Connect to Azure IoT Hub with the MGate 5105 Industrial Protocol Gateway

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Contents

 Released on March 30, 2019

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1. Introduction

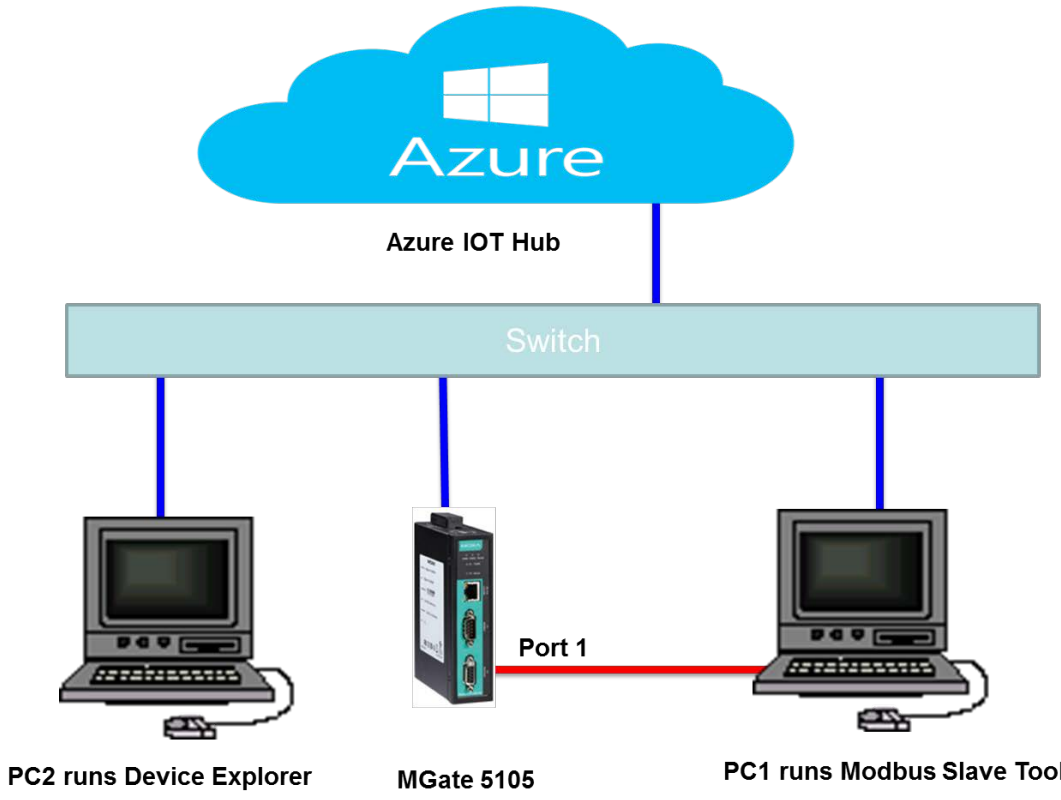
The MGate 5105 performs easy protocol conversions between Modbus RTU/ASCII, Modbus TCP, and EtherNet/IP protocols. From Firmware Version 4.0, it can support data that is collected from these fieldbus protocol devices and pushed to a cloud server. The cloud server could be Microsoft Azure, Alibaba Cloud, or MQTT Broker.

This document demonstrates how to use the MGate 5105 that connects to the Microsoft Azure IoT Hub and publishes fieldbus data messages to this IoT Hub or receives messages from it.

2. System Topology

Figure 1 illustrates the system topology. PC1 runs Modbus Slave tool to act as a Modbus RTU device. It connects to the MGate 5105's Port 1. The MGate 5105 acts as an Azure IoT device and connects to Azure IoT Hub. PC2 runs Device Explorer to monitor Azure IoT devices in the IoT Hub.

< Figure 1. System Topology >



3. Prerequisites

3.1 Modbus Slave Tool

Modbus Slave is a very popular Modbus slave simulator for testing and debugging of your modbus devices, which support Modbus RTU/ASCII and Modbus TCP/IP.

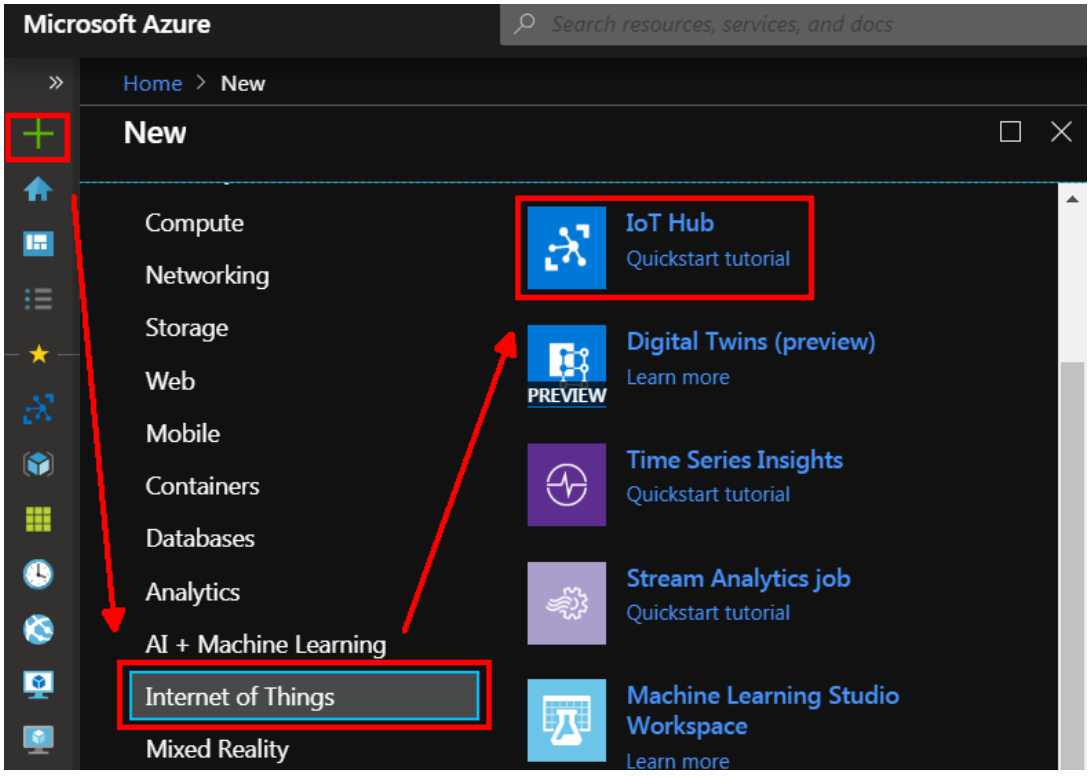
Download from website: http://www.modbustools.com/download.html

3.2 Device Explorer

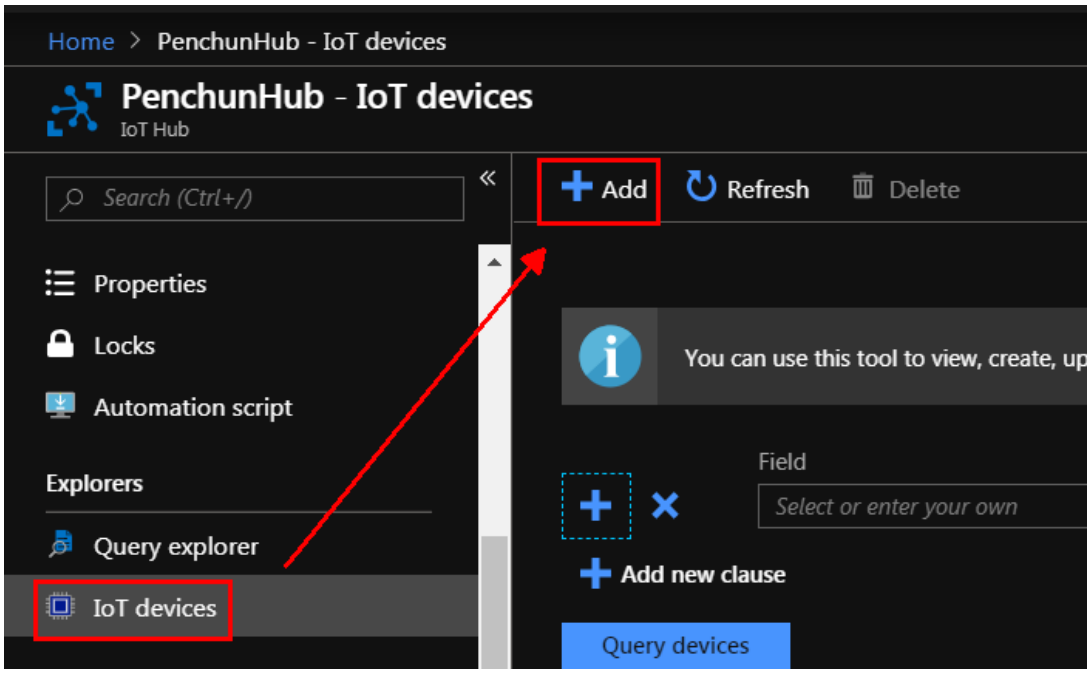
The Device Explorer is the gadget released by Azure to monitor "Azure IoT Hub" service. You can download a prebuilt version of the Device Explorer application. The latest release can be found at the following website:
https://github.com/Azure/azure-iot-sdk-csharp/releases/tag/2019-1-4

3.3 Create Azure IoT Hub and Device

1. Use Microsoft user account to log in to Azure Portal
   Azure Portal website: https://portal.azure.com
2. Create a New IoT Hub: New → Internet of Things → IoT Hub



3. When a new IoT Hub is created, click it to create a new IoT Device: Explorers → IoT device → Add.



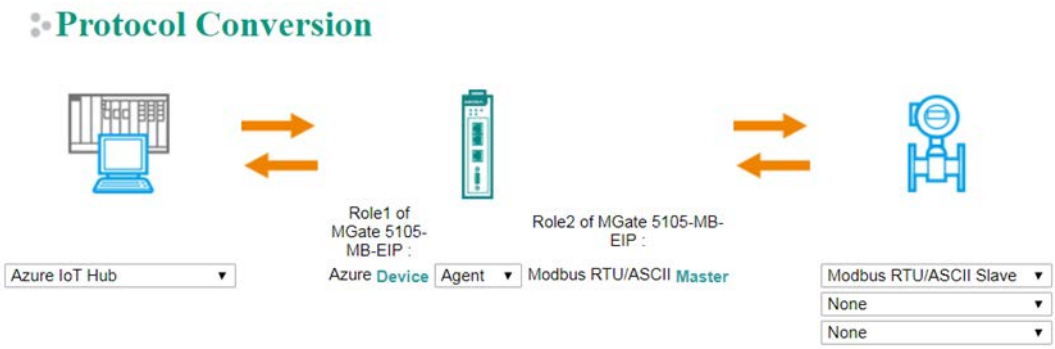
4. MGate 5105 Settings

Log in to MGate 5105's web console, then do the following settings:

4.1 Protocol Conversion

Under "Protocol Conversion" settings, we choose "Azure Device" as Role 1. In the fieldbus site, we can choose the following protocols: Modbus RTU/ASCII Slave, Modbus TCP Server, or EtherNet/IP Adapter, and multiple combinations are allowed for settings in Role 2. In this demonstration, we choose "Modbus RTU/ASCII Slave".

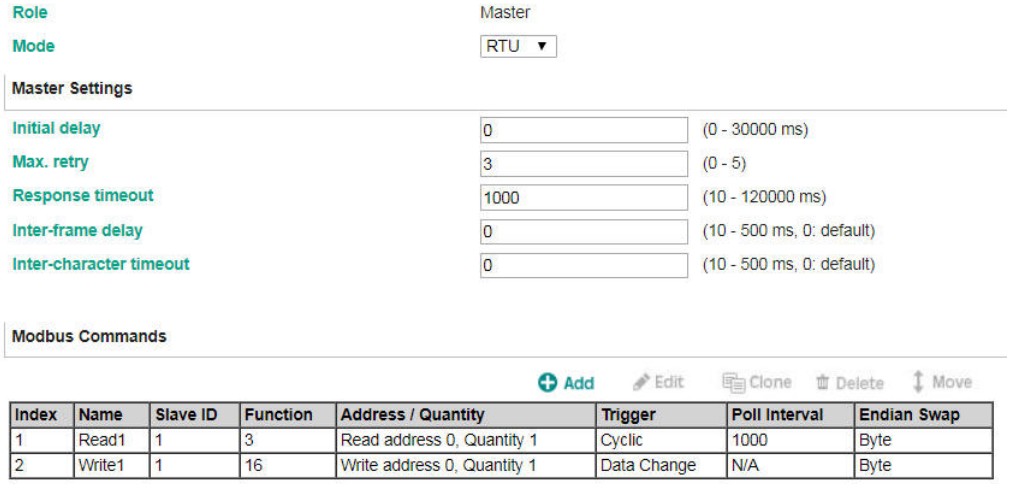
Set as below:



4.2 Modbus RTU Master Settings

1. In the “Modbus RTU/ASCII Master Settings” web page, under Mode, we choose “RTU” and keep the “Master Settings” as the default setting.
2. Add a “Read1” modbus command to send a function code 03, quantity as 1 command, Endian Swap as Byte. Its “Poll interval” is 1000 ms.
3. Add a “Write1” modbus command to send a function code 06 command, Endian Swap as Byte. Its command “Trigger” is by “Data Change”.

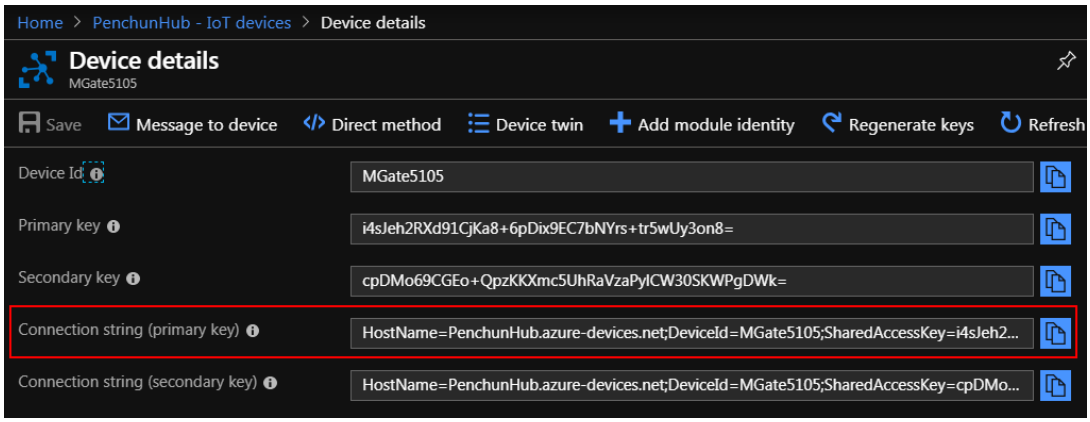
Set as below:



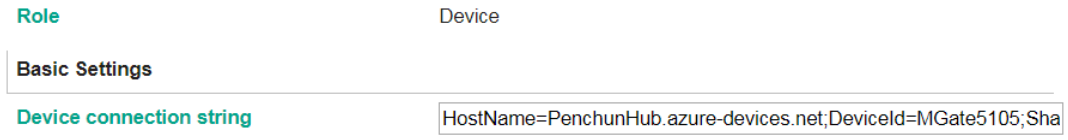
Index	Name	Slave ID	Function	Address / Quantity	Trigger	Poll Interval	Endian Swap
1	Read1	1	3	Read address 0, Quantity 1	Cyclic	1000	Byte
2	Write1	1	16	Write address 0, Quantity 1	Data Change	N/A	Byte

4.3 Azure Device Settings

1. Device connection string:
   In the Basic Settings → Device connection string, you must fill in your IoT device connection string. It can be found at “IoT Device details” within Azure Portal as below:

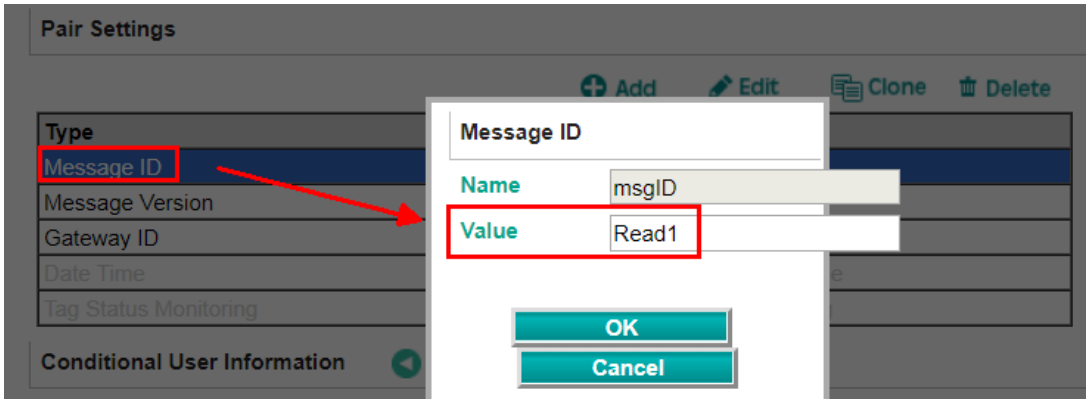


Set as below:

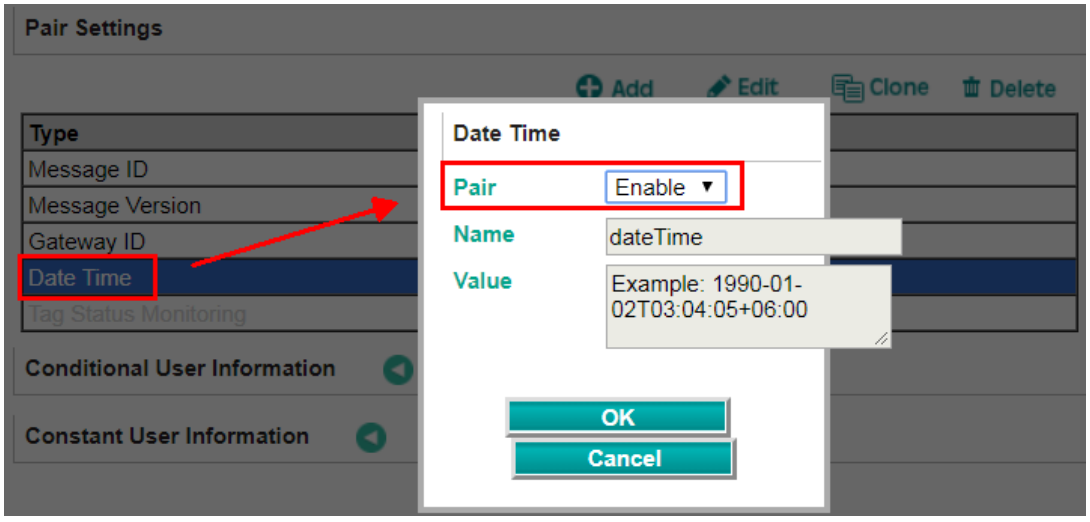


2. Device-to-cloud Messages:
   Click the **Add** button to create a Device-to-cloud Message, then click it to edit message settings.

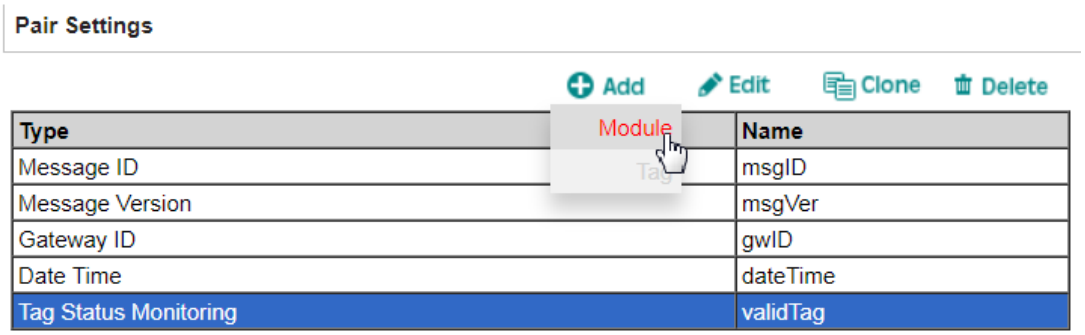
In "Pair Settings", we click "Message ID" to edit its Name as "Read1".



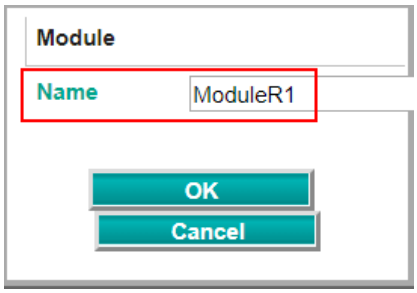
Click "Date Time" to enable "dateTime" padding in the message.



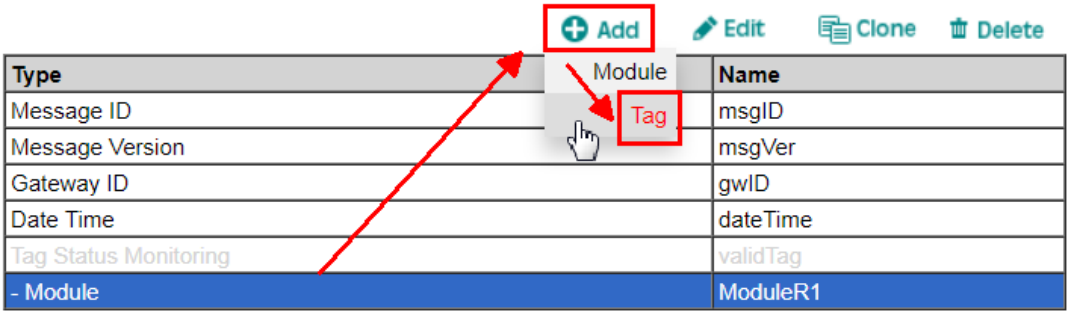
Click **Add → Module** to create a new module.



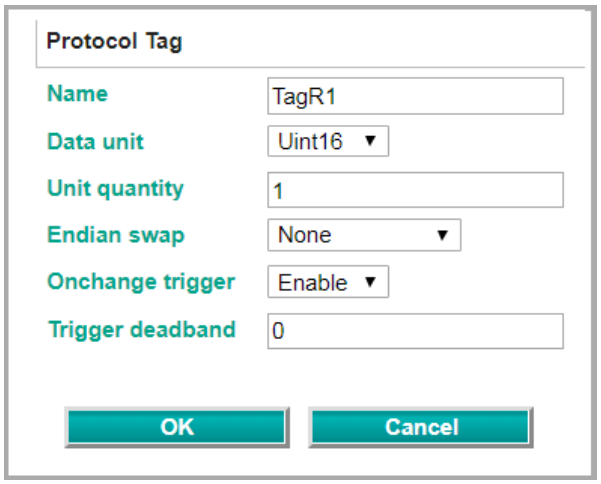
Select "ModuleR1" under Name.



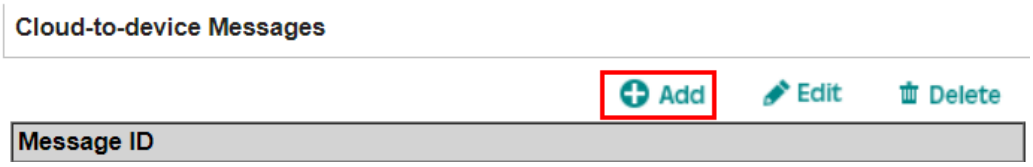
Choose "ModuleR1", then click **Add → Tag**.



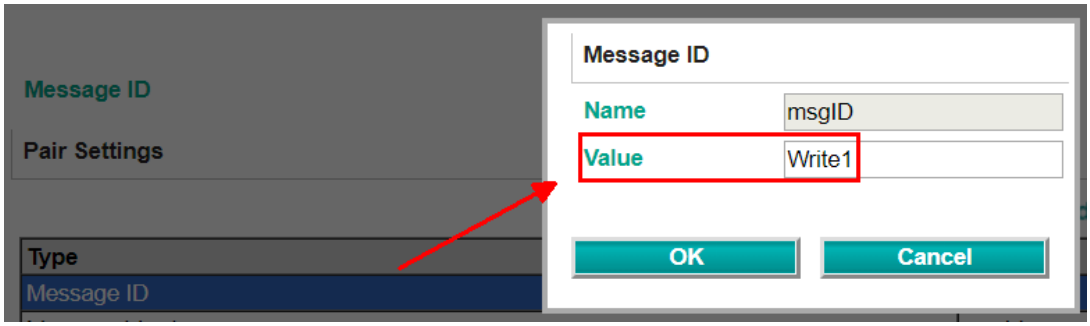
Create a Protocol Tag as below:



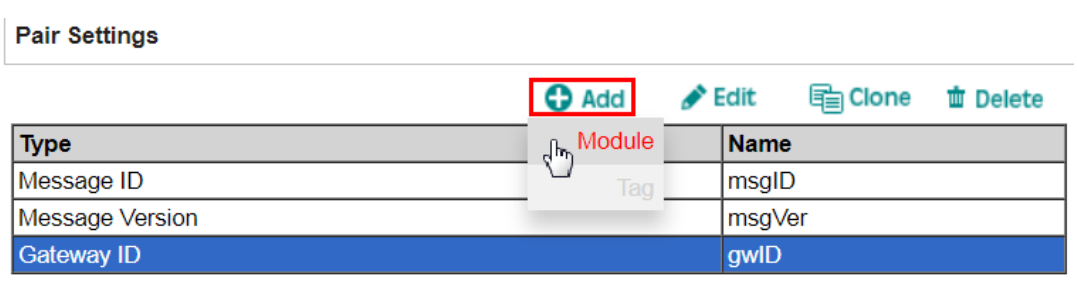
3. Cloud-to-device Messages:
   Click the **Add** button to create a Cloud-to-device message and then click it to edit message settings.



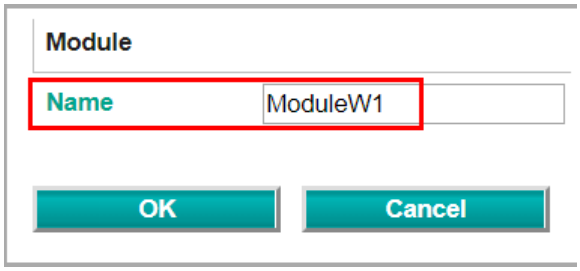
In “Pair Settings”, we click “Message ID” to edit its Name as “Write1”.



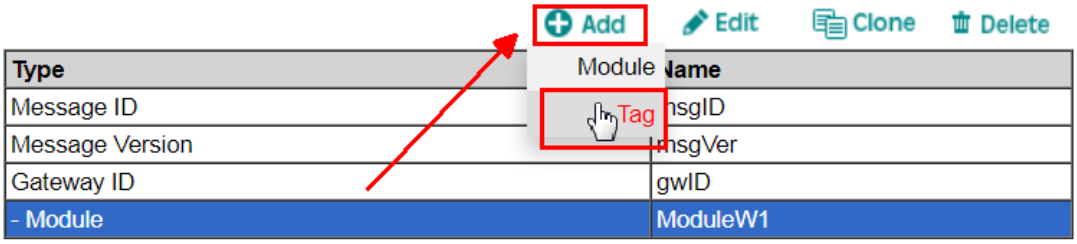
Click **Add → Module** to create a new module.



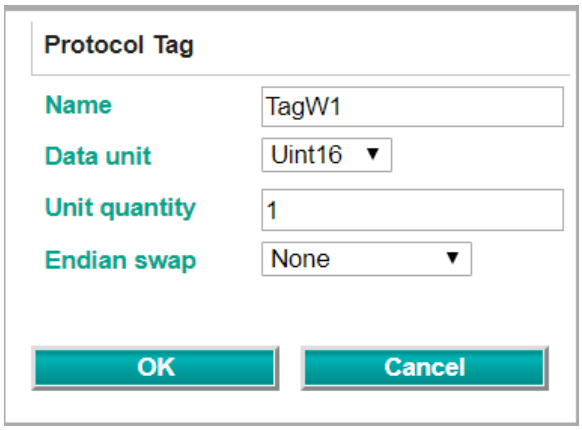
Select “ModuleW1” as Name.



Choose ModuleW1 and then click **Add → Tag**.

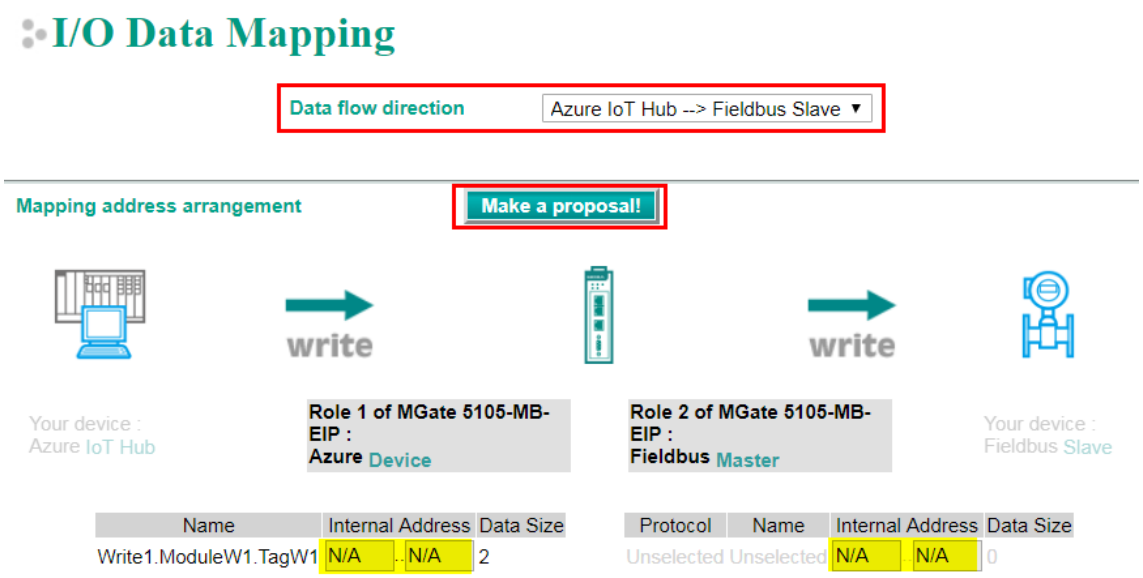


Create a Protocol Tag as below:

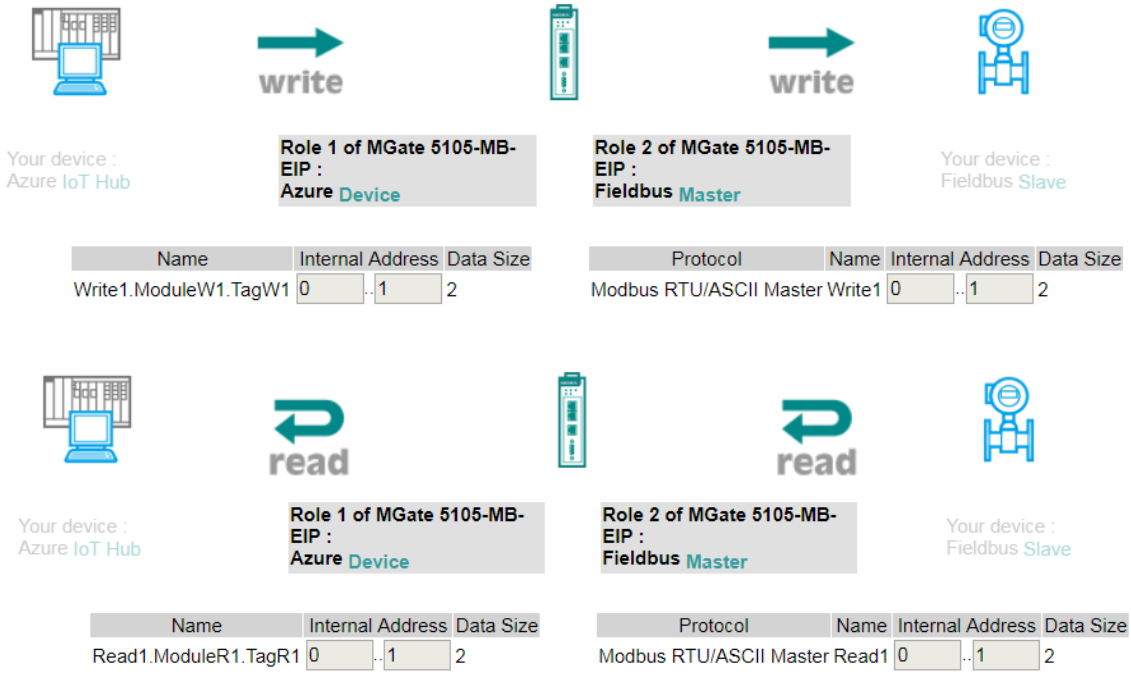


4.4 I/O Data Mapping

When the protocol settings are done, you just need one more step of I/O Data mapping for protocol configuration. You can click the **Make a proposal** button for auto mapping in both the **Azure IoT Hub → Fieldbus Slave** direction and **Azure IoT Hub ← Fieldbus Slave** direction.



The mapping result is as below:



4.5 Serial Settings

Serial Port1 connects to Modbus RTU device, so you must set the serial parameters of Port1.

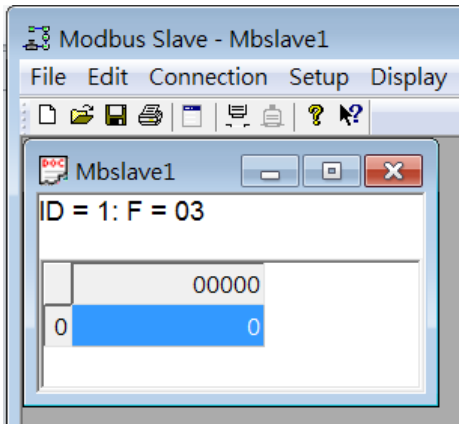
Set as below:

Serial Settings

Port	Baud rate	Parity	Data bit	Stop bit	Flow control	FIFO	Interface	RTS on delay	RTS off delay
1	115200	Even	8	1	None	Enable	RS-232	0	0

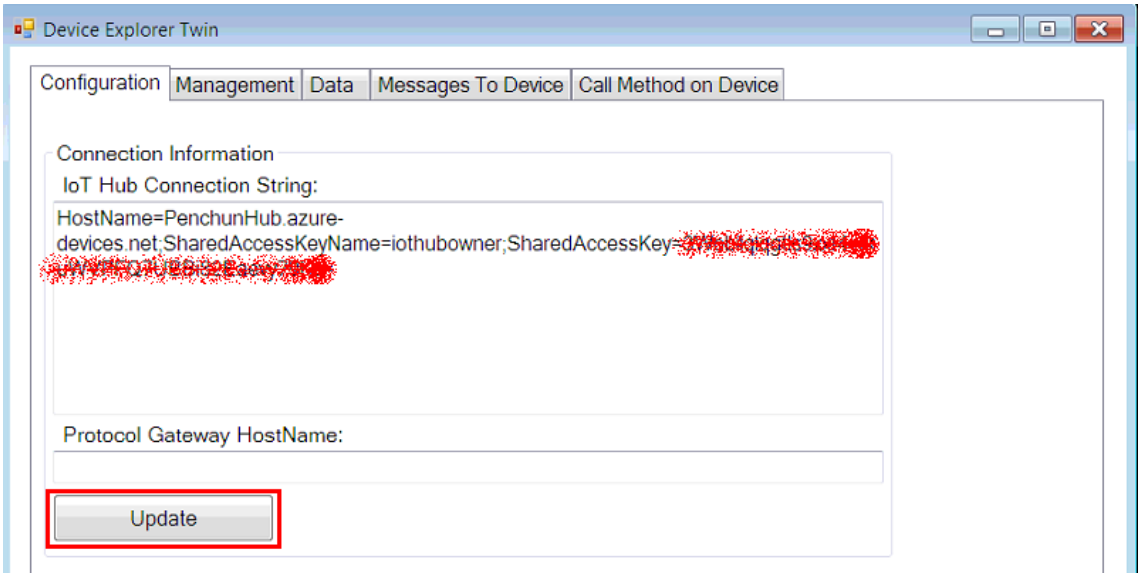
5. Modbus Slave Tool Settings

PC1 runs **Modbus Slave tool** and connects to MGate 5105's Serial Port. Add the Modbus definition below:

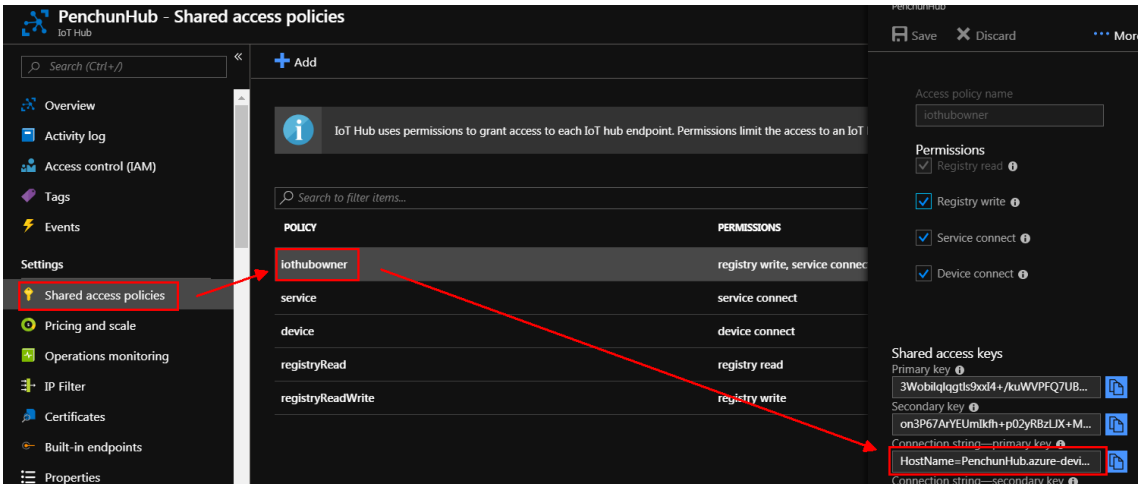


6. Device Explorer Settings

PC2 runs Device Explorer. In Configuration Tab, fill in IoT Hub Connection String.

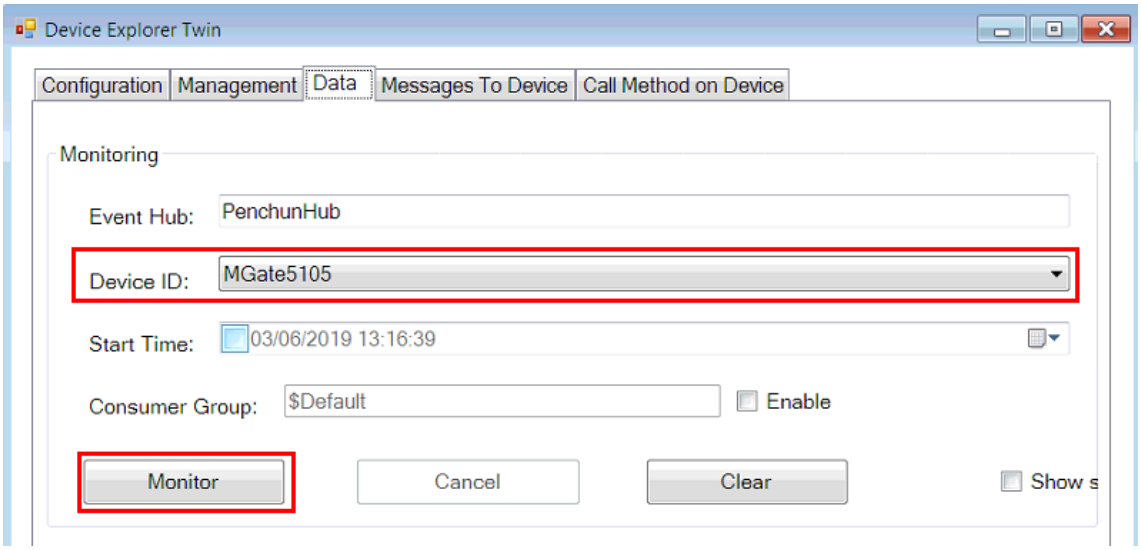


This string can be found under “IoT Hub Shared access policies” in Azure Portal as below:



After filling in the IoT Hub Connection String, click “Update” and it will connect to Azure IoT Hub.

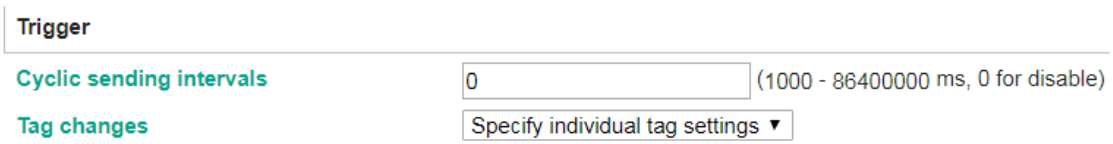
In Data Tab, choose your IoT Device from Device ID dropdown list. Then click “Monitor” to monitor Device-to-cloud message.



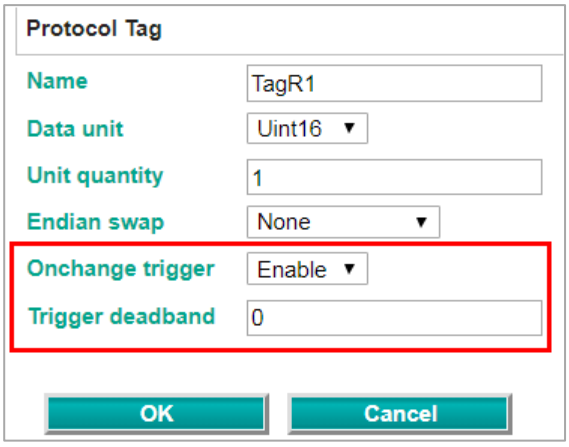
7. Communication Test

7.1 Device-to-cloud message

Set Device-to-cloud message Trigger as “no cyclic sending” and “by specific tag change”:

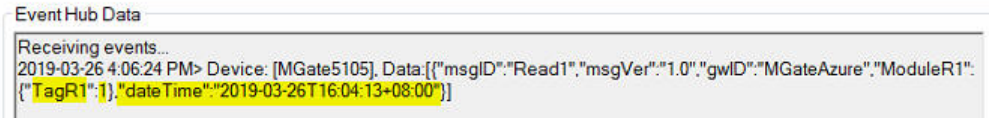


To enable Onchange trigger with Trigger deadband to 0 on TagR1.



So when the MGate 5105 gets Modbus RTU device Register0's value changed,it triggers to publish message to IoT Hub.

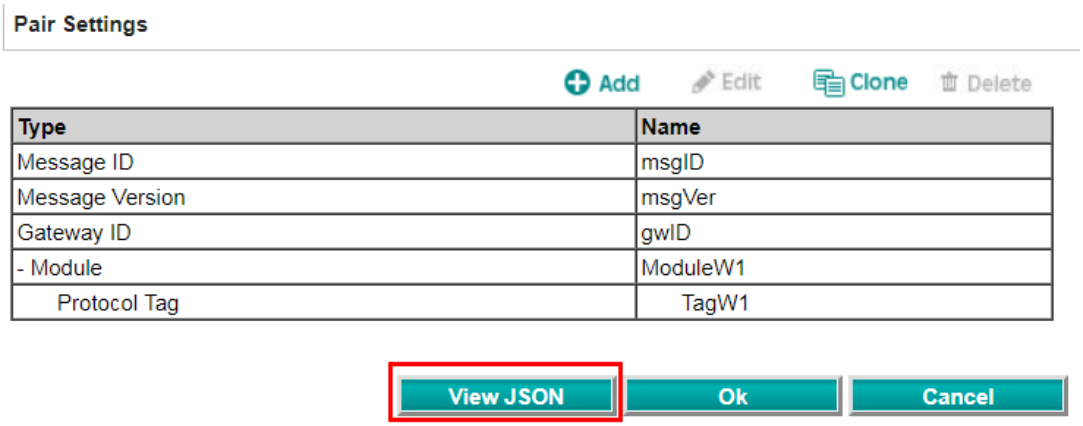
Now, you can try to update Modbus Register0's value to 1. In Device Explorer's Event Hub Data, it gets TagR1's value shown as 1 and with dateTime padding.



7.2 Cloud-to-device message

Device Explorer can be used to send messages to device. You can follow below steps:

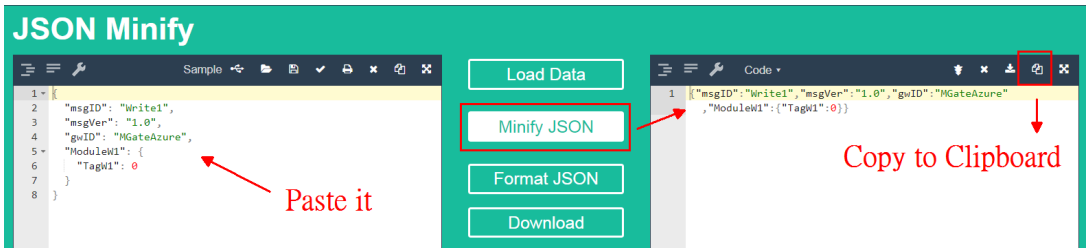
1. Click Cloud-to-device message "View JSON" button.



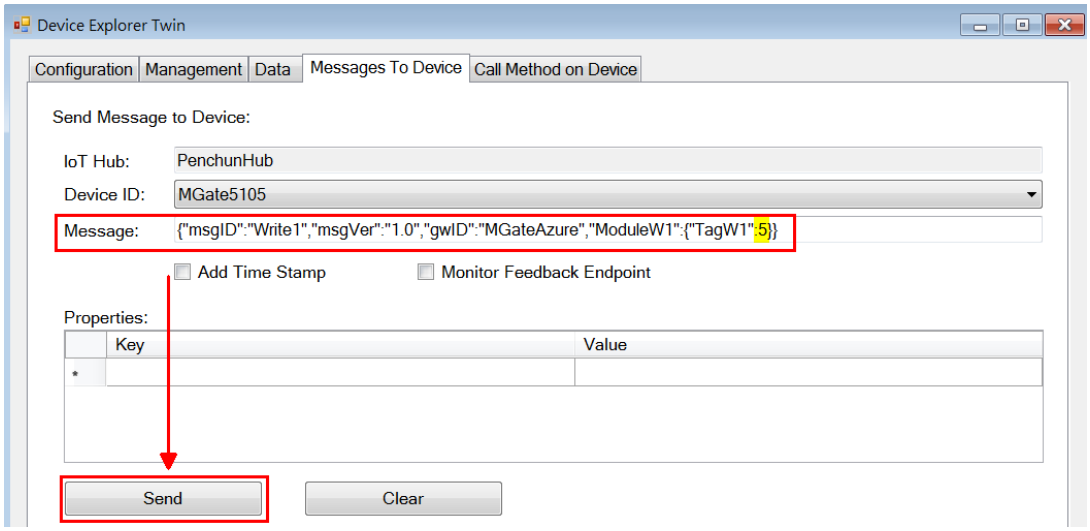
Copy Cloud-to-device message JSON format:

2. The copied message has a lot of space and line feed. We can use tool to compact it. Below is a free online tool:
   https://jsonformatter.org/json-minify

   Paste the message on the left side column, then click “Minify JSON”. It will show a compact JSON format message on the right side column. Click “Copy to Clipboard”.



3. Paste it on the Message field of Device Explorer, and modify TagW1 value to 5, then click "Send".



4. Check Modbus Slave tool that Register0's value is updated to 5.