RIO-2010BM

Use RIO-2010BM to connect Watson IoT platform and work with Node-RED

User Guide

Version: 1.2

2018 May

Artila

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Document Amendment History

Revision	Date	Remark
V 1.0	2017 Feb.	Initial
V 1.1	2017 Jul.	Add “WAPI (Web API) information”
V1.2	2018 May	Editorial amendment

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1 Introduction

RIO-2010BM is designed with FreeRTOS+lwIP (lightweight version of TCP/IP), which can automatically connect to Bluemix with verified instructions and push sensor data to cloud with Transport Layer Security (TLS) and MQTT Protocol. Applying on a Watson IoT platform, users can easily create a web-based application to monitor and analyze data. As for a more complex application, RIO-2010BM supports Node-RED, a powerful visual wiring tool for the Internet of Things which is easy to wire together events and devices for the Internet of Things. With it, customers can take their IoT innovation to market faster and create new business value.

1.1 Features

- One 10/100Mbps Ethernet port
- One isolated RS-485 port
- 16 photo isolated digital input port
- Isolation voltage 2500Vrms
- 8 channel relay output port
- Form A or form B relay with contact rating 30VDC@1A or 125VAC@0.5A
- Operation mode: Modbus IBM Watson IoT platform MQTT (TLS) and Web based I/O control and alarm.
- DIN Rail mounting
- Windows configuration utility included

1.2 Specification

- **Ethernet:**
  - 10/100Mbps, RJ45
  - Protection: 1500V Magnetic isolation
  - Protocol: Web API / MQTT
- **Serial Console Port:**
  - RS-232: 115200 baud rate, None flow control, 8 bits data, 1 stop bit
- **Isolation digital input:**
  - Channel number: 16
  - Photo isolation (AC in): 2500Vrms
  - Logical High: 5~24Vdc
  - Logical Low: 0~1.5Vdc
  - Input resistance: 1.2KOhm@0.5W

- **Relay Output:**
  - Channel number: 8
  - Contact rating: 30VDC@1A or 125VAC@0.5A
- **1-Wire port:** Three-pin terminals x 3 (Maxim 1-Wire)
- **Power:** 9~48VDC terminal block
- **Power Consumption:** Max. 220mA@12V (Min. 55mA@12V)
- **Dimension (W x H x D):** 182 x 118 x 35.82mm
- **Operating Temperature:** 0~70°C
- **Storage Temperature:** -20~85°C

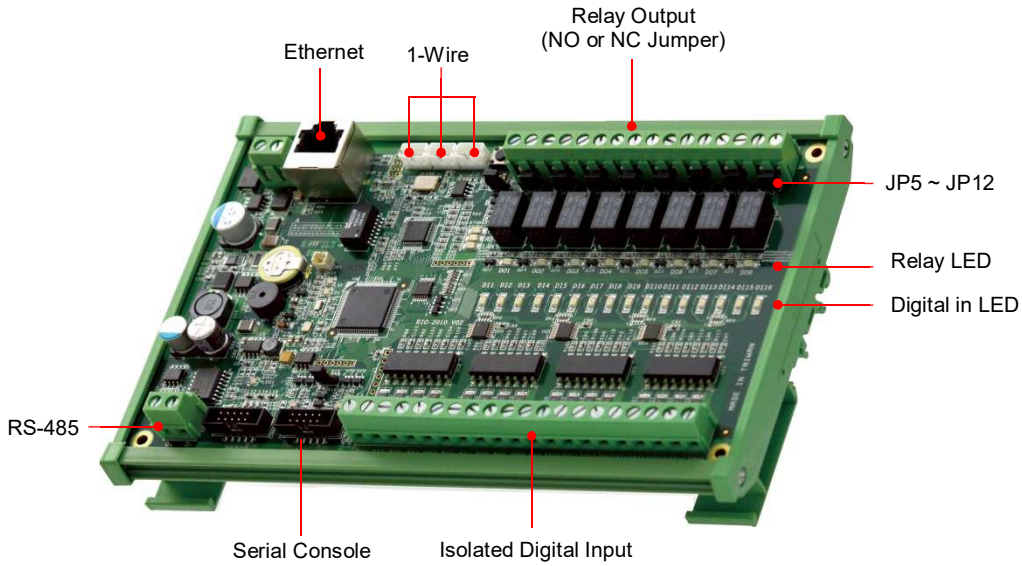
1.3 Packing List

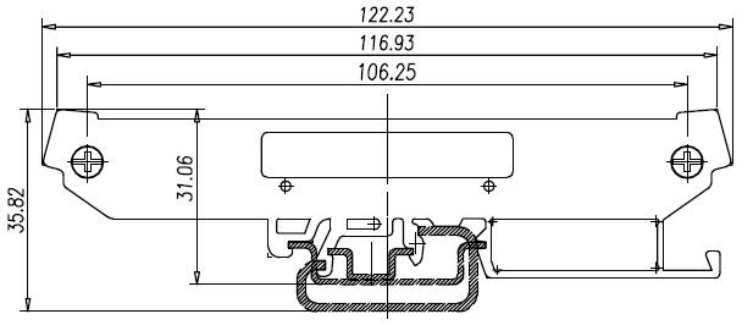
- RIO-2010BM: Bluemix-ready remote I/O module
- Software utility download from Artila Web (http://www.artila.com/download)

1.4 Optional Accessory

- CBL-F10M9-20 (91-0P9M9-001): Serial Console Cable (10Pin Header to DB9 male)
- DS18B20 (91-6DS18-001): Programmable Resolution 1-wire Digital Thermometer
- PWR-12V-1A (31-62100-000): 110~240VAC to 12VDC 1A Power Adaptor

2 Layout


Relay Output
(NO or NC Jumper)
Ethernet
1-Wire
JP5 ~ JP12
Relay LED
Digital in LED
RS-485
Serial Console
Isolated Digital Input


122.23
116.93
106.25
31.06
35.82

3 Pin Assignment and Definition

3.1 Power Connector

Connecting 9~48VDC power line to the Power in terminal block. If the power is properly supplied, the Power LED will keep solid green color and a beep will be heard.

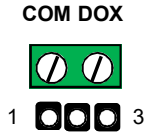
3.2 LED Status

The LED provides the RIO-2010BM operation information. The LED status is described as follow:

- **Power (PWR) LED:** Power LED keeps ON if power (+9VDC to +48VDC) is correct.
- **Ready (RDY) LED:** Ready LED keeps ON when RIO-2010BM firmware is ready for operation.
- **Link / Act (LAN) LED:** Link and Activity LED will turn ON when the Ethernet cable is connected. When there is network data traffic, this LED will flash.
- **LED 1 / 2 / 3:** These LEDs are dual color and they indicates the serial data traffic of RS-485, RS-232 and serial console respectively. The Yellow LED stands for receiving data and Green LED means transmitting data.
- **LED DO1 / DO8:** These LEDs indicates the DO status. When the coil of relay is energized, the LED will be ON.
- **LED DI1 / DI16:** These LEDs indicates the DI status. When the input is high, the LED will be ON.

3.3 Jumper Setting of Relay Output (JP5 ~ JP12)

- **Normal open:** when jumper is shorted to **2-3**, the terminal (DOX and COM) is normal open when DO LED is off.
- **Normal close:** when jumper is connected to **1-2**, the terminal (DOX and COM) is normal close when DO LED is off.



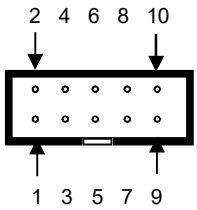
> ☞ **Note**
>
> JP2 and JP4 are designed for factory usage and should be set to position 2-3.

3.4 Serial Port Connector

- **RS-232 and Console Port:**

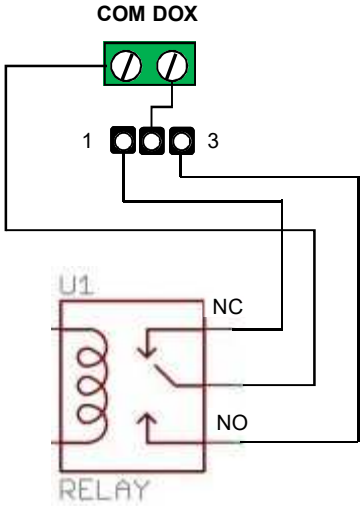
Pin	COM2	COM3
1	DCD	N/C
2	DSR	N/C
3	RXD	RXD
4	RTS	N/C
5	TXD	TXD
6	CTS	N/C
7	DTR	N/C
8	N/C	N/C
9	GND	GND
10	N/C	N/C

COM2: RS-232
COM3: Console



3.5 Relay Output Connector (J6)

The relay can be configured as Normal Open or Normal Closed by the relay jumpers.



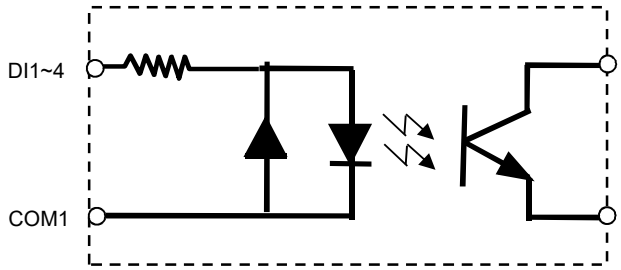
3.6 Reset Button (SW1)

Press the hardware reset button will reset the system.

3.7 Digital Input Connector (J5)

The 16 channel isolated input are equipped with 2500Vrms photo coupler isolator. Four of the channels form a group and share the same common ground. The specification of the isolated input channels are:

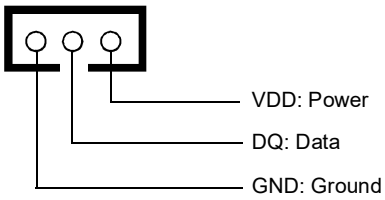
Logical High: 5~24Vdc
Logical Low: 0~1.5Vdc
Input resistance: 1.2KOhms@0.5W
Response time: 20μs
Isolation: 2500Vrms



DIx: Isolated digital input channels.
COMx: Common ground of four DIx.

3.8 1-Wire Port Connector (JP3, JP13, JP14)

1-Wire is a device communications bus system designed by Dallas Semiconductor Corp. It is typically used to communicate with small inexpensive devices such as digital thermometers such as DS18B20 from Maxim and weather instruments. RIO-2010BM provides three connectors for 1-Wire device. The pin definition is follow:



3.9 Factory Default Settings

IP Address: 192.168.2.127
Netmask: 255.255.255.0
Relay output: Normal open
Web port: http://192.168.2.127:5003
Telnet console: telnet 192.168.2.127 5001
MQTT publish: TLS secured
Alarm settings: Disabled
Email alert: Disabled

4 Connect to Watson IoT platform and work with Node-RED

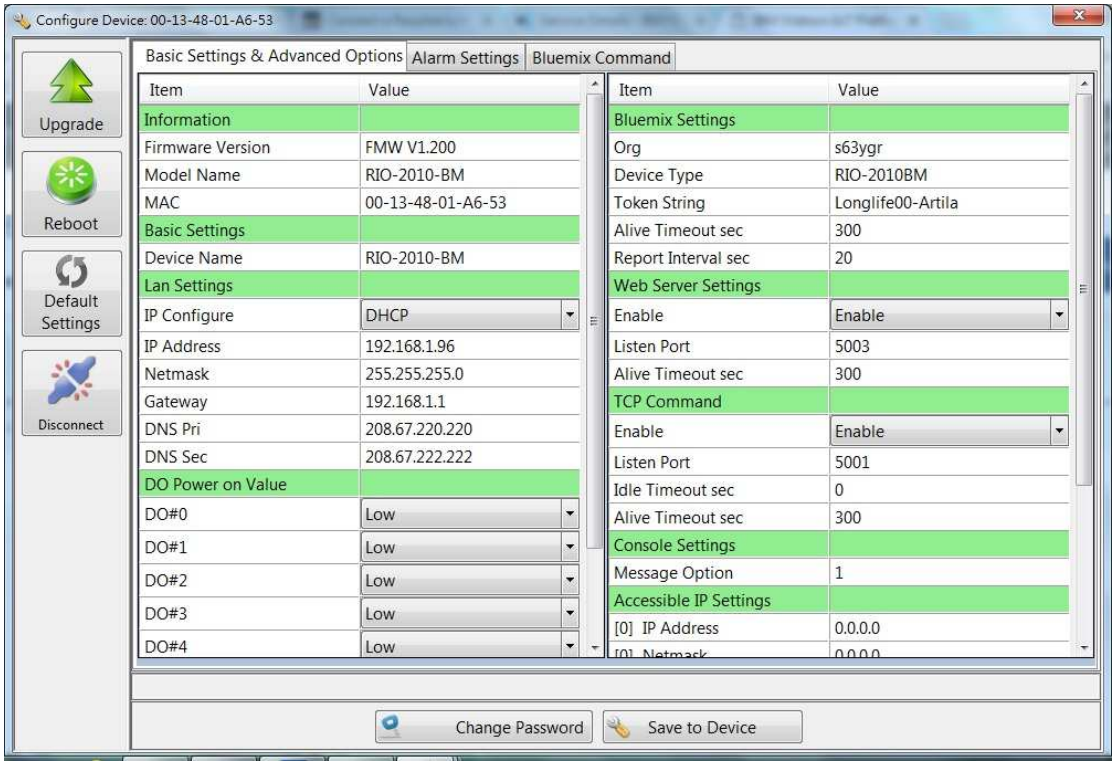
Securely connect the RIO-2010BM module to Watson IoT platform and visualize data by the dashboard of Watson IoT platform and then use Node-RED application to receive an event from RIO-2010BM.

4.1 Download Manager Utility

You may visit Artila website: http://www.artila.com/, click “Download”

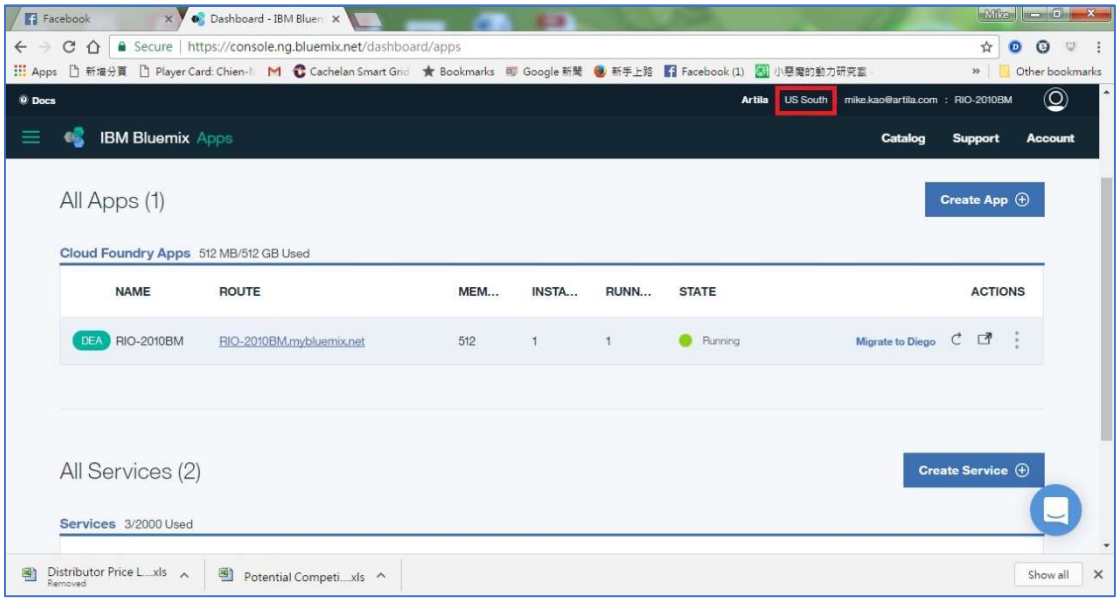
Select “RIO-2010BM” at Download page that shows the product series.
http://www.artila.com/download/RIO/RIO-2010BM.zip

4.2 Install Manager in your windows-based computer and run the Manager

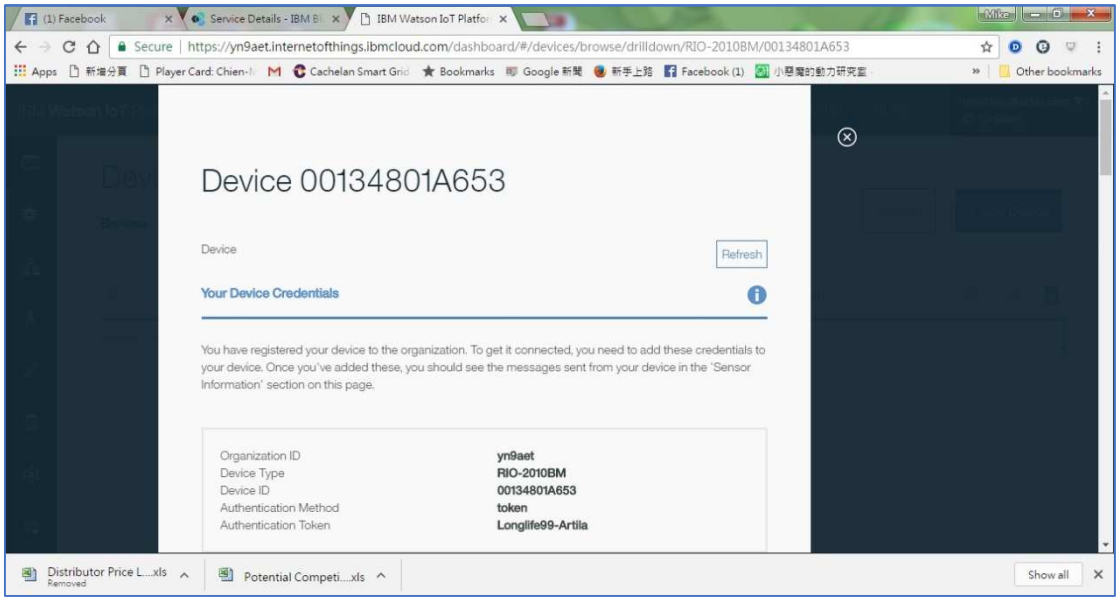


4.3 Register RIO-2010BM to Watson IoT Platform

To use Watson IoT platform, you need to register your device first. Please visit IBM Bluemix website for registration. Remember to select the Region (South USA) where IoT platform is available.



Carry out the steps present in the recipe to register your device in IBM Watson Internet of Things Platform. Remember to use RIO-2010BM MAC address which can be found in the Manager utility as device ID e.g. 00134801A653



4.4 Registration in Watson

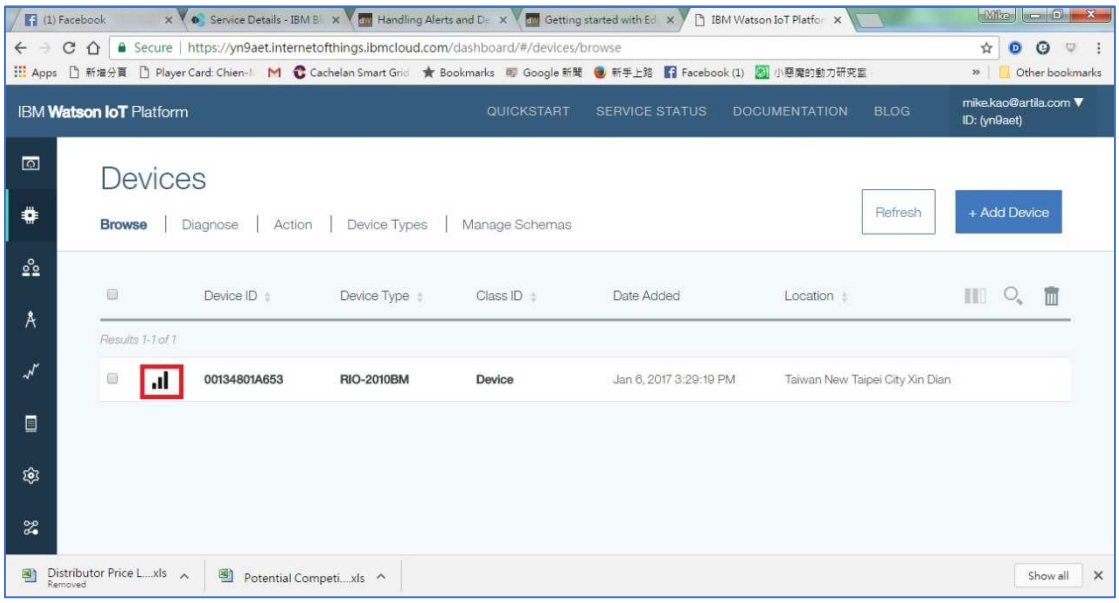
Fill the registration information of device in Watson to the Manager utility in this case as following:

Org: s63ygr

Device type: RIO-2010BM

Token String: Longlife00-Artila

Once connected, it is shown as below.



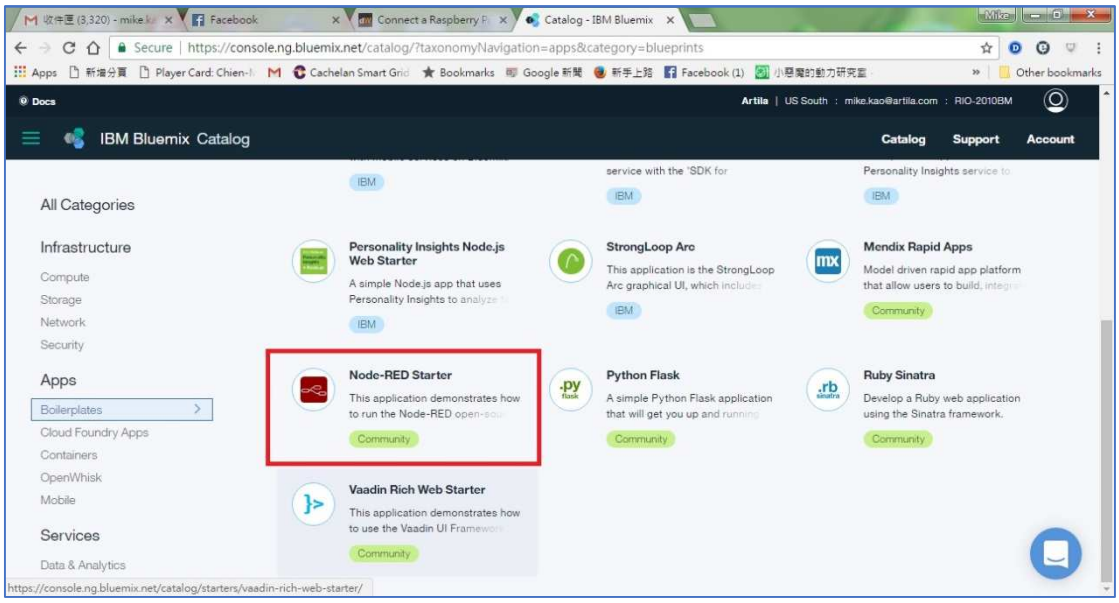
4.5 Visual the data in Watson IoT Platform Dashboard

With the new boards and cards capability in the Watson Internet of Things platform, you can build your own Custom dashboard without writing any code. You can use the boards as the landing page of interest and then make use of the cards within them to:

(1) Create visualization charts for the real time data from your devices
(2) Create Gauges for visualizing physical quantities like Temperature.
(3) Create Donuts charts, bar charts to display the current value of the data points
(4) See the Data and storage consumption of your devices
(5) List of registered devices and etc..

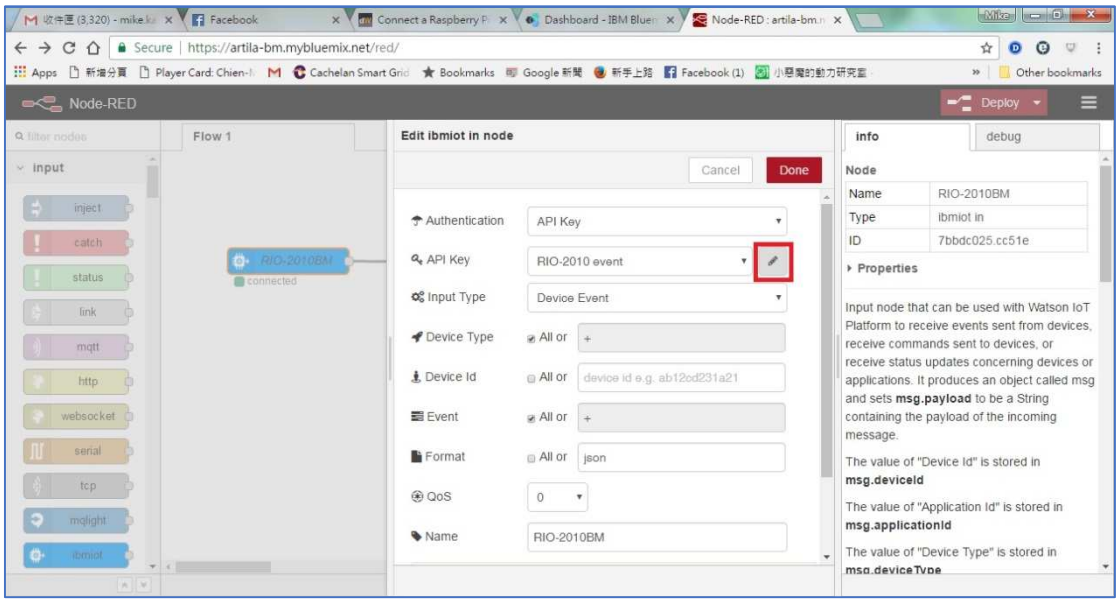
5 Connect to Watson IoT Platform & Work with Node-RED

In the Bluemix catalog, select the Node-RED Starter under the Boilerplate category as shown below,

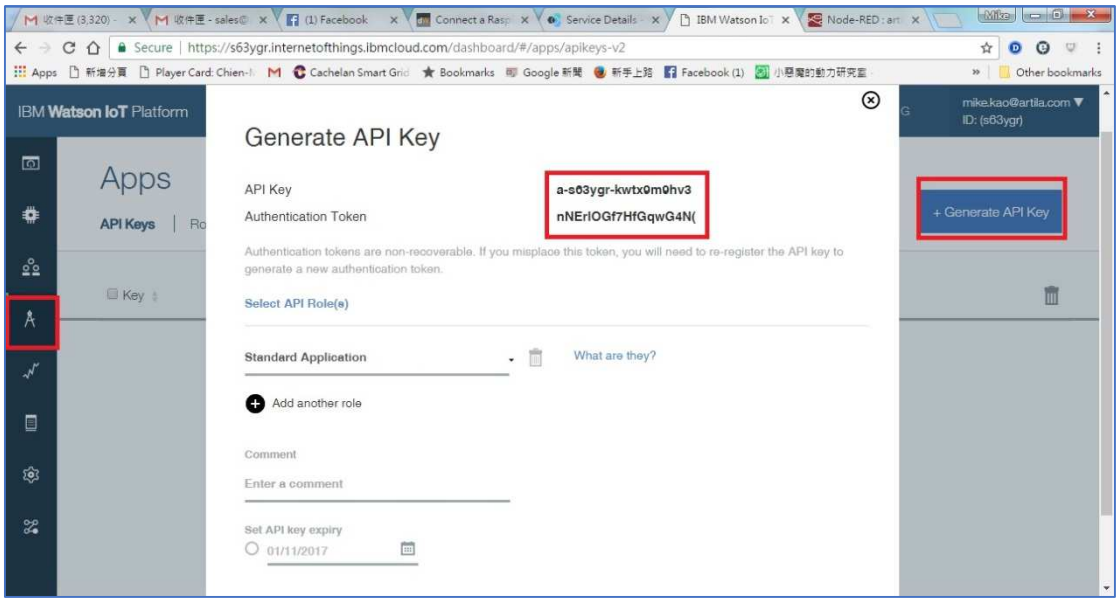


(1) Open Node-RED flow editor

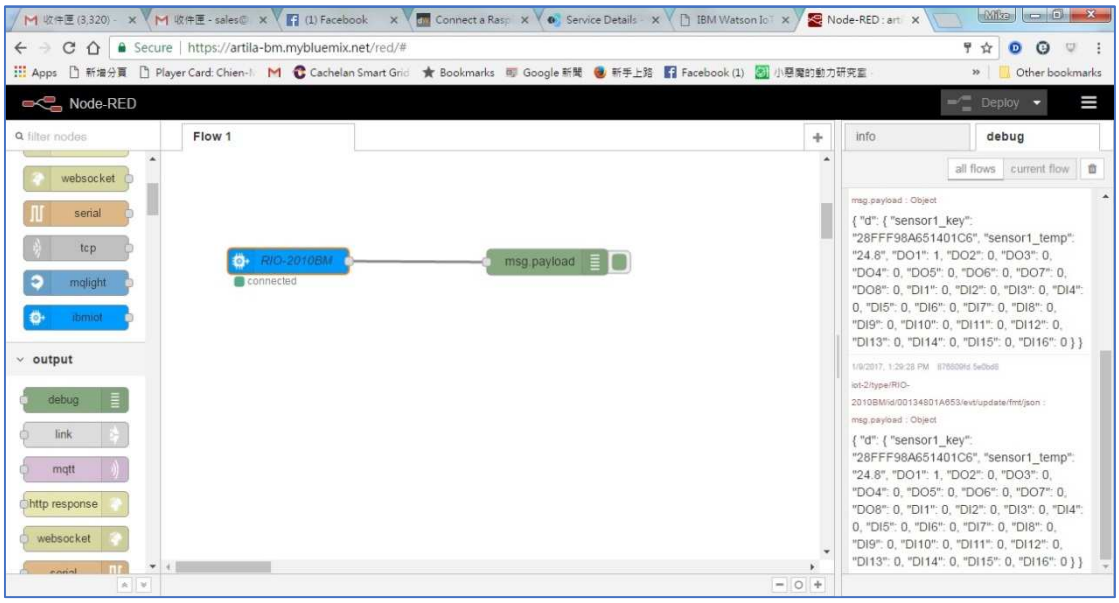
(2) Add an ibmiot input node and configure it to use API key authentication. Set the Device Type field to match the type you used to register your device with. Leave the Device Id and Event fields set to all.



(3) The API key is required and can be generated by Watson IoT Platform



(4) Attach the debug node to the IBM IoT node as shown below to output the data points in the debug panel.



6 WAPI (Web API) on RIO-2010BM

6.1 Read 1-Wire Temperature Sensor

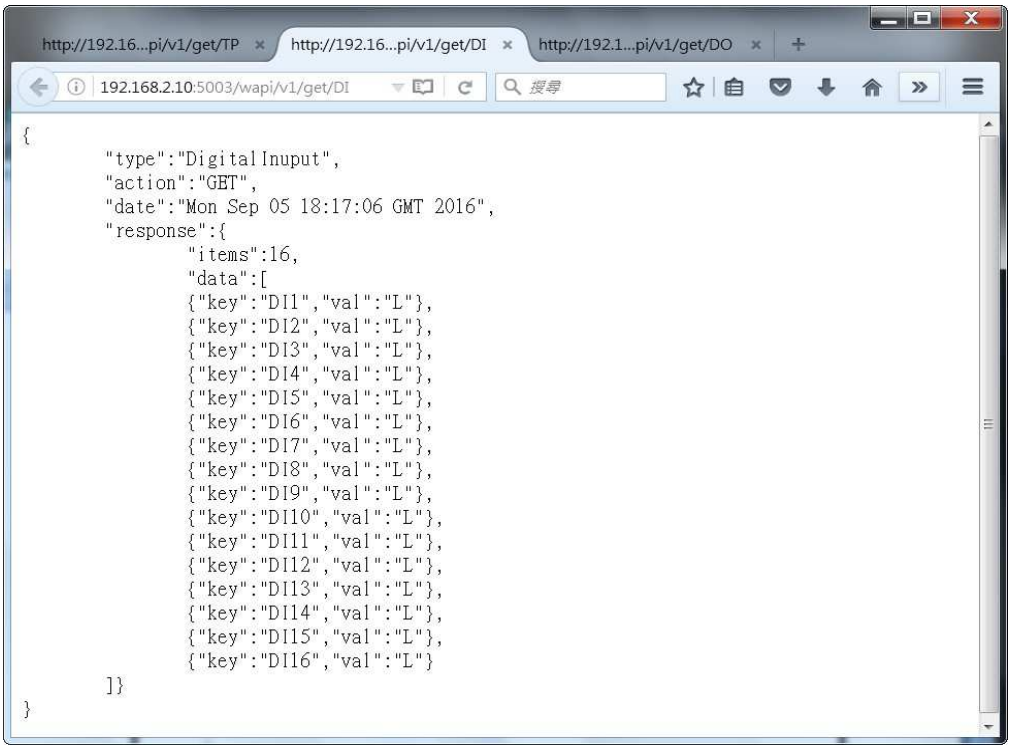
- Command: http://localHost:5003/wapi/v1/get/TP
- Response(JSON):


```
{
        "type":"Temperature",
        "action":"GET",
        "date":"Mon Sep 05 21:12:13 GMT 2016",
        "response":{
                "unit":"C",
                "items":1,
                "data":[
                {"key":"283A1E4A04000087","val":"28.6"}
                ]

        }
}
```


6.2 Read Digital Input Value

- Command: http://localHost:5003/wapi/v1/get/DI
- Response(JSON):




```
{
        "type":"DigitalInuput",
        "action":"GET",
        "date":"Mon Sep 05 18:17:06 GMT 2016",
        "response":{
                "items":16,
                "data":[
                {"key":"DI1","val":"L"},
                {"key":"DI2","val":"L"},
                {"key":"DI3","val":"L"},
                {"key":"DI4","val":"L"},
                {"key":"DI5","val":"L"},
                {"key":"DI6","val":"L"},
                {"key":"DI7","val":"L"},
                {"key":"DI8","val":"L"},
                {"key":"DI9","val":"L"},
                {"key":"DI10","val":"L"},
                {"key":"DI11","val":"L"},
                {"key":"DI12","val":"L"},
                {"key":"DI13","val":"L"},
                {"key":"DI14","val":"L"},
                {"key":"DI15","val":"L"},
                {"key":"DI16","val":"L"}
        ]}
}
```

6.3 Read Digital Output Data

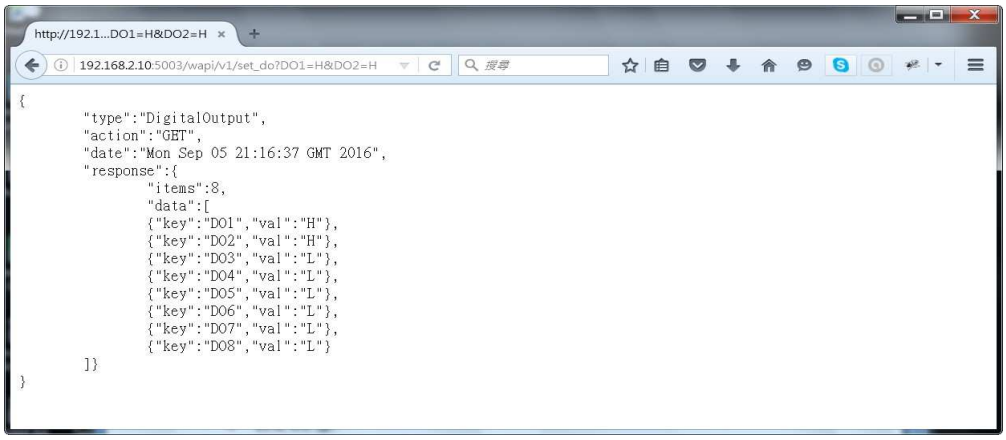
- Command: http://localHost:5003/wapi/v1/get/DO:
- Response(JSON):


```
{
        "type":"DigitalOutput",
        "action":"GET",
        "date":"Mon Sep 05 21:14:17 GMT 2016",
        "response":{
                "items":8,
                "data":[
                {"key":"DO1","val":"L"},
                {"key":"DO2","val":"L"},
                {"key":"DO3","val":"L"},
                {"key":"DO4","val":"L"},
                {"key":"DO5","val":"L"},
                {"key":"DO6","val":"L"},
                {"key":"DO7","val":"L"},
                {"key":"DO8","val":"L"}
        ]}
}
```


6.4 Set Digital Output Value

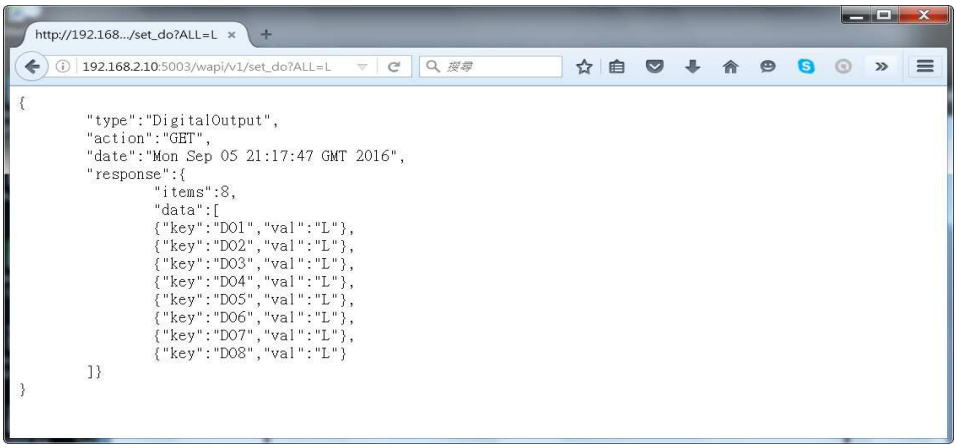
6.4.1 GET Method

- Set Individual DO Value:
  - Command: http://localHost:5003/wapi/v1/set_do?DO1=H&DO2=H
  - Response(JSON):



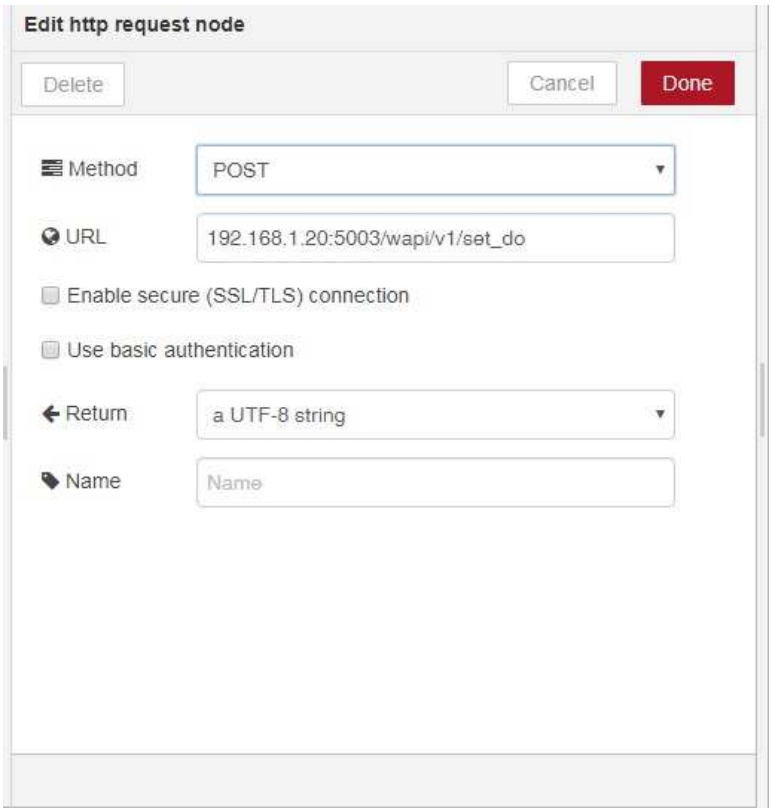

```
{
        "type":"DigitalOutput",
        "action":"GET",
        "date":"Mon Sep 05 21:16:37 GMT 2016",
        "response":{
                "items":8,
                "data":[
                {"key":"DO1","val":"H"},
                {"key":"DO2","val":"H"},
                {"key":"DO3","val":"L"},
                {"key":"DO4","val":"L"},
                {"key":"DO5","val":"L"},
                {"key":"DO6","val":"L"},
                {"key":"DO7","val":"L"},
                {"key":"DO8","val":"L"}
        ]}
}
```

- Set All DO channels value: GET method
  - Command: http://localHost:5003/wapi/v1/set_do?ALL=L
  - Response(JSON):

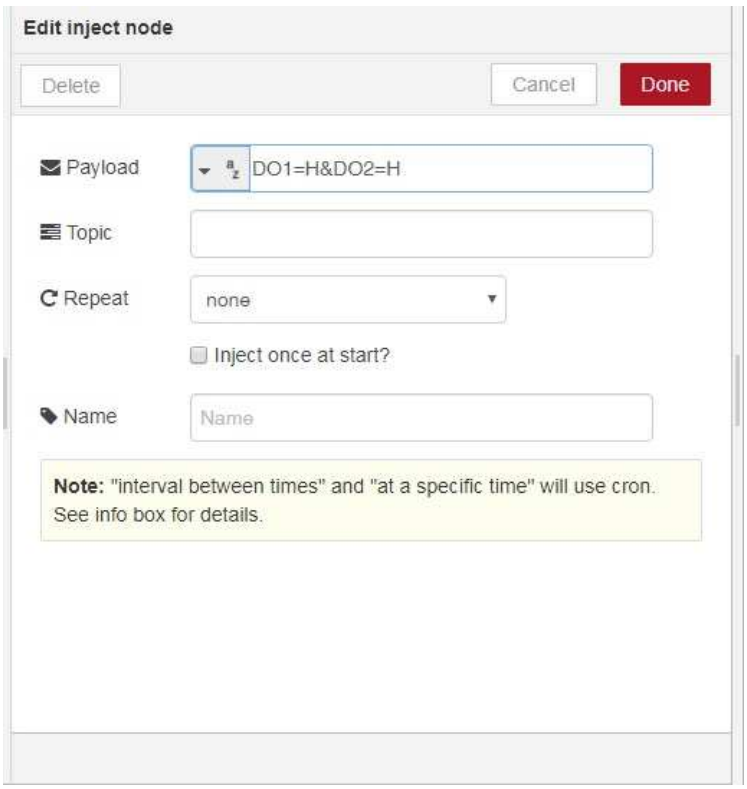


6.4.2 POST Method

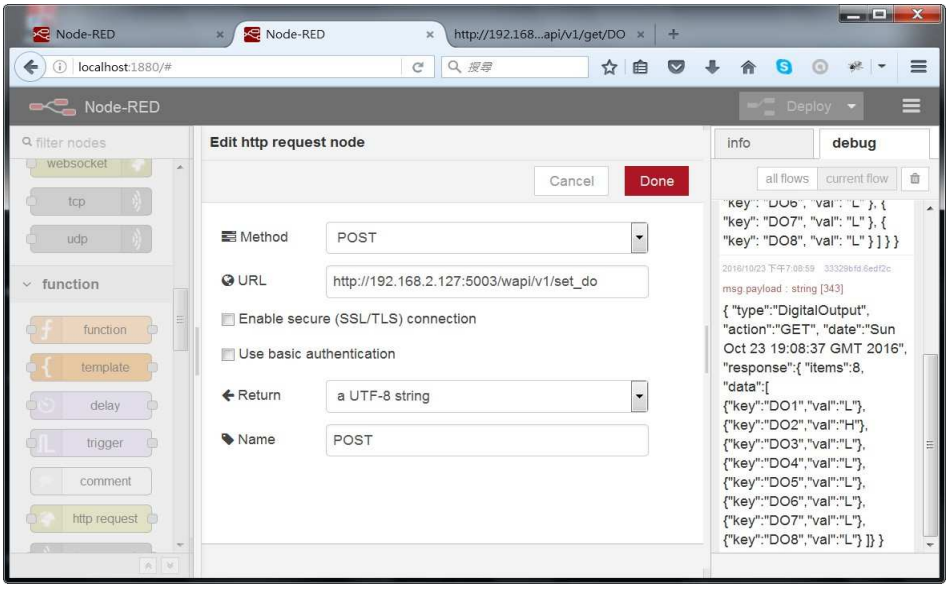
- Command: POST localhost:5003:/wapi/v1/set_do
- Use Node-RED http request node as follow:



- Set individual DO value:
  - Content of Request: DO1=H&DO2=L

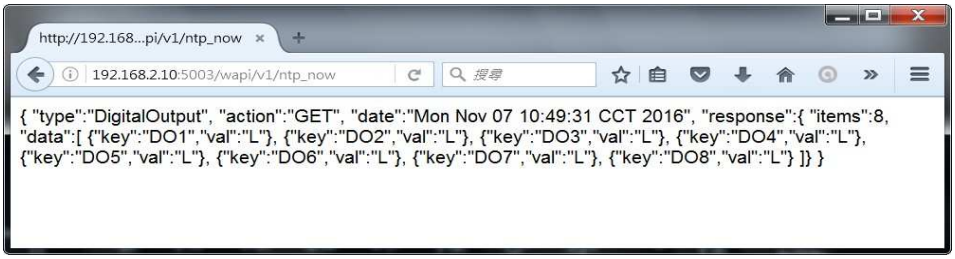


- Set All DO Channel value
  - Content of Request: ALL=L



6.5 NTP Time Synchronization

- GET Method
  - Command: http://localHost:5003/wapi/v1/ntp_now



  - NTP configuration settings in Manager utility：