

# Weintek Built-In Codesys with Internal Modbus Gateway

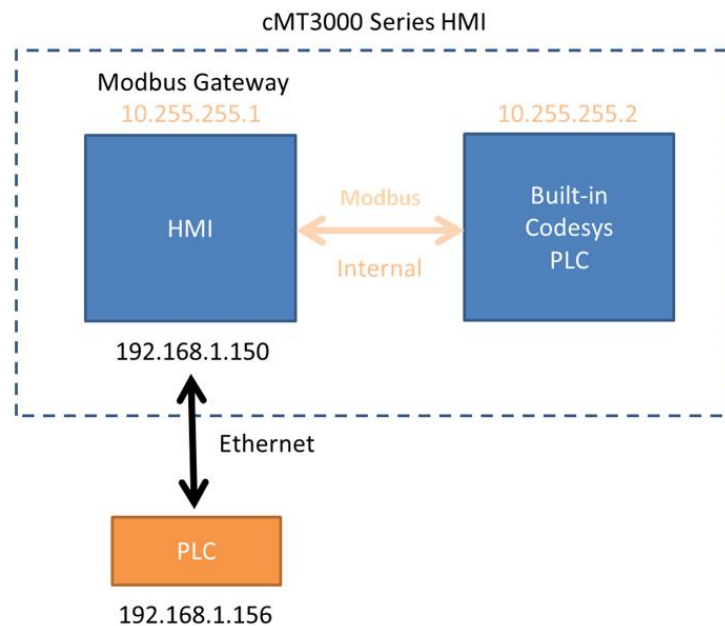


Weintek USA, Inc.  
[www.WeintekUSA.com](http://www.WeintekUSA.com)  
(425) 488-1100

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## Weintek Built-In Codesys with Internal Modbus Gateway

**Introduction:** This instruction manual discusses how to build communication between Weintek Built-In Codesys PLC and external PLCs via HMI's internal **Modbus Gateway**. The purpose of this document is to show you how to correctly set up the communication, including Modbus TCP configuration in Codesys and the Modbus TCP gateway in EasyBuilder Pro.

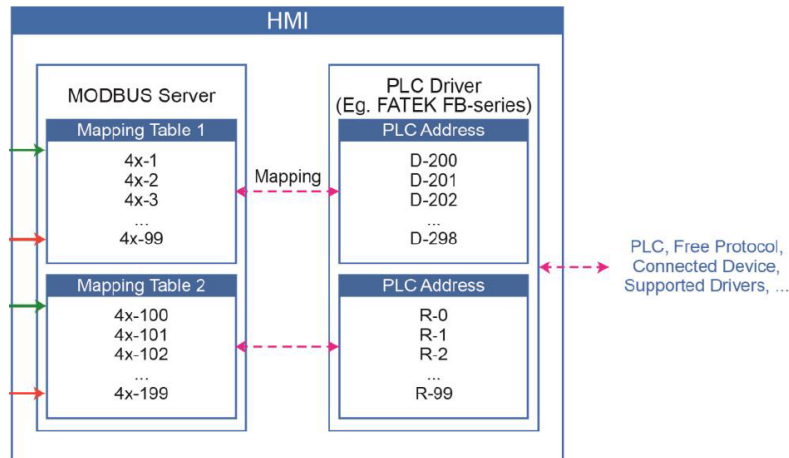


*Communication flowchart*

## Weintek Built-In Codesys with Internal Modbus Gateway

### Modbus TCP Gateway Concept:

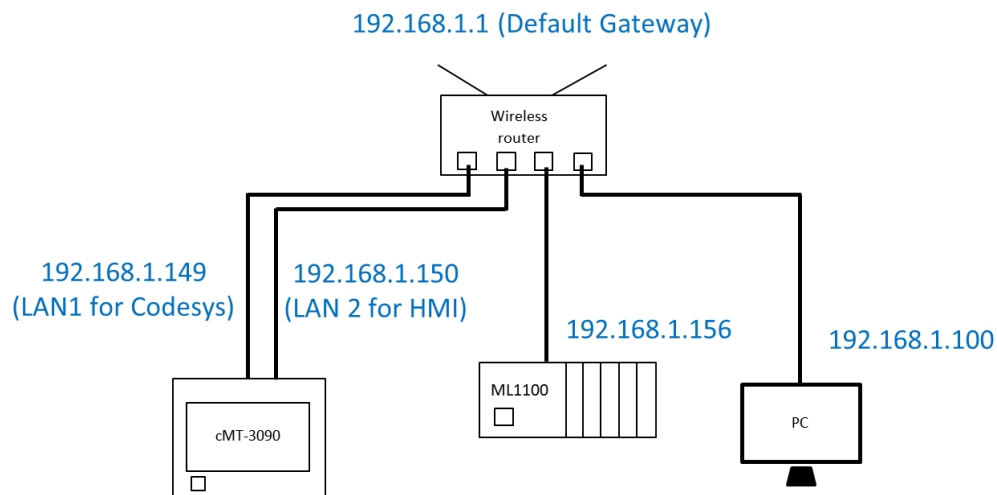
In an HMI, the Modbus TCP server contains multiple mapping tables. In this example, Mapping Table 1 associates MODBUS 4x-1 register with Fatek register D-200, and the number of elements is 99 words. Mapping Table 2 associates MODBUS register 4x-100 with Fatek register R-0, and the number of elements is 100 words.



### Equipment & Software:

1. cMT-3090 HMI with Codesys soft PLC activated
2. Allen Bradley MicroLogix 1100 PLC

### Wiring Diagram:



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### Details of the Communication Settings (HMI Side, EasyBuilder Pro):

1. Create a new project in Easybuilder Pro and choose the HMI model **cMT3090**.
2. To get the HMI taking to the MicroLogix PLC, go to [Home] » [System Parameters].
3. Add a [Rockwell EtherNet/IP (DF1)] driver to the Device List.
4. Click on [Settings] on the previous window. Enter the IP address of the PLC.
5. To create a MODBUS gateway, add [MODBUS Server] driver to the Device List as shown below.

The screenshot shows the 'Device Settings' dialog box for a 'MODBUS Server'. The 'Name' field is set to 'MODBUS Server'. The 'Location' is set to 'Local'. The 'Device type' is 'MODBUS Server'. The 'Device ID' is '54; V.1.00; MODBUS\_SERVER.c30'. The 'I/F' is set to 'Ethernet'. The 'IP' is set to 'Port = 502'. The 'Station no.' is set to '1'. The 'MODBUS TCP/IP Gateway' is checked 'Enable'. The 'Address Mapping Tables...' button is visible. The 'OK' and 'Cancel' buttons are at the bottom.

**[I/F]- Select Ethernet.**

**[IP]- Use the default port number 502.**

**[Station no.]**- The default station number is 1. You can change it if required.

**[Modbus TCP/IP gateway]**- Check **Enable** checkbox. Click on [Address Mapping Tables] to configure the Modbus tables.

Note: UDP won't be available when the **Modbus TCP gateway** option is used.

6. Configure Modbus tables by clicking on the [Address Mapping Tables...] button.

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Address Mapping Table

| Table | Description         | MODBUS Address | Device Name                | Mapped device Address | Table Size | Read/Write | Security |
|-------|---------------------|----------------|----------------------------|-----------------------|------------|------------|----------|
| 1     | Codesys analog read | 4x-1           | Rockwell EtherNet/IP (DF1) | N7-1                  | 3 Word(s)  | Read only  | N/A      |

\* Cross-table reading/writing not support, i.e. accessing data from multiple tables in one command.

\* LW-9288 indicates the last communication error :

|                                    |                           |
|------------------------------------|---------------------------|
| 0 : normal                         | 4 : read-only error       |
| 1 : read/write undefined registers | 5 : write-only error      |
| 2 : out of read/write range        | 6 : timeout               |
| 3 : bad command format             | 7 : invalid function code |

\* Support the following function codes :

|                                        |
|----------------------------------------|
| 0x : 1, 5, 15 (15 used only to set LB) |
| 1x : 2                                 |
| 3x : 4                                 |
| 4x : 3, 6, 16                          |

Add... Delete Settings... OK Cancel

**[Add] button**- Creates a new table.

**[Delete] button**- Removes the selected table.

**[Settings] button**- Modifies the selected table.

### Table Setting

Table Settings

Description : Codesys analog read

Address mode  
☐ Bit ☒ Word

Type  
☐ Read/Write ☒ Read only ☐ Write only

MODBUS address  
 Device : MODBUS Server  
 Address : 4x 1

Mapped device address  
 Device : Rockwell EtherNet/IP (DF1) Settings...  
 Address : N7 1

Table size  
 3 Word(s)

Conversion  
☐ AB -> BA ☐ ABCD -> CDAB

**[Description]**- Enter a comment if needed.

**[Address mode]**- Select a data type.

**[Type]**- Select a mode to access the data in the mapped register. Modbus address 1x and 3x are **Read only**.

**[Modbus address]**- Specify the Modbus function code and starting address. The starting address starts at 1. (**one-based**)

**[Mapped device address]**- Select the connected controller and specify the starting address.

**[Table size]**- The number of the bits or registers. Up to 65535 data points are available.

**[Conversion]**- This option is only available when the [Address mode] is set to **Word**.

**AB->BA** swaps high byte and low byte in each word when checked.

**ABCD->CDAB** swaps high word and low word in each double-word when checked.

Security

☒ Use execution function

☒ Disable when Bit is ON ☐ Disable when Bit is OFF

Device : Local HMI Settings...  
 Address : LB 0

**[Security]**- You can define a Boolean variable to prevent Modbus TCP client from writing data in this mapping table. This option is only available when **Type** is set to Write only or Read/Write.

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The Modbus table above maps Modbus address 4x-1 to N7:1, for a block of 3 words and read-only.

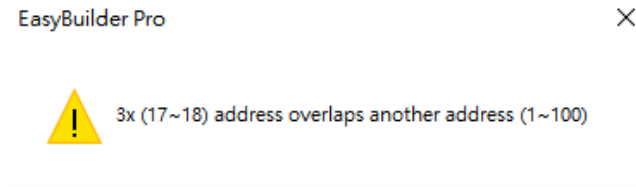
| Mapping Table 1 |        |
|-----------------|--------|
| 4x-1            | ← N7:1 |
| 4x-2            | ← N7:2 |
| 4x-3            | ← N7:3 |

The Modbus TCP master in Codesys can access data using the following Modbus function codes supported in this Modbus TCP server, at the IP address assigned to the cMT-3090.

| Modbus Address in EasyBuilder Pro | Modbus Function Code | Descriptions                                                                  |
|-----------------------------------|----------------------|-------------------------------------------------------------------------------|
| 0x                                | 1                    | Read Coil Status                                                              |
|                                   | 5                    | Force Single Coil                                                             |
|                                   | 15                   | Force Multiple Coils (LB addresses in the HMI internal memory available only) |
| 1x                                | 2                    | Read Input Status                                                             |
| 3x                                | 4                    | Read Input Registers                                                          |
| 4x                                | 3                    | Read Holding Registers                                                        |
|                                   | 6                    | Preset Single Register                                                        |
|                                   | 16                   | Preset Multiple Registers                                                     |

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Note: The defined **Modbus address** in a mapping table is not allowed to overlap the Modbus address in another mapping table. The warning message will be displayed as shown below.



For example,

| Mapping Table 1 |
|-----------------|
| 3x-1 ← N7:1     |
| 3x-2 ← N7:2     |
| 3x-3 ← N7:3     |
| .....           |
| 3x-100 ← N7:100 |

| Mapping Table 2 |
|-----------------|
| 3x-17 ← F8:1    |
| 3x-19 ← F8:2    |

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In this demonstration, four Modbus mapping tables are created as shown below.

Address Mapping Table

| Table | Description           | MODEBUS Address |      | Device Name                | Mapped device Address | Table Size | Read/Write | Security |
|-------|-----------------------|-----------------|------|----------------------------|-----------------------|------------|------------|----------|
| 1     | Codesys analog read   | 4x-1            | < == | Rockwell EtherNet/IP (DF1) | N7-1                  | 3 Word(s)  | Read only  | N/A      |
| 2     | Codesys analog write  | 4x-17           | == > | Rockwell EtherNet/IP (DF1) | N7-100                | 2 Word(s)  | Write only | N/A      |
| 3     | Codesys digital read  | 1x-1            | < == | Rockwell EtherNet/IP (DF1) | B3-1                  | 1 Bit(s)   | Read only  | N/A      |
| 4     | Codesys digital write | 0x-1            | == > | Rockwell EtherNet/IP (DF1) | B3-10                 | 1 Bit(s)   | Write only | N/A      |

| Mapping Table 1 |
|-----------------|
| 4x-1 ← N7:1     |
| 4x-2 ← N7:2     |
| 4x-3 ← N7:3     |

| Mapping Table 2 |
|-----------------|
| 4x-17 → N7:100  |
| 4x-18 → N7:101  |

| Mapping Table 3 |
|-----------------|
| 1x-1 ← B3:1     |

| Mapping Table 4 |
|-----------------|
| 0x-1 → B3:10    |

Note:

Data is stored in four different Modbus maps. Each data point of the Coil and Discrete input objects consists of 1 bit. Each data point of the Input register and Holding register consists of 16 bits (= 1 word). The Modbus TCP server uses the extended referencing as shown below.

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| Object Type                   | Access<br>(Read-write) | Address Range                |
|-------------------------------|------------------------|------------------------------|
| Coil<br>(Bit)                 | R/W                    | <b>000001-065535</b><br>(0x) |
| Discrete input<br>(Bit)       | R                      | <b>100001-165535</b><br>(1x) |
| Input register<br>(16-bits)   | R                      | <b>300001-365535</b><br>(3x) |
| Holding register<br>(16-bits) | R/W                    | <b>400001-465535</b><br>(4x) |

16-bit data occupies 1 register on the Modbus map.

|               |
|---------------|
| 16-bit data   |
| <b>400001</b> |

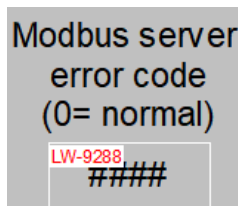
32-bit data occupies 2 register on the Modbus map.

|             |        |
|-------------|--------|
| 32-bit data |        |
| 400001      | 400002 |

64-bit data occupies 4 register on the Modbus map.

|             |        |        |        |
|-------------|--------|--------|--------|
| 64-bit data |        |        |        |
| 400001      | 400002 | 400003 | 400004 |

7. You can create a Numeric object on the HMI screen to show the error code if communication fails. The address is defined as LW-9288, and the data type is 16 bit unsigned.





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System register LW-9288 (16 bit unsigned) is used to indicate if errors exist during Modbus communication.

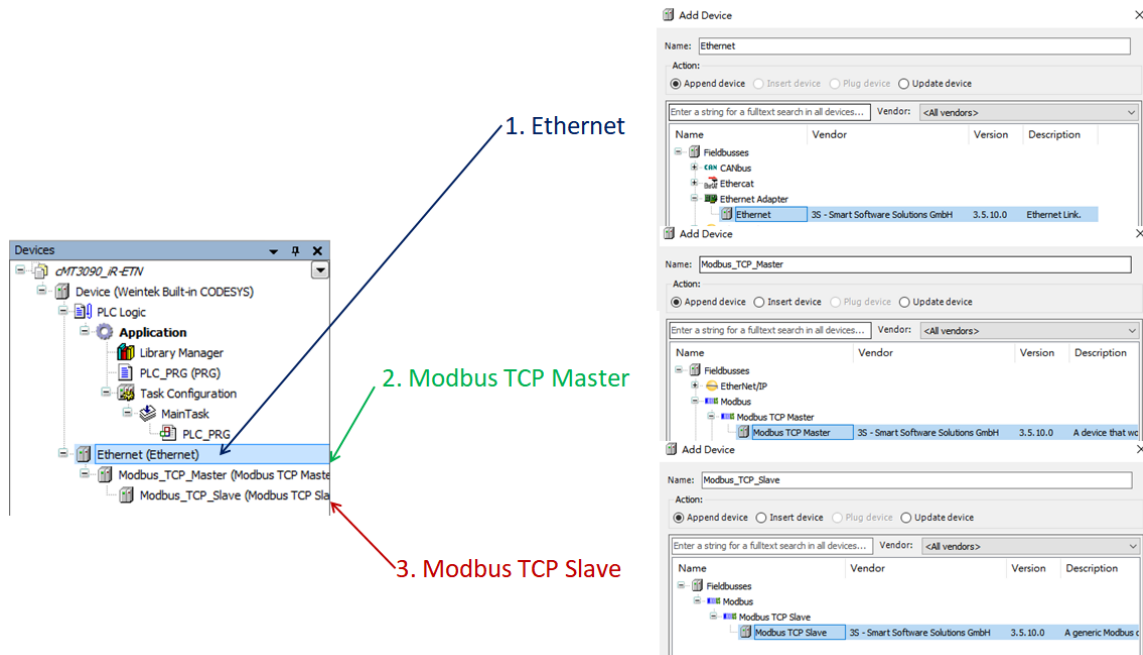
| Error Code (Value) | Error Name                     | Descriptions                                                                                                                                                                                          |
|--------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                  | Normal                         | No error exists                                                                                                                                                                                       |
| 1                  | Read/Write undefined registers | Reading or writing the register that is not defined in the Address Mapping Table.                                                                                                                     |
| 2                  | Out of read/write range        | Reading or writing a range of registers that is not within the range defined in a single Address Mapping Table.<br>(Or, reading / writing a register that is defined in other Address Mapping Table.) |
| 3                  | Bad command format             | The command format does not follow MODBUS TCP/IP protocol.                                                                                                                                            |
| 4                  | Read-only error                | Modifying a read-only register.                                                                                                                                                                       |
| 5                  | Write-only error               | Reading a write-only register.                                                                                                                                                                        |
| 6                  | Timeout                        | HMI cannot get the correct reply from PLC within the specified time range.                                                                                                                            |
| 7                  | Invalid function code          | Using a function code that is not supported by this Modbus Server.                                                                                                                                    |

8. Transfer the HMI project to the cMT-3090 HMI.

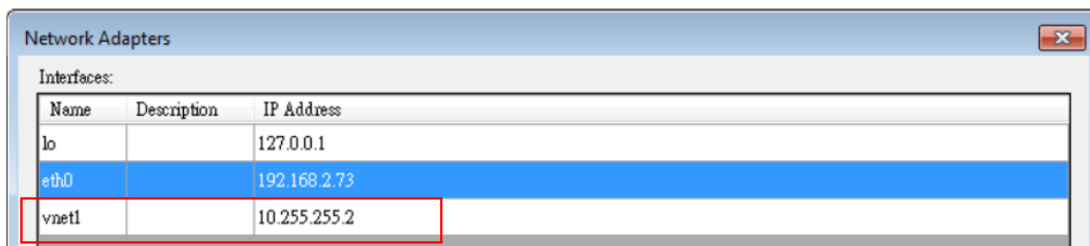
## Weintek Built-In Codesys with Internal Modbus Gateway

### Details of the Communication Settings (Codesys Side):

1. Right-click [Device] on the Device window and select [Add Device]. Then select [Ethernet Adapter] » [Ethernet]. Click [Add Device] button to add an Ethernet adapter.
2. Under the Ethernet adapter, create a Modbus\_TCP\_Master device. ([Fieldbusses] » [Modbus] » [Modbus TCP Master] » [Modbus TCP Master])
3. Under the Modbus\_TCP\_Master, add a Modbus\_TCP\_Slave device. ([Fieldbusses] » [Modbus] » [Modbus TCP Slave] » [Modbus TCP Slave])

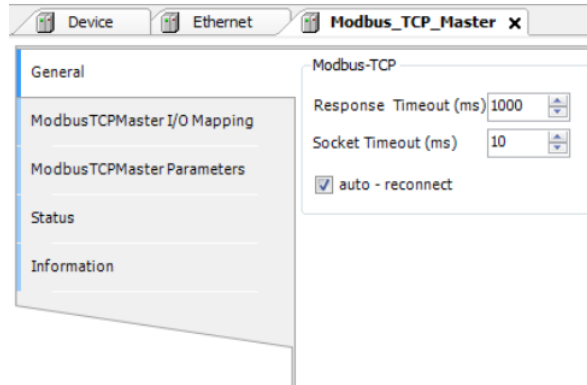


4. Double-click the [Ethernet] adapter. On the [General] tab, click on [...] button near [Interface]. Then select "vnet1."

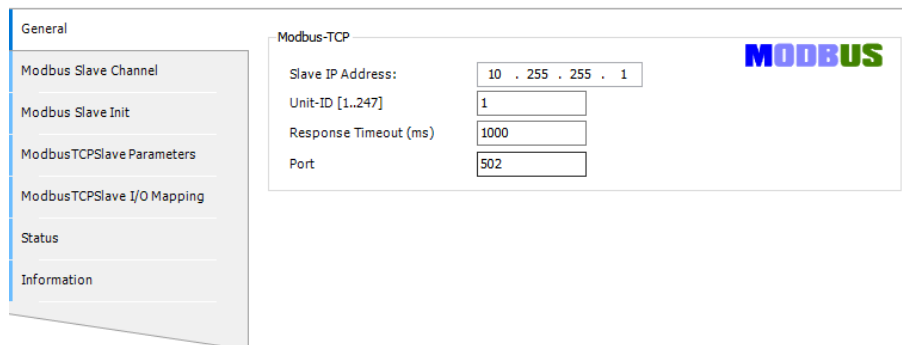


5. Double-click the [Modbus TCP Master]. On the [General] tab, check [auto-reconnect]. The Modbus TCP master will re-establish the connection if a communication error occurs.

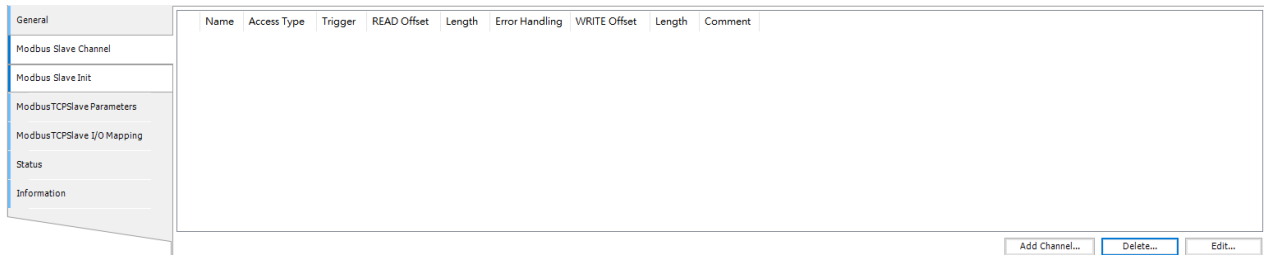
## Weintek Built-In Codesys with Internal Modbus Gateway



6. Double-click the [Modbus TCP Slave]. On the [General] tab,  
[Slave IP Address]-Set to 10.255.255.1.  
[Unit-ID]- Set to 1.  
[Port]- Modbus TCP port is configured to 502 by default.



7. On the [Modbus Slave Channel] tab, click [Add channel] to create Modbus commands.



## Weintek Built-In Codesys with Internal Modbus Gateway

**[Name]**- Channel name.

**[Access type]**- Selection of the Modbus function code.

**[Trigger]**- It determines if the command should be cyclic (time-based) or rising edge. (trigger-based)

**[Comment]**- You can enter a comment if needed.

**[Offset]**- The Modbus starting address. (hexadecimal format)

**[Length]**- The number of the bits or registers.

**Read Register** and **Write Register** are available depending on the function code you choose.

Configure Modbus channels as shown below.

|   | Name      | Access Type                                 | Trigger         | READ Offset | Length | Error Handling  | WRITE Offset | Length | Comment |
|---|-----------|---------------------------------------------|-----------------|-------------|--------|-----------------|--------------|--------|---------|
| 0 | Channel 0 | Read Holding Registers (Function Code 03)   | Cyclic, t#100ms | 16#0000     | 3      | Keep last Value |              |        |         |
| 1 | Channel 1 | Write Multiple Registers (Function Code 16) | Cyclic, t#100ms |             |        |                 | 16#0010      | 2      |         |
| 2 | Channel 2 | Write Single Coil (Function Code 05)        | Cyclic, t#100ms |             |        |                 | 16#0000      | 1      |         |
| 3 | Channel 3 | Read Discrete Inputs (Function Code 02)     | Cyclic, t#100ms | 16#0000     | 1      | Keep last Value |              |        |         |

| Function Code | Starting address (Hex)  | Length  | Corresponding to Modbus Starting Address in the Modbus Server (Dec) |
|---------------|-------------------------|---------|---------------------------------------------------------------------|
| 3             | Read Offset<br>16#0000  | 3 words | 4x-1 (=1+0)                                                         |
| 16            | Write Offset<br>16#0010 | 2 words | 4x-17 (=1+16)                                                       |
| 5             | Write Offset<br>16#0000 | 1 bit   | 0x-1(=1+0)                                                          |
| 2             | Read Offset<br>16#0000  | 1 bit   | 1x-1 (=1+0)                                                         |

Note: The Modbus TCP server uses one-based addressing.

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8. On the [Modbus TCP Slave I/O Mapping] tab, you can know the mapping configuration of the Modbus TCP slave. (In this case, it means the Modbus TCP server) This list is generated automatically according to the Modbus channels configured on the [Modbus Slave Channel] tab.

| General                    | Find                                                                              | Filter  | Show all     |        |                      |      |             |                          |
|----------------------------|-----------------------------------------------------------------------------------|---------|--------------|--------|----------------------|------|-------------|--------------------------|
| Modbus Slave Channel       |  | Mapping | Channel 0    | %IW0   | ARRAY [0..2] OF WORD | Unit | Description | Read Holding Registers   |
| Modbus Slave Init          |  |         | Channel 0[0] | %IW0   | WORD                 |      |             | 0x0000                   |
| ModbusTCPSlave Parameters  |  |         | Channel 0[1] | %IW1   | WORD                 |      |             | 0x0001                   |
|                            |  |         | Channel 0[2] | %IW2   | WORD                 |      |             | 0x0002                   |
| ModbusTCPSlave I/O Mapping |  |         | Channel 1    | %QW0   | ARRAY [0..1] OF WORD |      |             | Write Multiple Registers |
|                            |  |         | Channel 1[0] | %QW0   | WORD                 |      |             | 0x0010                   |
| Status                     |  |         | Channel 1[1] | %QW1   | WORD                 |      |             | 0x0011                   |
| Information                |  |         | Channel 2    | %QB4   | ARRAY [0..0] OF BYTE |      |             | Write Single Coil        |
|                            |  |         | Channel 2[0] | %QB4   | BYTE                 |      |             | Write Single Coil        |
|                            |  |         | Bit0         | %QX4.0 | BOOL                 |      |             | 0x0000                   |
|                            |  |         | Channel 3    | %IB6   | ARRAY [0..0] OF BYTE |      |             | Read Discrete Inputs     |
|                            |  |         | Channel 3[0] | %IB6   | BYTE                 |      |             | Read Discrete Inputs     |
|                            |  |         | Bit0         | %IX6.0 | BOOL                 |      |             | 0x0000                   |

9. Double-click the [PLC\_PRG(PRG)]. Define variables as shown below. The data type of variables depends on the Modbus TCP server. In this case, all registers in the Modbus server are 16-bit data, the data type of variables in Codesys would be **INT**.

Use **AT** syntax to do IO mapping.

Devices

Modbus server for Codesys reading2

Device (Weintek Built-in CODESYS)

Plc Logic

Application

Library Manager

PLC\_PRG (PRG)

Task Configuration

MainTask

PLC\_PRG

Ethernet (Ethernet)

Modbus\_TCP\_Master (Modbus TCP Master)

Modbus\_TCP\_Slave (Modbus TCP Slave)

PLC\_PRG

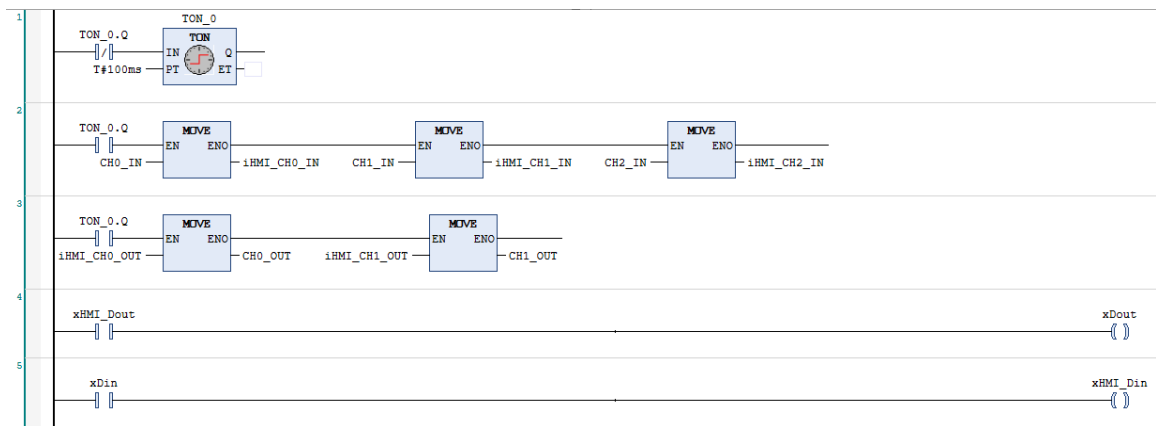
```

1 PROGRAM PLC_PRG
2   VAR
3     CH0_IN AT %IW0:INT;
4     CH1_IN AT %IW1:INT;
5     CH2_IN AT %IW2:INT;
6     CH0_OUT AT %QW0:INT;
7     CH1_OUT AT %QW1:INT;
8     iHMI_CH0_IN:INT;
9     iHMI_CH1_IN:INT;
10    iHMI_CH2_IN:INT;
11    iHMI_CH0_OUT:INT;
12    iHMI_CH1_OUT:INT;
13    TON_0: TON;
14    xHMI_Dout: BOOL;
15    xDout AT %QX4.0: BOOL;
16    xHMI_Din: BOOL;
17    xDin AT %IX6.0: BOOL;
18  END_VAR

```

## Weintek Built-In Codesys with Internal Modbus Gateway

10. Write a ladder diagram to read and write the Modbus addresses.

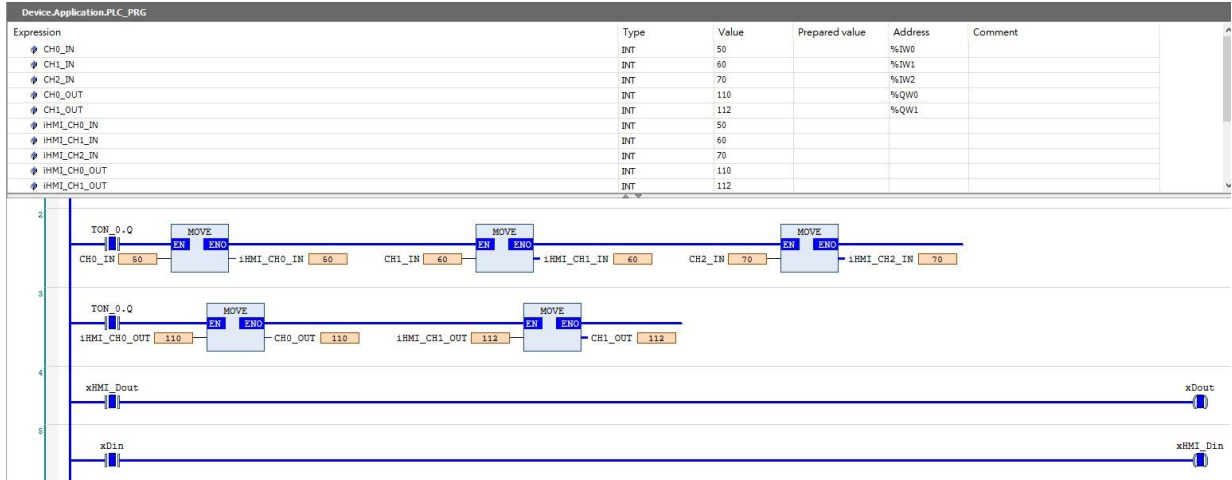


11. Transfer the Codesys PLC project to the cMT-3090 by clicking [Build] and then [Login] on the toolbar. To run the program, click on [Run].

## Weintek Built-In Codesys with Internal Modbus Gateway

### Testing Communication:

Now the Codesys PLC can access data of the Micrologix PLC.



*cMT-3090 HMI with Codesys soft PLC*

The screenshot shows the Data Manager window with two tabs: "Data File B3 (bin) -- BINARY" and "Data File N7 (dec) -- INTEGER".

**Data File B3 (bin) -- BINARY**

| Offset | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| B3:0   | 0  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| B3:1   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:2   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:3   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:4   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:5   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:6   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:7   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:8   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:9   | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B3:10  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Data File N7 (dec) -- INTEGER**

| Offset | 0   | 1   | 2  | 3  | 4 | 5 | 6 | 7 | 8 | 9 |
|--------|-----|-----|----|----|---|---|---|---|---|---|
| N7:0   | 0   | 50  | 60 | 70 | 0 | 5 | 0 | 0 | 0 | 0 |
| N7:10  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:20  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:30  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:40  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:50  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:60  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:70  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:80  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:90  | 0   | 0   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
| N7:100 | 110 | 112 | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |

*Allen Bradley MicroLogix 1100 PLC*

## **Weintek Built-In Codesys with Internal Modbus Gateway**

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6219 NE 181s Street STE 120  
Kenmore, WA 98028  
425-488-1100