BrainChild

SIO IO MODULES USER MANUAL

SIO-8AIU-H, SIO-16AIU-H, SIO-8TC, SIO-16TC, SIO-8AII, SIO-16AII, SIO-8AIV, SIO-16AIV, SIO-6RTD, SIO-8AOU, SIO-16DI, SIO-32DI, SIO-16DO, SIO-32DO, SIO-8RO, SIO-16RO, SIO-16DIO, SIO-16DI8RO

UMSIO01D

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Revision History

Version	Description	Date
UMSIO01D	All modules Modbus table updated General spelling and grammar check done.	January, 2021

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Within the duration of the warranty, any damage caused by any improper installation/operation by any individual other than manufacturer certified service technician, Manufacturer reserves the right to determine the warranty liabilities. Any kind of damage caused by human factors, improper installation and misuse, Manufacturer shall in no event be liable for any consequential and accidental damages whether by negligence specified above or otherwise.

The manufacturer guarantees the safety and stability of all the applications. The modules have been tested under a rigorous process which conforms to the criteria declared. In case of any failure, within the period of the warranty, the defective product will be repaired or be replaced at no extra cost; while for out-of-warranty service, Manufacturer will repair or replace the product at nominal cost to the customer.

Certification Claims Technology

Smart Series IO modules developed and tested by the manufacturer, all tests certified by EMC including EMI and EMS are designed for module protection. Hence, we strongly recommend pairing Smart series modules with industrial chassis certified by CE.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Certification

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1. Introduction

1.1 Product Overview

Smart series remote I/O module providing different kinds of modules like analog input, output, analog input/output, digital input, output, digital input/output and relay. All are connected by RS-485 Modbus communication. Each module provides the different number of input/output channels for user's choice- for instance, 8, 16 and 32.

Smart series IO module is controlled by the host command. After receiving commands sent by the host, remote IO modules start responding. The protocol used in-between host and modules is **Modbus RTU**. Furthermore, to have a more efficient application, variety of baud rates (1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k and 115.2k) are also available for user's selection

1.2 Packing List

Module Package

Accessories

- ❖ 14 pin Signal Connector 1pc 
- ❖ Plastic grounding tab 1pc 
- ❖ Plastic buckle 2pcs 

1.3 System Specification

Parameter	Specification
Power Supply	10 ~ 60 VDC
Watchdog Timer	System (1.6-second Fixed) Communication (Programmable)
Connector	Plug-in-terminal block (#16~30 AWG)
Temperature (Operating)	-25 ~ 70°C
Humidity	5 ~ 95 %RH
Temperature (Storage)	-30 ~ 75°C
Interface	RS-485

Parameter	Specification
Isolation Protection	3000 VDC
Communication Protocol	Modbus/RTU
Communication Speed	Serial: From 1200 to 115.2k bps

1-1 System Specification

1.4 Set-Up and Use

There will be a rotary switch available in the smart series remote IO module for the user to set up the address during the installation. Utility software is available for the user to set up the module configuration parameters. The factory default settings can be reset by pressing INIT switch for at least 3 seconds. Furthermore, EEPROM built in the modules is detachable and can be changed on the new module to retain the setting.

1.5 Watchdog

There are module watchdog and system watchdog available in Smart Series IO module. Modbus functions of watchdog described in the following table

Address	Function	R/W	Initial value
44108 (0x100B)	Timeout value (0.1s) Range: 0 ~ 0x00FF	R/W	0x0000
44109 (0x100C)	Function enable/disable 0x0001: Enable 0x0000: Disable	R/W	0x0000
44110 (0x100D)	Watchdog status 0x0001: Timeout 0x0000: Normal	R/W	0x0000

1-2 Watchdog Modbus Mapping

1.5.1 Module watchdog

Module watchdog is a hardware monitoring of the operation status of the module. It will automatically reset and reboot the module itself when working in a harsh/noisy environment and encountering interference. If discontinuation exceeds 1.6 sec (default), the system would reset the signal and reboot.

1.5.2 System watchdog

System watchdog is a software monitoring of the operation status of the system. It will provide immediate counter-measure when erroneous network, communication or breakdown occurs. Once time-out occurs, the module will reset all outputs to SAFE mode to prevent any improper operations on the controlled target. The system watchdog timer is programmable. When system watchdog is enabled and the module doesn't receive polling from the host at the set time, system watchdog time-out will automatically start. Outputs Safe mode is configurable on certain modules.

1.6 Power Requirements

DC Voltage ranged from +10V to 60V is applicable to Smart Series remote IO Module. The Reverse Polarity protection is available in all the modules.

1.7 RS-485 Network Connections

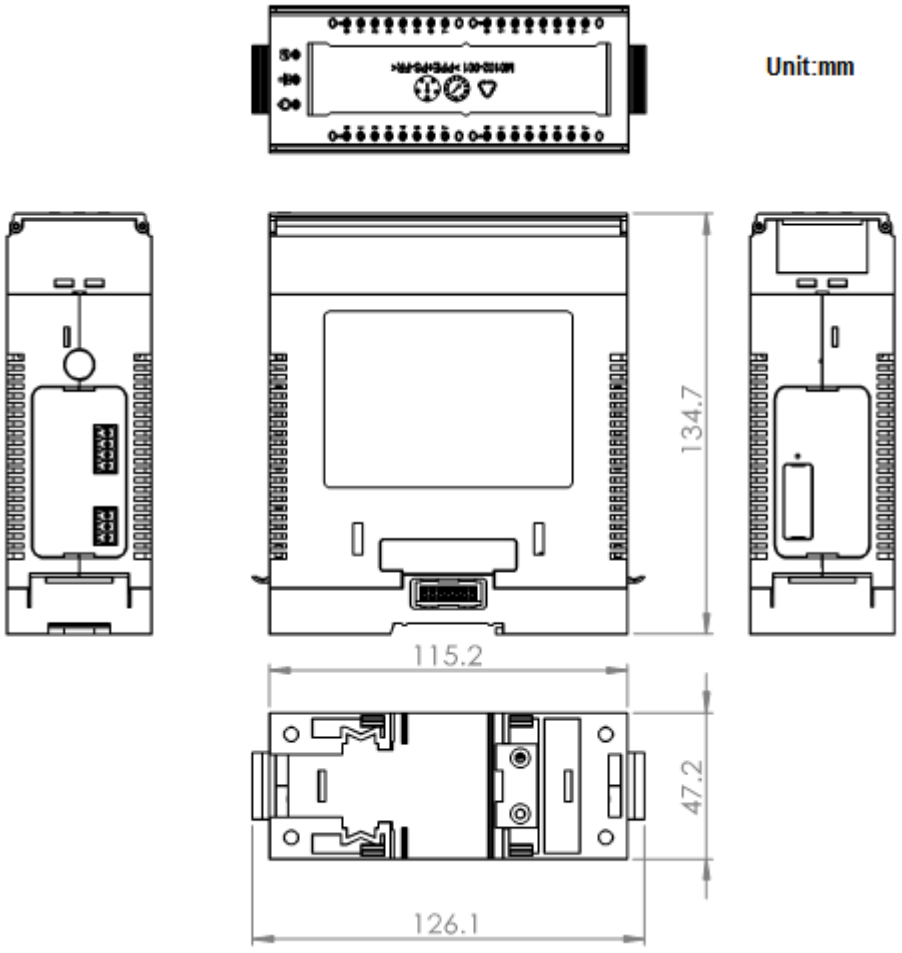
The most commonly used communication interface RS485 is included. It provides a remote transmitting and is applicable to all remote connections.

1.8 Environmental Safety

Smart series modules are EMC certified in many countries. With EMI and EMS FREE to ensure the environmental quality of modules.

1.9 Dimension

Smart series IO module dimension as mentioned below.



1-1 Dimension

2 Installation

2.1 Basic Installation

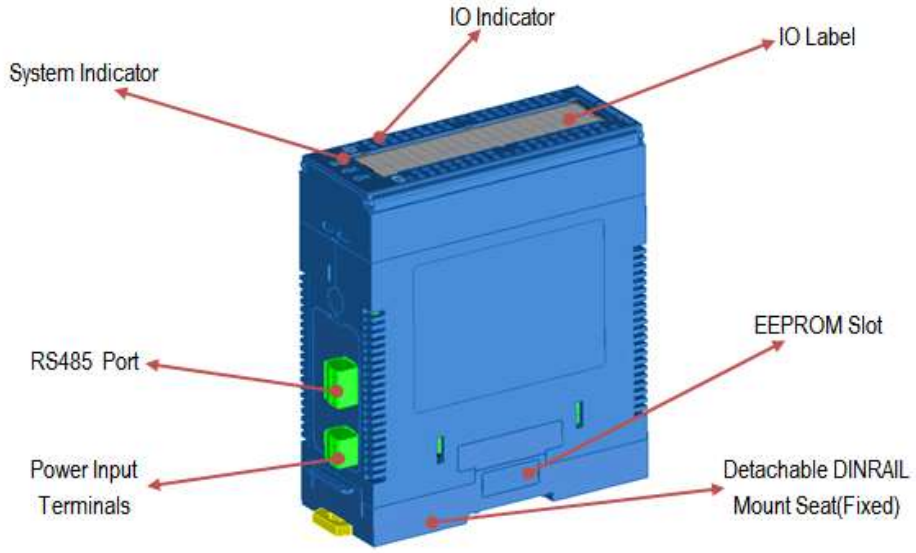
The following parts/devices are necessary when installing and configuring Smart Series IO module.

2.1.1 Host PC Requirement

A host PC equipped with RS-232 or RS-485 communication port. It would be connecting Smart IO modules directly by RS-485 port or RS-232-to-RS-485 converter. An isolated RS232 to RS485 converter is necessary if the PC is equipped with RS-232 port only. The USB to RS-485 converter can also be used as an alternative solution.

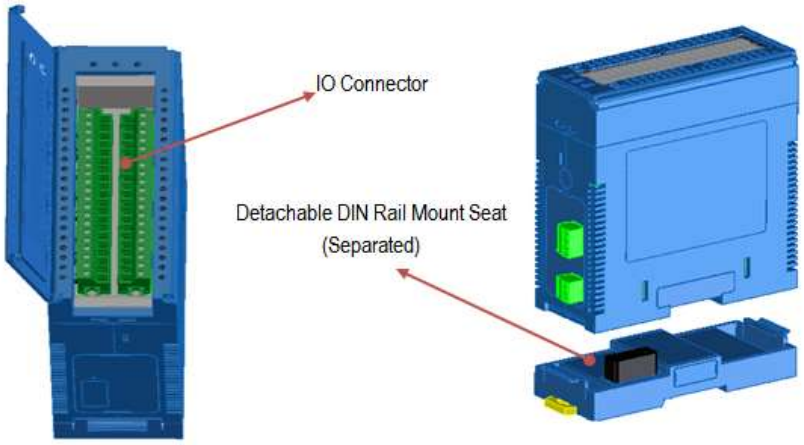
2.1.2 Smart Module

Ports connection and setup of the Smart Series module is shown as figures below. The external connection and construction will be described in the sequential chapters.



2-1 Smart Module Part Identification

2-2 Modbus Address Switch Identification



2-3 IO Connector and DIN RAIL Sheet Identification

Item	Description
Detachable DIN RAIL fixed seat	Each module connecting power and RS-485 via this fixed seat. It supports attach/detach module rapidly and easily extendable.
IO connector	Wiring of IO signals for application.
RS-485 port	Major communication port
Power input Terminals	For power input
System indicator	Represent system status.
IO indicator	Represent the status of each I/O channels
IO label	IO Labels for maintenance
EEPROM slot	Dedicated EEPROM to store system configuration.
Modbus node address switch	Setup Modbus node address
INIT switch (hole)	Restore module setting to factory default setting

2-1 Smart IO Module Parts

2.1.3 Installation

2.1.3.1 DIN rail mounting

Mounting the detachable DIN rail on standard DIN35 rail, therefore, more modules can be extended if required.

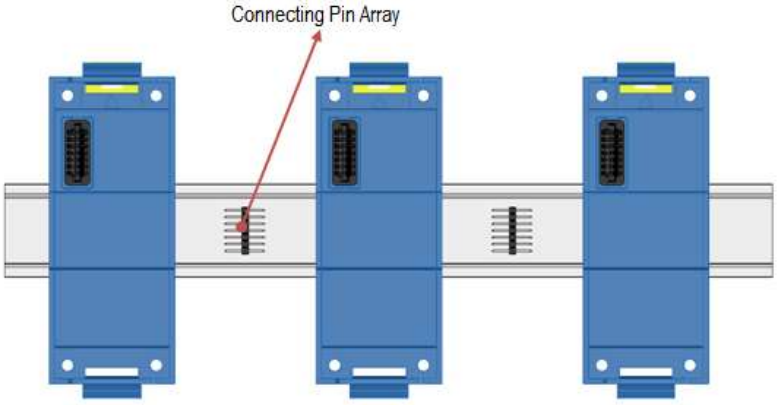
2-2 DIN Rail Mounting

DIN rail module chain installation

The DIN Rail mount seats can be installed on DIN35 rail. The Seats can be installed by using the connecting pin array to connect each fixed seats one by one as shown in the following figure. The communication and power would be daisy chain connected.

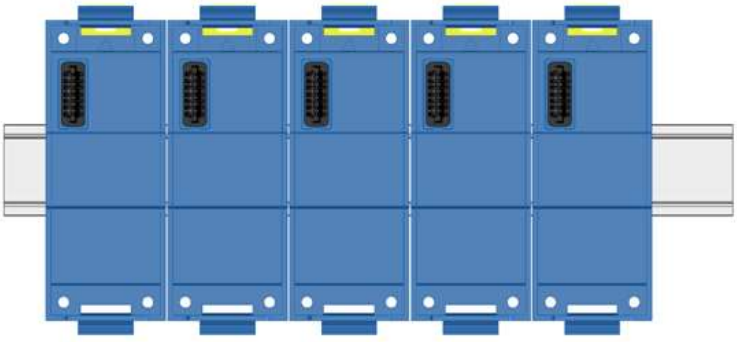
Daisy Chain connecting procedures as follows

1. Use the connecting pin array which is in the accessory pack to connect fixed seats as shown in the following figure.



2-4 Connecting Pin on DIN Rail Sheet

2. Push modules together on DIN rail and connect by connection pin array.



2-5 Daisy chain connection of DIN Rail Sheets on DIN Rail

A daisy-chained fixed seat of the module on DIN rail as shown in the following figure:

2-6 DIN Rail Base Sheet Daisy Chain Connection

3. Insert each I/O modules to detachable fixed seats by vertical direction:

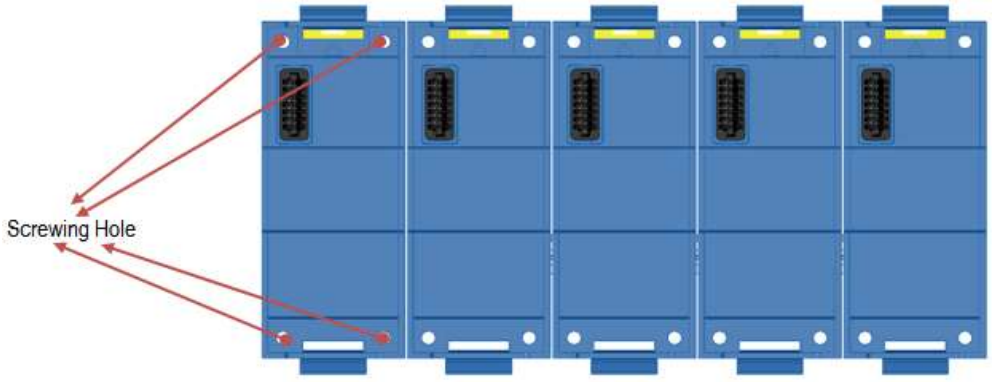
2-7 Vertical Mounting of IO Module

4. A complete daisy chain connected module on DIN rail as shown below

2-8 DIN Rail Mounted Smart IO Module

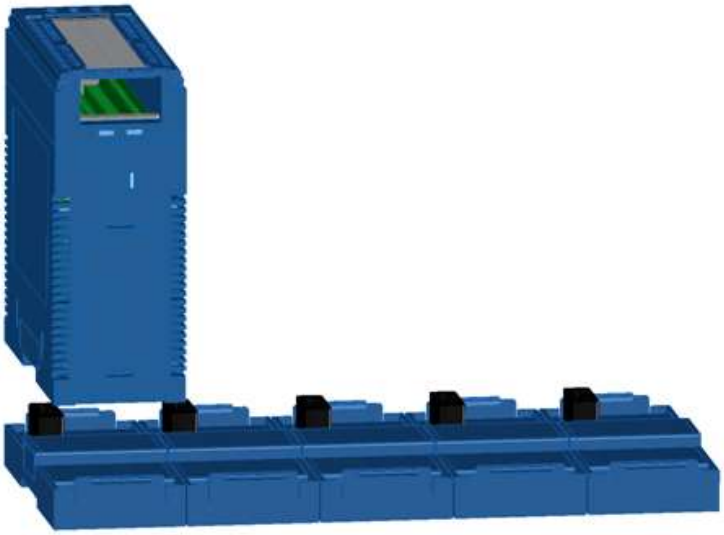
2.1.3.2 Wall mounting

Smart series IO modules also support wall mounting mechanism. Mounting a fixed seat on the wall by screws first. The locations of screw hole as shown in the following figure:



2-9 Wall Mounted Smart IO Module with Screw Holes

Insert each module to fixed seats on the wall, as shown in the following figure.



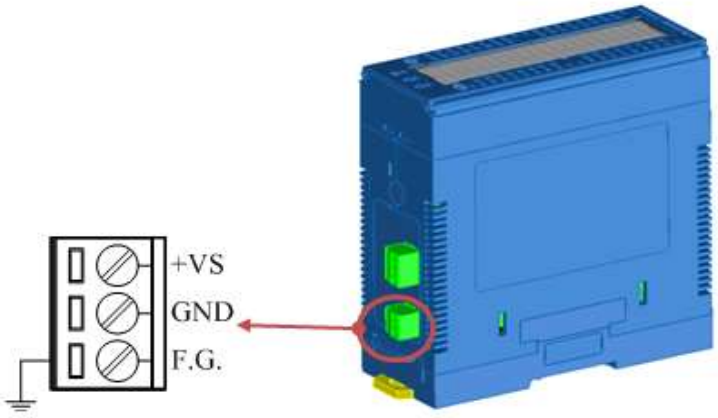
2-10 Wall Mounting of IO Modules

2.1.4 Module grounding

If Smart series modules were installed on an aluminium DIN rail, then the module grounding would utilize aluminium rail for F.G. (Frame Ground).

2.1.4.1 Module grounding by the power connector

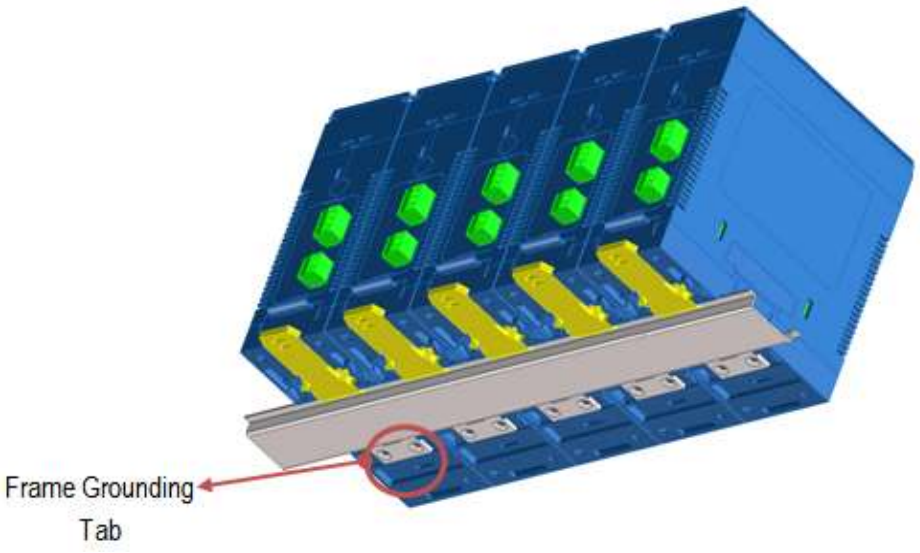
If the installation is not DIN rail type then the grounding should be connected by power connector. The frame grounding installation as shown below.



2-11 Grounding by Power Connector

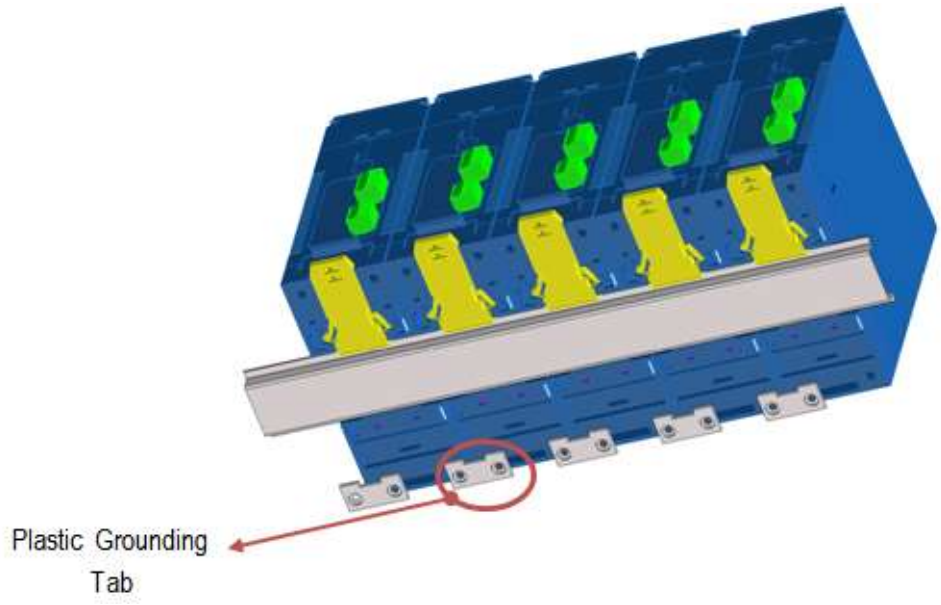
2.1.4.2 DIN rail grounding

When modules were installed on an aluminium DIN rail, a metal grounding tab could be installed between modules and rail. The install location of metal grounding tab as shown as the following figure:



2-12 DIN Rail Grounding -Metal Grounding

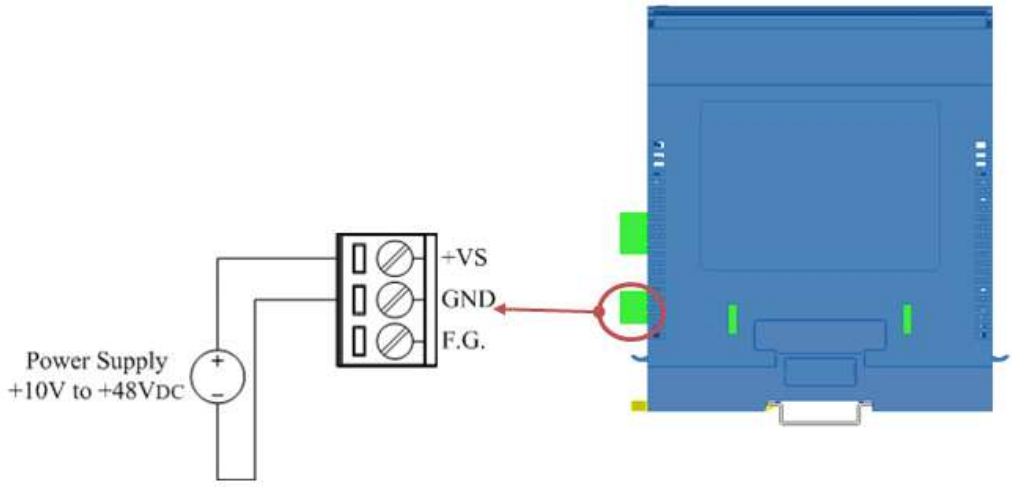
❖ *We strongly recommend a suitable Grounding (Frame Grounding) is necessary to ensure system stability. If the grounding of the power supply is poor or there is noise on frame grounding, then it needs to isolate frame grounding of the module. Use a plastic grounding tab instead of aluminium tab to isolate module frame ground and DIN rail as shown as the following figure.*



2-13 DIN Rail Grounding-Plastic Grounding

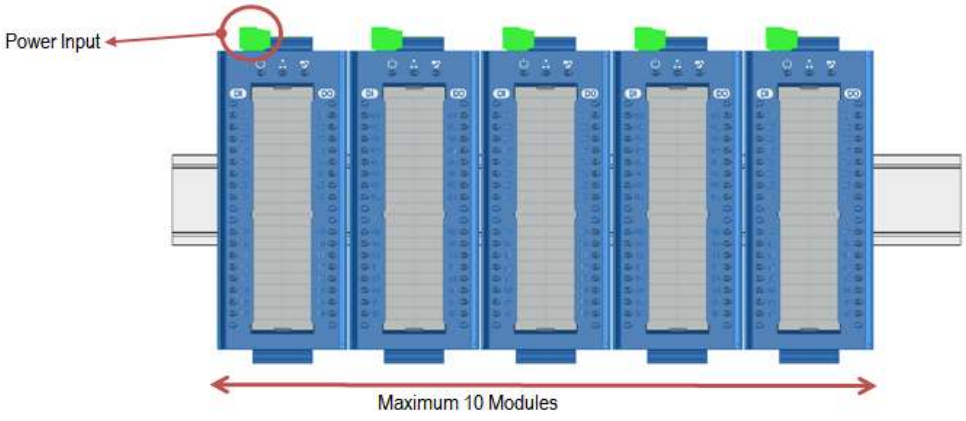
2.1.5 Power Supply

Smart series modules support a wide range DC power input voltage from +10V DC up to +60V DC to fit the industrial application. There is a power regulator inside the module for system power stabilization to supply high-quality power if supplied power is within support range. It is ideally voltage and current in the module are inversely proportional but the power ripple must be limited to 5V Vpp. The power connector wiring is shown in the following figure.



2-14 Power Supply Input Wiring

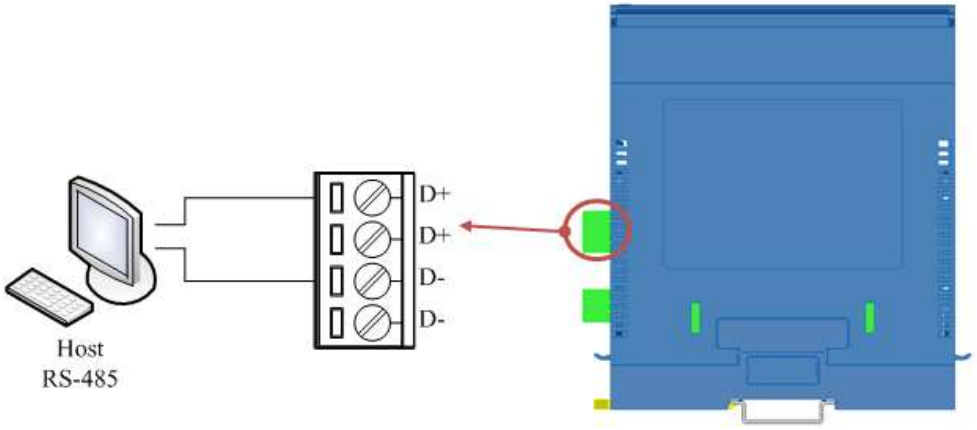
- ❖ *Power will drop when the distance of the power line is too long. So, we strongly recommend the distance between power and module should be as short as possible in order to prevent the system unstable.*
- ❖ *Each module power would be parallelly connected on DIN rail. While connecting the power supply to one of them on the rail then the power would distribute to every module via rail. (Be careful! only one power source could be connecting to one set of modules on one rail.) The maximum number of modules on one rail is 10 modules and power consumption are approximately 30W.*
- ❖ *Using a power connector to connect power source on every module if they are not connected on the rail.*



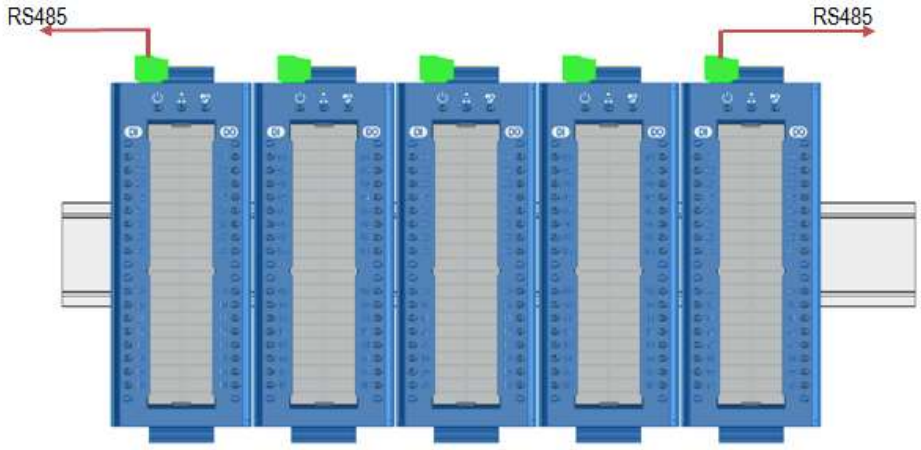
2-15 Chain Connection of Smart IO Modules for Power input

2.1.6 Connecting Communication Interface

Smart IO series modules support standard RS-485 communication. The RS-485 port position is shown on the following figure beside, the next figure is showing the RS-485 connection.



2-16 RS485 Connection Diagram

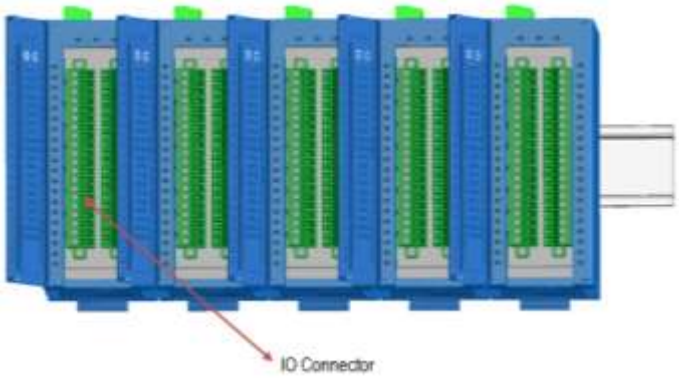


2-17 RS485 Daisy Chain connection

- *When DIN rail mounting with modules alongside and the mounting base are connected to the dock connector RS485 Signals can enter from the first module only and out from the last module only. It is prohibited to use the intermediate module for the pick out to avoid communication instability.*
- *If the base is not connected to the dock connector, then every module communication terminal needs to be connected to communication cables for communication.*

2.1.7 IO Connection

User can choose the suitable I/O feature on the module to fit the specified application. Please refer to the section of module information and check if each I/O channel has been assigned appropriately.



2-18 IO Connector

The description of each I/O channels printed on the back-side of IO Connector cover for the user quick reference.

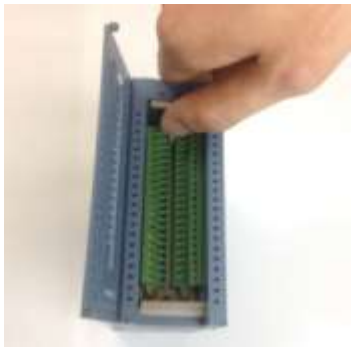
2-19 IO Connector Cover

2.1.7.1 Procedures of Removing I/O terminal

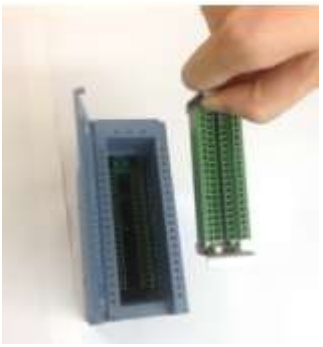
1. Insert a flat-head screwdriver into the position as below.

2. Push down the screwdriver.

3. Remove the terminal by pulling the hook upside.



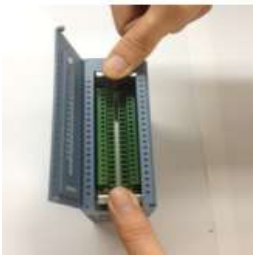
4. Terminal Removed



2.1.7.2 Restore terminal to I/O module

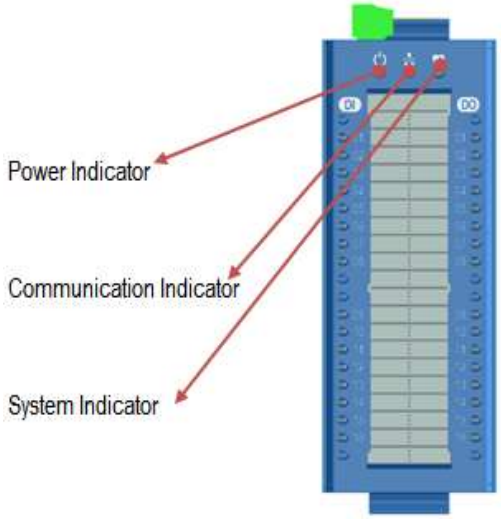
1. Insert the terminal on the module

2. Push the top and bottom side of the connector by two hands simultaneously.



2.1.8 Indicators

There are 3 LED indicators are available for indication of power, communication and system status indication. The functions of each indicator are described in the below table.



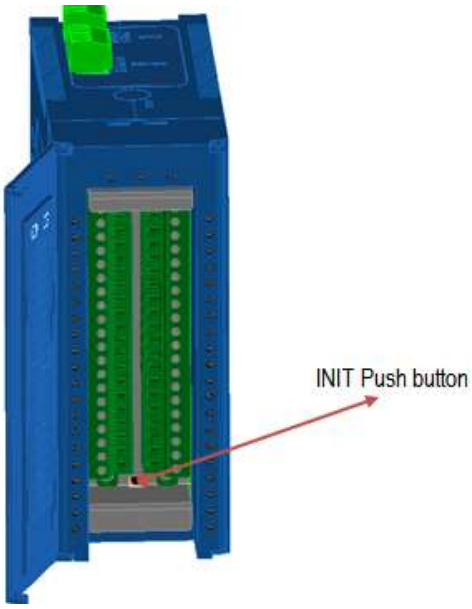
2-20 LED Indicators

Power	COM.	SYS.	Indication	Status
◎	◎	◎	Flash 3 times in 0.5 sec.	System initialization completed.
◎			Lighting	Power Stable and system ready.
	◎		Flashing	Communication
	◎		Lighting	Polling timeout
		◎	Flashing every 0.5 sec	Normal
		◎	Lighting	Abnormal
		◎	A flash pattern as lighting 2 sec, off 1 sec, lighting 0.5 sec, off 1 sec	EEPROM module accessing fail.
		◎	A flash pattern as lighting 2 sec, off 1 sec, lighting 0.5 sec 2 times off 1 sec	EEPROM accessing failed. If it is a new module or not be initialized, please perform EEPROM initialization procedure
		◎	A flash pattern as lighting 2 sec, off 1 sec, lighting 0.5 sec 3 times off 1 sec	The stored parameter in EEPROM not matched as the system. Please do re-initialization of it.

2-3 LED Indicator function

Remark 1:

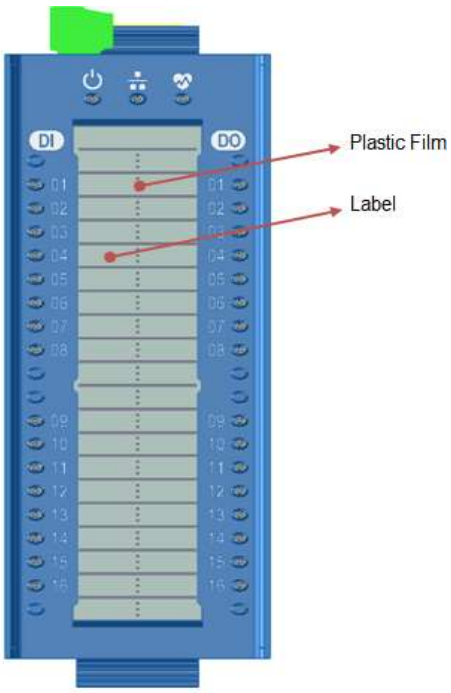
❖ *The re-initialization procedure of changed new EEPROM module is same as module initialization procedure. Push the INIT button on the upside of IO connector for 3 sec then the module will perform init procedure and store the new parameters into EEPROM and Keep the parameters which are in EEPROM same as system.*



2-21 INIT Push Button

2.1.9 Channel Label

Tabs under the plastic film are accessible for the user to mention the label of each channel. If the user wants to change the tabs, then print it and cut out the tabs. Remove the plastic film, insert the tab(s) and put the plastic film back.



2-22 Channel Label

2.1.10 Setup Utility

Smart series IO module can be configured via setup utility directly on the PC workstation equipped with RS-485 Port or using RS-232 port to RS-485 converter or USB to RS-485 converter. Utility Software and setup guidelines can be obtained from BrainChild Electronic company website.

2.1.11 Communication Setup

To set up the Smart series module, MODBUS node address should be determined first.

The factory default to the node address of the Smart IO series module is 01. The node address could be set up by two hexadecimal coded rotary switches. The range of node address is from 0x01 to 0xF7 (1 to 247). This setup should be done at Power OFF Condition. Power OFF the module then uses a screwdriver to rotate the rotary switches to set the address. Power ON the module after the setup has been completed to recognize the address by the module.

2-23 Node Address Setup

The factory default setting of RS-485 on Smart series module **is 9600bpsN, 8, 1.**

The frame format and baud rate can be changed via utility or MODBUS command. The baud rate range is from 1200bps to 115.2Kbps. Even and Odd parity check. The setup utility can be downloaded from BrainChild Electronic company website. Set up MODBUS command of RS-485 as the following

Address	Function		R/W	Initial value
44107 (0x100A)	Communication port parameter: 2 bytes High Byte 0x00: 8-N-1 0x01: 8-N-2 0x02: 8-E-1 0x03: 8-O-1	Low Byte 0x03:1.2K 0x04:2.4K 0x05:4.8K 0x06:9.6K 0x07:19.2K 0x08:38.4K 0x09:57.6K 0x0A:115.2K	R/W	0x0006

2-4 Communication Setup Modbus Mapping

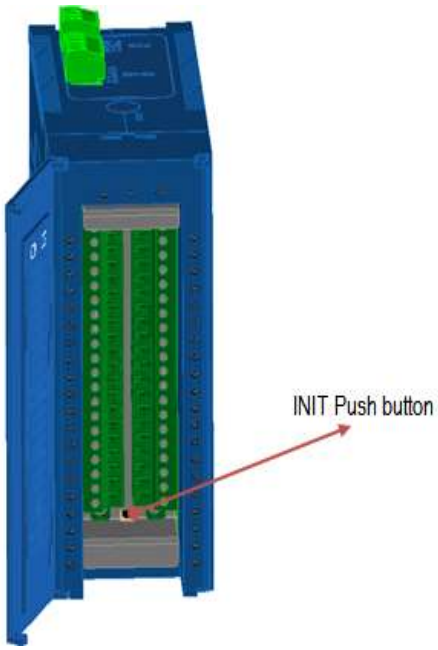
2.1.12 Factory Reset (INIT)

Use the factory reset (INIT) push-button if modules failed to communicate. Press “INIT Push Button” to complete INIT. “INIT Push Button” functions are described as follows:

Push INIT and hold for 3 seconds, the LED indication of power, communication and system will flash 3 times at 0.5-second interval.

After initialization operation, the module will resume factory default settings and reset modules to the below default communication settings.

Baud rate: 9600bps, Data format: N, 8, 1.



2-24 INIT Push Button

2.1.13 Isolated Type RS-232/RS-485 Converter (Optional)

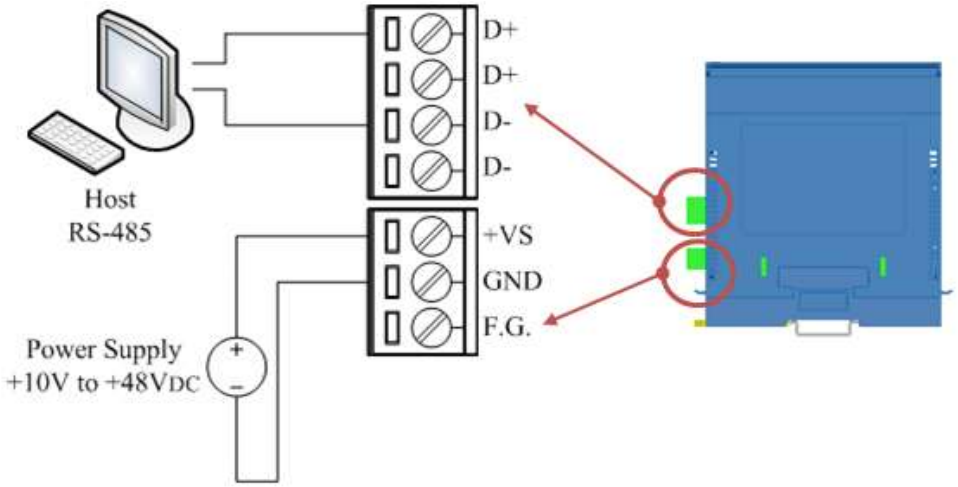
If only RS232 port is available, a converter to convert RS232 to RS485 will be needed.

2.1.14 Repeater (Optional)

If the communication distance surpasses 4000 feet (1200m) or more than 32 modules are used, expanding repeaters may be needed. A maximum number of modules is 247 by 8 repeaters can be connected on the network.

2.2 Single Module Configuration

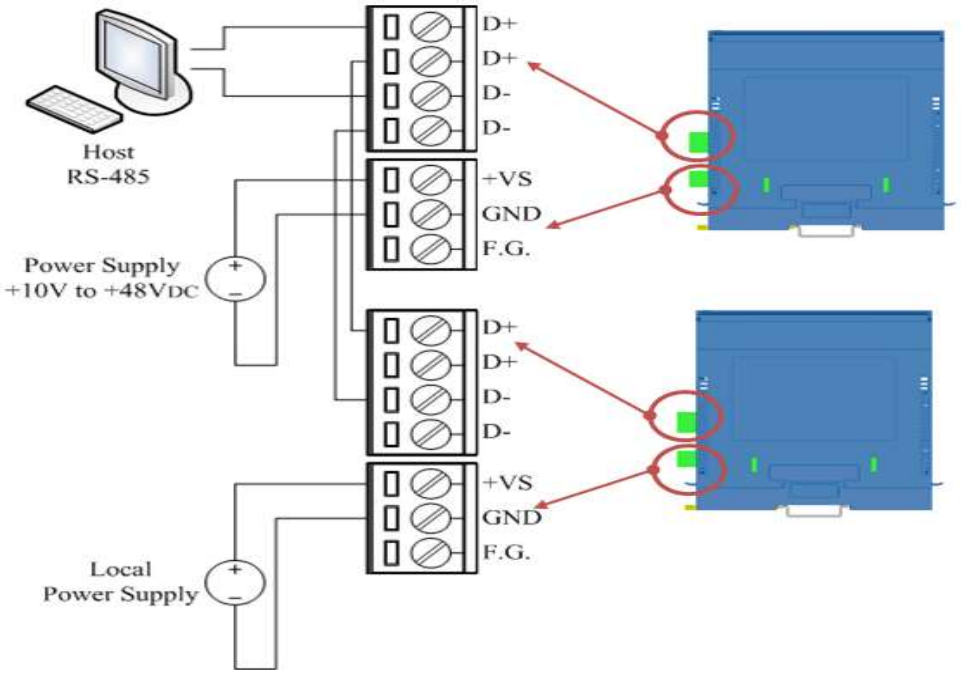
Configuration of a single module network for connecting Smart series IO module (single) is shown below.



2-25 Single Module Configuration

2.3 Multiple Modules (Multi-drop) Configuration

Configuration of multiple modules network connection of Smart series IO modules is shown below.



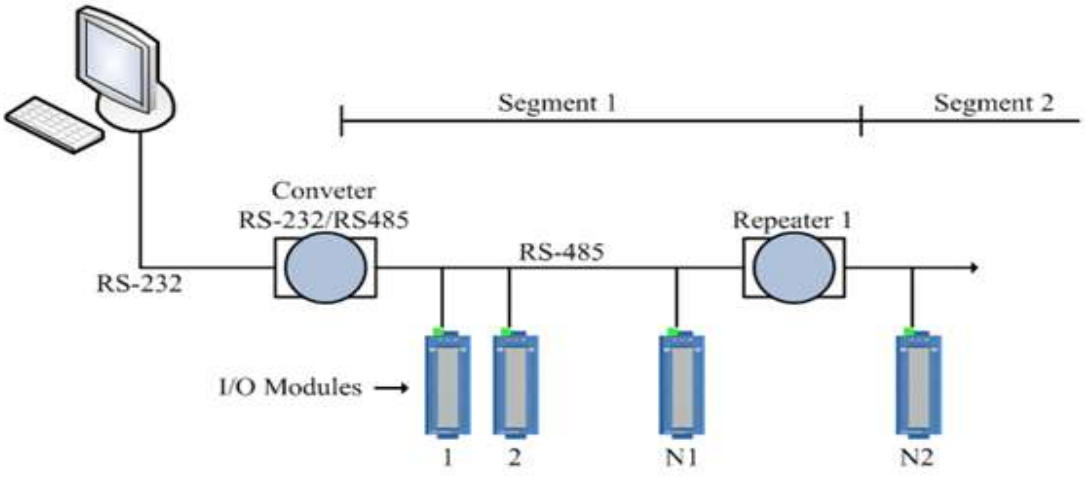
2-26 Multiple Module Configuration

2.4 System Configuration

All Smart series modules are connected in parallel by cables. Thus, the failure of one segment does not affect the entire network system. All the smart series modules are based on RS485 interface and MODBUS RTU protocol. The Smart series modules will act as a slave in the network...

2.4.1 Daisy Chain

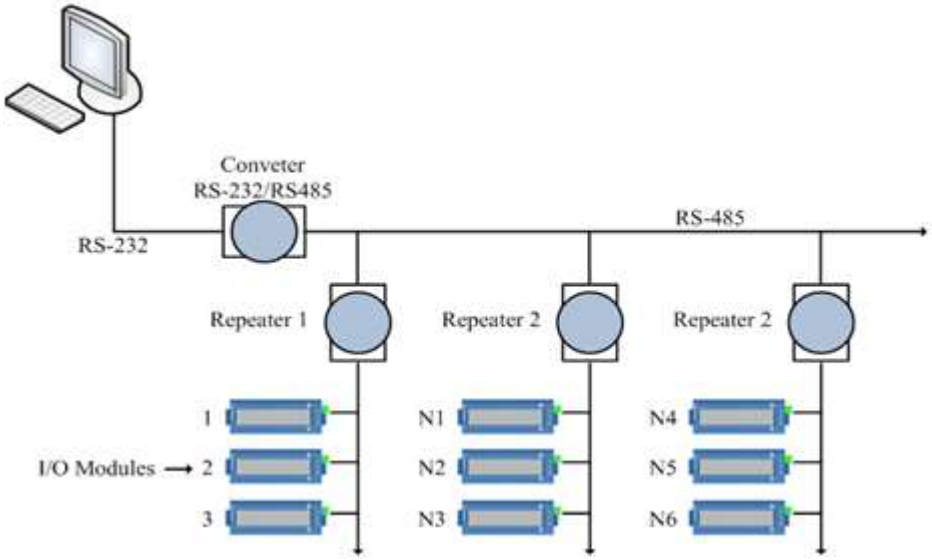
In each segment, the last node to connect modules must be a repeater, with another end connected to the main cable, it served as an important medium. Each repeater can be connected by 32 modules at most; otherwise, the low current might result in communication error.



2-27 Daisy Chain Topology

2.4.2 Star Topology

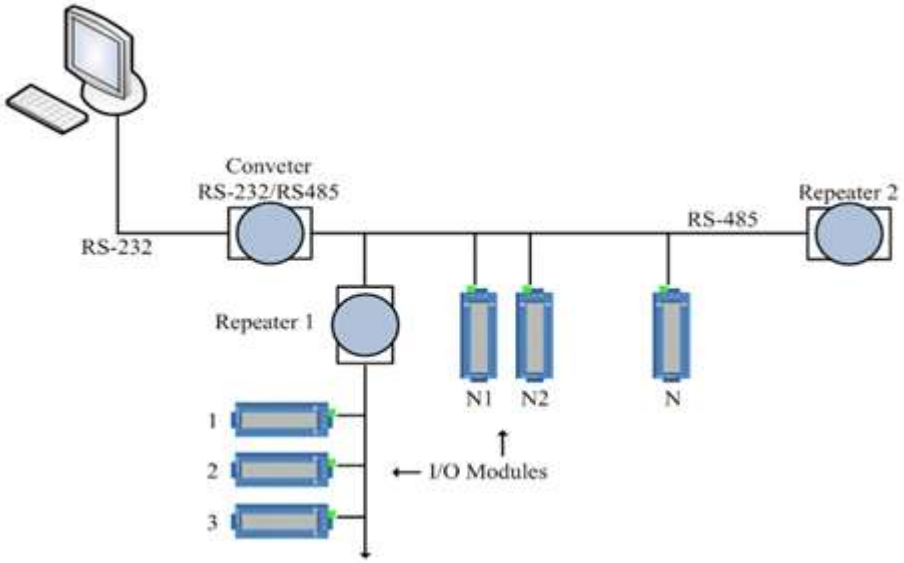
All the repeaters are connected to the main network through a cable and the modules are connected to the repeaters. It forms a tree.



2-28 Star Topology

2.4.3 Random Topology

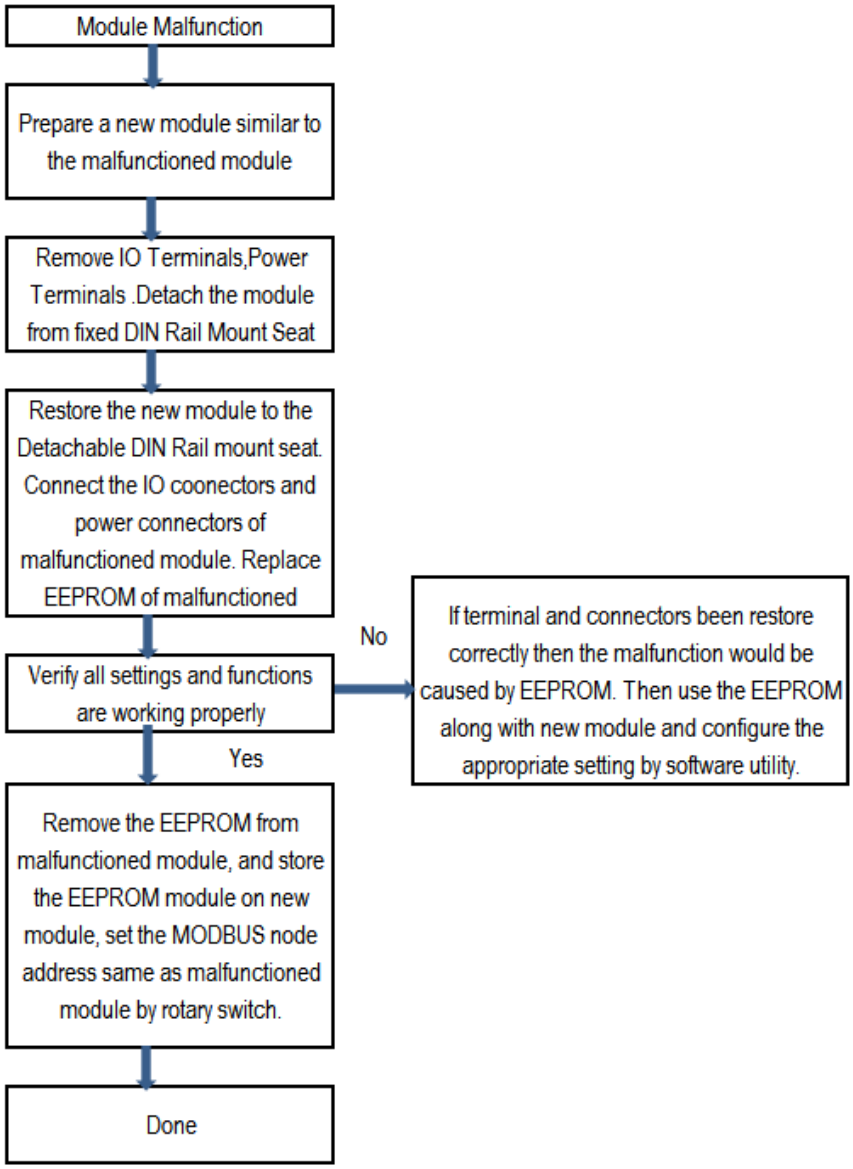
A combination of star and daisy chain topologies can be designated for every requirement.



2-29 Random Topology

2.5 Module Replacement

A quick replacement on-site in case of module failure is indicated as follows:



2-30 Module Replacement

2.5.1 EEPROM Replacement:

EEPROM location is marked in the following figure.

Smart Series IO module is an isolated module, under certain circumstances, if I/O is damaged, the parameter stored in EEPROM will remain active. The user can simply replace EEPROM and resume the setting immediately.

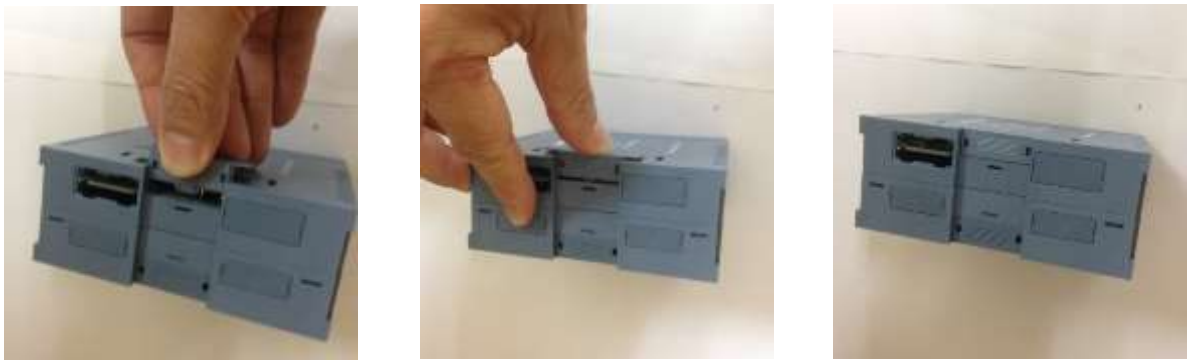
2-31 EEPROM Slot

2.5.1.1 Procedures for Removing EEPROM

To remove EEPROM, follow the steps below:

Procedures of restore EEPROM

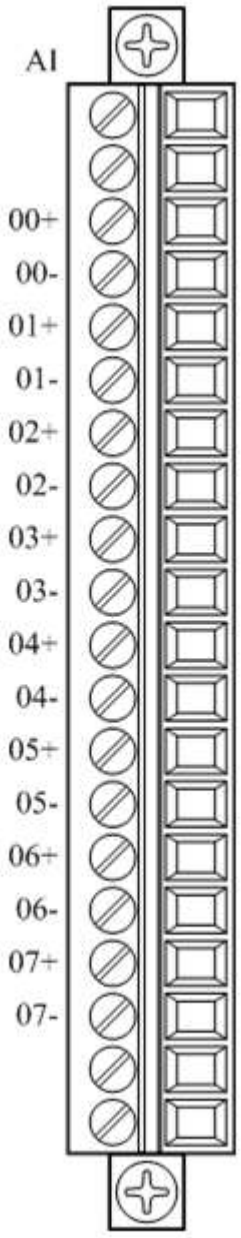
To restore EEPROM, follow the steps below:



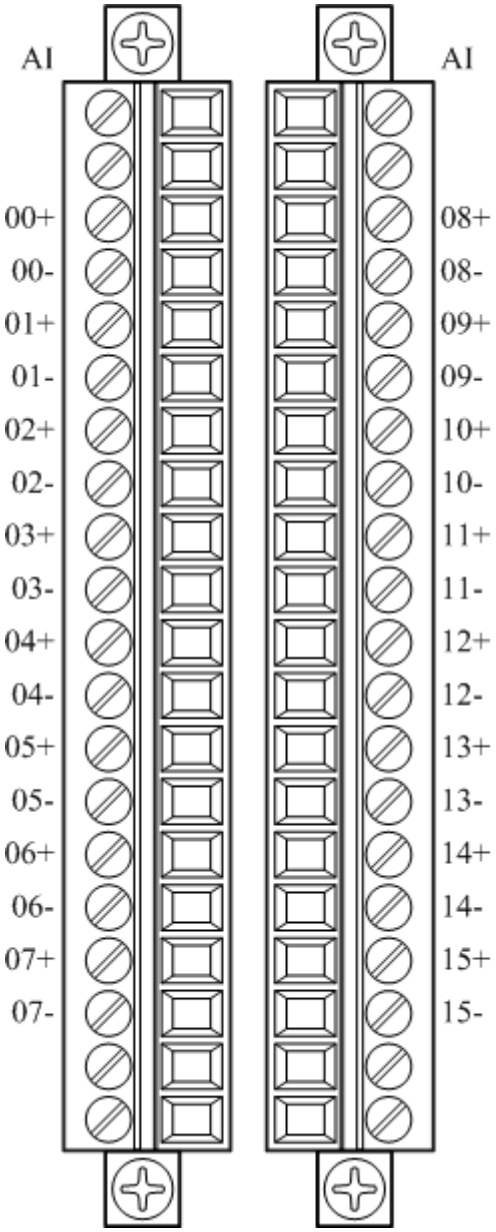
3 Analog Modules

3.1 SIO-8AIU-H / SIO-16AIU-H [8 / 16 Channels Universal Analog Input Module with High Voltage Protection]

3.1.1 Terminal Assignment

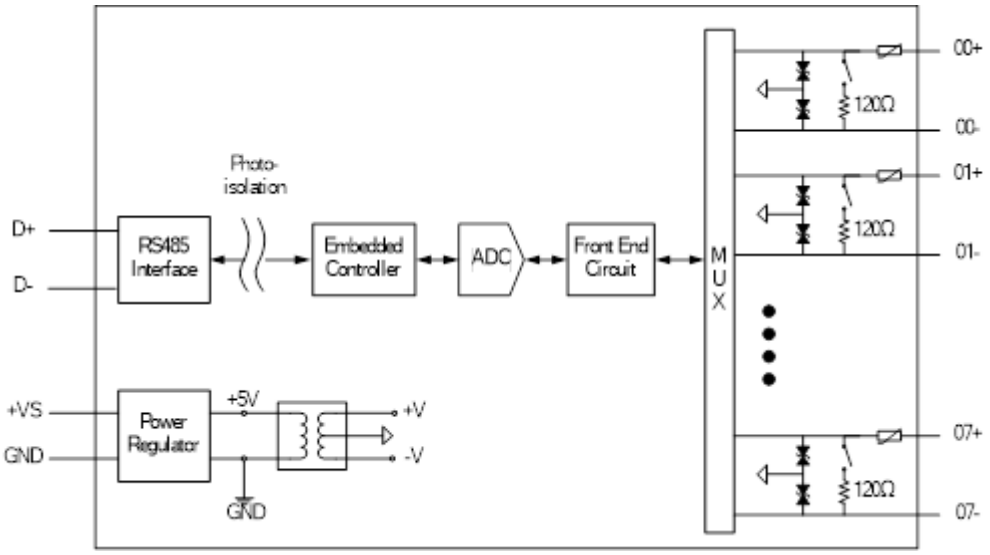


3-1 SIO-8AIU-H Terminal Assignment

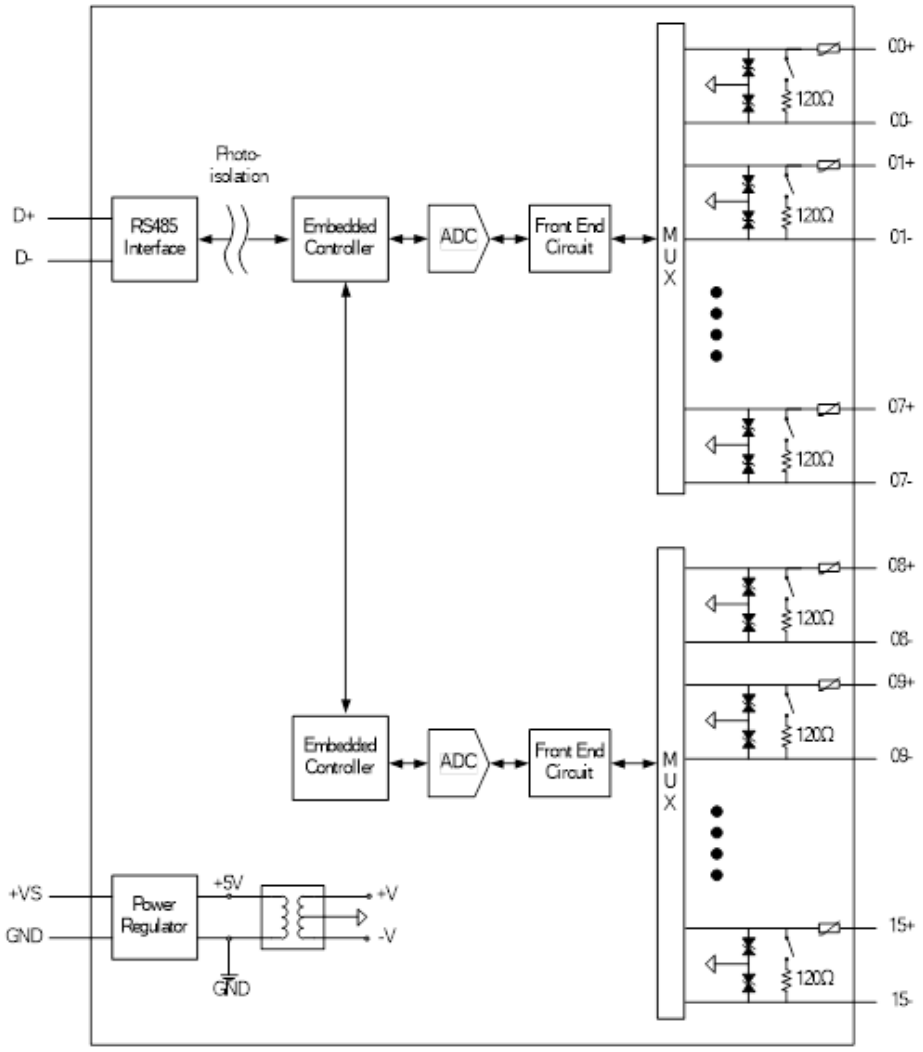


3-2 SIO-16AIU-H Terminal Assignment

3.1.2 Block Diagram



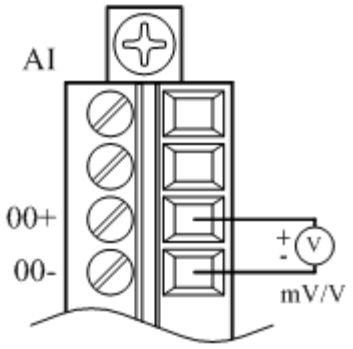
3-3 SIO-8AIU-H Block Diagram



3-4 SIO-16AIU-H Block Diagram

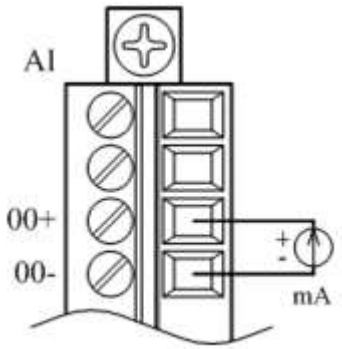
3.1.3 Wiring

3.1.3.1 Voltage Input Wiring



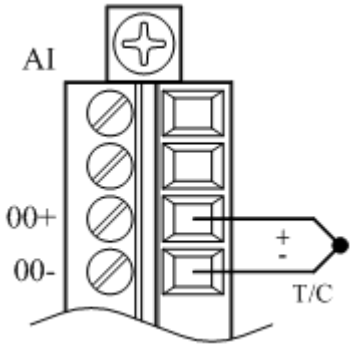
3-5 SIO-8AIU-H / SIO-16AIU-H Voltage Input Wiring

3.1.3.2 Current Input Wiring



3-6 SIO-8AIU-H / SIO-16AIU-H Current Input Wiring

3.1.3.3 Thermocouple Input Wiring



3-7 SIO-8AIU-H / SIO-16AIU-H Thermocouple Input Wiring

3.1.4 Specifications

Parameter	Specification	
	SIO-8AIU-H	SIO-16AIU-H
Channels	8 Channels	16 Channels
Voltage Input	±100mV, ±500mV, ±1V, ±5V, ±10V, 0~100mV, 0~500mV, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V	±100mV, ±500mV, ±1V, ±5V, ±10V, 0~100mV, 0~500mV, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V

Parameter	Specification	
	SIO-8AIU-H	SIO-16AIU-H
Current Input	±20mA, 4~20mA, 0~20mA (Dip switch selection required)	±20mA, 4~20mA, 0~20mA (Dip switch selection required)
Thermocouple Input	J, K, T, E, R, S, B, N	J, K, T, E, R, S, B, N
Burn-out Detection	Yes (all V, 4 ~ 20 mA & all T/C)	Yes (all V, 4 ~ 20 mA & all T/C)
Channel Independent Configuration	Yes	Yes
Sampling Rate	2.5 samples/second per channel	2.5 samples/second per channel
Resolution	16-bit	16-bit
Accuracy	±0.1% FSR	±0.1% FSR
Input Impedance	Voltage: 2MΩ Current: 120 Ω	Voltage: 2MΩ Current: 120 Ω
Span Drift	±25 ppm/°C	±25 ppm/°C
Zero Drift	±6 μV/°C	±6 μV/°C
CMR @ 50/60 Hz	120 dB	120 dB
NMR @ 50/60 Hz	100 dB	100 dB
Input Voltage Protection	±240V	±240V
Common Mode Voltage	240V	240V
Power Consumption	1.6W @ 24V	2.8W @ 24V

3-1 SIO-8AIU-H / SIO-16AIU-H Specification

3.1.5 Related Reference

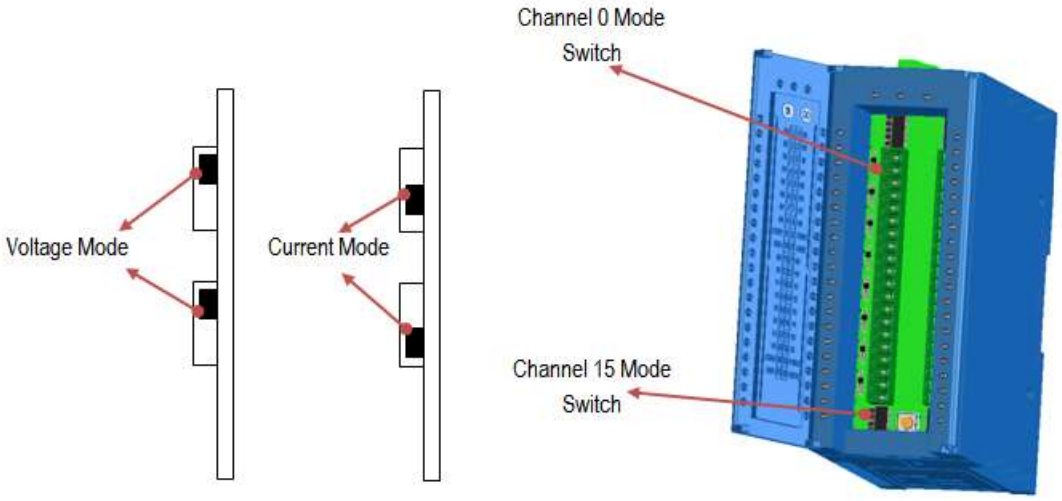
3.1.5.1 Input Signal Type Setup

Input ranges & type for each analog input channel is configurable. The configuration Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AIU-H	SIO-16AIU-H			
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106

3-2 SIO-8AIU-H / SIO=16AIU-H Input Type Selection Modbus Mapping

Note: If “Current” input is selected, please turn the switch to “Current” Input by a flathead screwdriver. While switching to voltage and thermocouple, it is required to turn the switch to the appropriate mode. (See figure below)



3-8 SIO-8AIU-H / SIO-16AIU-H Input Type Mode Selection

3.1.5.2 Input Signals Supported

Value	Input range	Initial value
Voltage Input		
0x0101	0~10 V	
0x0102	0~5 V	
0x0103	0~1 V	
0x0104	0-500mV	
0x0105	0-100mV	
0x0106	± 10 V	◎
0x0107	± 5 V	
0x0108	± 1 V	
0x0109	± 500 mV	
0x010A	± 100 mV	
Current Input		
0x0201	4~20mA	
0x0202	0~20 mA	
0x0203	± 20 mA	
Thermocouple Input		
0x0301	Type J Thermocouple -210 ~ 1200 °C	
0x0302	Type K Thermocouple -270 ~ 1372 °C	
0x0303	Type T Thermocouple -270 ~ 400 °C	
0x0304	Type E Thermocouple -270 ~ 1000 °C	
0x0305	Type R Thermocouple -50 ~ 1768 °C	
0x0306	Type S Thermocouple -50 ~ 1768 °C	
0x0307	Type B Thermocouple 0 ~ 1820 °C	
0x0308	Type N Thermocouple -270 ~ 1300 °C	

3-3 SIO-8AIU-H / SIO-16AIU-H Supported Input Types

3.1.5.3 CJC (Cold Junction Compensation)

There is a built-in thermal sensor in the module for the purpose of cold junction compensation of Thermocouple. The CJC Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AIU-H	SIO-16AIU-H			
00524 (0x020B)	00524 (0x020B)	CJC Enable ❖ 0: Disable. ❖ 1: Enable	R/W	0
40609~40616 (0x0260~0x0267)	40609~40624 (0x0260~0x026F)	CH0~CH7 / CH0~CH15 CJC Scale, Unit: 0.01°C, Range: -50.0°C ~ 50.0°C	R/W	0x0000
40641 (0x0280)	40641 (0x0280)	CH0~CH7 CJC Value, Unit 0.01°C	R	-
-	40642 (0x0281)	CH8~CH15 CJC Value, Unit 0.01°C	R	-
40657 (0x0290)	40657 (0x0290)	Module CJC Scale, Unit 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0

3-4 SIO-8AIU-H / SIO-16AIU-H CJC Modbus Mapping

3.1.5.4 Hexadecimal / Engineering Unit

Setup the measured input value on Hexadecimal, or user scaling. The Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AIU-H	SIO-16AIU-H			
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hex ❖ 0x0001: Engineering	R/W	0x0000

3-5 SIO-8AIU-H / SIO-16AIU-H Value Format Selection Modbus Mapping

3.1.5.5 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
Voltage Input			
0x0101	0~10 V	0 (0)	FFFF (65535)
0x0102	0~5 V	0 (0)	FFFF (65535)
0x0103	0~1 V	0 (0)	FFFF (65535)
0x0104	0-500mV	0 (0)	FFFF (65535)
0x0105	0-100mV	0 (0)	FFFF (65535)
0x0106	± 10 V	8000 (-32768)	7FFF (32767)
0x0107	± 5 V	8000 (-32768)	7FFF (32767)

Value	Range	Min. value	Max. value
0x0108	± 1 V	8000 (-32768)	7FFF (32767)
0x0109	± 500 mV	8000 (-32768)	7FFF (32767)
0x010A	± 100 mV	8000 (-32768)	7FFF (32767)
Current Input			
0x0201	4~20mA	0 (0)	FFFF (65535)
0x0202	0~20 mA	0 (0)	FFFF (65535)
0x0203	± 20 mA	8000 (-32768)	7FFF (32767)
Thermocouple Input			
0x0301	Type J Thermocouple -210 ~ 1200 °C	E999 (-5735)	7FFF (32767)
0x0302	Type K Thermocouple -270 ~ 1372 °C	E6CF (-6449)	7FFF (32767)
0x0303	Type T Thermocouple -270 ~ 400 °C	A99A (-22118)	7FFF (32767)
0x0304	Type E Thermocouple -270 ~ 1000 °C	DD70 (-8848)	7FFF (32767)
0x0305	Type R Thermocouple -50 ~ 1768 °C	FC61 (-927)	7FFF (32767)
0x0306	Type S Thermocouple -50 ~ 1768 °C	FC61 (-927)	7FFF (32767)
0x0307	Type B Thermocouple 0 ~ 1820 °C	0 (0)	7FFF (32767)
0x0308	Type N Thermocouple -270 ~ 1300 °C	E56A (-6806)	7FFF (32767)

3-6 SIO-8AIU-H Input Types supported and Range (HEX Unit)

3.1.5.6 Engineering Unit Data Range

Value	Range	Min. value	Max. value
Voltage Input			
0x0101	0~10 V	0	10000
0x0102	0~5 V	0	50000
0x0103	0~1 V	0	10000
0x0104	0-500mV	0	50000
0x0105	0-100mV	0	10000
0x0106	± 10 V	-10000	10000
0x0107	± 5 V	-5000	5000
0x0108	± 1 V	-10000	10000
0x0109	± 500 mV	-5000	5000
0x010A	± 100 mV	-10000	10000
Current Input			
0x0201	4~20mA	4000	20000
0x0202	0~20 mA	0	20000
0x0203	± 20 mA	-20000	20000
Thermocouple Input			
0x0301	Type J Thermocouple -210 ~ 1200 °C	-2100	12000

Value	Range	Min. value	Max. value
0x0302	Type K Thermocouple -270 ~ 1372 °C	-2700	13720
0x0303	Type T Thermocouple -270 ~ 400 °C	-2700	4000
0x0304	Type E Thermocouple -270 ~ 1000 °C	-2700	10000
0x0305	Type R Thermocouple -50 ~ 1768 °C	-500	17680
0x0306	Type S Thermocouple -50 ~ 1768 °C	-500	17680
0x0307	Type B Thermocouple 0 ~ 1820 °C	0	18200
0x0308	Type N Thermocouple -270 ~ 1300 °C	-270	13000

3-7 SIO-8AIU-H Input Types Supported and Range (Engineering Unit)

3.1.5.7 Input Signal Value

Once the setup is finished. The measured value needs to be verified to enable or disable the channels and check the value is out-of-range or not. (Voltage, 4~20mA or thermocouple break is considered as “out of range”). The input signal value Modbus command as following:

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 Out of range / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 Value / AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0

3-8 SIO-8AIU-H / SIO-16AIU-H Input Signal Modbus Mapping

3.1.5.8 Temperature Offset

The temperature offset can be set for the thermocouple input type selection in the module. This is helpful to fine-tune the input reading. The Modbus mapping for the temperature offset as below.

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
40577~40584 (0x0240~0x0247)	40577~40592 (0x0240~0x024F)	CH0~CH7 / CH0 ~ CH15 Temperature Offset Value, Unit: 0.01°C Range: -50.0°C to 50.0°C	R/W	0x0000

3-9 SIO-8AIU-H / SIO-16AIU-H Temperature Offset Modbus Mapping

3.1.5.9 Voltage / Current Gain & Offset

The voltage and current measurement can be fine-tuned with gain and offset parameters in the module. The Modbus mapping for the temperature offset as below.

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000

3-10 SIO-8AIU-H / SIO-16AIU-H Offset & Gain Modbus Mapping

The measured value will be calculated as below.

Output = (Input + Offset) x Gain

Ex1: Type: +10V, Input: 0.9 V, Offset: 0.01 FSR, Gain: 1.5;
Output = [0.9 V + (10V x 0.01)] x 1.5 = 1.5V

Ex2: Type: 0 ~ 20mA, Input: 5mA, Offset: 0.1 FSR, Gain: 1.2;
Output = [5mA + (20mA x 0.1)] x 1.2 = 8.4mA

Ex3: Type: 4 ~ 20mA, Input 6mA，Offset: 0.2 FSR, Gain: 0.9;
Output = [6mA + (20mA x 0.2)] x 0.9 = 9mA

Note: This feature is available after firmware version V1.14

3.1.6 Modbus Mapping Table

3.1.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
00524 (0x020B)	00524 (0x020B)	CJC Enable ❖ 0: Disable ❖ 1: Enable	R/W	0
00537 (0x0218)	00537 (0x0218)	Allow calibration ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0

3-11 SIO-8AIU-H / SIO-16AIU-H Modbus Mapping Coil (0xxxx & 1xxxx)

3.1.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 value / AI CH0 ~ CH15 Value	R	-
40577~40584 (0x0240~0x0247)	40577~40592 (0x0240~0x024F)	CH0~CH7 / CH0~CH15 Temperature Compensation Unit: 0.01°C, Range: -50.0°C ~ 50.0°C	R/W	0x0000
40609~40616 (0x0260~0x0267)	40609~40624 (0x0260~0x026F)	CH0~CH7 / CH0~CH15 CJC Scale, Unit: 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0x0000
40641 (0x0280)	40641 (0x0280)	CH0~CH7 CJC Value, Unit: 0.01°C	R	-
-	40642 (0x0281)	CH8~CH15 CJC Value, Unit 0.01°C	R	-
40657 (0x0290)	40657 (0x0290)	Module CJC Scale, Unit 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hexadecimal ❖ 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0
40757 (0x02F4)	40757 (0x02F4)	CH0~CH7 / CH0~CH15 Calibrate maximum value to each channel. (Each bit map to the corresponding channel) Ex. Bit 0=1, Calibrate CH0.Bit 1=1, calibrate CH1.	W	0x0000
40758 (0x02F5)	40758 (0x02F5)	CH0~CH7 / CH0~CH15 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000

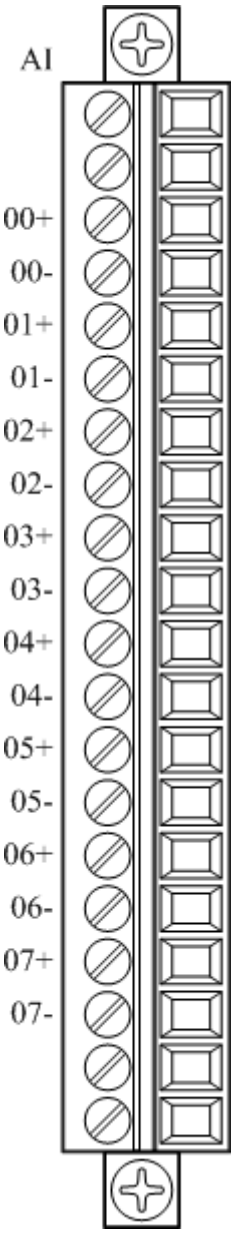
<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-8AIU-H</th><th>SIO-16AIU-H</th></tr>
<tr><td>40759
(0x02F6)</td><td>40759
(0x02F6)</td><td>CH0~CH7 / CH0~CH15 Perform internal calibration to each channel.
(Each bit map to corresponding channel)</td><td>W</td><td>0x0000</td></tr>
<tr><td>40760
(0x02F7)</td><td>40760
(0x02F7)</td><td>CH0~CH7 / CH0~CH15 Calibration in process
(Each bit map to the corresponding channel)
❖ 0: No operation
❖ 1: Calibration in process</td><td>R</td><td>-</td></tr>
<tr><td>44097
0x1000</td><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII characters)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>44106
(0x1009)</td><td>Modbus response delay time
Unit: milliseconds
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44110
(0x100D)</td><td>44110
(0x100D)</td><td>Status of system watch dog
❖ 0x0001: Timeout
❖ 0x0000: Normal</td><td>R/W</td><td>-</td></tr>
<tr><td>44111
(0x100E)</td><td>44111
(0x100E)</td><td>Counter of communication frame</td><td>R</td><td>0x0000</td></tr>
<tr><td>44112
(0x100F)</td><td>44112
(0x100F)</td><td>Program CRC</td><td>R</td><td></td></tr>
</table>

Address		Function	R/W	Initial Value
SIO-8AIU-H	SIO-16AIU-H			
44128 (0x101F)	44128 (0x101F)	Module Error Status ❖ Bit 0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	
-	44130 (0x1021)	Inner module Master/slave Communication Error code ❖ 0: No Error ❖ 1: No response ❖ 2: ID Not matching ❖ 3: Communication Time Out	R	

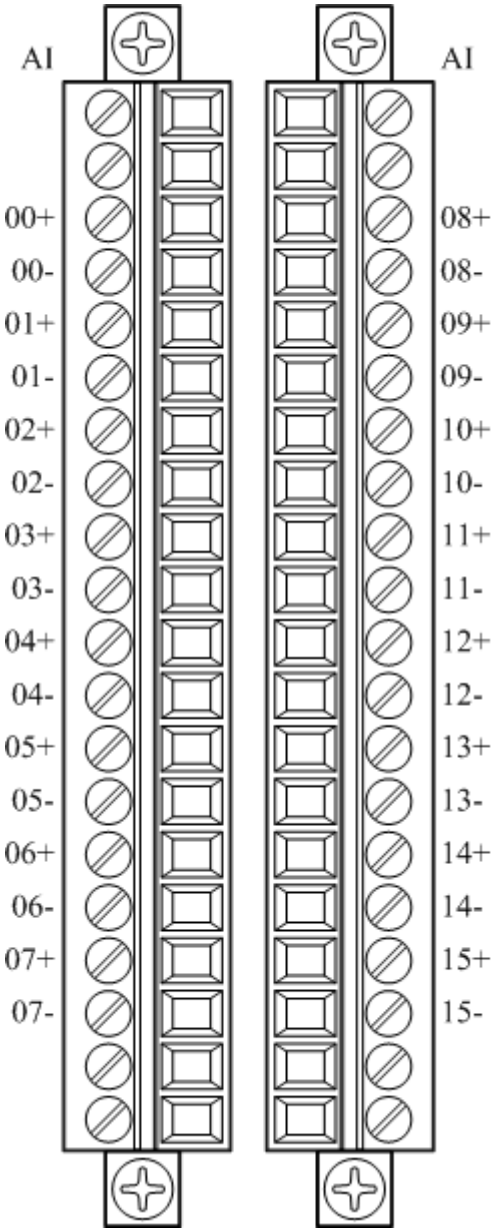
3-12 SIO-8AIU-H / SIO-16AIU-H Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

3.2 SIO-8TC / SIO-16TC [8 / 16 Channels Thermocouple Input Module]

3.2.1 Terminal Assignment

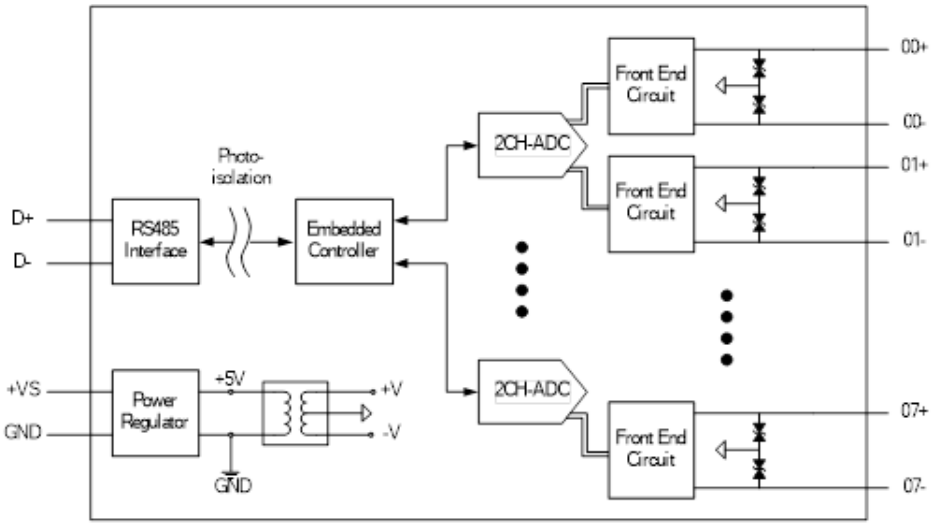


3-9 SIO-8TC Terminal Assignment

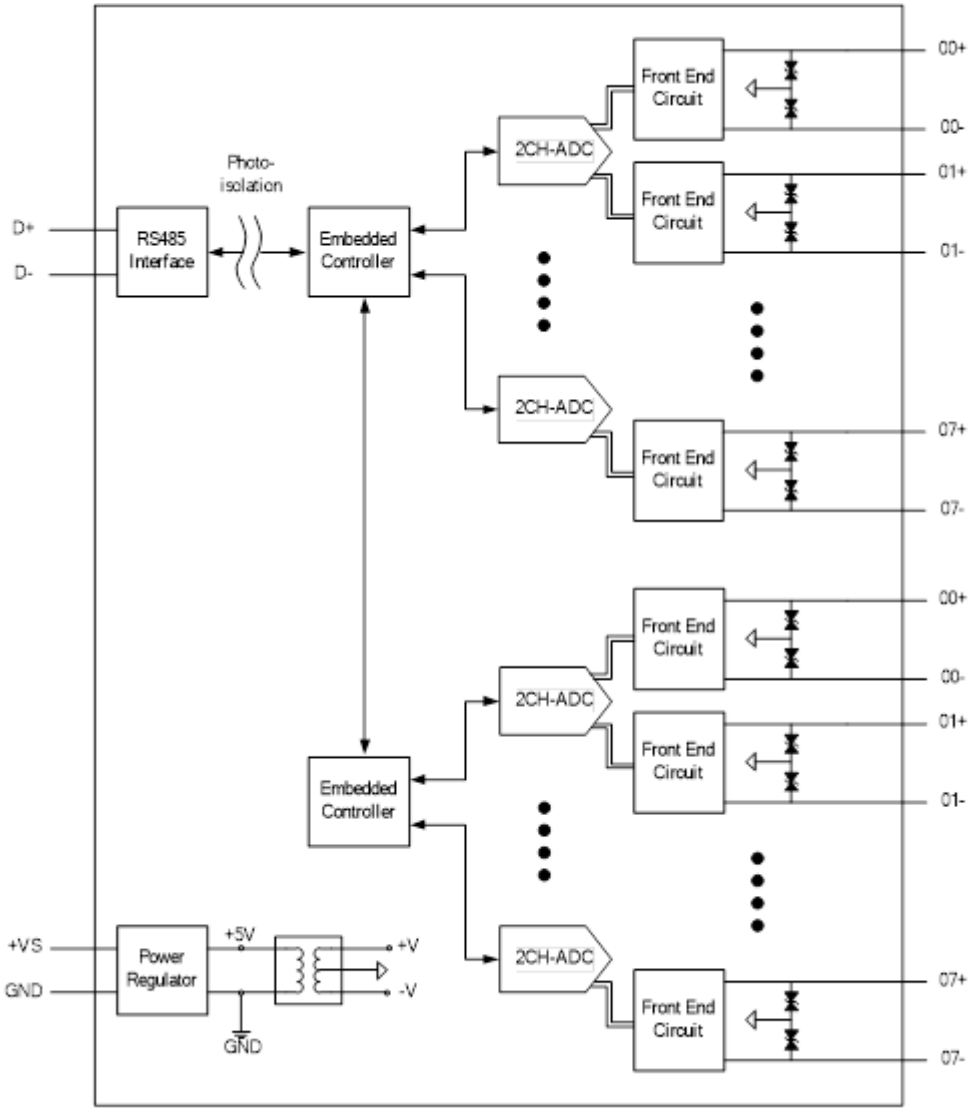


3-10 SIO-16TC Terminal Assignment

3.2.2 Block Diagram

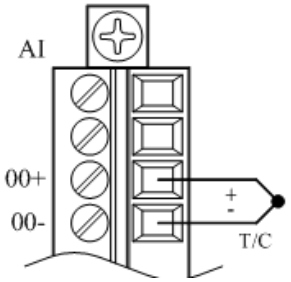


3-11 SIO-8TC Block Diagram



3-12 SIO-16TC Block Diagram

3.2.3 Wiring



3-13 SIO-8TC / SIO-16TC Thermocouple Input Wiring

3.2.4 Specifications

Parameter	Specification	
	SIO-8TC	SIO-16TC
Channels	8 Channels	16 Channels
Direct Sensor Input	J, K, T, E, R, S, B, N	J, K, T, E, R, S, B, N
Burn-out Detection	Yes	Yes
Channel Independent Configuration	Yes	Yes
Sampling Rates	2.5 samples/second per channel	2.5 samples/second per channel
Resolution	16-bit	16-bit
Accuracy	±0.1% FSR	±0.1% FSR
Input Impedance	2MΩ	2MΩ
Span Drift	±25 ppm/°C	±25 ppm/°C
Zero Drift	±6 μV/°C	±6 μV/°C
CMR @ 50/60 Hz	120 dB	120 dB
NMR @ 50/60 Hz	100 dB	100 dB
Input Voltage Protection	±35V	±35V
Common Mode Voltage	2.5V	2.5V
Power Consumption	1.6W @ 24V	2.8W @ 24V

3-13 SIO-8TC / SIO-16TC Specification

3.2.5 Related Reference

3.2.5.1 Input Signal Type Setup

Input ranges & type for each analog input channel is configurable. The configuration Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8TC	SIO-16TC			
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0301

3-14 SIO-8TC / SIO-16TC Input Type Selection Modbus Mapping

3.2.5.2 Signals Range

Value	Input range	Initial value
0x0301	Type J Thermocouple -210 ~ 1200 °C	◎
0x0302	Type K Thermocouple -270 ~ 1372 °C	
0x0303	Type T Thermocouple -270 ~ 400 °C	
0x0304	Type E Thermocouple -270 ~ 1000 °C	
0x0305	Type R Thermocouple -50 ~ 1768 °C	
0x0306	Type S Thermocouple -50 ~ 1768 °C	
0x0307	Type B Thermocouple 0 ~ 1820 °C	
0x0308	Type N Thermocouple -270 ~ 1300 °C	

3-15 SIO-8TC / SIO-16TC Input Type Supported

3.2.5.3 CJC (Cold Junction Compensation)

There is an inbuilt thermal sensor in the module for the purpose of cold junction compensation of Thermocouple. The Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8TC	SIO-16TC			
00524 (0x020B)	00524 (0x020B)	CJC Enable ❖ 0: Disable. ❖ 1: Enable	R/W	0
40609~40616 (0x0260~0x0267)	40609~40624 (0x0260~0x026F)	CH0~CH7 / CH0~CH15 CJC Scale, Unit: 0.01°C, Range: -50.0°C ~ 50.0°C	R/W	0x0000
40641 (0x0280)	40641 (0x0280)	CH0~CH7 CJC Value, Unit 0.01°C	R	-
-	40642 (0x0281)	CH8~CH15 CJC Value, Unit 0.01°C	R	-
40657 (0x0290)	40657 (0x0290)	Module CJC Scale, Unit 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0

3-16 SIO-8TC / SIO-16TC CJC Modbus Mapping

3.2.5.4 Hexadecimal / Engineering Unit

Setup the measured input value on Hexadecimal, or user scaling. The Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8TC	SIO-16TC			
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hex ❖ 0x0001: Engineering	R/W	0x0000

3-17 SIO-8TC Value Format Selection Modbus Mapping

3.2.5.5 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
0x0301	Type J Thermocouple -210 ~ 1200 °C	E999 (-5735)	7FFF (32767)
0x0302	Type K Thermocouple -270 ~ 1372 °C	E6CF (-6449)	7FFF (32767)
0x0303	Type T Thermocouple -270 ~ 400 °C	A99A (-22118)	7FFF (32767)
0x0304	Type E Thermocouple -270 ~ 1000 °C	DD70 (-8848)	7FFF (32767)
0x0305	Type R Thermocouple -50 ~ 1768 °C	FC61 (-927)	7FFF (32767)
0x0306	Type S Thermocouple -50 ~ 1768 °C	FC61 (-927)	7FFF (32767)
0x0307	Type B Thermocouple 0 ~ 1820 °C	0 (0)	7FFF (32767)
0x0308	Type N Thermocouple -270 ~ 1300 °C	E56A (-6806)	7FFF (32767)

3-18 SIO-8TC / SIO-16TC Input Type Supported & Range (HEX Unit)

3.2.5.6 Engineering Unit Data Range

Value	Range	Min. value	Max. value
0x0301	Type J Thermocouple -210 ~ 1200 °C	-2100	12000
0x0302	Type K Thermocouple -270 ~ 1372 °C	-2700	13720
0x0303	Type T Thermocouple -270 ~ 400 °C	-2700	4000
0x0304	Type E Thermocouple -270 ~ 1000 °C	-2700	10000
0x0305	Type R Thermocouple -50 ~ 1768 °C	-500	17680
0x0306	Type S Thermocouple -50 ~ 1768 °C	-500	17680
0x0307	Type B Thermocouple 0 ~ 1820 °C	0	18200
0x0308	Type N Thermocouple -270 ~ 1300 °C	-270	13000

3-19 SIO-8TC / SIO-16TC Input Type Supported & Range (Engineering Unit)

3.2.5.7 Input Signal Value

Once the setup is finished. The measured value needs to be verified to enable or disable the channels and check the value is out-of-range or not. The sensor break will be considered as out of range. The input signal value Modbus command as following:

Address		Function	R/W	Initial Value
SIO-8TC	SIO-16TC			
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 Out of range / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 Value / AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0

3-20 SIO-8AIU-H / SIO-16AIU-H Input Signal Modbus Mapping

3.2.5.8 Temperature Offset

The temperature offset can be set for the thermocouple input type selection in the module. This is helpful to fine-tune the input reading. The Modbus mapping for the temperature offset as below.

Address		Function	R/W	Initial Value
SIO-8TC	SIO-16TC			
40577~40584 (0x0240~0x0247)	40577~40592 (0x0240~0x024F)	CH0~CH7 / CH0 ~ CH15 Temperature Offset Value, Unit: 0.01°C Range: -50.0°C to 50.0°C	R/W	0x0000

3-21 SIO-8AIU-H / SIO-16AIU-H Input Signal Modbus Mapping

3.2.6 Modbus Mapping Table

3.2.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-8TC	SIO-16TC			
00524 (0x020B)	00524 (0x020B)	CJC Enable ❖ 0: Disable ❖ 1: Enable	R/W	0
00537 (0x0218)	00537 (0x0218)	Allow calibration ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0

3-22 SIO-8TC / SIO-16TC Modbus Mapping Coil (0xxxx & 1xxxx)

3.2.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address		Function	R/W	Initial Value
SIO-8TC	SIO-16TC			
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 value / AI CH0 ~ CH15 Value	R	-
40577~40584 (0x0240~0x0247)	40577~40592 (0x0240~0x024F)	CH0~CH7 / CH0~CH15 Temperature Compensation Unit: 0.01°C, Range: -50.0°C ~ 50.0°C	R/W	0x0000
40609~40616 (0x0260~0x0267)	40609~40624 (0x0260~0x026F)	CH0~CH7 / CH0~CH15 CJC Scale, Unit: 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0x0000
40641 (0x0280)	40641 (0x0280)	CH0~CH7 CJC Value, Unit: 0.01°C	R	-
-	40642 (0x0281)	CH8~CH15 CJC Value, Unit 0.01°C	R	-
40657 (0x0290)	40657 (0x0290)	Module CJC Scale, Unit 0.01°C Range: -50.0°C ~ 50.0°C	R/W	0
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hexadecimal ❖ 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to the corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0
40757 (0x02F4)	40757 (0x02F4)	CH0~CH7 / CH0~CH15 Calibrate maximum value to each channel. (Each bit map to the corresponding channel) Ex. Bit 0=1, Calibrate CH0.Bit 1=1, calibrate CH1.	W	0x0000
40758 (0x02F5)	40758 (0x02F5)	CH0~CH7 / CH0~CH15 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000
40759 (0x02F6)	40759 (0x02F6)	CH0~CH7 / CH0~CH15 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0x0000

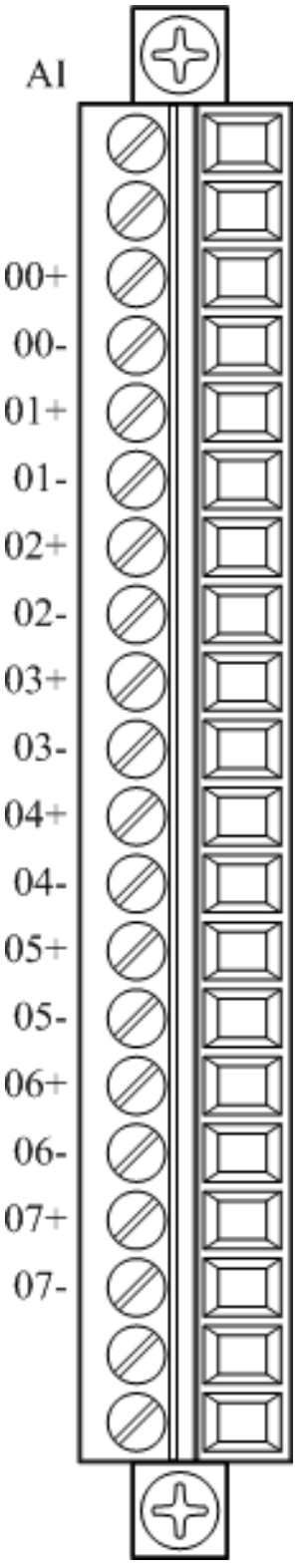
<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-8TC</th><th>SIO-16TC</th></tr>
<tr><td>40760
(0x02F7)</td><td>40760
(0x02F7)</td><td>CH0~CH7 / CH0~CH15 Calibration in process
(Each bit map to the corresponding channel)
❖ 0: No operation
❖ 1: Calibration in process</td><td>R</td><td>-</td></tr>
<tr><td>44097
0x1000</td><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII characters)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>44106
(0x1009)</td><td>Modbus response delay time
Unit: milliseconds
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44110
(0x100D)</td><td>44110
(0x100D)</td><td>Status of system watch dog
❖ 0x0001: Timeout
❖ 0x0000: Normal</td><td>R/W</td><td>-</td></tr>
<tr><td>44111
(0x100E)</td><td>44111
(0x100E)</td><td>Counter of communication frame</td><td>R</td><td>0x0000</td></tr>
<tr><td>44112
(0x100F)</td><td>44112
(0x100F)</td><td>Program CRC</td><td>R</td><td></td></tr>
<tr><td>44128
(0x101F)</td><td>44128
(0x101F)</td><td>Module Error Status
❖ Bit 0: EEPROM Error
❖ Bit1: Master/Slave Communication Error</td><td>R</td><td></td></tr>
</table>

Address		Function	R/W	Initial Value
SIO-8TC	SIO-16TC			
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	
-	44130 (0x1021)	Inner module Master/slave Communication Error code ❖ 0: No Error ❖ 1: No response ❖ 2: ID Not matching ❖ 3: Communication Time Out	R	

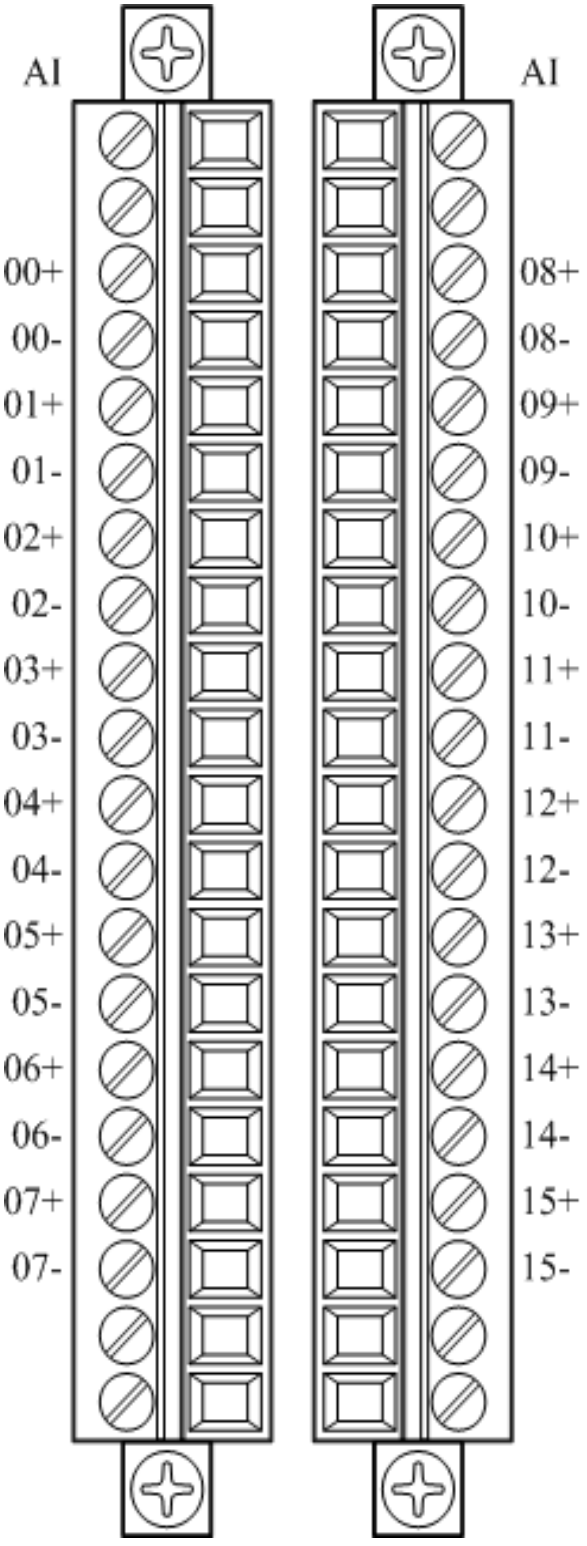
3-23 SIO-8TC / SIO-16TC Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

3.3 SIO-8AII / SIO-16AII [8 / 16 Channels Current Input Module]

3.3.1 Terminal Assignment

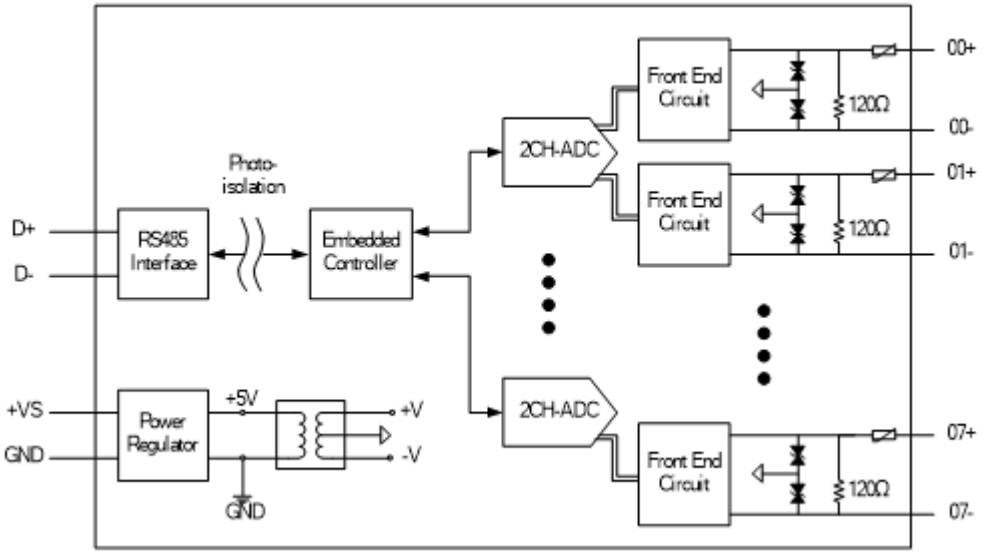


3-14 SIO-8AII Terminal Assignment

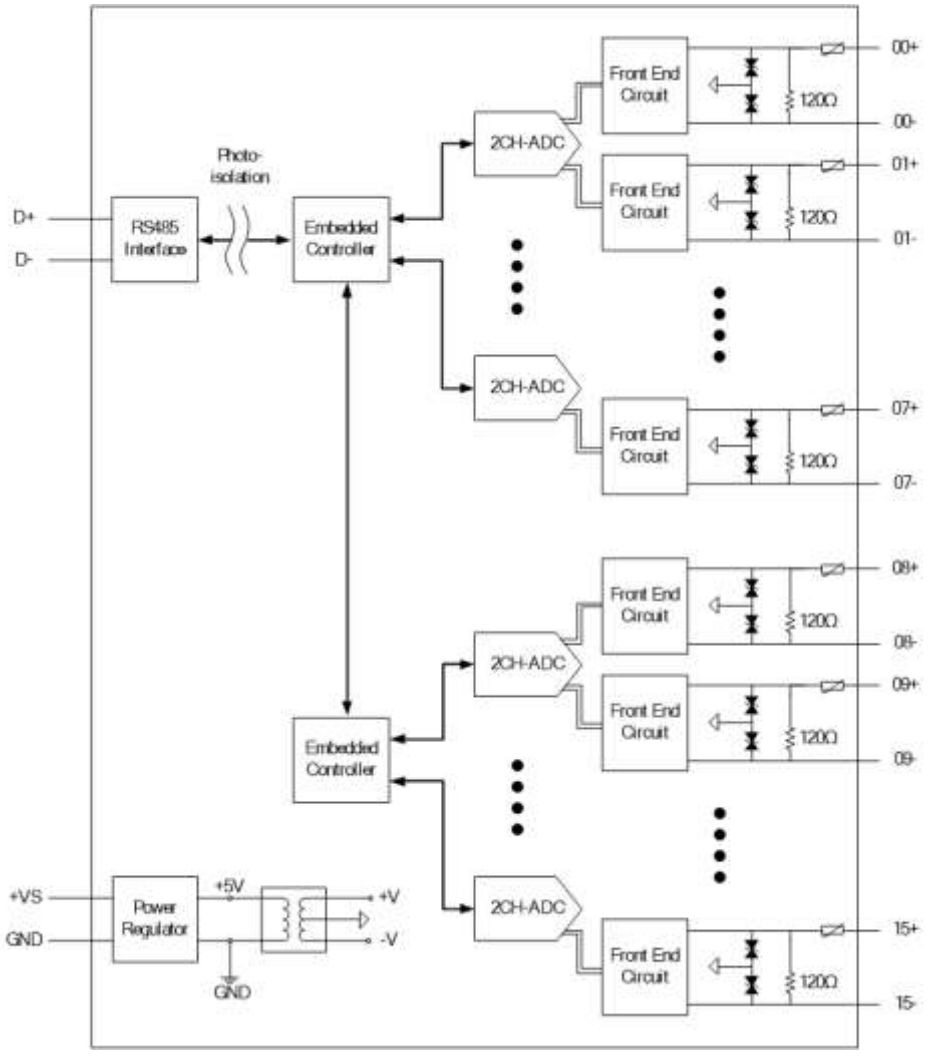


3-15 SIO-16AII Terminal Assignment

3.3.2 Block Diagram

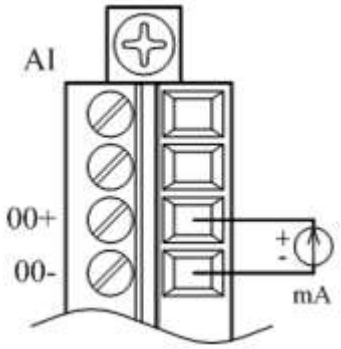


3-16 SIO-8AII Block Diagram



3-17 SIO-16AII Block Diagram

3.3.3 Wiring



3-18 SIO-8AII / SIO-16AII Current Input Wiring

3.3.4 Specifications

Parameter	Specification	
	SIO-8AII	SIO-16AII
Channels	8 channels	16 channels
Current Input	±20mA, 4~20mA, 0~20mA	±20mA, 4~20mA, 0~20mA
Burn-out Detection	4~20mA	4~20mA
Channel Independent Configuration	Yes	Yes
Sampling Rates	2.5 samples/second per channel	2.5 samples/second per channel
Resolution	16-bit	16-bit
Accuracy	±0.1% FSR	±0.1% FSR
Input Impedance	120Ω	120Ω
Span Drift	±25 ppm/°C	±25 ppm/°C
Zero Drift	±6 μV/°C	±6 μV/°C
CMR @ 50/60 Hz	120 dB	120 dB
NMR @ 50/60 Hz	100 dB	100 dB
Input Voltage Protection	±35V	±35V
Common Mode Voltage	35V	35V
Power Consumption	1.6W @ 24V	2.8W @ 24V

3-24 SIO-8AII / SIO-16AII Specification

3.3.5 Related Reference

3.3.5.1 Input Signal Type Setup

Input ranges & type for each analog input channel is configurable. The configuration Modbus command is shown below

Address		Function	R/W	Initial value
SIO-8AII	SIO-16AII			
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0301

3-25 SIO-8AII / SIO-16AII Input Type Selection Modbus Mapping

3.3.5.2 Input Signals Supported

Value	Input range	Initial value
0x0201	4~20mA	◎
0x0202	0~20 mA	
0x0203	± 20 mA	

3-26 SIO-8AII / SIO-16AII Input Types Supported

3.3.5.3 Hexadecimal / Engineering Unit

Setup the measured input value on Hexadecimal, or user scaling. Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AII	SIO-16AII			
40737 (0x02E0)	40737 (0x02E0)	AI Value format 0x0000: Hex 0x0001: Engineering	R/W	0x0000

3-27 SIO-8AII / SIO-16AII Value Format Selection Modbus Mapping

3.3.5.4 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
0x0201	4~20mA	0 (0)	FFFF (65535)
0x0202	0~20 mA	0 (0)	FFFF (65535)
0x0203	± 20 mA	8000 (-32768)	7FFF (32767)

3-28 SIO-8AII Input Type Supported and Ranges (HEX Unit)

3.3.5.5 Engineering Unit Data Range

Value	Range	Min. value	Max. value
0x0201	4~20mA	4000	20000
0x0202	0~20 mA	0	20000
0x0203	± 20 mA	-20000	20000

3-29 SIO-8AII Input Type Supported and Ranges (Engineering Unit)

3.3.5.6 Input Signal Value

Once the setup is finished. The measured value needs to be verified to enable or disable the channels and check the value is out-of-range or not. The input break will be considered as out of range. The input signal value Modbus command as following:

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 Out of range / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 Value / AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to the corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0

3-30 SIO-8AII / SIO-16AII Input Signal Modbus Mapping

3.3.5.7 Current Gain & Offset

The current measurement can be fine-tuned with gain and offset parameters in the module. The Modbus mapping for the temperature offset as below.

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000

3-31 SIO-8AII / SIO-16AII Offset & Gain Modbus Mapping

The measured value will be calculated as below.

Output = (Input + Offset) x Gain

Ex1: Type: 0 ~ 20mA, Input: 5mA, Offset: 0.1 FSR, Gain: 1.2;

Output = [5mA + (20mA x 0.1)] x 1.2 = 8.4mA

Ex2: Type: 4 ~ 20mA, Input 6mA，Offset: 0.2 FSR, Gain: 0.9;

Output = [6mA + (20mA x 0.2)] x 0.9 = 9mA

Note: This feature is available after firmware version V1.14

3.3.6 Modbus Mapping Table

3.3.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
00537 (0x0218)	00537 (0x0218)	Allow calibration ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0

3-32 SIO-8AII / SIO-16AII Modbus Mapping Coil (0xxxx & 1xxxx)

3.3.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 value / AI CH0 ~ CH15 Value	R	-
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hexadecimal ❖ 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0
40757 (0x02F4)	40757 (0x02F4)	CH0~CH7 / CH0~CH15 Calibrate maximum value to each channel. (Each bit map to the corresponding channel) Ex. Bit 0=1, Calibrate CH0.Bit 1=1, calibrate CH1.	W	0x0000
40758 (0x02F5)	40758 (0x02F5)	CH0~CH7 / CH0~CH15 Calibrate 0 level to each channel. (Each bit map to the corresponding channel)	W	0x0000

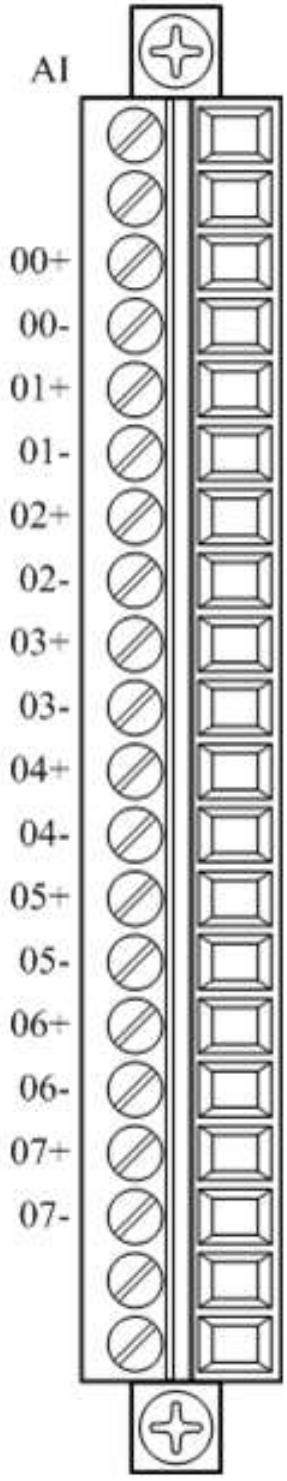
<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-8AII</th><th>SIO-16AII</th></tr>
<tr><td>40759
(0x02F6)</td><td>40759
(0x02F6)</td><td>CH0~CH7 / CH0~CH15 Perform internal calibration to each channel.
(Each bit map to corresponding channel)</td><td>W</td><td>0x0000</td></tr>
<tr><td>40760
(0x02F7)</td><td>40760
(0x02F7)</td><td>CH0~CH7 / CH0~CH15 Calibration in process
(Each bit map to the corresponding channel)
❖ 0: No operation
❖ 1: Calibration in process</td><td>R</td><td>-</td></tr>
<tr><td>44097
0x1000</td><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII characters)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>44106
(0x1009)</td><td>Modbus response delay time
Unit: milliseconds
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44110
(0x100D)</td><td>44110
(0x100D)</td><td>Status of system watch dog
❖ 0x0001: Timeout
❖ 0x0000: Normal</td><td>R/W</td><td>-</td></tr>
<tr><td>44111
(0x100E)</td><td>44111
(0x100E)</td><td>Counter of communication frame</td><td>R</td><td>0x0000</td></tr>
<tr><td>44112
(0x100F)</td><td>44112
(0x100F)</td><td>Program CRC</td><td>R</td><td></td></tr>
</table>

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
44128 (0x101F)	44128 (0x101F)	Module Error Status ❖ Bit 0: EEPROM Error ❖ Bit 1: Master/Slave Communication Error	R	
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	
-	44130 (0x1021)	Inner module Master/slave Communication Error code ❖ 0: No Error ❖ 1: No response ❖ 2: ID Not matching ❖ 3: Communication Time Out	R	

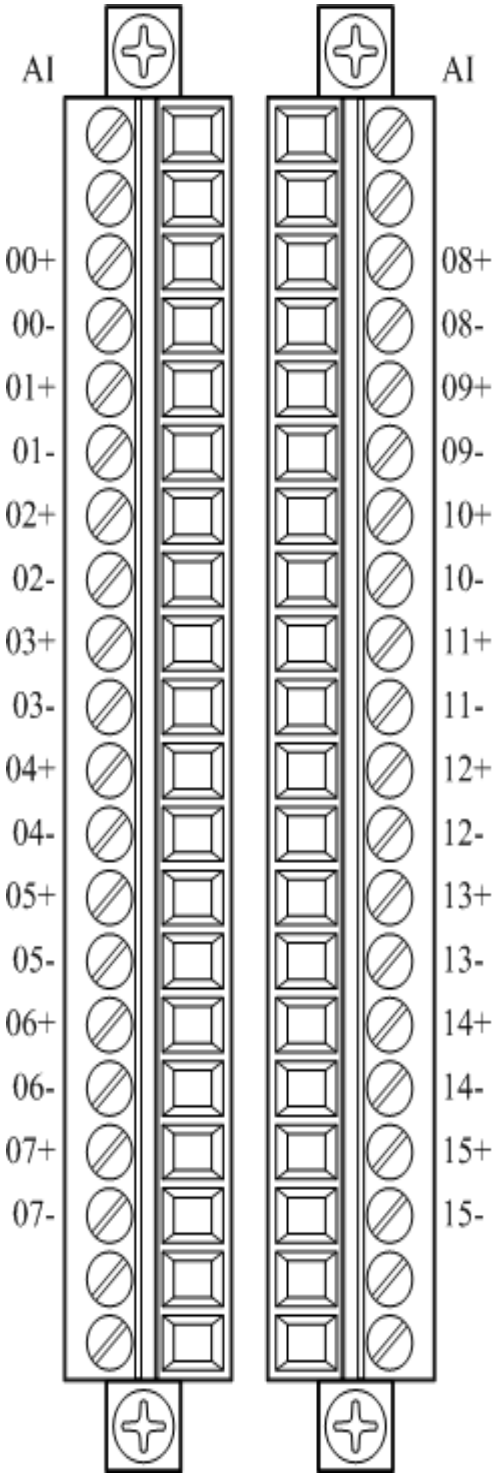
3-33 SIO-8AIU-H / SIO-16AIU-H Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

3.4 SIO-8AIV / SIO-16AIV [8 / 16 Channels Voltage Input Module]

3.4.1 Terminal Assignment

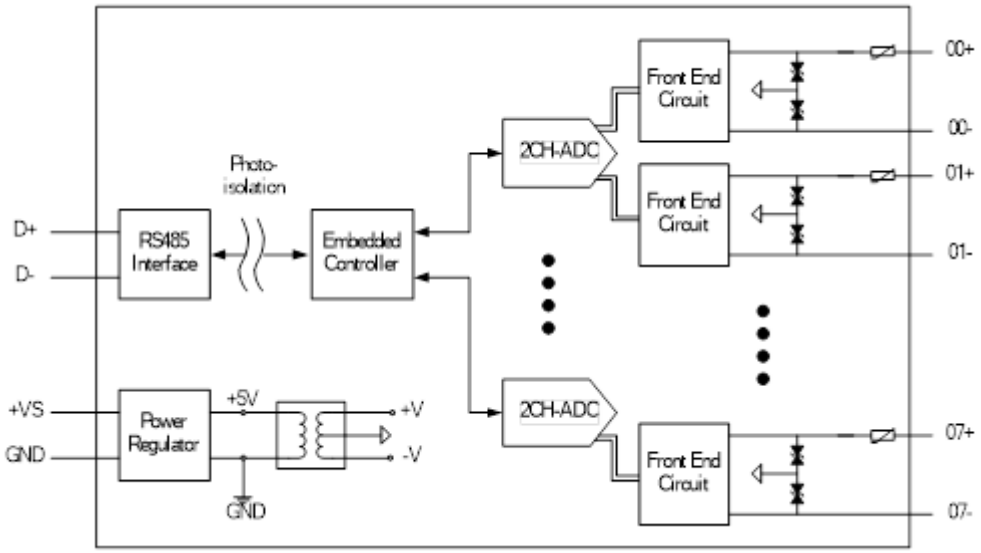


3-19 SIO-8AIV Terminal Assignment

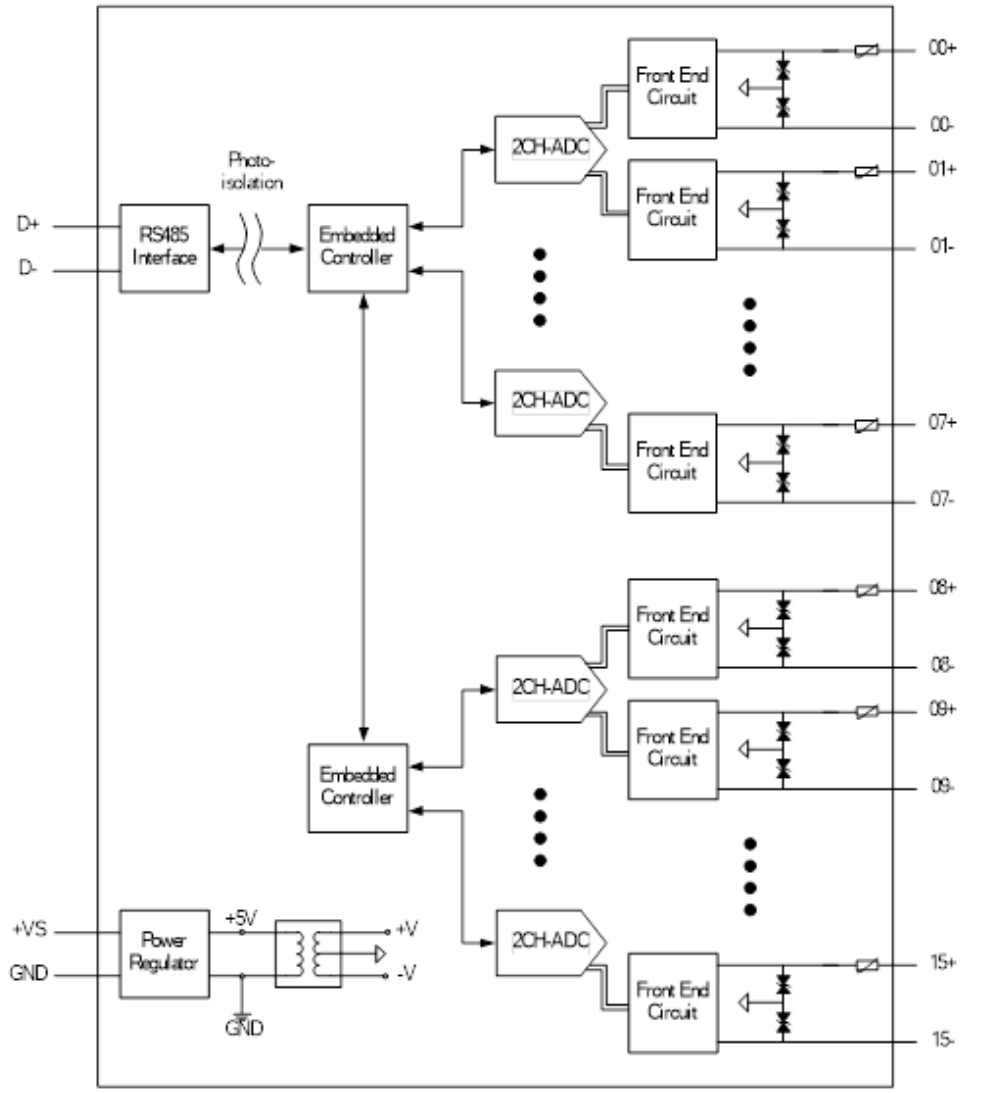


3-20 SIO-16AIV Terminal Assignment

3.4.2 Block Diagram

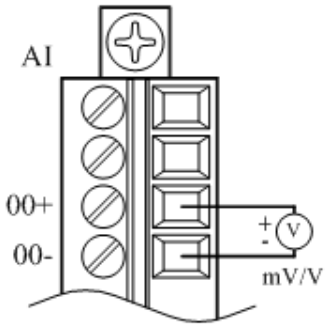


3-21 SIO-8AIV Block Diagram



3-22 SIO-16AIV Block Diagram

3.4.3 Wiring



3-23 SIO-8AIV / SIO-16AIV Voltage Input Wiring

3.4.4 Specifications

Parameter	Specification	
	SIO-8AIV	**SIO-16AIV**
Channels	8 Channels	16 Channels
Voltage Range	±1V, ±5V, ±10V, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V	±1V, ±5V, ±10V, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V
Burn-out Detection	Yes	Yes
Channel Independent Configuration	Yes	Yes
Sampling Rates	2.5 samples/second per channel	2.5 samples/second per channel
Resolution	16-bit	16-bit
Accuracy	±0.1% FSR	±0.1% FSR
Input Impedance	2MΩ	2MΩ
Span Drift	±25 ppm/°C	±25 ppm/°C
Zero Drift	±6 μV/°C	±6 μV/°C
CMR @ 50/60 Hz	120 dB	120 dB
NMR @ 50/60 Hz	100 dB	100 dB
Input Voltage Protection	±35V	±35V
Common Mode Voltage	35V	35V
Power Consumption	1.6W @ 24V	2.8W @ 24V

3-34 SIO-8AIV / SIO-16AIV Specification

3.4.5 Related Reference

3.4.5.1 Input Signal Type Setup

Input ranges & type for each analog input channel is configurable. The configuration Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AIV	SIO-16AIV			
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106

3-35 SIO-8AIV / SIO-16AIV Input Type Selection Modbus Mapping

3.4.5.2 Input Signals Supported

Value	Input range	Initial value
0x0101	0~10 V	
0x0102	0~5 V	
0x0103	0~1 V	
0x0106	± 10 V	◎
0x0107	± 5 V	
0x0108	± 1 V	

3-36 SIO-8AIV / SIO-16AIV Supported Input Types

3.4.5.3 Hexadecimal / Engineering Unit

Setup the measured input value on Hexadecimal, or user scaling. The Modbus command is shown below.

Address		Function	R/W	Initial value
SIO-8AIV	SIO-16AIV			
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hex ❖ 0x0001: Engineering	R/W	0x0000

3-37 SIO-8AIV / SIO-16AIV Value Format Selection Modbus Mapping

3.4.5.4 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
0x0101	0~10 V	0 (0)	FFFF (65535)
0x0102	0~5 V	0 (0)	FFFF (65535)
0x0103	0~1 V	0 (0)	FFFF (65535)
0x0106	± 10 V	8000 (-32768)	7FFF (32767)
0x0107	± 5 V	8000 (-32768)	7FFF (32767)
0x0108	± 1 V	8000 (-32768)	7FFF (32767)

3-38 SIO-8AIV / SIO-16AIV Input Type Supported and Ranges (HEX Unit)

3.4.5.5 Engineering Unit data range

Value	Range	Min. value	Max. value
0x0101	0~10 V	0	10000
0x0102	0~5 V	0	50000
0x0103	0~1 V	0	10000
0x0106	± 10 V	-10000	10000
0x0107	± 5 V	-5000	5000
0x0108	± 1 V	-10000	10000

3-39 SIO-8AIV / SIO-16AIV Input Type Supported and Ranges (Engineering Unit)

3.4.5.6 Input Signal Value

Once the setup is finished. The measured value needs to be verified to enable or disable the channels and check the value is out-of-range or not. (Input signal break is considered as “out of range”). The input signal value Modbus command as following:

Address		Function	R/W	Initial Value
SIO-8AII	SIO-16AII			
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 Out of range / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 Value / AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to the corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0

3-40 SIO-8AIV / SIO-16AIV Input Signal Modbus Mapping

3.4.5.7 Voltage Gain & Offset

The voltage measurement can be fine-tuned with gain and offset parameters in the module. The Modbus mapping for the temperature offset as below.

Address		Function	R/W	Initial Value
SIO-8AIV	SIO-16AIV			
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000

3-41 SIO-8AIV / SIO-16AIV Offset & Gain Modbus Mapping

The measured value will be calculated as below.

Output = (Input + Offset) x Gain

Ex1: Type: +10V, Input: 0.9 V, Offset: 0.01 FSR, Gain: 1.5;

Output = [0.9 V + (10V x 0.01)] x 1.5 = 1.5V

Note: This feature is available after firmware version V1.14

3.4.6 Modbus Mapping Table

3.4.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-8AIV	SIO-16AIV			
00537 (0x0218)	00537 (0x0218)	Allow calibration ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	00641~00656 (0x0280~0x028F)	CH0~CH7 / CH0~CH15 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0

3-42 SIO-8AIV / SIO-16AIV Modbus Mapping Coil (0xxxx & 1xxxx)

3.4.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address		Function	R/W	Initial Value
SIO-8AIV	SIO-16AIV			
30513~30520 40513~40520 (0x0200~0x0207)	30513~30528 40513~40528 (0x0200~0x020F)	AI CH0~CH7 value / AI CH0 ~ CH15 Value	R	-
40673~40680 (0x02A0~0x02A7)	40673~40688 (0x02A0~0x02AF)	CH0~CH7 / CH0 ~ CH15 Offset Value, Range: -0.5000 to 0.5000 FSR	R/W	0
40689~40696 (0x02B0~0x02B7)	40689~40704 (0x02B0~0x02BF)	CH0~CH7 / CH0 ~ CH15 Gain Value, Range: -3.0000 to 3.0000	R/W	1.0000
40705~40712 (0x02C0~0x02C7)	40705~40720 (0x02C0~0x02CF)	CH0~CH7 / CH0~CH15 Input signal type selection	R/W	0x0106
40737 (0x02E0)	40737 (0x02E0)	AI Value format ❖ 0x0000: Hexadecimal ❖ 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	40746 (0x02E9)	CH0~CH7 Disable / CH0 ~ CH15 Disable Each bit map to corresponding channel. Bit 0 = 1, CH0 Disable, Bit 1 = 1, CH1 Disable…. Bit 15 = 1, CH15 Disable	R/W	0

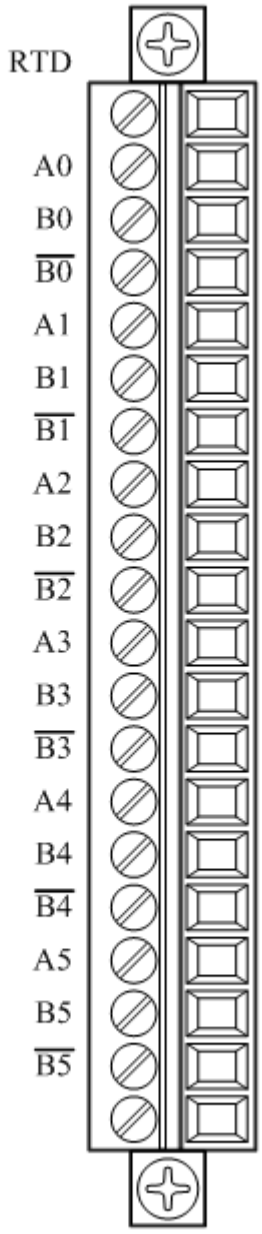
<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-8AIV</th><th>SIO-16AIV</th></tr>
<tr><td>40757
(0x02F4)</td><td>40757
(0x02F4)</td><td>CH0~CH7 / CH0~CH15 Calibrate maximum value to each channel.
(Each bit map to the corresponding channel)
Ex. Bit 0=1, Calibrate CH0.Bit 1=1, calibrate CH1.</td><td>W</td><td>0x0000</td></tr>
<tr><td>40758
(0x02F5)</td><td>40758
(0x02F5)</td><td>CH0~CH7 / CH0~CH15 Calibrate 0 level value to each channel. (Each bit map to corresponding channel)</td><td>W</td><td>0x0000</td></tr>
<tr><td>40759
(0x02F6)</td><td>40759
(0x02F6)</td><td>CH0~CH7 / CH0~CH15 Perform internal calibration to each channel.
(Each bit map to corresponding channel)</td><td>W</td><td>0x0000</td></tr>
<tr><td>40760
(0x02F7)</td><td>40760
(0x02F7)</td><td>CH0~CH7 / CH0~CH15 Calibration in process
(Each bit map to the corresponding channel)
❖ 0: No operation
❖ 1: Calibration in process</td><td>R</td><td>-</td></tr>
<tr><td>44097
0x1000</td><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII characters)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>44106
(0x1009)</td><td>Modbus response delay time
Unit: milliseconds
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
</table>

Address		Function	R/W	Initial Value
SIO-8AIV	SIO-16AIV			
44110 (0x100D)	44110 (0x100D)	Status of system watch dog ❖ 0x0001: Timeout ❖ 0x0000: Normal	R/W	-
44111 (0x100E)	44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	44112 (0x100F)	Program CRC	R	
44128 (0x101F)	44128 (0x101F)	Module Error Status ❖ Bit 0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	

3-43 SIO-8AIV / SIO-16AIV Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

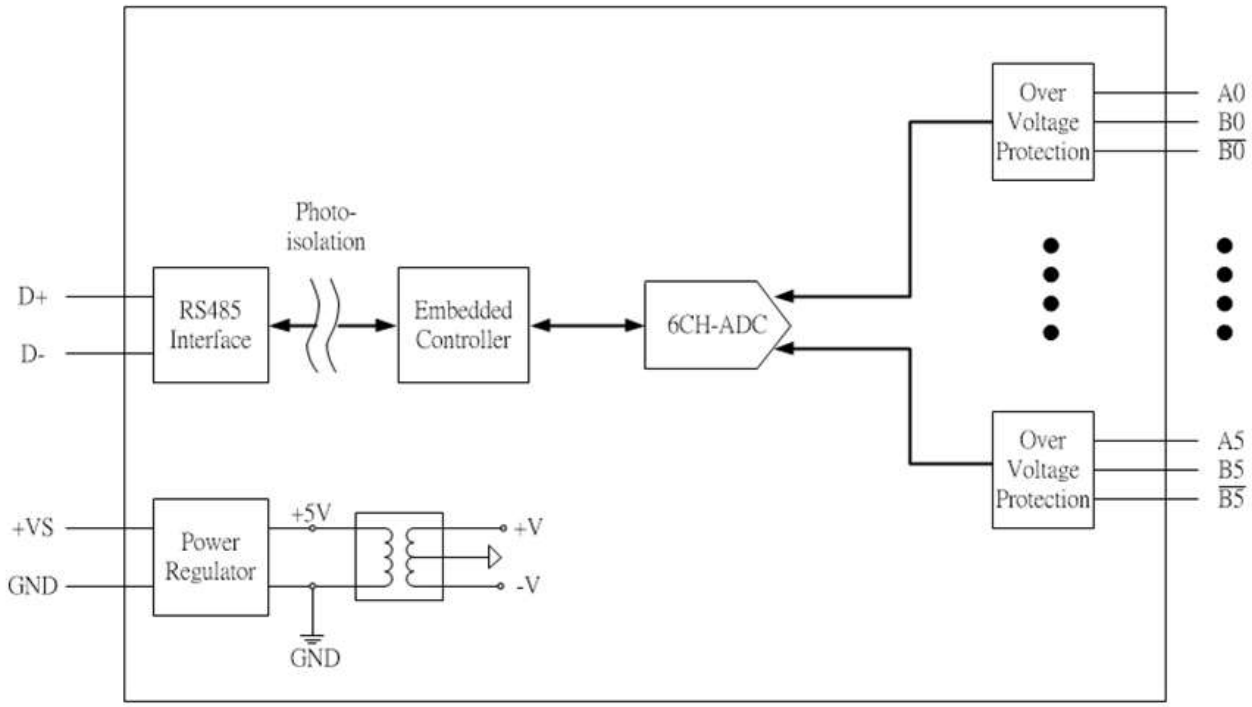
3.5 SIO-6RTD [6 Channels RTD Input Module]

3.5.1 Terminal Assignment



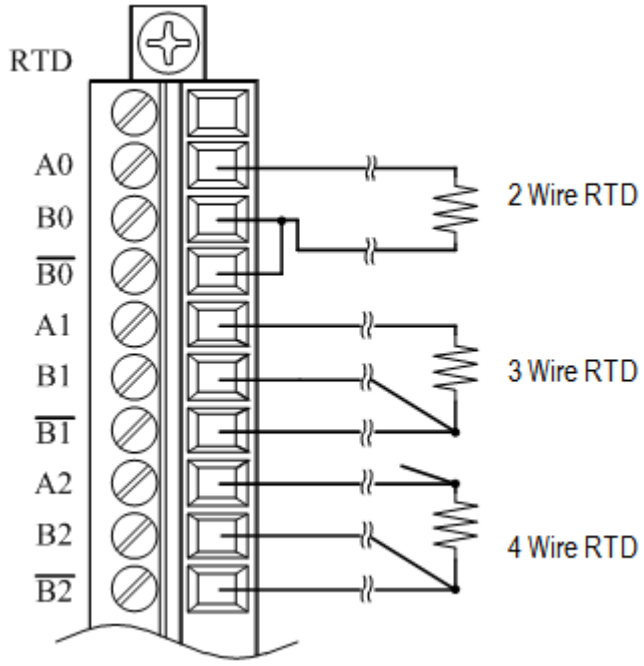
3-24 SIO-6RTD Terminal Assignment

3.5.2 Block Diagram



3-25 SIO-6RTD Block Diagram

3.5.3 Wiring



3-26 SIO-6RTD Channel RTD Input Wiring

3.5.4 Specifications

<table>
<tr><th>Parameter</th><th>Specification</th></tr>
<tr><td>Channels</td><td>6 Channels</td></tr>
<tr><td>Sensor Types</td><td>
<table>
<tr><th>RTD Type</th><th>Range</th></tr>
<tr><td>Platinum 100 α= 0.00385 (IEC)</td><td>-200 ~ 600°C</td></tr>
<tr><td>Platinum 100 α= 0.00392 (JIS)</td><td>-200 ~ 600°C</td></tr>
<tr><td>Platinum 1000 α= 0.00385 (IEC)</td><td>-200 ~ 600°C</td></tr>
<tr><td>Cu 100@0°C α = 0.00421</td><td>-20 ~ 150°C</td></tr>
<tr><td>Cu 1000@0°C α = 0.00421</td><td>-20 ~ 150°C</td></tr>
<tr><td>Cu 50@0°C</td><td>0~200°C</td></tr>
<tr><td>Nickel 100Ω α= 0.00618</td><td>-60 ~ 180°C</td></tr>
<tr><td>Nickel 120Ωα= 0.00672</td><td>-80 ~ 260°C</td></tr>
<tr><td>Nickel 604Ωα= 0.00518</td><td>-200 ~ 200°C</td></tr>
<tr><td>BALCO 500</td><td>-40 ~ 150°C</td></tr>
</table>
</td></tr>
<tr><td>Disconnection Detection</td><td>Yes</td></tr>
<tr><td>Channel Independent Configuration</td><td>Yes</td></tr>
<tr><td>Sampling Rates</td><td>12 samples/second (Total)</td></tr>
<tr><td>Resolution</td><td>16-bit</td></tr>
<tr><td>Accuracy</td><td>±0.1% FSR</td></tr>
<tr><td>Span Drift</td><td>±25 ppm/°C</td></tr>
<tr><td>Zero Drift</td><td>±6 μV/°C</td></tr>
<tr><td>Overvoltage Protection</td><td>±55V</td></tr>
<tr><td>Power Consumption</td><td>2.8W @ 24V</td></tr>
</table>

3-44 SIO-6RTD Specification

3.5.5 Related Reference

3.5.5.1 Input Signal Type Setup

Each channel of the module can be independently configured for various RTD signal input range. Modbus command is shown below.

Address	Function	R/W	Initial value
40705~40710 (0x02C0~0x02C5)	CH0~CH5 Input signal type setup	R/W	0x0401

3-45 SIO-6RTD Input Signal Type Selection Modbus Mapping

3.5.5.2 RTD Types Supported

Value	Input range	Initial value
0x0401	Platinum 100 α= 0.00385(IEC): -200 ~ 600 °C (18.52Ω~ 313.71 Ω)	◎
0x0402	Platinum 100α= 0.00392(JIS): -200 ~ 600 °C (17.08Ω ~ 317.59Ω)	
0x0403	Platinum 1000α=0.00385: -200 ~ 600 °C (185.2Ω ~ 3137.1Ω)	

Value	Input range	Initial value
0x0404	Cu 100@0°Cα=0.00421: -20 ~ 150 °C (91.564Ω ~ 163.168 Ω)	
0x0405	Cu 1000@0°Cα=0.00421: -20 ~ 150 °C (915.64Ω ~ 1631.68 Ω)	
0x0406	Cu 100@25°Cα=0.00427: 0 ~ 200 °C (90.346Ω ~ 167.750Ω)	
:0x0407	Cu 50@0°C: -50 ~ 150 °C (39.242Ω ~ 82.134Ω)	
0x0408	Nickel 100Ωα=0.00618: -60 ~ 180 °C (69.520Ω ~ 223.221Ω)	
0x0409	Nickel 120Ωα=0.00672: -80 ~ 260 °C (66.60Ω ~ 380.31Ω)	
0x040A	Nickel 507.5Ωα=0.00520: -80 ~ 260 °C (344.10Ω ~ 1328.16Ω)	
0x040B	Nickel604Ωα=0.00518: -200 ~ 200 °C (245.34Ω ~ 1301.9Ω)	
0x040C	BALCO 500: -40 ~ 150 °C (379.35Ω ~ 802.36Ω)	

3-46 SIO-6RTD Types of RTD Supported

3.5.5.3 Hexadecimal / Engineering Unit

Setup the measured input value on Hexadecimal or Engineering Unit format. The format selection Modbus command is shown below.

Address	Function	R/W	Initial value
40737 (0x02E0)	AI Value format 0x0000: Hex 0x0001: Engineering	R/W	0x0000

3-47 SIO-6RTD Value Format Selection Modbus Mapping

3.5.5.4 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
Resistance Input			
0x0402	Platinum 100α= 0.00392(JIS): -200 ~ 600 °C (17.08Ω ~ 317.59Ω)	0xD556	0x7FFF
0x0403	Platinum 1000α=0.00385: -200 ~ 600 °C (185.2Ω ~ 3137.1Ω)	0xD556	0x7FFF
0x0404	Cu 100@0°Cα=0.00421: -20 ~ 150 °C (91.564Ω ~ 163.168 Ω)	0xEEEF	0x7FFF
0x0405	Cu 1000@0°Cα=0.00421: -20 ~ 150 °C (915.64Ω ~ 1631.68 Ω)	0xEEEF	0x7FFF
0x0406	Cu 100@25°Cα=0.00427: 0 ~ 200 °C (90.346Ω ~ 167.750Ω)	0x0000	0x7FFF
0x0407	Cu 50@0°C: -50 ~ 150 °C (39.242Ω ~ 82.134Ω)	0xD556	0x7FFF
0x0408	Nickel 100Ωα=0.00618: -60 ~ 180 °C (69.520Ω ~ 223.221Ω)	0xD556	0x7FFF
0x0409	Nickel 120Ωα=0.00672: -80 ~ 260 °C (66.60Ω ~ 380.31Ω)	0xD89E	0x7FFF
0x040A	Nickel 507.5Ωα=0.00520: -80 ~ 260 °C (344.10Ω ~ 1328.16Ω)	0xD89E	0x7FFF
0x040B	Nickel604Ωα=0.00518: -200 ~ 200 °C (245.34Ω ~ 1301.9Ω)	0xFFFE	0x7FFF
0x040C	BALCO 500: -40 ~ 150 °C (379.35Ω ~ 802.36Ω)	0xDDDE	0x7FFF

3-48 SIO-6RTD Types of RTD Supported and Range (HEX Unit)

3.5.5.5 Engineering Unit Data Range

Value	Range	Min. value	Max. value
0x0401	Platinum 100 α= 0.00385(IEC): -200 ~ 600 °C (18.52Ω~ 313.71 Ω)	-200.0	600.0
0x0402	Platinum 100α= 0.00392(JIS): -200 ~ 600 °C (17.08Ω ~ 317.59Ω)	-200.0	600.0

Value	Range	Min. value	Max. value
0x0403	Platinum 1000α=0.00385: -200 ~ 600 °C (185.2Ω ~ 3137.1Ω)	-200.0	600.0
0x0404	Cu 100@0°Cα=0.00421: -20 ~ 150 °C (91.564Ω ~ 163.168 Ω)	-20.00	150.00
0x0405	Cu 1000@0°Cα=0.00421: -20 ~ 150 °C (915.64Ω ~ 1631.68 Ω)	-20.00	150.00
0x0406	Cu 100@25°Cα=0.00427: 0 ~ 200 °C (90.346Ω ~ 167.750Ω)	0.00	200.00
0x0407	Cu 50@0°C: -50 ~ 150 °C (39.242Ω ~ 82.134Ω)	-50.00	150.00
0x0408	Nickel 100Ωα=0.00618: -60 ~ 180 °C (69.520Ω ~ 223.221Ω)	-60.00	180.00
0x0409	Nickel 120Ωα=0.00672: -80 ~ 260 °C (66.60Ω ~ 380.31Ω)	-80.00	180.00
0x040A	Nickel 507.5Ωα=0.00520: -80 ~ 260 °C (344.10Ω ~ 1328.16Ω)	-80.00	260.00
0x040B	Nickel604Ωα=0.00518: -200 ~ 200 °C (245.34Ω ~ 1301.9Ω)	-200.00	200.00
0x040C	BALCO 500: -40 ~ 150 °C (379.35Ω ~ 802.36Ω)	-40.00	150.00

3-49 SIO-6RTD Types of RTD Supported and Range (Engineering Unit)

3.5.5.6 RTD Signal Value

Once the setup is finished. The measured value needs to be verified to enable or disable the channels and check the value is out-of-range or not. The input signal value Modbus command as following

Address	Function	R/W	Initial Value
00641~00646 (0x0280~0x0285)	CH0~CH5 out of range ❖ 0: Normal ❖ 1: Out of range	R	0
30513~30518 40513~405218 (0x0200~0x0205)	AI CH0 ~ CH5 Value	R	-
40746 (0x02E9)	CH0~CH5 Channel Disable (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disable, Bit1 = 1, CH1 Disable	R/W	0

3-50 SIO-6RTD Measured Temperature Modbus Mapping

3.5.5.7 Temperature Offset

The temperature offset can be set for all channels individually in this module. The offset setting address is shown below:

Address	Function	R/W	Initial Value
40577~40582 (0x0240~0x0245)	CH0~CH5 offset Temperature Unit:0.01°C Range: -50.00°C ~ 50.00°C	R/W	0x0000

3-51 SIO-6RTD Temperature Offset Modbus Mapping

3.5.6 Modbus Mapping Table

3.5.6.1 Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00537 (0x0218)	Allow calibration ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00641~00646 (0x0280~0x0285)	CH0~CH5 Out of range ❖ 0: Normal ❖ 1: Out of range	R	0

3-52 SIO-6RTD Modbus Mapping Coil (0xxxx &1xxxx)

3.5.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

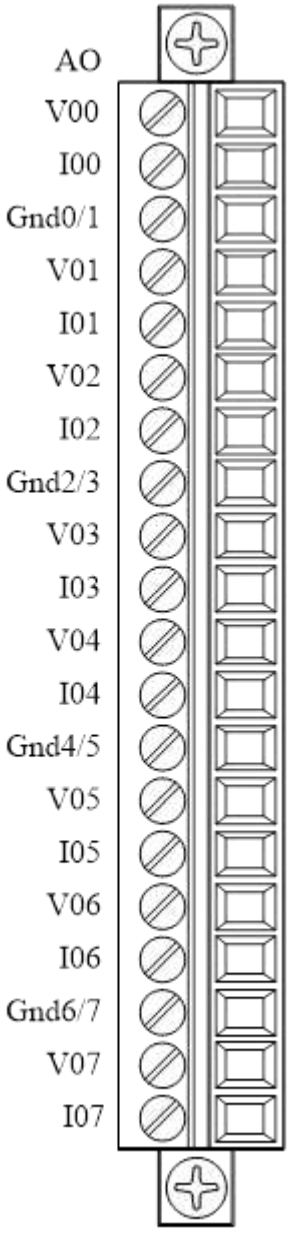
Address	Function	R/W	Initial Value
30513~30518 40513~40518 (0x0200~0x0205)	AI CH0 ~ CH5 Value	R	-
40577~40582 (0x0240~0x0245)	CH0 ~ CH5 Temperature Compensation unit: 0.01°C, Range: -50.0°C ~ 50.0°C	R/W	0x0000
40705~40710 (0x02C0~0x02C5)	CH0~CH5 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement ❖ 0x0000: Hex ❖ 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	CH0~CH5 Channel Disable (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disable, Bit1 = 1, CH1 Disable	R/W	0
40757 (0x02F4)	CH0~CH5 Calibrate Full-scale value to each channel. (Each bit map to the corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0x0000
40758 (0x02F5)	CH0~CH7 Calibrate Zero scale value to each channel. (Each bit map to the corresponding channel)	W	0x0000
40759 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to the corresponding channel)	W	0x0000
40760 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to the corresponding channel) ❖ 0: No operation ❖ 1: Calibration in process	R	-

<table>
<tr><th>Address</th><th>Function</th><th>R/W</th><th>Initial Value</th></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII characters)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>Modbus response delay time
Unit: milliseconds Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting: 2bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44110
(0x100D)</td><td>Status of system watch dog
0x0001: Timeout 0x0000: Normal</td><td>R/W</td><td>-</td></tr>
<tr><td>44111
(0x100E)</td><td>Counter of communication frame</td><td>R</td><td>0x0000</td></tr>
<tr><td>44112
(0x100F)</td><td>Program CRC</td><td>R</td><td></td></tr>
<tr><td>44128
(0x101F)</td><td>Module Error Status
❖ Bit 0: EEPROM Error
❖ Bit1: Master/Slave Communication Error</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>EEPROM Error Code
❖ 0: No Error
❖ 1: No Connection
❖ 2: Data Error
❖ 3: Configuration Error</td><td>R</td><td></td></tr>
</table>

3-53 SIO-6RTD Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

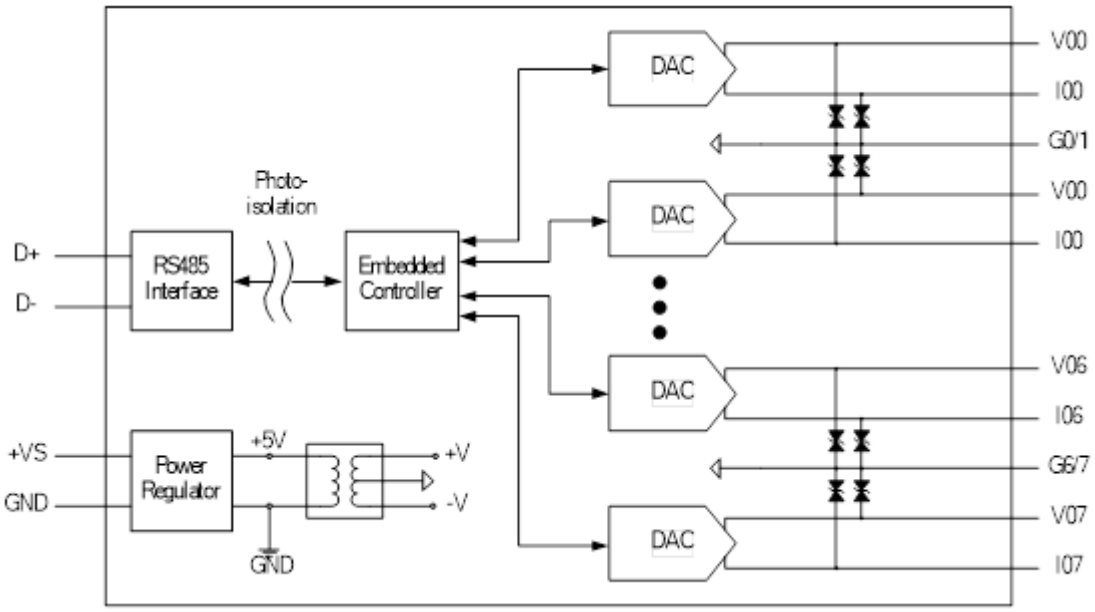
3.6 SIO-8AOU [8 Channels Analog Output Module]

3.6.1 Terminal Assignment



3-27 SIO-8AOU Terminal Assignment

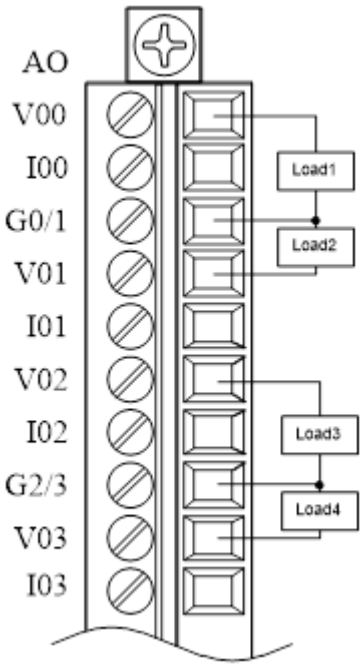
3.6.2 Block Diagram



3-28 SIO-8AOU Block Diagram

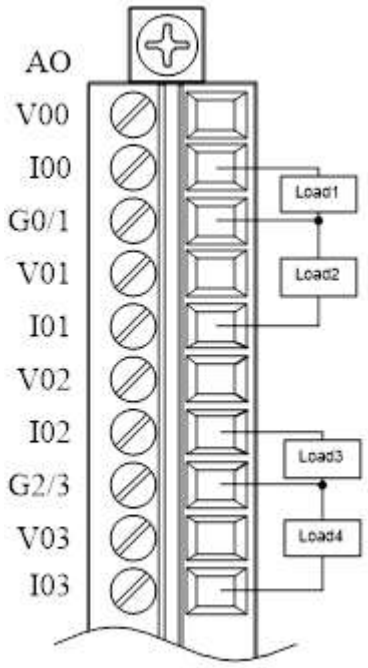
3.6.3 Wiring

3.6.3.1 Voltage Output Wiring



3-29 SIO-8AOU Voltage Output Wiring

3.6.3.2 Current Output Wiring



3-30 SIO-8AOU Current Output Wiring

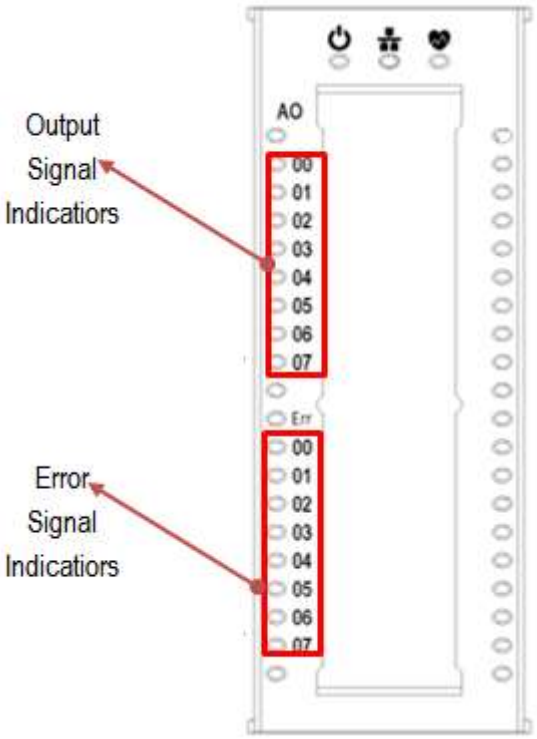
3.6.4 Specifications

Parameter	Specification
Channels	8 Channels
Voltage Output Range	±5V, ±10V, 0 ~ 5V, 0 ~ 10V
Current Output Range	4 ~ 20 mA, 0 ~ 20 mA
Disconnection Detection	For 4 ~ 20 mA
Channel Independent Configuration	Yes
Output Response Time	10ms
Resolution	12-bit
Accuracy	±0.1% FSR
Programmable Output Slope	Voltage: 0.0625 ~ 512 V/Sec Current: 0.125 ~ 1024 mA/Sec
Voltage Output Capacity	10V @ 10mA
Current Output Capacity	500Ω
Power on Value	Programmable
Safety Value	Programmable
LED Display	8 LEDs as Analog Output 8 LEDs as Fault Indicators
Power Consumption	0.5W @ 24V (No-Load) 3.6W @ 24V (Max-Load)

3-54 SIO-8AOU Specification

3.6.5 Related Reference

3.6.5.1 LED Indication



3-31 SIO-8AOU LED Indication

3.6.5.2 Output Signal Type Setup

Address	Function	R/W	Initial value
40897~40904 (0x0380~0x0387)	CH0 ~ CH7: Analog output Type selection ❖ 0x1101：0 ~ 10V ❖ 0x1102：0 ~ 5V ❖ 0x1106：-10V ~ 10V ❖ 0x1107：-5V ~ 5V ❖ 0x1201：4 ~ 20mA ❖ 0x1202：0 ~ 20mA	R/W	0x1106

3-55 SIO-8AOU Analog Output Signal Type Modbus Mapping

3.6.5.3 Hexadecimal / Engineering Unit

Setup the output value on Hexadecimal or Engineering Unit format. The format selection Modbus command is shown below.

Address	Function	R/W	Initial value
40913 (0x0390)	AO Value format ❖ 0x00: Hex ❖ 0x01: Engineering	R/W	

3-56 SIO-8AOU Value Format Selection Modbus Mapping

3.6.5.4 Hexadecimal Unit Data Range

Value	Range	Min. value	Max. value
Voltage Output			
0x1101	0~10 V	0 (0)	FFFF (65535)
0x1102	0~5 V	0 (0)	FFFF (65535)
0x1106	± 10 V	8000 (-32768)	7FFF (32767)
0x1107	± 5 V	8000 (-32768)	7FFF (32767)
Current Output			
0x1201	4~20mA	0 (0)	FFFF (65535)
0x1202	0~20 mA	0 (0)	FFFF (65535)

3-57 SIO-8AOU Analog Output Types and Range (HEX Unit)

3.6.5.5 Engineering Unit Data Range

Value	Range	Min. value	Max. value
Voltage Output			
0x1101	0~10 V	0	10000
0x1102	0~5 V	0	5000
0x1106	± 10 V	-10000	10000
0x1107	± 5 V	-5000	5000
Current Output			
0x1201	4~20mA	4000	20000
0x1202	0~20 mA	0	20000

3-58 SIO-8AOU Analog Output Types and Range (Engineering Unit)

3.6.5.6 Analog Output Channels Modbus Address

Address	Function	R/W	Initial value
40769~40776 (0x0300 ~ 0x0307)	CH0 ~ CH7: Read Back of Analog Output Value	R	
40785~40792 (0x0310 ~ 0x0317)	CH0 ~ CH7: Analog Output Value	R/W	0
40801~40808 (0x0320 ~ 0x0327)	CH0 ~ CH7: Safety Analog Output Value	R/W	0
40817~40824 (0x0330 ~ 0x0337)	CH0 ~ CH7: Power on Analog Output Value	R/W	0

3-59 SIO-8AOU Analog Output Channel Modbus Mapping

3.6.5.7 Output Signal Value

Address	Function	R/W	Initial Value
40785~40792 (0x0310 ~ 0x0317)	CH0 ~ CH7: Analog Output Value	R/W	0
40769~40776 (0x0300 ~ 0x0307)	CH0 ~ CH7: Read Back of Analog Output Value	R	

3-60 SIO-8AOU Analog Output Value Modbus Mapping

3.6.5.8 Initial Output Value

Address	Function	R/W	Initial Value
40817~40824 (0x0330 ~ 0x0337)	CH0 ~ CH7: Power on Analog Output Value	R/W	0

3-61 SIO-8AOU Initial Analog Output Value Modbus Mapping

3.6.5.9 Watchdog Timer Timeout Output Value

Address	Function	R/W	Initial Value
40801~40808 (0x0320 ~ 0x0327)	CH0 ~ CH7: Safety Analog Output Value	R/W	0

3-62 SIO-8AOU Watchdog Timer Timeout Value Modbus Mapping

When the host watchdog function is enabled and a timeout occurs, the module will reset all outputs to a safe state in order to ensure the safety of the system or device.

3.6.5.10 AO Response Time Setting

Address	Function	R/W	Initial Value
40833~40840 (0x0340 ~ 0x0347)	CH0 ~ CH7: Analog output Time (Unit 10ms) Range： 0 ~ 300.00 sec Set the time from 0 to full scale. Set to 0 for immediate response Slew Rate = Full scale/Setting time	R/W	0

3-63 SIO-8AOU Analog Output Response Time Setting Modbus Mapping

Set the output time from 0 to full scale time. The module update time: 10ms
Slew Rate = Full Scale value /setting time
Ex1: 0 ~ 10V range，set 5 sec，Slew Rate: 2 V/s
Ex2: 0 ~ 5V range，set 5sec，Slew Rate: 1 V/s
Ex3: 0 ~ 10V range，set 500ms，Slew Rate: 20 V/s
Ex4: -10 ~ 10range，set 500ms，Slew Rate: 20 V/s

3.6.5.11 Output Status

Address	Function	R/W	Initial Value
00897~00904 10897~10904 (0x0380~0x0387)	CH0~CH7 Open Wire Detected ❖ 0: Normal ❖ 1: Detected	R	-
40921 (0x0398)	CH0 ~ CH7 Open Wire Detected Status Each bit map to the corresponding channel Ex. Bit 0 = 1, CH0 Open Wire Detected Bit 1 = 1, CH1 Open Wire Detected	R	

3-64 SIO-8AOU Analog Output Status Monitoring Modbus Mapping

When using the current output type, if the output is open then the corresponding channel will output 1. If the output is in the normal state then the corresponding channel is 0.

3.6.6 Modbus Mapping Table

3.6.6.1 Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00793 (0x0318)	AO: Allowed to calibrate ❖ 0: Forbidden ❖ 1: Allow	R/W	0
00897~00904 10897~10904 (0x0380~0x0387)	CH0~CH7 Open Wire Detected ❖ 0: Normal ❖ 1: Detected	R	-
04113 (0x1011)	Please use the Factory default value; ❖ 0: Forbidden ❖ 1: Allow	R/W	0

3-65 SIO-8AOU Modbus Mapping Coil (0xxxx & 1xxxx)

3.6.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address	Function	R/W	Initial Value
40769~40134 (0x0300 ~ 0x0307)	CH0 ~ CH7: Read Back of Analog Output Value	R	
40785~40792 (0x0310 ~ 0x0317)	CH0 ~ CH7: Analog Output Value	R/W	0
40801~40808 (0x0320 ~ 0x0327)	CH0 ~ CH7: Safety Analog Output Value	R/W	0
40817~40824 (0x0330 ~ 0x0337)	CH0 ~ CH7: Power on Analog Output Value	R/W	0
40833~40840 (0x0340 ~ 0x0347)	CH0 ~ CH7: Analog output Time (Unit 10ms) Range： 0 ~ 300.00 sec	R/W	0

<table>
<tr><th>Address</th><th>Function</th><th>R/W</th><th>Initial Value</th></tr>
<tr><td>40897~40904
(0x0380~0x0387)</td><td>CH0 ~ CH7: Analog output Type Code
❖ 0x1101：0 ~ 10V
❖ 0x1102：0 ~ 5V
❖ 0x1106：-10V ~ 10V
❖ 0x1107：-5V ~ 5V
❖ 0x1201：4 ~ 20mA
❖ 0x1202：0 ~ 20mA</td><td>R/W</td><td>0x1106</td></tr>
<tr><td>40913
(0x0390)</td><td>AO value format
❖ 0x00: Hex
❖ 0x01: Engineering</td><td>R/W</td><td></td></tr>
<tr><td>40921
(0x0398)</td><td>CH0 ~ CH7 Open Wire Detected Status
Each bit map to the corresponding channel
Ex. Bit 0 = 1, CH0 Open Wire Detected
Bit 1 = 1, CH1 Open Wire Detected</td><td>R</td><td></td></tr>
<tr><td>40993
(0x03E0)</td><td>CH0 ~ CH7 Full scale Calibration point
Range：-100 ~ 100</td><td>R/W</td><td></td></tr>
<tr><td>41009
(0x03F0)</td><td>CH0 ~ CH7 zero scale calibration point
Range：-100 ~ 100</td><td>R/W</td><td></td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII format)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>Modbus response delay time (msec)
Range: 0 ~ 30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting:2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03:1.2K
0x04:2.4K
0x05:4.8K
0x06:9.6K
0x07:19.2K
0x08:38.4K
0x09:57.6K
0x0A:115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>Watch dog timer (0.1s)
Range： 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
</table>

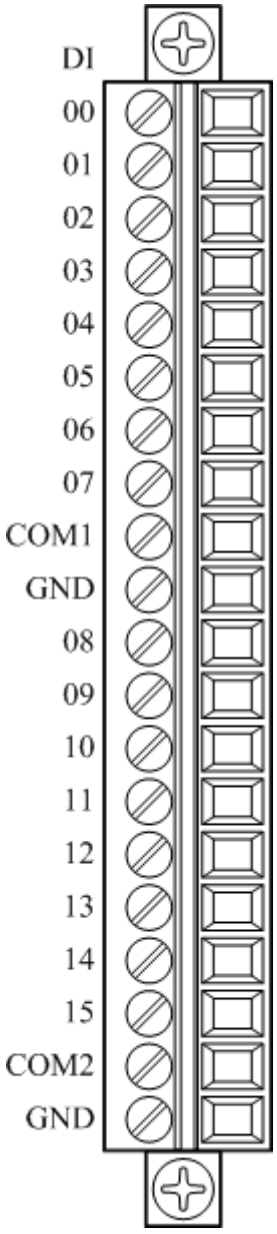
Address	Function	R/W	Initial Value
44109 (0x100C)	System watch dog ❖ 0x0001：Enable ❖ 0x0000：Disable	R/W	0x0000
44110 (0x100D)	Status of system watchdog ❖ 0x0001：Timeout ❖ 0x0000：Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	CRC checking code	R	-
44128 (0x101F)	Module Error Status ❖ Bit0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	-
44129 (0x1020)	EEPROM error ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	-

3-66 SIO-8AOU Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

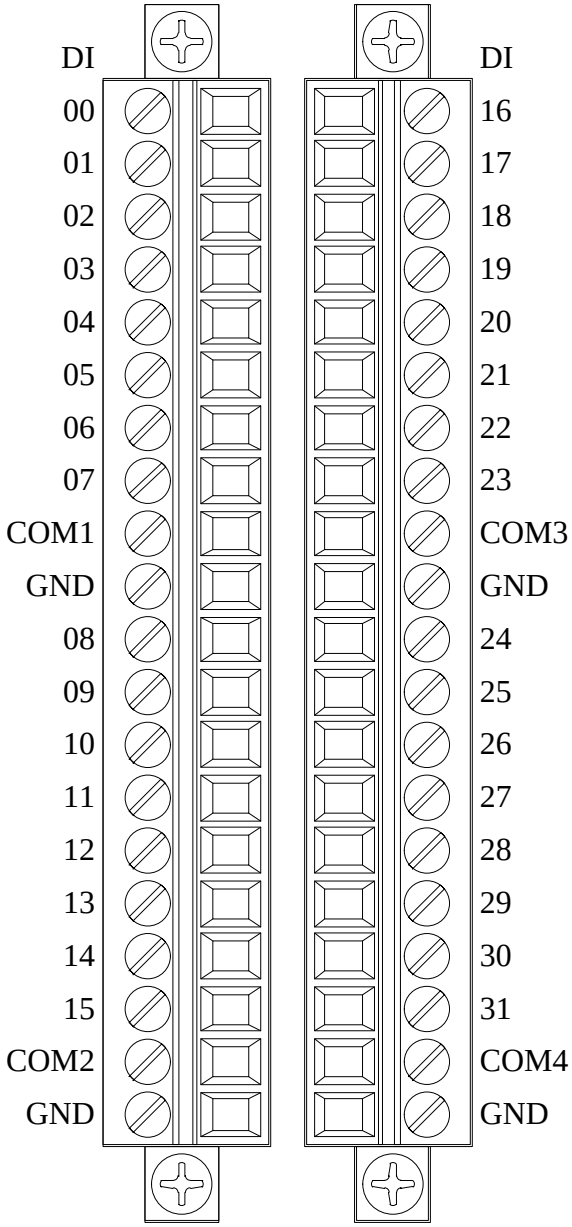
4 Digital Module Information

4.1 SIO-16DI / SIO-32DI [16 / 32 Channels Digital Input Module]

4.1.1 Terminal Assignment

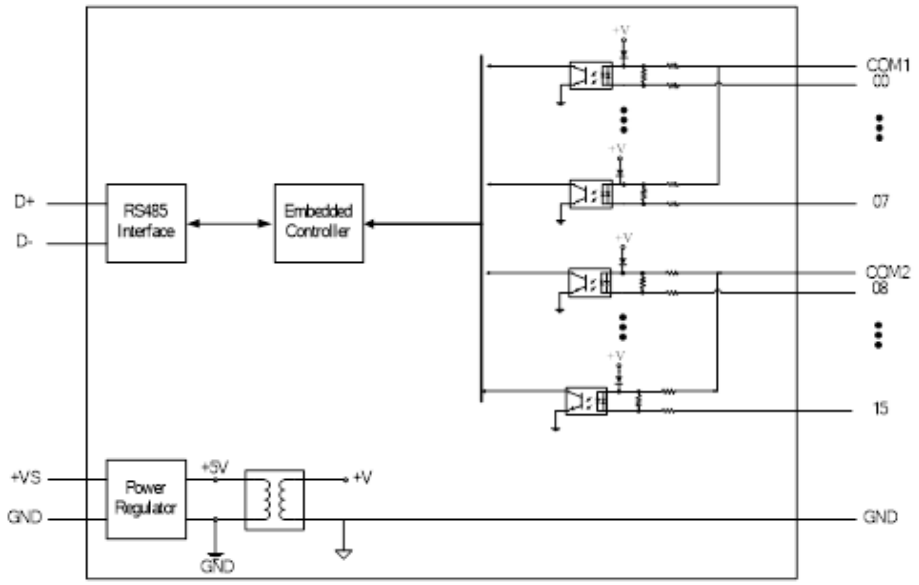


4-1 SIO-16DI Terminal Assignment

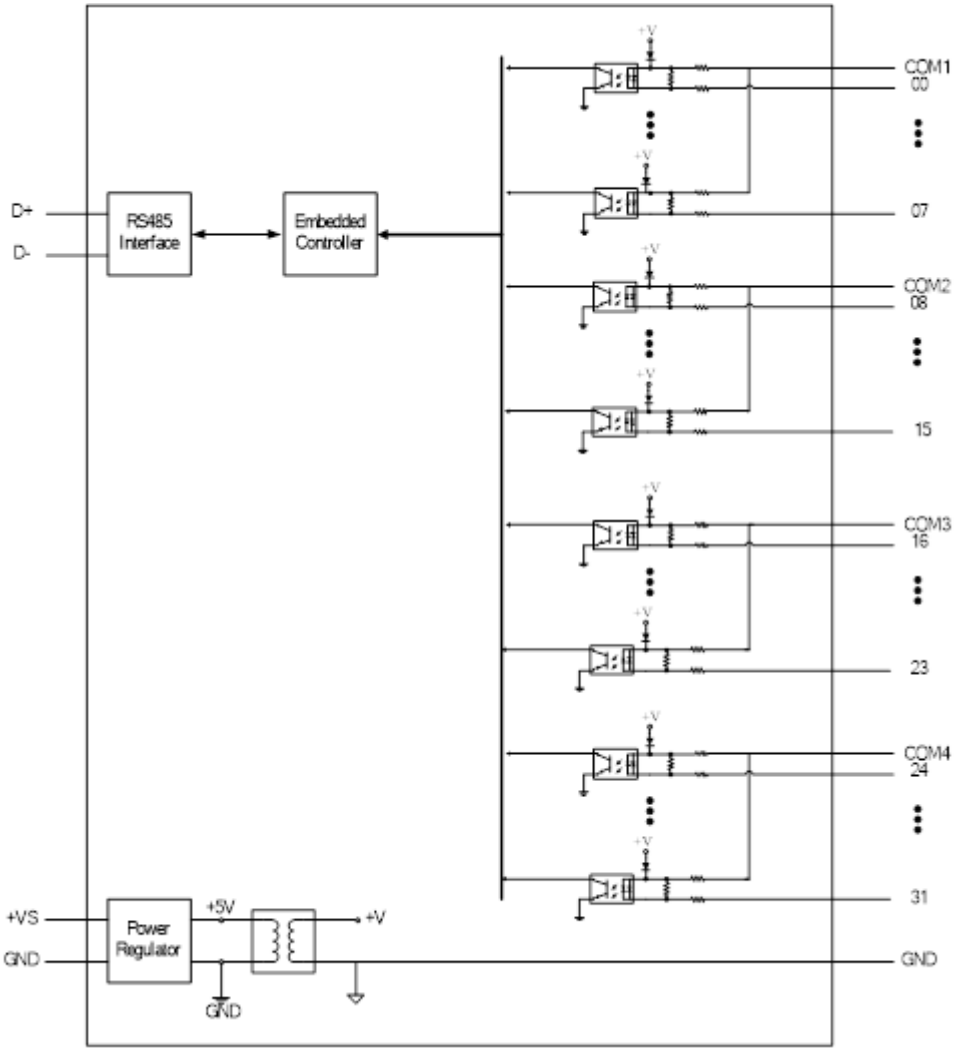


4-2 SIO-32DI Terminal Assignment

4.1.2 Block Diagram

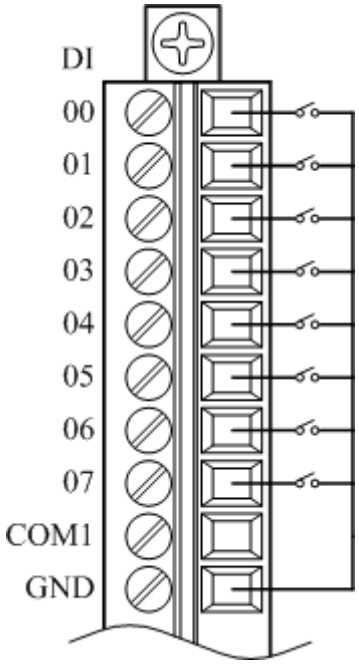


4-3 SIO-16DI Block Diagram

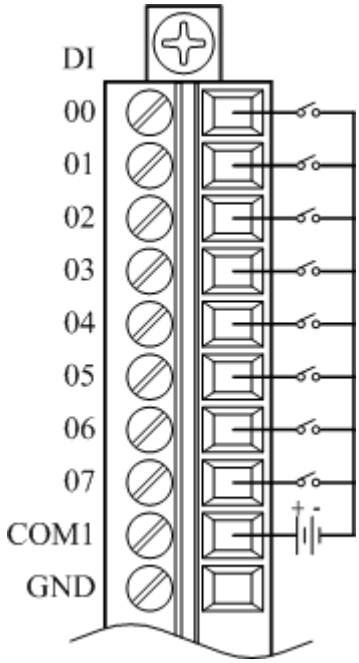


4-4 SIO-32DI Block Diagram

4.1.3 Wiring



4-5 SIO-16DI / SIO-32DI Dry Contact Wiring



4-6 SIO-16DI / SIO-32DI Wet Contact Wiring

4.1.4 Specifications

Parameters		Specification	
		SIO-16DI	SIO-32DI
Channels		16	32
Dry Contact	Logic Level 0	Open	Open
	Logic Level 1	Close to GND	Close to GND
Wet Contact	Logic Level 0	+3V maximum	+3V maximum
	Logic Level 1	+10 to 50V	+10 to 50V
Input resistance		10kΩ	10kΩ
Isolation voltage		2500Vdc	2500Vdc
Over-voltage Protection		70 VDC	70 VDC
Counter Input Range		Max.100Hz (16 bit)	Max.100Hz (16 bit)
Latch Value Read		Yes	Yes
Power Consumption		1.6W @ 24V	2.4W @ 24V

4-1 SIO-16DI / SIO-32DI Specification

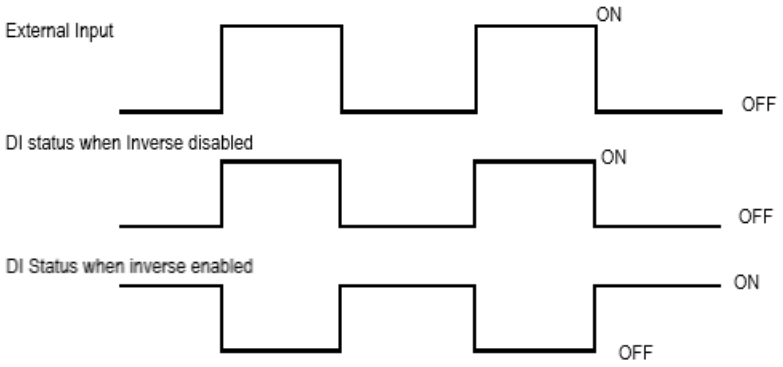
4.1.5 Related Reference

4.1.5.1 Digital Input Active State

Smart series digital input module supports invert DI status. When the setting is 0x0000, the DI status is high for logic level high and low for logic level low. When setting is 0x0001, the DI status is high for logic level low and low for logic level high. The Modbus setting is as below:

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
40129 (0x0080)	40129 (0x0080)	DI CH0~CH15 / CH0~CH31 Input Active Value Define ❖ 0x0000: Normal State ❖ 0x0001: Invert State	R/W	0x0000

4-2 SIO-16DI / SIO-32DI DI invert mode selection Modbus Mapping



4-3 SIO-16DI / SIO-32DI DI status with invert mode

4.1.5.2 Digital Input Status

Following Modbus address can be used to read digital input channel status:

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
00001~00016 10001~10016 (0x0000~0x000F)	00001~00032 10001~10032 (0x0000~0x001F)	DI CH0~CH15 / CH0~CH31 Input Status	R	All 0
30065 40065 (0x0040)	30065~30066 40065~40066 (0x0040~0x041)	DI CH0~CH15 / CH0~CH31 Input Status (Each bit map to the corresponding channel)	R	

4-4 SIO-16DI / SIO-32DI Input Status Modbus Mapping

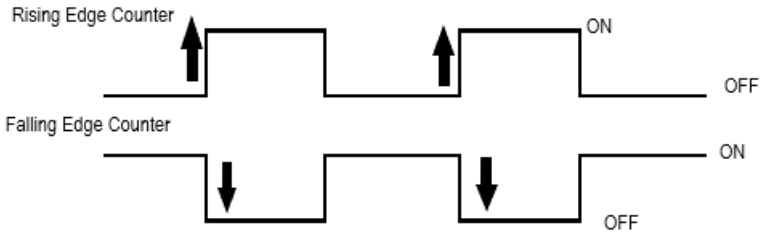
4.1.5.3 Read/Clear the Digital Input Counter

Digital input module has the function of counting the external pulse digital signal. The maximum frequency must be less than 100Hz. The following Modbus address can be used to read or clear current counter.

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
000145~000160 (0x0090~0x009F)	000145~000176 (0x0090~0x00AF)	DI CH0~CH15 / CH0~CH31 Counter Clear	W	All 0
30001~30016 40001~40016 (0x0000~0x000F)	30001~30032 40001~40032 (0x0000~0x001F)	DI CH0~CH15 / CH0~CH31 Counter Value	R	All 0x0000
40137 (0x0088)	40137~40138 (0x0088~0x0089)	DI CH0~CH15 / CH0~CH31 Counter Edge Define (Each bit map to corresponding channel) ❖ 1=Rising edge ❖ 0=Falling edge	R/W	0x0000
40077 (0x004C)	40077~40078 (0x004C~0x004D)	DI CH0~CH15 / CH0~CH31 Counter Clear (Each bit map to corresponding channel)	W	0

4-5 SIO-16DI / SIO-32DI Counter function Modbus Mapping

Refer the following picture for how the counter works:



4-6 Rising Edge & Falling Edge Counter function

4.1.5.4 Read/Clear Latch Status

Digital input module has the function of the latch the external pulse of the digital signal. The latch high will be latched when the input is high and the latch low will be latched when the input is low. The latch will be cleared using the latch clear function. The latch will be latched until the latch clear command sends to the module.

The following Modbus addresses can be used to read or clear current latch status in the digital input module:

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
00033~00048 (0x0020~0x002F)	00033~00064 (0x0020~0x003F)	DI CH0~CH15 / CH0~CH31 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	00065~00096 (0x0040~0x005F)	DI CH0~CH15 / CH0~CH31 Latch Low Value	R	All 0
000129 (0x0080)	000129 (0x0080)	DI CH0~CH15 / CH0~CH31 Latch Clear	W	0

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
40069 (0x0044)	40069~40070 (0x0044~0x0045)	DI CH0~CH15 / CH0~CH31 Latch High Value (Each bit map to the corresponding channel)	R	
40073 (0x0048)	40073~40074 (0x0048~0x0049)	DI CH0~CH15 / CH0~CH31 Latch Low Value (Each bit map to the corresponding channel)	R	
40113 (0x0070)	40113 (0x0070)	DI Latch Clear	W	0

4-7 SIO-16DI / SIO-32DI Latch function Modbus Mapping

4.1.6 Modbus Mapping Table

4.1.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
00001~00016 10001~10016 (0x0000~0x000F)	00001~00032 10001~10032 (0x0000~0x001F)	DI CH0~CH15 / CH0~CH31 Input Status	R	All 0
00033~00048 (0x0020~0x002F)	00033~00064 (0x0020~0x003F)	DI CH0~CH15 / CH0~CH31 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	00065~00096 (0x0040~0x005F)	DI CH0~CH15 / CH0~CH31 Latch Low Value	R	All 0
000129 (0x0080)	000129 (0x0080)	DI CH0~CH15 / CH0~31 Latch Clear	W	0
000145~000160 (0x0090~0x009F)	000145~000176 (0x0090~0x00AF)	DI CH0~CH15 / CH0~CH31 Counter Clear	W	All 0

4-8 SIO-16DI / SIO-32DI Modbus Mapping Coil (0xxxx & 1xxxx)

4.1.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
30001~30016 40001~40016 (0x0000~0x000F)	30001~30032 40001~40032 (0x0000~0x001F)	DI CH0~CH15 / CH0~CH31 Counter Value	R	All 0x0000
30065 40065 (0x0040)	30065~30066 40065~40066 (0x0040~0x041)	DI CH0~CH31 Input Status (Each bit map to the corresponding channel)	R	
40069 (0x0044)	40069~40070 (0x0044~0x0045)	DI CH0~CH15 / CH0~CH31 Latch High Value (Each bit map to the corresponding channel)	R	

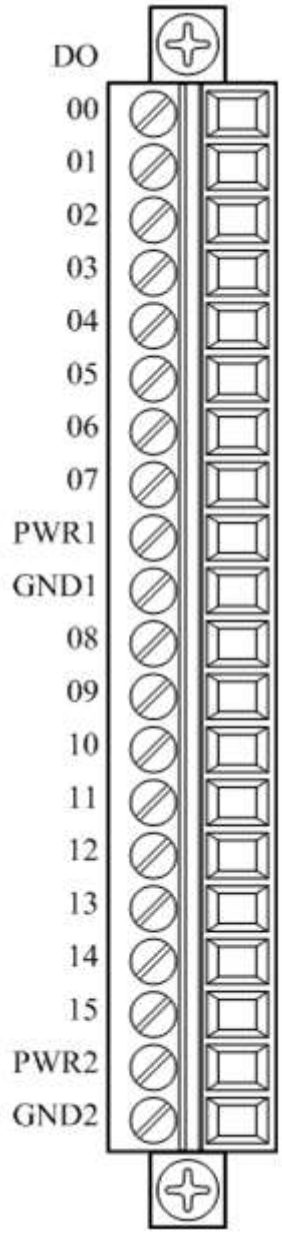
<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-16DI</th><th>SIO-32DI</th></tr>
<tr><td>40073
(0x0048)</td><td>40073~40074
(0x0048~0x0049)</td><td>DI CH0~CH15 / CH0~CH31 Latch Low Value
(Each bit map to the corresponding channel)</td><td>R</td><td></td></tr>
<tr><td>40077
(0x004C)</td><td>40077~40078
(0x004C~0x004D)</td><td>DI CH0~CH15 / CH0~CH31 Counter Clear
(Each bit map to corresponding channel)</td><td>W</td><td>0</td></tr>
<tr><td>40113
(0x0070)</td><td>40113
(0x0070)</td><td>DI Latch Clear
❖ 0x01: DI Latch Clear</td><td>W</td><td>0</td></tr>
<tr><td>40129
(0x0080)</td><td>40129
(0x0080)</td><td>DI CH0~CH15 / CH0~CH31 Input Active Value Define
❖ 0x0000: Normal State
❖ 0x0001: Invert State</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>40137
(0x0088)</td><td>40137~40138
(0x0088~0x0089)</td><td>DI CH0~CH15 / DI CH0~CH31 Counter Edge Define
(Each bit map to corresponding channel)
❖ 1=Rising edge
❖ 0=Falling edge</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44097
0x1000</td><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII char)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>44106
(0x1009)</td><td>Modbus response delay time (unit: msec)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
</table>

Address		Function	R/W	Initial Value
SIO-16DI	SIO-32DI			
44109 (0x100C)	44109 (0x100C)	System watch dog ❖ 0x0001: Enable ❖ 0x0000: Disable	R/W	0x0000
44110 (0x100D)	44110 (0x100D)	Status of system watch dog ❖ 0x0001: Timeout ❖ 0x0000: Normal	R/W	-
44111 (0x100E)	44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	44112 (0x100F)	Program CRC	R	
44128 (0x101F)	44128 (0x101F)	Module Error Status ❖ Bit 0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	

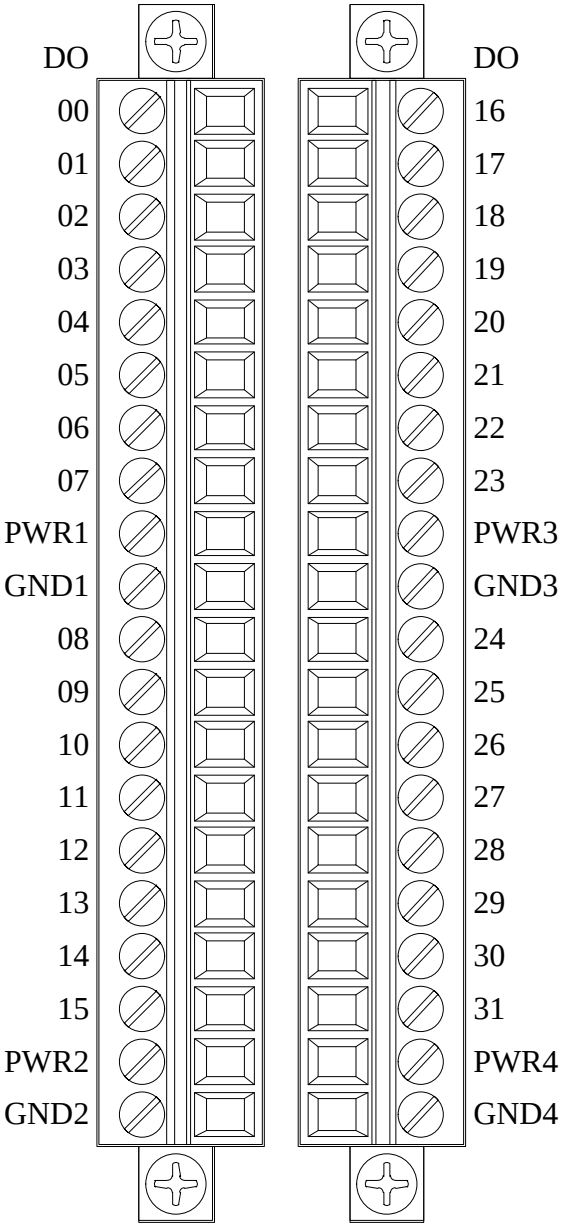
4-9 SIO-16DI / SIO-32DI Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

4.2 SIO-16DO / SIO-32DO [16 / 32 Channels Digital Output Module]

4.2.1 Terminal Assignment

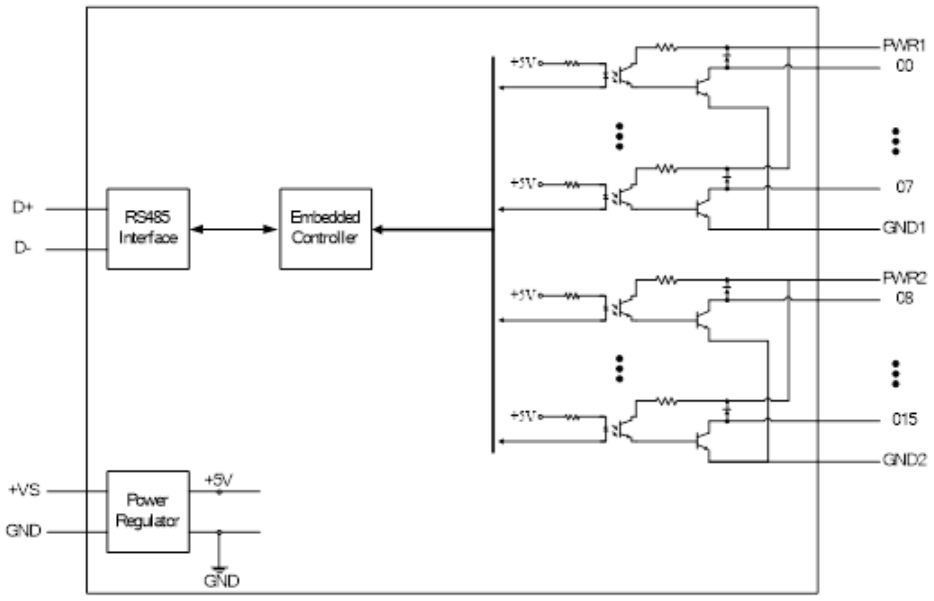


4-7 SIO-16DO Terminal Assignment

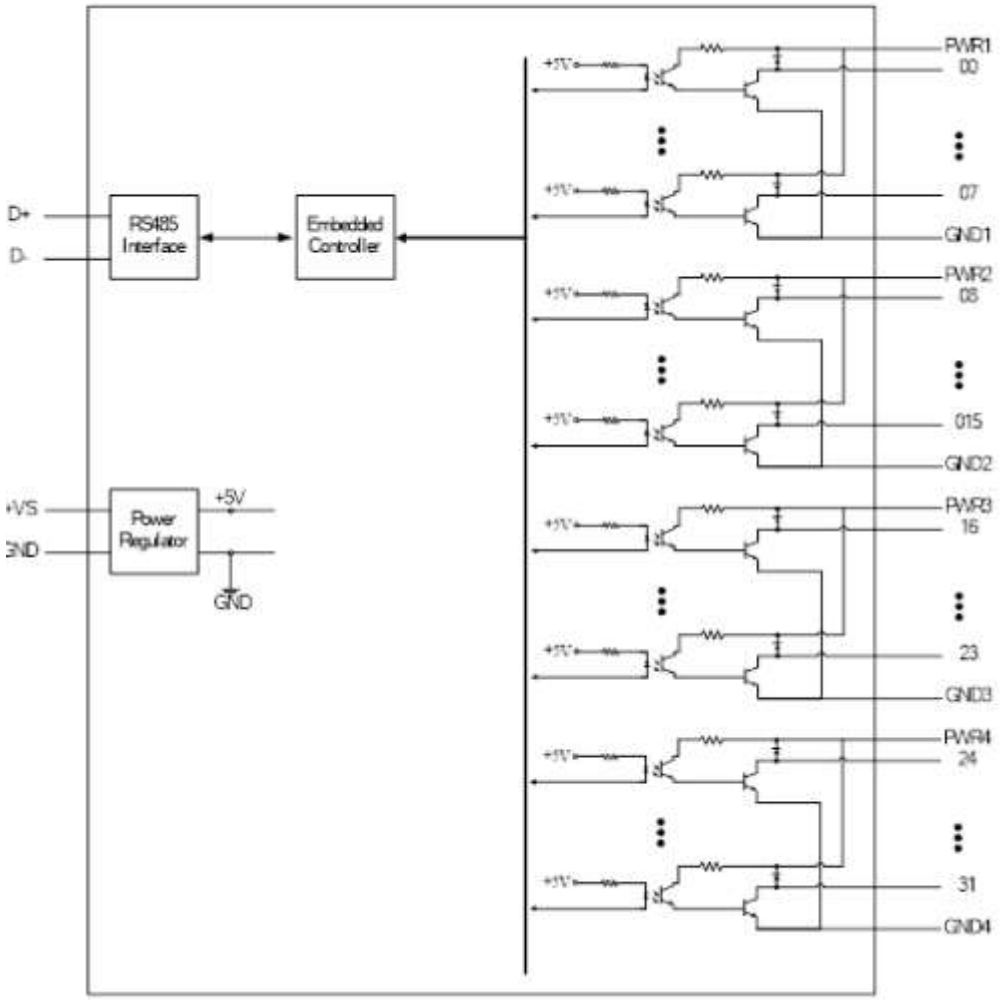


4-8 SIO-32DO Terminal Assignment

4.2.2 Block Diagram

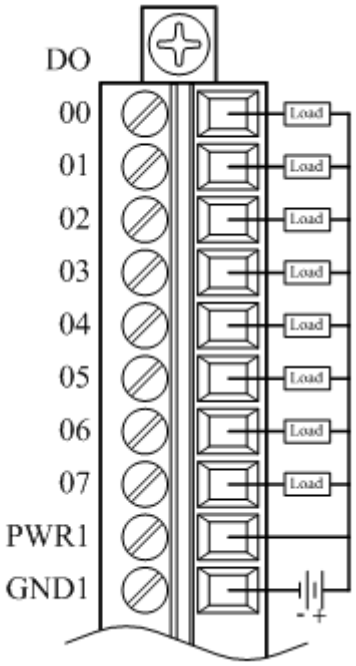


4-9 SIO-16DO Block Diagram



4-10 SIO-32DO Block Diagram

4.2.3 Wiring



4-11 SIO-16DO Digital Output Wiring

4.2.4 Specifications

Parameters	SIO-16DO	SIO-32DO
Digital Output Channels	16	32
Output Type	NPN	NPN
Output Voltage Range	3.5~30V	3.5~30V
Normal Output Current	500mA	500mA
Startup Value Setting	Yes	Yes
Communication Safety Value Setting	Yes	Yes
Power Consumption	0.5W @ 24V	0.7W @ 24V

4-10 SIO-16DO Specification

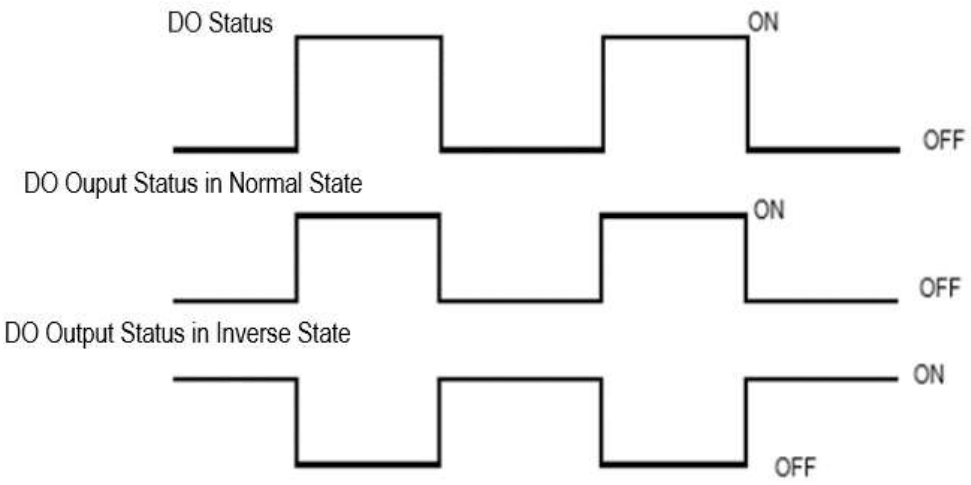
4.2.5 Related Reference

4.2.5.1 Digital Output Active State

Digital Output module supports invert digital output status. When the state is 0x0000, if the output channel is configured as 1, the digital output will be activated, if the output channel is configured as 0, the digital output will be inactivated. When the setting is 0x0001, if the output channel is configured as 0, the digital output will be activated, if the output channel is configured as 1, the digital output will be inactivated. The Modbus address setting is as below:

Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
40385 (0x0180)	40385 (0x0180)	DO CH0~CH15 / CH0~CH31 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000

4-11 SIO-16DO / SIO-32DO DO Active State Modbus Mapping



4-12 SIO-16DO / SIO-32DO DO Active State

4.2.5.2 Digital Output Status

Following Modbus address can be used to read digital output status:

Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
00257~00272 (0x0100~0x010F)	00257~00288 (0x0100~0x011F)	DO CH0~CH15 / CH0~CH31 Output Status	R/W	-
40321 (0x0140)	40321~40322 (0x0140~0x0141)	DO CH0~CH15 / CH0~CH31 Output Status (Each bit map to the corresponding channel)	R/W	-

4-13 SIO-16DO / SIO-32DO DO Status Modbus Mapping

4.2.5.3 Power-on Value

Digital Output Module has the function of power-on value. Following Modbus address can be used to configure the power-on value for all channels:

Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
40257 (0x0100)	40257~40258 (0x0100~0x101)	DO CH0~CH15 / CH0~CH31 Power on Value (Each bit mapping to corresponding channel)	R/W	All 0x0000

4-14 SIO-16DO Power ON Value Modbus Mapping

4.2.5.4 Host Watchdog Timer

When the host watchdog function is enabled and a timeout occurs, the module will reset all

outputs to a safe state in order to ensure the safety of the system or device. Following Modbus address can be used to configure the safe value of each digital output:

Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
40259 (0x0102)	40259~40260 (0x0102~0x103)	DO CH0~CH15 / CH0~CH31 Safety Output Value (Each bit mapping to corresponding channel)	R/W	All 0x0000

4-15 SIO-16DO / SIO-32DO Safe Value Modbus Mapping

4.2.6 Modbus Mapping Table

4.2.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
00257~00272 (0x0100~0x010F)	00257~00288 (0x0100~0x011F)	DO CH0~CH15 / CH0~CH31 Output Status	R/W	-

4-16 SIO-16DO / SIO-32DO Modbus Mapping Coils (0xxxx & 1xxxx)

4.2.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

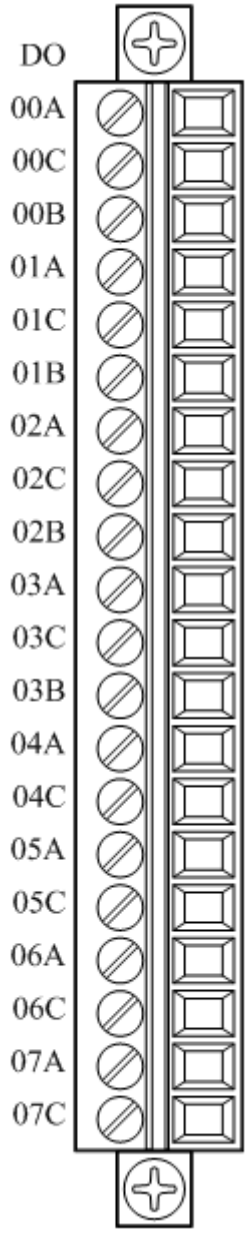
Address		Function	R/W	Initial Value
SIO-16DO	SIO-32DO			
40257 (0x0100)	40257~40258 (0x0100~0x101)	DO CH0~CH15 / CH0~CH31 Power on Value (Each bit mapping to corresponding channel)	R/W	All 0x0000
40259 (0x0102)	40259~40260 (0x0102~0x103)	DO CH0~CH15 / CH0~CH31 Safety Output Value (Each bit mapping to corresponding channel)	R/W	All 0x0000
40321 (0x0140)	40321~40322 (0x0140~0x0141)	DO CH0~CH15 / CH0~CH31 Output Status (Each bit map to the corresponding channel)	R/W	-
40385 (0x0180)	40385 (0x0180)	DO CH0~CH15 / CH0~CH15 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000
44097 0x1000	44097 0x1000	Firmware version 2 Bytes High Byte: Main version Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	44106 (0x1009)	Modbus response delay time (unit: msec) Range: 0~30	R/W	0

<table>
<tr><th colspan="2">Address</th><th rowspan="2">Function</th><th rowspan="2">R/W</th><th rowspan="2">Initial Value</th></tr>
<tr><th>SIO-16DO</th><th>SIO-32DO</th></tr>
<tr><td>44107
(0x100A)</td><td>44107
(0x100A)</td><td>COM port setting: 2bytes<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44110
(0x100D)</td><td>44110
(0x100D)</td><td>Status of system watch dog
❖ 0x0001: Timeout
❖ 0x0000: Normal</td><td>R/W</td><td>-</td></tr>
<tr><td>44111
(0x100E)</td><td>44111
(0x100E)</td><td>Counter of communication frame</td><td>R</td><td>0x0000</td></tr>
<tr><td>44112
(0x100F)</td><td>44112
(0x100F)</td><td>Program CRC</td><td>R</td><td></td></tr>
<tr><td>44128
(0x101F)</td><td>44128
(0x101F)</td><td>Module Error Status
❖ Bit 0: EEPROM Error
❖ Bit1: Master/Slave Communication Error</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>44129
(0x1020)</td><td>EEPROM Error Code
❖ 0: No Error
❖ 1: No Connection
❖ 2: Data Error
❖ 3: Configuration Error</td><td>R</td><td></td></tr>
</table>

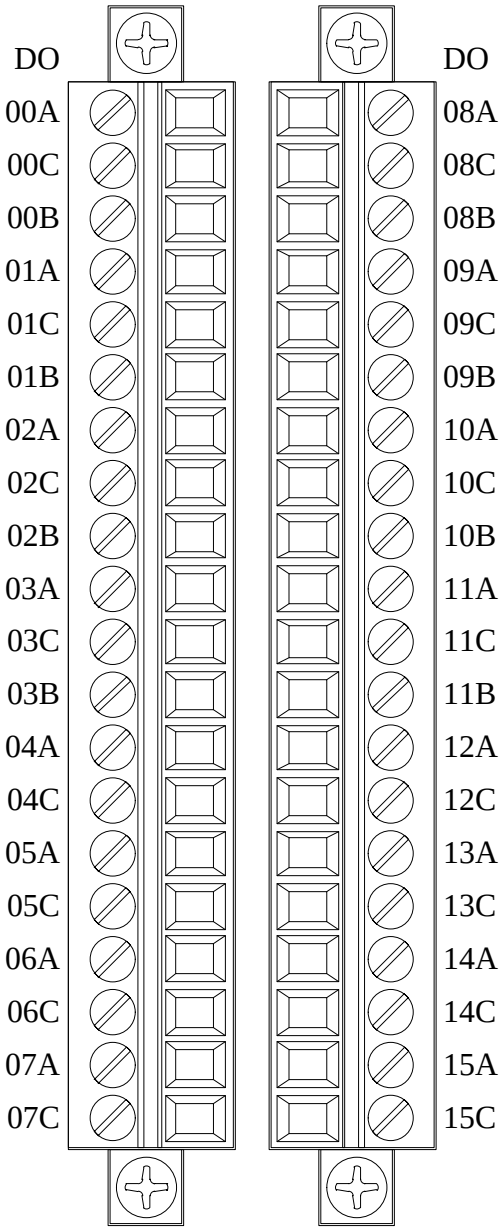
4-17 SIO-16DO / SIO-32DO Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

4.3 SIO-8RO / SIO-16RO [8 / 16 Channels Relay Output Module]

4.3.1 Terminal Assignment

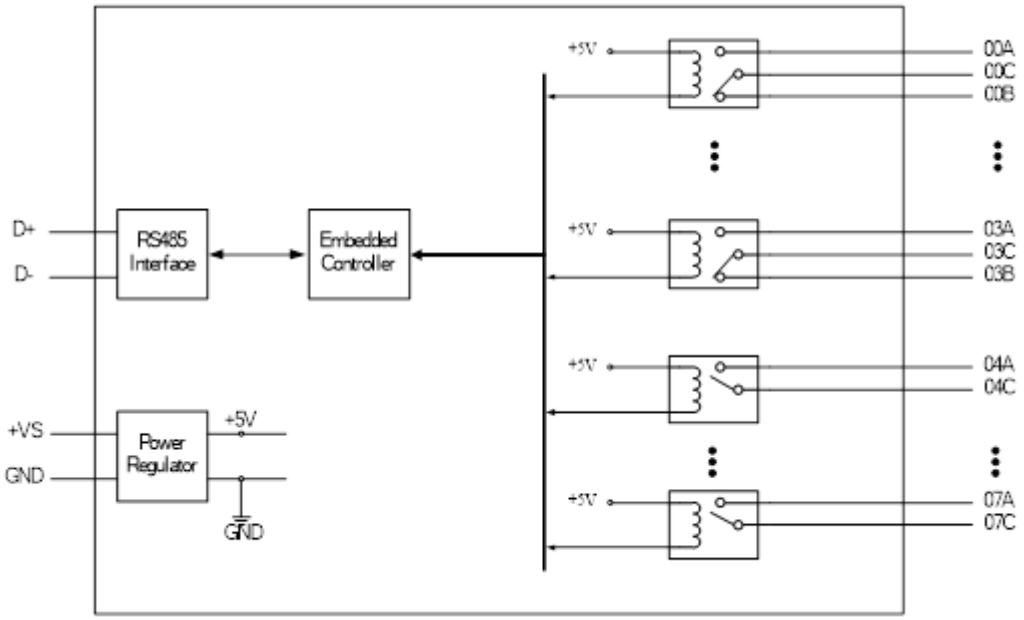


4-12 SIO-8RO Terminal Assignment

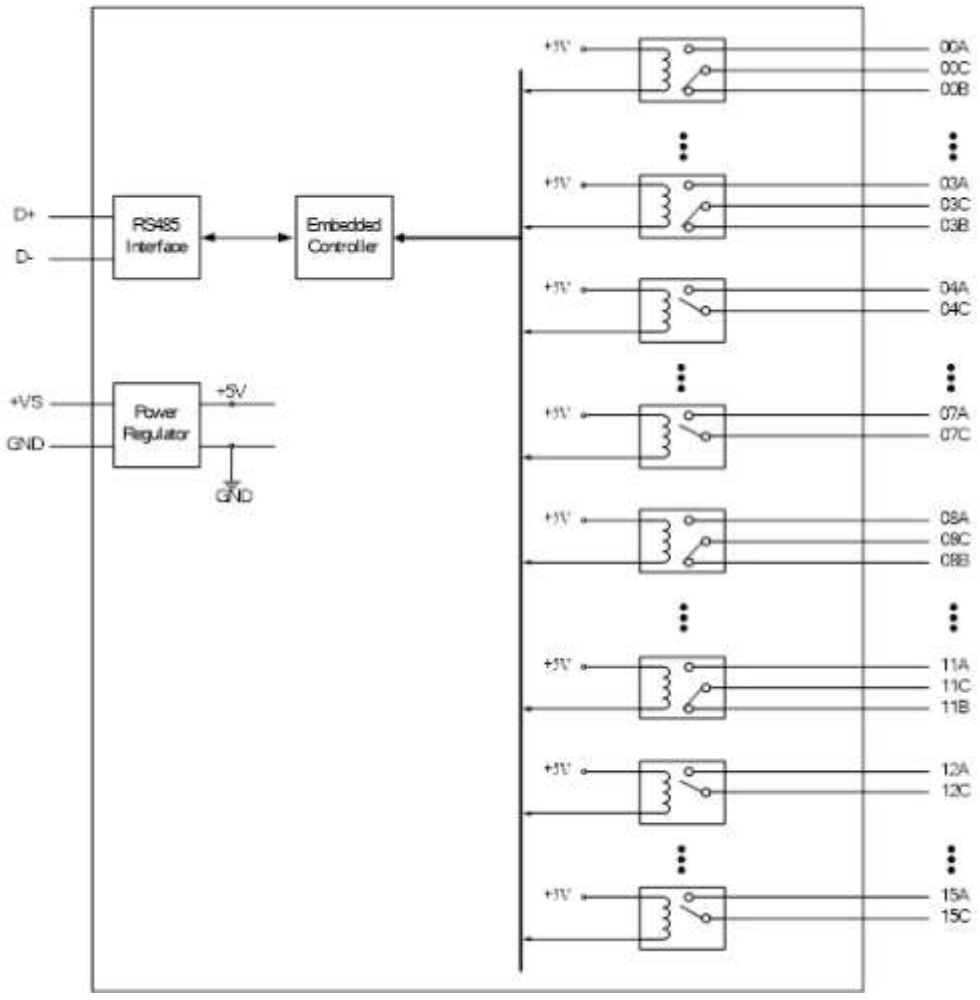


4-13 SIO-16RO Terminal Assignment

4.3.2 Block Diagram

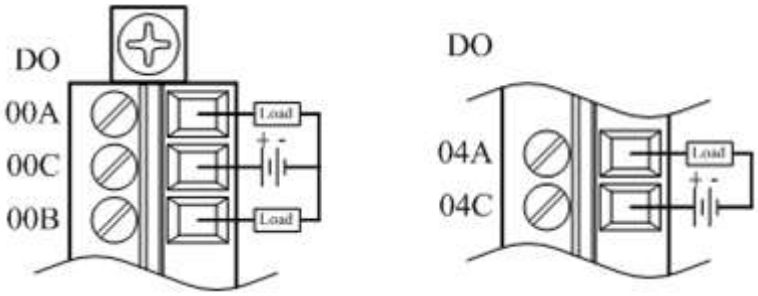


4-14 SIO-8RO Block Diagram



4-15 SIO-16RO Block Diagram

4.3.3 Wiring



4-16 SIO-8RO /SIO-16RO Relay Output Wiring

4.3.4 Specifications

Parameters	SIO-8RO	SIO-16RO
Relay Output Channels	4 Form A, 4 Form C	8 Form A, 8 Form C
Contact Rating	5A 250VAC/30VDC	5A 250VAC/30VDC
Dielectric Strength	3KV	3KV
Operate Time	10ms Max.	10ms Max.
Release Time	5ms Max.	5ms Max.
Electrical Endurance	$1x10^5$ops@3A 250VAC/30VDC	$1x10^5$ops@3A 250VAC/30VDC
Power Consumption	2.4W @ 24V	3.8W @ 24V

4-18 SIO-8RO / SIO-16RO Specification

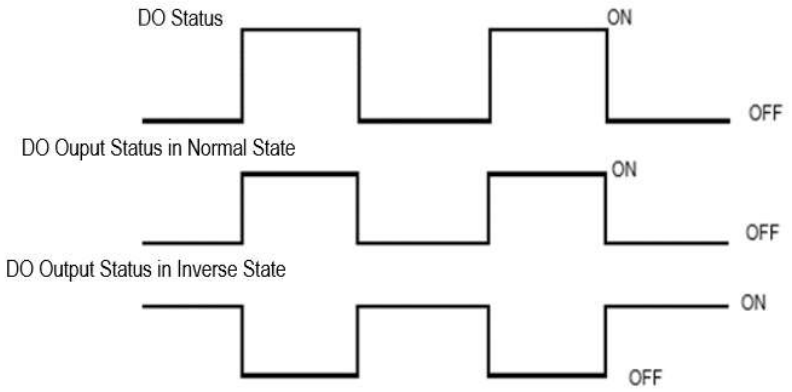
4.3.5 Related Reference

4.3.5.1 Digital Output Active State

Digital Output module supports invert digital output status. When the state is 0x0000, if the output channel is configured as 1, the digital output will be activated, if the output channel is configured as 0, the digital output will be inactivated. When the setting is 0x0001, if the output channel is configured as 0, the digital output will be activated, if the output channel is configured as 1, the digital output will be inactivated. The Modbus address setting is as below:

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
40385 (0x0180)	40385 (0x0180)	DO CH0~CH7 / CH0~CH15 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000

4-19 SIO-8RO / SIO-16RO DO Active State Modbus Mapping



4-20 SIO-8RO / SIO-16RO DO Active State

4.3.5.2 Digital Output Status

Following Modbus address can be used to read digital output status:

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
00257~00264 (0x0100~0x0107)	00257~00272 (0x0100~0x010F)	DO CH0~CH7 / CH0~CH15 Output Status	R/W	-
40321 (0x0140)	40321 (0x0140)	DO CH0~CH7 / CH0~CH15 Output Status (Each bit map to the corresponding channel)	R/W	-

4-21 SIO-8RO / SIO-16RO DO Status Modbus Mapping

4.3.5.3 Power-on Value

Digital Output Module has the function of power-on value. Following Modbus address can be used to configure the power-on value for all channels:

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
40257 (0x0100)	40257 (0x0100)	DO CH0~CH7 / CH0~CH15 Power on Value (Each bit mapping to corresponding channel)	R/W	All 0x0000

4-22 SIO-8RO / SIO-16RO Power ON Value Modbus Mapping

4.3.5.4 Host Watchdog Timer

When the host watchdog function is enabled and a timeout occurs, the module will reset all outputs to a safe state in order to ensure the safety of the system or device. Following Modbus address can be used to configure the safe value of each digital output:

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
40259 (0x0102)	40259 (0x0102)	DO CH0~CH7 / CH0~CH15 Safety Output Value (Each bit mapping to corresponding channel)	R/W	All 0x0000

4-23 SIO-8RO / SIO-16RO Safe Value Modbus Mapping

4.3.6 Modbus Mapping Table

4.3.6.1 Coil (0xxxx) / (1xxxx)

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
00257~00264 (0x0100~0x0107)	00257~00272 (0x0100~0x010F)	DO CH0~CH7 / CH0~CH15 Output Status	R/W	-

4-24 SIO-8RO / SIO-16RO Modbus Mapping Coil (0xxxx & 1xxxx)

4.3.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

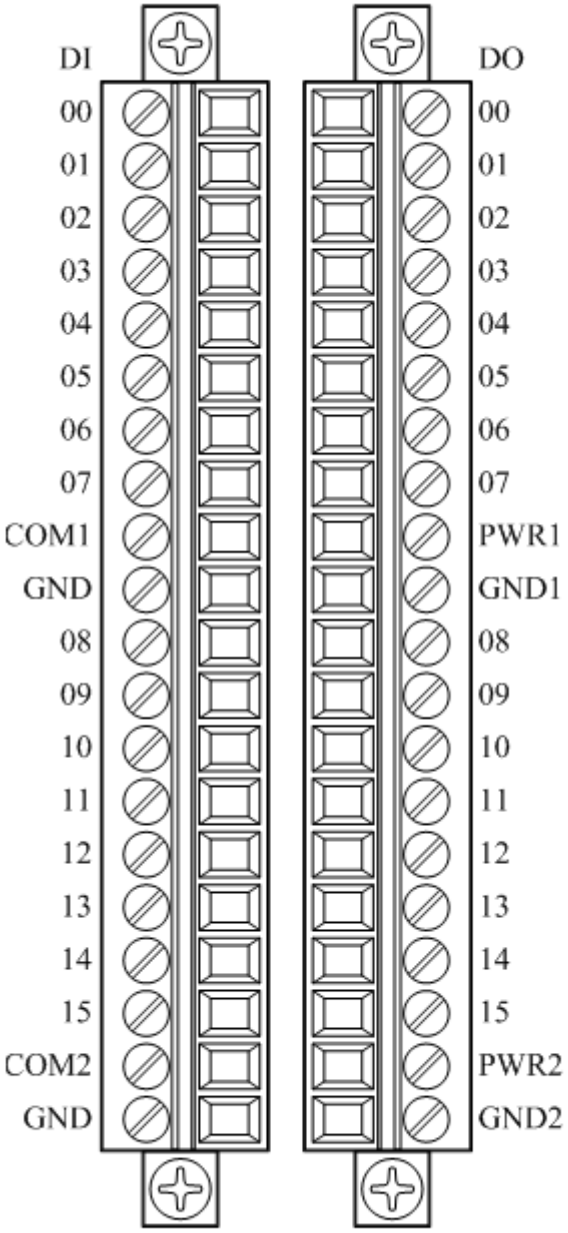
Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
40257 (0x0100)	40257 (0x0100)	DO CH0~CH7 / CH0~CH15 Power on Value (Each bit mapping to corresponding channel)	R/W	All 0x0000
40259 (0x0102)	40259 (0x0102)	DO CH0~CH7 / CH0~CH15 Safety Output Value (Each bit mapping to corresponding channel)	R/W	All 0x0000
40321 (0x0140)	40321 (0x0140)	DO CH0~CH7 / CH0~CH15 Output Status (Each bit map to the corresponding channel)	R/W	-
40385 (0x0180)	40385 (0x0180)	DO CH0~CH7 / CH0~CH15 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000
44097 0x1000	44097 0x1000	Firmware version 2 Bytes High Byte: Main version Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	44106 (0x1009)	Modbus response delay time (unit: msec) Range: 0~30	R/W	0
44107 (0x100A)	44107 (0x100A)	COM port setting: 2bytes High Byte: 0x00: 8-N-1 0x01: 8-N-2 0x02: 8-E-1 0x03: 8-O-1 Low Byte: 0x03: 1.2K 0x04: 2.4K 0x05: 4.8K 0x06: 9.6K 0x07: 19.2K 0x08: 38.4K 0x09: 57.6K 0x0A: 115.2K	R/W	0x0006
44108 (0x100B)	44108 (0x100B)	Watch dog timer (unit: 0.1s) Range: 0 ~ 0x00FF	R/W	0x0000

Address		Function	R/W	Initial Value
SIO-8RO	SIO-16RO			
44109 (0x100C)	44109 (0x100C)	System watch dog ❖ 0x0001: Enable ❖ 0x0000: Disable	R/W	0x0000
44110 (0x100D)	44110 (0x100D)	Status of system watch dog ❖ 0x0001: Timeout ❖ 0x0000: Normal	R/W	-
44111 (0x100E)	44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	44112 (0x100F)	Program CRC	R	
44128 (0x101F)	44128 (0x101F)	Module Error Status ❖ Bit 0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	
44129 (0x1020)	44129 (0x1020)	EEPROM Error Code ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	

4-25 SIO-8RO / SIO-16RO Modbus Mapping Input & Holding Register

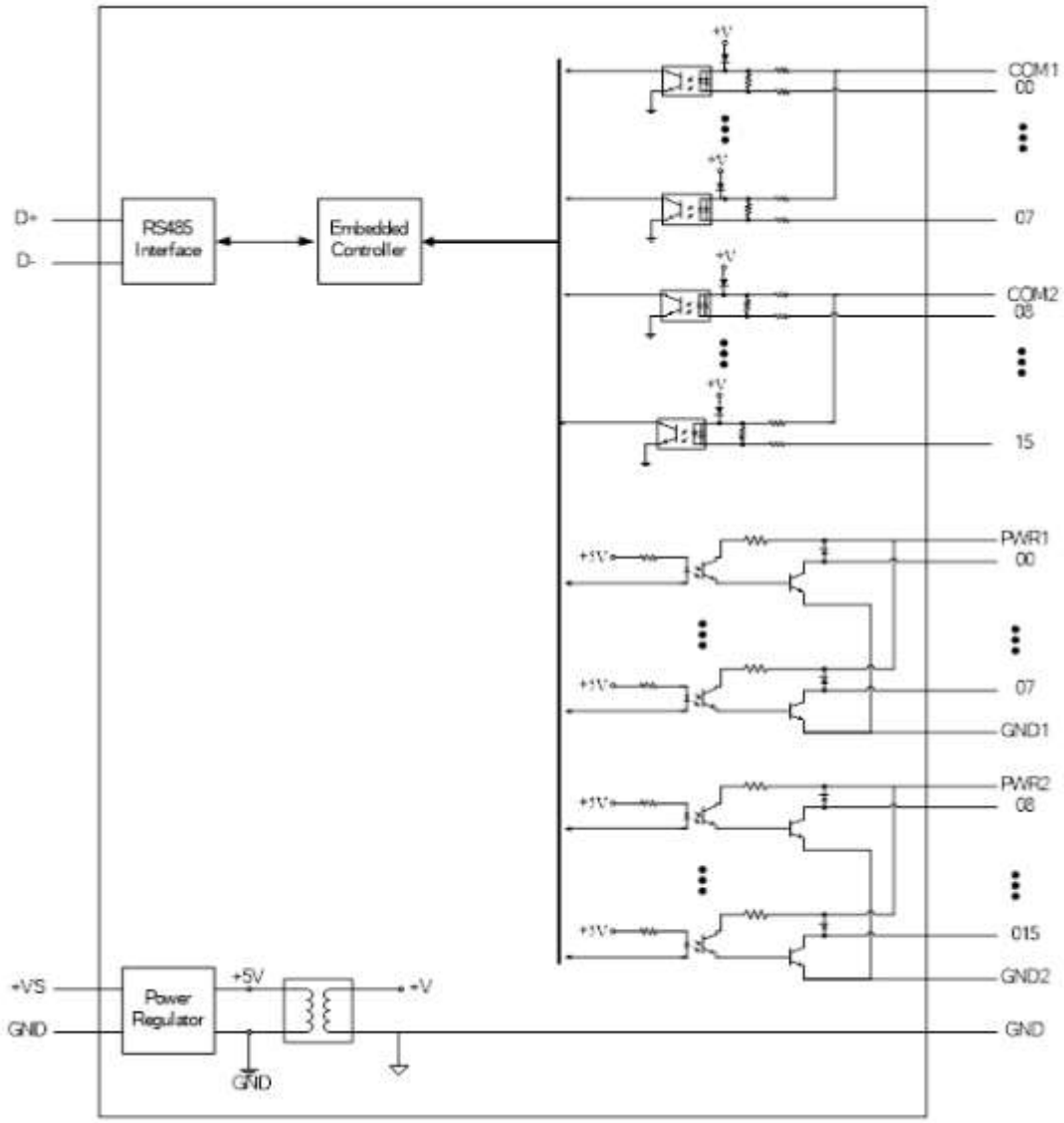
4.4 SIO-16DIO [16 Channels Digital Input / 16 Channels Digital Output Module]

4.4.1 Terminal Assignment



4-17 SIO16DIO Terminal Assignment

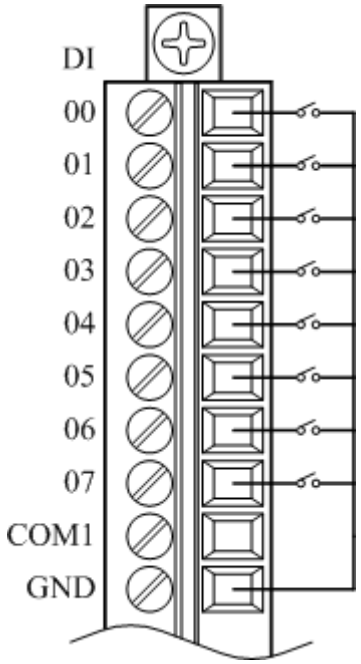
4.4.2 Block Diagram



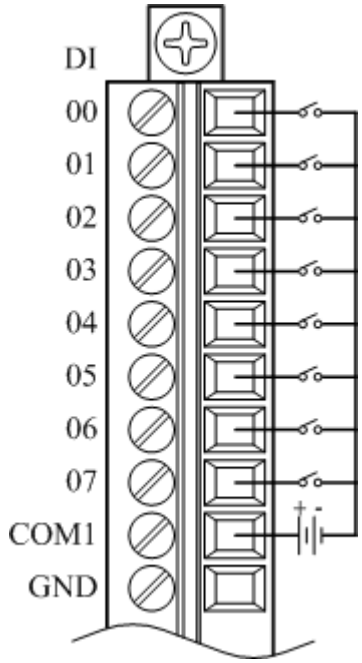
4-18 SIO-16DIO Block Diagram

4.4.3 Wiring

4.4.3.1 Input Wiring

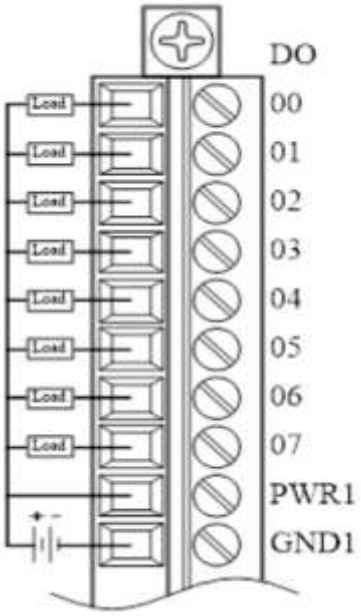


4-19 SIO-16DIO Dry Contact Input Wiring



4-20 SIO-16DIO Wet Contact Input Wiring

4.4.3.2 Output Wiring



4-21 SIO-16DIO Digital Output Wiring

4.4.4 Specifications

Parameter		Specification
Digital Input		
Digital Input Channels		16
Dry Contact	Logic Level 0	Open
	Logic Level 1	Close to GND
Wet Contact	Logic Level 0	+3V maximum
	Logic Level 1	+10 to 50V
Input resistance		10kΩ
Isolation voltage		2500Vdc
Over-voltage Protection		70 VDC
Counter Input Range		Max.100Hz (16 bit)
Latch Value Read		Yes

4-26 SIO-16DIO Input Specification

Parameter	Specification
Digital Output	
Digital Output Channels	16
Output Type	NPN
Output Voltage Range	3.5~30V
Normal Output Current	500mA
Startup Value Setting	Yes
Communication Safety Value Setting	Yes
Power Consumption	4.8W @ 24V

4-27 SIO-16DIO Output Specification

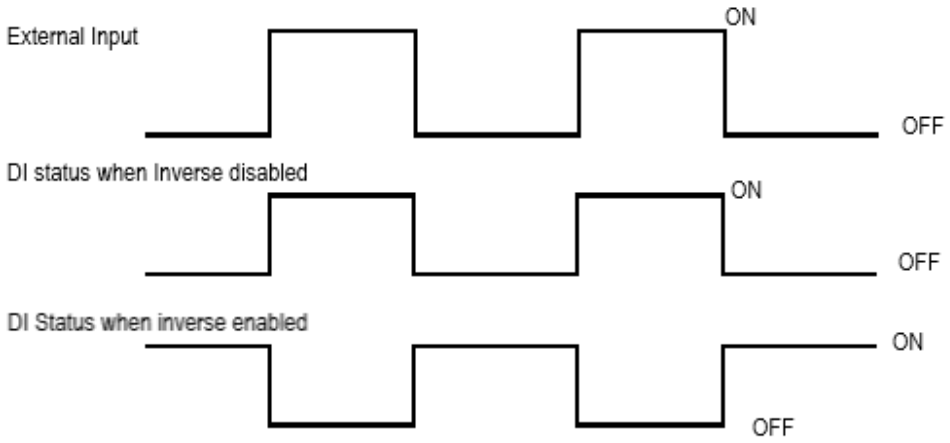
4.4.5 Related Reference

4.4.5.1 Digital Input Active State

Smart series digital input module supports invert DI status. When the setting is 0x0000, the DI status is high for logic level high and low for logic level low. When setting is 0x0001, the DI status is high for logic level low and low for logic level high. The Modbus setting is as below:

Address	Function	R/W	Initial Value
40129 (0x0080)	DI CH0~CH15 Input Active Value Define ❖ 0x0000: Normal State ❖ 0x0001: Invert State	R/W	0x0000

4-28 SIO-16DIO DI invert mode selection Modbus Mapping



4-29 SIO-16DIO DI status with invert mode

4.4.5.2 Digital Input Status

Following Modbus address can be used to read digital input channel status:

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	All 0
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to the corresponding channel)	R	

4-30 SIO-16DIO Input Status Modbus Mapping

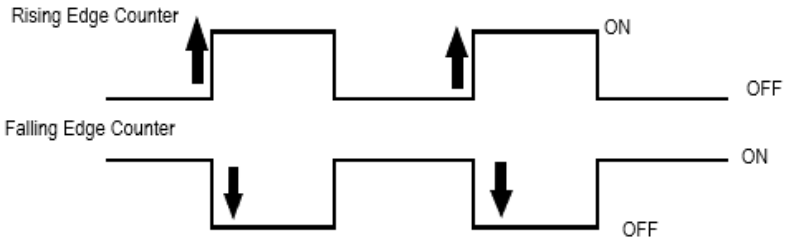
4.4.5.3 Read/Clear the Digital Input Counter

Digital input module has the function of counting the external pulse digital signal. The maximum frequency must be less than 100Hz. The following Modbus address can be used to read or clear current counter.

Address	Function	R/W	Initial Value
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	All 0
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 Counter Value	R	All 0x0000

Address	Function	R/W	Initial Value
40137 (0x0088)	DI CH0~CH15 Counter Edge Define (Each bit map to the corresponding channel) ❖ 1=Rising edge ❖ 0=Falling edge	R/W	0x0000
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to the corresponding channel)	W	0

4-31 SIO-16DIO Counter function Modbus Mapping



4-32 Rising Edge & Falling Edge Counter function

4.4.5.4 Read/Clear Latch Status

Digital input module has the function of the latch the external pulse of the digital signal. The latch high will be latched when the input is high and the latch low will be latched when the input is low. The latch will be cleared using the latch clear function. The latch will be latched until the latch clear command sends to the module.

The following Modbus addresses can be used to read or clear current latch status in the digital input module:

Address	Function	R/W	Initial Value
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	DI CH0~CH15 Latch Low Value	R	All 0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to the corresponding channel)	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to the corresponding channel)	R	
40113 (0x0070)	DI Latch Clear ❖ 0x01: DI Latch Clear	W	0

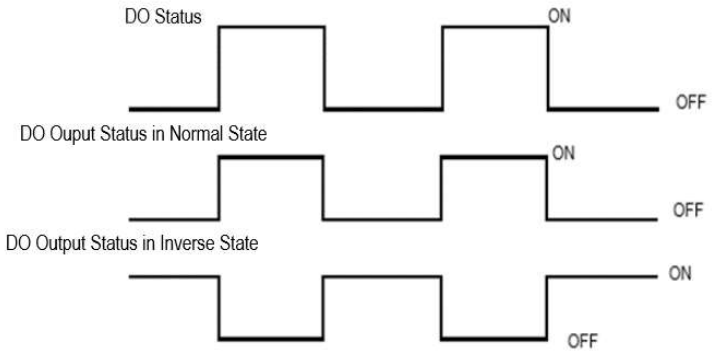
4-33 SIO-16DIO Latch function Modbus Mapping

4.4.5.5 Digital Output Active State

Digital Output module supports invert digital output status. When the state is 0x0000, if the output channel is configured as 1, the digital output will be activated, if the output channel is configured as 0, the digital output will be inactivated. When the setting is 0x0001, if the output channel is configured as 0, the digital output will be activated, if the output channel is configured as 1, the digital output will be inactivated. The Modbus address setting is as below:

Address	Function	R/W	Initial Value
40385 (0x0180)	DO CH0~CH15 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000

4-34 SIO-16DIO DO Active State Modbus Mapping



4-35 SIO-16DIO DO Active State

4.4.5.6 Digital Output Status

Following Modbus address can be used to read digital output status:

Address	Function	R/W	Initial Value
00257~00272 (0x0100~0x010F)	DO CH0~CH15 Output Status	R/W	-
40321 (0x0140)	DO CH0~CH15 Output Status (Each bit map to the corresponding channel)	R/W	-

4-36 SIO-16DIO DO Status Modbus Mapping

4.4.5.7 Power-on Value

Digital Output Module has the function of power-on value. Following Modbus address can be used to configure the power-on value for all channels:

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH15 Power-on Value (Each bit mapping to the corresponding channel)	R/W	All 0x0000

4-37 SIO-16DIO DO Power ON Value Modbus Mapping

4.4.5.8 Host Watchdog Timer

When the host watchdog function is enabled and a timeout occurs, the module will reset all

outputs to a safe state in order to ensure the safety of the system or device. Following Modbus address can be used to configure the safe value of each digital output:

Address	Function	R/W	Initial Value
40259 (0x0102)	DO CH0~CH15 Safety Output Value (Each bit mapping to the corresponding channel)	R/W	All 0x0000

4-38 SIO-16DIO DO Safe Value Modbus Mapping

4.4.6 Modbus Mapping Table

4.4.6.1 Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	All 0
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	DI CH0~C15 Latch Low Value	R	All 0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	All 0
00257~00272 (0x0100~0x010F)	DO CH0~CH15 Output Status	R/W	-

4-39 SIO-16DIO Modbus Mapping Coil (0xxxx & 1xxxx)

4.4.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address	Function	R/W	Initial Value
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 Counter Value	R	All 0x0000
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to the corresponding channel)	R	
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to the corresponding channel)	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to the corresponding channel)	R	
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to the corresponding channel)	W	0

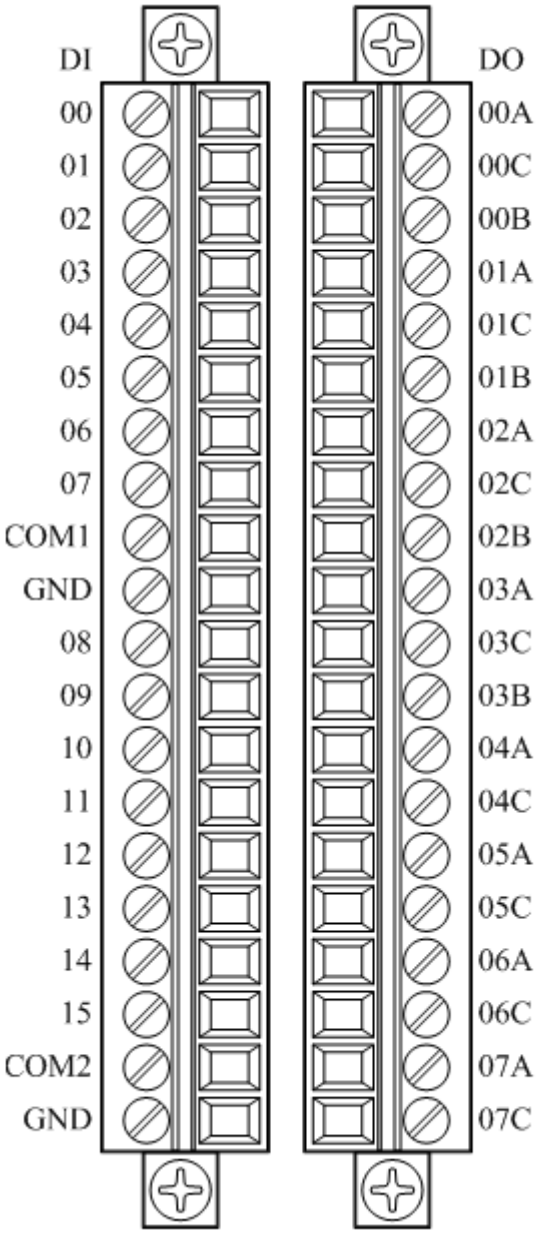
<table>
<tr><th>Address</th><th>Function</th><th>R/W</th><th>Initial Value</th></tr>
<tr><td>40113
(0x0070)</td><td>DI Latch Clear
❖ 0x01: DI Latch Clear</td><td>W</td><td>0</td></tr>
<tr><td>40129
(0x0080)</td><td>DI CH0~CH15 Input Active Value Define
❖ 0x0000: Normal State
❖ 0x0001: Invert State</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH15 Counter Edge Define
(Each bit map to the corresponding channel)
❖ 1=Rising edge
❖ 0=Falling edge</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>40257
(0x0100)</td><td>DO CH0~CH15 Power-on Value
(Each bit mapping to the corresponding channel)</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>40259
(0x0102)</td><td>DO CH0~CH15 Safety Output Value
(Each bit mapping to the corresponding channel)</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>40321
(0x0140)</td><td>DO CH0~CH15 Output Status
(Each bit map to the corresponding channel)</td><td>R/W</td><td>-</td></tr>
<tr><td>40385
(0x0180)</td><td>DO CH0~CH15 Output Active Value
❖ 0x0000: Normal
❖ 0x0001: Inverse</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII char)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>Modbus response delay time (unit: msec)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
</table>

Address	Function	R/W	Initial Value
44108 (0x100B)	Watch dog timer (unit: 0.1s) Range: 0 ~ 0x00FF	R/W	0x0000
44109 (0x100C)	System watch dog ❖ 0x0001: Enable ❖ 0x0000: Disable	R/W	0x0000
44110 (0x100D)	Status of system watch dog ❖ 0x0001: Timeout ❖ 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	CRC checking code	R	-
44128 (0x101F)	Module Error Status ❖ Bit0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	-
44129 (0x1020)	EEPROM error ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	-

4-40 SIO-16DIO Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

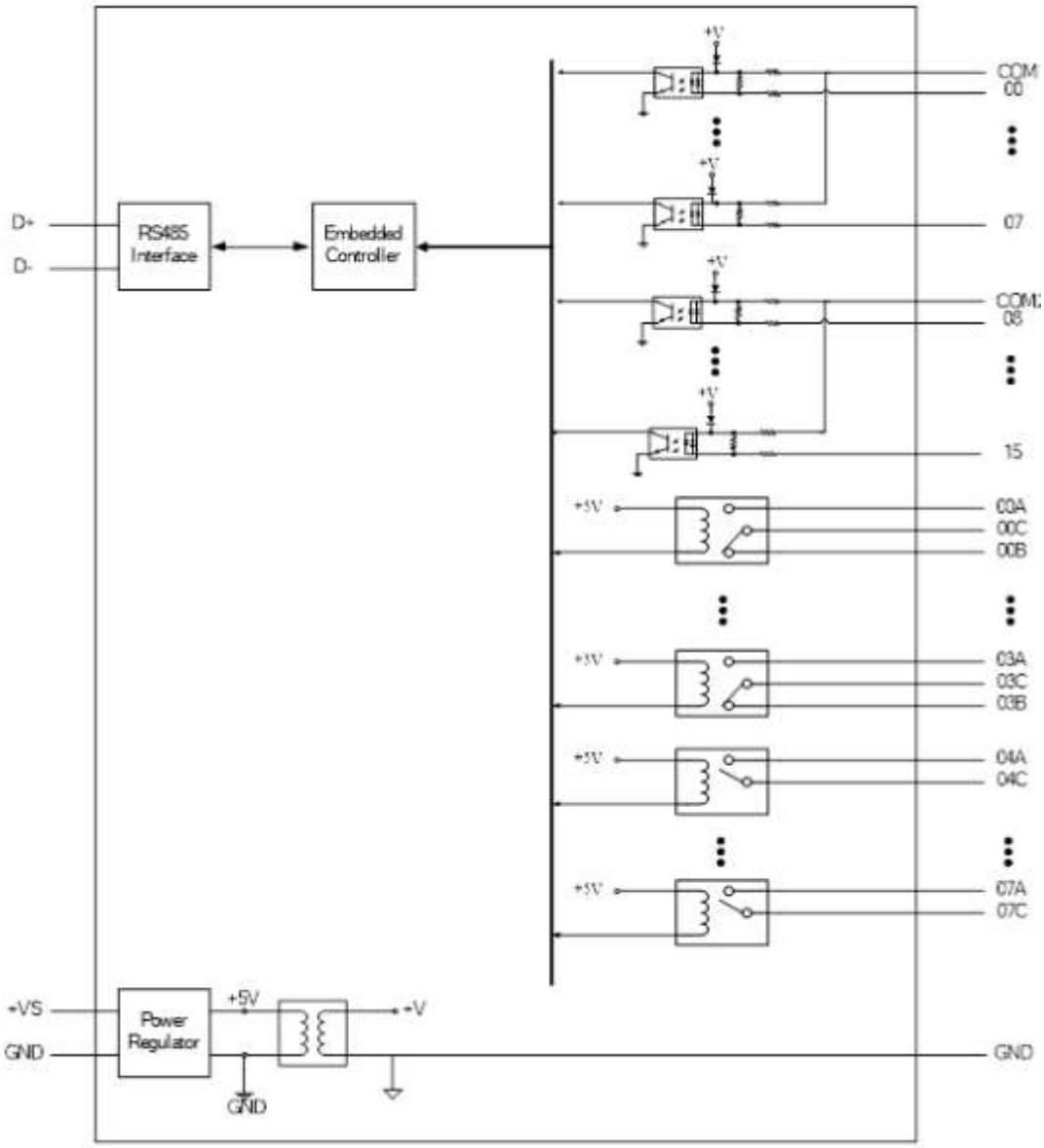
4.5 SIO-16DI8RO [16 Channels Digital Input / 8 Channels Relay Output Module]

4.5.1 Terminal Assignment



4-22 SIO-16DI8RO Terminal Assignment

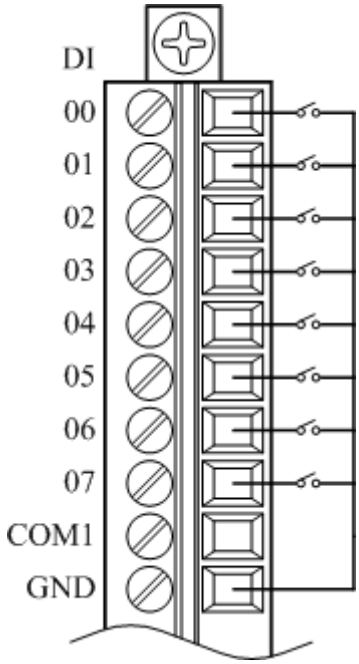
4.5.2 Block Diagram



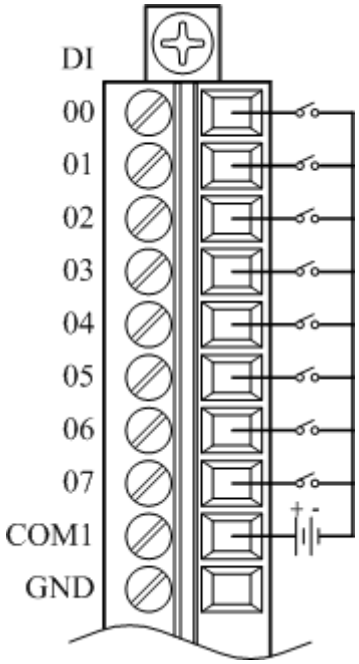
4-23 SIO-16DI8RO Block Diagram

4.5.3 Wiring

4.5.3.1 Input Wiring

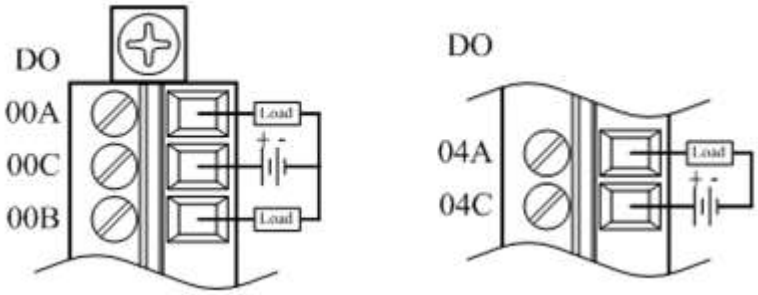


4-24 SIO-16DI8RO Dry Contact Input Wiring



4-25 SIO-16DI8RO Wet Contact Input Wiring

4.5.3.2 Relay Output Wiring



4-26 SIO-16DI8RO Relay Output Wiring

4.5.4 Specifications

Parameter		Specification
Digital Input		
Digital Input Channels		16
Dry Contact	Logic Level 0	Open
	Logic Level 1	Close to GND
Wet Contact	Logic Level 0	+3V maximum
	Logic Level 1	+10 to 50V
Input resistance		10kΩ

Parameter	Specification
Isolation voltage	2500Vdc
Over-voltage Protection	70 VDC
Counter Input Range	Max.100Hz (16 bit)
Latch Value Read	Yes

4-41 SIO-16DI8RO Digital Input Specification

Parameters	Specification
Relay Output	
Relay Output Channels	4 Form A, 4 Form C
Contact Rating	5A 250VAC/30VDC
Dielectric Strength	3KV
Operate Time	10ms Max.
Release Time	5ms Max.
Electrical Endurance	$1x10^5$ops@3A 250VAC/30VDC
Power Consumption	3W @ 24V

4-42 SIO-16DI8RO Relay Output Specification

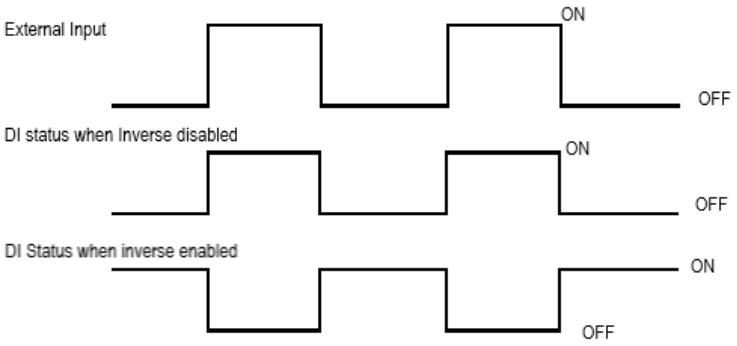
4.5.5 Related Reference

4.5.5.1 Digital Input Active State

Smart series digital input module supports invert DI status. When the setting is 0x0000, the DI status is high for logic level high and low for logic level low. When setting is 0x0001, the DI status is high for logic level low and low for logic level high. The Modbus setting is as below:

Address	Function	R/W	Initial Value
40129 (0x0080)	DI CH0~CH15 Input Active Value Define ❖ 0x0000: Normal State ❖ 0x0001: Invert State	R/W	0x0000

4-43 SIO-16DI8RO DI invert mode selection Modbus Mapping



4-44 SIO-16DI8RO DI status with invert mode

4.5.5.2 Digital Input Status

Following Modbus address can be used to read digital input channel status:

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	All 0
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to the corresponding channel)	R	

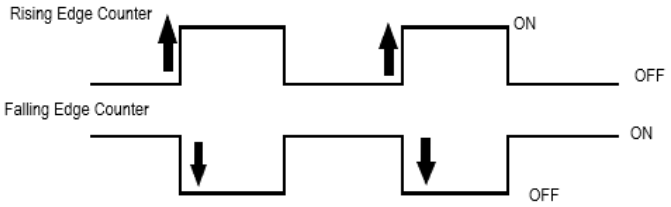
4-45 SIO-16DI8RO Input Status Modbus Mapping

4.5.5.3 Read/Clear the Digital Input Counter

Digital input module has the function of counting the external pulse digital signal. The maximum frequency must be less than 100Hz. The following Modbus address can be used to read or clear current counter.

Address	Function	R/W	Initial Value
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	All 0
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 Counter Value	R	All 0x0000
40137 (0x0088)	DI CH0~CH15 Counter Edge Define (Each bit map to the corresponding channel) ❖ 1=Rising edge ❖ 0=Falling edge	R/W	0x0000
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to the corresponding channel)	W	0

4-46 SIO-16DI8RO Counter function Modbus Mapping



4-47 Rising Edge & Falling Edge Counter function

4.5.5.4 Read/Clear Latch Status

Digital input module has the function of the latch the external pulse of the digital signal. The latch high will be latched when the input is high and the latch low will be latched when the input is low. The latch will be cleared using the latch clear function. The latch will be latched until the latch clear command sends to the module. The following Modbus addresses can be used to read or clear current latch status in the digital input module:

Address	Function	R/W	Initial Value
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	DI CH0~CH15 Latch Low Value	R	All 0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to the corresponding channel)	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to the corresponding channel)	R	
40113 (0x0070)	DI Latch Clear ❖ 0x01: DI Latch Clear	W	0

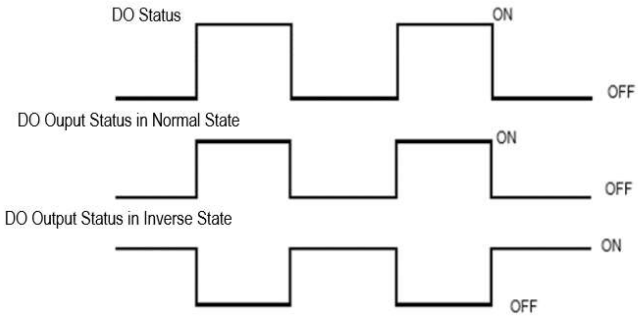
4-48 SIO-16DI8RO Latch function Modbus Mapping

4.5.5.5 Digital Output Active State

Digital Output module supports invert digital output status. When the state is 0x0000, if the output channel is configured as 1, the digital output will be activated, if the output channel is configured as 0, the digital output will be inactivated. When the setting is 0x0001, if the output channel is configured as 0, the digital output will be activated, if the output channel is configured as 1, the digital output will be inactivated. The Modbus address setting is as below:

Address	Function	R/W	Initial Value
40385 (0x0180)	DO CH0~CH15 Output Active Value ❖ 0x0000: Normal ❖ 0x0001: Inverse	R/W	All 0x0000

4-49 SIO-16DI8RO Relay Active State Modbus Mapping



4-50 SIO-16DI8RO Relay Active State

4.5.5.6 Digital Output Status

Following Modbus address can be used to read digital output status:

Address	Function	R/W	Initial Value
00257~00264 (0x0100~0x0107)	DO CH0~CH7 Output Status	R/W	-
40321 (0x0140)	DO CH0~CH7 Output Status (Each bit map to the corresponding channel)	R/W	-

4-51 SIO- SIO-16DI8RO Relay Status Modbus Mapping

4.5.5.7 Power-on Value

Digital Output Module has the function of power-on value. Following Modbus address can be used to configure the power-on value for all channels:

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH7 Power-on Value (Each bit mapping to the corresponding channel)	R/W	All 0x0000

4-52 SIO-16DI8RO Relay Power ON Value Modbus Mapping

4.5.5.8 Host Watchdog Timer

When the host watchdog function is enabled and a timeout occurs, the module will reset all outputs to a safe state in order to ensure the safety of the system or device. Following Modbus address can be used to configure the safe value of each digital output:

Address	Function	R/W	Initial Value
40259 (0x0102)	DO CH0~CH7 Safety Output Value (Each bit mapping to the corresponding channel)	R/W	All 0x0000

4-53 SIO-16DI8RO Relay Safe Value Modbus Mapping

4.5.6 Modbus Mapping Table

4.5.6.1 Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	All 0
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	All 0
00065~00080 (0x0040~0x004F)	DI CH0~C15 Latch Low Value	R	All 0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	All 0
00257~00264 (0x0100~0x010F)	DO CH0~CH7 Output Status	R/W	-

4-54 SIO-16DI8RO Modbus Mapping Coil (0xxxx & 1xxxx)

4.5.6.2 Holding Register (4xxxx) / Input Register (3xxxx)

Address	Function	R/W	Initial Value
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 Counter Value	R	All 0x0000
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to the corresponding channel)	R	
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to the corresponding channel)	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to the corresponding channel)	R	
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to the corresponding channel)	W	0
40113 (0x0070)	DI Latch Clear ❖ 0x01: DI Latch Clear	W	0
40129 (0x0080)	DI CH0~CH15 Input Active Value Define ❖ 0x0000: Normal State ❖ 0x0001: Invert State	R/W	0x0000

<table>
<tr><th>Address</th><th>Function</th><th>R/W</th><th>Initial Value</th></tr>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH15 Counter Edge Define
(Each bit map to the corresponding channel)
❖ 1=Rising edge
❖ 0=Falling edge</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>40257
(0x0100)</td><td>DO CH0~CH7Power on Value
(Each bit mapping to the corresponding channel)</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>40259
(0x0102)</td><td>DO CH0~CH7 Safety Output Value
(Each bit mapping to the corresponding channel)</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>40321
(0x0140)</td><td>DO CH0~CH7 Output Status
(Each bit map to the corresponding channel)</td><td>R/W</td><td>-</td></tr>
<tr><td>40385
(0x0180)</td><td>DO CH0~CH7 Output Active Value
❖ 0x0000: Normal
❖ 0x0001: Inverse</td><td>R/W</td><td>All 0x0000</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</td><td>Module name 16 Bytes (16 ASCII char)</td><td>R</td><td>-</td></tr>
<tr><td>44106
(0x1009)</td><td>Modbus response delay time (unit: msec)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table><tr><th>High Byte</th><th>Low Byte</th></tr><tr><td>0x00: 8-N-1
0x01: 8-N-2
0x02: 8-E-1
0x03: 8-O-1</td><td>0x03: 1.2K
0x04: 2.4K
0x05: 4.8K
0x06: 9.6K
0x07: 19.2K
0x08: 38.4K
0x09: 57.6K
0x0A: 115.2K</td></tr></table></td><td>R/W</td><td>0x0006</td></tr>
<tr><td>44108
(0x100B)</td><td>Watch dog timer (unit: 0.1s)
Range: 0 ~ 0x00FF</td><td>R/W</td><td>0x0000</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
❖ 0x0001: Enable
❖ 0x0000: Disable</td><td>R/W</td><td>0x0000</td></tr>
</table>

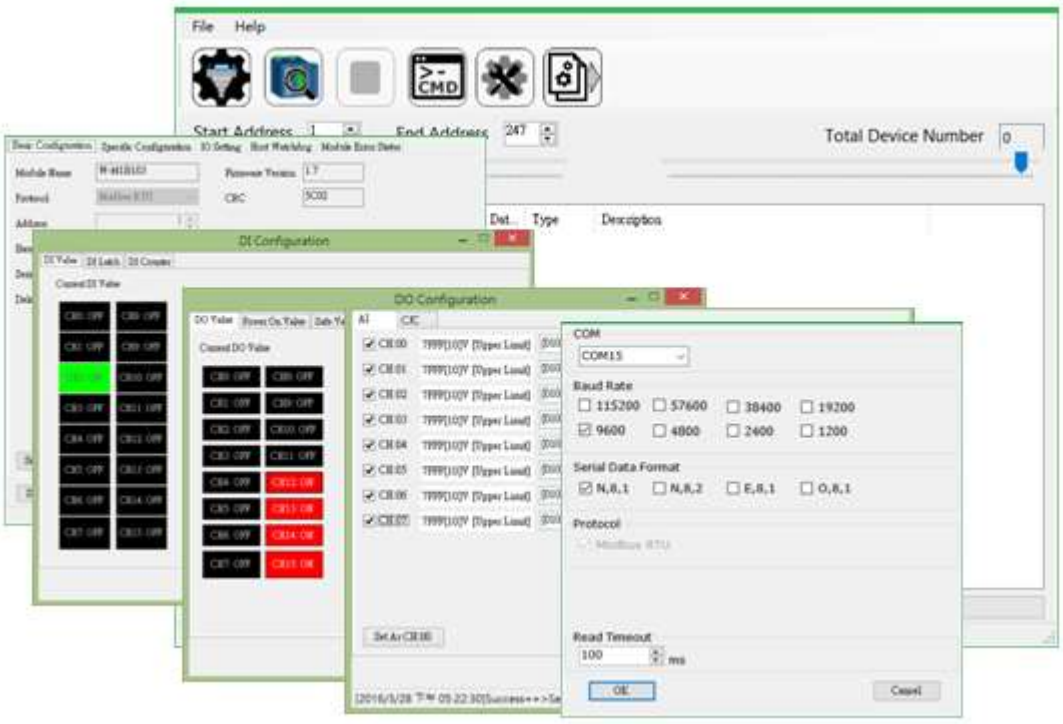
Address	Function	R/W	Initial Value
44110 (0x100D)	Status of system watch dog ❖ 0x0001: Timeout ❖ 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0x0000
44112 (0x100F)	CRC checking code	R	-
44128 (0x101F)	Module Error Status ❖ Bit0: EEPROM Error ❖ Bit1: Master/Slave Communication Error	R	-
44129 (0x1020)	EEPROM error ❖ 0: No Error ❖ 1: No Connection ❖ 2: Data Error ❖ 3: Configuration Error	R	-

4-55 SIO-16DI8RO Modbus Mapping Input & Holding Register (3xxxx & 4xxxx)

5 Utility Software

5.1 Utility Overview

Welcome to use Smart series module configuration utility. This utility is provided for Smart series remote I/O module using RS-485 to configure the I/O configuration. Smart series remote I/O module provides 7 kinds of control mode: analog input, output, analog input/output, digital input, output, digital input/output and relay etc. The protocol used in-between host and modules is Modbus/RTU. A great variety of baud rates (1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k and 115.2k) are also available for the user to select appropriate transmission rate.



5-1 Utility Software Overview

5.2 Power Requirement

The Smart series module needs to be powered before using this utility. The power supply ranges from DC +10 to +60V.

5.3 RS-485 Network Connections

This utility uses RS-485 as a network connection. If the PC is not equipped with RS-485 communication port, the user needs a USB to RS-485 converter or RS-232 to RS-485 converter

5.4 Setup and Use

5.4.1 Power Supply and RS-485 Network Connections

When the Smart series module, power supply, and RS-485 communication port ready Connect the power supply and network. After that, the user can use the utility software to configure and test the functionality of the module.

5.4.2 Module Address Setup and Default Communication Configuration

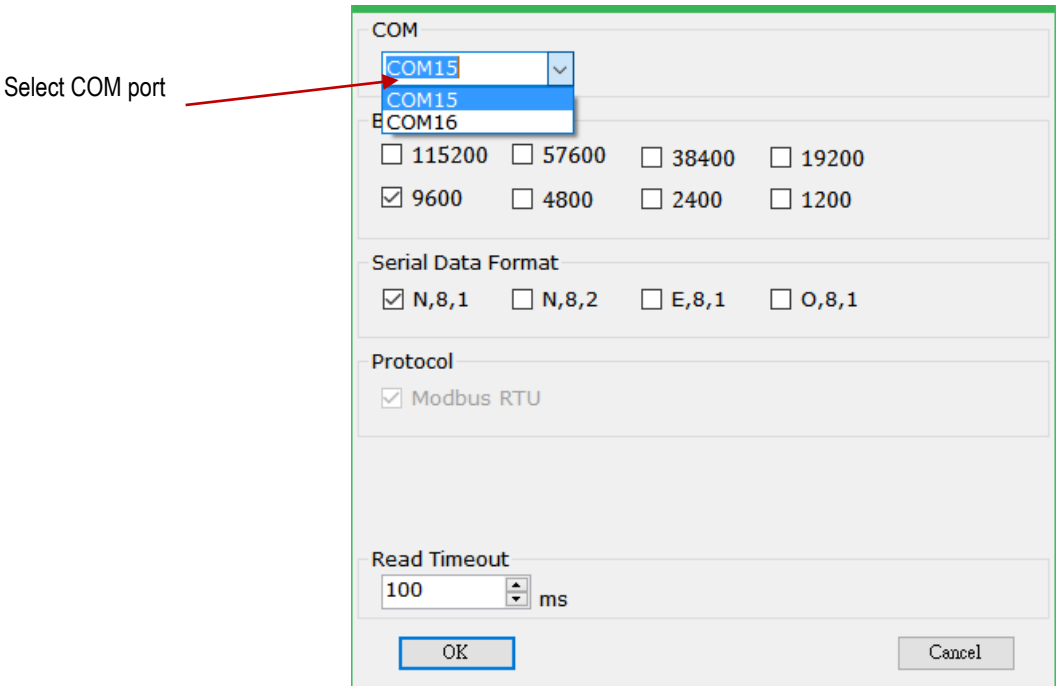
After connecting the power supply and network, the first step is to set up the module address for each module. Please note that the address of the connected module on the same RS-485 port is not replicable. Please refer to section 2.1.11 for setup procedures. The factory default baud rate setting of modules is 9600bps, and the default parity, data bits, and stop bit format is N, 8, 1. The baud rate range is from 1200bps to 115.2Kbps. The parity, data bits, and stop bit format is N, 8, 1, N, 8, 2, E, 8, 1, or O, 8, 1. If the configuration of the module is unknown, the user can revert to the factory default setting by INIT function explained in section 2.1.12.

5.4.3 Setup Host PC Communication Port

Run utility software on a PC workstation, the following main screen will appear:

5-2 Utility Software Main Screen

This utility will get all usable COM port on the PC，select the com port setting to select a correct COM port.

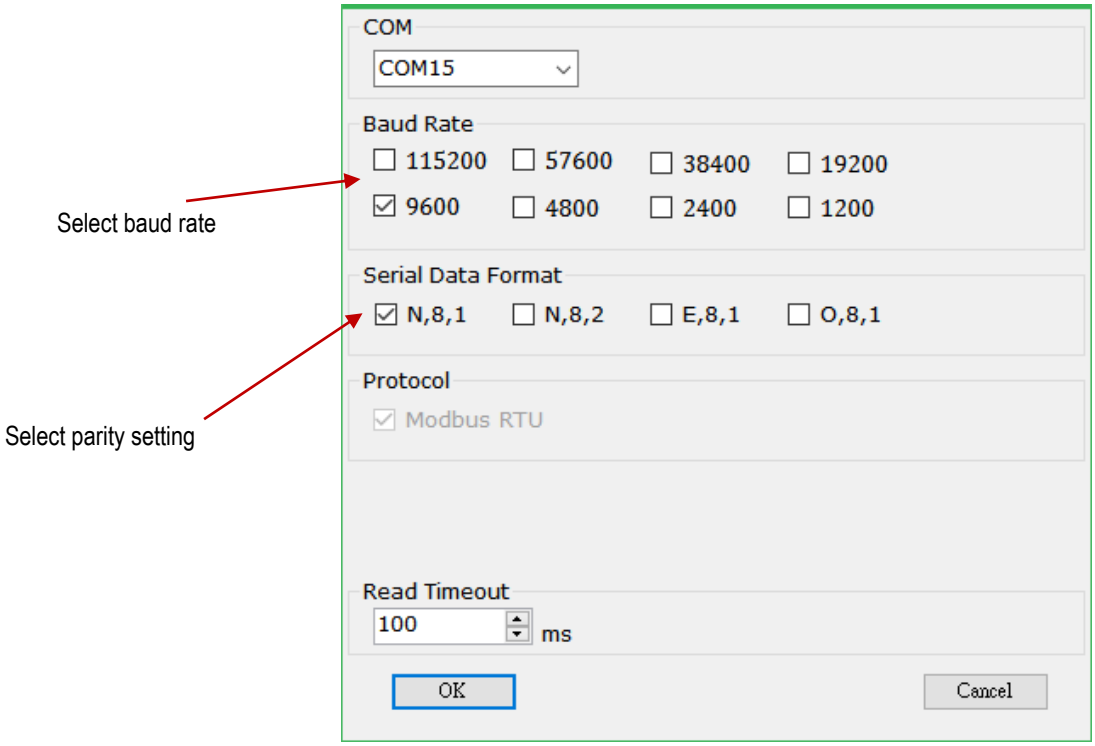


5-3 Com Port Selection Window

5.4.4 Search Module

After the module has been connected and the COM port has been configured, use the following default search condition to search module (If the module setting is unknown select all the conditions. It will extend the search time)

5.4.4.1 Communication parameter



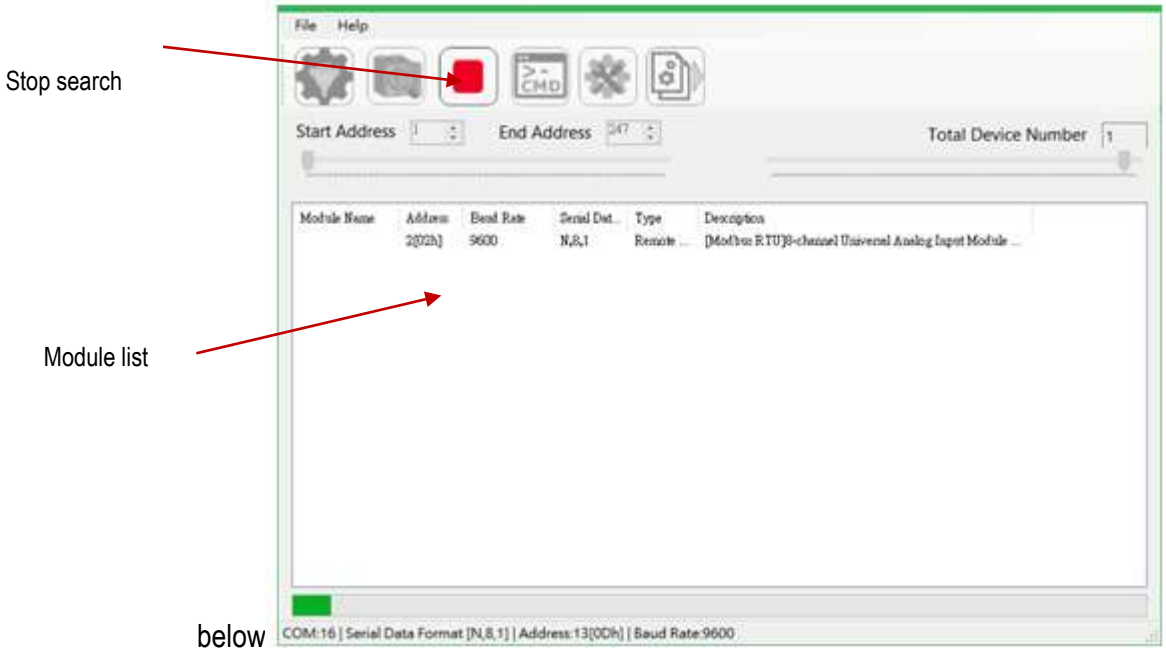
5-4 Com Port Parameter Setting

5.4.4.2 Address Range

Select address range (If the address in unknown chooses 1 to 247.But it will extend the search time).

5-5 Search Module Address Setting

The result of the search module is as below



5-6 Module Search Result

5.4.4.3 Guideline for Failure to Find Module

If there are any modules that are connected on the same RS-485 port and unable to be found, check the below case:

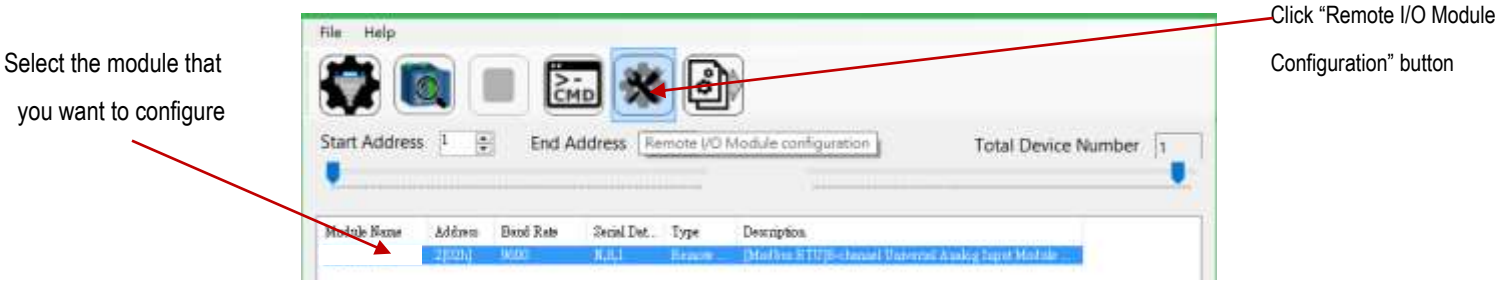
1. Check if the module is connected on the same RS-485 port and the cable is connected properly
2. Check the cable is broken or not
3. Whether the connection distance is too long (Which is also related to cable characteristics of RS-485) or excessive module number. Try to decrease the baud rate or add a repeater. There will be a maximum of 32 units only can be connected in the same segment. The repeater needs to be used if the module number exceeds.
4. Communication configuration might not include the setting of partial modules. Try to select all configurations and search module again, although utility might spend a lot of time to search, wait for a while.

5. If none of the above is the correct case, initialize the module to factory default, and try to search it again.

6. If the problem still cannot be resolved, it could be the malfunction of the module.

5.5 Module Configuration

In the list of modules, select the module that needs to be configured, and then click the "Remote I/O Module Configuration" button to configure the module.

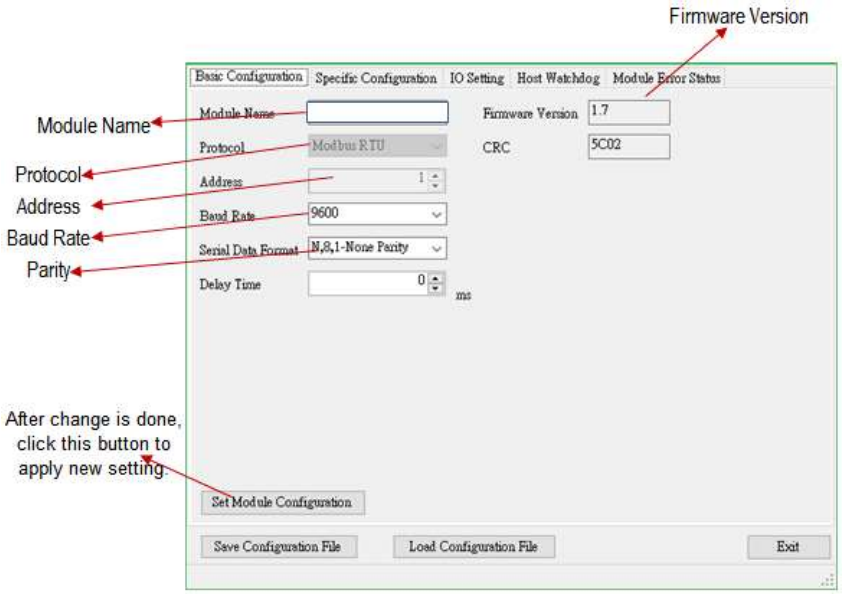


5-7 Selection of Configuration Module

In the module configuration window, 4-tab pages are available for configuration. They are listed as

1. Basic configuration
2. Channel Input / Output Specific configuration
3. Watchdog
4. Module Error Status

5.5.1 Basic Configuration



5-8 Basic Configuration

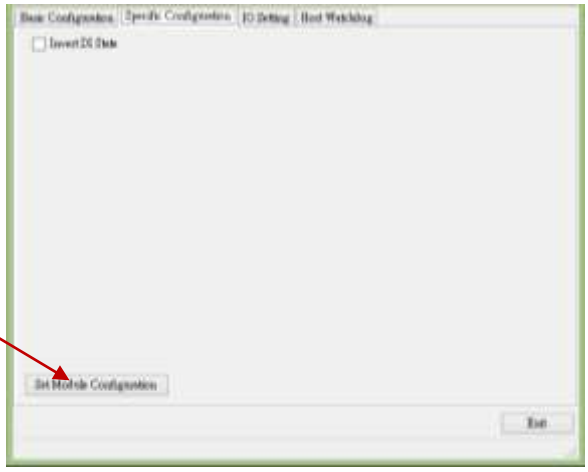
Note: After the setting is done in this tab, the user must recycle the power of the module for taking effect of the new configuration.

5.5.2 Channel Input/output specific parameters

Each module has some specific parameter setting, Refer module information section for more details.

1. Digital Input Module: Invert DI State

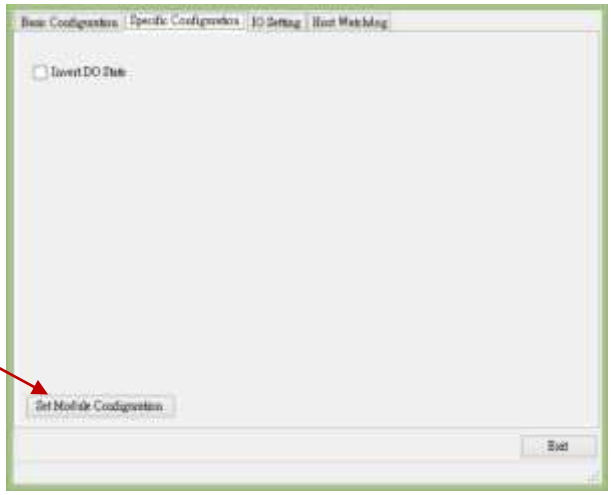
After change is done, click this button to apply new setting.



5-9 DI Module Invert State Configuration

2. Digital Output Module: Invert DO State

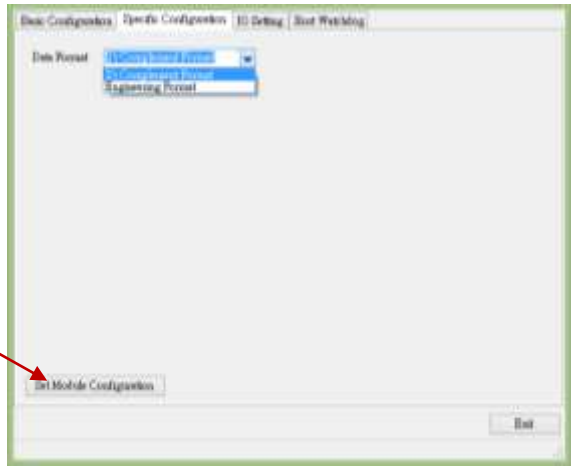
After change is done, click this button to apply new setting.



5-10 DO Module Invert State Configuration

3. Analog Input Module: Set the data format of the module to be 2's complement hexadecimal or engineering format.

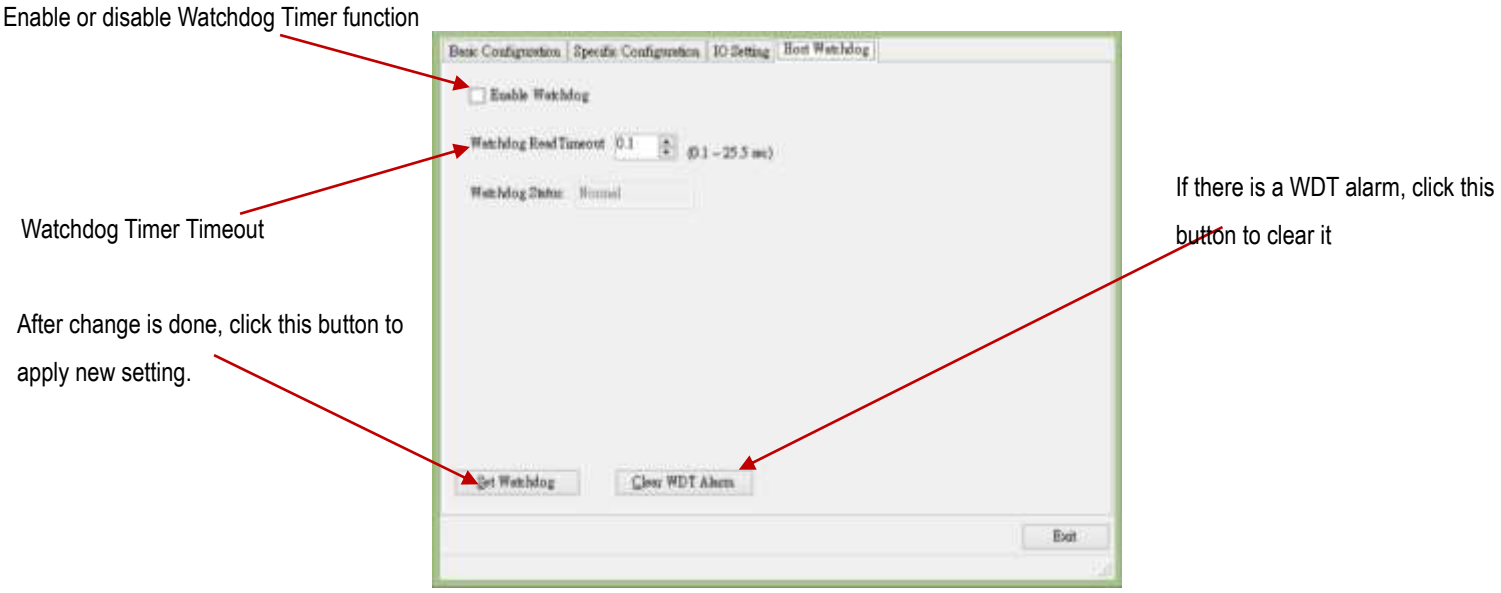
After change is done, click this button to apply new setting.



5-11 AI Module Value Format Configuration

5.5.3 Watchdog

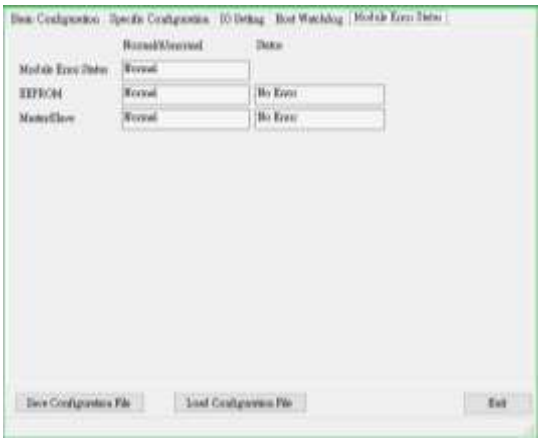
Host watchdog is software monitoring of the operation status of the system, its purpose is to provide immediate counter-measure when erroneous network, communication or breakdown occur. Once time-out occurs, the module will reset all outputs to configured SAFE mode.



5-12 Watchdog Timer Setting

5.5.4 Module Error Status

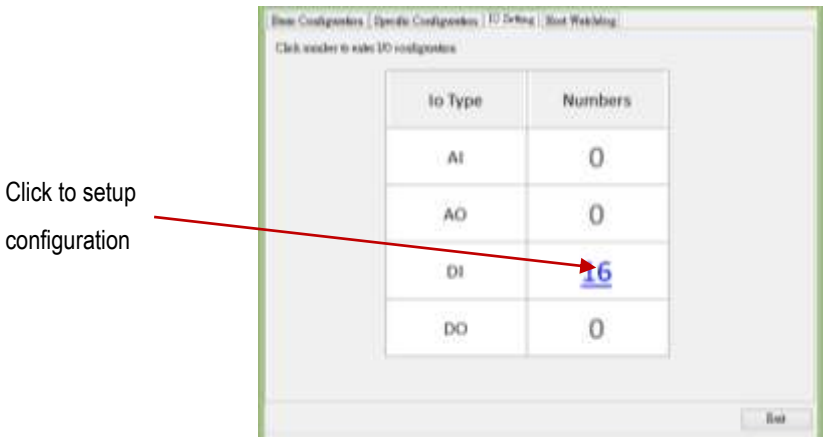
Display EEPROM status and the communication status between master and slave. The module error status indicates if any error occurs.



5-13 Error Status

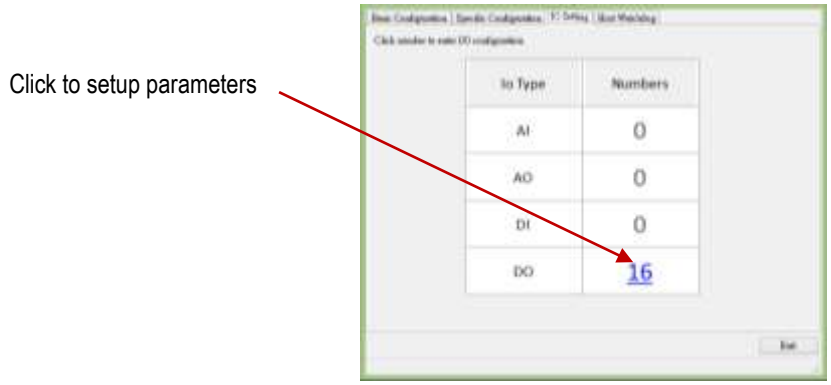
5.6 Module IO Setting

When the module has Digital Input channels, DI will show the number of channels in the module. It can be clicked for configuration.



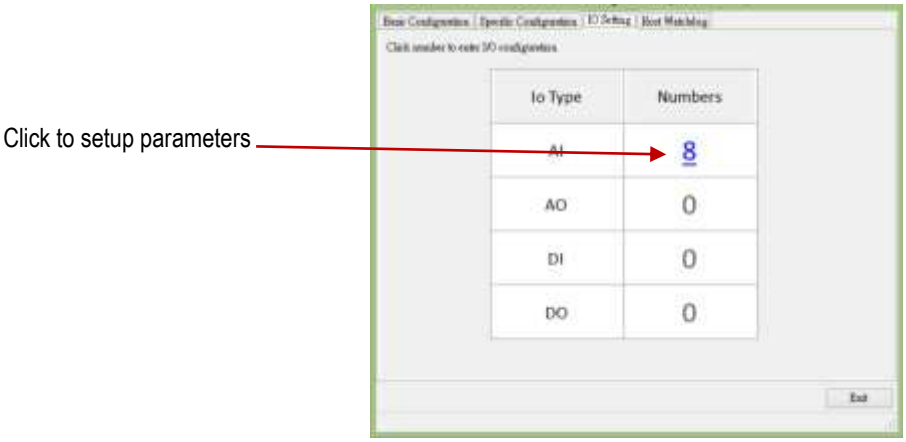
5-14 DI Configuration

When the module has Digital Output channels, DO will show the number of channels in the module. It can be clicked for configuration.



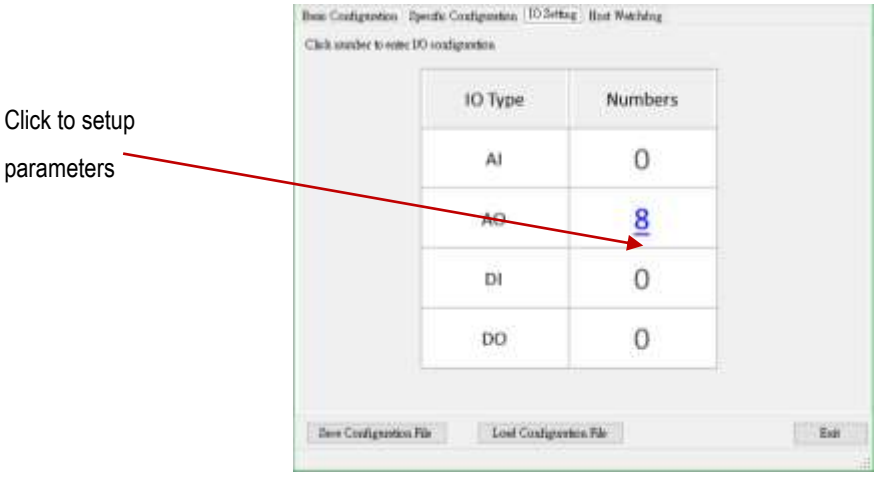
5-15 DO Configuration

When the module has Analog Input channels, AI will show the number of channels in the module. It can be clicked for configuration.



5-16 AI Configuration

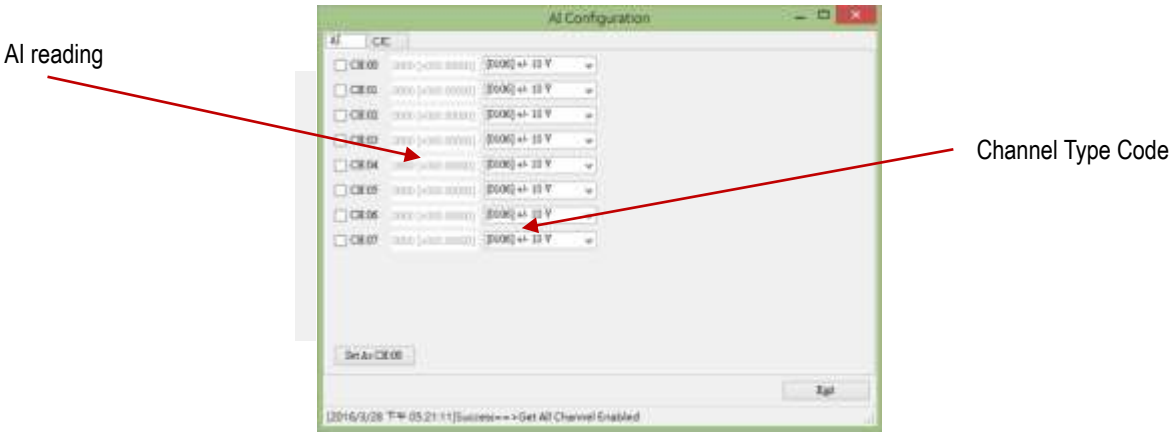
When the module has Analog Output channels, AO will show the number of channels in the module. It can be clicked for configuration.



5-17 AO Channel Configuration

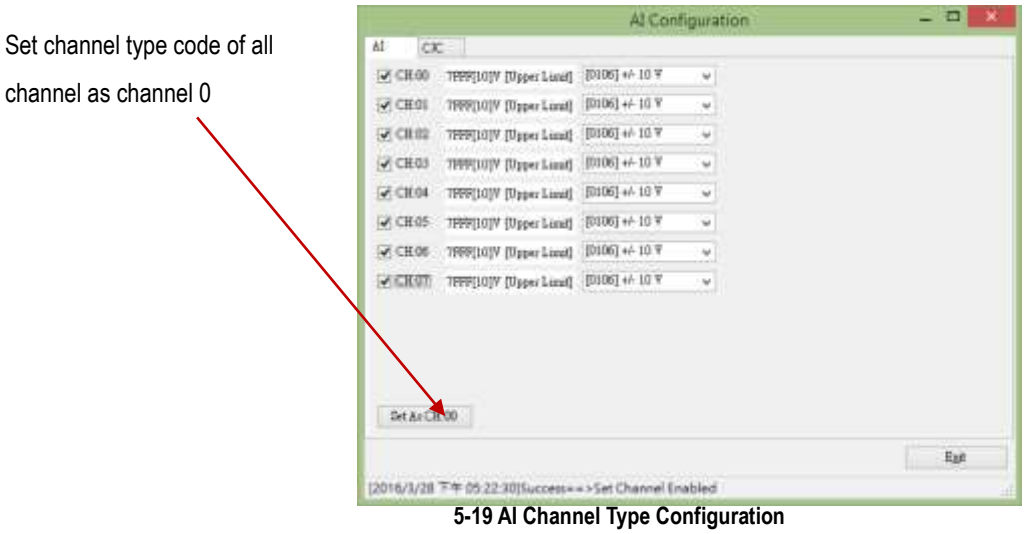
5.6.1 Analog Input channel setting and test

After entering the AI configuration window, AI channel and Temperature/CJC (Cold Junction Compensation) can be configured.



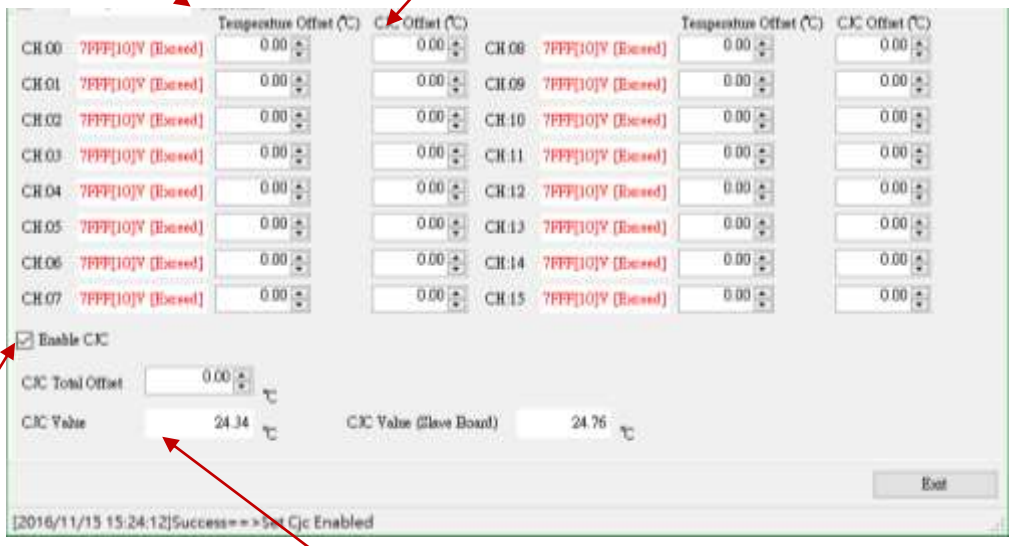
5-18 AI Channel Configuration

5.6.1.1 AI Channel Type Configuration



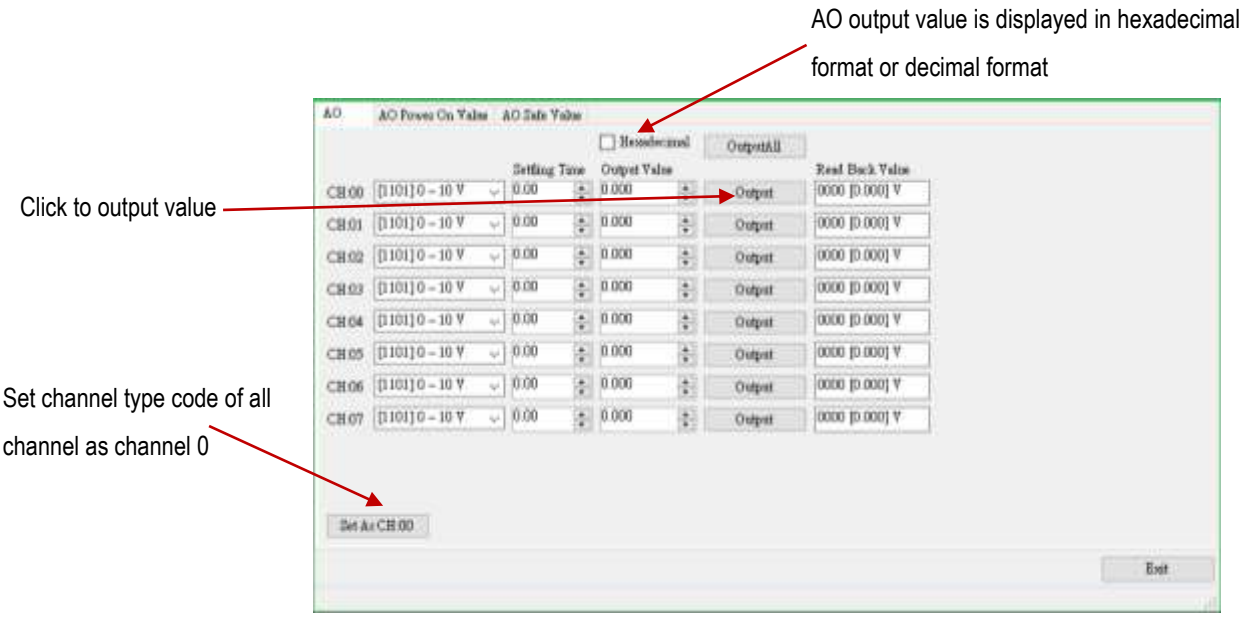
5-19 AI Channel Type Configuration

5.6.1.2 Temperature/CJC Configuration



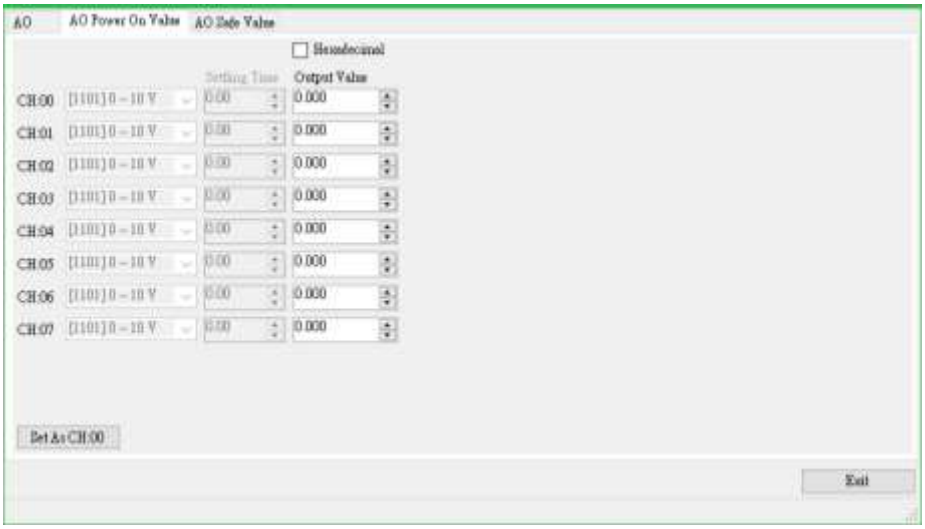
5-20 AI CJC Configuration

5.6.2 Analog Output Channel



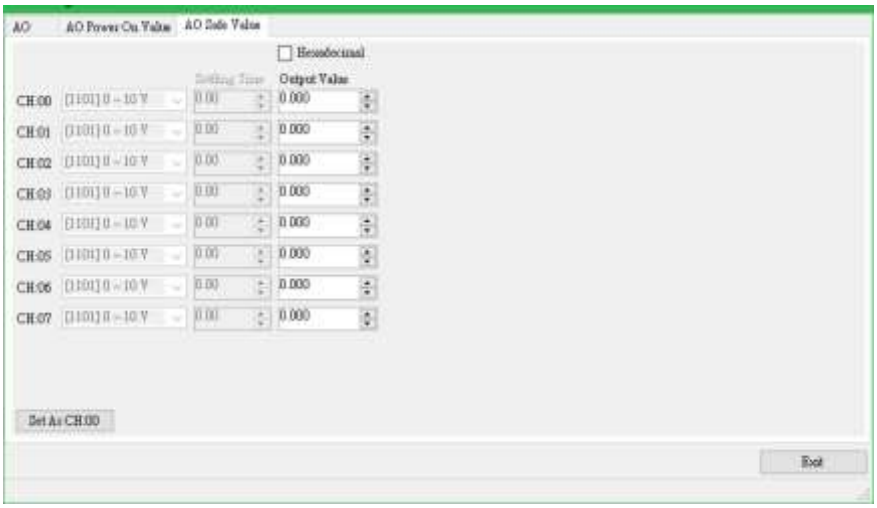
5-21 AO Configuration

5.6.2.1 AO Power-on Value



5-22 AO Power-on Value

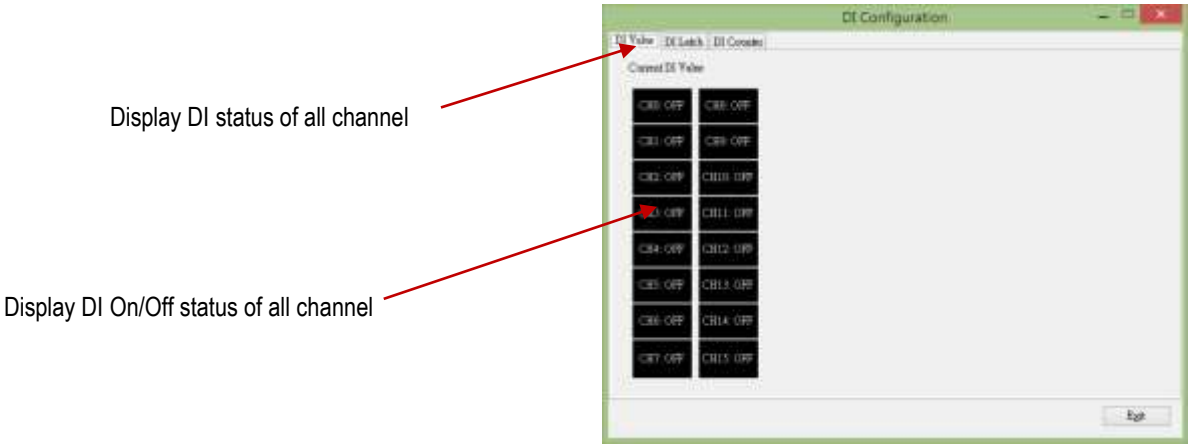
5.6.2.2 AO Safe Value:



5-23 AO Safe Value

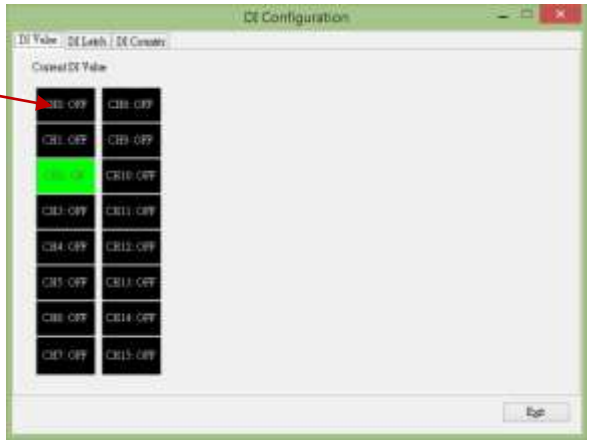
5.6.3 Digital Input Channel Test

After entering the digital input configuration, DI on/off status, latch status, and counter function can be tested.



5-24 DI Status

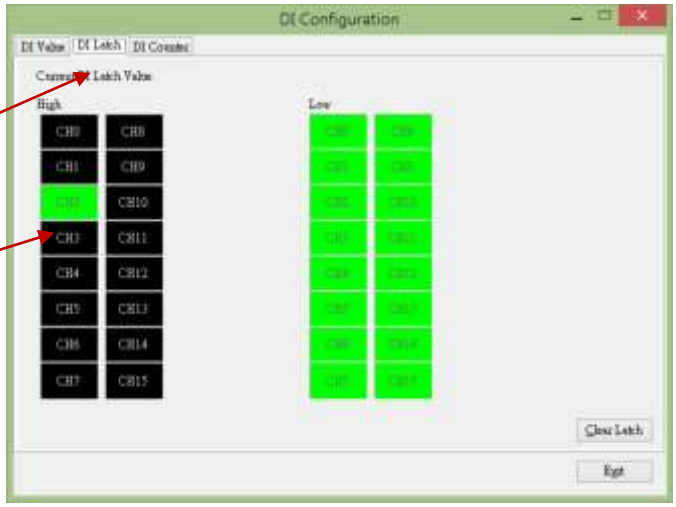
Display DI On/Off status of all channel



5-25 DI Status

LATCH status

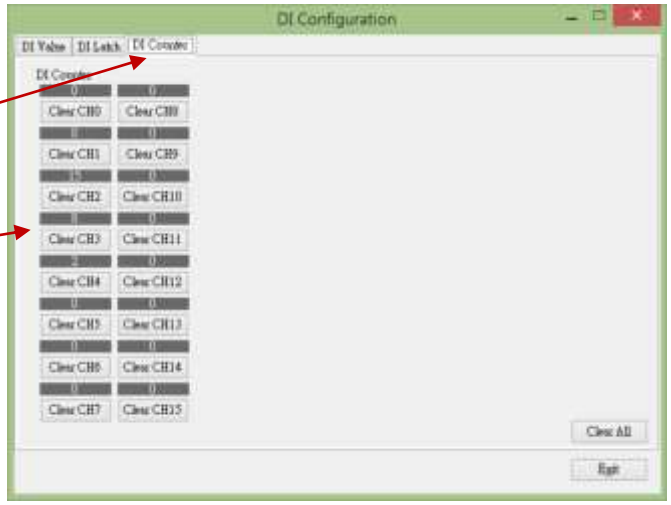
Display LATCH status of all channel (including LATCH HIGH and LATCH LOW)



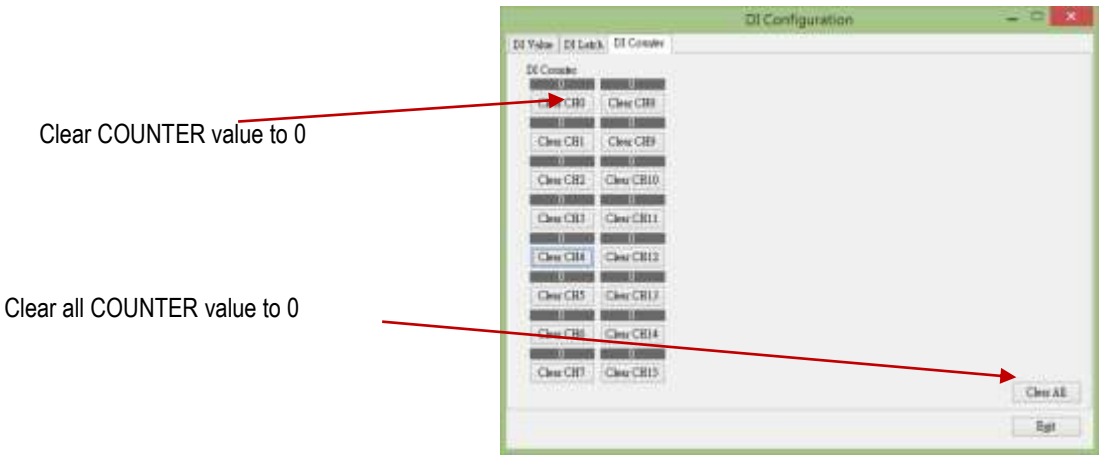
5-26 DI Latch Status

COUNTER

Display COUNTER value of all channel



5-27 DI Counter

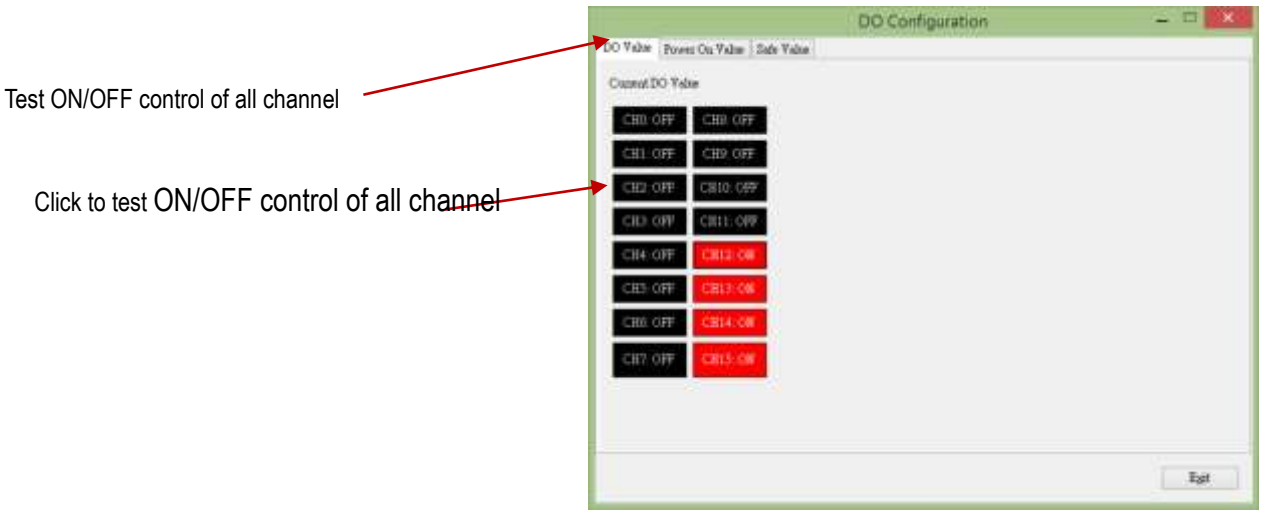


5-28 DI Counter

5.6.4 Digital Output Channel Configuration

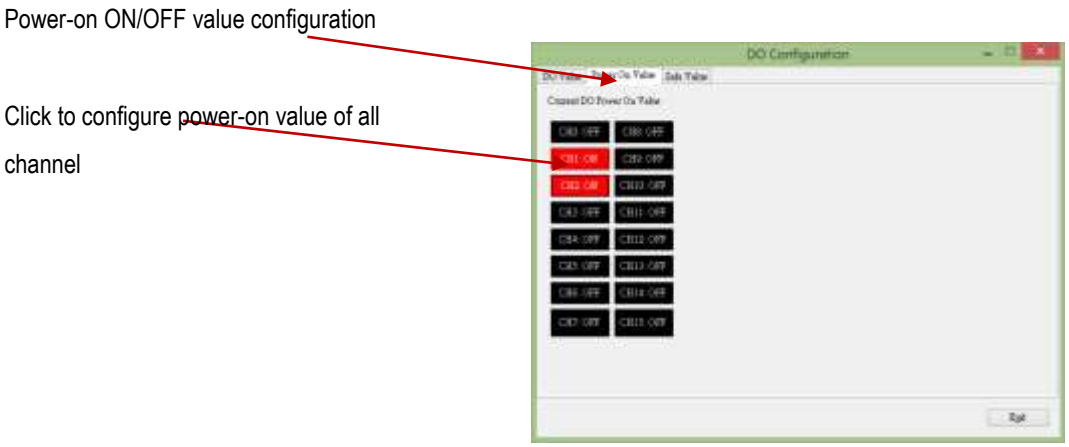
After entering DO (digital output) configuration, testing of DO on/off, and configuration of power-on value and safe value (which takes effect when host watchdog timeout has occurred) can be performed.

5.6.4.1 DO On/Off Testing



5-29 DO Testing

5.6.4.2 DO Power-on Value Configuration



5-30 DO Power on Value

5.6.4.3 DO Safe Value Configuration

5-31 DO Safe value

5.7 Safe/Load Module Configuration File

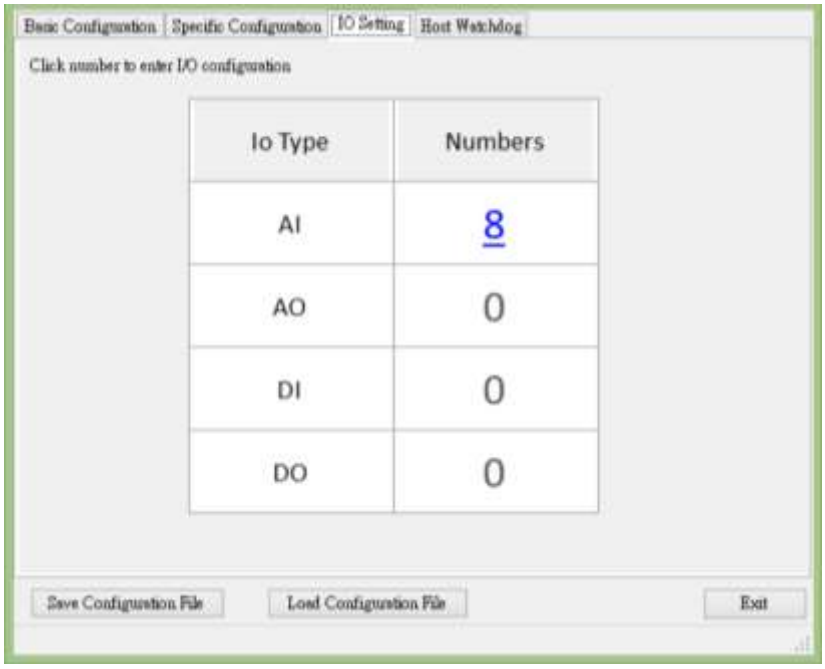
Module configuration can be saved to file for backup or template file. The template file also can be loaded into the module for quick setup module configuration. The operating steps are as follows:

There are two options available in IO Setting tab page as [Save Configuration File] and [Load Configuration File] button.

5.7.1 Save Configuration File

Click the [Save Configuration File] button.

.

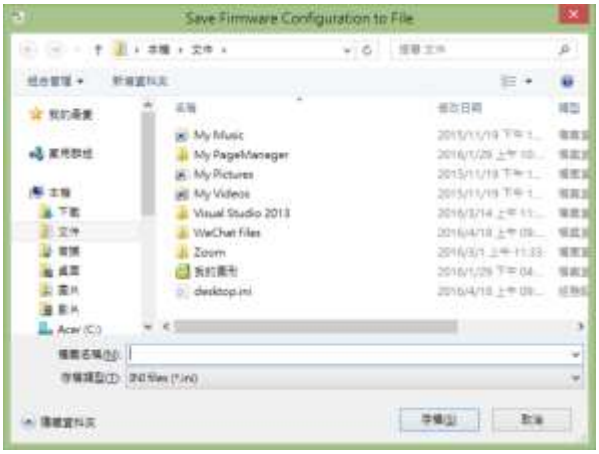


5-32 Save Configuration

It will pop up a window for type in file description to describe data for management. Click [Ok] to continue or [Cancel] to cancel this operation.

5-33 Save File Description

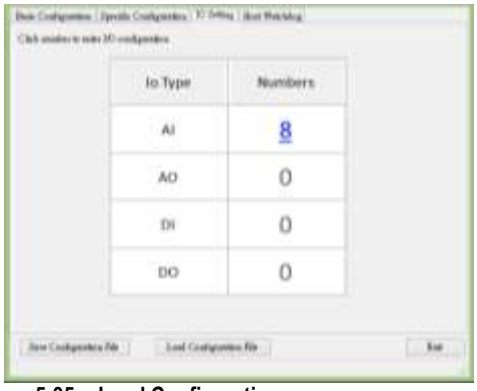
After clicking the [Ok] button, it will pop up a save file dialogue to prompt the user to select a location for saving a file. Specify a file name and select a location to save the file.



5-34 Save File Location

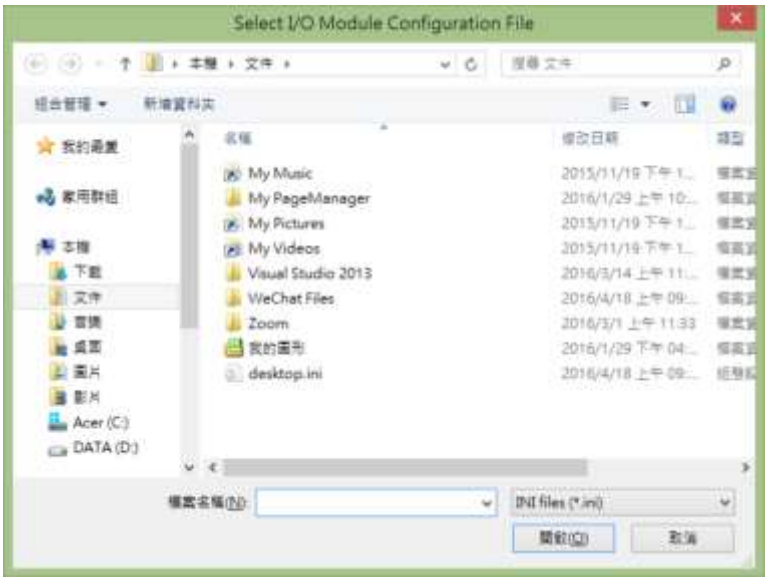
5.7.2 Load a Template File

In IO Setting tab page, click the [Load Configuration File] button.



5-35 Load Configuration

It will pop up an open file dialogue to prompt the user to open a file, select the file and click open to load the file.

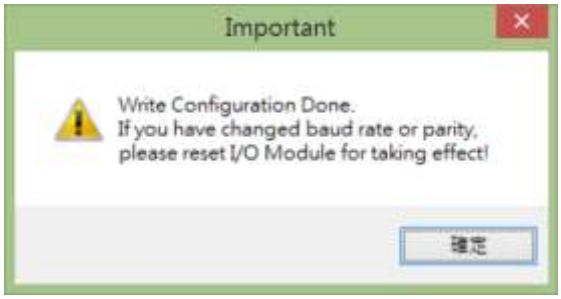


5-36 Load File Selection

After loading the file and before loading configuration to the module, it will pop up a warning window, indicating notes for attention and the contents of configuration file ， click [ok] button to continue or [Cancel] to cancel this operation.

5-37 Load File Warning

If the communication configuration has been changed, the I/O module must be restarted for loading new configuration correctly.

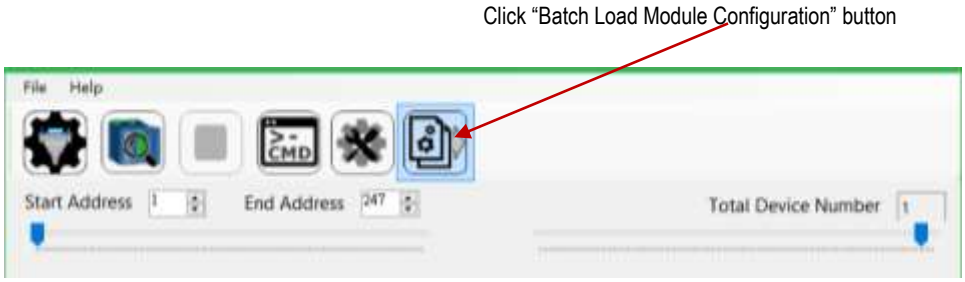


5-38 Communication Configuration Warning

5.8 Batch Load Module Configuration

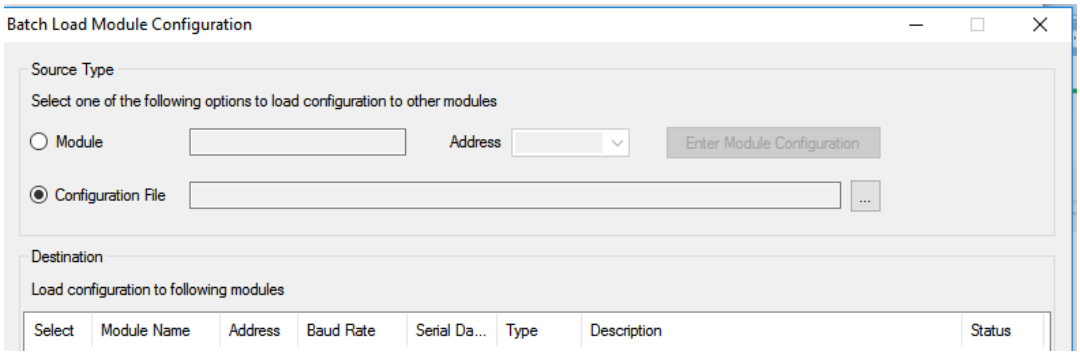
Module configuration can also be loaded into more than one module using batch load module configuration. The operating steps are as follows:

5.8.1 Loading Configuration from One Module to Other Modules



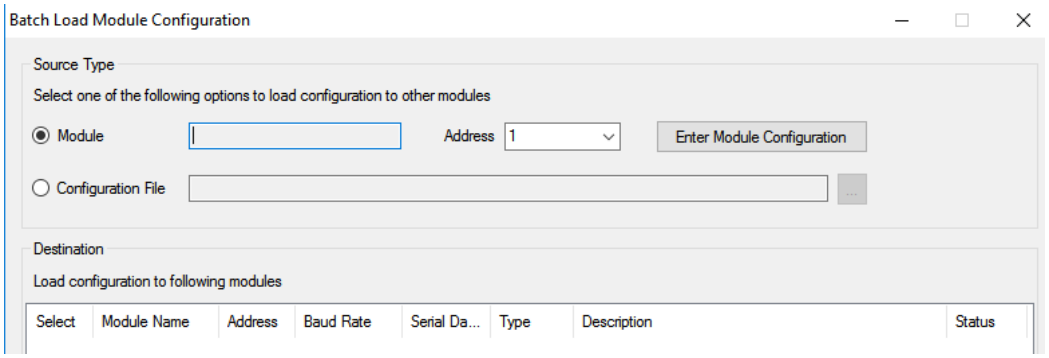
5-39 Batch Load Configuration

Choose the source type to load the configuration for module configuration



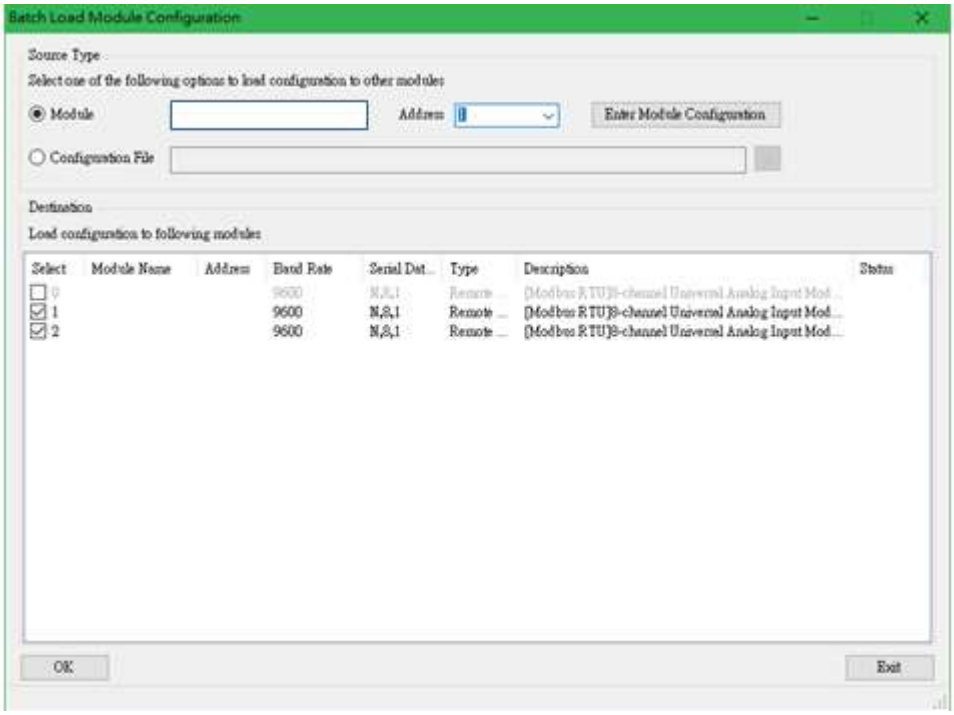
5-40 Batch Load Source

If the module is chosen as source type then select the right module by node address



5-41 Source Module Address

Select the target modules to load the configuration

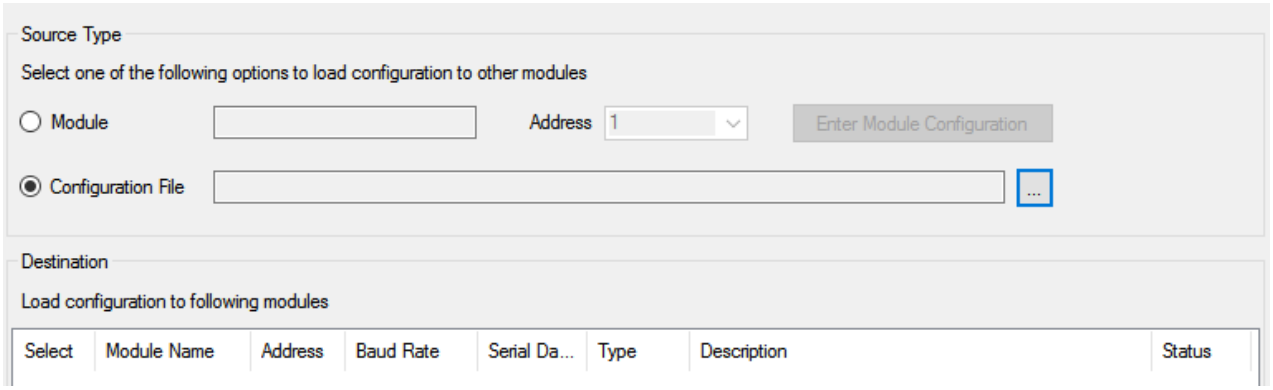


5-42 Target Module to Load

Click Ok to apply the configuration to selected modules

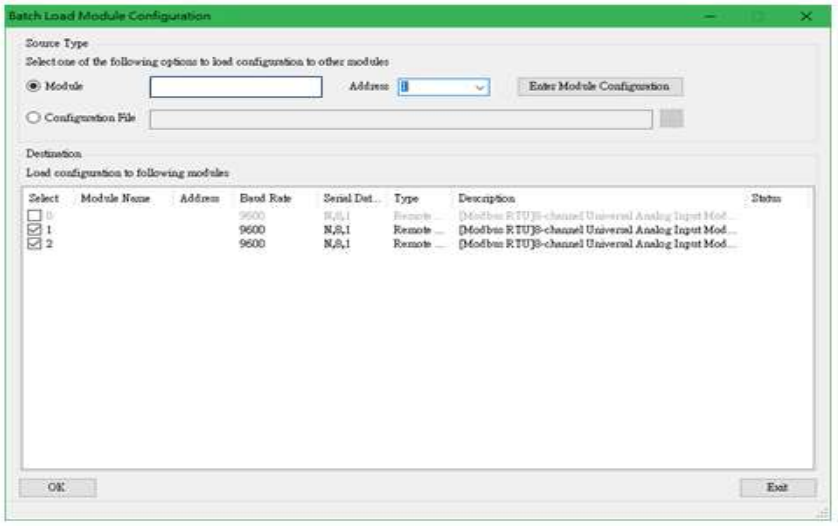
5.8.2 Load Configuration from File to Other Modules

If the configuration file is chosen as source type then select the configuration file



5-43 Source Configuration File

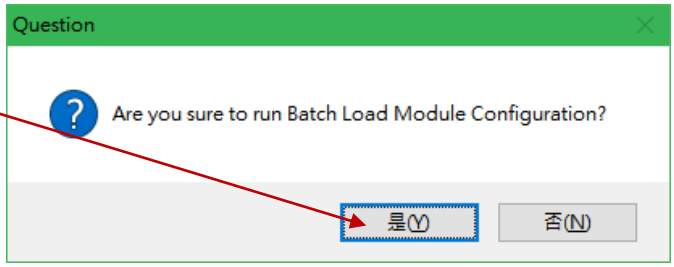
Select the target modules to load the configuration



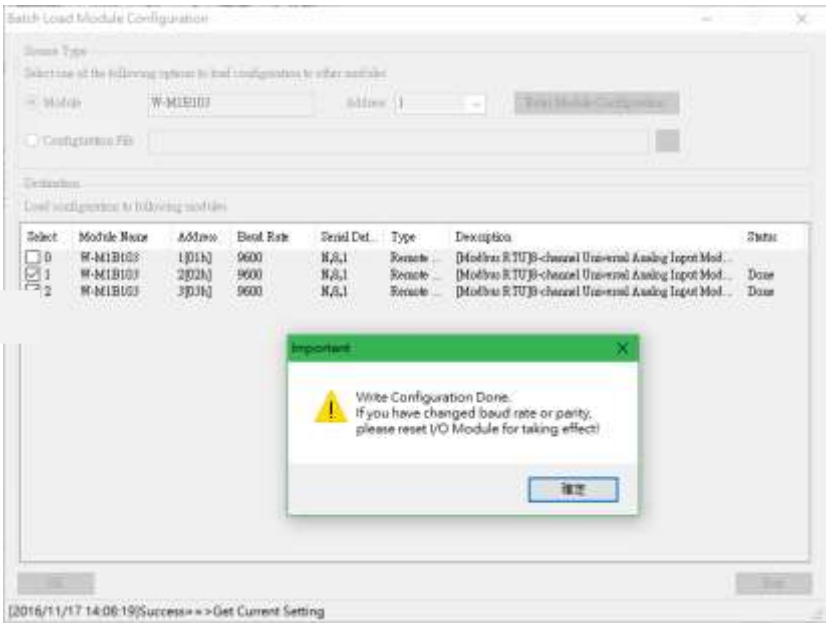
5-44 Target Module to Load

Click Ok to apply the configuration to selected modules

Click “Yes” to continue.



5-45 Configuration Confirmation Warning



5-46 Configuration Written Confirmation

If the communication configuration has been changed, the I/O module must be restarted for loading new configuration correctly.

6 FAQ

For more information visit our website and contact us. With the greatest enthusiasm and endeavor, we will be always ready to serve you.

Email: service@brainchild.com.tw

Website: http://www.brainchild.com.tw

6.1 Communication

If there is an error in communication, then follow the below steps.

1. Confirm the power supply voltage range is set at +10 to + 60V DC, otherwise, make sure the power LED indicators on the module is normal.
2. Upon receiving the command, the Power LED will flash once. Follow this procedure to check if the module receives a command from the host.
3. Under permissive conditions, other equipment may also be used to detect whether the host PC can communicate with a normal communication protocol which is based on RS485 communication network equipment.
4. If the host is a PC with Windows Operation System installed, user can execute Utility software to check the availability of I/O module. (The utility Software can be downloaded from BrainChild Electronic Co Ltd., official web site. http://www.brainchild.com.tw
5. Setup the module into INIT mode, and have it communicated with the following parameters: Node address **01**, the baud rate is 9600bps, no parity bit and the communication protocol is Modbus RTU.

6.2 Read data

If data collected from I/O module are abnormal, perform the following steps to check it:

Abnormal data read may be resulted from the abnormal parameter stored in Memory, please use Utility software to check it or reset it to INIT mode.

Please refer to section 2.1.12 (Factory Reset) to solve I/O module abnormality.

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