RIO-2018

Analog Input Remote I/O Module

User Guide

Version 1.0



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1. Introduction

RIO-2018 is a thermocouple input remote I/O module supports Modbus TCP and Web interface. RIO-2018 has two models 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.

1.1 Features

- Remote Thermocouple Input Module with Web Access AJAX and Modbus TCP
- One 10/100Mbps Ethernet port
- 3 channels J or K type thermocouple input with cold junction compensation
- Two 2500Vrms 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

1.2 Specification

- Ethernet:
 - IO/100Mbps, 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: 20µs

Opto-isolation: 2500Vrms

1.3 Packing List

- RIO-2018J / RIO-2018K: Analog Input Remote I/O Module
- Software utility download from Artila FTP

1.4 Optional Accessory

- 5SRTC-GG-J-24-36 (91-5SRTC-J50)*: Standard Size Connector, J Thermocouple, Glass Braid Insulation, 24 AWG, 36 inch Length, 5 PACK
- 5SRTC-GG-K-24-36 (91-5SRTC-K50)*: Subminiature Connector, K Thermocouple, Glass Braid Insulation, 24 AWG, 36 inch Length, 5 PACK
- DK-35A (36-DK35A-000): DIN RAIL Mounting Kit
- PWR-12V-1A (31-62100-000): 110~240VAC to 12VDC 1A Power Adapter

*: Artila generally suggests our customers to purchase this item from the original manufacturer directly.

2. Layout





OMEGA PCC-SMP

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-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.

3.3 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.



3.4 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.



3.5 Digital Input Connector (DI1, DI2, DI_COM)

The two channels isolated input are equipped with 2500Vrms 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: 20µs Isolation: 2500Vrms





Thermocouple connector

3.6 Factory Default Settings

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

4. 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.



4.1 Broadcast Search

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



4.2 Configure RIO-2018

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

DIG 201	And in case of the local division of the loc		11	MAC	Password	CommandP
RIO-201	18-K	RIO-2018-K	192.168.2.127	00-13-48-FF-FF-02	â	5001
1						
[-111			

4.3 Basic Settings

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

	Basic Settings Advan	ced Options	
ŻŻ	Item	Value	
Upgrade	Information		
R	Firmware Version	FMW V1.002	
Reheat	Model Name	RIO-2018-K	
Rebool	MAC	00-13-48-FF-FF-02	
Q.	Basic Settings		
Defāult	Device Name	RIO-2018-K	
settings	Lan Settings		
-	IP Configure	Static 💌	
Discourset	IP Address	192.168.2.127	
Disconnect	Netmask	255.255.255.0	
	Gateway	0.0.00	
	Modbus Settings		
	Listen Port	502	
	TC Input		
	TC#1	Enable 🔹	
	TC#1 comple rate	13 🗤	

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

4.4 Advanced Options

The Advanced options allow user to configure following settings:

🍾 Configure Dev	Racic Settings Advanced C	Intions		X
	Item	Value		•
Upgrade	Web Server Settings			
	Enable	Enable	-	
	Listen Port	5003		
Pahoat	Idle Timeout sec	1		
	Alive Timeout sec	0		
(5)	TCP Command Settings			-
Default	Enable	Enable	•	-
Settings	Listen Port	5001		
	Idle Timeout sec	15		
	Alive Timeout sec	300		
Disconnect	Console Settings			
Disconnect	Serial Message Enable	Enable	-	
	TCP Enable	Debug Message Enable	-	
	Listen Port	5002		
	Idle Timeout sec	0		
	Alive Timeout sec	300		
	Message Option	1		
	Accessible IP Settings			
	[0] IP Address	0.0.0.0		*
	Change Pas	ssword 💊 Save to Devic	e	

- Web Server Settings
 - Enable: Enable/Disable
 - Listen Port: Web listen port
- **TC Input:** Thermocouple Input setting
 - 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

4.5 Web Console

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

3 192.168	.2.127:5003/kcfg.html	▼ C 8 - Google	Q	ŧ	A	>>	-
	Configure	Basic Setting	js				
	Information						
	Kernel	FMW V1.002					
	Lan Settings						
	IP Configure	Static	•				
	IP Address	192.168.2.127					
	Netmask	255.255.255.0					
	Gateway	0.0.0.0					
	TCP Command	Settings					
	Listen port	5001					
	Enable	Enable	•				
		- · · ·]					

- 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).

4.6 How to Access the Data of RIO-2018

There are three way to access RIO-2018:

- 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.

4.7 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.

檔案(E) 編輯(E) 检視	【(⊻) 歴史(S) 書籤(B)	工具(I) 說明(H)								x
I/O Monitoring / Co	ontrol +									
• • • • • • • • • • • • • • • • • • •	2:5003		∀ C'	8 - Googl	е	ρ.	ł 🕯		- 14	
RIO-2018	3									•
										_
Monitor	Configure									
Chanel: TC:	1	Chanel: TC2			Chane	I: TC	3			
Enable:	1	Enable:	1		Enable	:	1			H
Fault:	NONE	Fault:	NONE		Fault:		Open			
Temperature	e:27.0	Temperature	:-69.50		Tempe	rature	e:0.0			
Reference:	30.32	Reference:	29.87		Refere	nce:	0.0			
Unit:	degree Celsius	Unit:	degree	Celsius	Unit:		degree	e Celsi	us	
Sample:	12Hz	Sample:	12Hz		Sample	e:	12Hz			
	-									
Control										
D01										
HIGH										
				_		_				Ŧ

4.8 AJAX Command

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:

金野	橋店	同演	XMI	ISON
BARY	TOTCAR		ATTL	3001
	"DOVal"	:[
		{"nam	e":"DO1	","val":"L"}
],			
	"DINum"	:2,		
	"DIVal"	:[
		{"nam	e":"DI1	","val":"H"},
		{"nam	e":"DI2	!","val":"L"}
],			
	"TCVal"]:		
		{"id"	:"TC1",	"en":"1","fault":"NONE","tc_val":"27.25","rf_val":"30.45","unit":"0","sr":"12Hz"}
		{"id"	:"TC2",	"en":"1","fault":"NONE","tc_val":"-70.0","rf_val":"30.21","unit":"0","sr":"12Hz"}
		{"id"	:"TC3",	"en":"1","fault":"Open","tc_val":"0.0","rf_val":"0.0","unit":"0","sr":"12Hz"}
	1			
	-			

Set Relay Output: http://URL:port/action/CtrIDO

	nttp://1	92.168	3.2.127:5003/action/CtrlDO 200 OK 213ms	
標頭	Post	回應	XML	
参数	a	oplicatio	n/x-www-form-urlencoded	
DO1] 原始碼	L.			
D01=L				

GET Thermocouple:

Settings can be done by command:

```
GET URL:port/action/fetchAlcfg?all_val=0
```

For example:

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

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

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

• SET Thermocouple:

Settings can be done by command:

POST URL:port/action/CfgAI

For example:

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

POST	htt	tp://1	92.168	.2.127:5003/action/CfgAI	200 OK 199ms
標頭	ŧ	Post	回應	XML	
參數		ap	oplication	n/x-www-form-urlencoded	不排序
en_0	1				
en_1	1				
en_2	1				
save	1				
sp_0	12	2			
sp_1	12	2			
sp_2	12	2			
unit	1				
原始碼					
en_0=1	âsŗ	0=128	ten_1=1&	sp_1=12&en_2=1&sp_2=12&unit=	=l&save=1

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

OST ht	tp://1	92.168	3.2.127:5003/action/CfgAI	200 OK 211ms
標頭	Post	回應	XML	
Device r	eboot n	.ow.		
Web will	be ref	reshed	5 seconds later.	

4.9 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.

NO	Device_Name	Model_Name	IP	MAC	Password	Command
	RIO-2018	RIO-2018	192.168.2.127	00-13-48-FF-FF-02	a	5001
	(An Connection Allower 1997) A Stationary 1997		111	39-W. K. Sore		
	Anna Connai, Marrie A	nan Jampin Basa	m	19-m. s Sore	C. Commune	

The default web page source is available at Artila Web for download.

📕 scripts	2014/6/13
퉲 style	2014/6/13
💿 index	2014/6/12

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-2018.

Convert Base Address: 0x20000	Upload Target device		
Source directory:	IP Address: 192.168.2.127		
c\Example\TC_DIO\ Browse	MAC:	00-13-48-FF-FF-02	
Output .anf file:	.anf file:		
Example\tc_dio.anf Browse	:\Example\tc_dio.anf Browse		

4.10 Access RIO-2018 via Modbus TCP

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

	U	•	
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

Register Map

	1 ()	0 0	
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	

Thermocouple (TC) Holding Register

Please refer to Modbus TCP function list for more information.