
# Acyclic communication between S7-1200 and V20 via Modbus

SINAMICS V20 / SIMATIC S7-1200

https://support.industry.siemens.com/cs/ww/en/view/109780737

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# 1 Task

## Introduction

Effective from the firmware version V03.96.00.00 of SINAMICS V20 drive, it supports DS47 in Modbus communication. Then all parameters in V20 drive can be accessed via acyclic communication.

The new firmware can be downloaded from the following link:

https://support.industry.siemens.com/cs/ww/en/view/109767473

## Overview of the automation task

The figure 1-1 below provides an overview of the automation task.

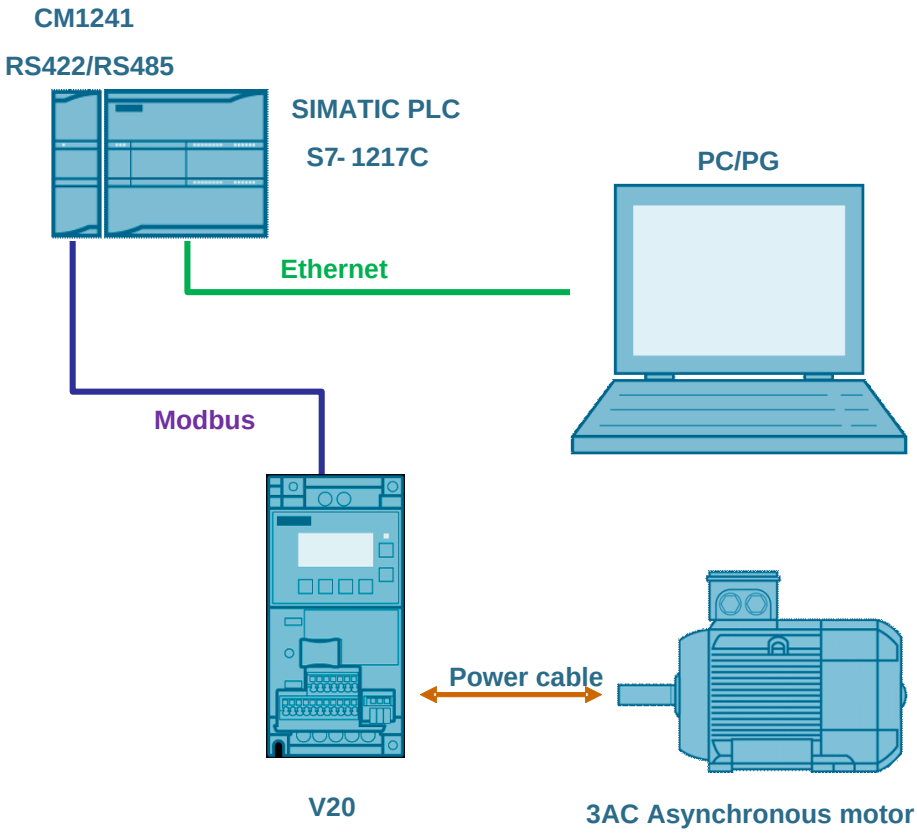



Figure 1-1

# 2 Solution

## 2.1 Solution overview

**Schema Display**

The following figure 2-1 displays the most important components of the solution:

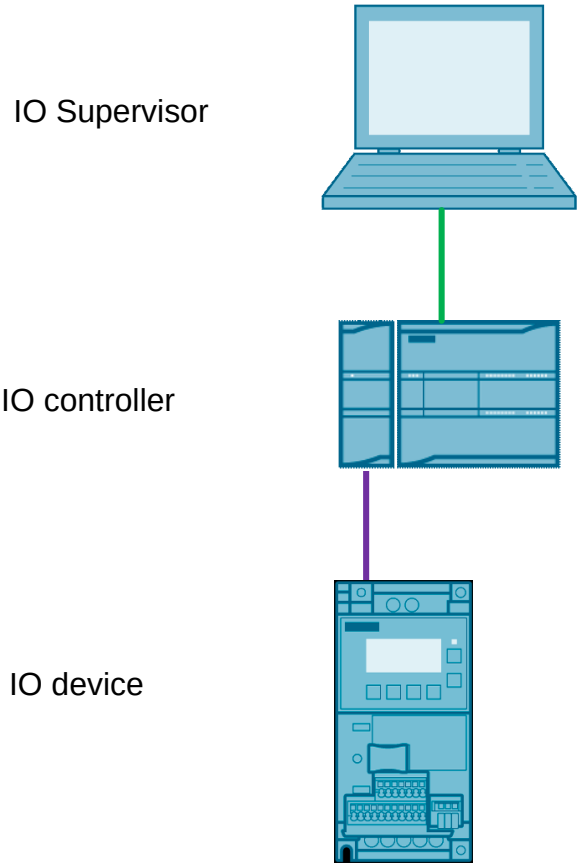



Figure 2-1

**Required knowledge**

Basic knowledge about TIA Portal is assumed.

The configuration of S7-1200 PLC with the Modbus function in TIA Portal is assumed.

The knowledge of commission of SINAMICS V20 is assumed.

## 2.2 Hardware and Software Components

### 2.2.1 Validity

This application example is valid for

- TIA Portal V15.1
- SINAMICS V20 FW V03.96.00.00

### 2.2.2 Used Components

The application was generated with the following components:

**Hardware components**

Table 2-1 hardware components

| Component | No. | Article number | Note |
|---|---|---|---|
| SIMATIC S7-1200 1217C DC/DC/DC | 1 | 6ES7217-1AG40-0XB0 | V4.1 |
| CM1241 RS422/RS485 | 1 | 6ES7 241-1CH32-0XB0 | V2.1 |
| SINAMICS V20 | 1 | 6SL3210-5BB11-2UV1 | V03.96.00.00 |

**Standard software components**

Table 2-2 software components

| Component | No. | Note |
|---|---|---|
| TIA Portal | 1 | V15.1 |
| | | |

**Sample files and projects**

The table 2-3 includes all files and projects that are used in this example.

Table 2-3

| Component | Note |
|---|---|
| 109780737_Acyclic_communication_between_SINAMICS_V20_and_S7-1200_via_DS47 | Project file |
| 109780737_Modbus_Acyclic_Communication_between_S7-1200_and_V20_DOC_en | Document |

# 3 Acyclic data exchange

## 3.1 Description

The acyclic data exchange mode allows the following task:

- Exchange large “user data”.
- By using the PLC function blocks, the user can exchange the data. The transferred data block structure should follow the DS47 data structure.

Acyclic communication or general parameter access is realized using the Modbus registers 40601 to 40722.

Acyclic communication is controlled using register 40601. The register 40602 contains the function code, always equal to 47. User data are contained in registers 40603 to 40722.

## 3.2 Diagram of acyclic data exchange

The figure 3-1 describes the principle of acyclic data exchange.

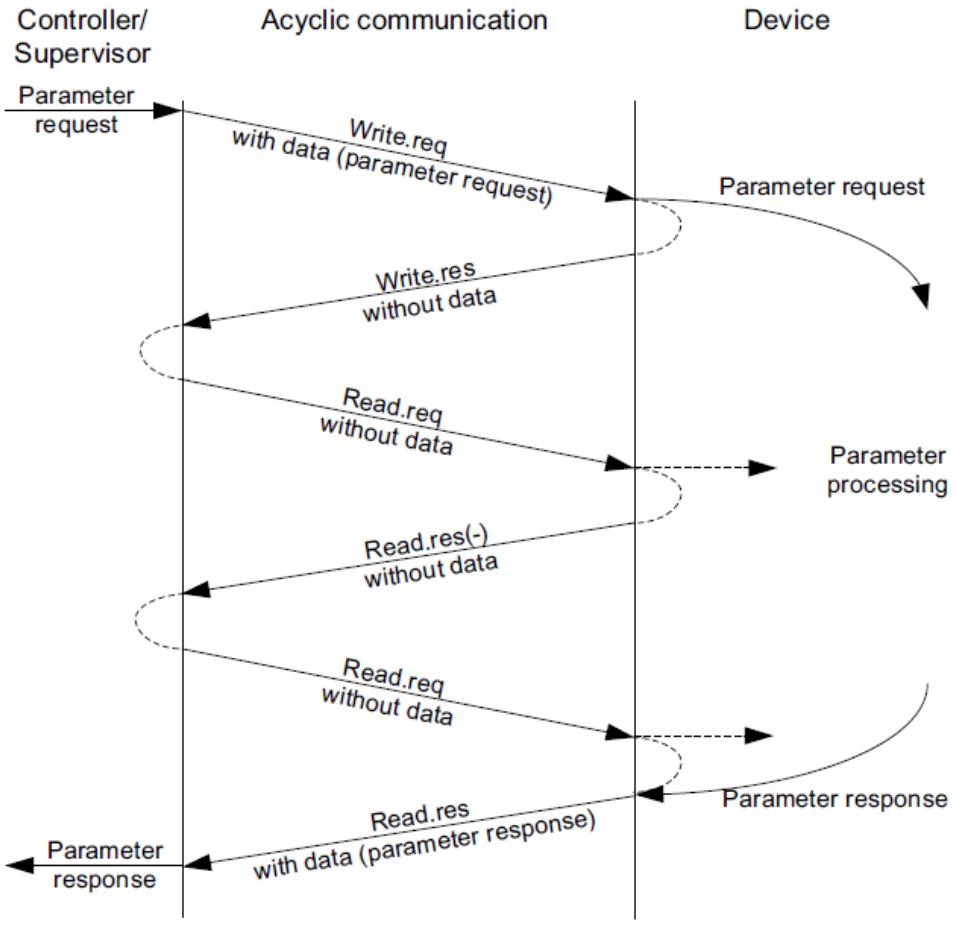



Figure 3-1

## 3.3 Overview of acyclic communication

The table 3-1 shows the overview structure of the acyclic communication.

Table 3-1 Overview of acyclic communication

| Value in the register | | | | Explanation |
|---|---|---|---|---|
| 40601 | 40602 | | 40603…40722 | |
| 0 | 47 | … | … | Write values for acyclic access |
| 1 | 47 | Request length [bytes] | Request data | Activate acyclic access |
| 2 | 47 | Response length [bytes] | Response data | Response for a successful request |
| 2 | 47 | 0 | Response data | Response for an error request |

The error codes shows below

1 hex: Invalid length

2 hex: Invalid state

3 hex: Invalid function code

4 hex: Response not ready

5 hex: Internal error

Incorrect access operations to parameters via data set 47 are logged in registers 40603 to 40722.



Table 3-2 shows the data structure of the parameter reading task.

Table 3-2 data structure of the parameter reading task

| **Data block** | **Byte n** | **Byte n+1** | **Register** |
|---|---|---|---|
| Message header | Reference 80 hex | 01 hex: request identifier | 40603 |
| | 01 hex | quantity of the parameters (m) 01 hex … 27 hex | 40604 |
| Parameter 1 | Properties<br>10 hex: parameter value | Quantity of the parameter index:<br>00 hex … EA hex<br>(parameter has no index: 00 hex) | 40605 |
| | Parameter number: 0001 hex … FFFF hex | | 40606 |
| | The first index number: 0000 hex … FFFF hex<br>(parameter has no index: 0000 hex) | | 40607 |
| Parameter 2 | … | | … |
| … | … | | … |
| Parameter m | … | | … |

Table 3-3 shows the data structure of successful reading operation.

Table 3-3 data structure of successful reading operation

| **Data block** | **Byte n** | **Byte n+1** | **Register** |
|---|---|---|---|
| Message header | Reference 80 hex | 01 hex: request identifier | 40603 |
| | 01 hex | quantity of the parameters (m) 01 hex … 27 hex | 40604 |
| Parameter 1 | Data format | Quantity of the parameter index: | 40605 |
| | Parameter value | | 40606 |
| | Parameter value | | 40607 |
| Parameter 2 | … | | … |
| … | … | | … |
| Parameter m | … | | … |

Table 3-4 shows the data structure of non-successful reading operation

Table 3-4 data structure of non-successful reading operation

| **Data block** | **Byte n** | **Byte n+1** | **Register** |
|---|---|---|---|
| Message header | Error code | | 40603 |

Table 3-5 shows the data structure of the writing parameters

Table 3-5 data structure of the writing parameters

| **Data block** | **Byte n** | **Byte n+1** | **Register** |
|---|---|---|---|
| Message header | Reference 80 hex | 02 hex: request identifier | 40603 |
| | 01 hex | quantity of the parameters (m) 01 hex … 27 hex | 40604 |
| Parameter 1 | Properties<br>10 hex: parameter value | Quantity of the parameter index:<br>00 hex … EA hex<br>(parameter has no index: 00 hex) | 40605 |
| | Parameter number: 0001 hex … FFFF hex | | 40606 |
| | The first index number: 0000 hex … FFFF hex<br>(parameter has no index: 0000 hex) | | 40607 |
| | Data format | Number of values | 40608 |
| | Parameter value | | 40609 |
| | Parameter value | | 40610 |
| Parameter 2 | … | | … |
| … | … | | … |
| Parameter m | … | | … |

# 4 Operation

## 4.1 Hardware installation

The figure 4-1 is the main power supply diagram of the V20 drive and PLC.

Figure 4-1

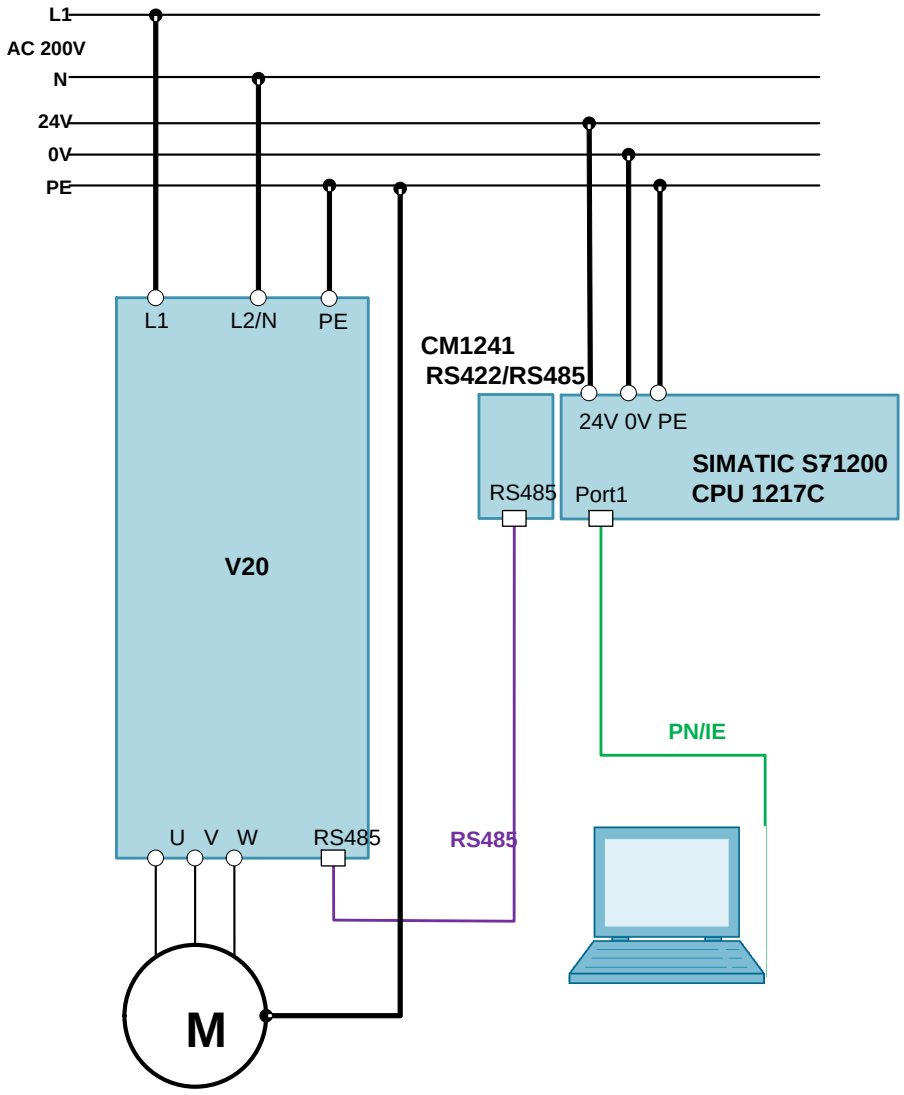
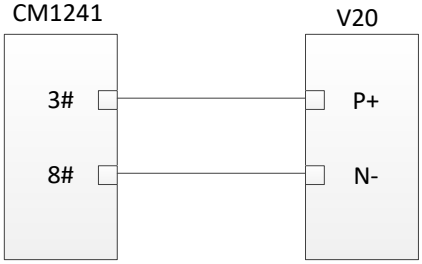



Figure 4-2 is the communication wiring between V20 and CM1241.

Figure 4-2



## 4.2 V20 drive parameter setting

Set the related Modbus communication parameters as the table 4-1 in V20 drive.

Table 4-1

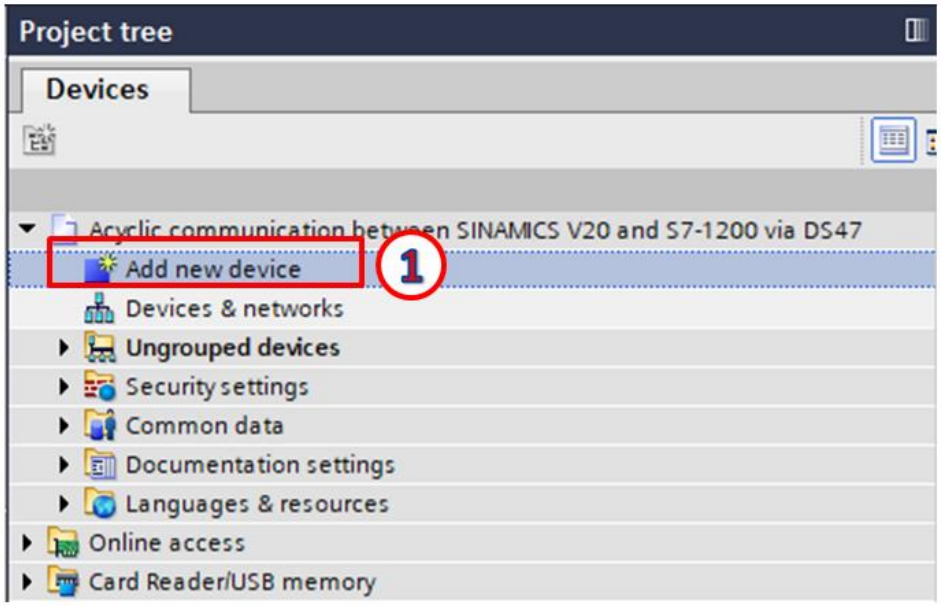
| Item | Parameter number | Parameter value | Remarks |
|---|---|---|---|
| 1. | P2010 | 6 | Modbus baudrate |
| 2. | P2014 | 2000 | Modbus telegram off time |
| 3. | P2021 | 2 | Modbus address |
| 4. | P2022 | 1000 | Modbus reply time out |
| 5. | P2023 | 2 | RS485 protocol selection |
| 6. | P2034 | 0 | Modbus parity on RS485 |
| 7. | P2035 | 1 | Modbus stop bits on RS485 |
| 8. | | | |
| 9. | | | |

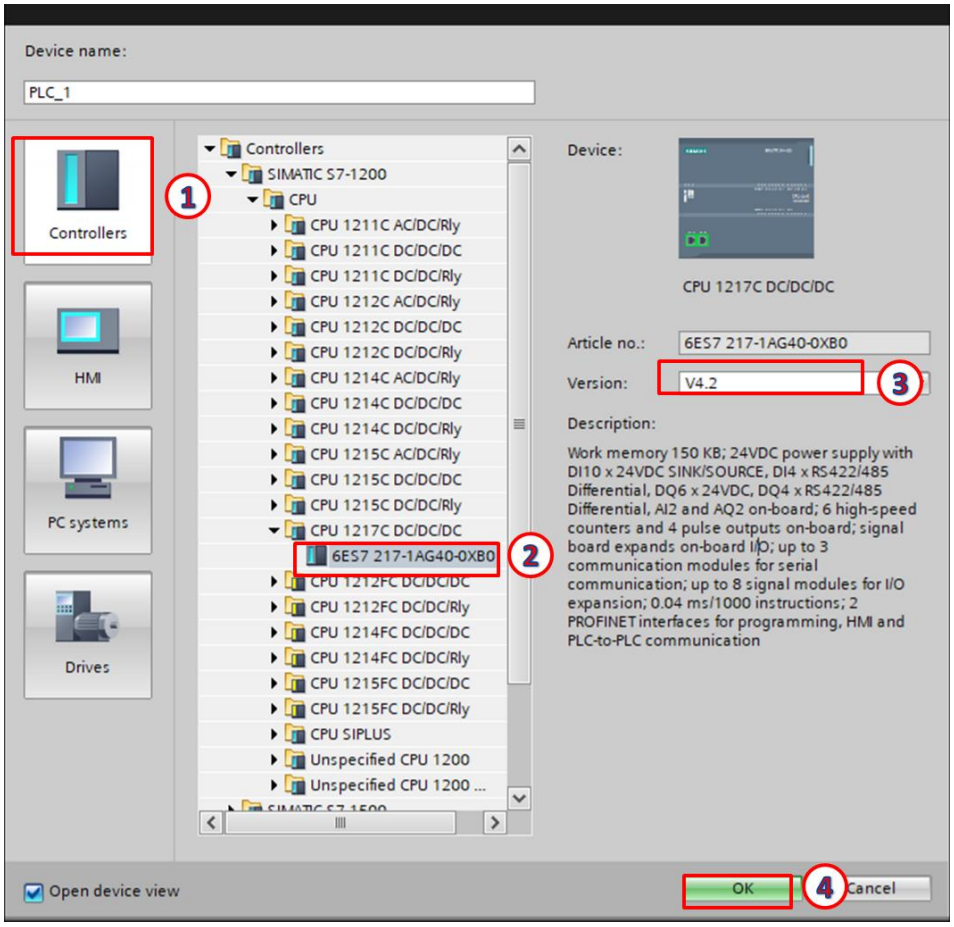
# 4.3 PLC engineering

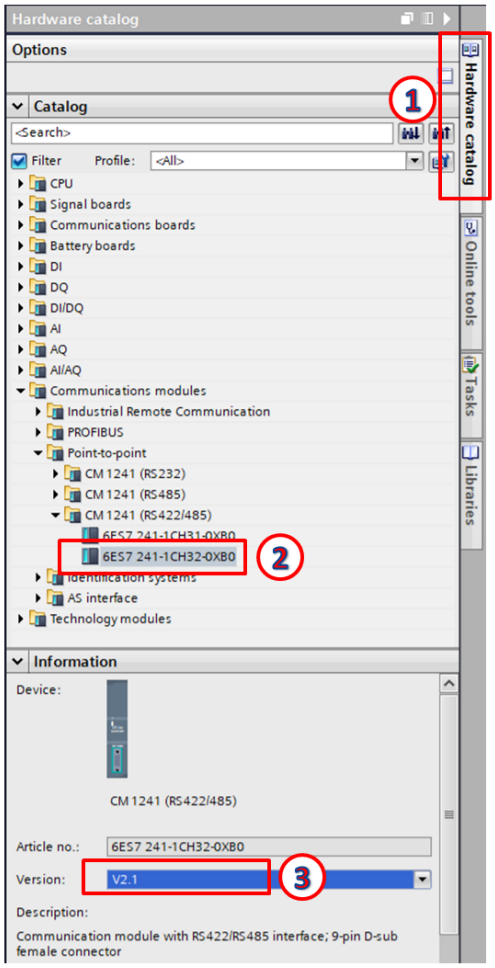
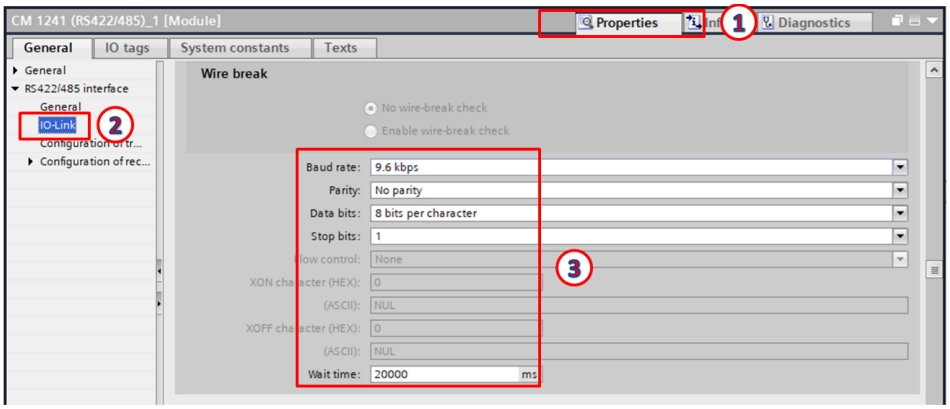
## 4.3.1 Configuration and programming

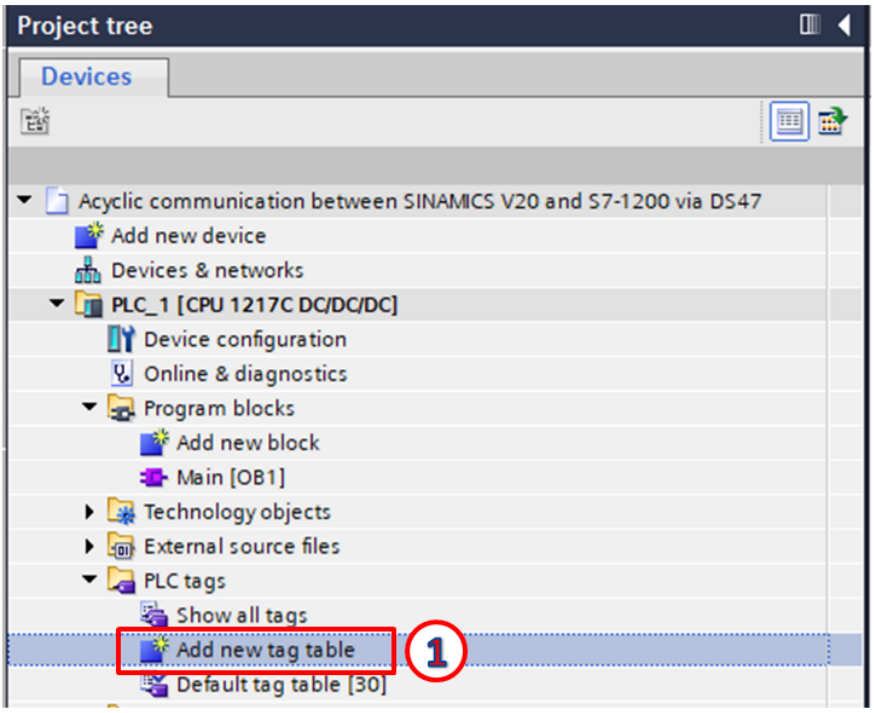
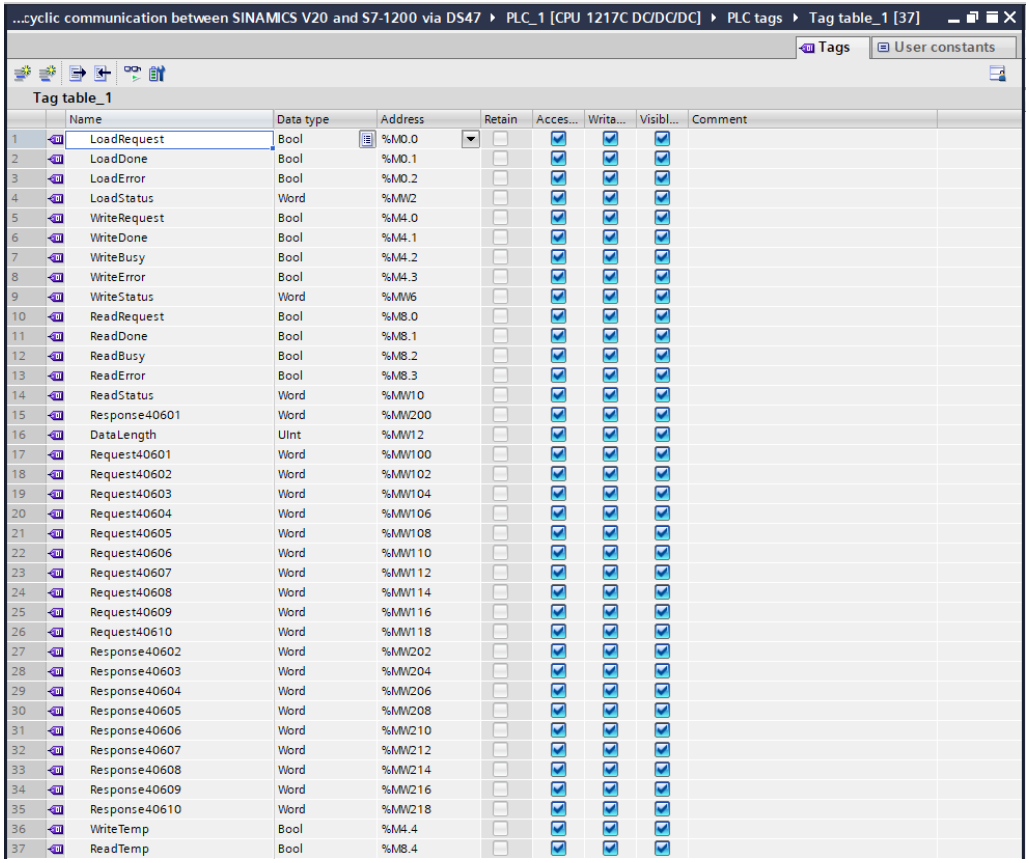
The configuration and programming is showed in table 4-2.

Table 4-2

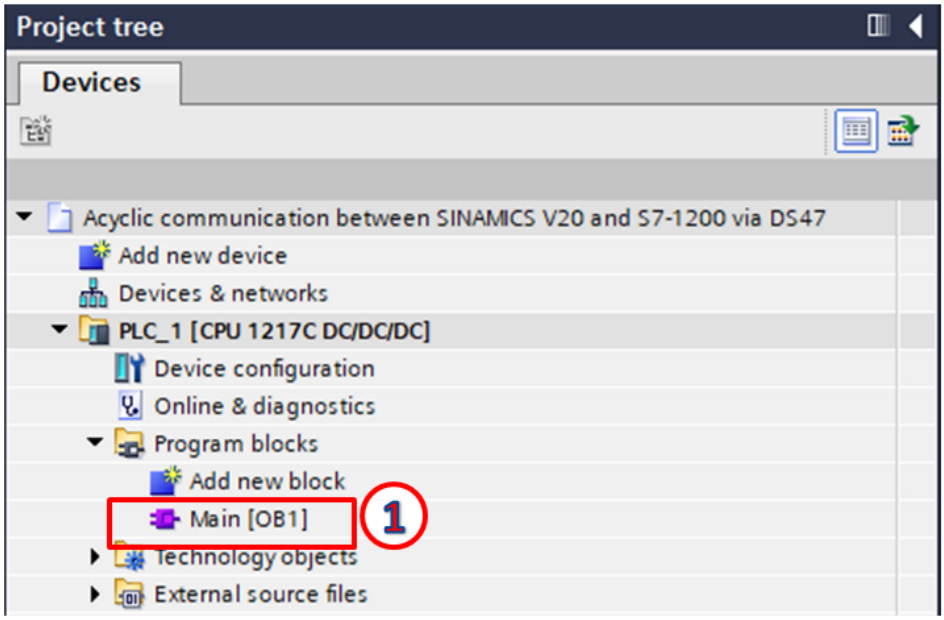
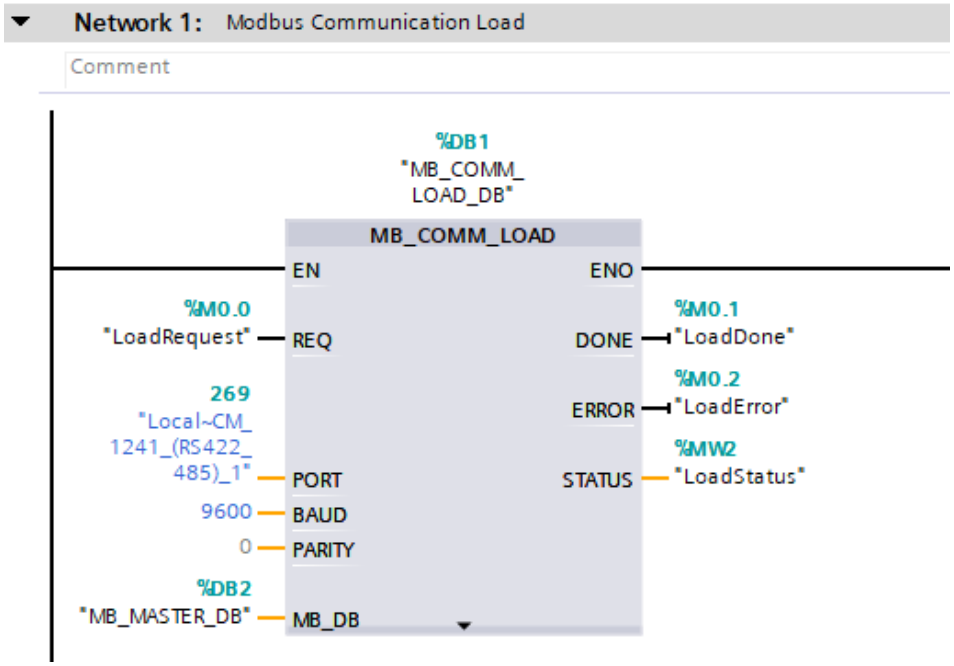
| No. | Action |
|---|---|
| 1. |  <br>1. Create a TIA project and input the project name.<br>2. Press “Create” button to create the project. |
| 2. |  <br>1. Double click the “Add new device” to open the hardware configuration. |

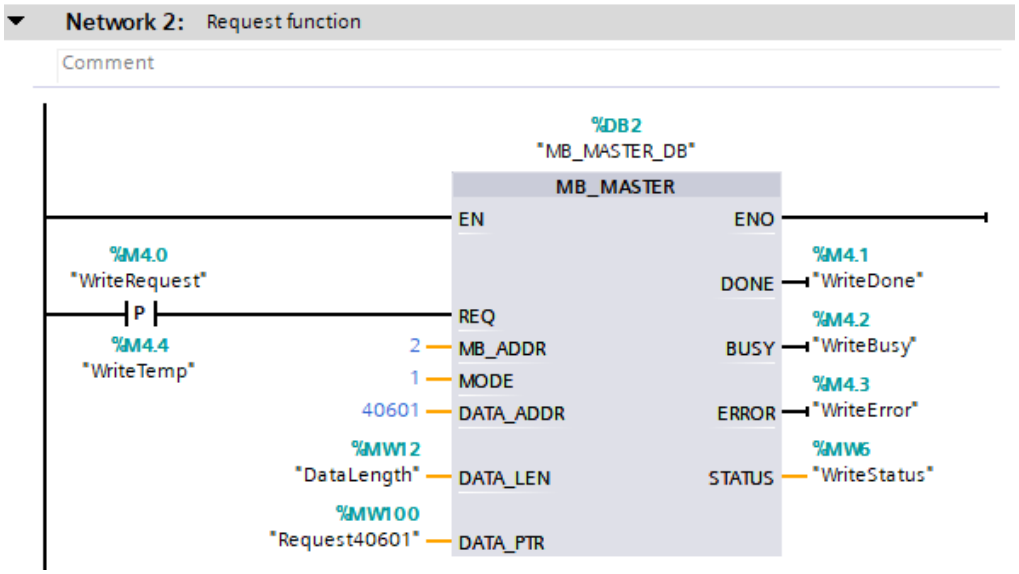
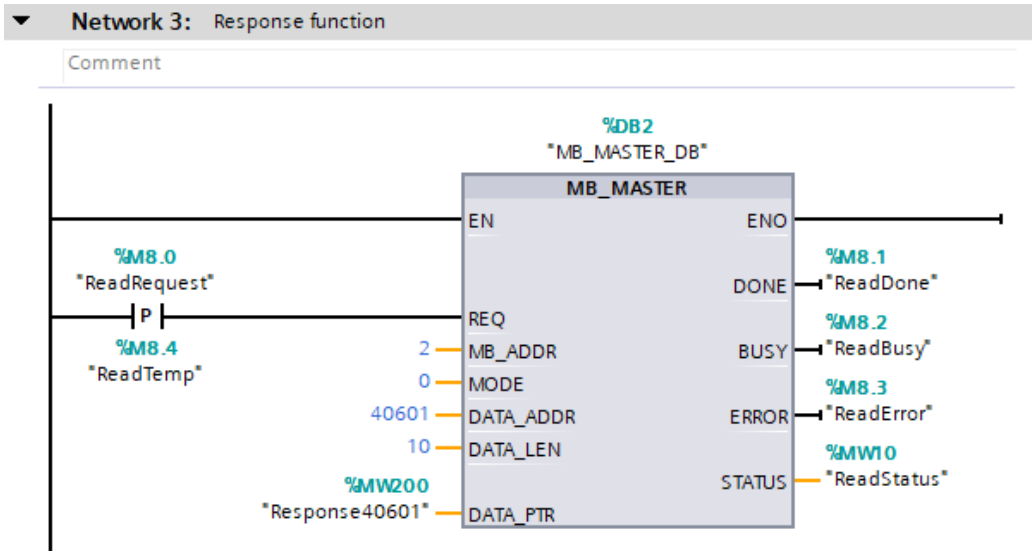
| No. | Action |
|---|---|
| 3. |  <br>1. Select the controllers.<br>2. Find the target CPU.<br>3. Select the target firmware version.<br>4. Press “OK”. |

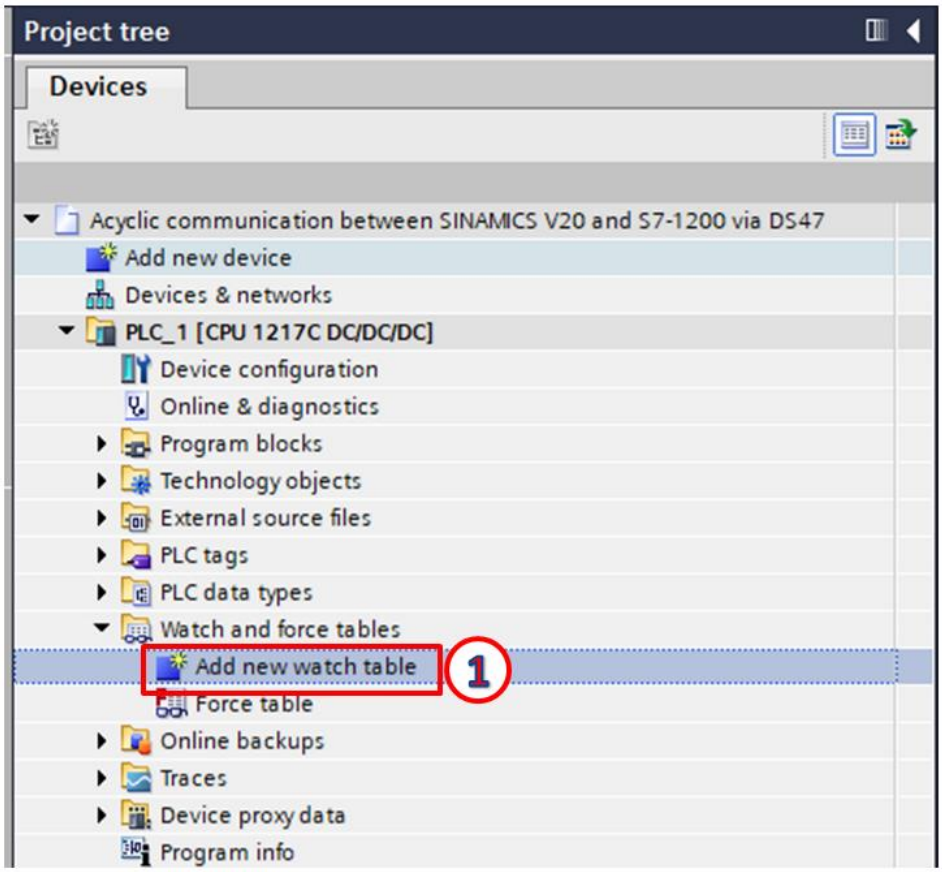
| No. | Action |
|---|---|
| 4. |  <br>1. Click the “hardware catalog”.<br>2. Find the target communication modules<br>3. Select target firmware version.<br>4. Add this module into the project. |
| 5. |  <br>1. In the properties view of the CM module.<br>2. Select the IO-Link option.<br>3. Set the related communication parameters. |

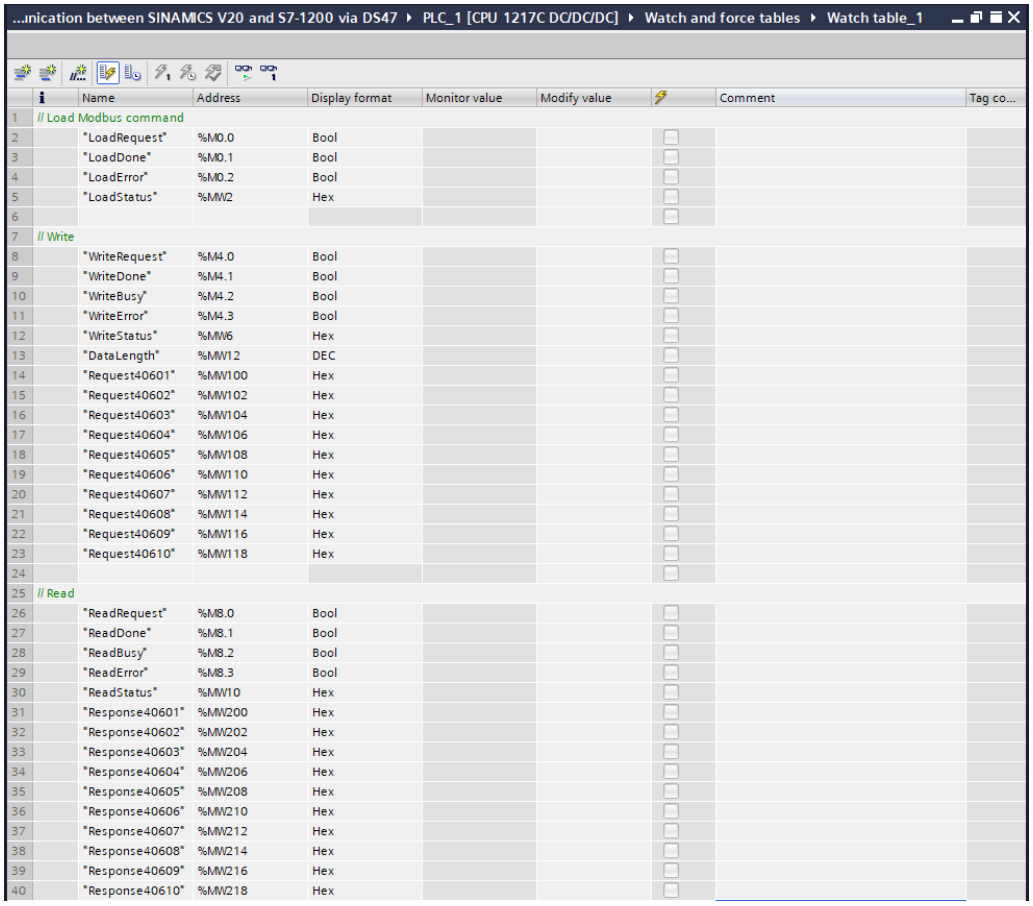
| No. | Action |
|---|---|
| 6. |  <br>1. in the project tree, double click “Add new tag table” to new a tag table and open it. |
| 7. |  <br>Create the tags as the tag table. |

| | Name | Data type | Address | Retain | Acces... | Writa... | Visibl... | Comment |
|---|---|---|---|---|---|---|---|---|
| 1 | LoadRequest | Bool | %M0.0 | | ✓ | ✓ | ✓ | |
| 2 | LoadDone | Bool | %M0.1 | | ✓ | ✓ | ✓ | |
| 3 | LoadError | Bool | %M0.2 | | ✓ | ✓ | ✓ | |
| 4 | LoadStatus | Word | %MW2 | | ✓ | ✓ | ✓ | |
| 5 | WriteRequest | Bool | %M4.0 | | ✓ | ✓ | ✓ | |
| 6 | WriteDone | Bool | %M4.1 | | ✓ | ✓ | ✓ | |
| 7 | WriteBusy | Bool | %M4.2 | | ✓ | ✓ | ✓ | |
| 8 | WriteError | Bool | %M4.3 | | ✓ | ✓ | ✓ | |
| 9 | WriteStatus | Word | %MW6 | | ✓ | ✓ | ✓ | |
| 10 | ReadRequest | Bool | %M8.0 | | ✓ | ✓ | ✓ | |
| 11 | ReadDone | Bool | %M8.1 | | ✓ | ✓ | ✓ | |
| 12 | ReadBusy | Bool | %M8.2 | | ✓ | ✓ | ✓ | |
| 13 | ReadError | Bool | %M8.3 | | ✓ | ✓ | ✓ | |
| 14 | ReadStatus | Word | %MW10 | | ✓ | ✓ | ✓ | |
| 15 | Response40601 | Word | %MW200 | | ✓ | ✓ | ✓ | |
| 16 | DataLength | UInt | %MW12 | | ✓ | ✓ | ✓ | |
| 17 | Request40601 | Word | %MW100 | | ✓ | ✓ | ✓ | |
| 18 | Request40602 | Word | %MW102 | | ✓ | ✓ | ✓ | |
| 19 | Request40603 | Word | %MW104 | | ✓ | ✓ | ✓ | |
| 20 | Request40604 | Word | %MW106 | | ✓ | ✓ | ✓ | |
| 21 | Request40605 | Word | %MW108 | | ✓ | ✓ | ✓ | |
| 22 | Request40606 | Word | %MW110 | | ✓ | ✓ | ✓ | |
| 23 | Request40607 | Word | %MW112 | | ✓ | ✓ | ✓ | |
| 24 | Request40608 | Word | %MW114 | | ✓ | ✓ | ✓ | |
| 25 | Request40609 | Word | %MW116 | | ✓ | ✓ | ✓ | |
| 26 | Request40610 | Word | %MW118 | | ✓ | ✓ | ✓ | |
| 27 | Response40602 | Word | %MW202 | | ✓ | ✓ | ✓ | |
| 28 | Response40603 | Word | %MW204 | | ✓ | ✓ | ✓ | |
| 29 | Response40604 | Word | %MW206 | | ✓ | ✓ | ✓ | |
| 30 | Response40605 | Word | %MW208 | | ✓ | ✓ | ✓ | |
| 31 | Response40606 | Word | %MW210 | | ✓ | ✓ | ✓ | |
| 32 | Response40607 | Word | %MW212 | | ✓ | ✓ | ✓ | |
| 33 | Response40608 | Word | %MW214 | | ✓ | ✓ | ✓ | |
| 34 | Response40609 | Word | %MW216 | | ✓ | ✓ | ✓ | |
| 35 | Response40610 | Word | %MW218 | | ✓ | ✓ | ✓ | |
| 36 | WriteTemp | Bool | %M4.4 | | ✓ | ✓ | ✓ | |
| 37 | ReadTemp | Bool | %M8.4 | | ✓ | ✓ | ✓ | |

| No. | Action |
|---|---|
| 8. |  <br>1. Double click OB1 in the project tree to open the block |
| 9. |  <br>Call the communication load block and set the related parameters. |

| No. | Action |
|---|---|
| 10. |  <br>Call the MASTER function used to send the request command to drive. |
| 11. |  <br>Call the MASTER function used to receive the response command from the drive. |

| No. | Action |
|---|---|
| 12. |  <br>1. In the project tree, double click “Add new watch table” and open it. |

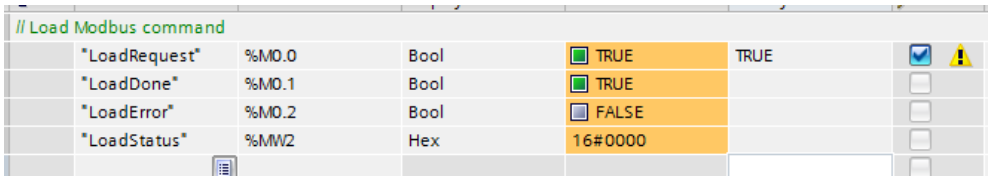
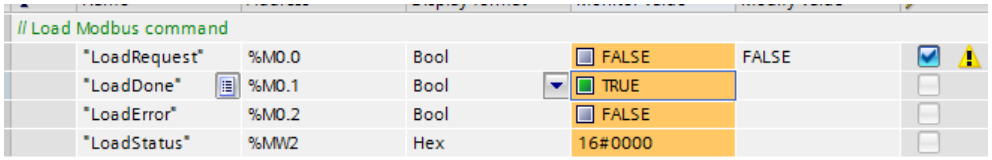
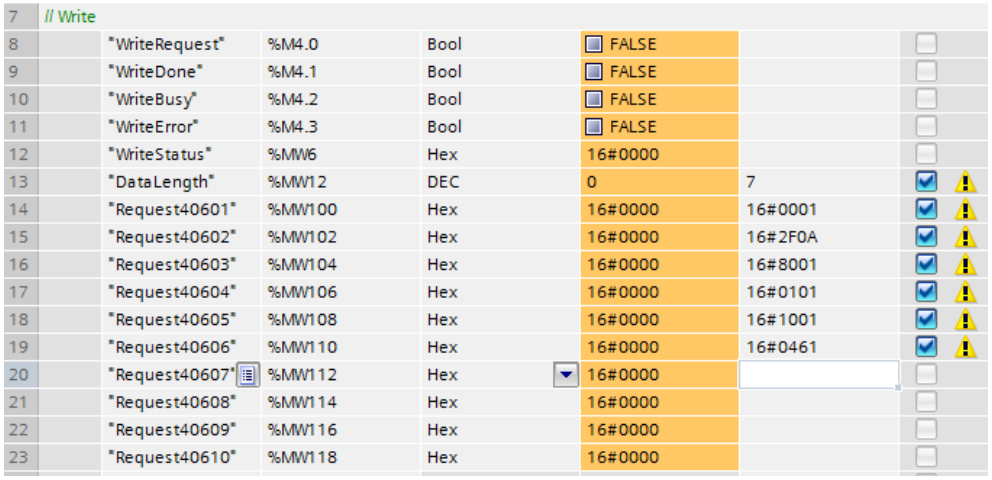
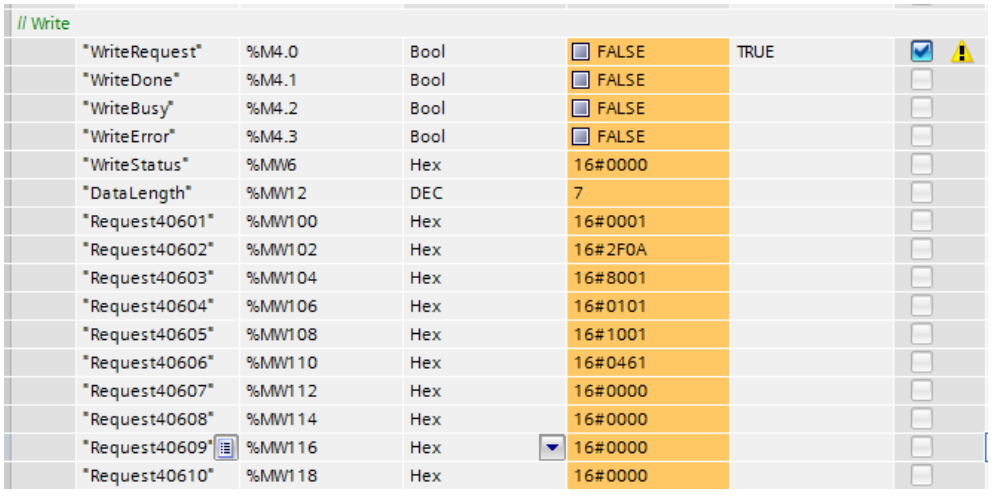
| No. | Action |
|---|---|
| 13. |  <br>Create it as the picture. |
| 14. | |

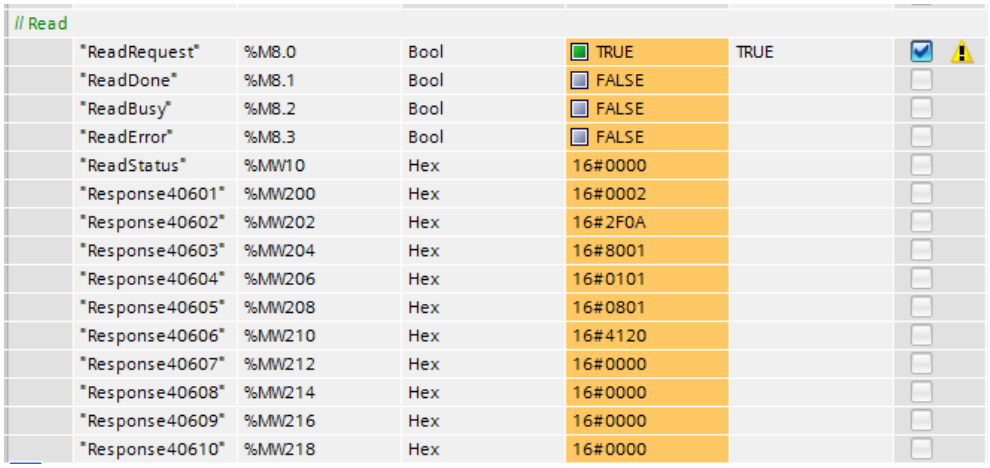
| | Name | Address | Display format | Monitor value | Modify value | Comment | Tag co... |
|---|---|---|---|---|---|---|---|
| 1 | // Load Modbus command | | | | | | |
| 2 | "LoadRequest" | %M0.0 | Bool | | | | |
| 3 | "LoadDone" | %M0.1 | Bool | | | | |
| 4 | "LoadError" | %M0.2 | Bool | | | | |
| 5 | "LoadStatus" | %MW2 | Hex | | | | |
| 6 | | | | | | | |
| 7 | // Write | | | | | | |
| 8 | "WriteRequest" | %M4.0 | Bool | | | | |
| 9 | "WriteDone" | %M4.1 | Bool | | | | |
| 10 | "WriteBusy" | %M4.2 | Bool | | | | |
| 11 | "WriteError" | %M4.3 | Bool | | | | |
| 12 | "WriteStatus" | %MW6 | Hex | | | | |
| 13 | "DataLength" | %MW12 | DEC | | | | |
| 14 | "Request40601" | %MW100 | Hex | | | | |
| 15 | "Request40602" | %MW102 | Hex | | | | |
| 16 | "Request40603" | %MW104 | Hex | | | | |
| 17 | "Request40604" | %MW106 | Hex | | | | |
| 18 | "Request40605" | %MW108 | Hex | | | | |
| 19 | "Request40606" | %MW110 | Hex | | | | |
| 20 | "Request40607" | %MW112 | Hex | | | | |
| 21 | "Request40608" | %MW114 | Hex | | | | |
| 22 | "Request40609" | %MW116 | Hex | | | | |
| 23 | "Request40610" | %MW118 | Hex | | | | |
| 24 | | | | | | | |
| 25 | // Read | | | | | | |
| 26 | "ReadRequest" | %M8.0 | Bool | | | | |
| 27 | "ReadDone" | %M8.1 | Bool | | | | |
| 28 | "ReadBusy" | %M8.2 | Bool | | | | |
| 29 | "ReadError" | %M8.3 | Bool | | | | |
| 30 | "ReadStatus" | %MW10 | Hex | | | | |
| 31 | "Response40601" | %MW200 | Hex | | | | |
| 32 | "Response40602" | %MW202 | Hex | | | | |
| 33 | "Response40603" | %MW204 | Hex | | | | |
| 34 | "Response40604" | %MW206 | Hex | | | | |
| 35 | "Response40605" | %MW208 | Hex | | | | |
| 36 | "Response40606" | %MW210 | Hex | | | | |
| 37 | "Response40607" | %MW212 | Hex | | | | |
| 38 | "Response40608" | %MW214 | Hex | | | | |
| 39 | "Response40609" | %MW216 | Hex | | | | |
| 40 | "Response40610" | %MW218 | Hex | | | | |

### 4.3.2 Read parameters

In this example the task is to read parameters from the drive. The parameter is P1121.Table 4-3 shows the operation sequence.

Table 4-3

| No. | Action |
|---|---|
| 1. |  <br>Set “LoadRequest” = TRUE to load the Modbus command. |
| 2. |  <br>Set “LoadRequest” = FALSE. |
| 3. |  <br>Set the “DataLength” =7;<br>Set the value “Request40601” to “Request40607” as the screenshot. |
| 4. |  <br>Set the “WriteRequest” = TRUE to send the read parameter command to the drive. |

| No. | Action |
|---|---|
| 5. |  Set the “ReadRequest” = TRUE to read the feedback of the parameter reading operation. “Response40606” and “Response40607” is the parameter value. And it is the same value as the drive. P1121=10.0 |

### 4.3.3 Write multiple parameters

In this example the task is to write P1121=12.15. Table 4-4 shows the operation sequence.

Table 4-4

| No. | Action |
|---|---|
| 1. | // Write<br>"WriteRequest" %M4.0 Bool FALSE FALSE<br>"WriteDone" %M4.1 Bool FALSE<br>"WriteBusy" %M4.2 Bool FALSE<br>"WriteError" %M4.3 Bool FALSE<br>"WriteStatus" %MW6 Hex 16#0000<br>"DataLength" %MW12 DEC 7 10<br>"Request40601" %MW100 Hex 16#0001 16#0001<br>"Request40602" %MW102 Hex 16#2F0A 16#2F10<br>"Request40603" %MW104 Hex 16#8001 16#8002<br>"Request40604" %MW106 Hex 16#0101 16#0101<br>"Request40605" %MW108 Hex 16#1001 16#1001<br>"Request40606" %MW110 Hex 16#0461 16#0461<br>"Request40607" %MW112 Hex 16#0000 16#0000<br>"Request40608" %MW114 Hex 16#0000 16#0801<br>"Request40609" %MW116 Hex 16#0000 16#4142<br>"Request40610" %MW118 Hex 16#0000 16#6666<br>Set the “DataLength” =10;<br>Set the value “Request40601” to “Request40610” as the screenshot. |
| 2. | // Write<br>"WriteRequest" %M4.0 Bool FALSE TRUE<br>"WriteDone" %M4.1 Bool FALSE<br>"WriteBusy" %M4.2 Bool FALSE<br>"WriteError" %M4.3 Bool FALSE<br>"WriteStatus" %MW6 Hex 16#0000<br>"DataLength" %MW12 DEC 10<br>"Request40601" %MW100 Hex 16#0001<br>"Request40602" %MW102 Hex 16#2F10<br>"Request40603" %MW104 Hex 16#8002<br>"Request40604" %MW106 Hex 16#0101<br>"Request40605" %MW108 Hex 16#1001<br>"Request40606" %MW110 Hex 16#0461<br>"Request40607" %MW112 Hex 16#0000<br>"Request40608" %MW114 Hex 16#0801<br>"Request40609" %MW116 Hex 16#4142<br>"Request40610" %MW118 Hex 16#6666<br>Set the “WriteRequest” = TRUE to send the parameter writing command to the drive.<br>Check the value of P1121 in the drive, it is changed to 12.15. |
| 3. | |

# 5 Related literature

Table 5-1

| | Topic |
|---|---|
| \1\ | Siemens Industry Online Support<br>https://support.industry.siemens.com |
| \2\ | Download page of this entry<br>https://support.industry.siemens.com/cs/ww/en/view/109780737 |
| \3\ | |

# 6 Contact

Siemens Ltd., China

DI MC GMC

No. 18 Siemens Road
Jiangning Development Zone

Nanjing, 211100
China
mailto: mc_gmc_mp_asia.cn@siemens.com



# 7 History

Table 9-1

| Version | Date | Modifications |
|---|---|---|
| V1.0 | 07/2020 | First version |
| | | |
| | | |