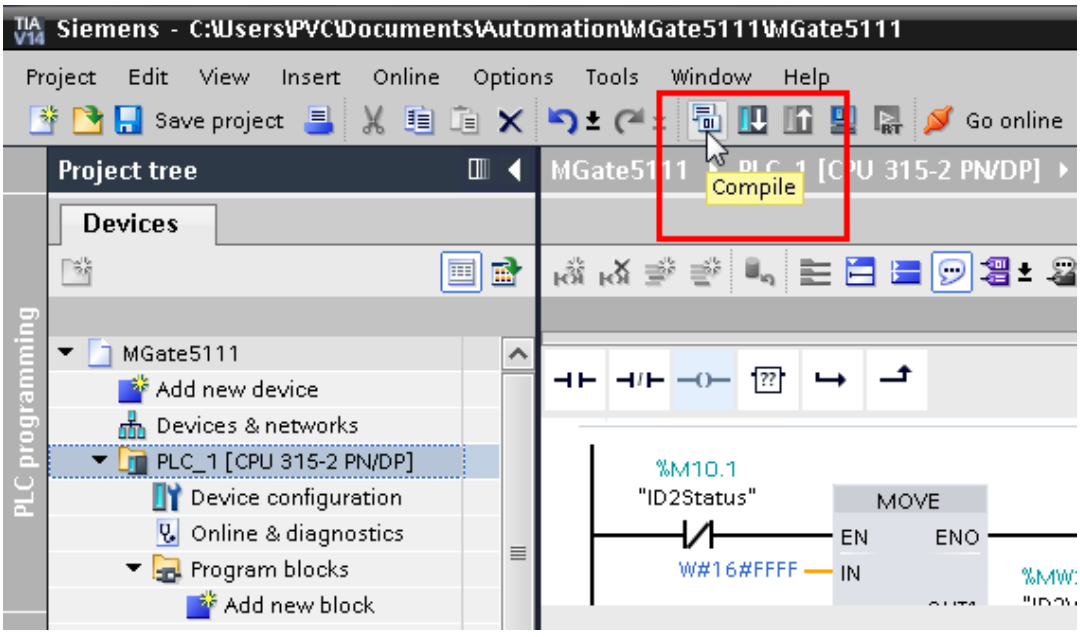
Each Network program shows as follows:



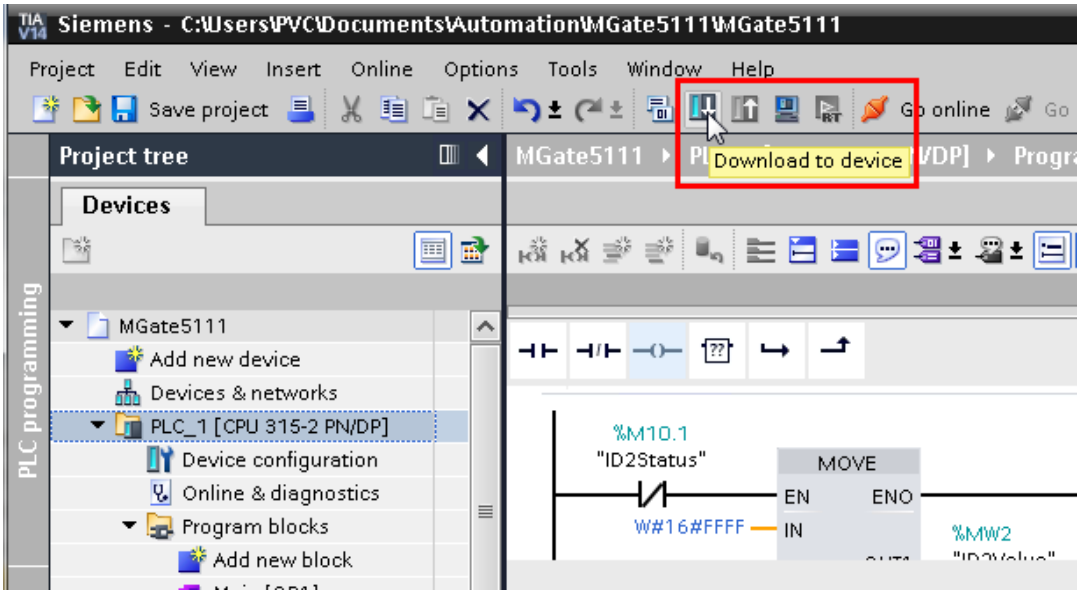




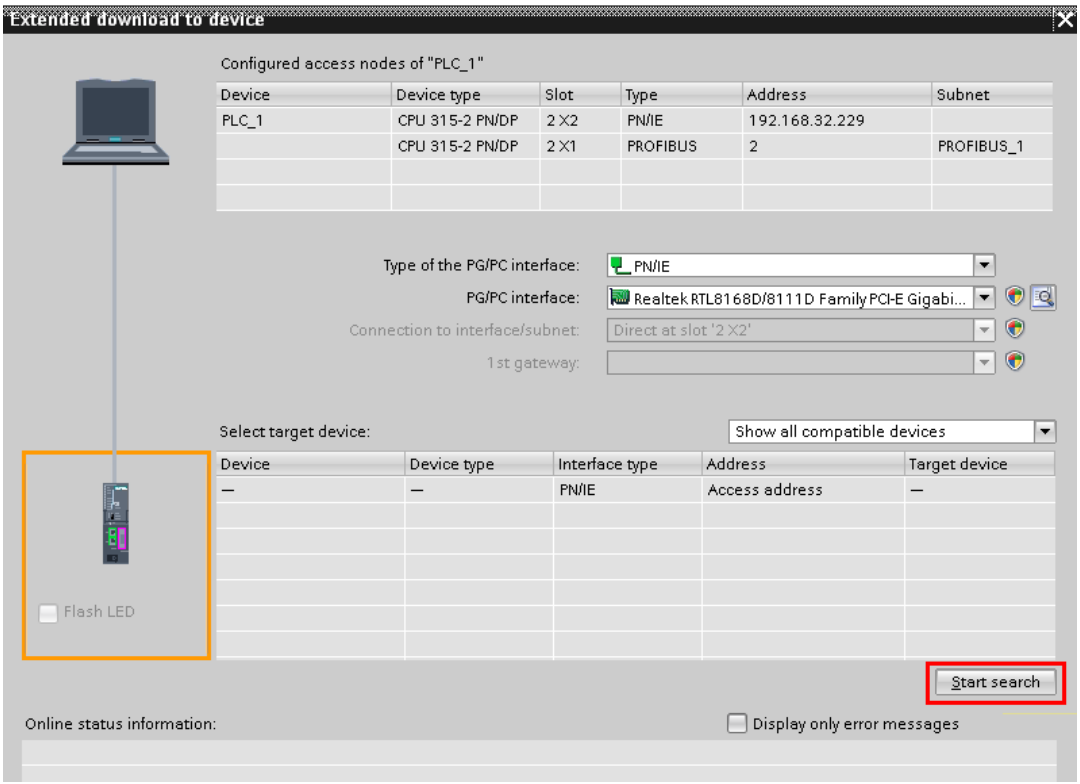
(11) Execute **Compile** and make sure there are no errors.



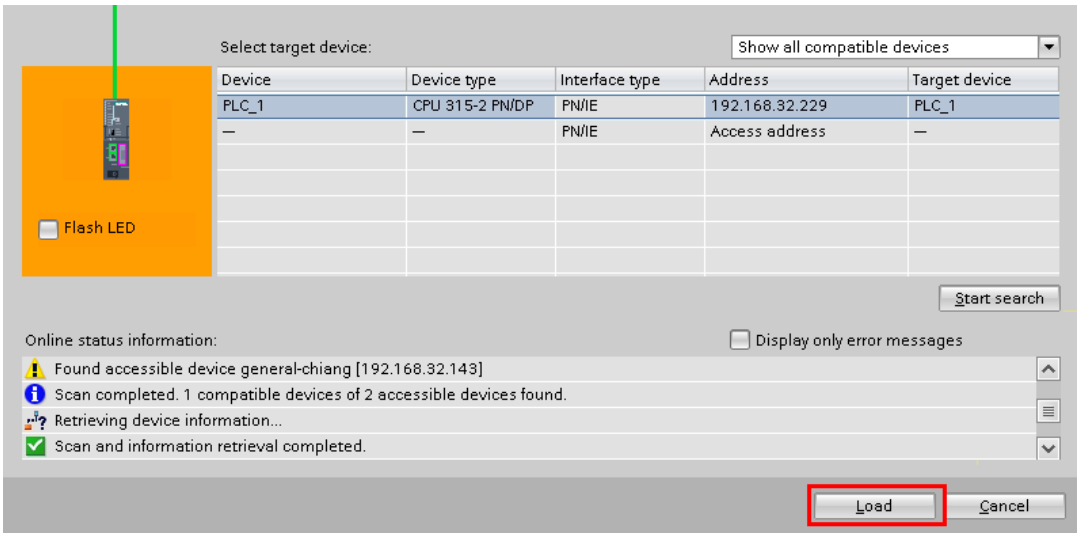
(12) Execute **Download**



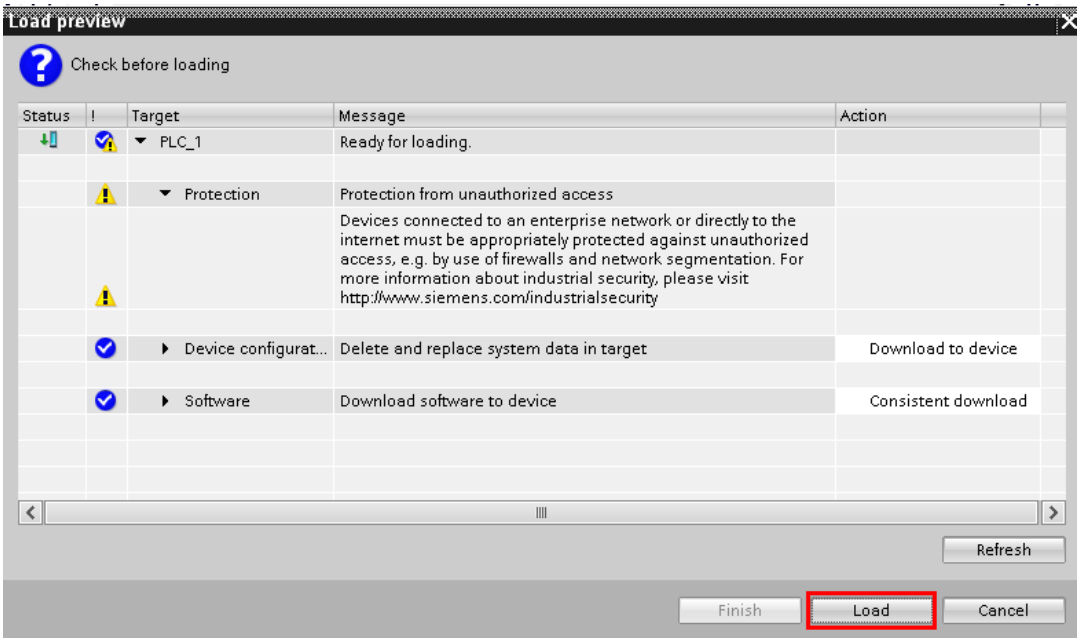
Click **Start Search** to search for an accessible PLC.



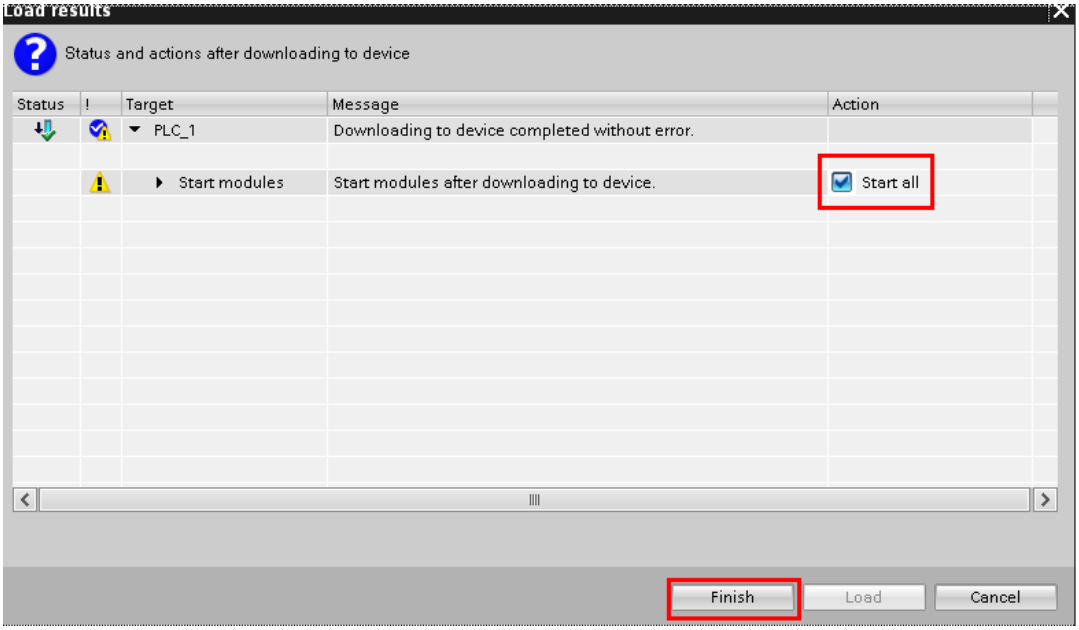
After locating an accessible PLC, execute **Load**.



The **TIA Portal** will check hardware and software consistency. After checking for errors, click **Load** to download.



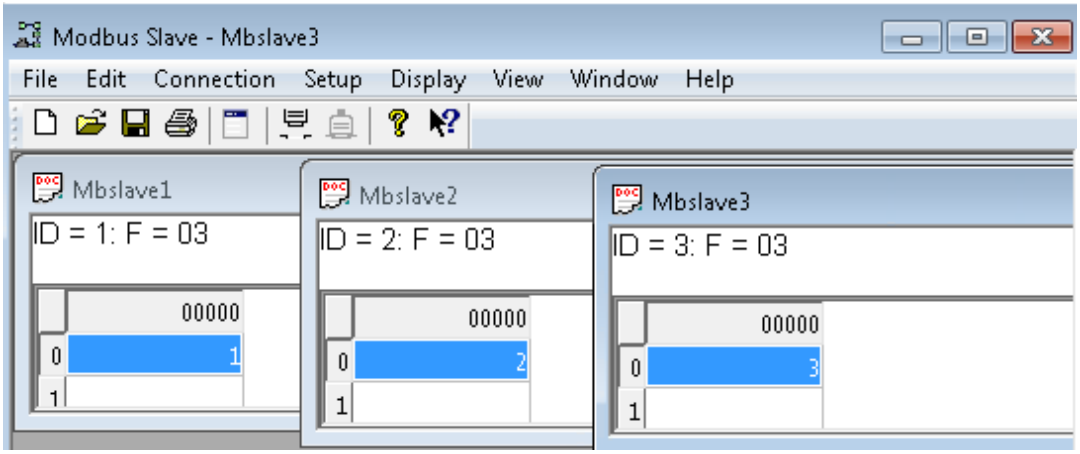
After loading, enable **Start all** to start modules and then click **Finish**.



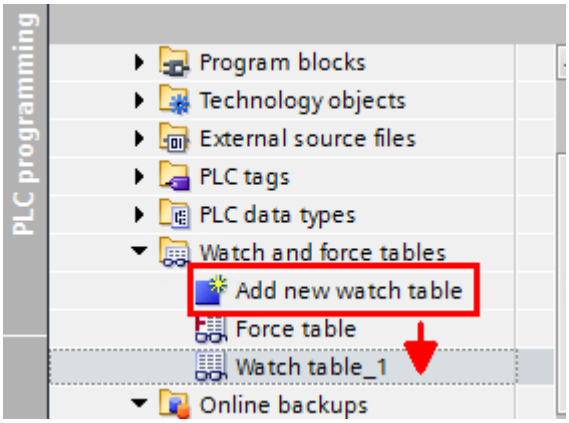
6 Communication Test

A. Status Monitoring

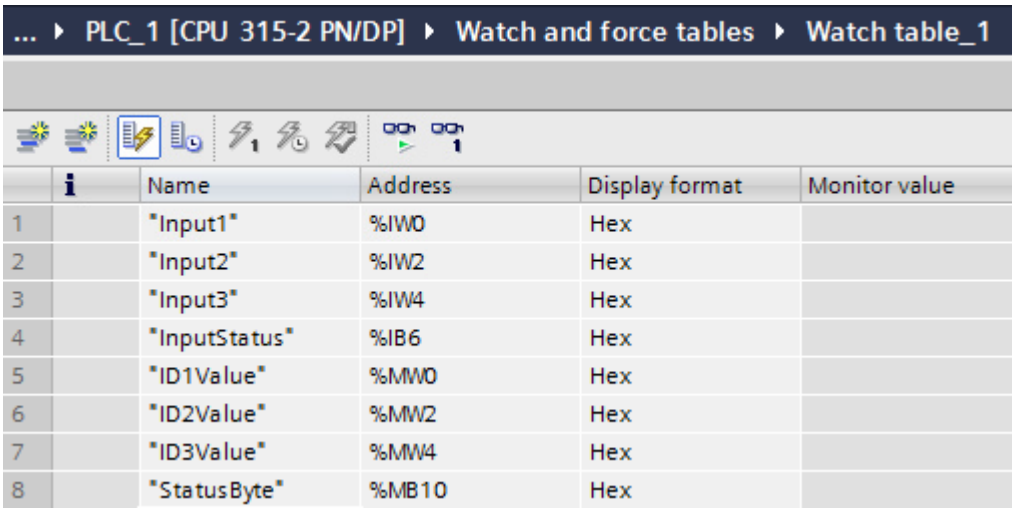
(1) The PC runs a **Modbus Slave** tool and listens on TCP port 502. Add slave IDs 1-3 and set their register 0's value as 1, 2, 3, respectively.



(2) Click **Add new watch table** to create the **Watch table_1**.

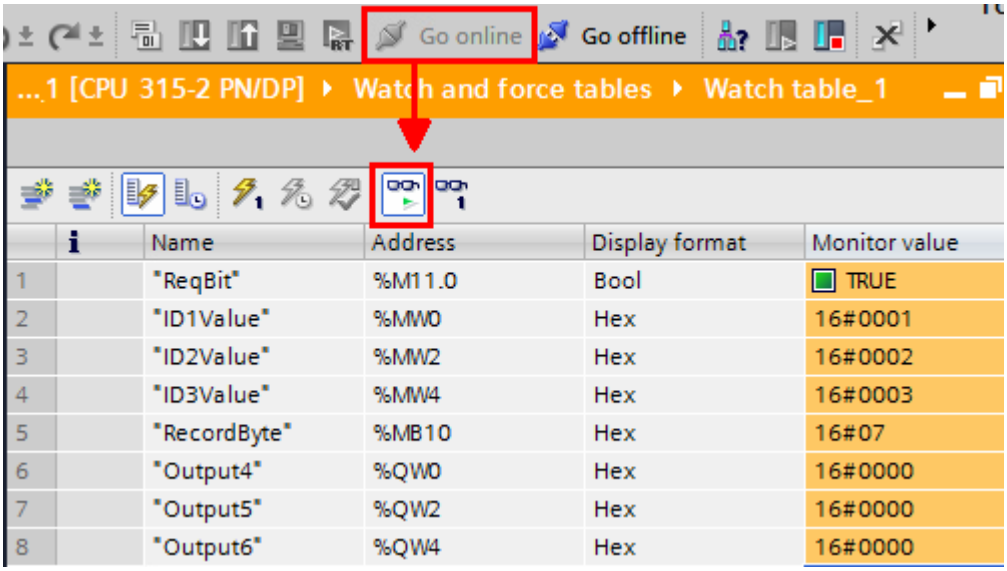


Add the following tags to be monitored:



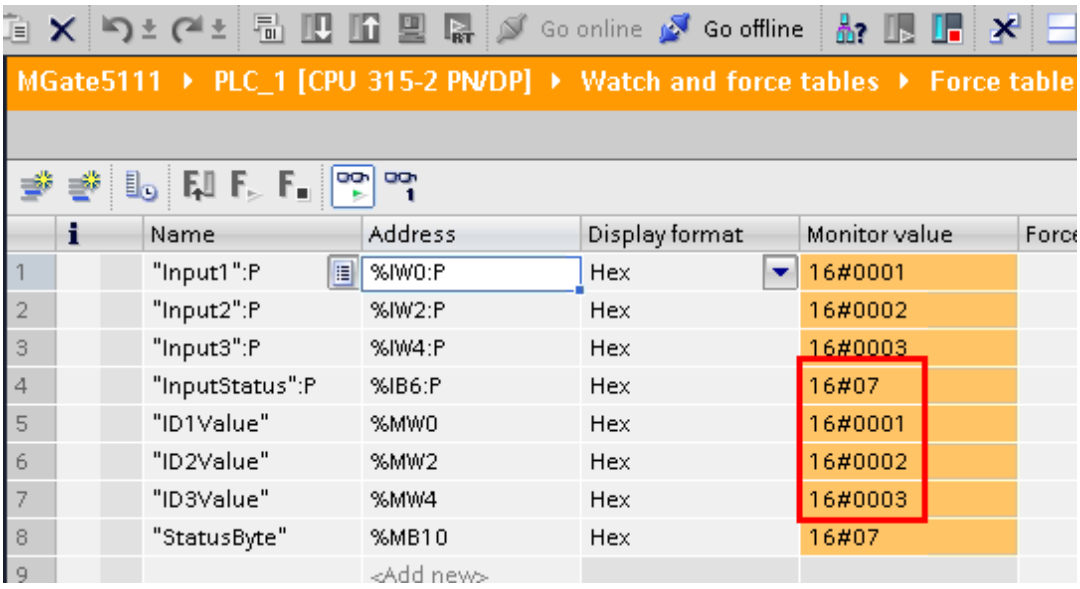
	i	Name	Address	Display format	Monitor value
1		"Input1"	%IW0	Hex	
2		"Input2"	%IW2	Hex	
3		"Input3"	%IW4	Hex	
4		"InputStatus"	%IB6	Hex	
5		"ID1Value"	%MW0	Hex	
6		"ID2Value"	%MW2	Hex	
7		"ID3Value"	%MW4	Hex	
8		"StatusByte"	%MB10	Hex	

(3) Click **Go online** and then click **Monitor all**.



	Name	Address	Display format	Monitor value
1	"ReqBit"	%M11.0	Bool	TRUE
2	"ID1Value"	%MW0	Hex	16#0001
3	"ID2Value"	%MW2	Hex	16#0002
4	"ID3Value"	%MW4	Hex	16#0003
5	"RecordByte"	%MB10	Hex	16#07
6	"Output4"	%QW0	Hex	16#0000
7	"Output5"	%QW2	Hex	16#0000
8	"Output6"	%QW4	Hex	16#0000

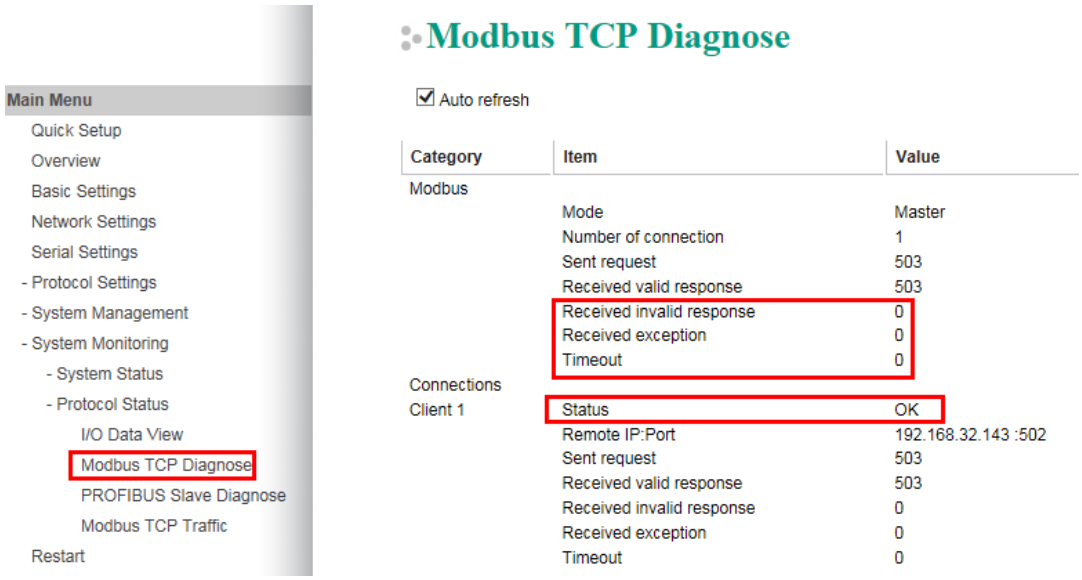
When **Input Status module** shows a value of 7, then commands 1-3 are successful. **ID1Value**- **ID3Value** are running as 1, 2, 3, respectively.



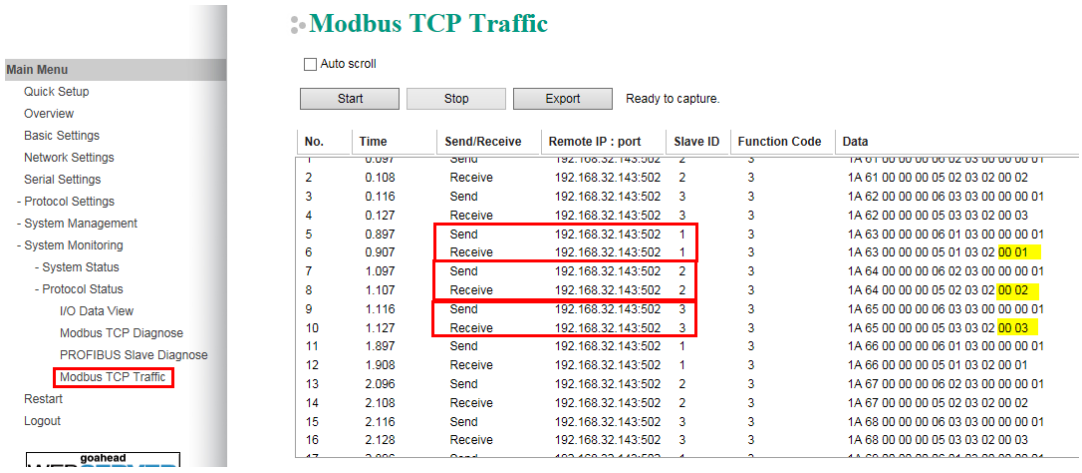
	Name	Address	Display format	Monitor value
1	"Input1":P	%IW0:P	Hex	16#0001
2	"Input2":P	%IW2:P	Hex	16#0002
3	"Input3":P	%IW4:P	Hex	16#0003
4	"InputStatus":P	%IB6:P	Hex	16#07
5	"ID1Value"	%MW0	Hex	16#0001
6	"ID2Value"	%MW2	Hex	16#0002
7	"ID3Value"	%MW4	Hex	16#0003
8	"StatusByte"	%MB10	Hex	16#07
9		<Add new>		

(4) We can use the MGate's Protocol Diagnostics tool on the Web Console to check Modbus and PROFIBUS communication status:

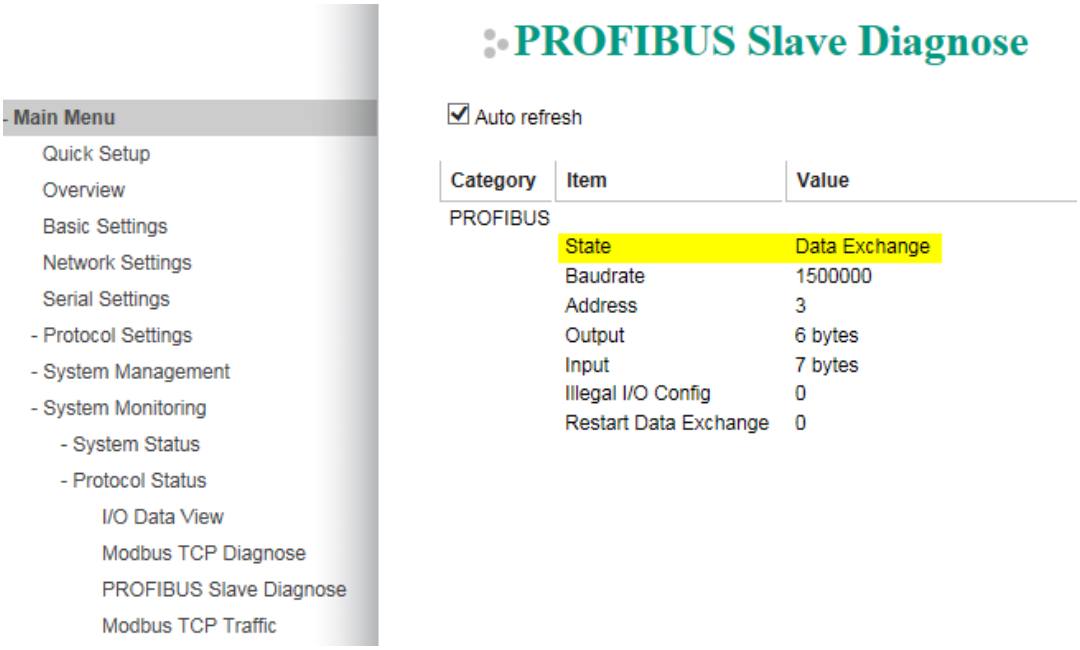
Via **System Monitoring → Protocol Status → Modbus TCP Diagnose**, we can see its connection status is **OK** with no invalid responses.



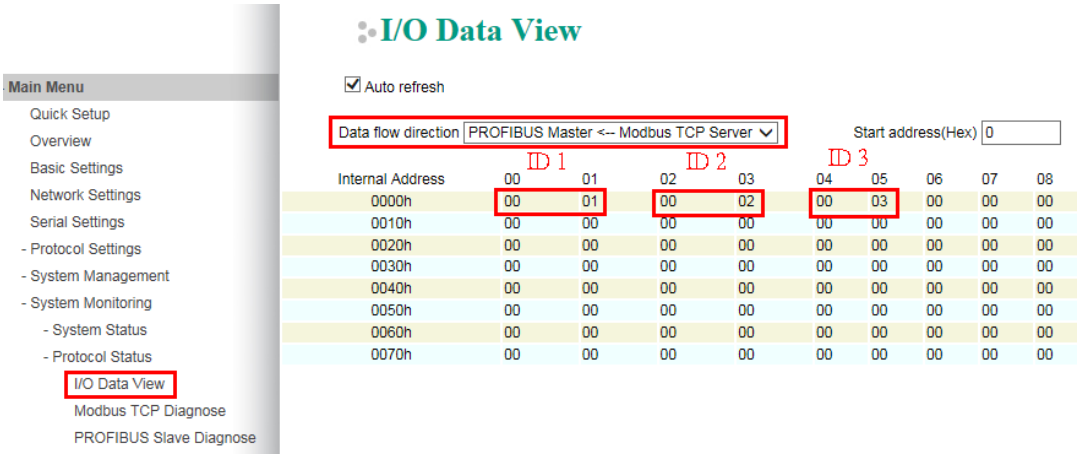
Via **System Monitoring → Protocol Status → Modbus TCP Traffic**, we can log Modbus TCP communication traffic:



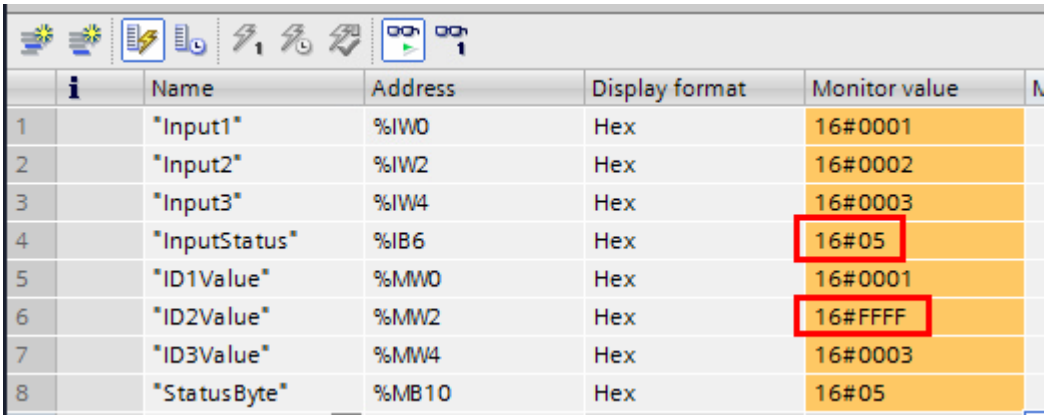
Via **System Monitoring → Protocol Status → PROFIBUS Slave Diagnose**, we can see **State's** value is note as **Data Exchange**:



Via **System Monitoring → Protocol Status → I/O Data View**, we can choose **PROFIBUS Master ← Modbus TCP Server** data flow side to see Modbus slave input data:

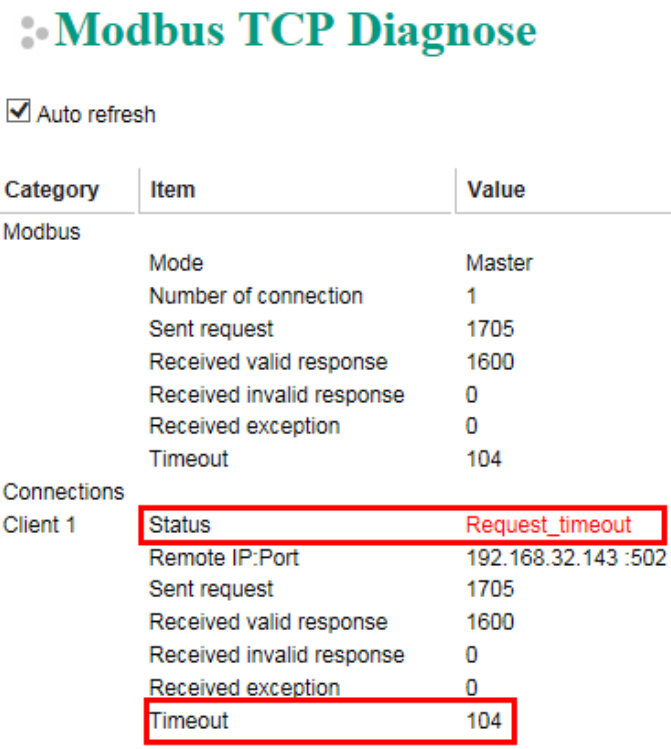


(5) Disable Modbus Slave ID 2 on the **Modbus Slave** tool, so Modbus Command 2 can't receive any responses. Check **Watch table**; **Input Status module** shows a value of 5 and **ID2Value** a value of 0xFFFF.



	i	Name	Address	Display format	Monitor value
1		"Input1"	%IW0	Hex	16#0001
2		"Input2"	%IW2	Hex	16#0002
3		"Input3"	%IW4	Hex	16#0003
4		"InputStatus"	%IB6	Hex	16#05
5		"ID1Value"	%MW0	Hex	16#0001
6		"ID2Value"	%MW2	Hex	16#FFFF
7		"ID3Value"	%MW4	Hex	16#0003
8		"StatusByte"	%MB10	Hex	16#05

Disable Modbus Slave ID 1 and 3 on the **Modbus Slave** tool. Check Modbus TCP Diagnose; **Status** shows that the **Request_timeout** and **Timeout** counters are increasing:



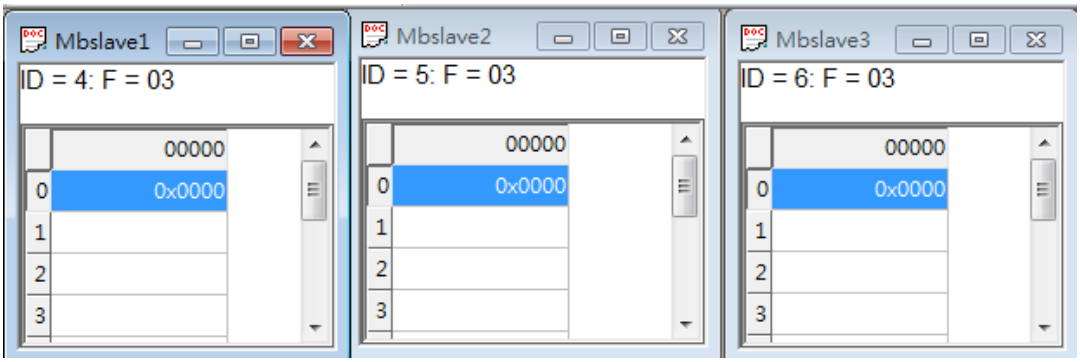
Modbus TCP Diagnose

☑ Auto refresh

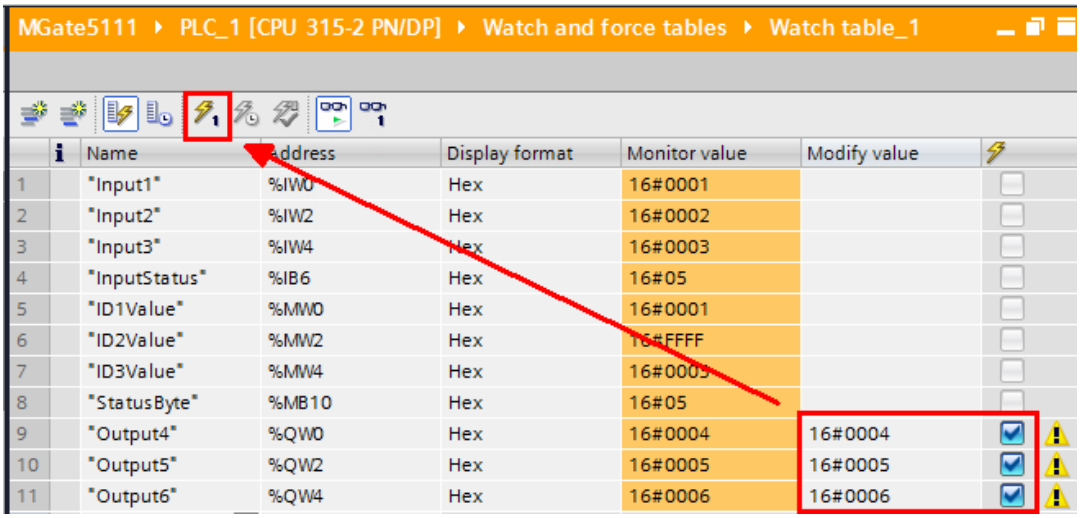
Category	Item	Value
Modbus		
	Mode	Master
	Number of connection	1
	Sent request	1705
	Received valid response	1600
	Received invalid response	0
	Received exception	0
	Timeout	104
Connections		
Client 1	Status	Request_timeout
	Remote IP:Port	192.168.32.143 :502
	Sent request	1705
	Received valid response	1600
	Received invalid response	0
	Received exception	0
	Timeout	104

B. Fault Protection

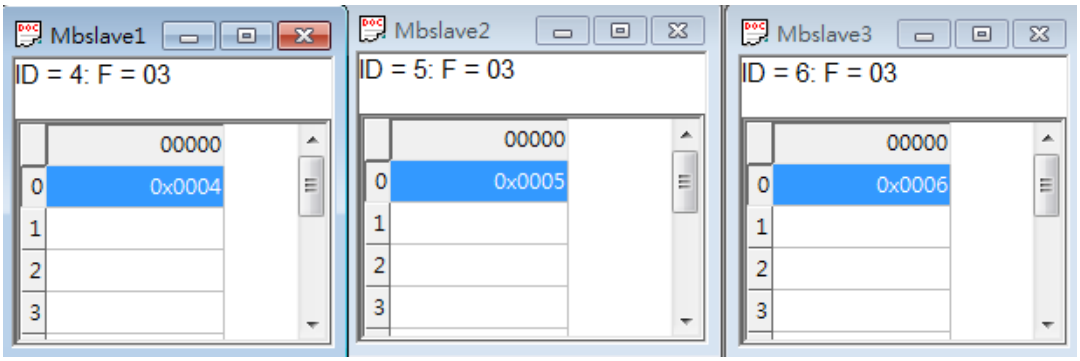
(1) Add slave ID4-ID6 on the Modbus Slave tool as below:



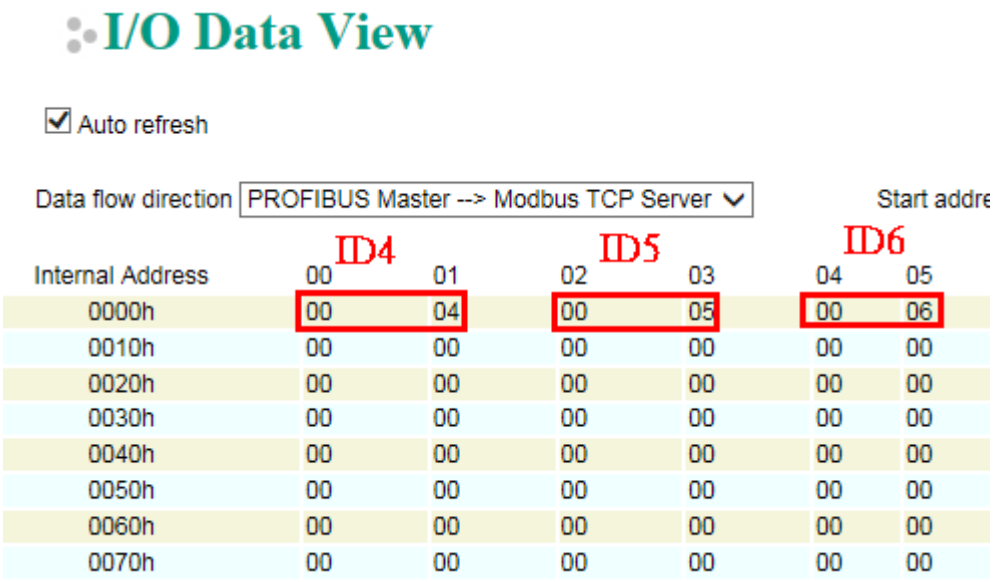
(2) On the Watch table, set **Modify value** on QW0 as 0x0004, QW2 as 0x0005, QW4 as 0x0006. Then click the **Modify** button.



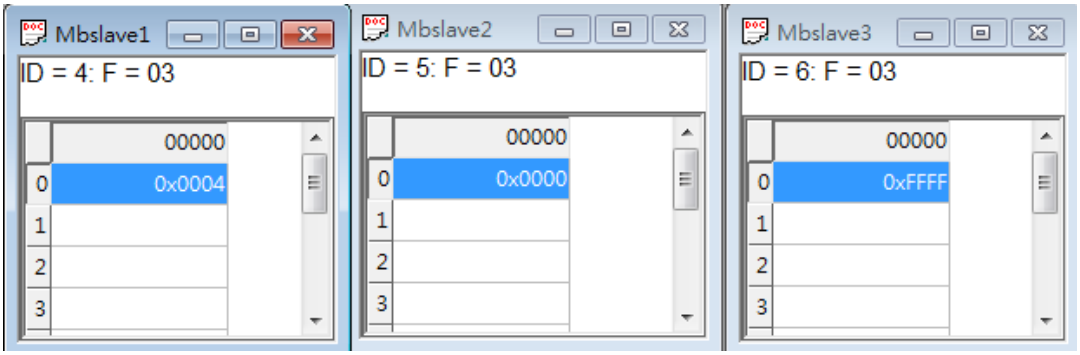
(3) Check Modbus Slave IDs 4-6; they are updated as 0x0004, 0x0005, 0x0006, respectively.



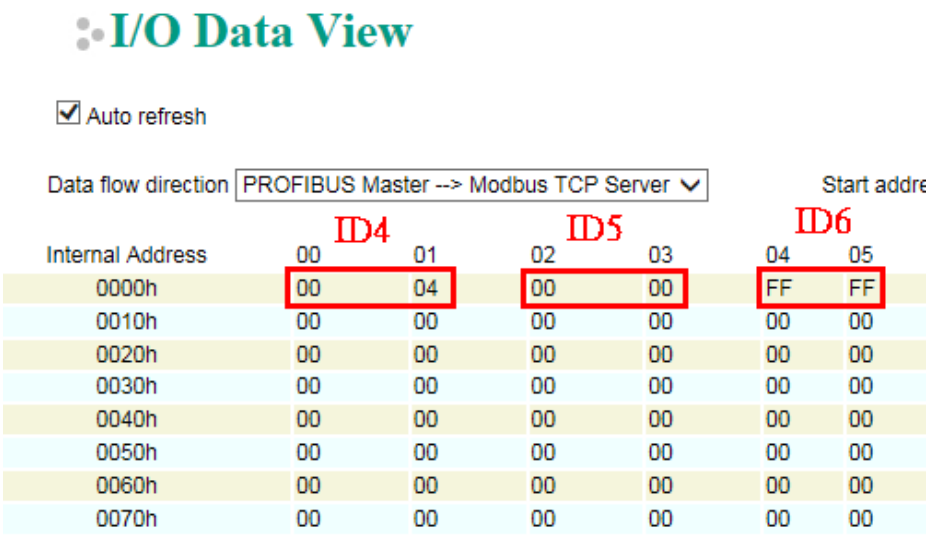
Via **System Monitoring → Protocol Status → I/O Data View**, we can choose **PROFIUS Master → Modbus/TCP Server** data flow side to see the PROFIBUS output data:



(4) Remove the PROFIBUS cable. After 10000 ms, the **Fault Timeout** is on. Check whether Modbus Slave ID 4's register 0 value is still 0x0004. Slave ID 5's register 0 value is updated to 0x0000 and Slave ID 6's register 0 to 0xFFFF.



Check **PROFIBUS Master → Modbus/TCP Server** data flow side. We can see they all updated as its **Fault Value**:



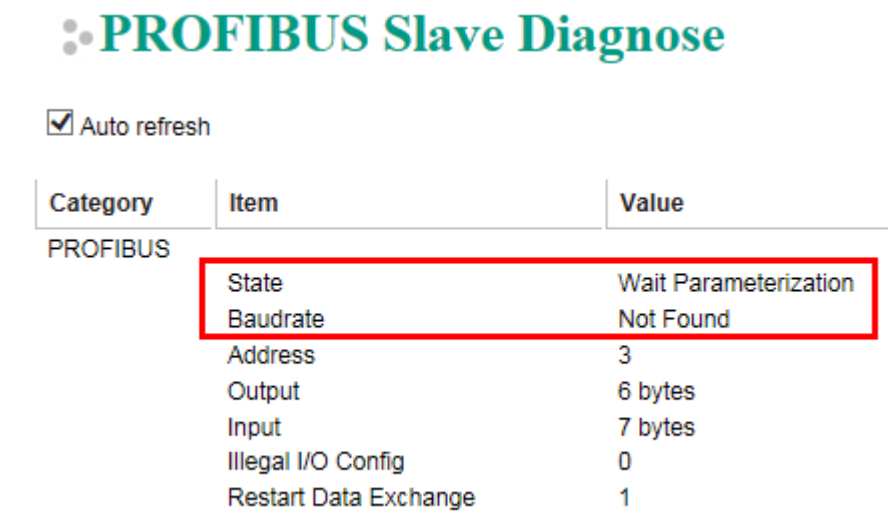
I/O Data View

Auto refresh

Data flow direction: PROFIBUS Master --> Modbus TCP Server Start addre

Internal Address	ID4 00	ID4 01	ID5 02	ID5 03	ID6 04	ID6 05
0000h	00	04	00	00	FF	FF
0010h	00	00	00	00	00	00
0020h	00	00	00	00	00	00
0030h	00	00	00	00	00	00
0040h	00	00	00	00	00	00
0050h	00	00	00	00	00	00
0060h	00	00	00	00	00	00
0070h	00	00	00	00	00	00

Check **PROFIBUS Slave**. Its Baudrate shows **Not Found** and State shows **Wait Parameterization**:



PROFIBUS Slave Diagnose

Auto refresh

Category	Item	Value
PROFIBUS		
	State	Wait Parameterization
	Baudrate	Not Found
	Address	3
	Output	6 bytes
	Input	7 bytes
	Illegal I/O Config	0
	Restart Data Exchange	1