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# Document Amendment History

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<td>V 1.0</td>
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1. Introduction

RIO-2017BM is an Analog input remote I/O module supports IBM Bluemix IoT and Web interface. The analog input channel can be configured as current and voltage and it is auto calibrated and 1500Vrms isolated. In addition to the analog input, RIO-2017BM also has one relay output. Therefore, it is suitable for remote data acquisition and control. RIO-2017BM also supports RESTful API and data exchange that can be achieved by Web interface.

1.1 Features

- Remote Analog Input Module with TLS MQTT for Bluemix and Web RESTful API
- One 10/100Mbps Ethernet port
- 8 channels 16-bit A/D
- Isolation up to 1500Vrms
- One channel relay output port
- Form A or form B relay with contact rating 30VDC@1A or 125VAC@0.5A
- Support Web-based I/O control and standalone alarm
- DIN Rail mounting
- Windows configuration utility included

1.2 Specification

- **Ethernet:**
  - 10/100Mbps, RJ45
  - Protection: 1500V Magnetic isolation
  - Protocol: MQTT, UDP, HTTP, DHCP
    (MQTT Port is Fixed at 8883)

- **Isolation analog input:**
  - Channel number: 8
  - Input type: Differential input
  - Input mode: Voltage / Current (0~20mA)
  - Resolution: 16-bit
  - Input range:
    - Unipolar: 0~150mV, 0~500mV, 0~1V, 0~5V, 0~10V
    - Bipolar: +/- 150mV, +/- 500mV, +/- 1V, +/- 5V, +/- 10V
    - Current: 0~20mA
  - Input impedance: 20MOhm (voltage), 120Ohm (current)
  - Accuracy: +/- 1% FSR
  - Isolation: 1500VDC
- **Relay output:**
  - Channel number: 1
  - Contact rating: 30VDC@1A or 125VAC@0.5A

- **Power:**
  - 9~48VDC power input
  - Terminal block
  - Protection: Auto polarity and surge protect

- **Dimension:** 108 x 78 x 25mm (H x W x D)

1.3 **Packing List**
- RIO-2017BM: Analog Input Remote I/O Module
- Software utility download from Artila Web (http://www.artila.com/download)

1.4 **Optional Accessory**
- DK-35A (36-DK35A-000): DIN RAIL Mounting Kit
- PWR-12V-1A (31-62100-000): 110~240VAC to 12VDC 1A Power Adaptor
2. Layout

![Diagram showing the layout of the RIO-2017BM module with labels for 9~48VDC Power-In, LAN, Relay Output, A/I CH7~8, and A/I CH1~6.]
3. Pin Assignment and Definitions

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-2017BM operation information. The LED status is described as follow:

- **Power LED**: Power LED keeps ON if power (+9VDC to +48VDC) is correct.
- **Ready LED**: Ready LED keeps ON when RIO-2017BM firmware is ready for operation.
- **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.

3.3 Input Mode Selection Jumper (JP4 ~ JP11)
To configure the voltage or current input, users need to open the metal case to set the jumper to proper position.

Voltage Input: Short 1-2 (Default setting)
Current Input: Short 2-3 (a 120Ohm resistor in shunt with +/-)
3.4 Relay Output Connector (DO_OUT, DO_COM)
The relay provides normal open output as shown. It can switch voltage source up to 30VDC@1A or 125VAC@0.5A.

3.5 Factory Default Settings
- **IP Address**: 192.168.2.127
- **Netmask**: 255.255.255.0
- **IBM IoT Watson connection**: MQTT TLS
- **Relay output**: Normal open
- **Web port**: 5003
- **Telnet console port**: 5001
4. Manager Utility Software

Manager Utility is a software provided by Artila that is used to configure and test devices through networking. Please install “Manager Utility” on PC before start up RIO-2017BM.

4.1 Download Manager Utility


![Artila Website](http://www.artila.com/)


You may also go for RIO-2017BM product page at “Remote I/O”

![Artila Product Page](http://www.artila.com/download/RIO/RIO-2017BM/)

Click “resource button” to download Artila Manager utility

![Download Artila Manager Utility](http://www.artila.com/download/RIO/RIO-2017BM/)

Index of /download/RIO/RIO-2017BM

- Parent Directory
- AIO_Lib/
- UserWeb/
- Utility/
- document/

Apache Server at www.artila.com Port 80
4.2 Manager Utility Installation and Execution

Install Manager Utility in your Windows-based computer and run the software.

4.3 Start-Up Manager Utility

After completed installation of Manager Utility, you may see an icon on PC. Click it to execute Manager Utility. It shows the home page as following:

- **Broadcast Search and device configuration**
- **Modbus test (NOT Available for RIO-XXXXBM series)**
- **Modbus user define test (NOT Available for RIO-XXXXBM series)**
- **Log (NOT Available for RIO-XXXXBM series)**
4.4 Broadcast Search
Start-up the Manager utility software and click telescope icon to search the device: RIO-2017BM in the network.

4.5 Configure the device
Double-click the device: RIO-2017BM at previous figure, it will go to “Configure Device” page

Command Button:
- ![Upgrade](image) : Device firmware upgrade
- ![Reboot](image) : Device Reboot
- ![Default](image) : Set device to default setting (device will reboot)
- ![Disconnect](image) : Disconnect networking
- ![Change Password](image) : Password setting (Default: NO password)
4.5.1 Basic Settings & Advanced Options

User can upgrade firmware, reboot/disconnect device, set to default setting, change device name/password and other basic setting easily via remote operating.

After configured, be sure to press “Save to Device” to save all settings.

- **Device Name**: user configurable device name
- **IP Configure**: Static IP or DHCP
- **Analog Input / AI#**: Analog input range setting
- **DO Power on Value / DO#**: Digital Output setting
- **Bluemix Settings**
  
  Input Bluemix related information after registration.
- **NTP Settings**
  
  Clock Synchronization setting
- **Web Server Settings**
  
  - **Enable**: Enable or Disable Web server
  - **Listen Port**: Web server port
  - **Alive Timeout sec**: disconnect connection while no data on line, time out and no response to Ack signal
- **TCP Command**
  
  - **Enable**: Enable or Disable TCP command port
  - **Listen Port**: TCP command port number
  - **Idle Timeout sec**: disconnect connection while no data on line and time out occur
Alive Timeout sec: disconnect connection while no data on line, timeout and no response to Ack signal

- **Console Settings**
  - Console setting is used for designer to perform system debug.
  - Currently it is not available for user’s application

- **Accessible IP Settings**
  - Access control setting. Let user configure the IP address and Netmask range and masters only with these IP address can access the device.
  - User can setup three IP Address / Netmask (Maximum)

- **DHCP Options**
  - LinkDown Renew sec: Setting the time period while device linkdow. after then, it will renew IP automatically.
  - Continue Discover: While device fails to get IP,
    - OFF: back to default setting (static IP)
    - ON: Keep-on discover

### 4.5.2 Alarm Setting

User can setup for alarm conditions and action via DO.
4.5.3 Bluemix Command

Setup “Factory Reset” function of Bluemix to:

- NONE: No action
- DO: Low
- DO: High
5. Connect to Watson IoT Platform & Work with Node-RED

Securely connect the RIO-2017BM device to IBM Bluemix Watson IoT platform and visualize data by the dashboard of Watson IoT platform and then use Node-RED application to receive events from RIO-2017BM.

5.1 Start to Use IBM Bluemix

5.1.1 Sin-Up IBM Bluemix

To use Watson IoT platform, you need to register your device first. Please visit IBM Bluemix website for registration at https://console.ng.bluemix.net/

Press “Sign Up” or “Create a free account” to sign up your IBMID and create your Bluemix account.

After confirm Account via email, the registration has been completed.
5.1.2 Log-in and setup
At first Log-in, it needs to setup some information step by step.

Create Organization and Space
Remember to select the Region (US South) where Watson IoT platform is available.
After completing the settings, press “I’m Ready” to explore Bluemix.

5.1.3 Apps of Bluemix

Get started with one of the options that follow,

or go to the catalog to create an app at [https://console.ng.bluemix.net/](https://console.ng.bluemix.net/)
5.2 Device Registration

To register devices at following website:

https://console.ng.bluemix.net/catalog/?category=apps&taxonomyNavigation=apps

Select “Internet of Things Platform” at IBM Bluemix Catalog.

Press “Create” at bottom to get into Watson IoT Platform.
After Pressing “Launch”, you may start to manage device under Watson IoT Platform.

Remember to use RIO-2017BM MAC address which can be found in the Manager utility as Device ID. For example: 001348023F83
Also, enter Token string, for example: artila@rio2017, at following page.

**Add Device**

**Security**

You have two options:

**Auto-generated authentication token**

Allow the service to generate an authentication token for you. The token will be 18 characters long and will contain a mix of alphanumeric characters and symbols. The token will be returned to you at the end of the registration process.

**Self-provided authentication token**

Provide your own authentication token for this device. The token must be between 8 and 30 characters long, and should contain a mix of lower and upper case letters, numbers, and symbols (hyphen, underscore, exclamation point, ampersand, at sign, question mark, period, right and left parentheses are permitted). The token should be free of repetition, dictionary words, user names, and other predefined sequences.

Provide a token (optional)  Enter authentication token here

Then, the device has been registered.

**Device 001348023F83**

You have registered your device to the organization. To get it connected, you need to add these credentials to your device. Once you’ve added these, you should see the messages sent from your device in the ‘Sensor Information’ section on this page.

<table>
<thead>
<tr>
<th>Organization ID</th>
<th>e35ipf</th>
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<tr>
<td>Device Type</td>
<td>artila</td>
</tr>
<tr>
<td>Device ID</td>
<td>001348023F83</td>
</tr>
<tr>
<td>Authentication Method</td>
<td>token</td>
</tr>
<tr>
<td>Authentication Token</td>
<td>artila@rio2017</td>
</tr>
</tbody>
</table>
Fill-in the registration information of device in Watson to the Manager utility in this case as following and save to device.

Then, the Devices page will display all devices that you have registered also online/offline status.

Once connected shown as below, it can start to transit events from RIO device to Watson IoT Platform.
5.3 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..

5.4 Working on Node-RED

Create a Node-RED application to receive events from RIO-2017BM.

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

https://console.ng.bluemix.net/catalog/?category=apps&taxonomyNavigation=apps
(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-2017BM

6.1 Read All Value

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

```
{
  "DOVal": [{"name":"DO1","val":"L"}, {"name":"DO2","val":"H"}, ...
},
"AlVal": [{"name":"AI1","val":6.71}, {"name":"AI2","val":8.24}, ...
}
```

6.2 Set DO Channels Value

6.2.1 GET Method

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

```
{
  "type":"DigitalOutput", "action":"GET", "date":"Sun Nov 06 20:37:52.302 2018", "response":{
    "items":1, "data":{
      "key":"DO1","val":"H"
    }
}
```

- Set All DO value:
  - Response(JSON):

```
{
  "type":"DigitalOutput", "action":"GET", "date":"Sun Nov 06 20:38:03.302 2018", "response":{
    "items":1, "data":{
      "key":"DO1","val":"H"
    }
}
```
6.2.2 POST Method

- POST /wapi/v1/set_do
- Set individual DO value:
  - Content of Request: DO1=H&DO2=L
- Set All DO value:
  - Content of Request: ALL=L
6.3 NTP Time Synchronization

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

- NTP configuration settings in Manager utility;