

RIO-2010

Web-based Remote I/O Module

User Guide

Version 1.0



Table of Contents

1.	Introduction	1
1.1	Features	1
1.2	Specification	1
1.3	Packing List.....	2
1.4	Optional Accessory	2
2.	Layout	3
3.	Pin Assignment and Definition.....	4
3.1	Power Connector	4
3.2	LED Status	4
3.3	Jumper Setting of Relay Output (JP5 ~ JP12).....	4
3.4	Serial Port Connector.....	5
3.5	Relay Output Connector (J6)	5
3.6	Digital Input Connector (J5)	6
3.7	1-Wire Port Connector (JP3, JP13, JP14)	6
3.8	Reset Button (SW1)	6
3.9	Factory Default Settings.....	7
4.	Manager Utility Software.....	8
4.1	Broadcast Search.....	8
4.2	Configure RIO-2010.....	9
4.3	Basic Settings	9
4.4	Advanced Options.....	10
4.5	Web-based I/O Control	11
4.6	Stand-alone I/O Alarm and Email Alert.....	12
4.7	Date and Time Setting	13
4.8	Temperature Alarm Setting.....	13
4.9	Digital Input Alarm Setting	14
4.10	Email Server.....	14
4.11	Email Address List	15
5.	MQTT.....	16

5.1	Event	16
5.2	MQTT Periodically Report Data	17
5.3	Web API to Read DI, Relay Status and 1-Wire Sensor	18
5.4	Web API to Control Relay	19
5.5	Convert HTML File to Anf Binary	20
5.6	Command Line Interface.....	20

1. Introduction

RIO-2010 is a Web-based Remote I/O Module.

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 TCP / RTU / ASCII, Web based I/O control and alarm.
- DIN Rail mounting
- Windows configuration utility included

1.2 Specification

- **Serial Port:**
 - RS-485 port
 - Protocol: Modbus RTU or ASCII
 - Baud rate: 1200 to 460800bps
 - Parity: None, Even, Odd, Space, Mark
 - Data bit: 5 to 8
 - Stop bit: 1 to 2
 - Isolation protection: 2500Vrms
- **Ethernet:**
 - 10/100Mbps, RJ45
 - Protection: 1500V Magnetic isolation
 - Protocol: Modbus TCP / 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: 1.2KOhms@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:** 182 x 118 x 35.82mm (W x H x D)
- **Operating Temperature:** 0~70°C
- **Storage Temperature:** -20~85°C

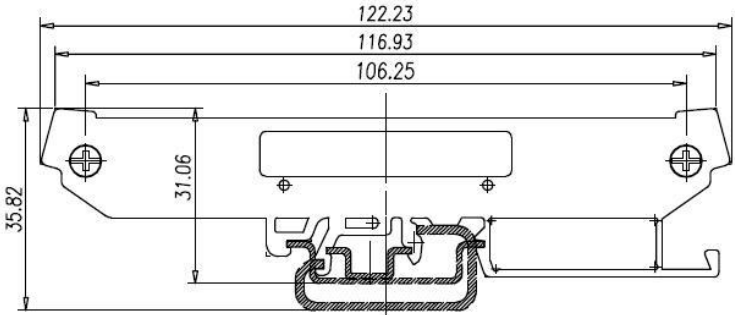
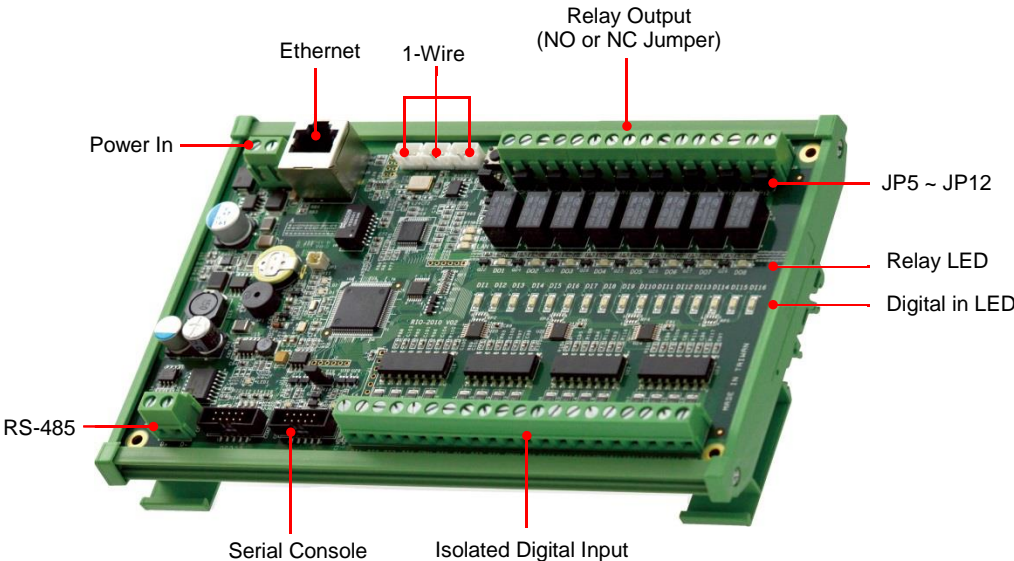
1.3 Packing List

- RIO-2010: Web-based remote I/O module
- Software utility: <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



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.

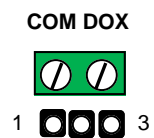
3.2 LED Status

The LED provides the RIO-2010 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-2010 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 connect 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-485:

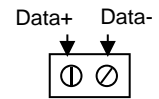
When RIO-2010 is set to Modbus RTU / ASCII mode, use RS-485 to connect to Modbus mater.

Data+ is pull up to isolated 3.3VDC with 10KOhm resistor.

Data- is pull low to isolated ground.

Termination resistor is not included. User can add a termination resistor to pad at position R37 for SMD resistor or dual hole for DIP type resistor.

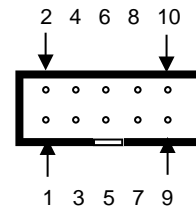
COM1: RS-485



▪ RS-232 and Console Port:

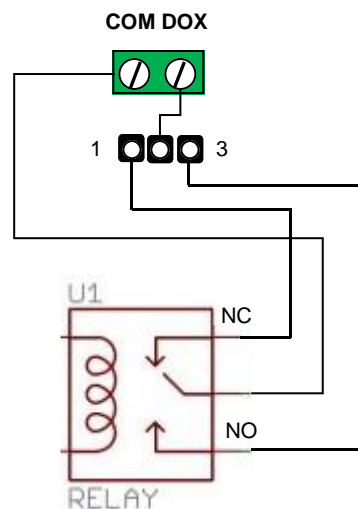
Pin	COM2	COM3
1	DCD	N/C
2	DSR	N/C
3	RXD	RXD
4	RTS	N/C
5	TXD	TXD
6	CTS	N/C
7	DTR	N/C
8	N/C	N/C
9	GND	GND
10	N/C	N/C

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 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:

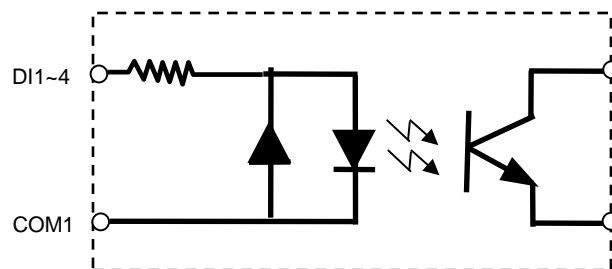
Logical High: 5~24Vdc

Logical Low: 0~1.5Vdc

Input resistance: 1.2KOhms@0.5W

Response time: 20 μ s

Isolation: 2500Vrms

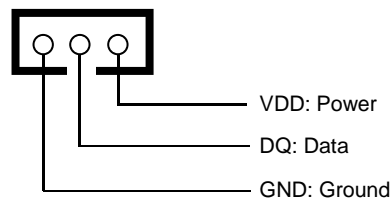


DIx: Isolated digital input channels.

COMx: Common ground of four DIx.

3.7 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-2010 provides three connectors for 1-Wire device. The pin definition is follow:



3.8 Reset Button (SW1)

Press the hardware reset button will reset the system.

3.9 Factory Default Settings

IP Address: 192.168.2.127

Netmask: 255.255.255.0

Modbus mode: Modbus TCP

Port number: 502

Relay output: Normal open

Web server: enabled

Home page: <http://192.168.2.127:5003>

Telnet console: telnet 192.168.2.127 5001

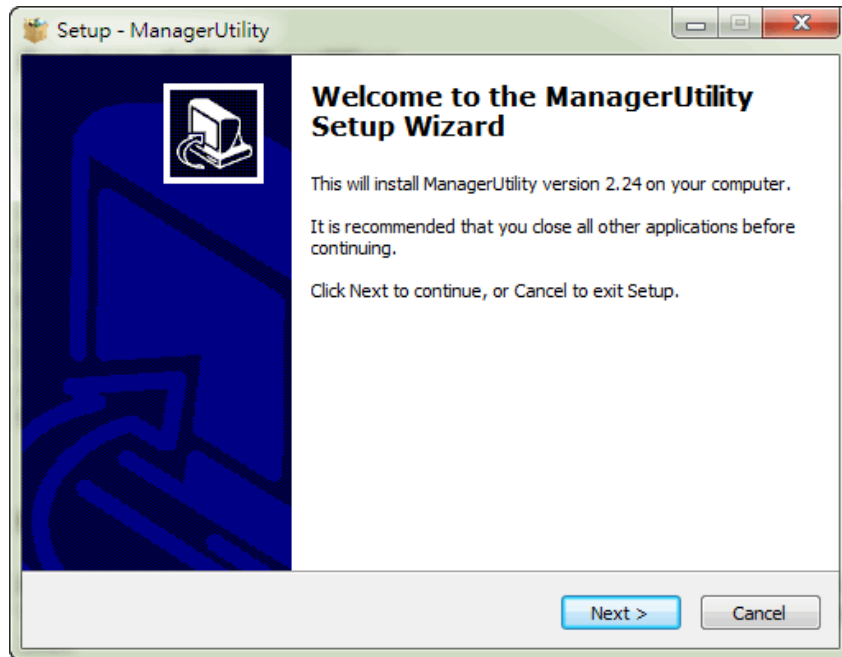
MQTT publish: Disabled

Alarm settings: Disabled

Email alert: Disabled

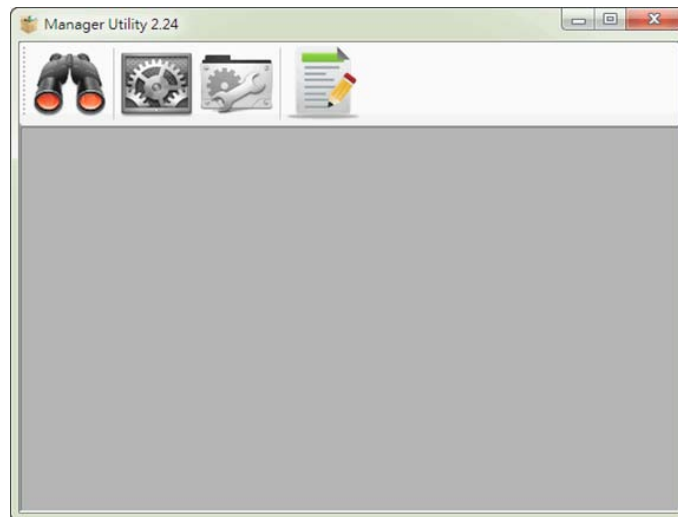
4. Manager Utility Software

Before powering on RIO-2010, please install the manager utility available on Artila FTP. This utility is used to search RIO-2010 in the network and configure and test the RIO-2010.



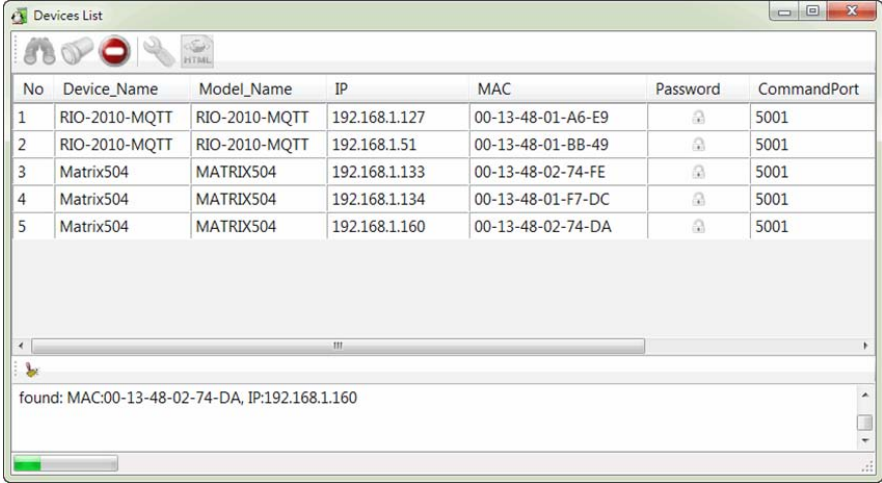
4.1 Broadcast Search

Once start Manager utility, you can click telescope icon to search the RIO-2010 in the network.



4.2 Configure RIO-2010

Once RIO-2010 is discovered, Manager will show following information.



No	Device_Name	Model_Name	IP	MAC	Password	CommandPort
1	RIO-2010-MQTT	RIO-2010-MQTT	192.168.1.127	00-13-48-01-A6-E9	🔒	5001
2	RIO-2010-MQTT	RIO-2010-MQTT	192.168.1.51	00-13-48-01-BB-49	🔒	5001
3	Matrix504	MATRIX504	192.168.1.133	00-13-48-02-74-FE	🔒	5001
4	Matrix504	MATRIX504	192.168.1.134	00-13-48-01-F7-DC	🔒	5001
5	Matrix504	MATRIX504	192.168.1.160	00-13-48-02-74-DA	🔒	5001

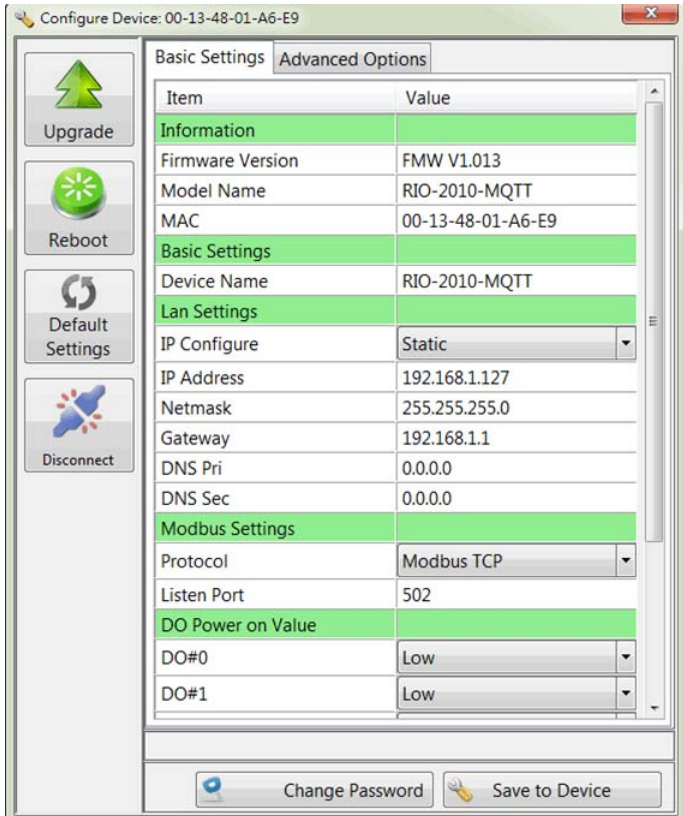
found: MAC:00-13-48-02-74-DA, IP:192.168.1.160

4.3 Basic Settings

Click the RIO-2010 will open the windows to configure. The Basic settings allows user to configure following settings:

- Device name: RIO-2010-MQTT (default)
- LAN settings: Network setting
- Modbus setting: Modbus mode
- Do power on value: Digital Output power on setting

If Modbus mode is set to Modbus RTU or ASCII, RIO-2010 will use RS-485 bus to connect to Modbus master.



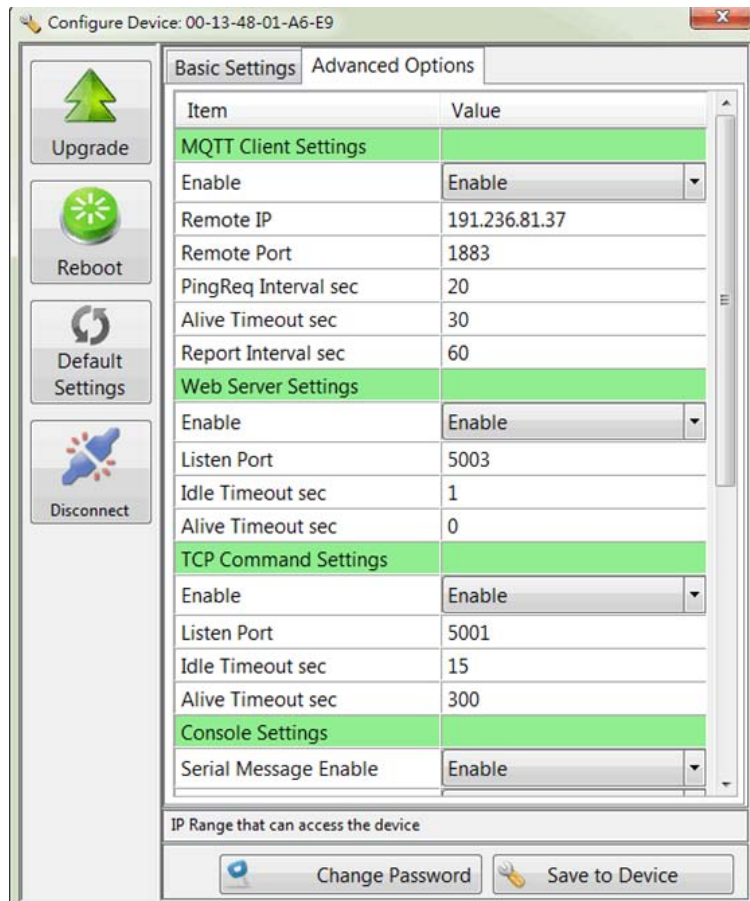
Item	Value
Information	
Firmware Version	FMW V1.013
Model Name	RIO-2010-MQTT
MAC	00-13-48-01-A6-E9
Basic Settings	
Device Name	RIO-2010-MQTT
Lan Settings	
IP Configure	Static
IP Address	192.168.1.127
Netmask	255.255.255.0
Gateway	192.168.1.1
DNS Pri	0.0.0.0
DNS Sec	0.0.0.0
Modbus Settings	
Protocol	Modbus TCP
Listen Port	502
DO Power on Value	
DO#0	Low
DO#1	Low

Buttons: Upgrade, Reboot, Default Settings, Disconnect, Change Password, Save to Device

4.4 Advanced Options

The Advanced options allow user to configure following settings:

- MQTT Client (Publisher) settings
- Web server settings
- TCP command port settings: Use text command to system configure
- Console setting: serial console debug message setting
- Access IP setting: Authorized IP access settings
- DHCP setting: DHCP behavior



4.5 Web-based I/O Control

In addition to Modbus TCP, user can also use Web browser to control and monitor the I/O of RIO-2010. The default web page is used to demo how to use web browser to control RIO-2010. Use mouse to click the DO icon can trigger DO on/off. The sensor monitoring demo using 1-Wire interface to read the Maxim thermometer DS18B20. User can edit a custom web page using Web APIs. The default web page demonstrates how to use AJAX to write a dynamic web page to access and control the I/O channels of RIO-2010.

I/O Monitoring / Control

Wed Jun 24 17:56:15 CCT 2015
[Intelligent Alarm >>](#)

Monitoring

DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8
DI9 DI10 DI11 DI12 DI13 DI14 DI15 DI16

Control

DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8

HIGH
 LOW

Sensor Monitoring

Celsius Fahrenheit
Sensor sum: 1
ID:28FFB19B651401A6
Temperature:
27.6 degree C

Alarm Log

ID	Value	DateTime
28FFB19B651401A6	28.8 C	Jun 24 16:20:23 2015
28FFB19B651401A6	29.6 C	Jun 24 16:18:37 2015
28FFB19B651401A6	29.2 C	Jun 24 16:17:14 2015
28FFB19B651401A6	28.6 C	Jun 24 16:17:47 2015
28FFB19B651401A6	29.4 C	Jun 24 16:16:47 2015

4.6 Stand-alone I/O Alarm and Email Alert

RIO-2010 supports I/O and temperature alarm and email alert functions. The iAlarm page demonstrates how to use web to configure the alarm settings. Click the Configure link at the right bottom to enter the iAlarm page.

Intelligent Alarm

[I/O Monitoring / Control >>](#)

Date-Time Settings

Set Time: Time Zone:

June 2015

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

HH:MM:SS(24 Hour Format)

: :

Temperature Alarm

Sensor ID	Alarm Type	Threshold	DO Action	Email	Delete
28FFB19B651401A6	High	28.0 C	High DO#	Yes	<input type="button" value="Delete"/>

DI Alarm

DI No.	Alarm Type	DO Action	Email	Delete
--------	------------	-----------	-------	--------

Mail Server

SMTP Server:

Server Port:

User Name:

Password:

Email Address List

Address	Delete
dennis.kao@artila.com	<input type="button" value="Delete"/>

Save all changes to device

4.7 Date and Time Setting

You can manually adjust the real time clock of RIO-2010 or synchronize the clock with a NTP server.

You can choose daily, weekly or monthly synchronization at the beginning of the period.

Date-Time Settings

Set Time: Time Zone:

NTP Server:

Sync Frequency:

Sync Time(HH):

4.8 Temperature Alarm Setting

Add a temperature alarm can trigger a relay on or off and send an email to alert user. To get a temperature information, you need to use or purchase an 1-wire temperature sensor.

Temperature Alarm

Sensor ID	Alarm Type	Threshold	DO Action	Email	Delete
28FFB19B651401A6	High	26.0 C	High DO#	No	<input type="button" value="Delete"/>

Add Temperature Alarm

Sensor ID:

Alarm Type:

Threshold:

DO Action:

Email:

4.9 Digital Input Alarm Setting

Add a digital input (DI) alarm can trigger a relay on or off and send an email alert.

DI Alarm

DI No.	Alarm Type	DO Action	Email	Delete
DI#1	Low	Low DO#1	No	<input type="button" value="Delete"/>

Mail Server

SMTP Server:

Server Port:

User Name:

Password:

Add DI Alarm

Sensor ID:

Alarm Type:

DO Action:

Email:

Email Address List

4.10 Email Server

Email server setting is used to configure your email account for alert. After this is done, you can start to add email alert list.

Mail Server

SMTP Server:

Server Port:

User Name:

Password:

4.11 Email Address List

Add a list of email address to send email once alarm. An email with event log will be send by RIO-2010.

Email Address List	
Address	Delete
sales@artila.com	Delete
webmaster@matrix.com	Delete

Add New...



5. MQTT

MQTT is an IoT connectivity protocol and RIO-2010 supports MQTT and send the sensor data and alarm event to a broker. Subscriber can get the data and event through the MQTT broker.

5.1 Event

When Digital input status change or temperature alarm triggered, RIO-2010 will send a message in JASON format.

Topic: RIO-2010/event

Message as follow:

```
1  {
2      "name": "RIO-2010-MQTT",
3      "MAC": "00:13:48:FF:01:01",
4      "date": "Thu Jun 04 20:22:43 GMT 2015",
5      "QoS": 2,
6      "event": [
7          {
8              "key": "DI#1",
9              "val": "1"
10         },
11         {
12             "key": "DI#2",
13             "val": "1"
14         },
15         {
16             "key": "283A1E4A04000087",
17             "val": "28.6 C"
18         }
19     ]
}
```

5.2 MQTT Periodically Report Data

RIO-2010 will periodically report sensor data, DI and relay status to broker. The default period is 60 seconds and can be modified by Manager utility.

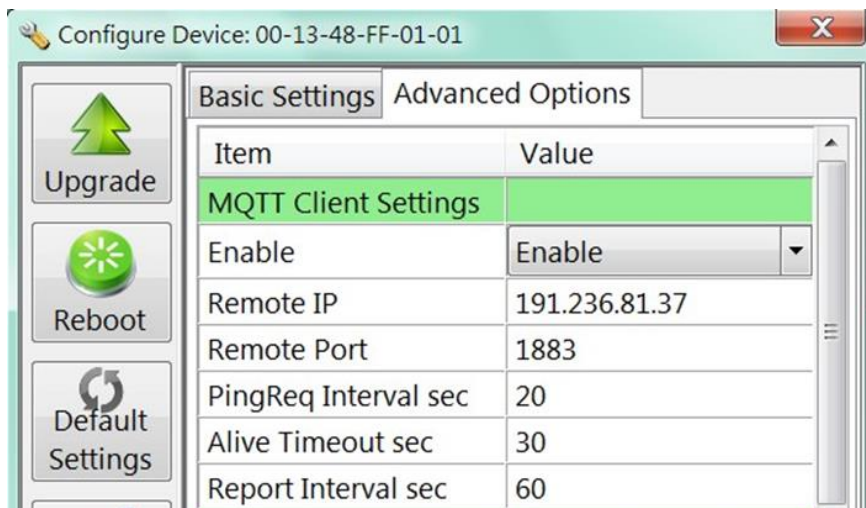
Topic: RIO-2010/data

Message:

```

1  {
2      "name": "RIO-2010-MQTT",
3      "MAC": "00:13:48:FF:01:01",
4      "date": "Thu Jun 04 20:11:59 GMT 2015",
5      "QoS": 1,
6      "sensor": [
7          {
8              "key": "288A214A0400006B",
9              "val": "27.0 C"
10         },
11         {
12             "key": "283A1E4A04000087",
13             "val": "28.9 C"
14         }
15     ],
16     "DO": "100000000",
17     "DI": "100000000010000000"
18 }

```



Remote IP: Broker IP address

Remote Port: 1883 (default)

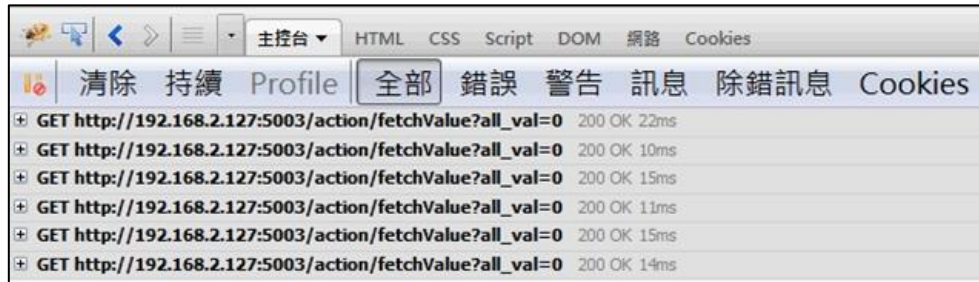
PingReq Interval (sec): Ping request to keep alive link

Alive Timeout (sec): if timeout and no data in traffic, broker will disconnect the connection. Alive timeout is always longer than PingReq.

Report Interval (sec): period for data report to broker

5.3 Web API to Read DI, Relay Status and 1-Wire Sensor

Using *GET URL:/action/fetchValue?all_val=0* to retrieve DI, DO and sensor data.



The response data in **JSON** format as follow:

```

參數 標頭 回應 XML JSON
{
  "DINum":16,
  "DIVal": [
    {"name": "DI01", "val": "L"},
    {"name": "DI02", "val": "L"},
    {"name": "DI03", "val": "L"},
    {"name": "DI04", "val": "L"},
    {"name": "DI05", "val": "L"},
    {"name": "DI06", "val": "L"},
    {"name": "DI07", "val": "L"},
    {"name": "DI08", "val": "L"},
    {"name": "DI09", "val": "L"},
    {"name": "DI10", "val": "L"},
    {"name": "DI11", "val": "L"},
    {"name": "DI12", "val": "L"},
    {"name": "DI13", "val": "L"},
    {"name": "DI14", "val": "L"},
    {"name": "DI15", "val": "L"},
    {"name": "DI16", "val": "L"}
  ],
  "DONum":8,
  "DOVal": [
    {"name": "DO01", "val": "L"},
    {"name": "DO02", "val": "L"},
    {"name": "DO03", "val": "L"},
    {"name": "DO04", "val": "L"},
    {"name": "DO05", "val": "L"},
    {"name": "DO06", "val": "L"},
    {"name": "DO07", "val": "L"},
    {"name": "DO08", "val": "L"}
  ],
  "SensorSum":2,
  "SensorVal": [
    {"id": ["28", "8A", "21", "4A", "04", "00", "00", "6B"], "val": ["37", "01", "4B", "46", "7F", "FF", "09", "10"]},
    {"id": ["28", "3A", "1E", "4A", "04", "00", "00", "87"], "val": ["38", "01", "4B", "46", "7F", "FF", "08", "10"]}
  ]
}

```

DI and DO val "H" or "L" means logic high or low of the digital input and output.

SensorVal is the raw data from 1-wire including ID and Value in hex format.

5.4 Web API to Control Relay

Use POST request to set the output of relay.

POST URL: `/action/CtrlDO`



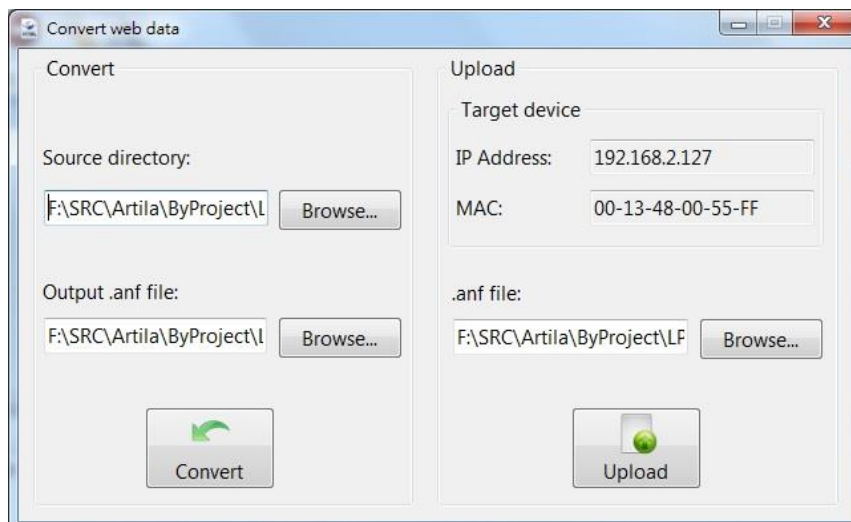
D001=H sets relay 1 to be energized.

The web server will response.



5.5 Convert HTML File to Anf Binary

User can customize web page to control RIO-2010. Once ready, you can use Manager utility to convert the web files to binary file (.anf) to upload to RIO-2010. First to create a folder to save all the Web files and then click the HTML icon to convert web data to .anf file and upload to RIO-2010. The default web files is available on Artila FTP.



5.6 Command Line Interface

RIO-2010 supports Command Line Interface (CLI) configuration. Users can use CLI in Telnet console port and serial console to write their own manager utility software. Make sure the Command option is Enable in TCP Command Setting and Serial Console setting.

The Command format is:

```
[G/S]:Command=Parameter{carriage return}
```

For example:

```
G:ip_ip=
```

Will get the ip address:

```
S:ip_ip=192.168.2.127
```


All command are terminated by a carriage return (0x0d).

```
G: ip_ip=  
A: ip_ip=192.168.2.127  
G: txt_dn=  
A: txt_dn=Aport-212
```

Remember to save and reboot the RIO-2010 by command.

S;save=1 & reboot=1

Please refer to Appendix A for the Command list.