cMT-G01 with OPC UA Server and Modbus Gateway

Introduction:

Industrial IT Technology has quickly advanced with the integration of plant-floor data, supervisory control demand, ERP, and even new cloud-based applications. Integrating legacy and different brands of factory machines has never been an easy task since the controllers in a factory use different communication protocols. To facilitate integration of numerous proprietary protocols, Weintek has developed the first Gateway protocol converter: cMT-G01. The cMT-G01 gateway provides the necessary IIoT connectivity to retrofit existing machines into a single protocol.

This document discusses how to utilize the cMT-G01 to build an OPC UA server, which is a standard protocol for IIoT systems, and allows OPC UA client to access data.

Benefits of cMT-G01

- Supports OPC UA for Integration of SCADA or ERP systems
- Supports MQTT and has built-in broker for publish-subscribe messaging protocol
- Connectivity to AWS, Azure, and IBM IoT platforms via MQTT
- Supports MQTT Sparkplug B specification
- Supports Modbus gateway
- Supports Protocol conversion
- Additional Data logger and event detector
- SQL synchronization capability to MySQL and MS SQL database server for data log and event log
- EasyAccess2.0(Optional)– Remote access factory equipment
**cMT-G01 with OPC UA Server and Modbus Gateway**

**Equipment & software:**

1. HMI
2. Arduino board
3. iR-ETN remote IO
4. cMT-G01

Note: In this demonstration, Easybuilder pro version 6.01.02 is used.

**Wiring diagram:**

Before configuration-

The HMI communicates with the Arduino board via Modbus RTU protocol.
The HMI communicates with the iR-ETN remote IO via Modbus TCP protocol.

After configuration-

In this way, the HMI program is changed because the HMI uses Modbus TCP Master protocol to query the cMT-G01. The cMT-G01 acts as a ModbusTCP-to-ModbusRTU bridge, which is a Modbus gateway. It saves the cost of purchasing an extra communication module of the PLC.
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Hardware configuration:

I/O ports of cMT-G01 -

<table>
<thead>
<tr>
<th>Port Name</th>
<th>Connecting to</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN2</td>
<td>Machine network</td>
</tr>
<tr>
<td>LAN1</td>
<td>Company or factory network</td>
</tr>
<tr>
<td>COM</td>
<td>Serial-based controller</td>
</tr>
</tbody>
</table>

Software configuration:

Launch Easybuilder Pro and select cMT-G01 Gateway.
The popup window will be displayed as shown. Click [New Device] to select drivers of the controllers.

Add this driver “Modbus TCP/IP” into [Device list]. Enter the IP address of the iR-ETN.
Add this driver “Modbus RTU, RTU over TCP” into [Device list]. Enter the communication parameters of COM port.

[Device List] includes two drivers to communicate with the iR-ETN and the Arduino board. Double [Local HMI] to change the name of the cMT-G01.
Click [OK] to close [System Parameter Settings].

You can see the three main steps on the main screen to complete this project.

**Step 1.** Add a driver into Device List in the project. *(This step is completed)*

**Step 2.** Enable OPC UA Server and designate PLC addresses.

**Step 3.** Download this project to cMT-G01.

**Step2.** -

Click [OPC UA] button on the main screen or go to [IIoT/Energy] » [OPC UA Server] on the toolbar, and check [Enable] checkbox to enable OPC UA server.
Click [Tags] within [IR-ETN remoteIO](Controller name) and then click [New Tag] to add OPC UA tags.

For example, add a tag for the output of the iR-ETN.

[Name]: Enter a tag name.
[Type]: Data type is **Bit**.
[Address]: Enter **Modbus function code + register number (Decimal)**.
[Type]: data is readable and writable.

Click [OK] to exit.
Click [Tags] within [Arduino board](Controller name) and then click [New Tag] to add OPC UA tags.

For example, add a tag for the analog input of the Arduino board.

[Name]: Enter a tag name.
[Type]: Data type is Word.
[Address]: Enter Modbus function code + register number (Decimal).
[Type]: data is readable.

Click [OK] to exit.

The window as shown includes all tags created in the OPC UA server.
Modbus gateway configuration -

Click [Settings] button on the main screen or go to [Home] » [System Parameters] on the toolbar, add this driver “Modbus Server” into [Device list]. Check the checkbox within [Modbus TCP/IP Gateway] and go to [Address Mapping Tables].

The window “Address Mapping table” will be displayed as shown below. Click [Add] to open table settings for register mapping.
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[Address mode]: Data type is **Word**.

[Type]: Select **Read/Write**.

[Modbus address]: Enter **Modbus TCP function code + register number** (Decimal).

[Mapped device address]: Enter **Modbus RTU function code + register number** (Decimal).

[Table size]: Total memory size. (Unit: words)

The Modbus gateway is added to [Device list] as shown.
Change the HMI program to read and write Modbus TCP registers. The following Modbus function codes are supported.

<table>
<thead>
<tr>
<th>Modbus Function Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Read Coil Status</td>
</tr>
<tr>
<td>2</td>
<td>Read Input Status</td>
</tr>
<tr>
<td>3</td>
<td>Read Holding Registers</td>
</tr>
<tr>
<td>4</td>
<td>Read Input Registers</td>
</tr>
<tr>
<td>5</td>
<td>Force Single Coil</td>
</tr>
<tr>
<td>6</td>
<td>Preset Single Register</td>
</tr>
<tr>
<td>16</td>
<td>Preset Multiple Registers</td>
</tr>
</tbody>
</table>

**Step3.**

Connect the **LAN1** port of the cMT-G01 and the PC to a router with an Ethernet cable. Click [Download] button on the main screen or go to [Project] » [Download] on the toolbar.

Find the cMT-G01 and click [Download].
You can change the **LAN1** IP address of the cMT-G01 by going to [Search and Change IP]. Disable DHCP and then enter IP address as well as subnet mask according to the company/factory network. Click on [Apply] to finish. The popup window will show “Successfully updated Ethernet settings.”

**Change the IP address of the LAN2**

Connect the **LAN1** port of the cMT-G01 and the PC to a router with an Ethernet cable. Open a web browser (IE, Chrome, or Firefox) on a PC, and make sure the IP address of the PC has a same subnet IP. Enter the IP address of cMT-G01. For example, 192.168.0.133.

Select an identity and enter its password. The default password is 111111.

Go to [Network] tab. The IP address of the Ethernet1 is the IP address of **LAN1** port, and it is changed by the earlier step.
Click [Ethernet2] and then enter the IP address as well as mask for the communication of the machine network.
Testing:

Launch the OPC UA client software UAExpert on a PC to monitor OPC UA tags data.

You can drag and drop tags configured in the OPC UA server to [Data Access View].
The data will be displayed as shown.

<table>
<thead>
<tr>
<th>#</th>
<th>Server</th>
<th>Node Id</th>
<th>Display Name</th>
<th>Value</th>
<th>Datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr Arduino board Tags.HUMIDITY(%)</td>
<td>HUMIDITY(%)</td>
<td>63</td>
</tr>
<tr>
<td>2</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr Arduino board Tags.LIGHT INTENS...</td>
<td>LIGHT INTENSITY (Lux)</td>
<td>111</td>
</tr>
<tr>
<td>3</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr Arduino board Tags.LED TUNER(0)</td>
<td>PV (Lux)</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr Arduino board Tags.LED TUNER(5)</td>
<td>SV (Lux)</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr IR-ETN remoteIO.Tags.Actuator</td>
<td>Actuator</td>
<td>true</td>
</tr>
<tr>
<td>6</td>
<td>UServer...</td>
<td>NS2</td>
<td>Starr IR-ETN remoteIO.Tags.Sensor</td>
<td>Sensor</td>
<td>false</td>
</tr>
</tbody>
</table>

Reference Link:

Weintek Labs website: http://www.weintek.com