

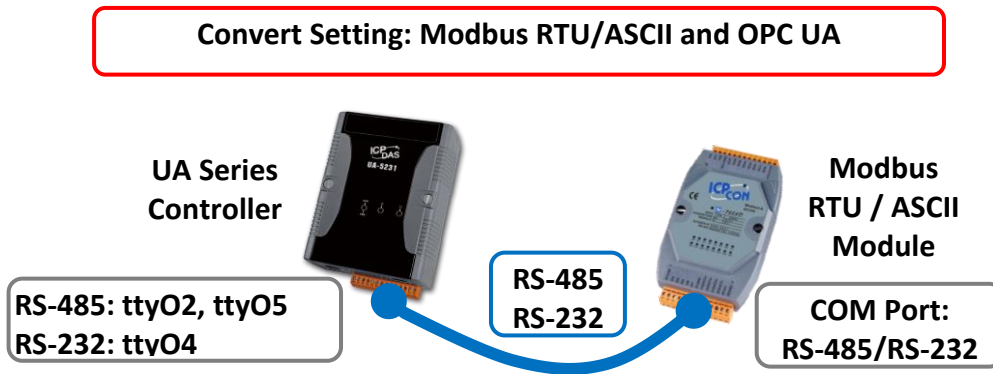
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FAQ-CNV-01: UA Web UI Function Wizard – Module Communication Conversion - How to Convert Modbus RTU / OPC UA or Modbus ASCII / OPC UA ? (Use M-7055D)

Modbus / OPC UA Conversion include the conversion of **OPC UA** and **Modbus RTU / TCP / ASCII** three protocols. With the OPC UA Service function, the OPC UA Server can read and write the Modbus RTU/TCP/ASCII devices that connected to the controller.

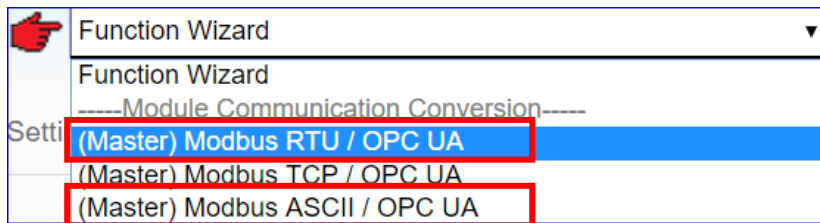
The settings of Modbus RTU/ASCII are the same. Here will introduce them together for a setting sample.

- Convert Setting: Modbus RTU/ASCII and OPC UA**



Note: The hardware/network connection methods please see the UA Manual [Chapter 2](#).

When UA series controller connects the Modbus RTU or ASCII module (via RS-485 / RS-232, as the picture) and read/write the Modbus I/O by OPC UA Server, user can choose the item [**Modbus RTU / OPC UA**] or [**Modbus ASCII / OPC UA**] of the “Module Communication Conversion” in the Function Wizard.



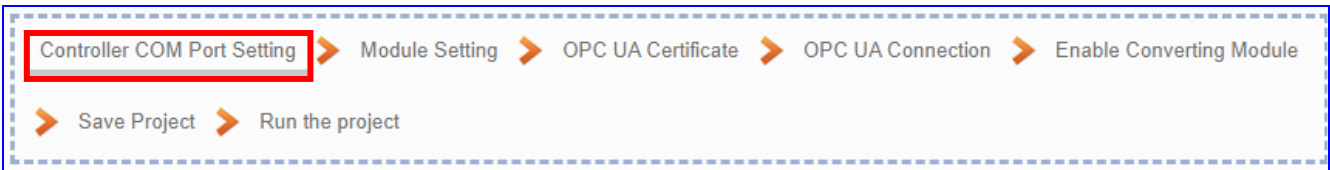
[Step Box]:

The Step Box of the [**Modbus RTU / OPC UA**] and [**Modbus ASCII / OPC UA**] has the same steps, here will introduce them together. When enabling the Step Box, it auto-enters the first step setting page (The step with a bold underline means it is the current step.). The user just needs to follow the “Step Box” step-by-step and then can complete the project quickly and rightly.



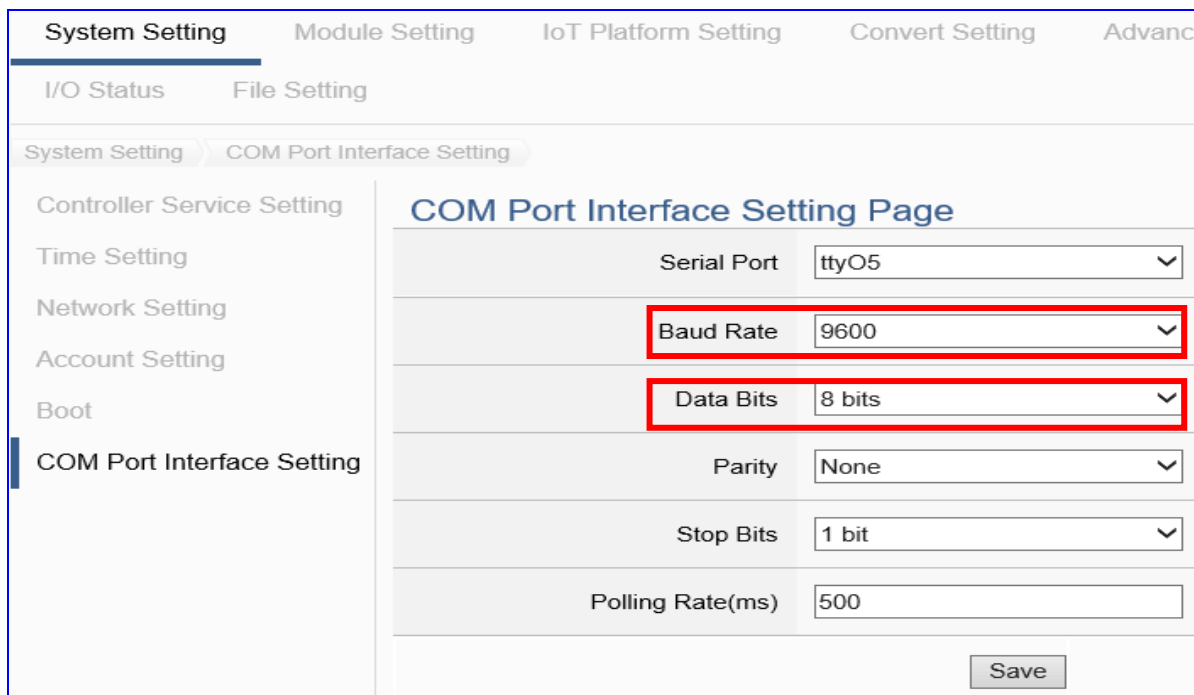
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● **Step 1. Controller COM Port Setting**



This step allows display and set the COM port interface of the controller for the RS-232/RS-485 serial communication.

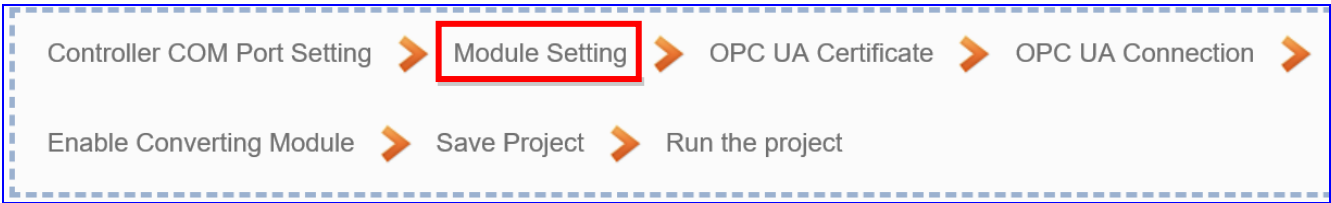
The user can find the default communication values of our I/O modules from the module CD, manual or [I/O Module website](#).



COM Port Interface Setting Page	
Serial Port	Choose the serial port of UA controller that links with the I/O module. ttyO2: RS-485 ; ttyO4: RS-232 ; ttyO5: RS-485
Baud Rate	Choose a baud rate to communicate with the module: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. The UA controller and the I/O module need have the same baud rate.
Data Bits	The number of bits used to represent one byte of data: 7 bits or 8 bits. Default: 8 Bits.
Parity	Choose one way for the parity checking. Options: None, Even, and Odd. Default: None.
Stop Bits	Choose the number of stop bit: 1 bit or 2 bits. Default: 1.
Polling Rate(ms)	Set a time interval for the command. Default: 500 ms
Save	Click [Save] button could save the settings of this page.

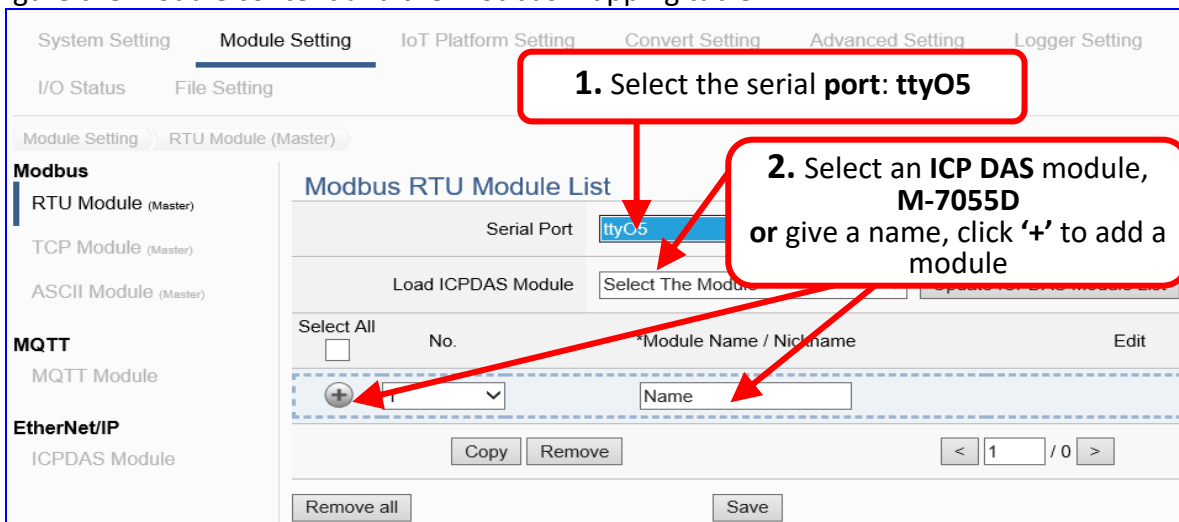
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● **Step 2. Module Setting**

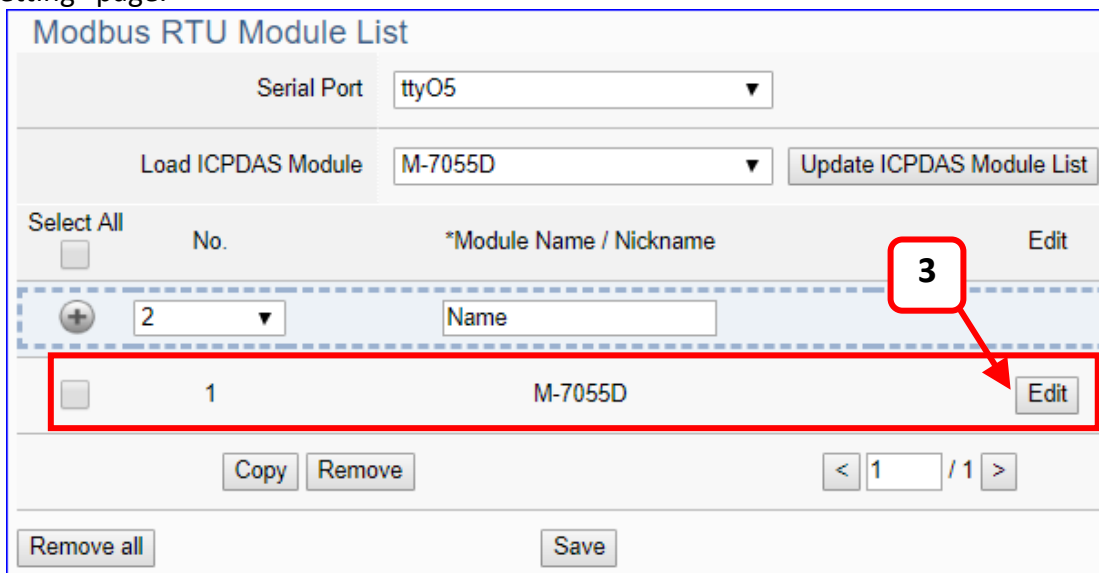


Click the next step, and enter the **Step 2 [Module Setting]** of the UI setting.

This page is for setting the communication values with the connected modules. If using ICP DAS module, user just need to select the model number, system will auto add and setup the module. If not, give a module name (Default: Name), click [+] button to add a new module, and then click [Edit] button to configure the module content and the Modbus mapping table.



Add a module (ex: No.: 1, Name: M-7055D) as below, and then click [Edit] button to enter the “Module Content Setting” page.



If set up a wrong module, user can click the box in the left side of the module number and click the [Remove] button to delete the module.

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[Module Content Setting] page can set up the module and the Modbus address mapping table:

Module Content Setting

No.	3
Module Name	M-7055D
Slave ID	2
Timeout(ms)	500
Write Retry	<input type="checkbox"/> 1

Modbus Mapping Table Setting

DO mapping 01	Data Model	01 Coil Status
UA start address: 0	Start Address	0
If DO x 8, enter 8	Data Number	1
Click [Add]	Create Tables	Add

If use ICP DAS module, system will auto setup the Modbus Mapping Table; if not, user needs to check the Modbus address or I/O number from the module user manual.

> **Modbus Mapping Table Setting:**

Set module in the order of Data Model, Start Address and Data Number, then click "Add".

Ex: M-7055D has 8 Data Models of "01 Coil Status (0x)" (Mapping: DO), so select Model "01", Start Add. "0", Number "8", and click "Add".

Coil Status(0x)

Address	0
Number	8
Type	Bool
Edit	

Module Content Setting	
No.	The module number in the module list (Not editable here)
Module Name	Give a name, e.g. model number or name. Default: Name.
Slave ID	Set the module Slave ID of the UA. (Range: 1 ~ 247)
Timeout	Set the timeout value for the module. Default: 500 ms
Write Retry	Check to retry writing again when there is no response after the set time is up, and it can be set up to retry 3 times
Modbus Mapping Table Setting	
Data Model	System provides 4 Modbus data models "01" ~ "04" for mapping to address of DO, DI, AO and AI. (ex. 01: DO channels, 02: DI, 03: AO, 04: AI)
Start Address	The start address of the Modbus command. Note: Start Address of UA is bass on 0, even if some modules are bass on 1, here it needs to follow UA to set bass on 0.
Data Number	The number of the Modbus address. Need to give enough number for the DO, DI, AO, AI channels of the module. Default: 1.
Type	This item only when the data model is 03 or 04. Choose the suitable data type: 16-bit Short, 16-bit Unsigned Short, 32-bit Long, 32-bit Unsigned Long, 32-bit Float, 64-bit Double.
Create Tables	Click [Add] button, it will add a table in the Modbus mapping table.

- 01 Coil Status(0x)
- 02 Input Status(1x)
- 03 Holding Registers(4x)
- 04 Input Registers(3x)

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If use ICP DAS module, system will auto-setup the module and its Modbus Mapping Table. Such as this example, we select the module from “Load ICP DAS Module”, it auto-shows the M-7055D (DO x 8, DI x 8) module content and Modbus Mapping Table as below.

Module Content Setting

No.	3
Module Name	M-7055D
Slave ID	2
Timeout(ms)	500
Write Retry	<input type="checkbox"/> 1

Modbus Mapping Table Setting

Data Model	01 Coil Status(0x) ▼
Start Address	0
Data Number	1
Create Tables	<input type="button" value="Add"/>

Modbus Mapping Table

		Address	Nickname	Scaling	Bitwise
Coil Status(0x)		Input Status(1x)		Holding Registers(4x)	
Input Registers(3x)					
Address	0	Address	0		
Number	8	Number	8		
Type	Bool	Type	Bool		
<input type="button" value="Edit"/>		<input type="button" value="Edit"/>			

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If not use ICP DAS Module, please check the module’s user manual to find out the module Modbus Address, and refer to the chapter “Module Setting” of the UA manual as below.

Please set up the addresses mapping with the module I/O channels in the [Modbus Mapping Table Setting]. The system provides 4 Modbus data models (as below) “01” to “04” for mapping to the DO, DI, AO and AI channels.

01 Coil Status(0x)
02 Input Status(1x)
03 Holding Registers(4x)
04 Input Registers(3x)

Note: the start address of UA series is bass on “0”. Some modules start address are bass on “1”, but please note UA is follow the rule of start address “0”, and set enough Data Number for mapping to the I/O channels of the linking module.

In this example, M-7055D has 8 DO and 8 DI channels, please create the table as following pictures of the [Modbus Mapping Table Setting]. After complete the setting, the DO and DI Modbus address settings will show in the [Modbus Mapping Table].

M-7055D 8 DO setting (left) and the [Coil Status(0x)] table after setting (right):

Modbus Mapping Table Setting

DO mapping 01 → Data Model: 01 Coil Status(0x)

UA start address: 0 → Start Address: 0

DO x 8 → Data Number: 8

Click [Add] → Create Tables: Add

Coil Status(0x)

Address	0
Number	8
Type	Bool
Edit	

M-7055D 8 DI setting (left) and the [Input Status(1x)] table after setting (right):

Modbus Mapping Table Setting

DI mapping 02 → Data Model: 02 Input Status(1x)

UA start address: 0 → Start Address: 0

DI x 8 → Data Number: 8

Click [Add] → Create Tables: Add Success.

Input Status(1x)

Address	0
Number	8
Type	Bool
Edit	

The Modbus Mapping table is showing as below. Click [OK] to save and exit.

Modbus Mapping Table		Address	Nickna
Coil Status(0x)		Input Status(1x)	
Address	0	Address	0
Number	8	Number	8
Type	Bool	Type	Bool
Edit		Edit	

For more setting item descriptions, please refer to UA User Manual Chapter 5.2. Module Setting.

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The finished Modbus Mapping Table as below is in order of DO, DI, AO and AI.

Address:

Display and edit the Modbus Mapping Table.

Modbus Mapping Table		Address	Nickname	Scaling	Bitwise		
Coil Status(0x)		Input Status(1x)		Holding Registers(4x)		Input Registers(3x)	
Address	0	Address	0				
Number	8	Number	8				
Type	Bool	Type	Bool				
<input type="button" value="Edit"/>		<input type="button" value="Edit"/>					

If user selects ICP DAS module, the system will auto set up the Modbus Mapping Table. If not, user needs to check the module Modbus address or I/O number from the module user manual.

Modbus Mapping Table – Address	
Address Setting	The “Address Setting” page of the Modbus Mapping Table
Nickname Setting	Click can switch to the The “Nickname Setting” page of the Modbus Mapping Table. (Next page)
Modbus Mapping Table	Coil Status(0x): Mapping to DO Modbus address Input Status(1x): Mapping to DI Modbus address Holding Registers(4x): Mapping to AO Modbus address Input Registers(3x): Mapping to AI Modbus address
Address	The start address of the Modbus command. Default: 0. Note: the Start Address of UA is bass on 0, even if some modules are bass on 1, here it needs to follow UA to set bass on 0.
Number	The number of the Modbus address. Need to give enough number for the DO, DI, AO, AI channels of the module. At least 1.
Type	DO/DI type: Bool (Boolean) AO/AI type: depend on setting of [Modbus Mapping Table Setting]
Edit	Click to change the address and Number.
Delete	Click to delete this address table.
Save	Click to save and exit this table editing.
Cancel	Click to exit without saving and back to the module list page.
OK	Click to save this page settings and back to the module list page.

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Nickname:

Setting the variable nickname and description.

Modbus Mapping Table		Address	Nickname	Scaling	Bitwise
01 Coil Status(0x)					
Table Display		<input type="button" value="Show"/> <input type="button" value="Hide"/>			
Address	Variable name	Data Type	Description		
0	<input type="text" value="DO0"/>	Bool	<input type="text" value="Light 01"/>		
1	<input type="text" value="DO1"/>	Bool	<input type="text"/>		
2	<input type="text" value="DO2"/>	Bool	<input type="text"/>		
3	<input type="text" value="DO3"/>	Bool	<input type="text"/>		
4	<input type="text" value="DO4"/>	Bool	<input type="text"/>		
5	<input type="text" value="DO5"/>	Bool	<input type="text"/>		
6	<input type="text" value="DO6"/>	Bool	<input type="text"/>		
7	<input type="text" value="DO7"/>	Bool	<input type="text"/>		
02 Input Status(1x)					
Table Display		<input type="button" value="Show"/> <input type="button" value="Hide"/>			
Address	Variable name	Data Type	Description		
0	<input type="text" value="DI0"/>	Bool	<input type="text"/>		

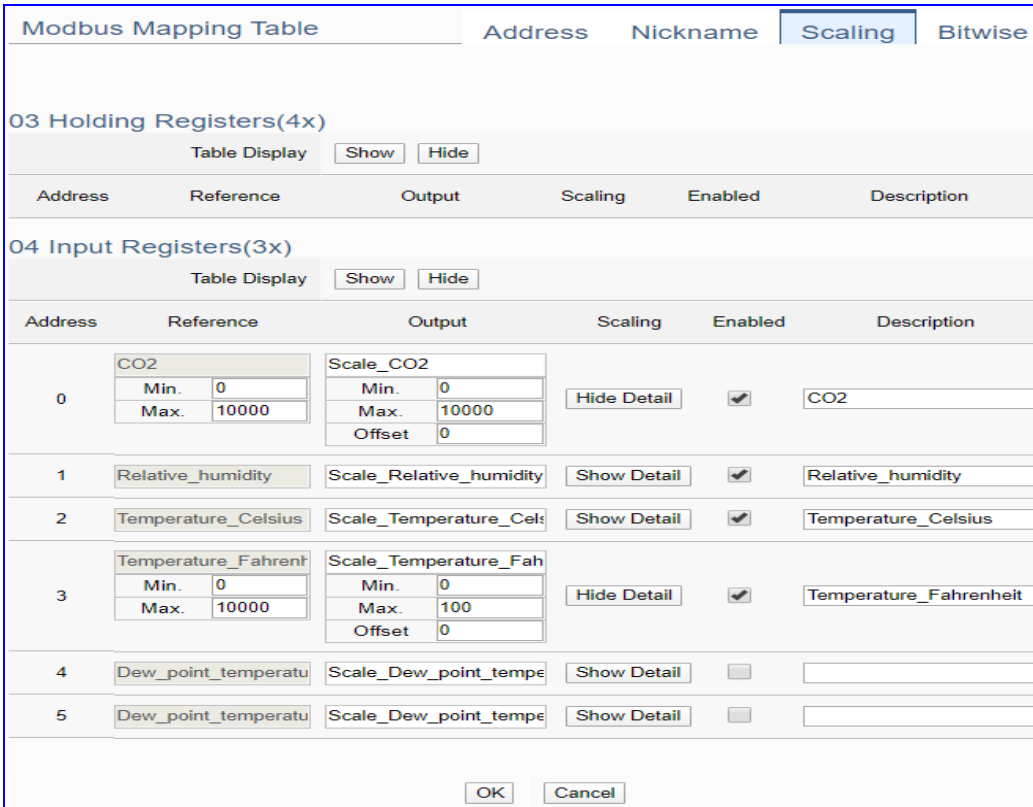
Modbus Mapping Table – Nickname	
Modbus Mapping Table	Coil Status(0x): Mapping to DO Modbus address Input Status(1x): Mapping to DI Modbus address Holding Registers(4x): Mapping to AO Modbus address Input Registers(3x): Mapping to AI Modbus address
Table Display	Click [Show] to display all fields, click [Hide] to hide some fields.
Address	Modbus address. System auto arrange.
Variable name	The variable name of the mapping address. Default: Tag0 and auto arrange the number. User can define the name.
Data Type	Display data type of the variable. (Not editable)
Swap	Check to swap the byte order (Lo-Hi/Hi-Lo) for 4-byte or 8-byte.
Description	Write a note for this variable.
OK	Click to save this page settings and back to the module list page.

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Scaling:

Scaling is only available in the AI/AO settings of Modbus RTU/TCP. When the variable value needs to be scaled or converted before output, click the "Advanced Setting" button of the variable on the **Scaling** page, input the **Min./Max./Offset** of the Reference/Output items, add a description, and check "Enable" box, The Scaling conversion function will be activated.

The M-7055D has no AI/AO, so here uses the screen of DL-302 for an example.



Modbus Mapping Table – Scaling	
Modbus Mapping Table	Holding Registers(4x): Mapping to AO Modbus address Input Registers(3x): Mapping to AI Modbus address Scaling do not support 01 Coil Status(0x):DO & 02 Input Status(1x):DI
Table Display	Click [Show] to display all fields, click [Hide] to hide some fields.
Address	Modbus address. System auto arrange.
Reference	The I/O variable of the Modbus address.
Output	The scaling variable for scaling output. User can define the variable name.
Scaling	Click [Show Detail] to set up the Scaling parameters, and click [Hide Detail] to hide the parameters. Fill in the Min/Max range values of the source in the Reference column. Fill in the Min/Max range values after scaling in the Output column. If needs offset, fill the offset value in the Offset item. Remember check "Enable" box.
Enable	Check the box of the variable can enable just that variable for scaling.
Description	Write a note for this variable.
OK	Click to save this page settings and back to the module list page.

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Bitwise:

Bitwise is only available in the AI/AO settings of Modbus RTU/TCP. When the data needed to take out the value of the specified bit, fill in the variable name in the specified Bit# of the required address, and the value of the bit can be output to the filled variable.

The M-7055D has no AI/AO, so here uses other module’s setting screen as an example.

Modbus Mapping Table – Bitwise	
Modbus Mapping Table	Holding Registers(4x): Mapping to AO Modbus address Input Registers(3x): Mapping to AI Modbus address Bitwise do not support 01 Coil Status(0x):DO & 02 Input Status(1x):DI Bitwise do not supports 32-bit Float & 64-bit Double data types.
Table Display	Click [Show] to display all fields, click [Hide] to hide some fields.
Address	Modbus address. System auto arrange.
Reference	The Bit# variables of the Modbus address.
Bitwise	Set up the variables for Bitwise. Click [Advanced Settings] to set up the Bitwise parameters, and click [Hide] to hide the parameters. Fill in the variable names to the Bit# that wanted to do the Bitwise. The value in the fixed bit number will be assigned into the variable.
OK	Click to save this page settings and back to the module list page.

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● **Step 3. OPC UA Certificate**



Click the next step, and enter the **Step 3 [OPC UA Certificate]** of the UI setting.

This step is about setting the OPC UA Certificate for the security and encryption, e.g. upload, download, delete certificate. **If the user's project does not need to use the secure encryption connection, please skip this step and click the next step directly.**

In the **[OPC UA Certificate]** step, users can add mutual credentials on both side's devices to strengthen security encryption.

- ① First, obtain the **OPC UA Client** trust certificate file of the device from the connected party, save it to the PC. In this step, select this file and upload it to the UA controller. (If there was an old certificate file in UA, remove it first.)
- ② The device of the other side needs the UA certificate also. In this step, download the **OPC UA Server** certificate file (**Certicate_IPAddress_.tar**) to the other party, so that they can decompress the file (**icpdasuaserver.der**) and upload to their device.



File Setting > OPC UA Certificate > Upload the file to the controller

Trusted Certificate	<p>Select File: select the OPC UA Trusted Certificate file in PC.</p> <p>Upload: upload the Trusted Certificate file to the UA controller.</p> <ul style="list-style-type: none"> File format must be DER. Extension name must be “der / cer / crt”. <div style="border: 1px solid #ccc; padding: 5px; width: fit-content; margin: 5px 0;"> Trusted Certificate <input type="text" value="Select File icpdasuaserver.der"/> <input type="button" value="Upload"/> </div> <ul style="list-style-type: none"> If select a wrong file, the system will show an error message.
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File Setting > OPC UA Certificate > Download the file from controller

OPC UA Server Certificate	<p>Download: Download the OPC UA Server Certificate file to the PC.</p> <ul style="list-style-type: none"> File format: DER. File name: Certicate_IP-address_.tar <p>e.g. Certicate_192.168.255.102.tar. Before using, decompress to icpdasuaserver.der, as below. icpdasuaserver.der</p>
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● **Step 4. OPC UA Connection**

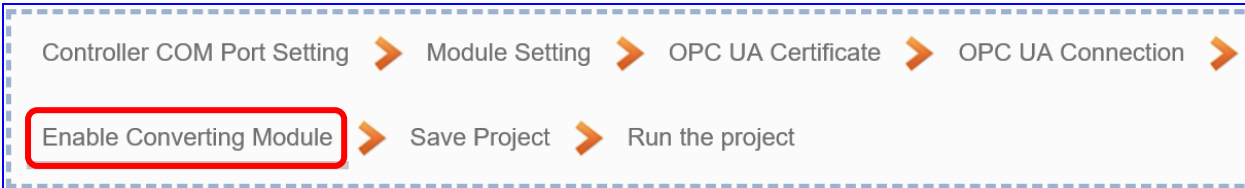


Click the next step, and enter the **Step 4 [OPC UA Connection]** of the UI setting. This page is for setting the IoT platform and the OPC UA connection, e.g. the server name, port, login identity information, etc.

OPC UA Connection > Local Server Setting –Server	
Server Name	Display the active OPC UA Server name. Not editable. System values: ICPDAS OPC UA Server
Port	The communication port number of the OPC UA Server. System Default: 48010.
Save	Click to save the settings of this item.
OPC UA Connection > Local Server Setting –User Identity Tokens	
Anonymous Login	Check to enable the anonymous login of clients. Default: check.
User Password Login	Check to enable the user password login of clients. Default: uncheck.
Certificate Login	Check to enable the certificate login of clients. Default: uncheck.
Save	Click to save the settings of this item.

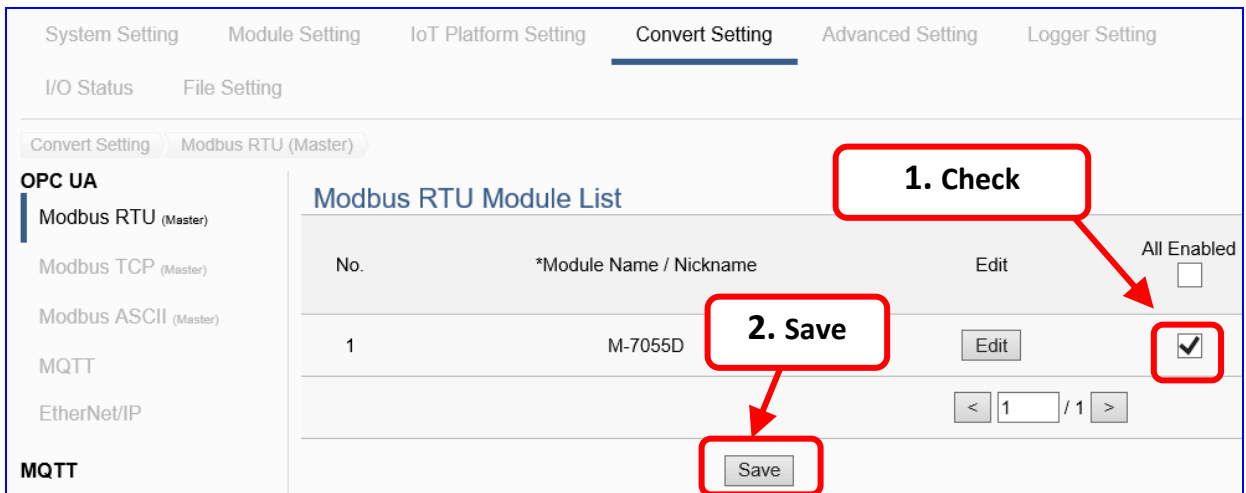
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● **Step 5. Enable Converting Module**



Click the next step, and enter the **Step 5 [Enable Converting Module]** UI setting
 This step is for enabling the Modbus RTU (or ASCII) / OPC UA conversion.

In this step, user just need check the enabled box of the module. If user want to enable some I/O only, please click “Edit” to check the I/O one by one.



Convert Setting > OPC UA > Modbus RTU (Master) Module List	
No.	The module number in the module list (Not editable here)
*Module Name / Nickname	The module name set in the module list (Not editable here)
All Enabled	Check [All Enabled] box to enable all modules in list for conversion. Default: Uncheck. Check the box of each module can enable just that module for conversion.
Edit	If user wants to enable some I/O channels for conversion, click [Edit] of that module to enter the “Variable Tale” setting. It is normal to set all channels as enabled, and the conversion will not affect the unconnected channels.
< 1 / 1 >	The page number of the module list: Current page / Total pages. Click < or > to go to the previous or next page.
Save	Click to save the settings of this page.

If users need to enable some channels only, please click [Edit] to enable individual channels.

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If there had set up the Scaling or Bitwise in the step 2, the Scaling or Bitwise function will available only when the Enabled box is checked. So, in this step, be sure to check the Enabled box (as picture). For the setting method, please refer the Step 2.

Module Content Setting

No.

Module Name

Variable Table
I/O
Scaling
Bitwise

Name	Attribute	Data Type	Enabled
Scale_AI0	<input type="text" value="Read"/>	Float	<input checked="" type="checkbox"/>
Scale_AI1	<input type="text" value="Read"/>	Float	<input checked="" type="checkbox"/>

More Descriptions:

1. Scaling:

Scaling is only available in the AI/AO settings of Modbus RTU/TCP. When the variable value needs to be scaled or converted before output, click the "**Advanced Setting**" button of the variable on the **Scaling** page, input the **Min./Max./Offset** of the Reference/Output items, add a description, and check "**Enable**" box, The Scaling conversion function will be activated.

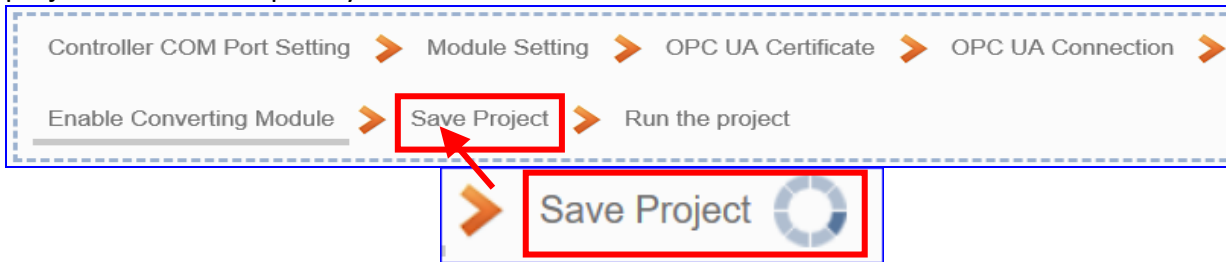
2. Bitwise:

Bitwise is only available in the AI/AO settings of Modbus RTU/TCP. When the data needed to take out the value of the specified bit, fill in the variable name in the specified Bit# of the required address, and the value of the bit can be output to the filled variable.

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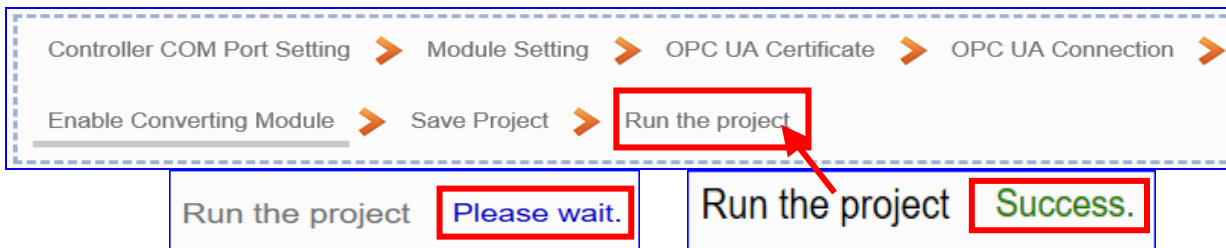
● **Step 6. Save Project**

The setting of this example is finished now. Click the next step [**Save Project**], the Step Box will show an animation as below picture, that means the project is saving. When the animation vanished, the project is saved completely.



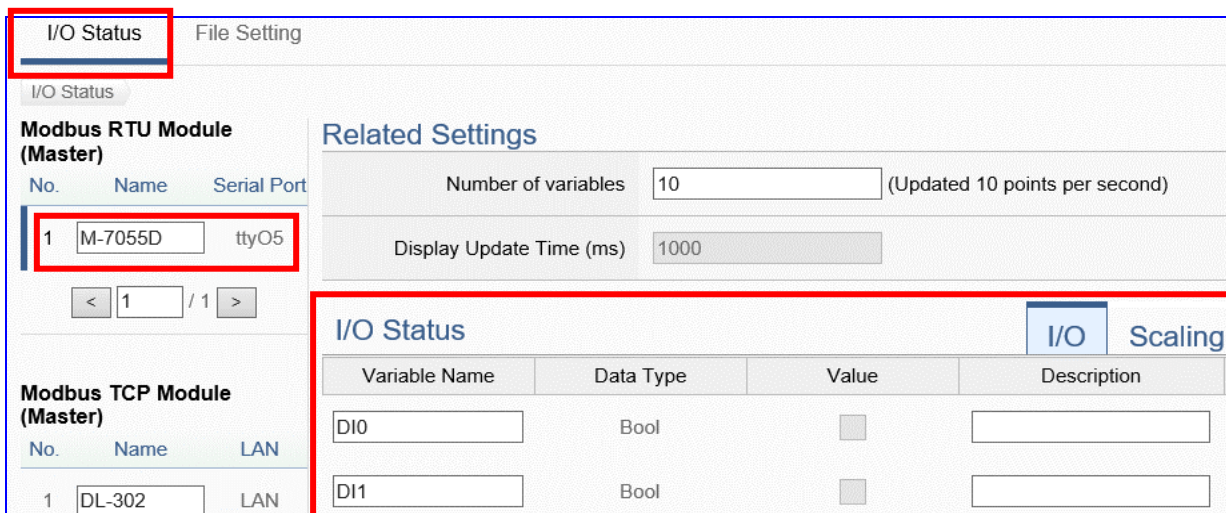
● **Step 7. Run the Project**

The project, after saving, needs to be executed. Click the next step [**Run the Project**]. This step can also via the [**System Setting > Controller Service Setting > Run Project**] to Stop and Run the project.



When the words “**Please wait**” disappears, the new words “**Success**” appears, that means the UA controller is running new project successfully. Then the Step Box will disappear automatically now, and back to the first screen view of the Web UI.

The new project now completes the setting, uploading and running in the UA controller and can process the conversion communication. Users can see the I/O status from the menu [**I/O Status**]. For more about the Web UI settings, please refer to UA Manual CH4 and CH5.



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- **Verify if the OPC UA Conversion is Correct**

The UA series has finished setting the OPC UA function and viewing the I/O data in the "I/O Status" menu.

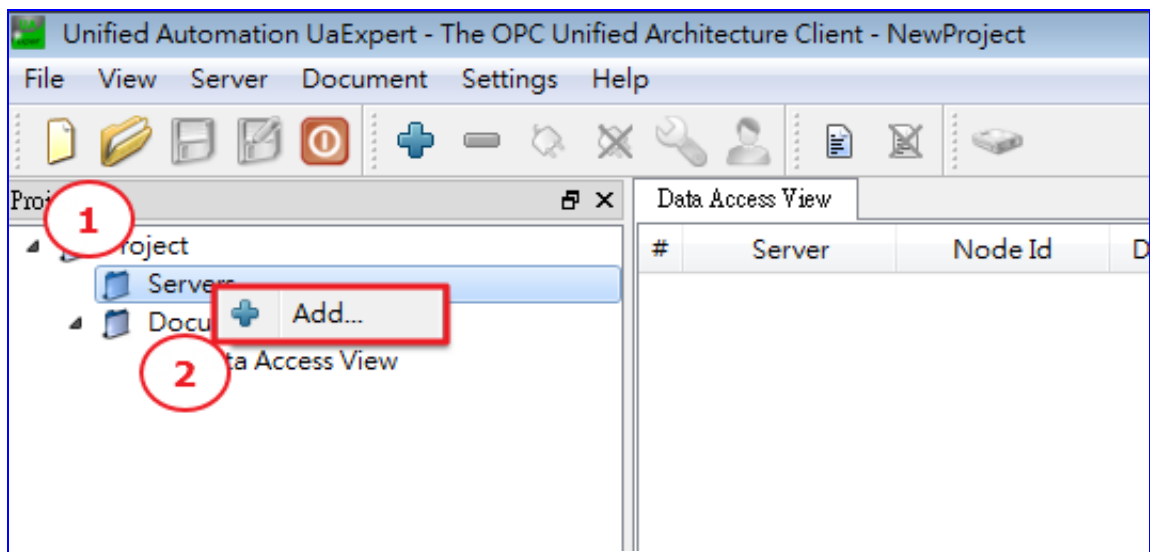
If the user wants to verify whether the OPC UA conversion is correct, he can use the OPC UA client software "**UaExpert**". Please download the "UaExpert" software from the official website:

<https://www.unified-automation.com/products/development-tools/uaexpert.html>

Operation instructions of the UaExpert software:

1. After setting UA-5231, run the **UaExpert**

Mouse right-click on **Server** at the top left of the screen, then click **Add**.



2. When the following window appears, click **Advanced**



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3. In the field **Endpoint Url**, specify the OPC UA Server to be connected

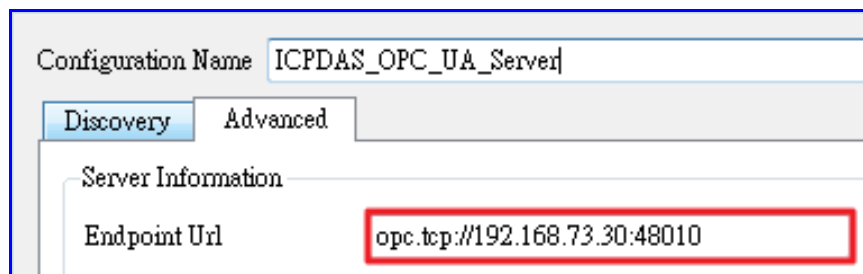
The **format is `opc.tcp://192.168.73.30:48010`**

opc.tcp:// is the fixed beginning format of OPC UA connection;

Next is the **IP** of OPC UA Server, which is the IP of UA-5231;

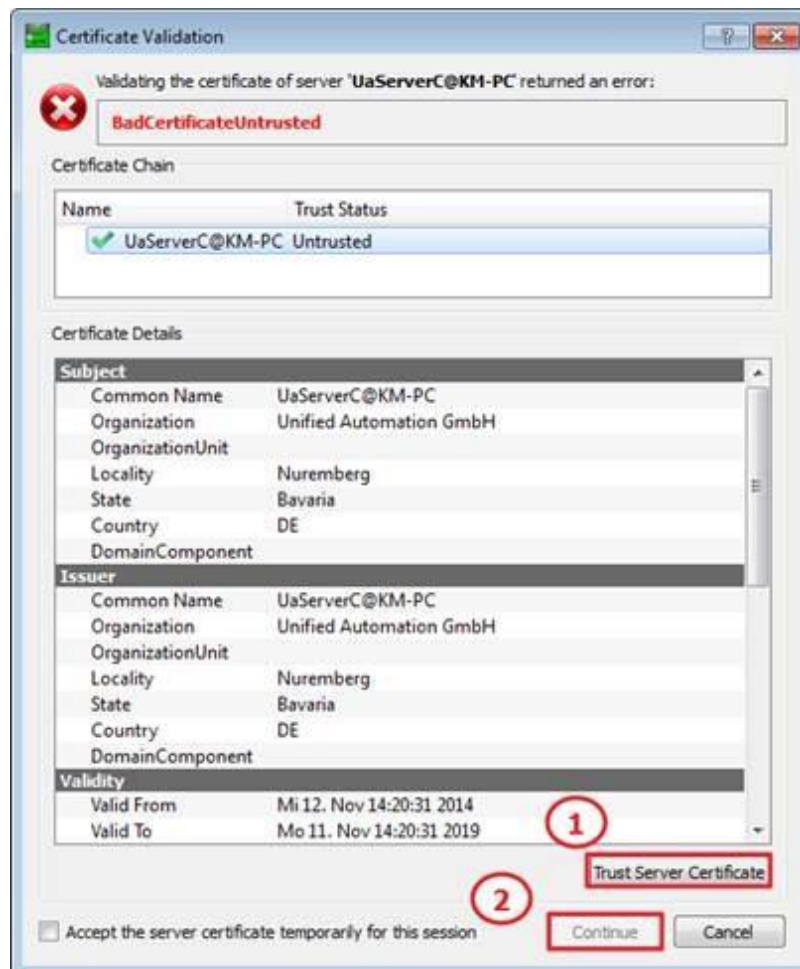
The last is the **port**, UA-5231 is **48010** by default.

Click OK after setting.



Note:

After clicking OK, if the **"BadCertificateUntrusted"** message is displayed, click **"Trust Server Certificate"** at the bottom right, and then click the **"Continue"** button.



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4. Specify the module connected with UA Server in the lower-left corner of the screen to view its status

First click the arrow on the left of the module name, as shown as **Circle 1** in the figure below. All the tags of the module will be displayed. Select all tags and mouse drag them to the right window **Data Access View** to see all the tag status. **Note that whether the column of "Statuscode" shows Good.** If not, please check whether the UA-5231 setting is wrong.

• Modbus RTU Example

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	ICPDAS_OPC...	NS2 String MRTU_No.1...	Holding_Registers.Tag486	8	UInt16	PM 12:34:59.799	PM 12:34:59.799	Good
2	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag0	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
3	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag1	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
4	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag2	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
5	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag3	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
6	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag4	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
7	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag5	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
8	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag6	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good
9	ICPDAS_OPC...	NS2 String MRTU_No.1...	Input_Registers.Tag7	0	Int16	PM 12:34:59.799	PM 12:34:59.799	Good

• Modbus TCP Example

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	ICPDAS_OPC...	NS2 String MTCP_No.1_DL-30...	Input_Register...	691	Int16	AM 10:51:09.772	AM 10:51:09.7...	Good
2	ICPDAS_OPC...	NS2 String MTCP_No.1_DL-30...	Input_Register...	763	Int16	AM 11:08:35.792	AM 11:08:35.7...	Good
3	ICPDAS_OPC...	NS2 String MTCP_No.1_DL-30...	Input_Register...	6332	Int16	AM 10:58:37.787	AM 10:58:37.7...	Good
4	ICPDAS_OPC...	NS2 String MTCP_No.1_DL-30...	Input_Register...	5631	Int16	AM 11:08:21.990	AM 11:08:21.9...	Good
5	ICPDAS_OPC...	NS2 String MTCP_No.1_DL-30...	Input_Register...	264	Int16	AM 11:08:30.273	AM 11:08:30.2...	Good