Introduction:

RIO-2018 is a thermocouple input remote I/O module supports Modbus TCP and Web interface. RIO-2018 has two model J and K to support J and K type thermocouple. In addition to the thermocouple input, RIO-2018 also has two isolated digital input channels and one form C relay output. Therefore it is suitable for temperature measurement and control. RIO-2018 has a tiny web server built-in which allows user to access it through a web browser. A data exchange can be achieved by AJAX or Modbus TCP.

Features:

◆ Remote Thermocouple Input Module with Web Access AJAX and Modbus TCP
◆ One 10/100 Ethernet port
◆ 3 channels J or K type thermocouple input with cold junction compensation
◆ Two 2500 Vrms isolated digital input (bipolar input photocouple)
◆ One Form C relay with contact rating 30VDC@1A or 125VAC@0.5A
◆ Support Web-based temperature monitoring and DIO control
◆ Optional DIN Rail mounting kit (DK-35A)
◆ Windows configuration utility included

Specification:

Ethernet:
　10/100 Mbps, RJ45
　Protection: 1500V Magnetic isolation
　Protocol: Modbus/TCP, UDP, HTTP, DHCP

Thermocouple input:
　J type: Maxim MAX31855J converter with CJC

　Range:-210° C to +1200° C

　K type: Maxim MAX31855K converter with CJC

　Range:200 ° C to +1350° C

　Resolution: 14-bit, 0.25° C
　connector: OMEGA PCC-SMP Thermocouple connector
　Thermocouple fault detection

Relay output:
　Channel number: 1 form C
　Contact rating: 30VDC@1A or 125VAC@0.5A

Isolated digital input:
　Channel number: 2
　Logic high: 5~24VDC
　Logic low: 0~1.5VDC
　Input resistance: 1.2KOhm@0.5W
　Response time: 20 μs

Packing List

1.　RIO-2018
2.　Software utility download from Artila Web

Layout

OMEGA PCC-SMP

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.

LED Status

The LED provides the RIO-2018 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-2018 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.

Thermocouple input (T/C1 to T/C3)

The thermocouple input is connected to MAX31855 with Cold Junction Compensated Thermocouple to Digital Converter. The connector is OMEGA PCC-SMP. Please make sure the type of thermocouple matches the model of RIO-2018. Refer to data sheet of MAX31855 for the technical specification of thermocouple measurement.
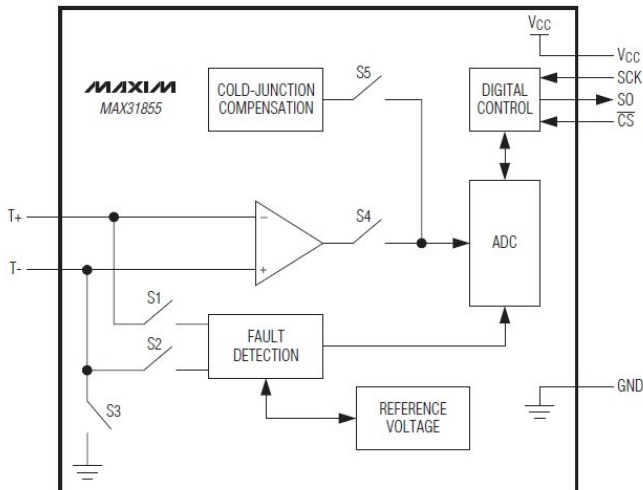
Relay output connector (DO_OUT, DO_COM)

The relay provides normal open output (NO) and normal close (NC) as shown. It can switch voltage source up to 30VDC@1A or 125VAC@0.5A

Digital Input Connector (DI1, DI2, DI_COM)

The two channels isolated input are equipped with 2500 Vrms photo coupler isolator. The two channels form a group and share the same common ground. The specification of the isolated input channels are:
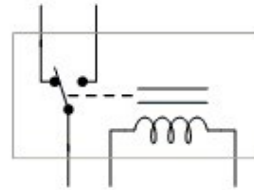
Logical High: 5~24Vdc
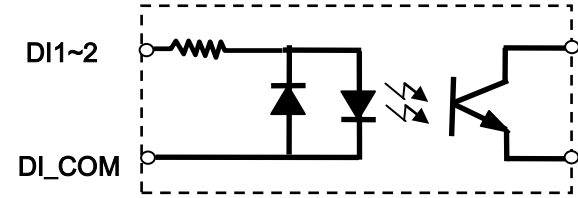Logical Low: 0~1.5Vdc
Input resistance: 1.2KOhms @0.5W
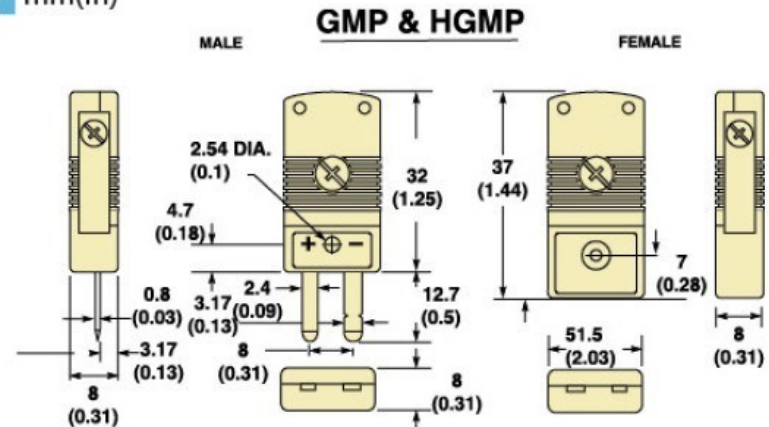Response time: 20us
Isolation: 2500Vrms

Thermocouple connector

Factory default setting

IP Address: 192.168.2.127
Netmask: 255.255.255.0
Modbus port: 502
Web port: 5003
Telnet console port: 5001
Web console: http://192.168.2.127:5003/kcfg.html

Manager utility software

Before powering on RIO-2018, please install the manager utility available from Artila website download section. This utility is used to search RIO-2018 in the network and configure and test the RIO-2018.
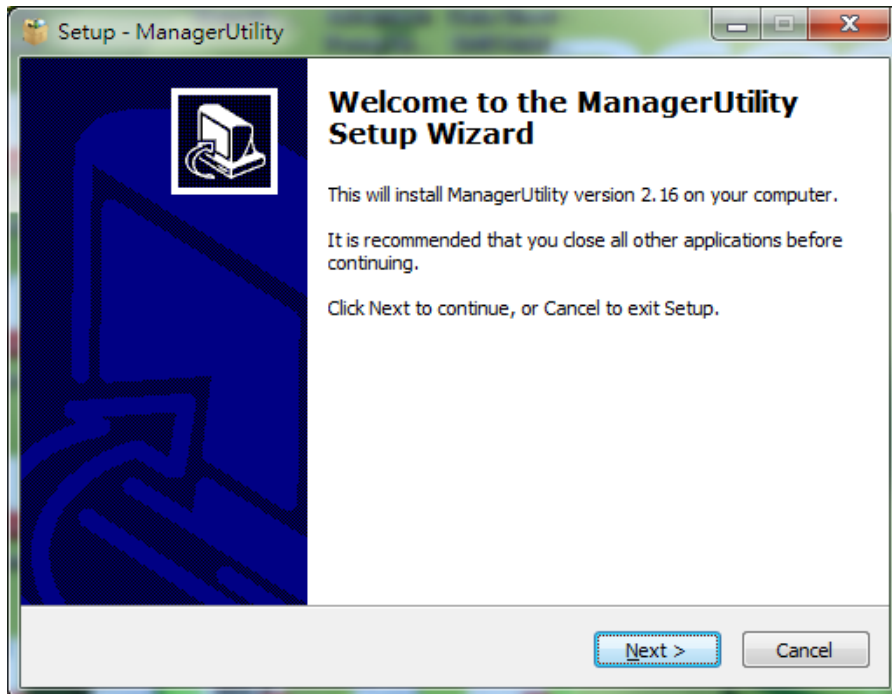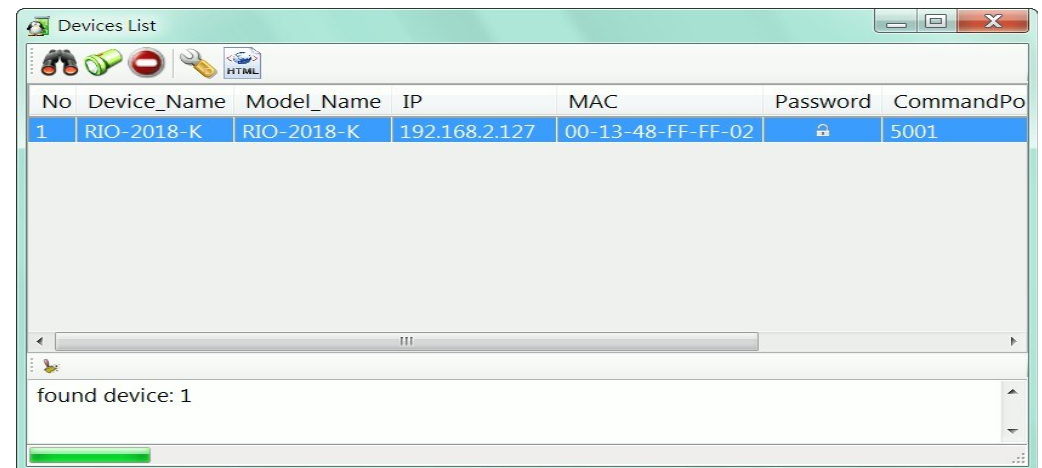

Broadcast search

Once start Manager utility, you can click telescope icon to search the RIO-2018 in the network.
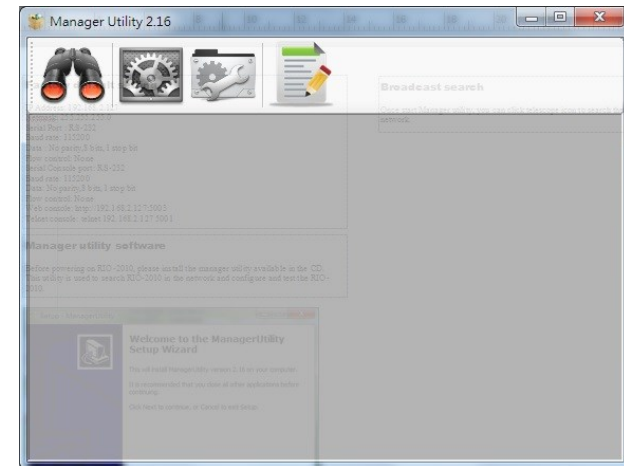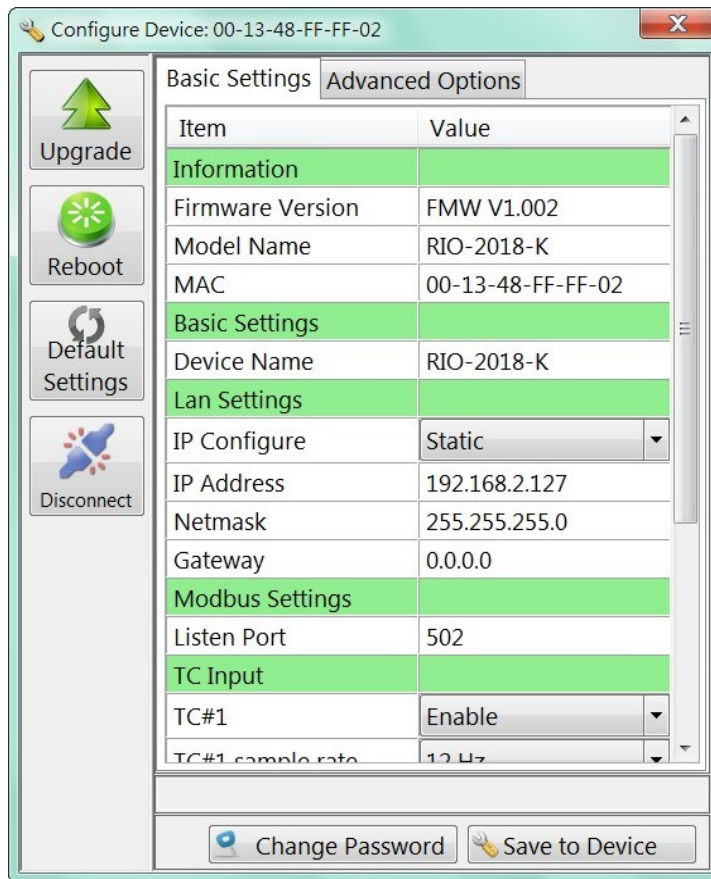

Configure RIO-2018

Once RIO-2018 is discovered, Manager will show following information.

Basic settings

Click the RIO-2018 will open the windows to configure. The Basic settings allows user to configure following settings:

Modbus settings:
      Listen Port: Modbus TCP listen port
TC Input: Thermocouple Input setting
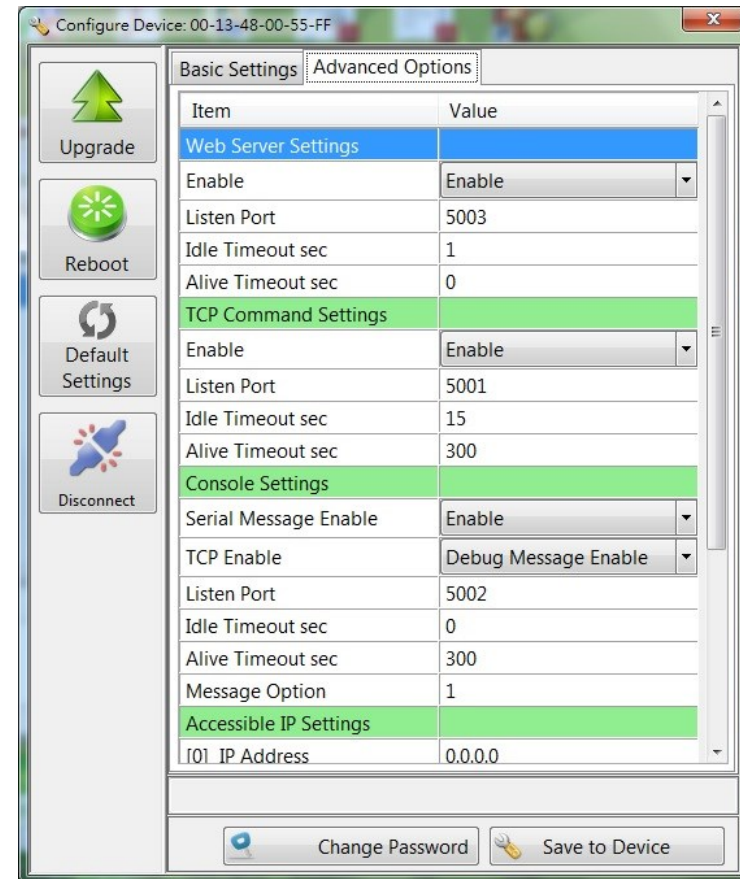   **TC#:** Enable/Disable TC channels
      Sample rate: 1~12Hz
DO power on value:
      Low: Relay is de-energized
      High: Relay is energized

Advanced options

The Advanced options allow user to configure following settings:

Web server settings:
      Enable: Enable/disable
      Listen Port: Web listen port
TC Input: Thermocouple Input setting
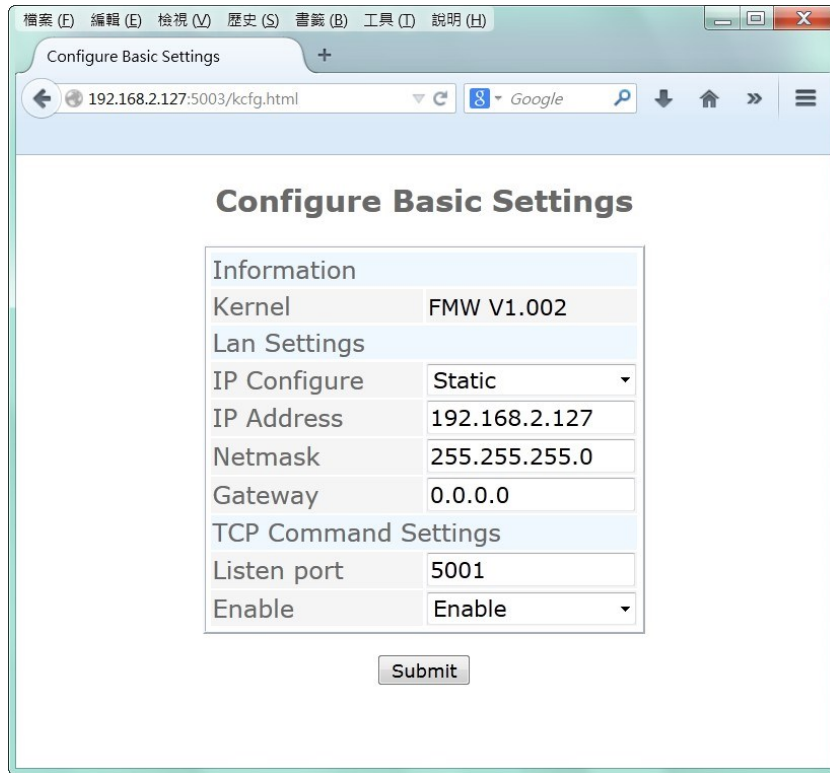   **TC#:** Enable/Disable TC channels
      Sample rate: 1~12Hz
Idle Timeout sec: disconnect connection while no data on line and time out occur
Alive Timeout sec: disconnect connection while no data on line, time out and no response to Ack signal

Web Console
RIO-2018 web console page is at http://192.168.2.127:5003/kcfg.html

TCP Command Settings: TCP Command port is used to configure RIO-2018 by text command. Please refer the TCP command sets for the information of the text command. User can use TCP command port to develop a user application software to configure RIO-2018.

Console Settings: Console port is reserved for debug. It is not open to customer's application.

Access IP settings: Configure the IP address or Netmask which are allowed to access RIO-2018

DHCP option:
   Linkdown renew sec: Linkdown and time is out, RIO-2018 will request a new IP address
   Continue Discover: On/Off, If failing in obtain IP address after power up, RIO-2018 will continuously request IP (On) or use static IP (Off).
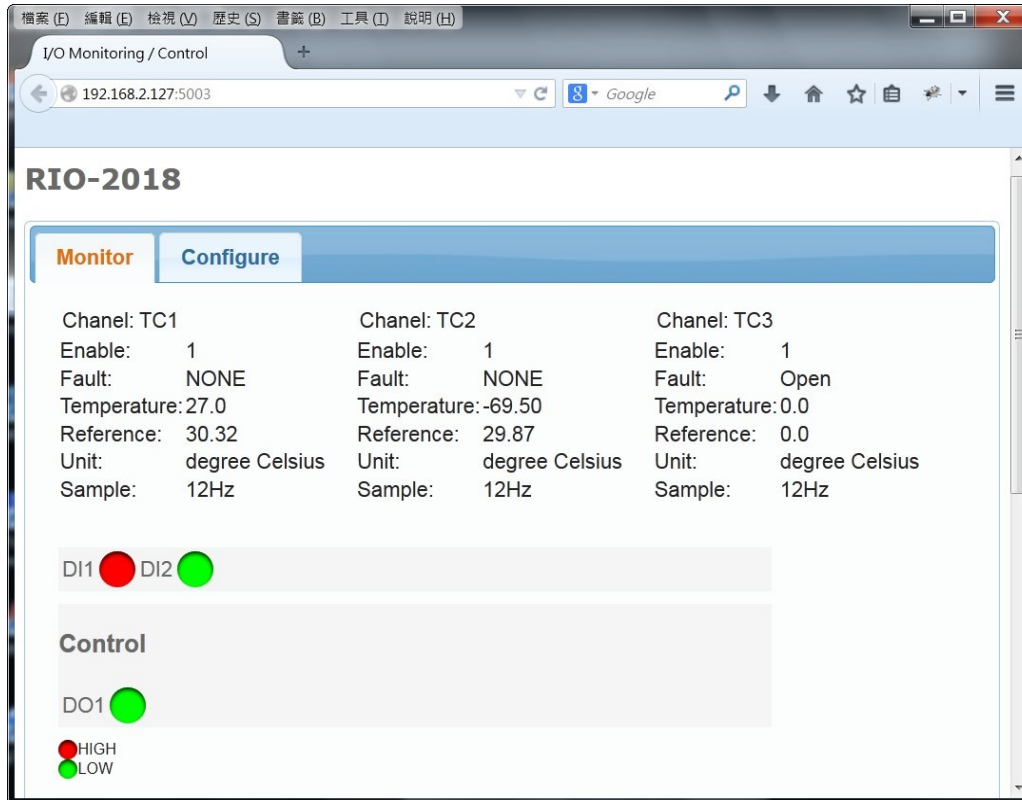
How to access the data of RIO-2018

There are three way to access RIO-2018

1. **Modbus**: user can use Modbus TCP to access RIO-2018. Using the holding register of RIO-2018, user can read the data of thermocouple channels and control the relay On/Off. The register format of RIO-2018 is available in the appendix

2. **Web interface**: RIO-2018 support AJAX interface. It is designed for user to develop Web based application. A demo web page is available for your reference.

3. **X86 and Matrix ARM Linux API**: For users who want to develop their own application software using C language, they can use AIO library which is bundled with RIO-2018. Please refer the on line help of the API for the information of using the AIO library.

Web based I/O control

In addition to Modbus TCP, user can also use Web port to access data and information of RIO-2018. RIO-2018 uses AJAX scheme to read and write I/O of the RIO-2018. Use GET request together with command parameter, you can retrieve data and information from the web server of RIO-2018. Use mouse to click the DO icon can trigger DO on/off.
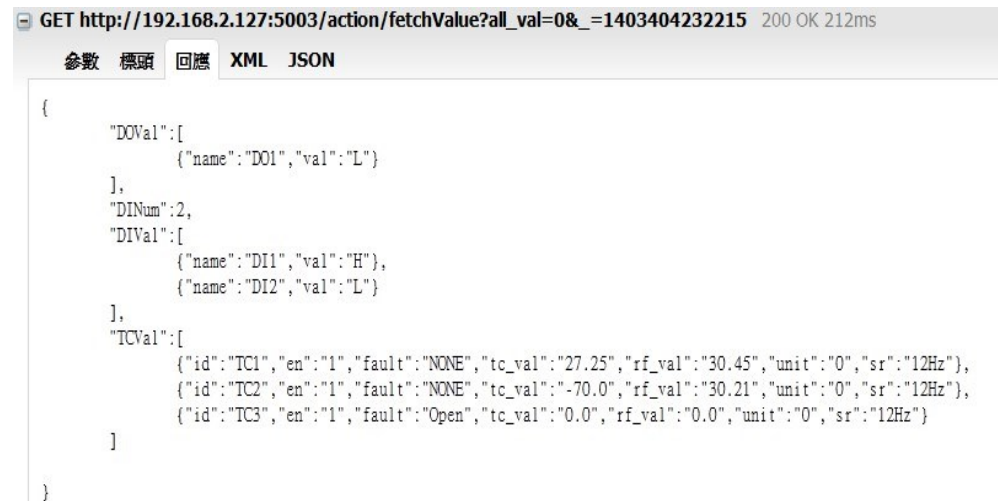

AJAX Command

1. **Fetch ALL Value:** To get all value and settings of analog and digital channels of RIO-2018, you can use

GET URL:port/action/fetchValue?all_val=0

For example

GET http://192.168.2.127:5003/action/fetchValue?all_val=0

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

2. Set Relay Output: http://URL:port/action/CtrlDO

3. **GET Thermocouple** settings can be done by command

GET URL:port/action/fetchAIcfg?all_val=0

For example:

GET http://192.168.2.127:5003/action/fetchAIcfg?all_val=0

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


```
{
        "CfgSelect":[
                {"name":"en_0","val":"1"},
                {"name":"sp_0","val":"12"},
                {"name":"en_1","val":"1"},
                {"name":"sp_1","val":"12"},
                {"name":"en_2","val":"1"},
                {"name":"sp_2","val":"12"},
                {"name":"unit","val":"0"}
        ]

}
```

en_x: 0: disable, 1:enable
sp_x: sampling rate: 1~12 (Hz)
unit: 0: degree Celcius, 1: Fahrenheit

3. **SET Thermocouple** settings can be done by command

POST URL:port/action/CfgAI

For example:

POST http://192.168.2.127:5003/action/CfgAI



```
en_0=1&sp_0=12&en_1=1&sp_1=12&en_2=1&sp_2=12&unit=1&save=1
```

add *&save=1* will save the configuration and reboot RIO-2018 and RIO-2018 will response


```
Device reboot now.
Web will be refreshed 5 seconds later.
```

Convert HTML file to anf binary

User can customize web page to access RIO-2018. Once ready, you can use Manager utility to convert the web files to binary file (.anf) to upload to RIO-2018. 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-2018.
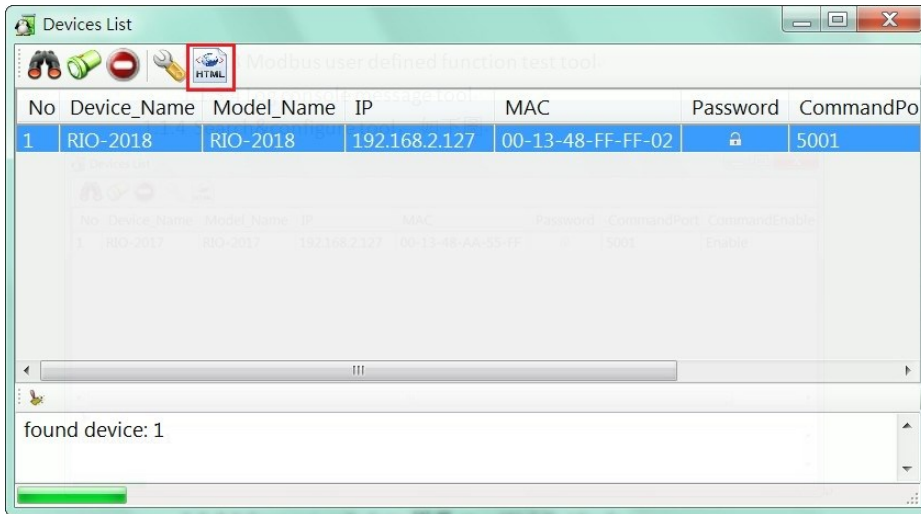
The default web page source is available at Artila Web for download

Click the HTML icon and use following tool to convert the folder of Web page files to a binary file with extension of anf and upload it to web server of RIO-2017.
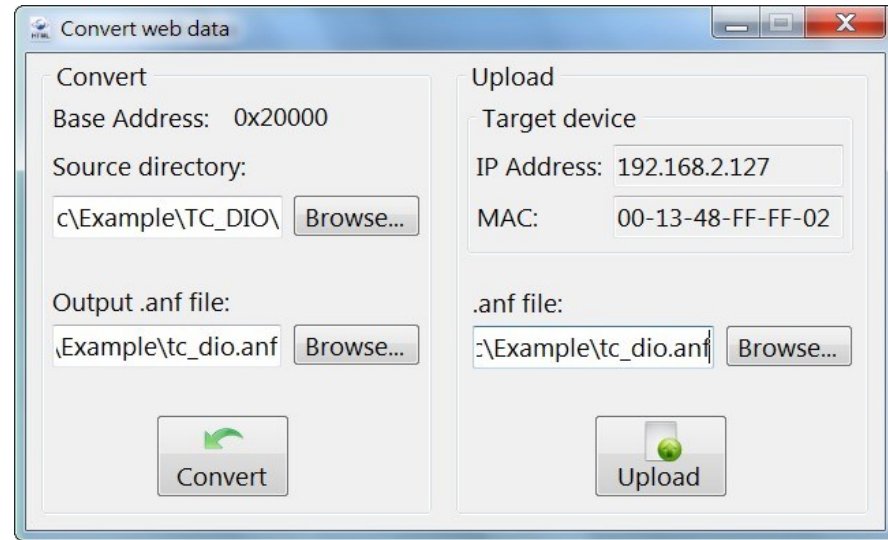
Access RIO-2018 via Modbus TCP

RIO-2018 supports Modbus TCP access. The Holding register is as follow:

Register map

Starting address	Stoping address		
0x0000	0x000F	Temp sensor 1	RIO-2010 only
0x0010	0x001F	Temp sensor 2	RIO-2010 only
0x0020	0x002F	Temp sensor 3	RIO-2010 only
0x0100	0x0105	AI1	RIO-2017 only
0x0106	0x010B	AI2	RIO-2017 only
0x010C	0x0111	AI3	RIO-2017 only
0x0112	0x0117	AI4	RIO-2017 only
0x0118	0x011D	AI5	RIO-2017 only
0x011E	0x0123	AI6	RIO-2017 only
0x0124	0x012B	AI7	RIO-2017 only
0x012A	0x012F	AI8	RIO-2017 only
0x0200	0x0209	TC1	RIO-2018 only
0x020A	0x0213	TC2	RIO-2018 only
0x0214	0x021D	TC3	RIO-2018 only

Thermocouple (TC) holding register

Register[0] Hi	TC enable/disable	0x01:enable 0x00:disable	
Register[0] Lo	TC Sign flag	0x00: + 0x01: -	
Register[1] Hi	TC integer Hi	degree Celsius	
Register[1] Lo	TC integer Lo	degree Celsius	
Register[2] Hi	TC decimal Hi	degree Celsius	
Register[2] Lo	TC decimal Lo	degree Celsius	
Register[3] Hi	Reference integer	degree Celsius	
Register[3] Lo	Reference decimal	degree Celsius	
Register[4] Hi	Reference Sign flag	0x00: + 0x01: -	
Register[4] Lo	Fault	0x00: None 0x01:Open 0x02:short to GND 0x03:short to VCC	

Please refer to Modbus TCP function list for more information