

NPort IA5000A-I/O or NPort IAW5000A-I/O to Azure

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About Moxa

Moxa is a leading provider of edge connectivity, industrial networking, 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.

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1. Introduction

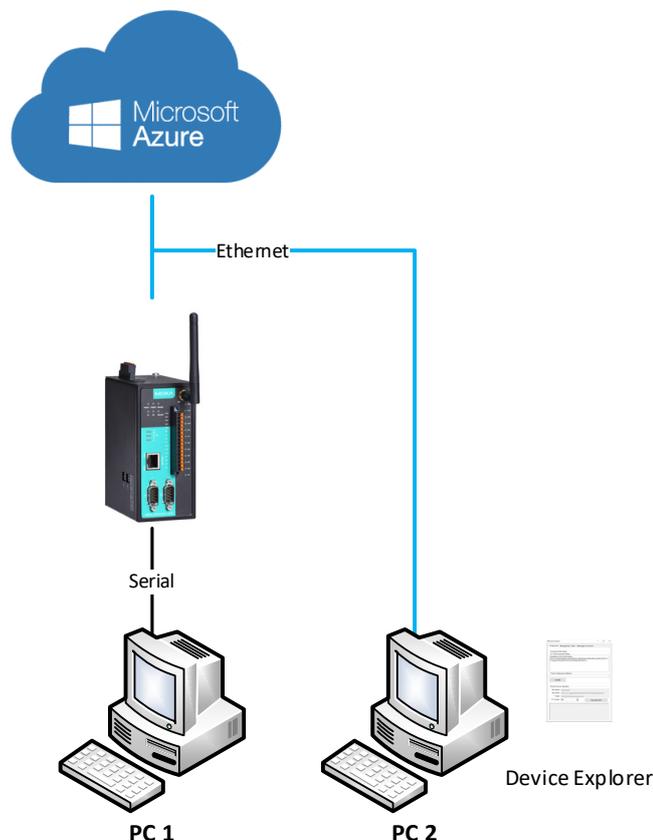
The NPort IA5000A-I/O and NPort IAW5000A-I/O serial device servers, which have built-in digital I/Os, provide maximum flexibility when you need to integrate serial equipment in the field with an Ethernet network or cloud platform. From Firmware Version 2.0 onwards, they support communications with IIoT applications, using generic MQTT or third-party cloud services, such as Azure and Alibaba Cloud.

This document demonstrates how to use the NPort IA5000A-I/O or NPort IAW5000A-I/O serial device when connecting to Microsoft Azure IOT. We also demonstrate how to send serial or I/O data messages and receive messages from Microsoft Azure.

2. System Topology

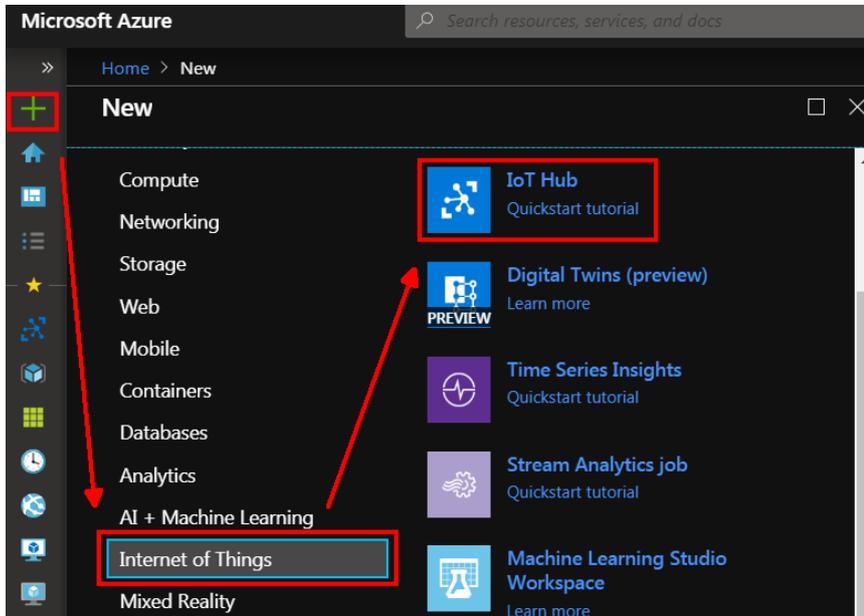
Figure 1 illustrates the system topology. PC1 runs PComm Lite to act as a serial device. It connects to Port 1 of the NPort IA5000A-I/O or NPort IAW5000A-I/O serial device. The NPort IA5000A-I/O or NPort IAW5000A-I/O serial device acts as an Azure IOT device and connects to Azure IOT Hub. PC2 runs **Device Explorer** to monitor the Azure IOT device in the IOT Hub.

< Figure 1. System Topology >

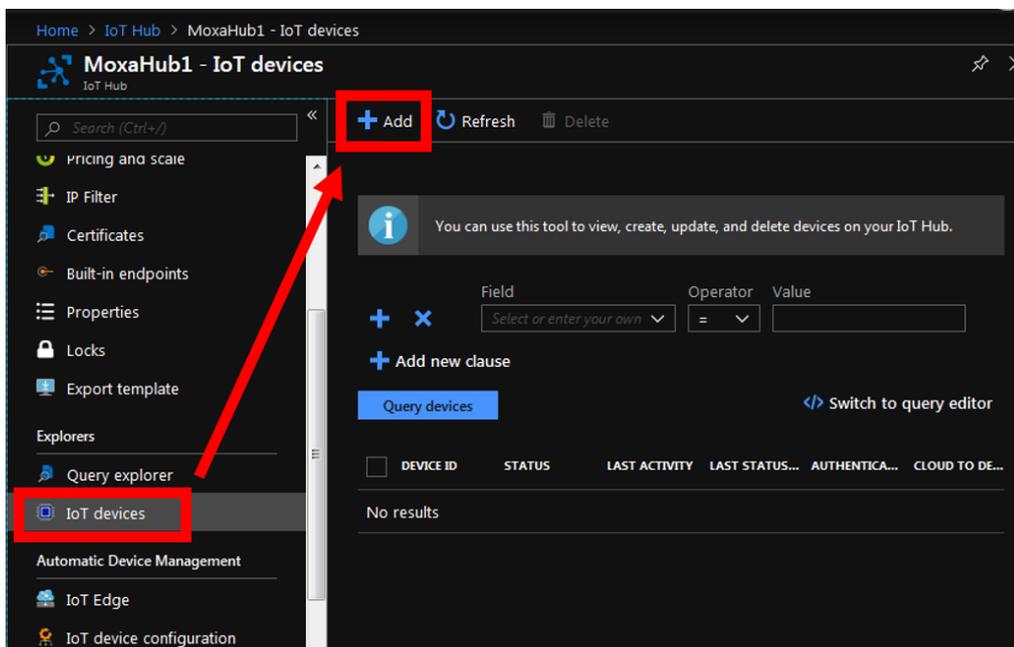


2.1 Creating an IoT Hub and IoT Device on Azure

1. Use a 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 has been created, click to create a new IoT Device: **Explorers** → **IoT devices** → **Add**.



Fill in the device name on **Device ID**, and click **Save**, which will create an IoT device.

Home > IoT Hub > MoxaHub1 - IoT devices > Create a device

Create a device

Find Certified for Azure IoT devices in the Device Catalog

* Device ID ⓘ
NPort ✓

Authentication type ⓘ
Symmetric key X.509 Self-Signed X.509 CA Signed

* Primary key ⓘ
Enter your primary key

* Secondary key ⓘ
Enter your secondary key

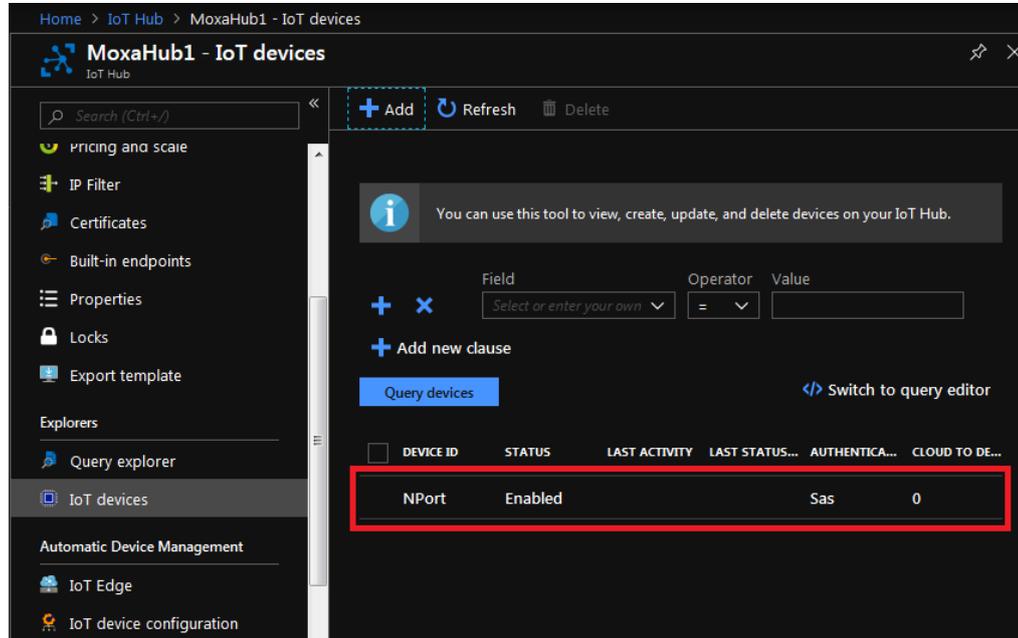
Auto-generate keys ⓘ

Connect this device to an IoT hub ⓘ
Enable Disable

Parent device ⓘ
No parent device
[Set a parent device](#)

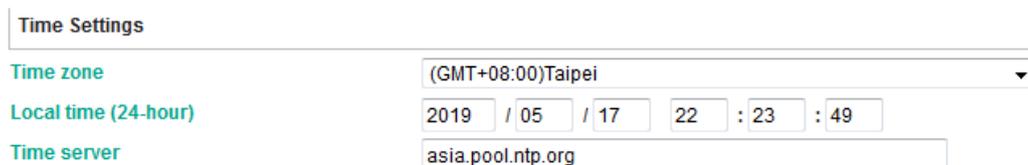
Save

After successfully creating the IoT device, you will see (as below) that its **Device ID** is "NPort".



2.2 Set Up the NPort IA5000A-I/O and IAW5000A-I/O to Connect to Azure IoT Hub

1. Log in to the NPort IA5000A-I/O or NPort IAW5000A-I/O's web console. Set the correct time setting on the **Basic Settings** page. Also, fill in **Time server** to correct the NPort's time-on period. You can find the NTP service at <https://www.pool.ntp.org/zone/@>



2. Go to **Main Menu → IoT Management → IoT Mode**, to set **IoT platform** as "Azure IoT Hub".

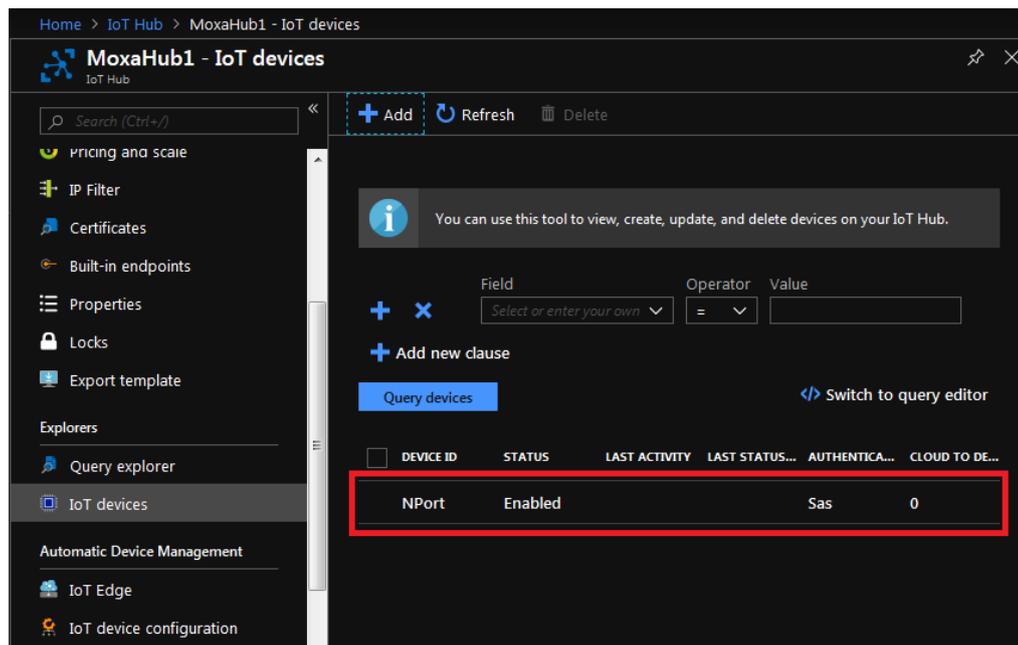
IoT Mode



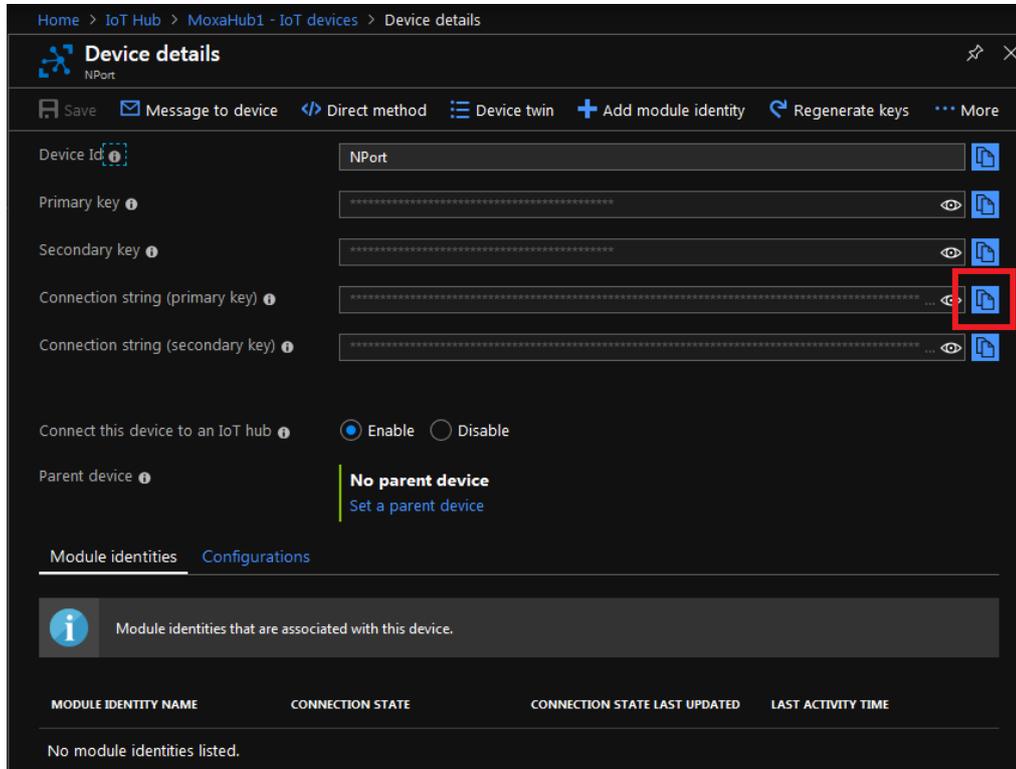
The IoT Mode is running with Azure IoT Hub. It will show more settings about Azure IoT Hub as below:



3. In **Device connection string**, fill in your IoT device connection string. Go back to Azure Portal, and click **NPort** to show the details of the device.



On the **Device details** page, click the copy icon for **Connection string (primary key)** within Azure Portal as below.



Go back to the NPort web console and paste (Ctrl + V) it in **Device connection string**, and click **Submit**.

IoT Mode

Basic Settings

IoT platform: Azure IoT Hub

Azure IoT Hub Settings

Device connection string: `HostName=MoxaHub1.azure-devices.net;DeviceId=NPort;Shar`

Serial and I/O Message Format Settings

Serial and I/O message definition: Serial JSON | I/O JSON

I/O publish trigger mode: Specific I/O change | DI-00

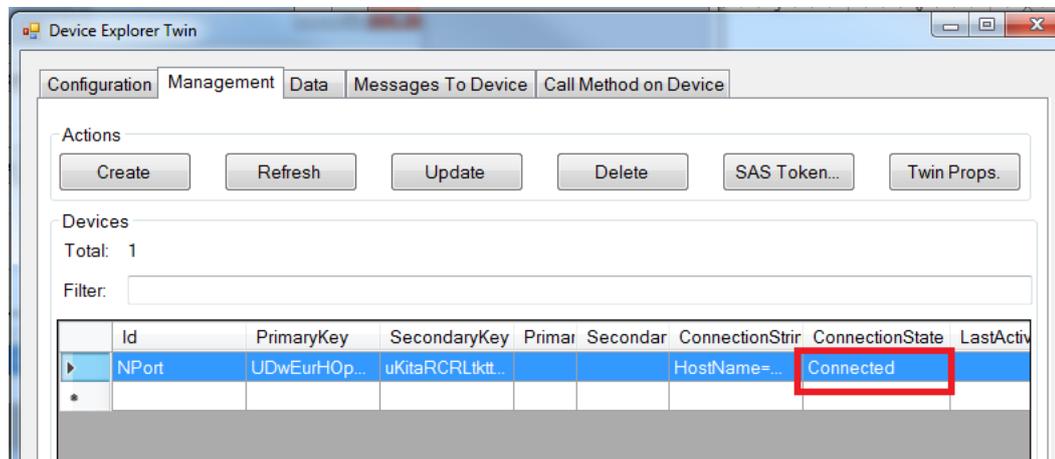
Submit

4. After clicking **Submit**, the NPort IA5000A-I/O or NPort IAW5000A-I/O will connect to Azure IoT Hub, and you can check if the **Connection Status** shows **Connected** under **Azure IoT Connection Information** as below:

Azure IoT Connection Information

Target	MoxaHub1.azure-devices.net
Connection status	Connected
Diagnostics log	2019/05/16 20:45:29 Connecting... 2019/05/16 20:45:31 Connected successfully!

You can also check **ConnectionState** under the **Management** tab on the **Device Explorer Twin** page. For more about the Device Explorer Twin, please refer to the "Device Explorer Twin" section.

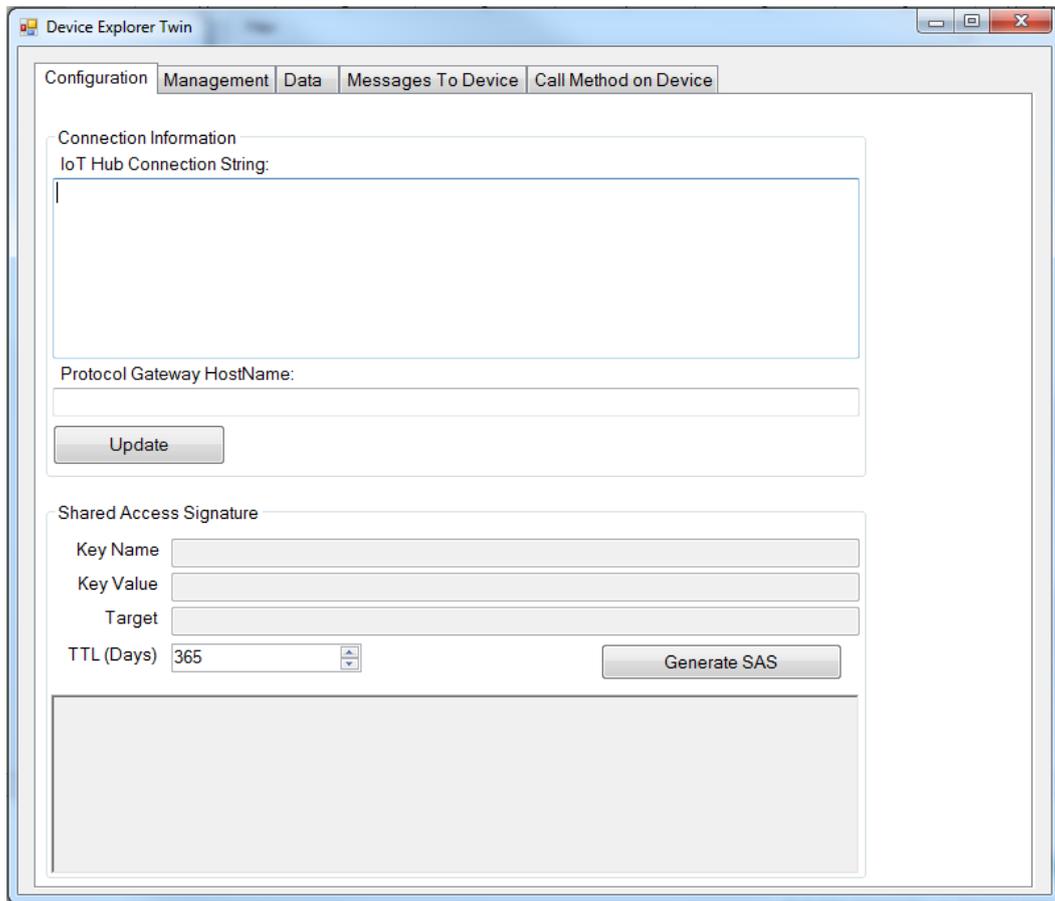


2.3 Device Explorer Twin

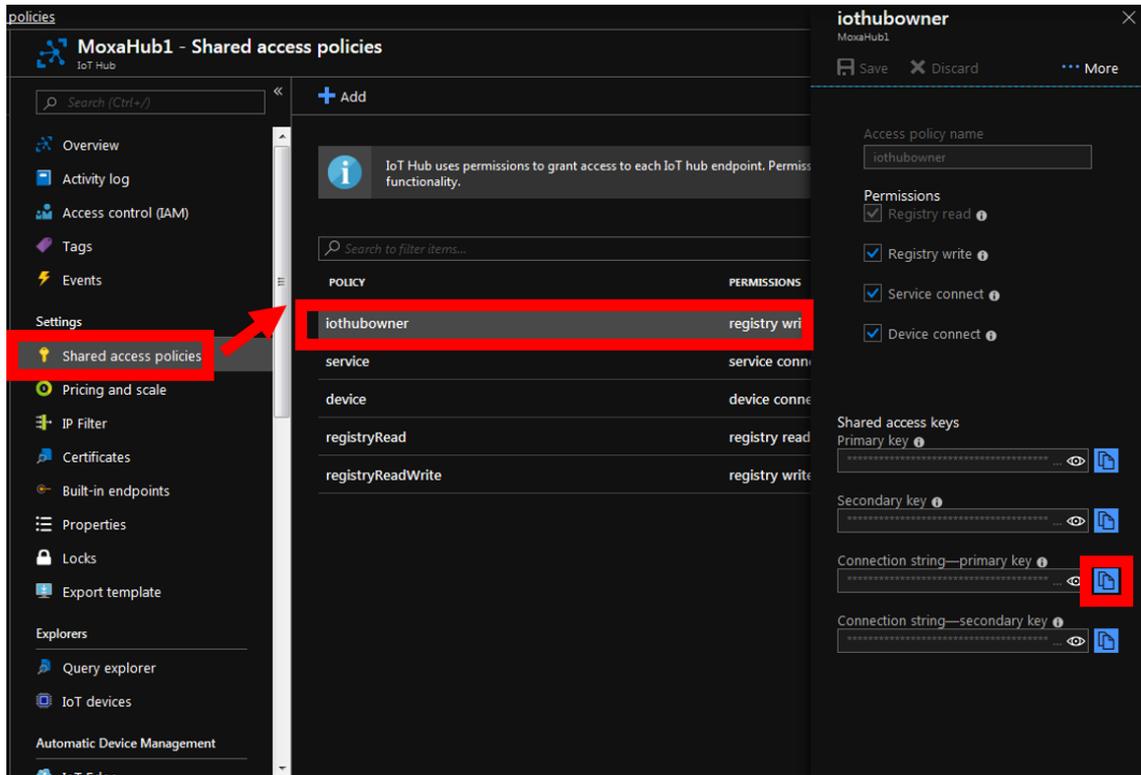
The Device Explorer Twin is a gadget released by Azure to monitor the Azure IoT Hub service. Device Explorer Twin manages devices that are connected to your IoT hub. It monitors messages from your devices and send messages to your devices. For more information, please reference <https://github.com/Azure/azure-iot-sdk-csharp/tree/master/tools/DeviceExplorer>.

It can be downloaded from <https://github.com/Azure/azure-iot-sdk-csharp>

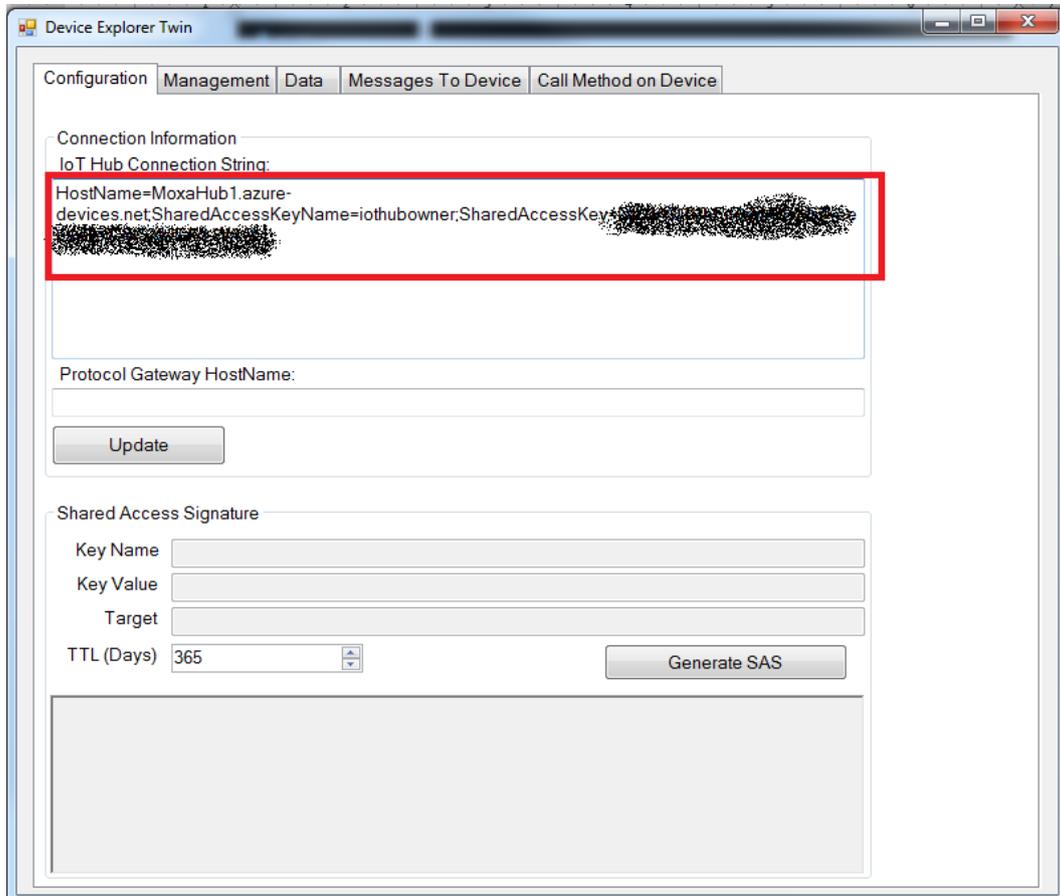
Install the latest version of **SetupDeviceExplorer.msi** to launch it.



Under **IoT Hub Connection String**, fill in "Connection string—primary key". This string is used for API calls and uses the primary key. Go back to Azure Portal and click **Shared access policies > iothubowner** to show "Shared access keys". Click the copy icon for **Connection string—primary key** as below.



Go back to **Device Explorer Twin**, and paste (Ctrl + V) it in **IoT Hub Connection String**, and click **Update**.



3. Upload/Download Serial Pattern and I/O Status With Cloud

In this section, we will instruct you on how the NPort IA5000A-I/O and NPort IAW5000A-I/O (in sections below, referred to as NPort or NPorts) send and receive serial pattern to and from the cloud. If a DI is triggered, the NPorts will publish I/O status to the cloud, and publish a message from the cloud to the NPorts to change I/O status. Azure IoT Hub only supports MQTT data message format. Under **I/O publish trigger mode**, select **Specific I/O change** along with **DI-00**.

IoT Mode

Basic Settings

IoT platform Azure IoT Hub ▼

Azure IoT Hub Settings

Device connection string HostName=MoxaHub1.azure-devices.net;DeviceId=NPort;Shar

Serial and I/O Message Format Settings

Serial and I/O message definition Serial JSON I/O JSON

I/O publish trigger mode Specific I/O change ▼ DI-00 ▼

Submit

For the purpose of this demonstration, we will show you the text content of the data we upload to the cloud platform. Click the **Serial JSON** button to uncheck the **enable Base64 Encode/Decode for serial data** checkbox. JSON format does not support special characters. If needed, set **Encode/Decode for serial data**. For more about JSON format rules, please reference <http://json.org/>

Serial JSON Message Definition

Publish JSON Message

```

{
  "msgVer"      :      "1.0",
  "gwID"       :      "NPortIAW5250A-12I/O_2647",
  "devID"      :      "SerialPort1",
  "dateTime"   :      "2018-08-27T15:43:14+08:00",
  "msgNumber"  :      0-65535,
  "msgType"    :      "Data",
  "msgFrame"   :      "Raw data from serial port"
}

```

port 1 port 2 (devID is referred to Alias in Ser

enable

enable

enable Base64 Encode/Decode for serial data

Note: You must fill in serial **alias name**, which is an identifiable ID for serial data on the **Serial Parameter** page.

Serial Parameter

* Modifying "Serial Parameter" settings will cause the serial ports to restart connections.

Port	Alias	Alias code	Baud rate	Parity	Data bit	Stop bit	Flow control	FIFO	Interface
1	SerialPort1	p1	115200	None	8	1	RTS/CTS	Enable	RS-232
2	SerialPort2	p2	115200	None	8	1	RTS/CTS	Enable	RS-232

Submit

In this demonstration, we use the NPorts' DO-00 to trigger DI-00 (connect DO-00 to DI-00 by wire).



3.1 Sending Serial Patterns From the Device to the Cloud

In this section, we will instruct you how to send serial data to the cloud. We use Device Explorer Twin to monitor whether the PC has sent a pattern through the NPort’s Serial Port 1 to the cloud.

1. Log in to the NPort’s web console and change Serial Port 1’s **Operation mode** to IoT and set **Force transmit** at 500. The NPorts support several types of data packing combinations. For the purposes of this demonstration, we use **Force transmit**. If needed, set the correct **Data Packing** method.

⚙️ Operation Mode

Port Settings

Port: 1

Operation mode: IoT

Sniffer mode: Enable (Subscribed messages will be dropped)

Data Packing

Packet length: (0 - 2880)

Delimiter 1: (HEX) Enable

Delimiter 2: (HEX) Enable

Delimiter process: Do Nothing (Processed only when the packet length is 0)

Force transmit: (0 - 65535 ms)

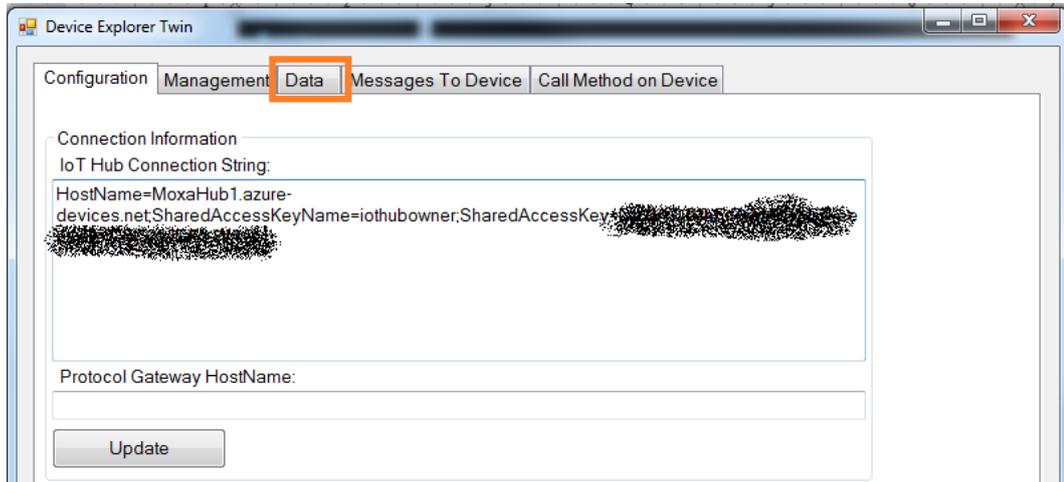
Apply the above settings to all serial ports

Click **Submit** to activate the new settings.

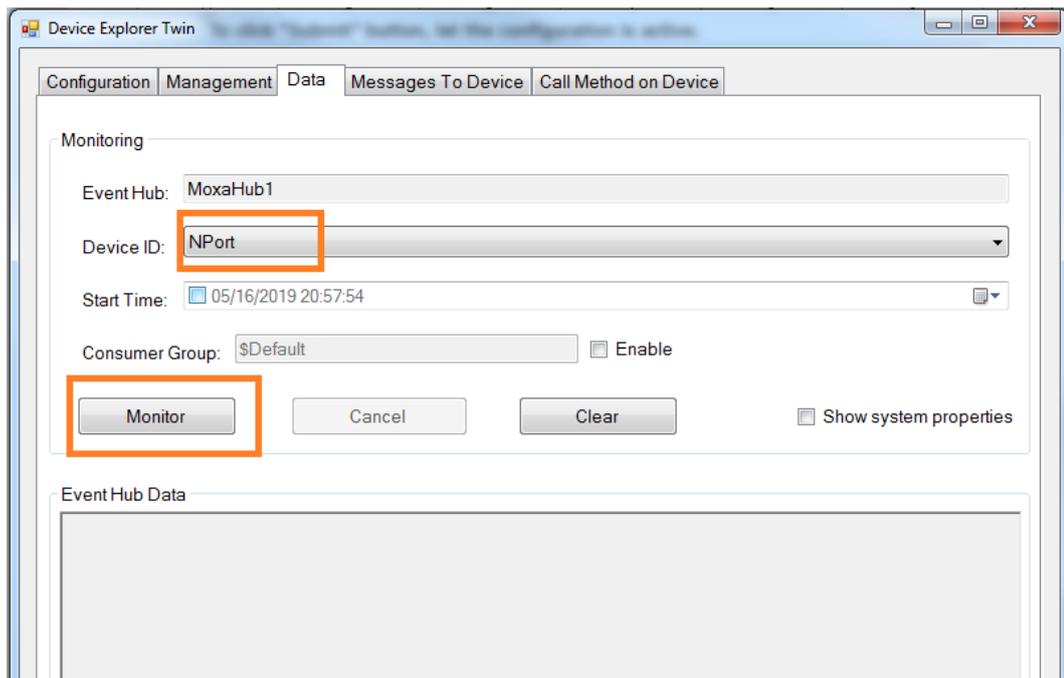
⚙️ Operation Mode

Port	Operating mode	Packet length	Delimiter 1	Delimiter 2	Delimiter process	Force transmit
1	IoT	0	00 (Disable)	00 (Disable)	Do Nothing	500
2	Real COM	0	00 (Disable)	00 (Disable)	Do Nothing	0
Max connection:			1			

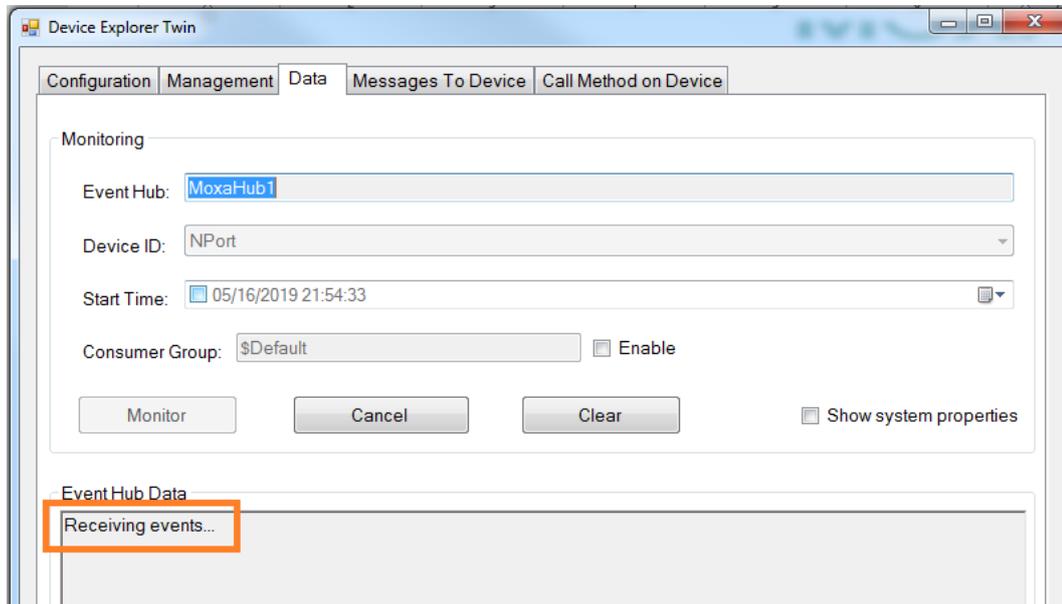
2. On the **Device Explorer Twin** page, click the **Data** tab.



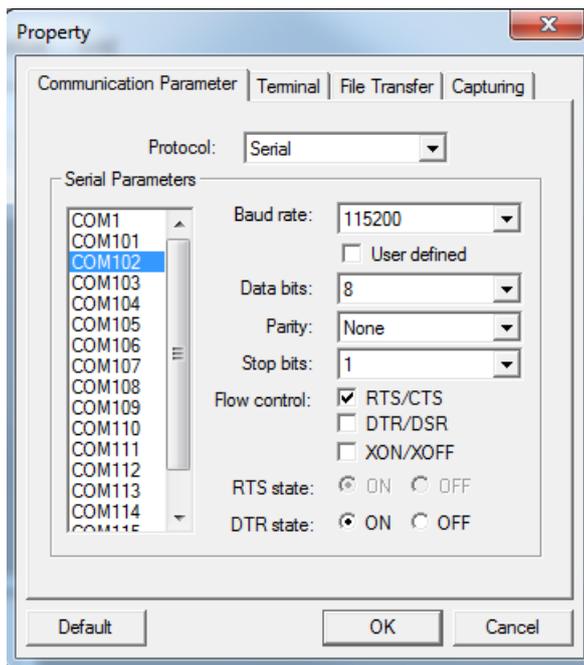
Select **NPort** in the drop-down menu under **Device ID** and click **Monitor** to begin monitoring the NPort's IoT messages.



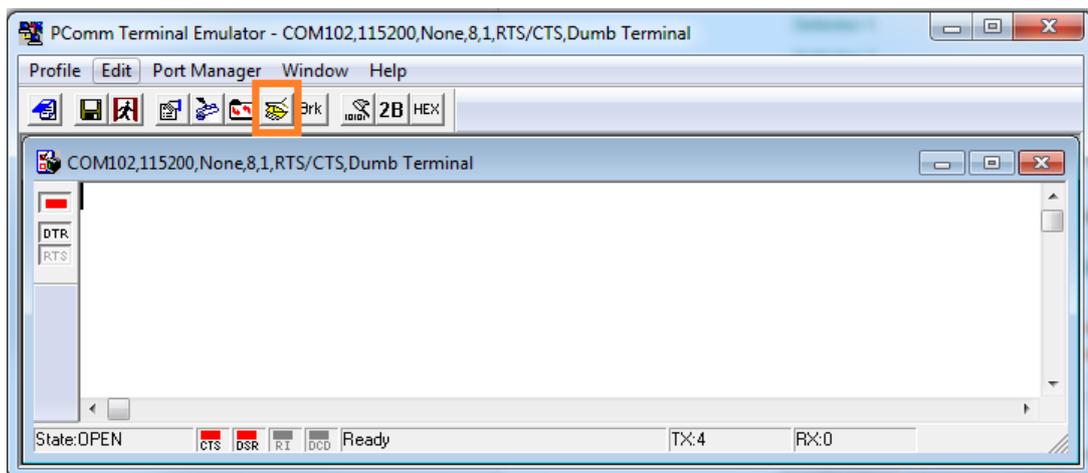
Under the **Event Hub Data** status box, the message will read "Receiving events".



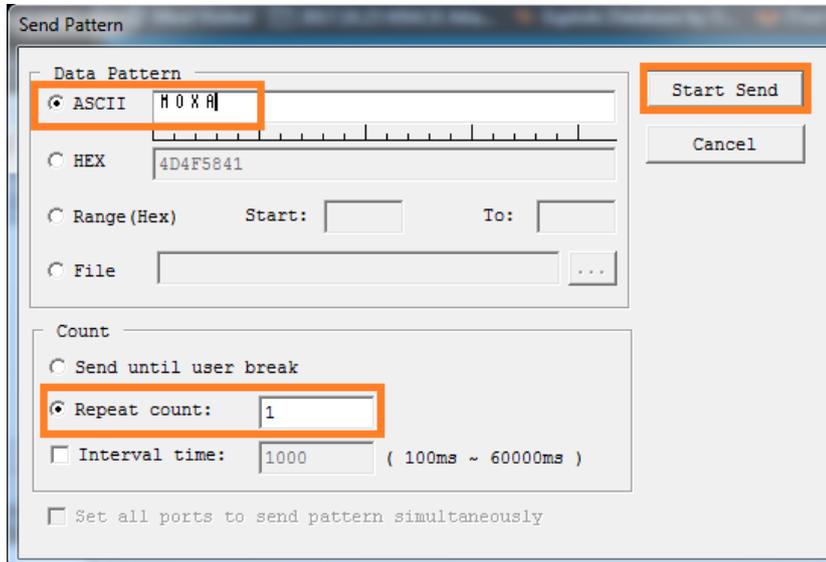
3. Launch PComm Terminal Emulator on PC 1 and open COM Port with the NPort's serial default settings as below:
 - Port number: PC 1's native COM port connecting to the NPort's Port 1
 - Baud rate: 115200
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow control: RTS/CTS



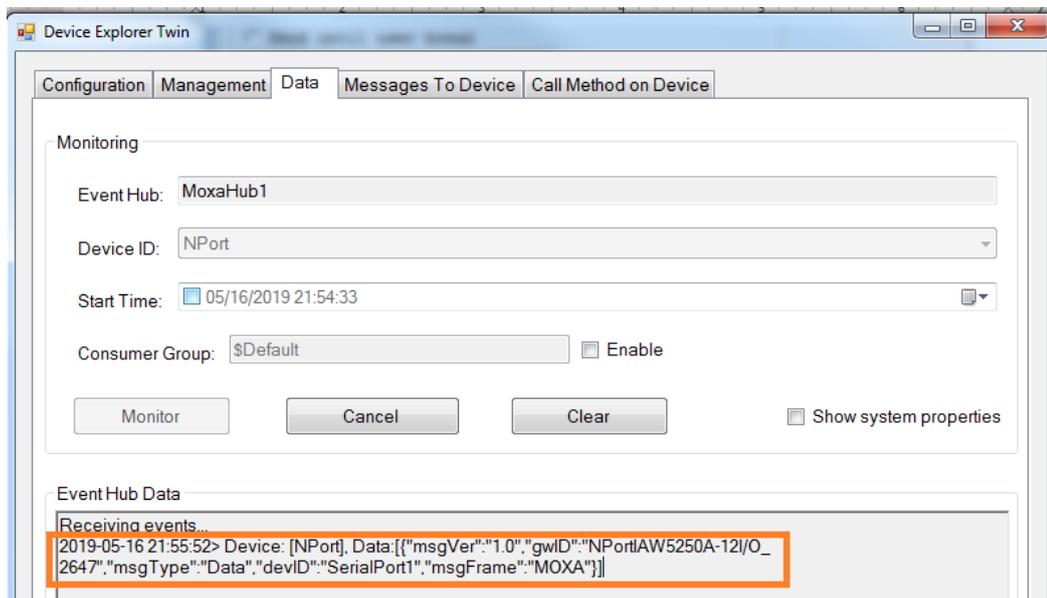
4. Click the **Send Pattern** button, or on the toolbar, select **Port Manager** → **Send Pattern** to send a serial pattern.



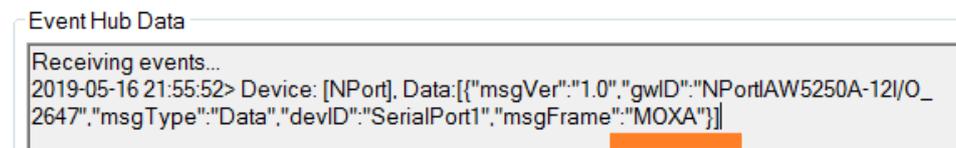
In the **Send Pattern** window, select **ASCII** and fill in "MOXA"; then, select **Repeat count** and enter "1". Click **Start Send** to send the pattern.



5. On the **Device Explorer Twin** page, you will receive an IoT message from the cloud that was sent from the NPort.



The serial data pattern will be filled in the msgFrame.



3.2 Sending Serial Data From the Cloud to the Device

In this section, we will instruct you on how to send serial data to PC 1 from the cloud. We use **Device Explorer Twin** to send an IoT message to the NPort's Serial Port 1.

1. Click **Serial JSON**.

IoT Mode

Basic Settings

IoT platform

Azure IoT Hub Settings

Device connection string

Serial and I/O Message Format Settings

Serial and I/O message definition

I/O publish trigger mode

Copy **Subscribe JSON Message**:

Serial JSON Message Definition

Publish JSON Message

```
{
  "msgVer"      :      "1.0",
  "gwID"        :      "NPortIAW5250A-12I/O_2647",
  "devID"       :      "SerialPort1",
  "dateTime"    :      "2018-08-27T15:43:14+08:00",
  "msgNumber"   :      0-65535,
  "msgType"     :      "Data",
  "msgFrame"   :      "Raw data from serial port"
}
```

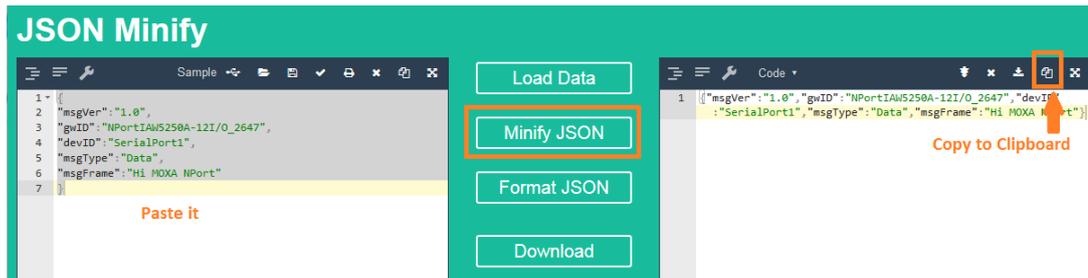
Subscribe JSON Message

```
{
  "msgVer"      :      "1.0",
  "gwID"        :      "NPortIAW5250A-12I/O_2647",
  "devID"       :      "SerialPort1",
  "msgType"     :      "Data",
  "msgFrame"   :      "Raw data to serial port"
}
```

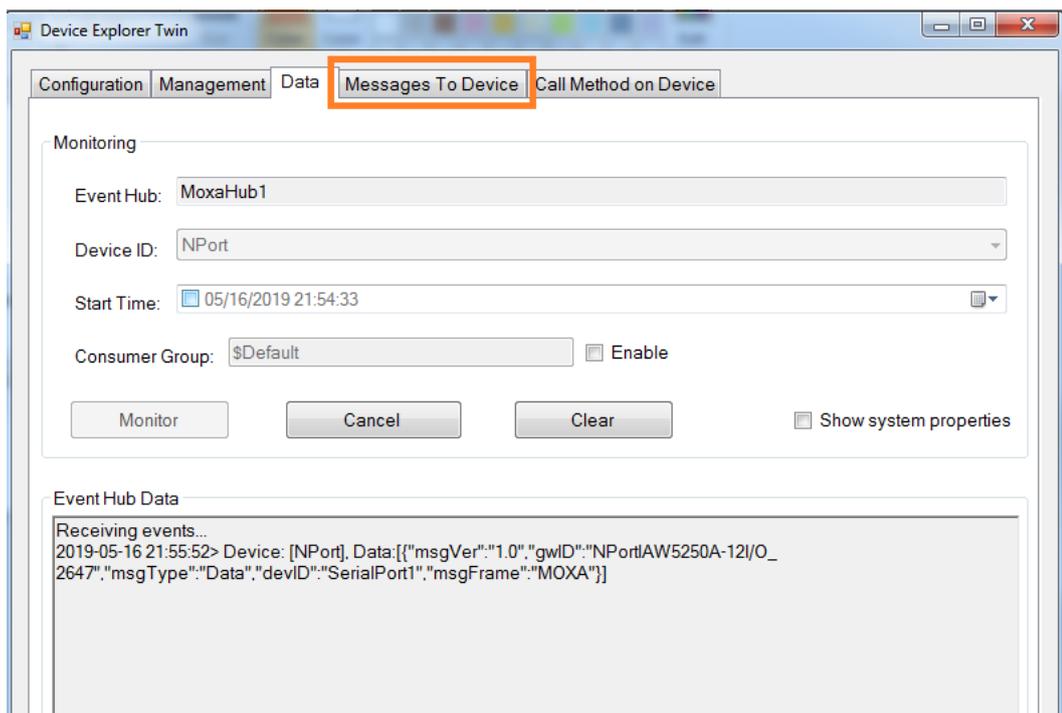
- The copied message has a lot of space and line feed. We can use a tool to compact it.
Below is a free online tool:

<https://jsonformatter.org/json-minify>

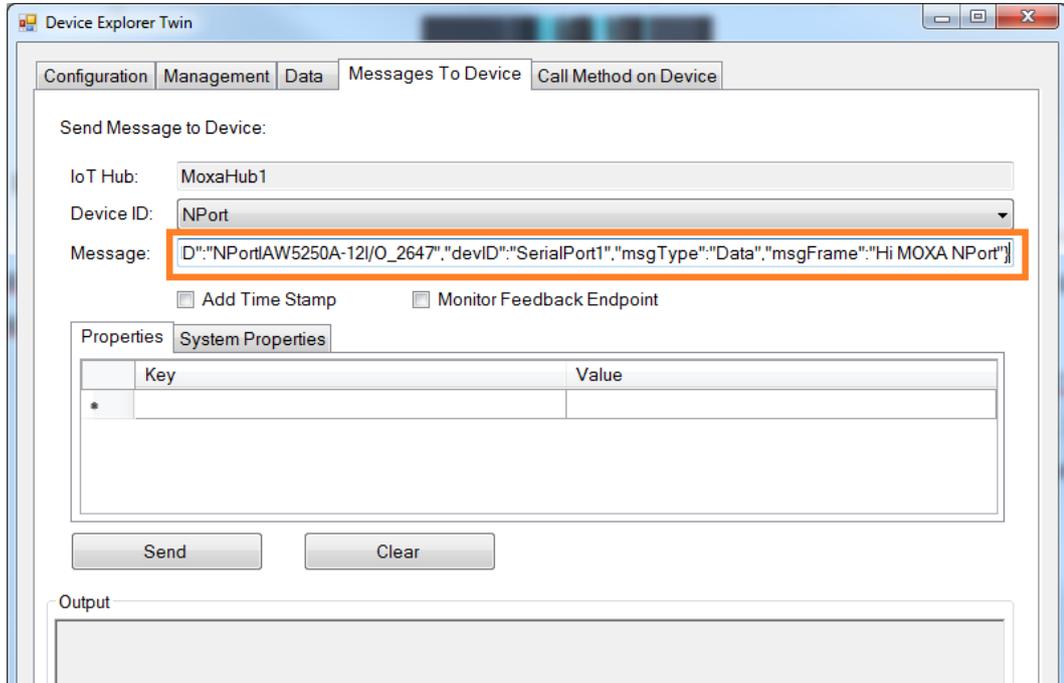
Paste the message in the column on the left and change the msgFrame stating "Raw data to serial port" to read "Hi MOXA NPort"; then, click **Minify JSON**. It will show a compact JSON format message in the column on the right. Click **Copy to Clipboard**.



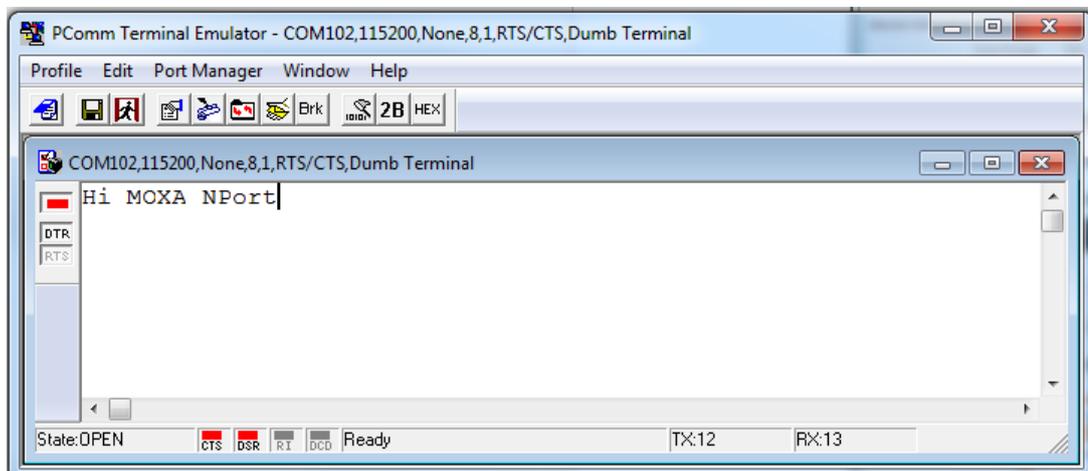
- On the **Device Explorer Twin** page, click the **Message To Device** tab.



4. To send a message to the NPort's Serial Port 1, click the **Message To Device** tab, paste the clipboard message in text area of **Message** and click **Send**.



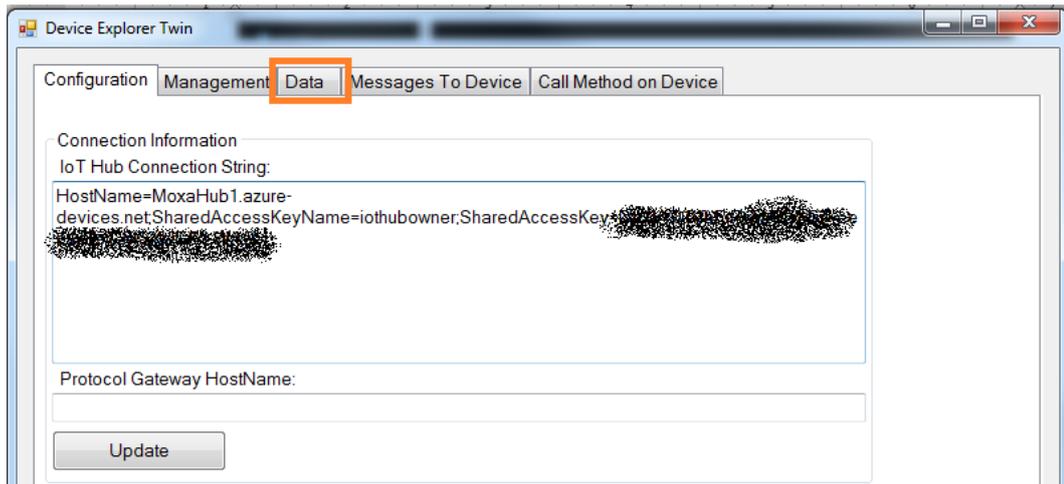
On the **PComm Terminal Emulator** page, you will receive an IoT message from the cloud, sent from Device Explorer Twin.



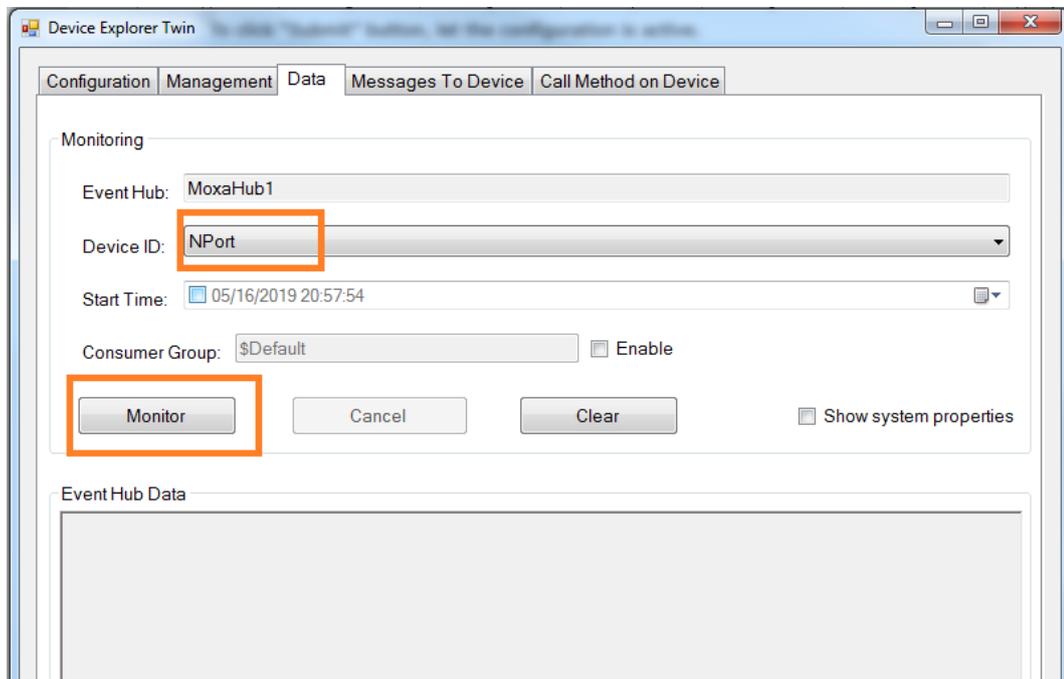
3.3 Sending the NPort's DI and DO Status to the Cloud

In this section, we will instruct you on how to trigger the DI status to the cloud. First, we use the Device Explorer Twin tool to monitor the NPort's I/O status; then, trigger the DI status to change; lastly, you will receive an IoT message regarding the NPort's DI and DO status.

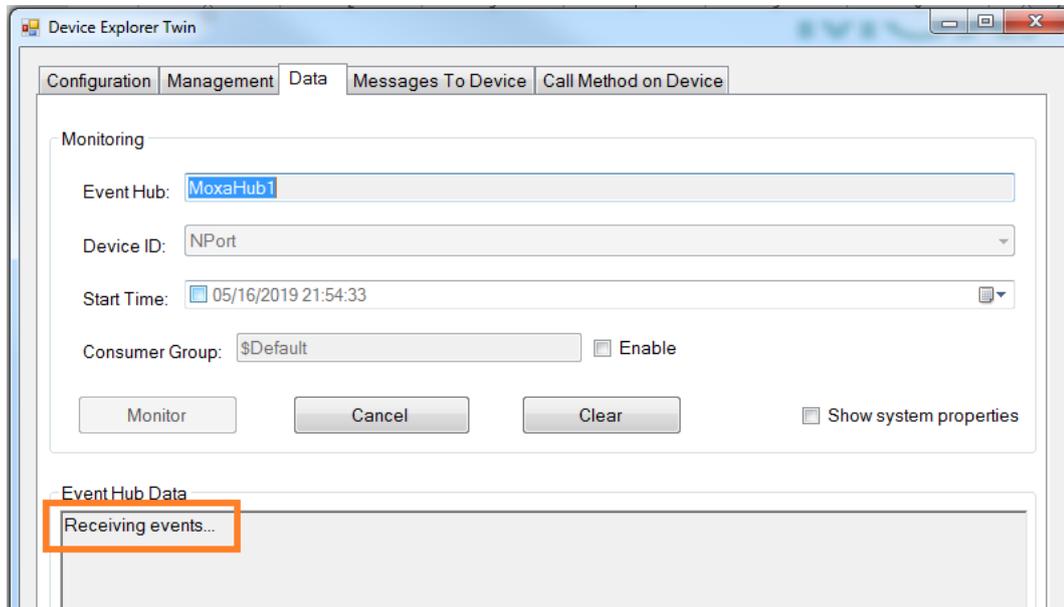
1. On the Device Explorer Twin page, click **Data**.



Select **NPort** in the drop-down menu under **Device ID**, and click **Monitor** to start monitoring the NPort's IoT messages.



In the **Event Hub Data** message box, a message should read "Receiving events..."



2. Log in to the NPort's web console and change **DI assess interface** to "IoT+Web+Modbus address mapping" on the **Remote I/O Access Interface** page.

Remote I/O Access Interface

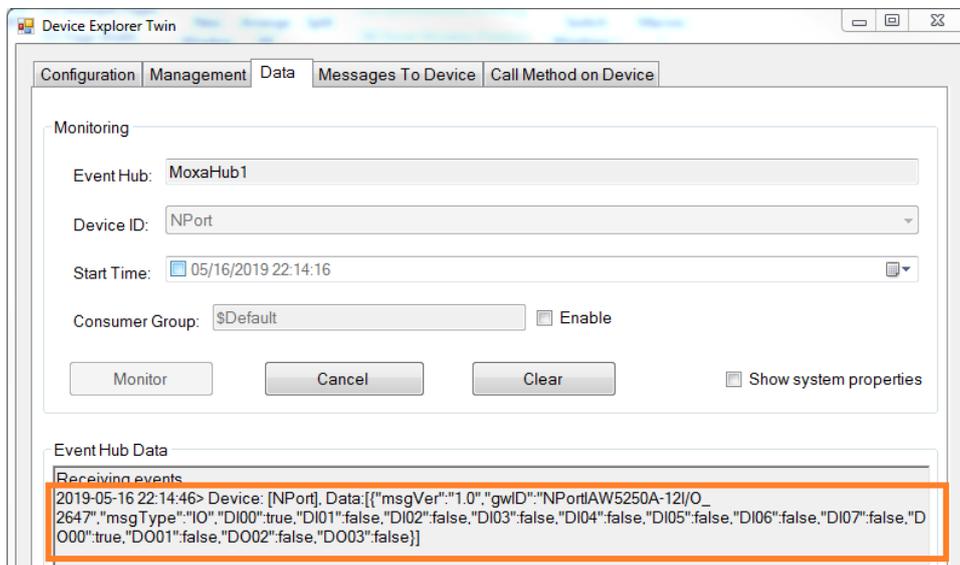


3. Change **DO Status** to "ON" in the **DO Channel 0 Settings** page.

⚙️ DO Channel 0 Settings

Mode	DO Status	ON Width*	OFF Width*	Pulse Count	Pulse Start
1. Current Setting					
DO	ON				
2. Power On Setting					
	OFF				
3. Safe Status Setting					
	OFF				
Apply to all					
<input type="checkbox"/> Apply to all DO channels					
4. Alias Name					
Alias name of channel					
DO-00					
Alias name of "OFF" status					
OFF					
Alias name of "ON" status					
ON					

4. On the **Device Explorer Twin** page, you should receive a message from the cloud that which was sent from the NPort.



The DI and DO status will appear in JSON message format. The DI00 and DO00 status will read as "true".

Event Hub Data

```
Receiving events...  
2019-05-16 22:14:46> Device: [NPort], Data:[{"msgVer":"1.0","gwID":"NPortIAW5250A-12/I/O_2647","msgType":"IO","DI00":true,"DI01":false,"DI02":false,"DI03":false,"DI04":false,"DI05":false,"DI06":false,"DI07":false,"DO00":true,"DO01":false,"DO02":false,"DO03":false}]
```

3.4 Control the NPort's DO Status Through the Cloud

In this section, we instruct you on how to change an NPort's DO status via the cloud. First, we use the Device Explorer Twin tool to send an IoT message to the NPort's I/O topic; then, the NPort will receive an IoT message from the cloud to change the DO status; lastly, we will set the NPort's DO status on the web console.

1. Click **I/O JSON**.

IoT Mode

Basic Settings

IoT platform Azure IoT Hub

Azure IoT Hub Settings

Device connection string HostName=MoxaHub1.azure-devices.net;DeviceId=NPort;Shar

Serial and I/O Message Format Settings

Serial and I/O message definition Serial JSON **I/O JSON**

I/O publish trigger mode Specific I/O change DI-00

Submit

Copy **Subscribe JSON Message**:

Subscribe JSON Message

The following DI and DO key-values are all optional

```
{  
  "msgVer"      : "1.0",  
  "gwID"        : "NPortIAW5250A-12/I/O_2647",  
  "msgType"     : "IO",  
  "DO00"        : true/false,  
  "DO01"        : true/false,  
  "DO02"        : true/false,  
  "DO03"        : true/false  
}
```

- The copied message has a lot of space and line feed. We can use a tool to compact it.

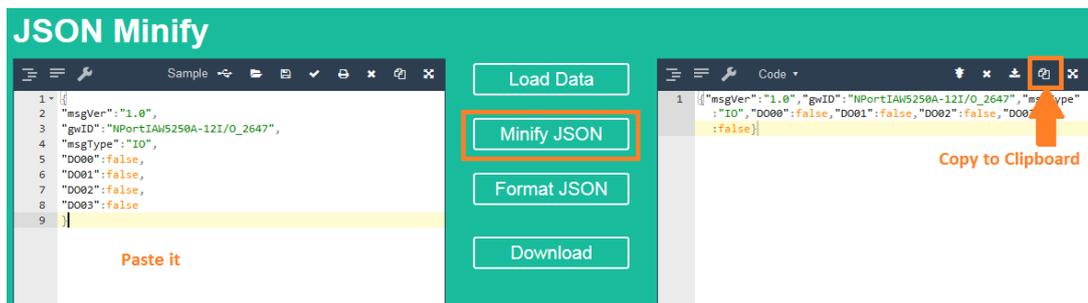
Below is a free online tool:

<https://jsonformatter.org/json-minify>

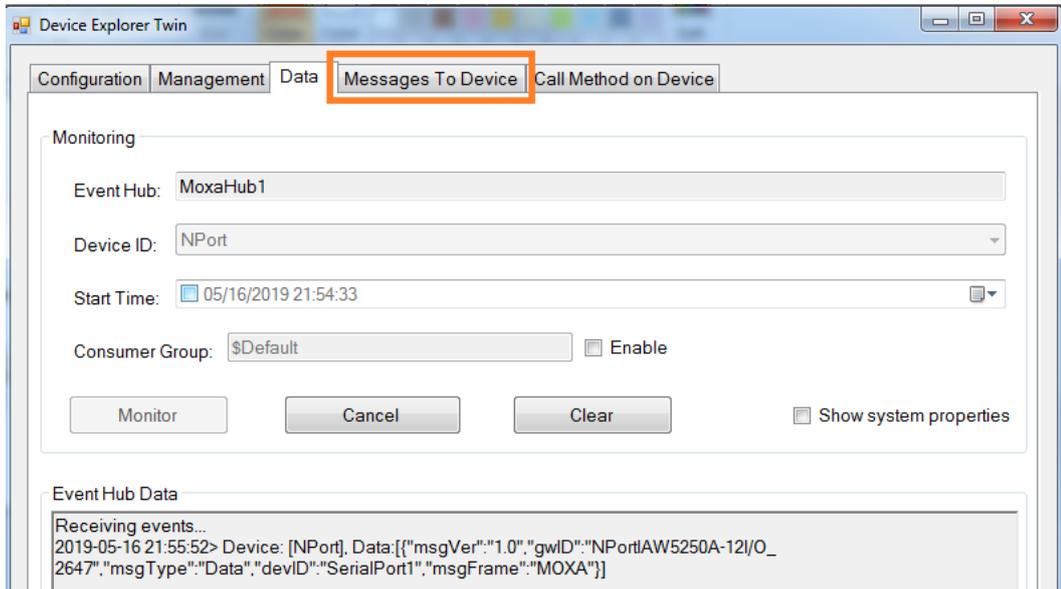
Paste the message in the column on the left side and change all the DO statuses to false.



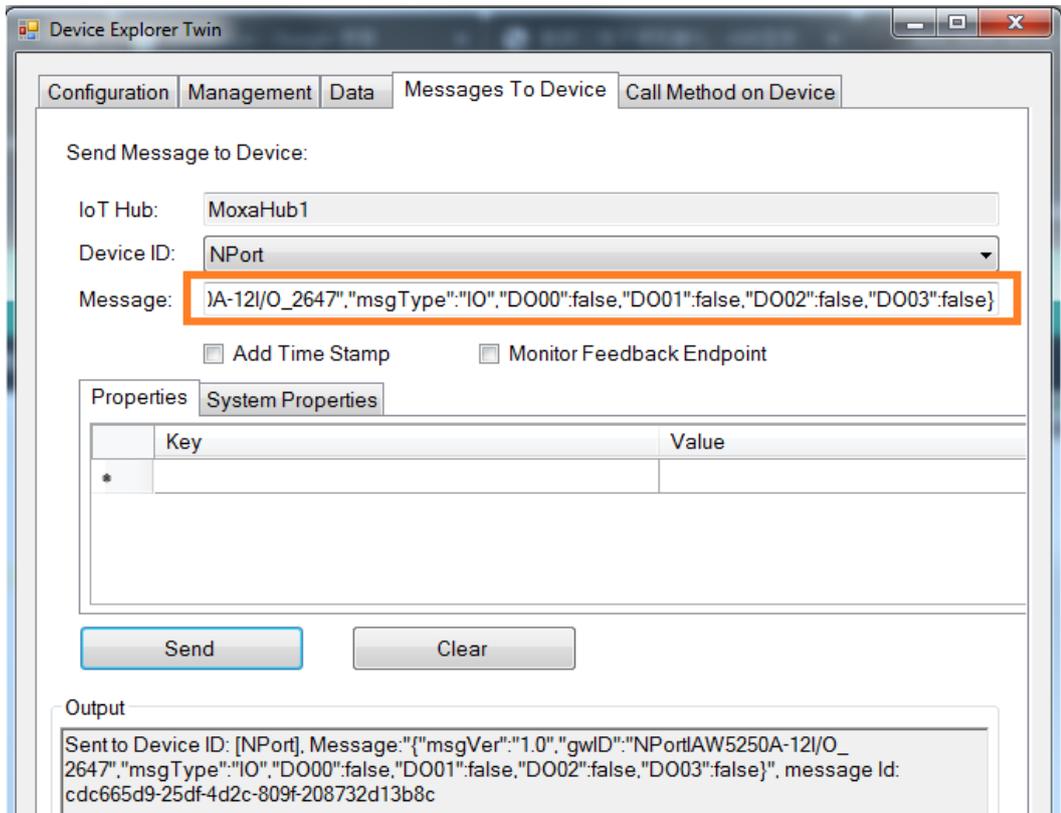
Click **Minify JSON**. It will show a compact JSON format message in the column on the right. Click **Copy to Clipboard**.



3. On the **Device Explorer Twin** page, click the **Message To Device** tab.



4. To send a message to the NPort, click the **Message To Device** tab, paste the clipboard message in the text area of **Message**, and click **Send**.

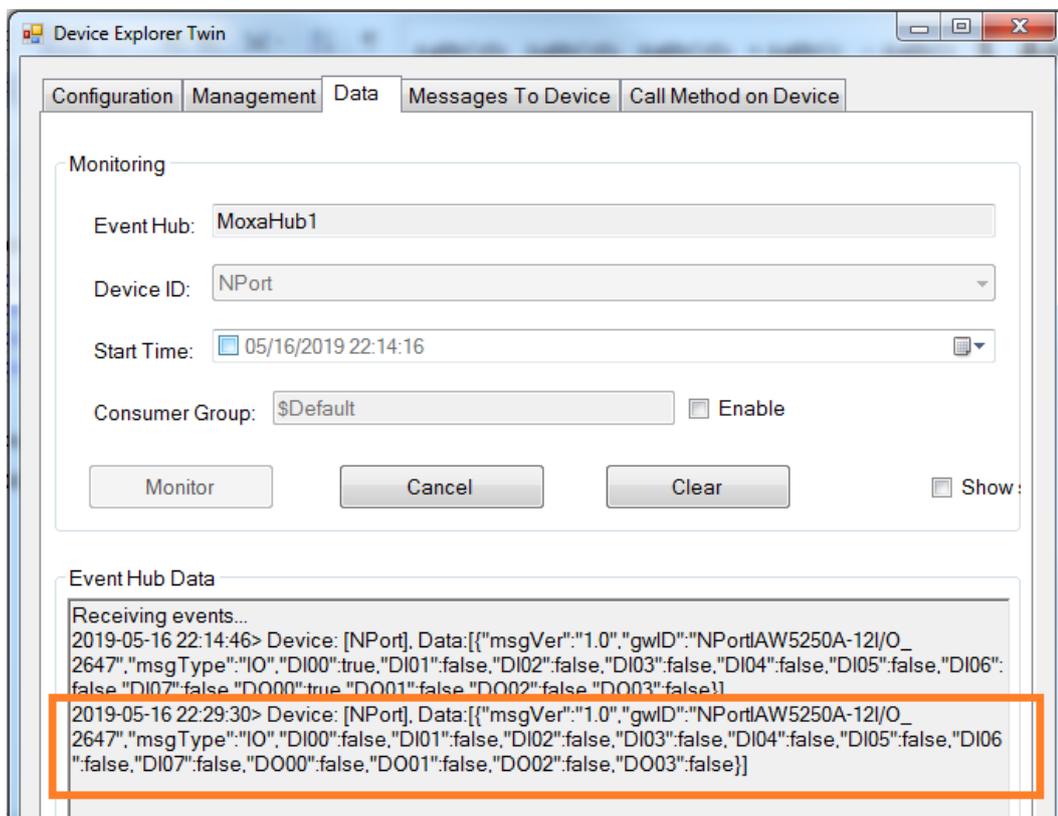


On the NPort's web console set DO-00 status as OFF.

DO Channel Settings

DO Channel	Mode	Status	ON Width	OFF Width
DO-00	DO	OFF	--	--
DO-01	DO	OFF	--	--
DO-02	DO	OFF	--	--
DO-03	DO	OFF	--	--

Also you can find a new message under the **Data** tab on the **Device Explorer Twin** page, because we connect DO-00 to DI-00.



That new message shows both DI-00 and DO-00 statuses as false.

```
2019-05-16 22:29:30> Device: [NPort], Data:[{"msgVer":"1.0","gwID":"NPortIAW5250A-12I/O_2647","msgType":"IO","DI00":false,"DI01":false,"DI02":false,"DI03":false,"DI04":false,"DI05":false,"DI06":false,"DI07":false,"DO00":false,"DO01":false,"DO02":false,"DO03":false}]
```