How to Use ThingsPro Gateway to Publish Processed Edge Data to the AWS IoT Cloud

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Contents

1 Background ..................................................................................... 2
2 Requirements ................................................................................. 2
3 Overview ......................................................................................... 2
   3.1 Creating Custom Tags/Registers ...................................................... 2
   3.2 Setting Up a Modbus TCP Device .................................................. 3
   3.3 Running a Program to Read and Publish Data from the Device to the AWS IoT Cloud ........................................... 5
   3.4 Enabling the AWS IoT Client in the ThingsPro Gateway .................... 9
   3.5 Checking the Data on AWS IoT ..................................................... 10
4 Additional Reading .......................................................................... 12

About Moxa
Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things. With over 30 years of industry experience, Moxa has connected more than 50 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for industrial communications infrastructures. Information about Moxa’s solutions is available at www.moxa.com. You may also contact Moxa by email at info@moxa.com.

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1 Background

Moxa’s ThingsPro Gateway provides a convenient way to acquire device data through Modbus RTU or Modbus/TCP protocol. In addition, you can create your own data tags and automatically transmit processed data to a remote IoT cloud using the ThingsPro Gateway software.

2 Requirements

- ThingsPro Gateway software installed on an eligible Moxa device (e.g., UC-8112-LX)
- AWS IoT user account

3 Overview

In this tech note, we explain how you can take advantage of the Custom Equipment Management function in ThingsPro Gateway to read temperature values from a device via Modbus/TCP protocol and publish the current temperature, the highest temperature, and lowest temperature values to the AWS IoT cloud using the following steps:

- Creating Custom Tags/Registers
- Setting Up a Modbus TCP Device
- Running a Program to Read and Publish Data from the Device to the AWS IoT Cloud
- Enabling the AWS IoT Client in the ThingsPro Gateway
- Checking the Data on AWS IoT

3.1 Creating Custom Tags/Registers

To create the custom tags required for this project, do the following:

1. Connect to the ThingsPro Gateway homepage using the Chrome browser.
2. In the main menu, click MODBUS & Logging and select the EQUIPMENT TEMPLATE tab.
3. In the Custom Equipment Management section, click Edit to open the Edit Custom Equipment page
4. Fill in a name of custom equipment ("ioLogik-temperature-sensor" in this example)
5. Add three custom tags—current-temp, max-temp, and min-temp—as shown in Figure 1.
How to Use ThingsPro Gateway to Publish Processed Edge Data to the AWS IoT Cloud

Note: The custom tags created here are used in the example code in Section 3.3.

Figure 1

6. Click SAVE

3.2 Setting Up a Modbus TCP Device

1. In the main menu, click **MODBUS & Logging** and select the **MODBUS DEVICE** tab.

2. Click on the **MODBUS/TCP** tab.

3. Click **Edit TCP Interface Settings** page.

4. Specify the **Interface Name**, **Host IP**, **Port**, **Interval**, and **Response Timeout** values for the TCP interface.

   The **Host IP** is the IP address of Modbus TCP Server. In this example, a temperature sensor is connected to an ioLogik E1260, which allows a Modbus client in the ThingsPro Gateway to pull temperature values via the Modbus TCP protocol at time intervals specified in the **Interval** field (unit: millisecond). See Figure 2 for an example configuration.
5. Click **SAVE**

   A new item, `my_ioLogik-E1260` is created in TCP List.

![Figure 2](image)

**Figure 2**

![Figure 3](image)

**Figure 3**
6. Click corresponding to the `my_ioLogik-E1260` device to open the **Edit Device** page.

7. In the **Template** field, select the built-in template `ioLogik-E1260`.

8. Specify the **Device Name** (`ioLogik-a10` in this example).

**Note:** The device name, `ioLogik-a10`, specified here has been used to read the Modbus TCP values in the example code in Section 3.3.

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**Figure 4**

### 3.3 Running a Program to Read and Publish Data from the Device to the AWS IoT Cloud

We have created an example Python program to read Modbus TCP temperature value every five seconds and publish the value of a user-defined tag (``max-temp``) value to ThingsPro Gateway's MQTT server if the current temperature value is higher than the maximum value it has recorded. ThingsPro Gateway will then publish this maximum temperature value to AWS IoT cloud. A similar approach is used to transmit the minimum temperature to the AWS IoT cloud.
To run the example program, do the following:

1. Copy and save the sample code given below in the
   `/home/moxa/usertag-example.py` file on the UC-8112-LX computer.

**Note:** At the beginning of the example code, you must call the Moxa proprietary library
`libmxidaf_py` to import the modules `Modbus`, `TagV2`, `Tag`, `Time` and `Value` to
enable your program to read Modbus data from the ThingsPro Gateway. For more
detailed information on the data acquisition API, refer to *ThingsPro Programmer’s Guide*.

```python
#!/usr/bin/env python
import time
from libmxidaf_py import Modbus, TagV2, Tag, Time, Value

modbus = Modbus.instance()
tagv2_tmin = TagV2.instance()
tagv2_tmax = TagV2.instance()
tagv2_t = TagV2.instance()

global tmin, tmax
tmin=50 # minimum temperature
tmax=0 # maximum temperature

def update_tmin():
global tmin
if (tag.value().as_float()<tmin):
    tmin=tag.value().as_float()
    # update user tag "min-temp"
at = Time.now()
```
tagv2_tmin.publish(
    "ioLogik-temperature-sensor",
    "min-temp",
    Tag(
        tag.value(),
        at,
        "C"
    )
)
print 'tmin: ' 
print (tmin)

def update_tmax():
    global tmax
    if (tag.value().as_float()>tmax):
        tmax=tag.value().as_float()
        # update user tag "max-temp"
        at = Time.now()

        tagv2_tmax.publish(
            "ioLogik-temperature-sensor",
            "max-temp",
            Tag(
                tag.value(),
                at,
                "C"
            )
        )
        print 'tmax: ' 
        print (tmax)
def update_t():
    # update user tag "current-temp"
    at = Time.now()
    tagv2_t.publish(
        "ioLogik-temperature-sensor",
        "current-temp",
        Tag(
            tag.value(),
            at,
            "C"
        )
    )
    print (tag.value().as_float())

while (True):
    tag = modbus.read("ioLogik-ai0", "rtdi0")  # A temperature sensor is connected to ioLogik AI0. The tag name "rtdi0" is pre-defined in template "ioLogik-E1260" in EQUIPMENT TEMPLATE to read temperature value.
    update_tmin()
    update_tmax()
    update_t()
    time.sleep(5)

2. Log in to the UC-8112-LX via the serial console or SSH.
3. Create an executable Python script using the command:
   moxa@Moxa:~$ chmod +x usertag-example.py
4. Run the Python program using the following command:
   moxa@Moxa:~$ ./usertag-example.py
3.4 Enabling the AWS IoT Client in the ThingsPro Gateway

Follow the instructions in the ThingsPro Software Suite User’s Manual to configure the AWS IoT client on the ThingsPro Gateway. The **AWS IoT** Client configuration window can be accessed from the main menu and is listed under the **Applications** section. Make sure you enable the AWS IoT on ThingsPro Gateway as per the example shown in Figure 5.

![AWS IoT Configuration Window](image)

**Figure 5**
3.5 Checking the Data on AWS IoT

You can subscribe the topic of your interest on the AWS IoT Console. In order to subscribe to the data acquired in the example illustrated in this document, type the topic, 
\$aws/things/UC-8112_demo/shadow/update/ioLogik-temperature-sensor/#

in the Subscription topic field on the MQTT client page and click Subscribe to topic, as shown in Figure 6.

**Note:** The strings marked in red in the subscription topic will vary based on the AWS IoT Thing Shadow for your device.

Figure 6

Once you subscribe to the topic, you will be able to view the max-temp, min-temp, and current-temp data on the AWS IoT console as shown in Figure 7, Figure 8, and Figure 9.

Figure 7: User tag data (max-temp)
How to Use ThingsPro Gateway to Publish Processed Edge Data to the AWS IoT Cloud

Figure 8: User tag data (min-temp)

Figure 9: User tag data (current-temp)
3.5.1 Deploying Your Custom Program on ThingsPro Gateways

Once you have completed developing your own program development, follow the instructions given in the previous sections of this document to create the required custom tags. You can then run your program permanently using the User Programs function provided in the ThingsPro Gateway. Refer to chapter "Managing User Programs" in the ThingsPro Software Suite User’s Manual for details.

If you want to deploy this program to a group of ThingsPro Gateways located at different field sites, you can export the settings from the ThingsPro Gateway which has the right configuration by using ThingsPro Device Enablement Utility and use the Restore function provided by the ThingsPro Server to push the configuration to the ThingsPro Gateways in the group. Refer to the chapter "Restoring the Configuration Setting for a Device Group" in the ThingsPro Software Suite User’s Manual for details.

4 Additional Reading

- ThingsPro Programmer’s Guide

- Latest version of the ThingsPro Software Suite User’s Manual available at:
  https://www.moxa.com/support/sarch_result.aspx?prod_id=5151&type_id=7&type=doc