ADPower series Remote IO

User's Manual

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The information provided in the manual is limited, ADTEK Co., Ltd assume no liability for damage or loss resulting from use of this product.

Certification Claims Technology

ADPower Series Product is developed and tested by ADTEK, all tests certified by EMC including EMI and EMS are designed for module protection.

Hence, we strongly recommend pairing ADPower series modules with industrial chassis certified by CE.

Certification:

CE

FC

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.

Table of Contents

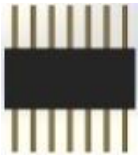
Chapter 1. Introduction

1.1 Product Overview

Thank you for selecting ADPower series. ADPower series is a remote I/O module providing 7 kinds of control mode: analog input, output, analog input/output, digital input, output, digital input/output and relay, all are connected by RS-485. Each control mode in ADPower series also provides different number of input/output channels for user's choice- for instance, 8, 16 and 32.

ADPower series module is a kind of remote I/O Module which is host sends command to control it. After receiving commands sent by host, remote control modules start responding. The protocol used in-between host and modules is Modbus/RTU. Furthermore, to have a more efficient application, a great variety of baud rates for user's selection (1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k and 115.2k) are also available.

Product packing is shown below:

<table>
<tr><td rowspan="2">Module Package
  </td><td colspan="3">Accessories</td></tr>
<tr><td> 
14 pin Signal Connector
1pcs</td><td> 
Plastic grounding tab
1pcs</td><td> 
Plastic buckle
2pcs</td></tr>
</table>

1.2 System Specification

Power Requirement	10 ~ 60 VDC
Watchdog Timer	System (1.6 second Fixed) Communication (Programmable)
Connector	Plug-in-terminal block (#16~30 AWG)
Temperature (Operating)	-25 ~ 70 ℃
Humidity	5 ~ 95 %RH
Temperature (Storage)	-30 ~ 75 ℃
Interface	RS-485
Isolation Protection	3000 VDC
Communication Protocol	Modbus RTU
Communication Speed	Serial: From 1200 to 115.2k bps
Communication Distance	Serial: 1.2km

1.3 Set Up and Use

The rotary switch provided by ADPower series module is a handy gadget for user to facilitate the address setup during the installation Utility software is employed to set up the module configuration parameter. The factory default can be reset by pressing INIT for at least 3 second. Furthermore, EEPROM built in the modules is detachable and can be changed on new module to retain the setting.

For the module installation and system settings in details, please refer to Chapter 2, for the module details information please refer to Chapter 3 & Chapter 4, for the frequently asked questions, please refer to Chapter 5 for the technical support.

1.4 Watchdog

There are module watchdog and system watchdog in ADPower Series module. Module watchdog is a hardware monitoring the operation status of module, when working in a harsh/noisy environment and encountering interference, the module can automatically reset and reboot by itself. The system watchdog is software monitoring the operation status of 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 SAFE mode to prevent any improper operations on the controlled target.

Watchdog of Modbus functions as 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

Module watchdog: If discontinuation exceeds 1.6 sec (default), the system would reset the signal and reboot.

System watchdog: System watchdog is time programmable. When system watchdog is enabled and module doesn’t receive polling from the host at the time set, system watchdog time-out will automatically start. Outputs mode is configurable on certain modules. Please refer to Chapter 3 & Chapter4.

1.5 Power Requirements

DC ranged from 10V to 60V is applicable to ADPower Series Module; the reverse power protection is also available.

1.6 RS-485 Network Connections

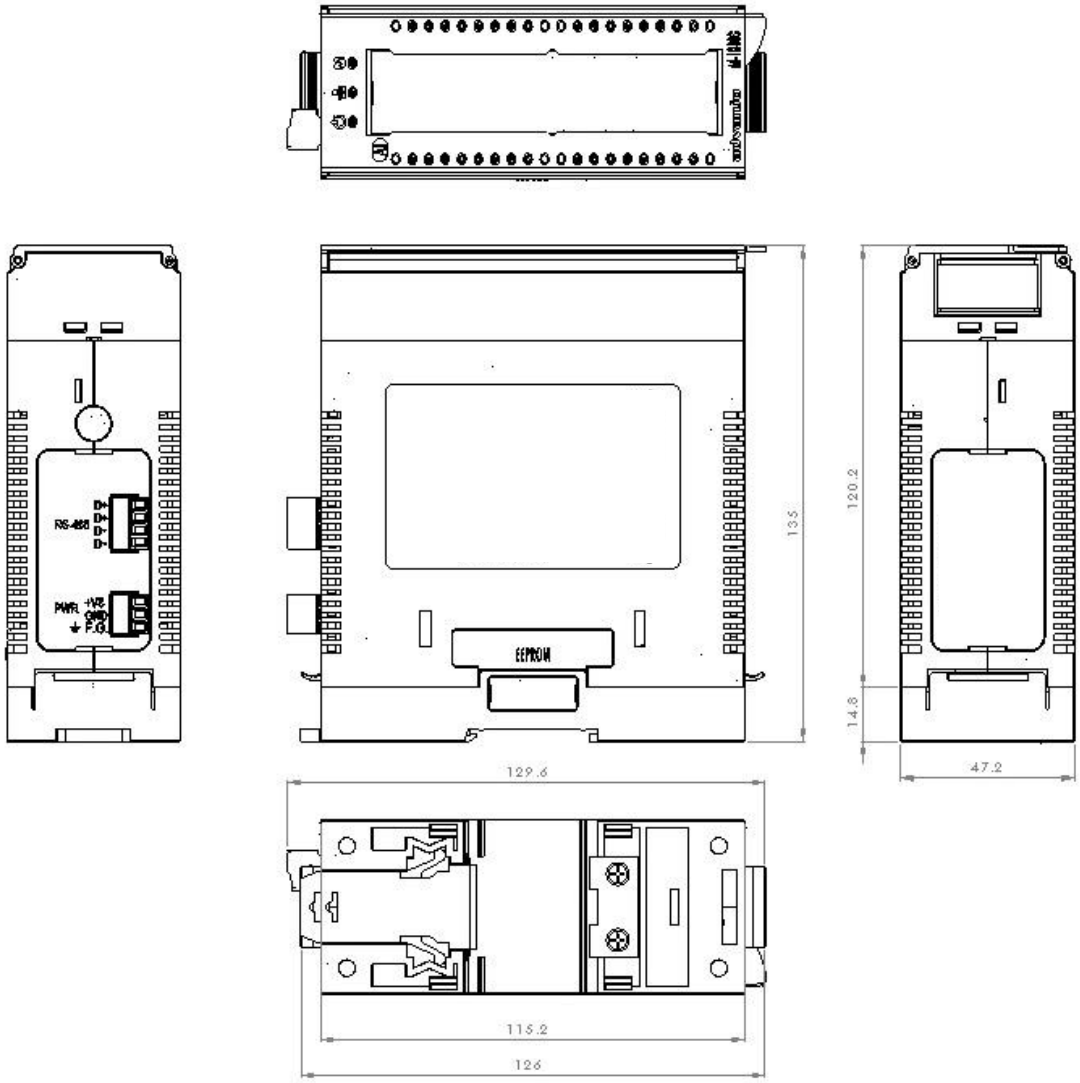
The most commonly used communication interface is adapted, co-called RS-485. It provides a remote transmitting and is applicable to all remote connect.

1.7 Environmental Safety

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

1.8 Dimension

ADPower series module dimension as following:



Unit : mm

Chapter 2. Installation

2.1 Basic Installation

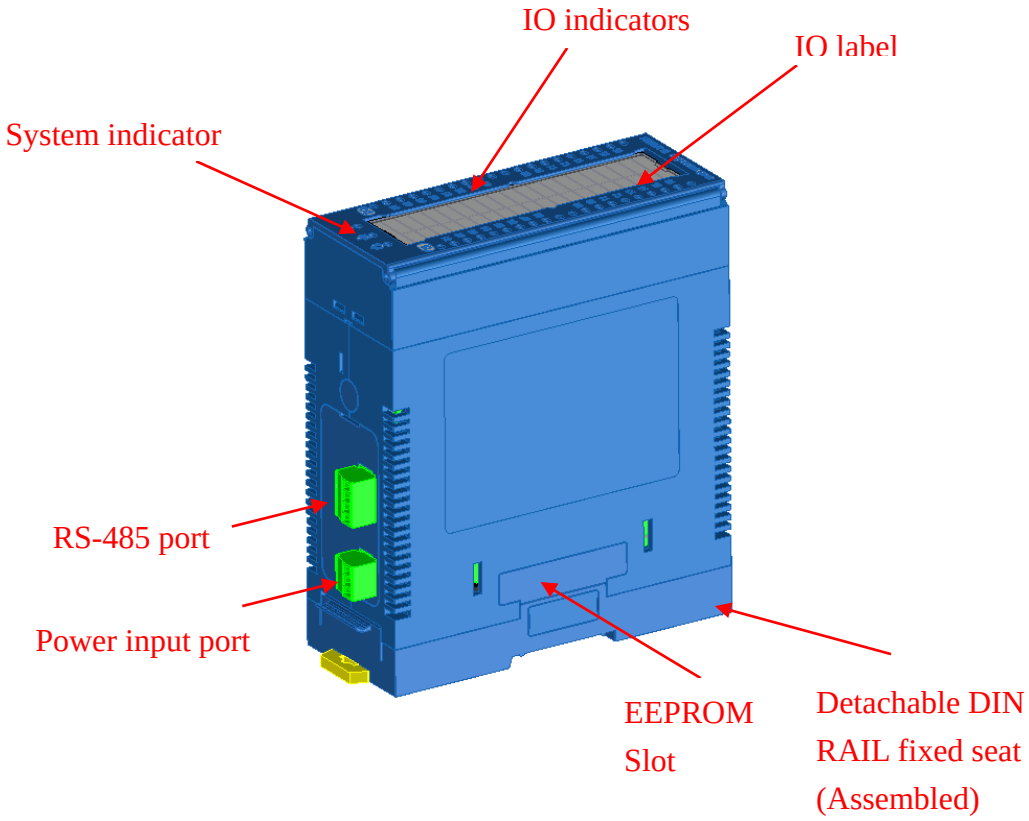
The following parts/devices are necessary when constructing ADPower Series module.

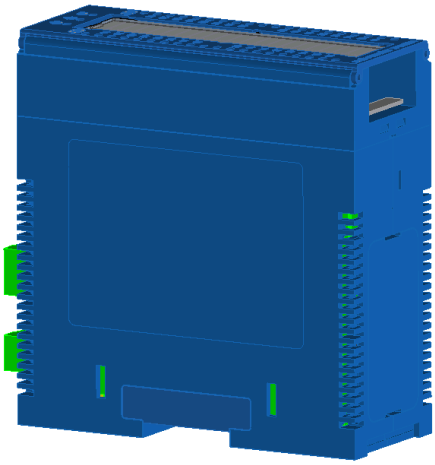
2.1.1 Host PC Requirement

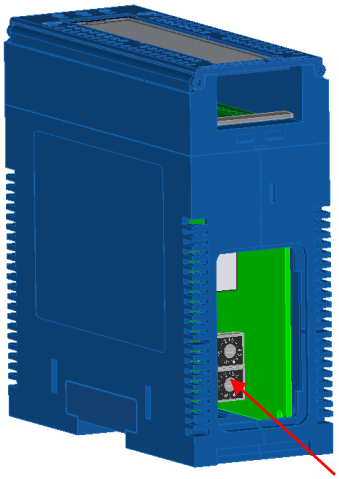
A PC equipped RS-232 or RS-485 communication port. It would be connecting ADPower modules directly by RS-485 port. Or an isolated RS-232-to-RS-485 converter from our company is necessary if this PC workstation is equipped RS-232 port only. Also, a USB to RS-485 converter of our company is alternative solution. These isolated converters are based on photo couple to protect your PC workstation.

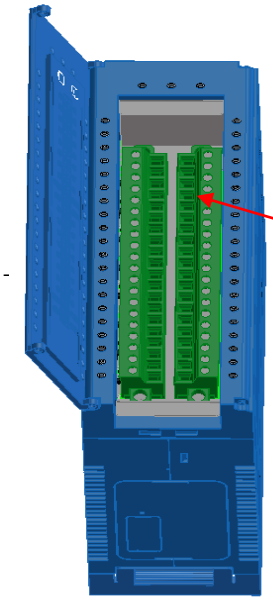
2.1.2 ADPower Module

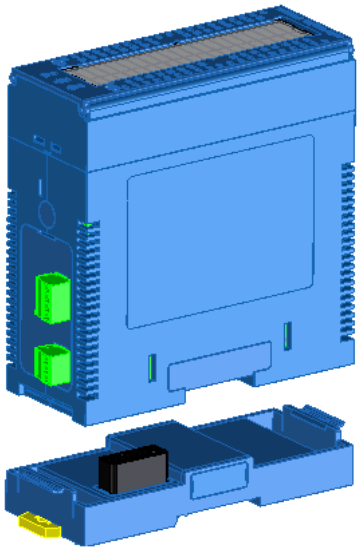
Ports connection and setup of ADPower Series module is shown as figures below. The external connecting and construction will be described in the sequential chapters.











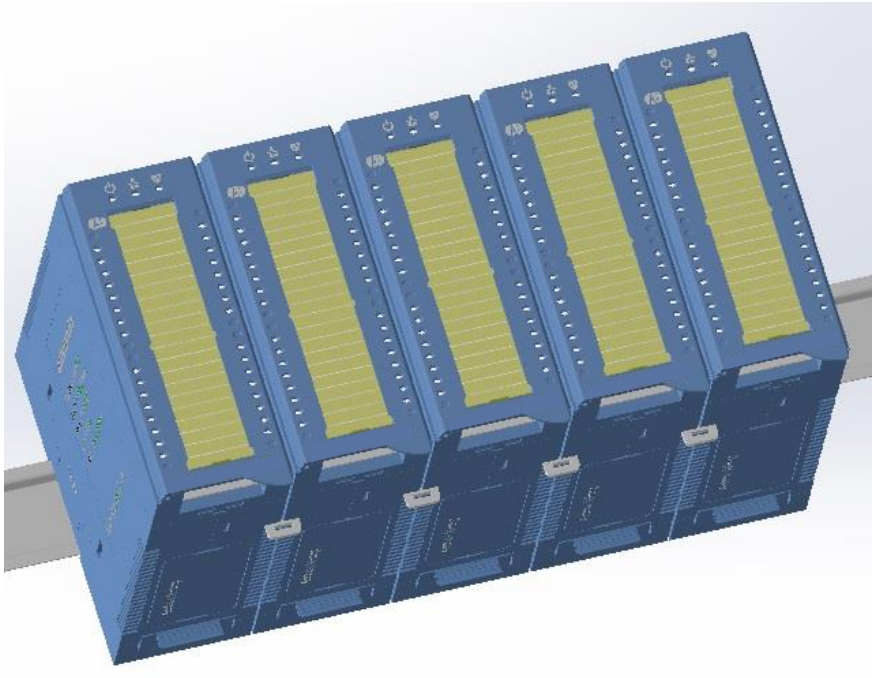
Item	Description
Detachable DIN RAIL fixed seat	Each modules connecting power and RS-485 via this fixed seat. It support attach/detach module rapidly and easy extendable.
IO connector	Wiring IO signals for your application.
RS-485 port	Major communication port
Power input power	For power input
System indicator	Represent system status.

IO indicator	Represent the status of each I/O channels
IO label	Note I/O function for after maintains.
EEPROM slot	Dedicate EEPROM to store system configuration.
ModBus node address switch	Setup Modbus node address by fastest way.
INIT switch (hole)	Restore module setting to factory default.

2.1.3 Installation

DIN rail mounting

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

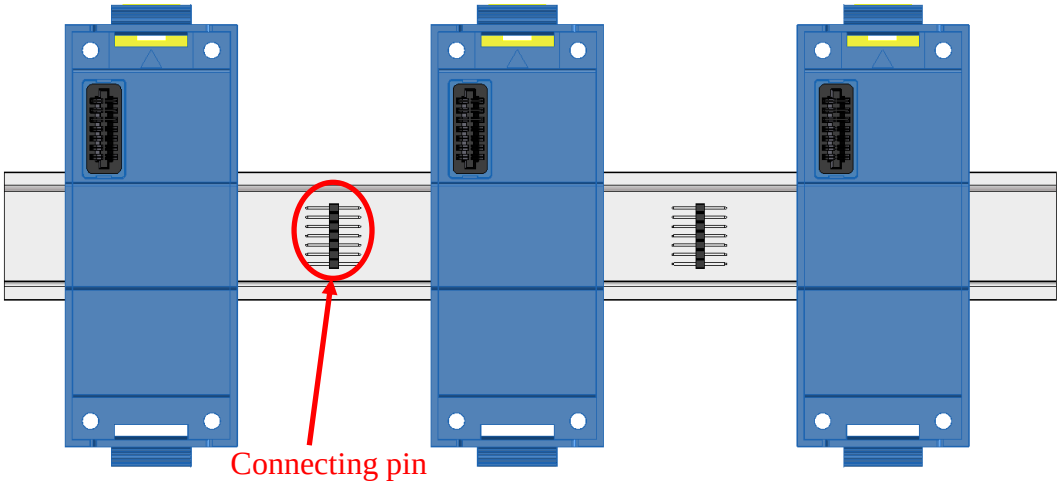


DIN rail module chain installation

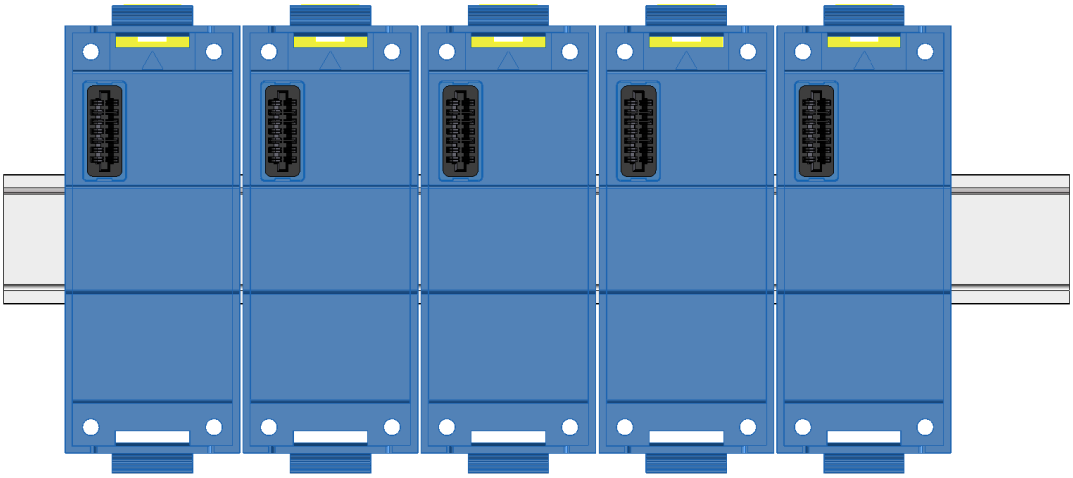
Fixed seats been installed on DIN35 rail, also using connecting pin array to connect each fixed seats one by one as shown as following figure. The communication and power would be chain connected.

Chain connecting procedures as following:

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

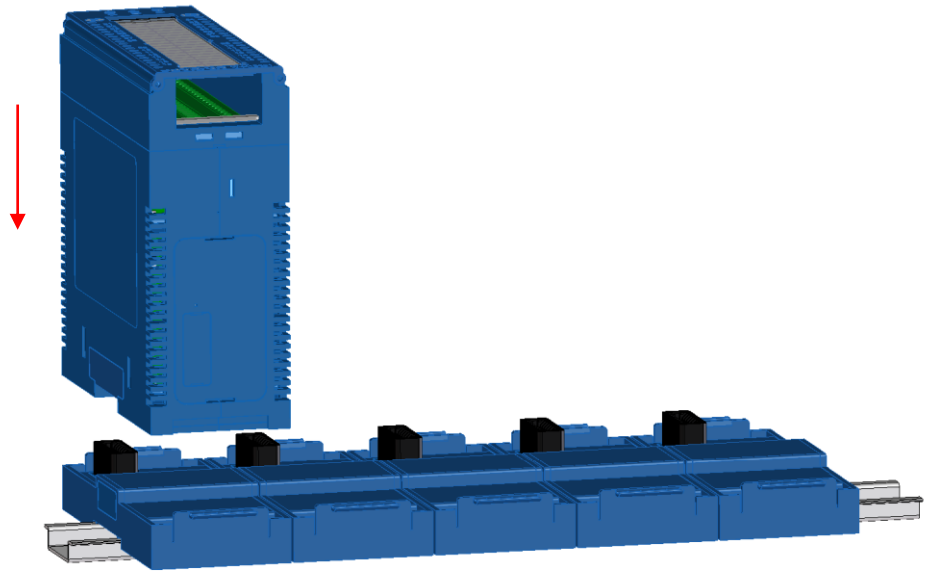


Step 2: Push modules together on DIN rail and connected by pin array.

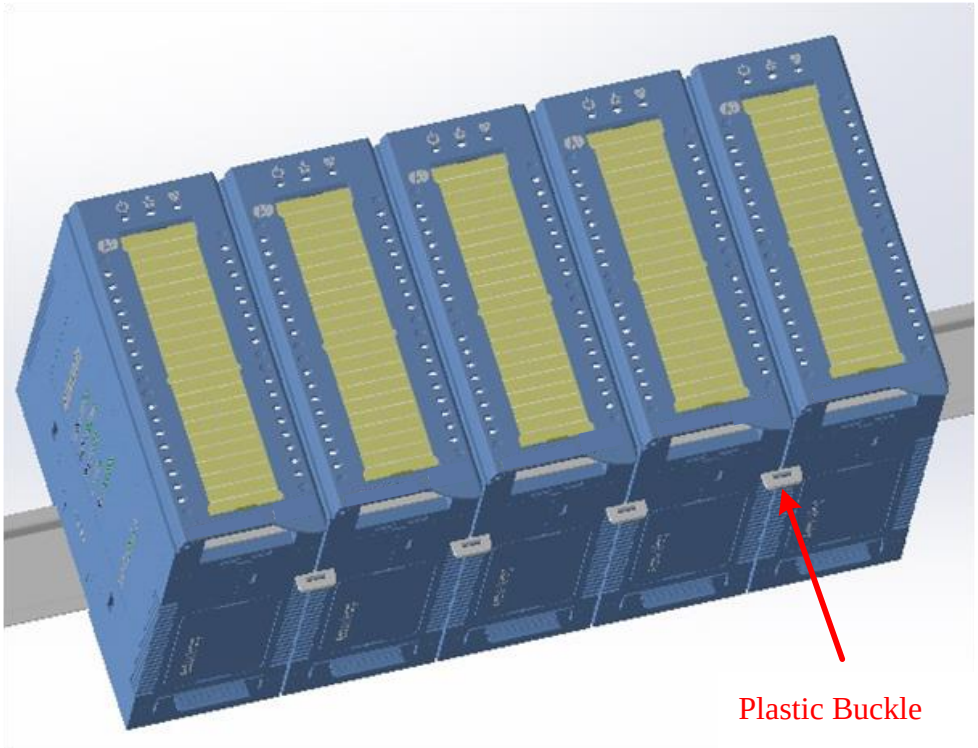


A chained fixed seat of module on DIN rail as shown as following figure:

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

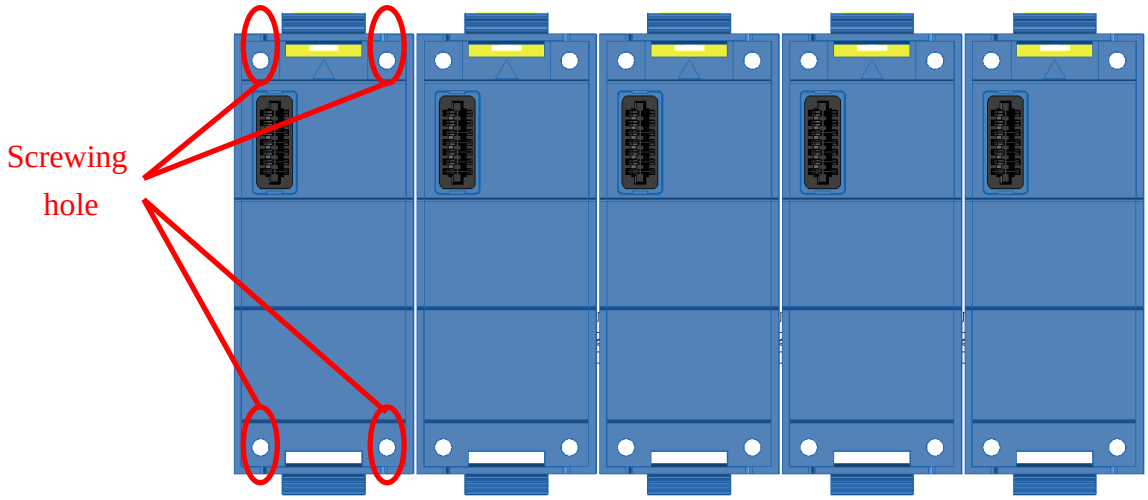


Step 4: A complete module chain on DIN rail as show as following figure:

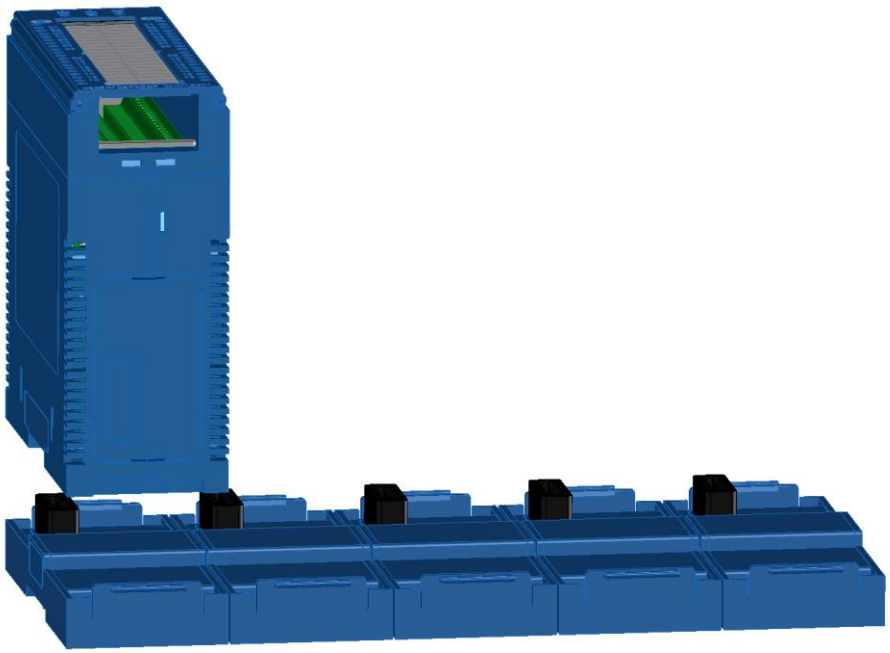


Wall mounting

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



Insert each modules to fixed seats on wall, as shown as following figure：

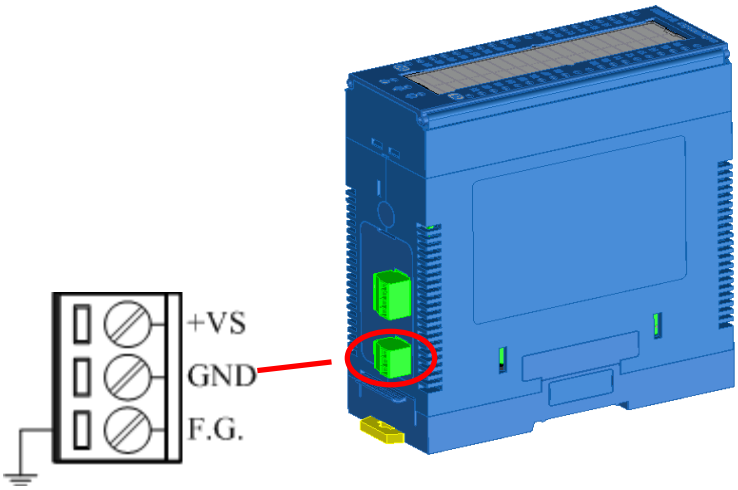


Module grounding

If ADPower series modules were installed on an aluminum DIN rail, then the module grounding would utilize aluminum rail for F.G. (Frame Ground), the grounding also could be connected by connector as shown as following figure:

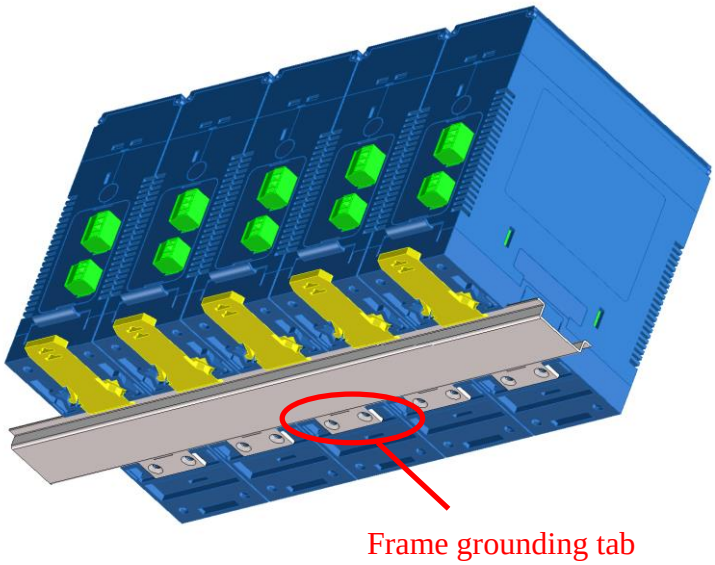
Module grounding by power connector

If not DIN rail typed installation, the grounding could be connected by power connector. The detail for the frame grounding installation as shown as following figure:

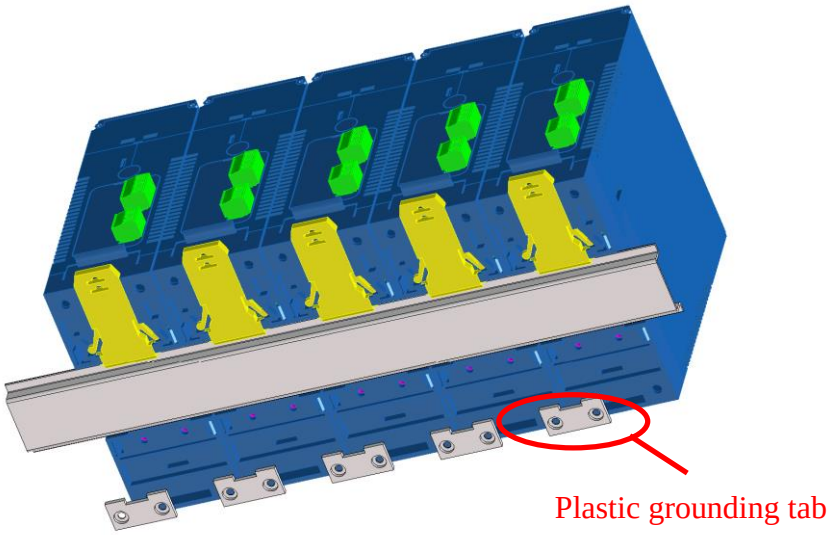


DIN rail grounding

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

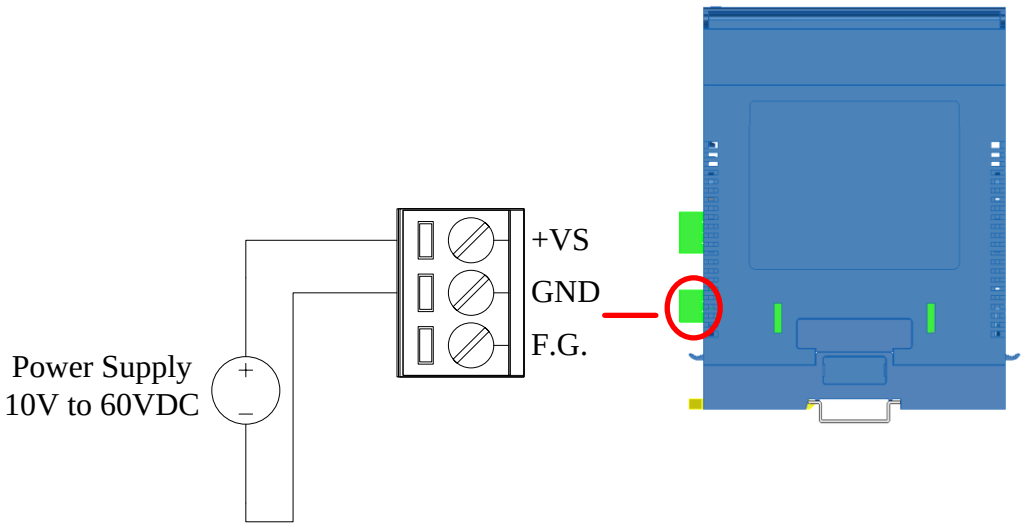


※ We strongly recommends a suitable Grounding (Frame Grounding) is necessary to ensure the system stability. If the grounding of power supply is poor or there have noise on frame grounding, then it need isolate frame grounding of module. Use a plastic grounding tab instead to isolate module frame ground and DIN rail as show as following figure.



2.1.4 Power Supply

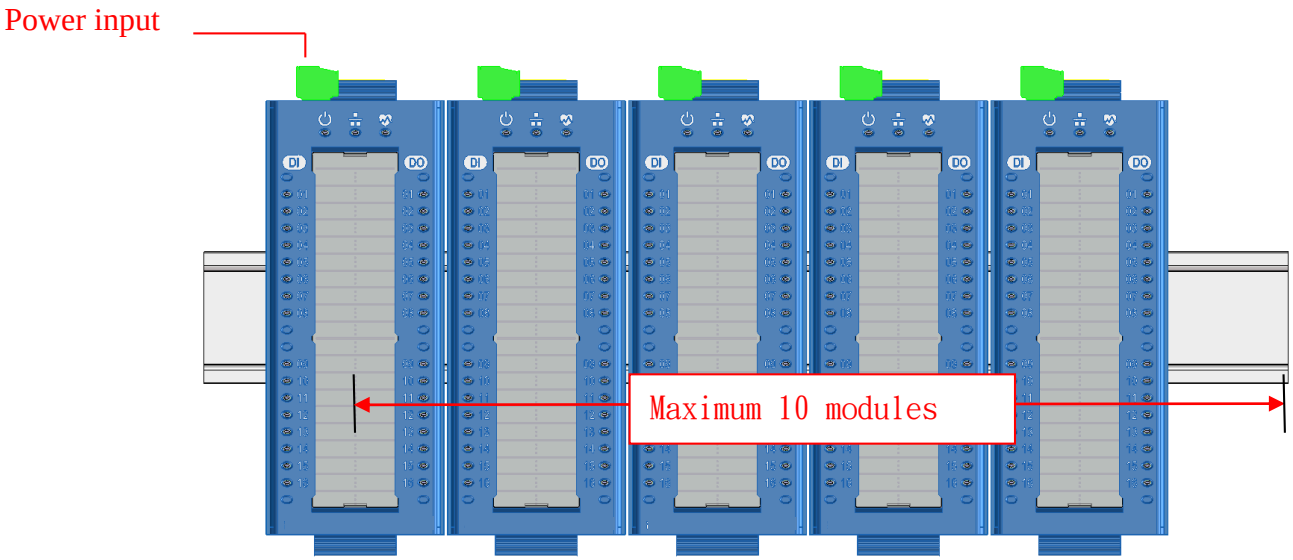
ADPower series modules support wide range DC power input, the voltage from 10V up to 60V to fit industrial application, there is power regulator inside for system power stabilization to supply high quality power if supplied power is within support rang. It is ideally on voltage and current in module are inversely proportional but the power ripple must be limited to 5V Vpp. How wire power connector as shown as following figure.



※ Power level would be drop low when connected power line is too long, so strongly recommend the distance between power and module should be as short as possible in order to prevent the system unstable.

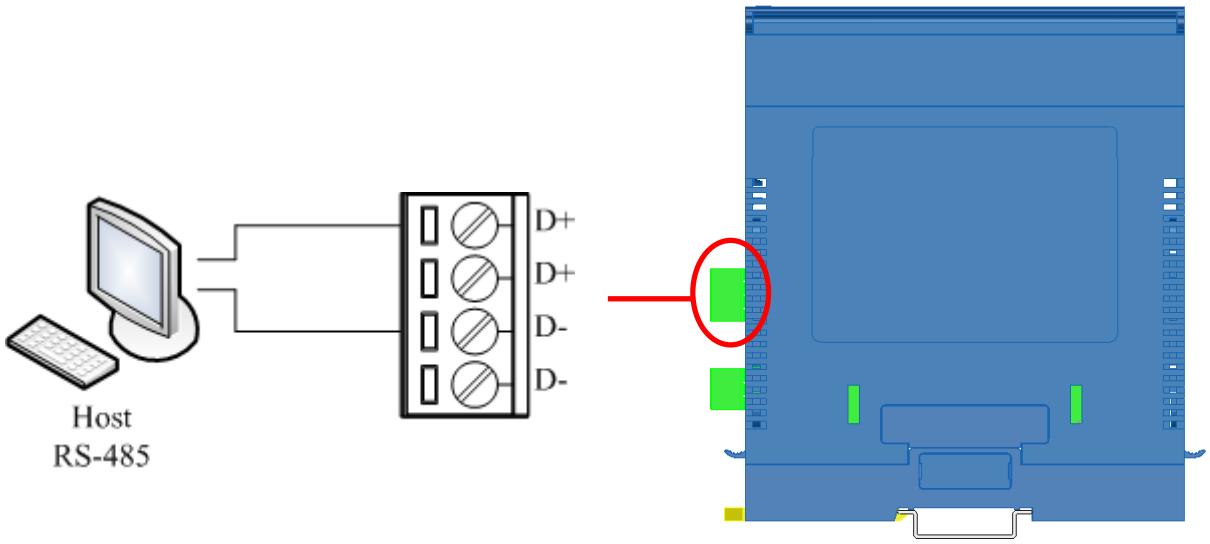
※ Each module power would be parallel connected on DIN rail, so the power connector are on same situation. While connecting the power supply to one of them on the rail then the power would distribute to every module via rail. (Be careful! only one power source could be connecting to one set of modules on one rail.) The maximum number of modules on one rail is 10 modules and power consumption approximant 30W.

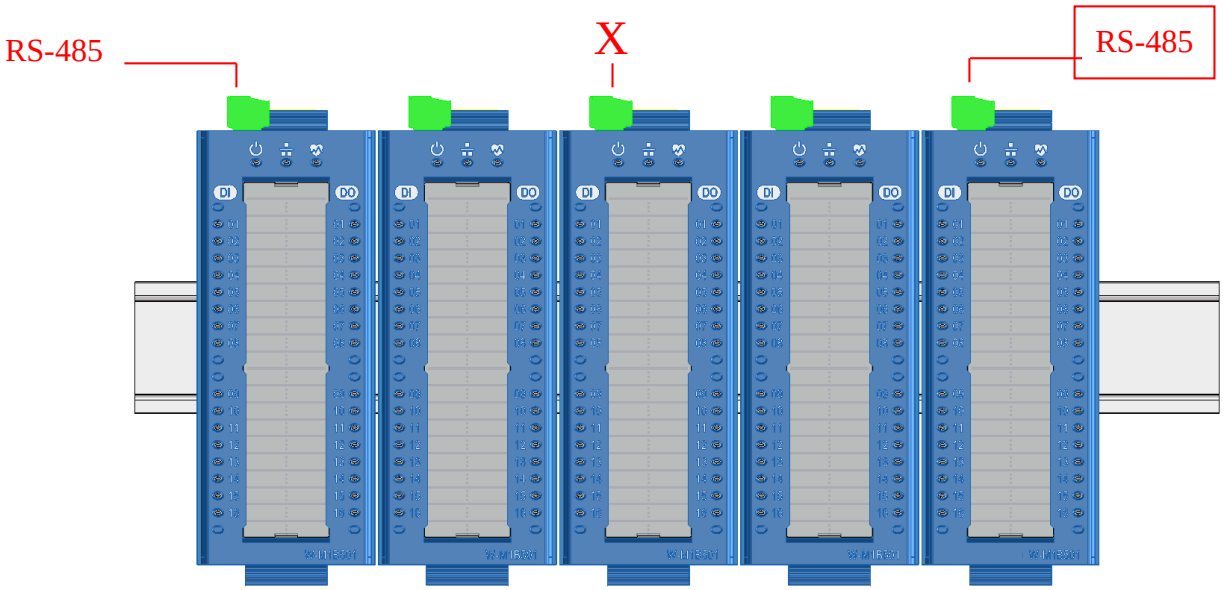
※ Using power connector to connect power source on every modules if not on rail.



2.1.5 Connecting Communication Interface

ADPower series modules follow the standard RS-485 to support communication. The RS-485 port and placement as following figure Besides, the next figure is show the RS-485 connection..



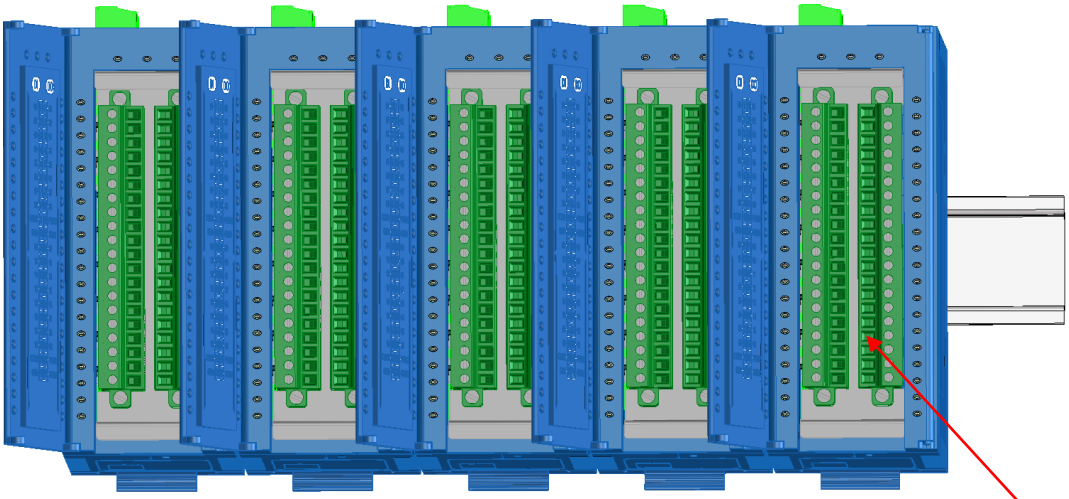


※ When DIN rail mounting with modules alongside and the mounting base are connected to the dock connector RS485 Signals can enter from the first module only and out from the last module only. It is prohibited to use the intermediate module for the pick out to avoid communication instability.

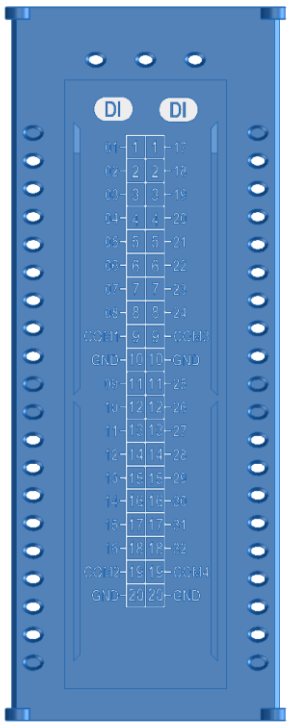
※ If the base is not connected to the dock connector, then every module need to be connected with input communication cables for communication.

2.1.6 IO Connection

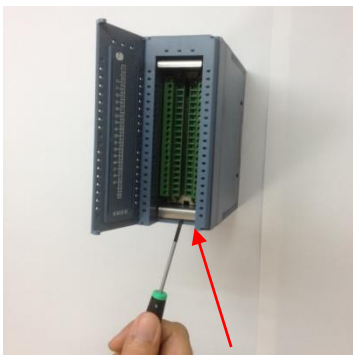
User can choose the suitable I/O feature on module to fit specified application. Please refer to the section of module information and check if each I/O channel has been assigned appropriately.



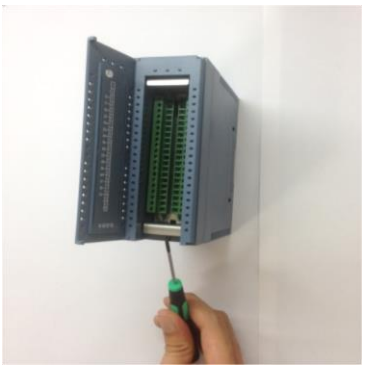
The description of each I/O channels on the back-side of cover. It is for user quick reference easily:



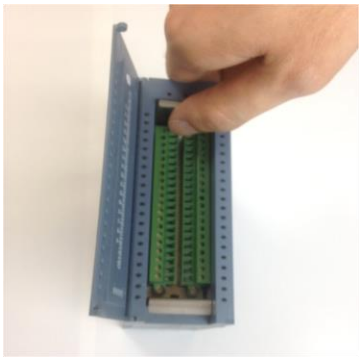
Procedures of removing I/O terminal



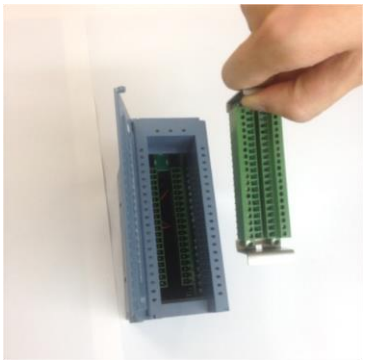
1. Insert the flathead screwdriver into the position as shown as above.



2. Push down the screwdriver



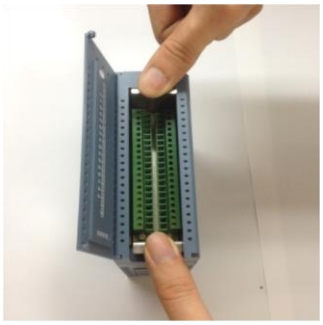
3. Remove the terminal by pulling the hook of up side.



4. Terminal removed

Procedures of set back I/O terminal

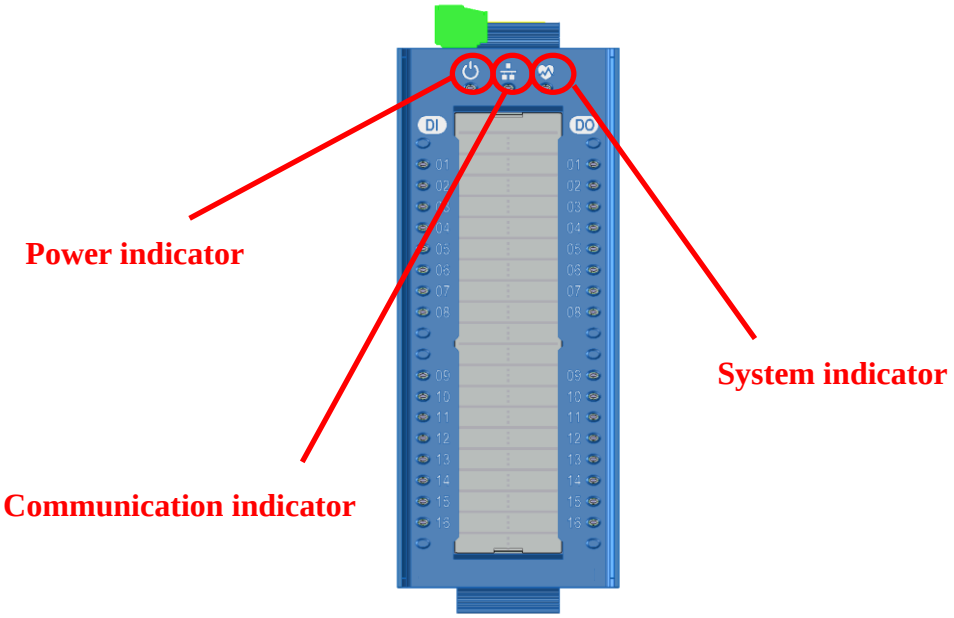
1. Put the terminal on module



2. Push the top side and bottom side by two hands then complete.

2.1.7 Indicators

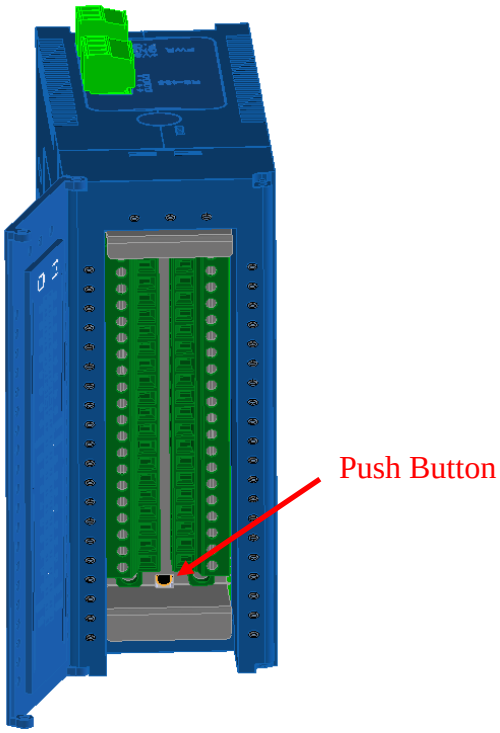
The functions of each indicator are described in the attached table:



Power	COM.	SYS.	Indication	Status
◎	◎	◎	Flash 3 times in 0.5 sec.	System initial completed.
◎			Lighting	Power good 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 1sec	EEPROM module accessing fail.
		◎	Flash pattern as~ Lighting 2 sec. Off 1 sec. Lighting 0.5 sec. 2 times Off 1 sec	EEPROM accessing failed. If it is new part or not be initialized, please perform EEPROM initial procedures as appendix section 1.
		◎	Flashing 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 system. Please re-initial it.

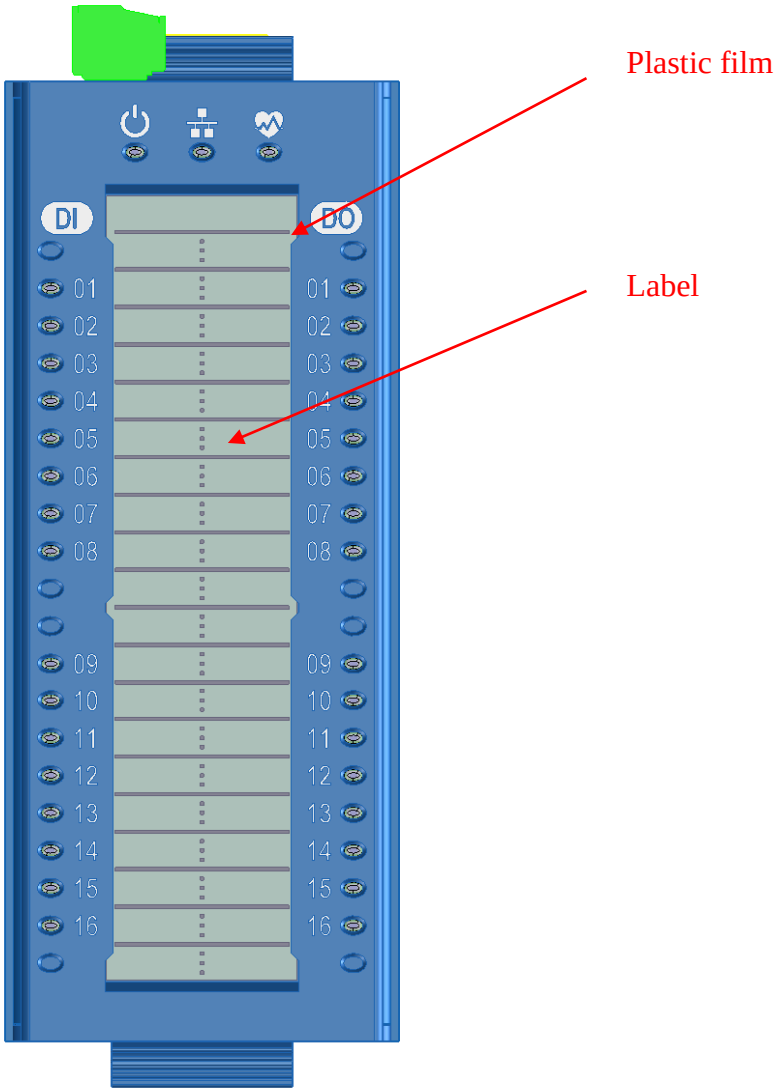
Remark 1:

The re-initial procedure of change new EEPROM module is same as module initial procedure. Push the button on up side of connector board 3 sec then module would perform init procedure and store new parameter into EEPROM. Keeping the parameters which are in EEPROM same as system.



2.1.8 Channel Label

Tabs under the plastic film are accessible for user to record the assignment of each channel. Remove the plastic film, insert the tab(s) and put the plastic film back.



2.1.9 Setup Utility

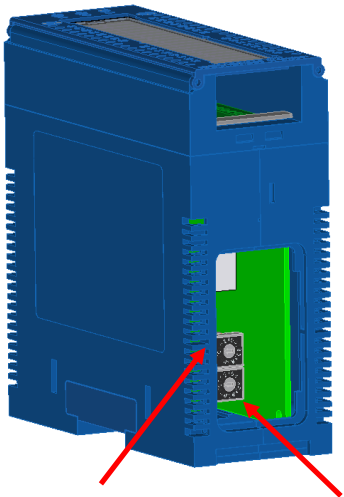
ADPower series module could be configured via setup utility directly on the PC workstation equipped with RS-485. Or, use a RS-232 port through RS-485 converter, USB to RS-485 converter. Utility and setup guideline could be obtained from ADTEK website.

2.1.10 Communication Setup

To setup ADPower series module, MODBUS node address should be determined first.

The factory default to the node address of ADPower series module is 01. The node address could be setup by two hexadecimal coded rotary switches. The range of node address is from 0x01 to 0xF7 (1 to 247).

This setup should turn off the power, then use a screwdriver to rotate the rotary switches, when complete the setup and power on module then the node address should be determined.



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

The frame format and baud rate could 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 could be downloaded via–ADTEK official website, set up MODBUS command of RS-485 as the following:

Address	Function	R/W	Initial value
44107 (0x100A)	Com 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

2.1.11 Factory Reset

Use factory reset if modules failed to communicate. Press “Push Button” to complete 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.

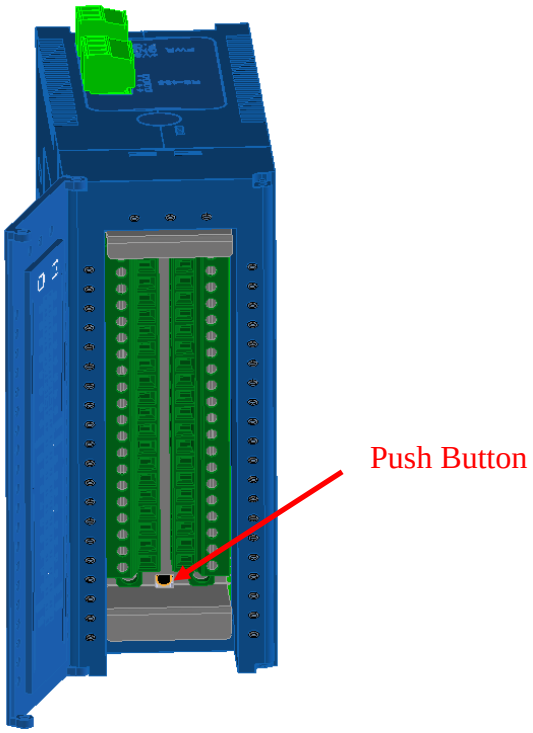
After initial operation:

Resume factory default and reset modules:

Baud rate: 9600bps

Data format: N,8,1

Refer to chapter 4 for factory default setting:



2.1.12 Isolated RS-232/RS-485 Converter (Optional)

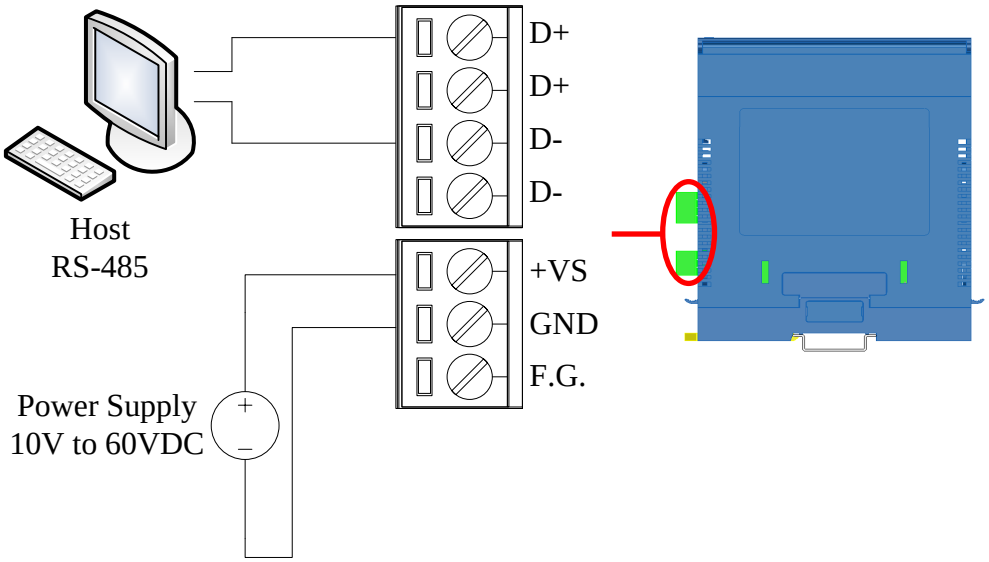
If only RS232 port is available, a converter to isolate RS232/RS485 will be needed. Setup of module address for the converter is not required.

2.1.13 Repeater (Optional)

With a communication distance surpasses 4000 feet (1200m) or more than 32 modules are used, expanding repeaters may be needed. Maximum number of modules is 247 by 8 repeaters.

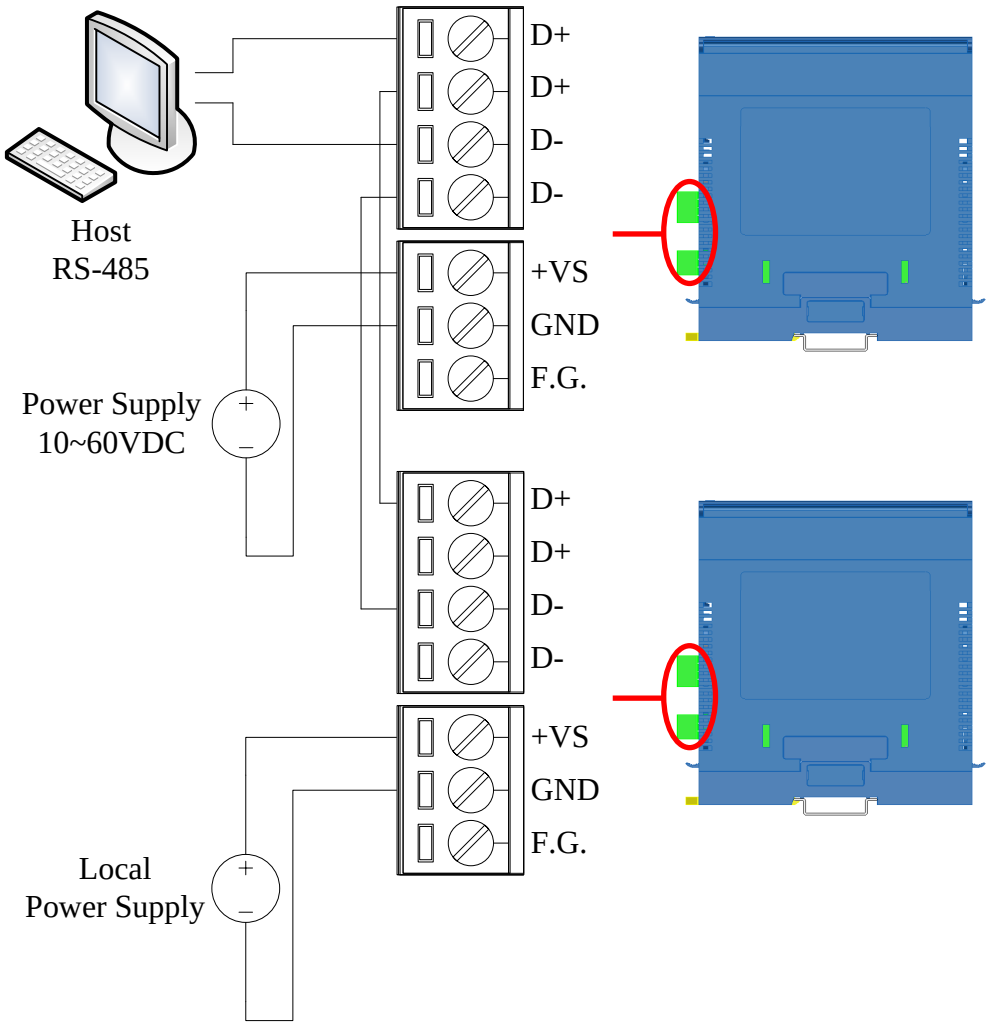
2.2 Example: Single Module

Construction of basic modules featuring network connecting of ADPower series module (single) is show as figures below.



2.3 Example: Multiple Modules

Construction of multiple modules featuring network connecting of ADPower series modules is show as figures below.

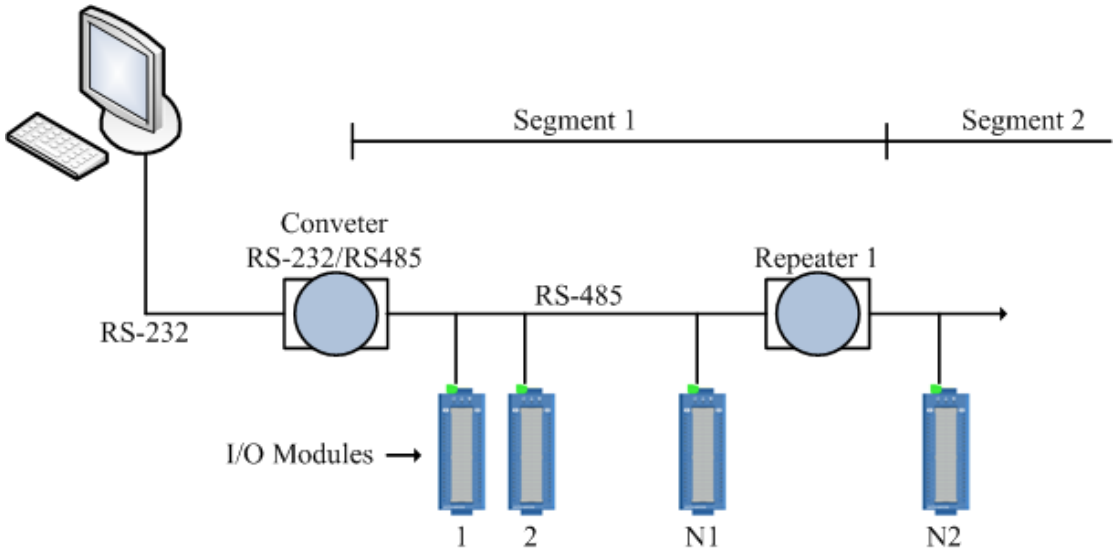


2.4 System Configuration

ADPower series modules are all connected in parallel by cables. Thus, failing of one segment does not affect the entire network system. The modules applied are based on RS485 interface and MODBUS protocol. When communicating via host or terminal is required, RS485 would be taken in consideration in term of different system architecture. Star topology, daisy chain and random topology will be briefed in the next sections.

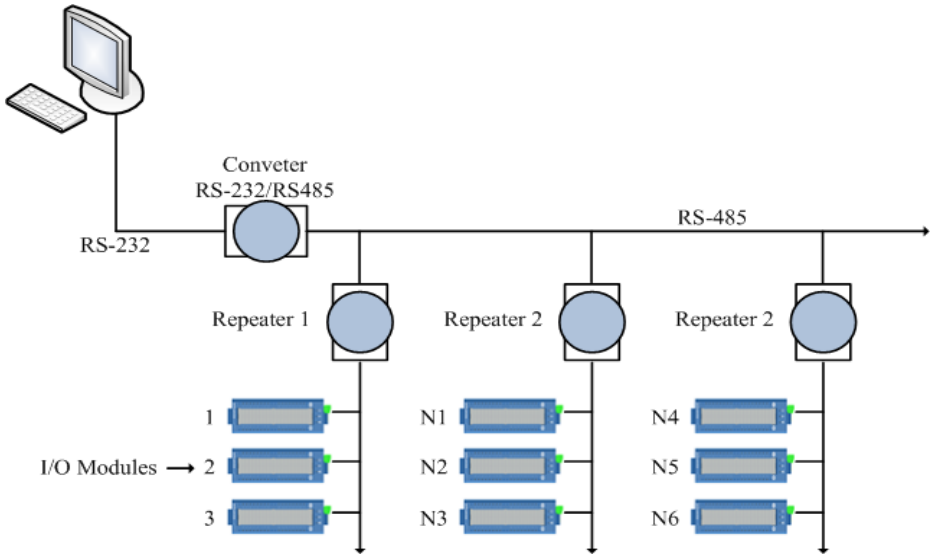
2.4.1 Daisy Chain

In each segment, the last node to connect modules must be 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.



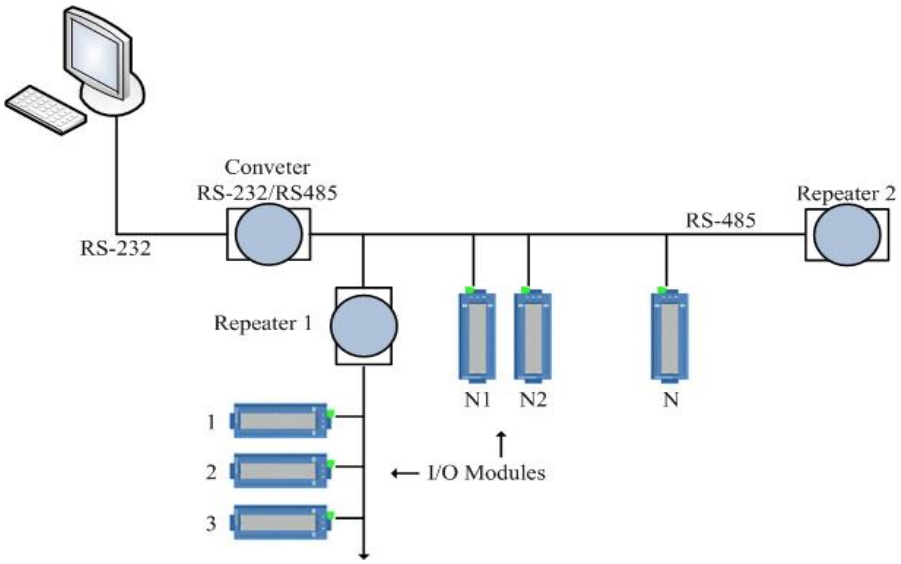
2.4.2 Star Topology

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



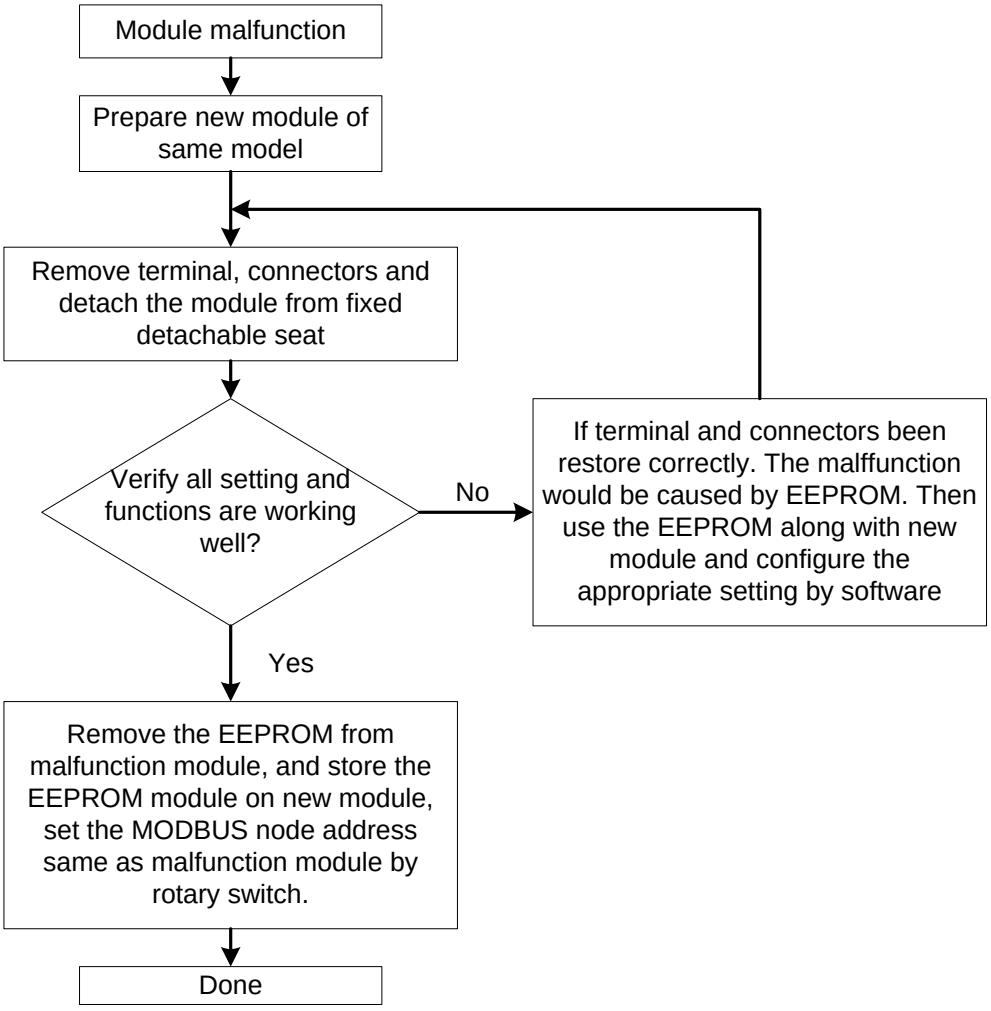
2.4.3 Random Topology

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



2.5 Module Replacement

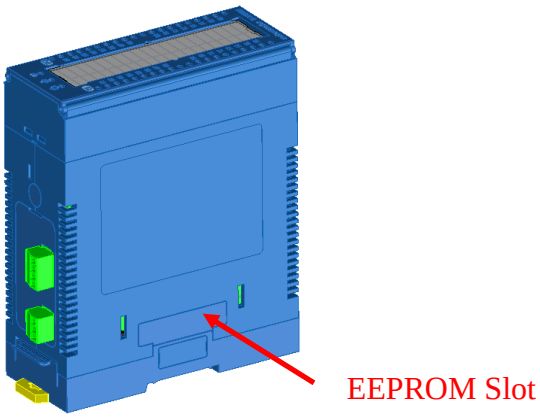
A quick replacement on site in case of module failure is indicated as follows:



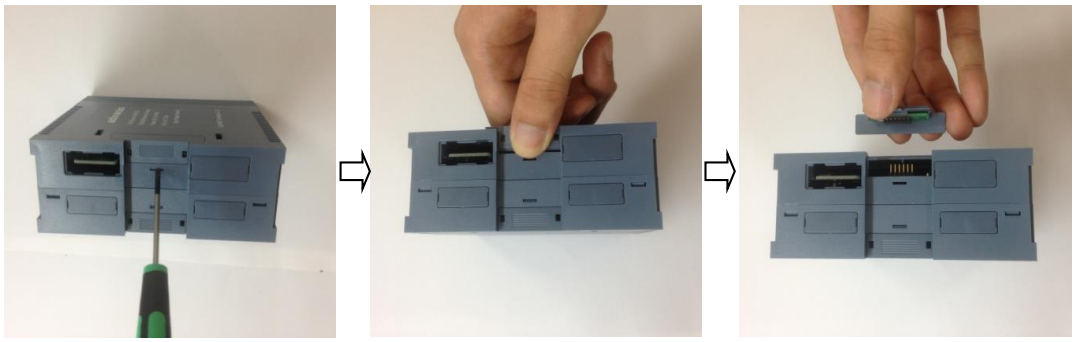
EEPROM Replacement:

EEPROM location is marked in the following figure.

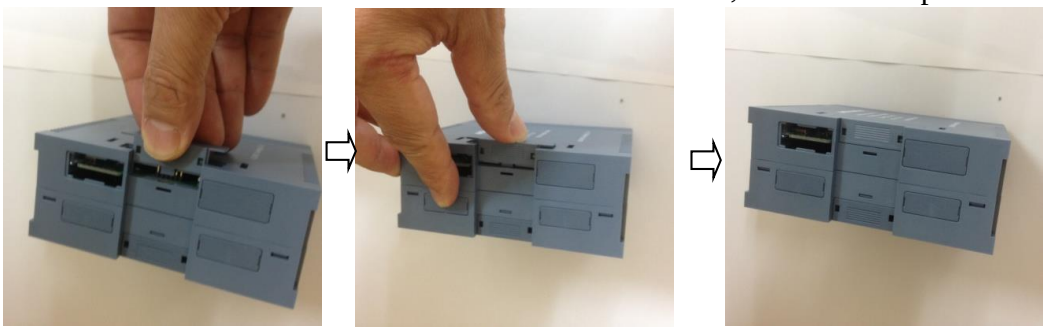
ADPower Series module is an isolated module, under certain circumstances, if I/O is damaged, the parameter stored in EEPROM will remain intact. You can simply replace EEPROM and resume the setting.



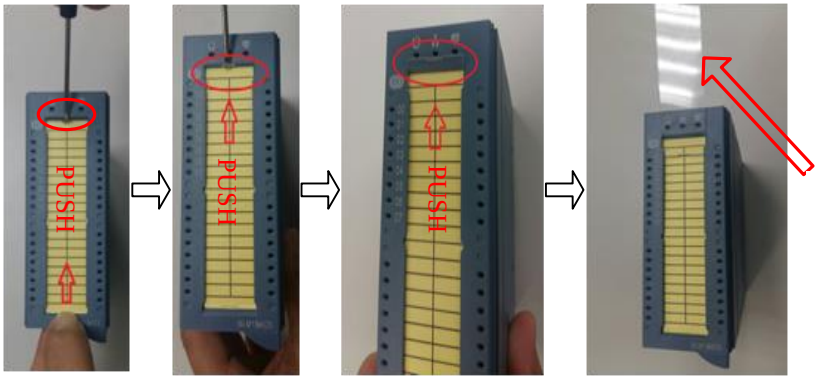
Procedures of remove EEPROM : To remove EEPROM, follow the steps below:



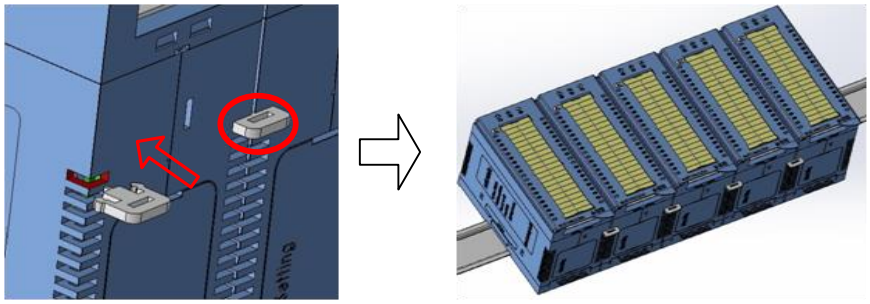
Procedures of restore EEPROM: To restore EEPROM, follow the steps below:



Replace IO signage, follow the steps below:

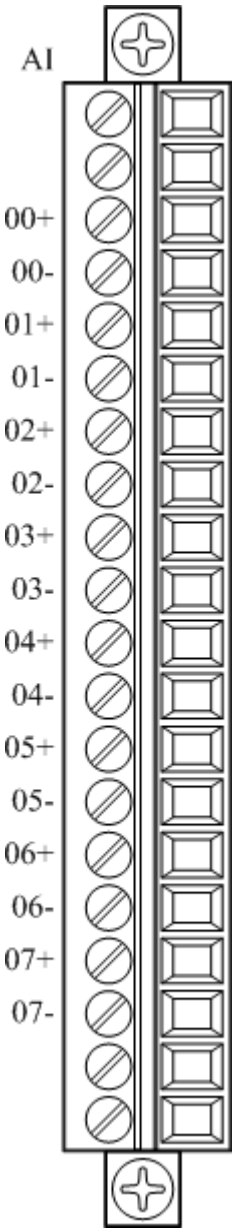


Install the module with plastic buckle, follow the steps below:

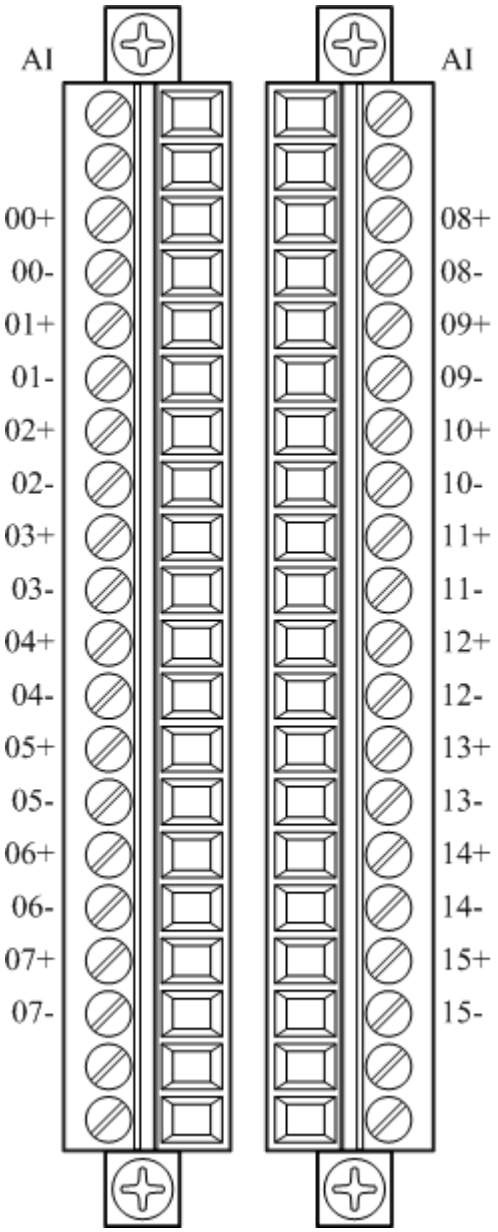


3.1 AD-UC-08/16 8/16-Channel Universal Analog Input Module with High Voltage Protection

3.1.1 Terminal Assignment

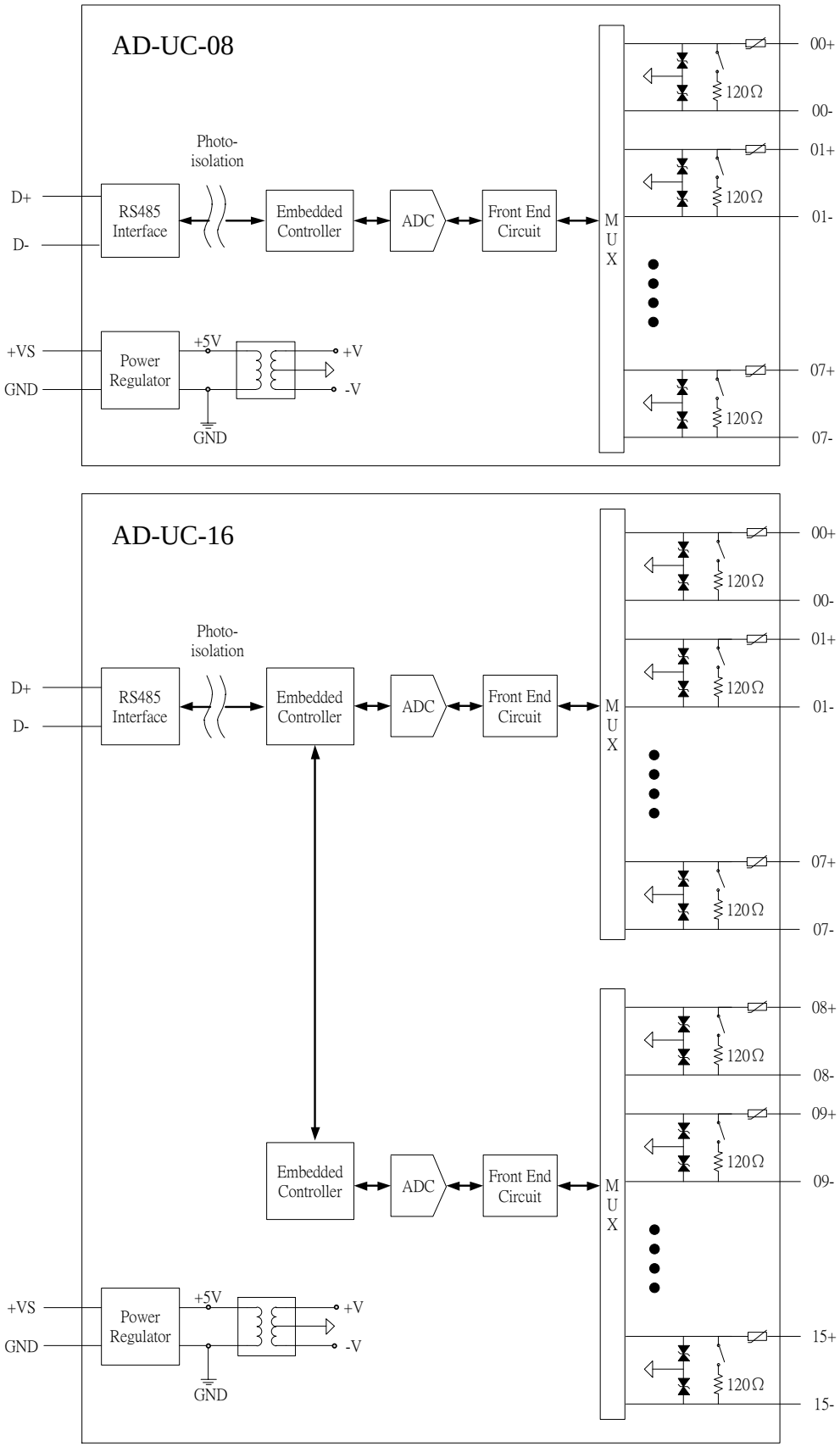


AD-UC-08

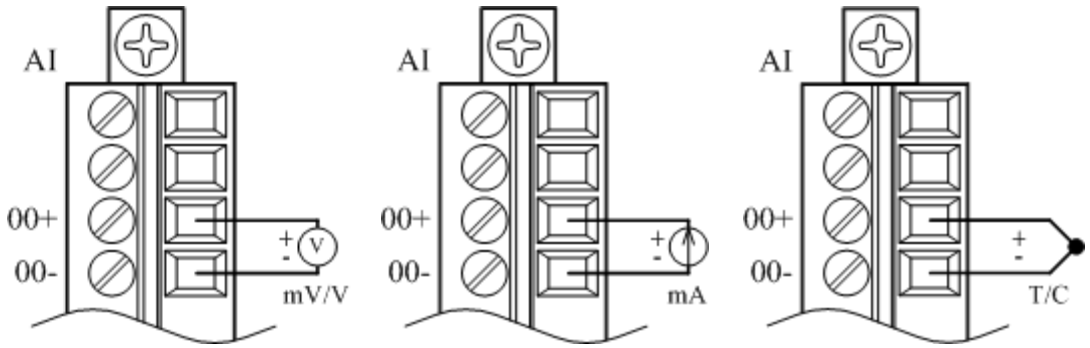


AD-UC-16

3.1.2 Block Diagram



3.1.3 Channel Connecting



3.1.4 IO Specifications

	AD-UC-08	AD-UC-16
Channels	8 channels	16 channel
Voltage Range	±100mV, ±500mV, ±1V, ±5V, ±10V, 0~100mV, 0~500mV, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V	
Current Input	±20mA, 4~20mA, 0~20mA (Slide switch select)	
Direct Sensor Input	J, K, T, E, R, S, B, N	
Burn-out Detection	4 ~ 20 mA & all T/C	
Channel Independent Configuration	Yes	
Sampling Rates	12 samples/second(Group)	
Resolution	16-bit	
Accuracy	±0.1% FSR	
Input Impedance	Voltage: 2MΩ Current: 120 Ω	
Span Drift	±25 ppm/℃	
Zero Drift	±6 μV/℃	
Input Voltage Protection	±240V	
Common Mode Voltage	240V	
Power Consumption	1.6W @ 24V	2.8W @ 24V

3.1.5 Related Reference

3.1.5.1 Input Signal Type Setup

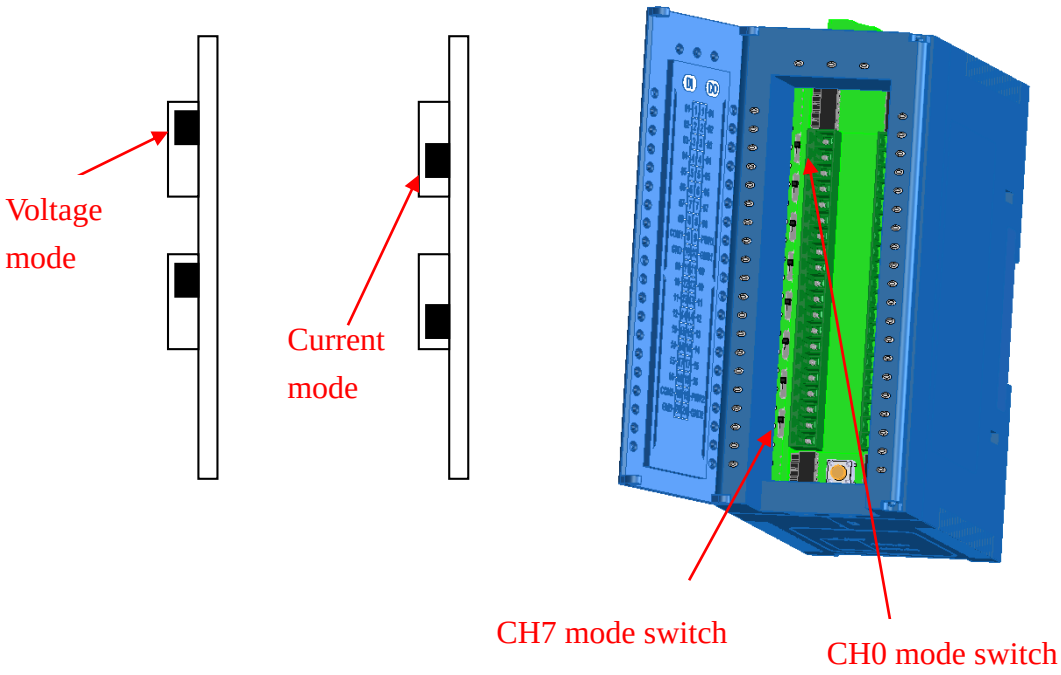
Address	Function	R/W	Initial value
40705~40720 (0x02C0~0x02CF)	CH0~CH15 Input signal type setup	R/W	0x0106

Input ranges & type for each analog signal is adjustable.

Signals detect range:

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 ℃	
0x0302	Type K Thermocouple -270 ~ 1372 ℃	
0x0303	Type T Thermocouple -270 ~ 400 ℃	
0x0304	Type E Thermocouple -270 ~ 1000 ℃	
0x0305	Type R Thermocouple -50 ~ 1768 ℃	
0x0306	Type S Thermocouple -50 ~ 1768 ℃	
0x0307	Type B Thermocouple 0 ~ 1820 ℃	
0x0308	Type N Thermocouple -270 ~ 1300 ℃	

※Caution: 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)



3.1.5.2 CJC (Cold Junction Compensation)

Address	Function	R/W	Initial value
00524 (0x020B)	CJC Enable 0: disable 1: enable	R/W	0
40609~40624 (0x0260~0x026F)	CH0~CH15 CJC Scale, Unit: 0.01℃ Range: -50.0℃ ~ 50.0℃	R/W	0x0000
40641 (0x0280)	CJC Value, Unit 0.01℃	R	-
40642 (0x0281)	CH8~CH15 Value, Unit 0.01℃	R	-
40657 (0x0290)	Module CJC Scale, Unit: 0.01℃ Range: -50.0℃ ~ 50.0℃	R/W	0

There is thermal sensor built in the module, the purpose is cold junction compensation to thermocouple.

3.1.5.3 Hexadecimal / Engineering Unit

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

Setup the output value on 2's Comp Hexadecimal, or Engineering scaling. As Below

Voltage Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0101	0~10 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	10000 (2710H)
0x0102	0~5 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	50000 (C350H)
0x0103	0~1 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	10000 (2710H)
0x0104	0-500mV	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	50000 (C350H)
0x0105	0-100mV	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	50000 (C350H)
0x0106	± 10 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-10000 (D8F0H)	10000 (2710H)
0x0107	± 5 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-5000 (EC78H)	5000 (1388H)
0x0108	± 1 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-10000 (D8F0H)	10000 (2710H)
0x0109	± 500 mV	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-5000 (EC78H)	5000 (1388H)
0x010A	± 100 mV	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-10000 (D8F0H)	10000 (2710H)

Current Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0201	4~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	4000 (0FA0H)	20000 (4E20H)
0x0202	0~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	20000 (4E20H)
0x0203	±20 mA	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-20000 (B1E0H)	20000 (4E20H)

Thermocouple Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0301	Type J -210 ~ 1200 ℃	2's Comp Hex	-5735 (E999H)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	12000 (2EE0H)
0x0302	Type K -270 ~ 1372 ℃	2's Comp Hex	-6449 (E6CFH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	13720(3598H)
0x0303	Type T -270 ~ 400 ℃	2's Comp Hex	-22118 (A99AH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	4000 (0FA0H)
0x0304	Type E -270 ~ 1000 ℃	2's Comp Hex	-8848 (DD70H)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	10000 (2710H)
0x0305	Type R -50 ~ 1768 ℃	2's Comp Hex	-927 (FC61H)	32767 (7FFFH)
		Engineering Unit	-500 (FE0CH)	17680 (4510H)
0x0306	Type S -50 ~ 1768 ℃	2's Comp Hex	-927 (FC61H)	32767 (7FFFH)
		Engineering Unit	-500 (FE0CH)	17680 (4510H)
0x0307	Type B 0 ~ 1820 ℃	2's Comp Hex	0 (0000H)	32767 (7FFFH)
		Engineering Unit	0 (0000H)	18200 (4718H)
0x0308	Type N -270 ~ 1300 ℃	2's Comp Hex	-6806 (E56AH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	13000 (32C8H)

3.1.5.4 Signal Value

Address	Function	R/W	Initial Value
00641~00646 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disalbe. Bit1 = 1, CH1 Disable	R/W	0

Once completing the setup, please enter the measured value. This is to enable/ disable the channel(s) and check if the value is out-of-range (4~20mA or thermocouple contact loss is deemed to be “out of range”)

3.1.5.5 Temperature Offset

Address	Function	R/W	Initial Value
40577~40592 (0x0240~0x024F)	CH0~CH15 temp offset, Unit 0.01℃ Range：-50.00℃ ~ 50.00℃	R/W	0x0000

Setting the temperature offset register with in the module. When selecting thermocouple intput mdoe, register can fine-tuning of temperature.

3.1.5.6 Voltage/Current Measurement Adjustment

Address	Function	R/W	Initial Value
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Offset Range：-0.5000~0.5000 FSR	R/W	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Gain Range：-3.0000~3.0000	R/W	1.0000

The Module provides Offset/Gain Register for Voltage/Current Type, which is used to fine-tune the readings.

Calculated as follows:

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 V1.14

3.1.6 Modbus Address

3.1.6.1 AD-UC-08 Modbus Address Table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00524 (0x020B)	CJC Enable 0: Disable 1: Enable	R/W	0
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	CH0~CH7 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30520 40513~40520 (0x0200~0x0207)	AI CH0 ~ CH7 Value	R	-
40577~40584 (0x0240~0x0247)	Temperature Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40609~40616 (0x0260~0x0267)	CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40641 (0x0280)	CJC Value, Unit : 0.01℃	R	-
40657 (0x0290)	Module CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40673~40680 (0x02A0~0x02A7)	AI CH0 ~ CH7 Volt/Curr Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40696 (0x02B0~0x02B7)	AI CH0 ~ CH7 Volt/Curr Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40712 (0x02C0~0x02C7)	CH0~CH7 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH7 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0x0000

40577 (0x02F4)	CH0~CH7 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0x0000
40578 (0x02F5)	CH0~CH7 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000
40579 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0x0000
40580 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	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)	Program CRC	R	
44128 (0x101F)	Module Error Status Bit0: EEPROM Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEPROM Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.1.6.2 AD-UC-16 Modbus Address Table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00524 (0x020B)	CJC Enable 0: Disable 1: Enable	R/W	0
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00656 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40577~40584 (0x0240~0x0247)	Temperature Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0x0000
40609~40616 (0x0260~0x0267)	CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0x0000
40641 (0x0280)	CJC Value, Unit : 0.01℃	R	-
40642 (0x0281)	CH8~CH15 Value, Unit : 0.01℃		
40657 (0x0290)	Module CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Volt/Curr Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Volt/Curr Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40720 (0x02C0~0x02C7)	CH0~CH15 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0x0000
40746	CH0~CH15 Channel Disalbe。	R/W	0x0000

(0x02E9)	(Each bit map to corresponding channel)		
40577 (0x02F4)	CH0~CH15 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0x0000
40578 (0x02F5)	CH0~CH7 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000
40579 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0x0000
40580 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

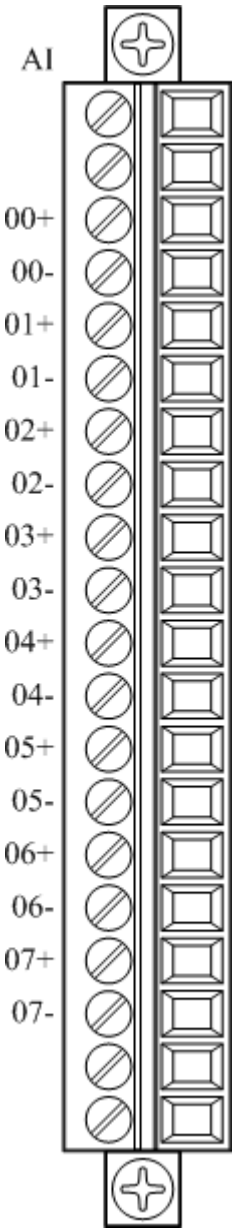
Address	**Function**	**R/W**	**Initial Value**
44097 0x1000	Firmware version 2 Bytes High Byte: Main version Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
44107 (0x100A)	COM port setting: 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)	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)	Program CRC	R	
44128 (0x101F)	Module Error Status Bit0: EEPROM Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEPROM Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

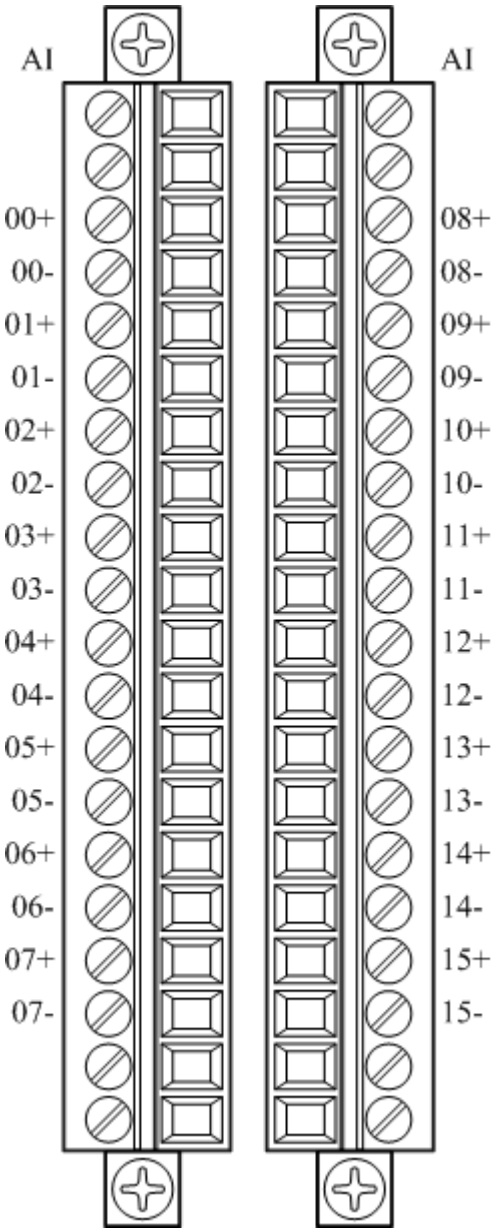
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.2 AD-TC-08/16 8/16-Channel Thermoucouple Input Module

3.2.1 Terminal Assignment

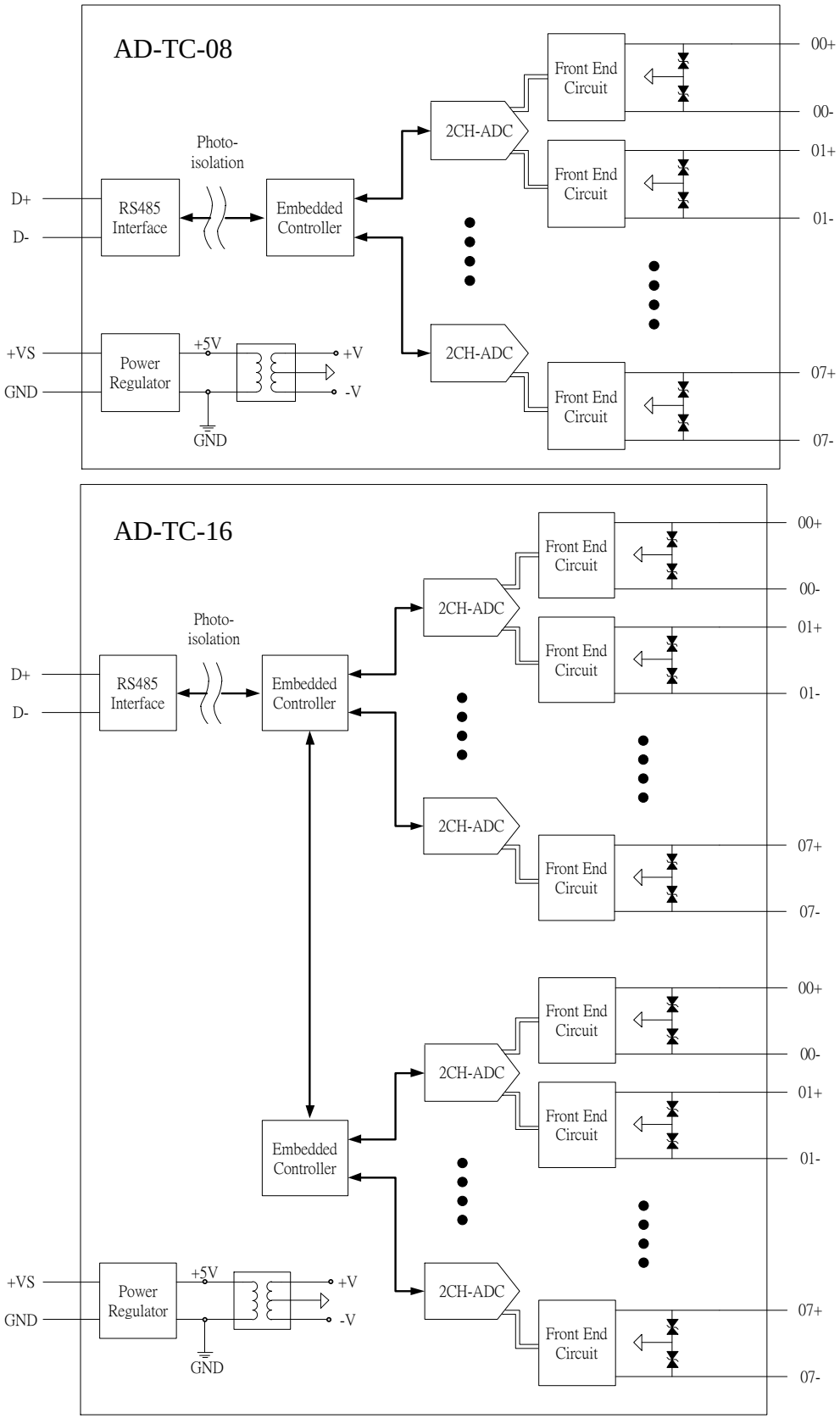


AD-TC-08

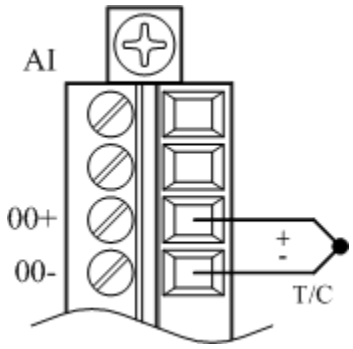


AD-TC-16

3.2.2 Block Diagram



3.2.3 Channel Connecting



3.2.4 IO Specifications

	AD-TC-08	AD-TC-16
Channels	8 channels	16 channels
Direct Sensor Input	J, K, T, E, R, S, B, N	
Burn-out Detection	Yes	
Channel Independent Configuration	Yes	
Sampling Rates	2.5 samples/second per channel	
Resolution	16-bit	
Accuracy	±0.1% FSR	
Input Impedance	2MΩ	
Span Drift	±25 ppm/℃	
Zero Drift	±6 μV/℃	
Input Voltage Protection	±35V	
Power Consumption	1.6W @ 24V	2.8W @ 24V

3.2.5 Related Reference

3.2.5.1 Input Signal Type Setup

Address	Function	R/W	Initial value
40705~40712 (0x02C0~0x02CF)	CH0~CH15 Input signal type setup	R/W	0x0301

Input ranges & type for each analog signal is adjustable.

Signals detect range:

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

3.2.5.2 CJC (Cold Junction Compensation)

Address	Function	R/W	Initial value
00524 (0x020B)	CJC Enable 0: disable 1: enable	R/W	0
40609~40624 (0x0260~0x026F)	CH0~CH15 CJC Scale, Unit: 0.01℃ Range: -50.00℃ ~ 50.00℃	R/W	0
40641 (0x0280)	CJC Value, Unit 0.1℃	R	-
40642 (0x0281)	CH8~CH15 CJC Value, 0.01℃	R	-
40657 (0x0290)	Module CJC Scale, Unit: 0.01℃ Range: -50.00℃ ~ 50.00℃	R/W	0

There is thermal sensor built in the module, the purpose is cold junction compensation to thermocouple.

3.2.5.3 Hexadecimal / Engineering Unit

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

Setup the output value on 2's Comp Hexadecimal, or Engineering scaling. As Below

Thermocouple Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0301	Type J -210 ~ 1200 ℃	2's Comp Hex	-5735 (E999H)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	12000 (2EE0H)
0x0302	Type K -270 ~ 1372 ℃	2's Comp Hex	-6449 (E6CFH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	13720(3598H)
0x0303	Type T -270 ~ 400 ℃	2's Comp Hex	-22118 (A99AH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	4000 (0FA0H)
0x0304	Type E -270 ~ 1000 ℃	2's Comp Hex	-8848 (DD70H)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	10000 (2710H)
0x0305	Type R -50 ~ 1768 ℃	2's Comp Hex	-927 (FC61H)	32767 (7FFFH)
		Engineering Unit	-500 (FE0CH)	17680 (4510H)
0x0306	Type S -50 ~ 1768 ℃	2's Comp Hex	-927 (FC61H)	32767 (7FFFH)
		Engineering Unit	-500 (FE0CH)	17680 (4510H)
0x0307	Type B 0 ~ 1820 ℃	2's Comp Hex	0 (0000H)	32767 (7FFFH)
		Engineering Unit	0 (0000H)	18200 (4718H)
0x0308	Type N -270 ~ 1300 ℃	2's Comp Hex	-6806 (E56AH)	32767 (7FFFH)
		Engineering Unit	-2700 (F574H)	13000 (32C8H)

3.2.5.4 Signal Value

Address	Function	R/W	Initial Value
00641~00646 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disalbe. Bit1 = 1, CH1 Disable	R/W	0

Once completing the setup, please enter the measured value. This is to enable/ disable the channel(s) and check if the value is out-of-range (thermocouple contact loss is deemed to be “out of range”)

3.2.5.5 Temperature Offset

Address	Function	R/W	Initial Value
40577~40592 (0x0240~0x024F)	CH0~CH15 temp offset, Unit 0.01℃ Range：-50.00℃ ~ 50.00℃	R/W	0

Setting the temperature offset register with in the module.

3.2.6 Modbus Address

3.2.6.1 AD-TC-08 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00524 (0x020B)	CJC Enable 0: Disable 1: Enable	R/W	0
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	CH0~CH7 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30520 40513~40520 (0x0200~0x0207)	AI CH0 ~ CH7 Value	R	-
40577~40584 (0x0240~0x0247)	Temperature Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40609 ~ 40616 (0x0260~0x0267)	CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40641 (0x0280)	CJC Value, Unit : 0.01℃	R	-
40657 (0x0290)	Module CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40705~40712 (0x02C0~0x02C7)	CH0~CH7 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH7 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0
40577 (0x02F4)	CH0~CH7 Calibrate maximum value to each channel. (Each bit map to corresponding channel)	W	0

	Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.		
40578 (0x02F5)	CH0~CH7 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0
40579 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0
40580 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	Watch dog timer (unit: 0.1s) Range: 0 ~ 0x00FF	R/W	0
44109 (0x100C)	System watch dog 0x0001: Enable 0x0000: Disable	R/W	0
44110 (0x100D)	Status of system watch dog 0x0001: Timeout 0x0000: Normal	R/W	-

44111 (0x100E)	Counter of communication frame	R	0
44112 (0x100F)	Program CRC	R	
44128 (0x101F)	Module Error Status Bit0: EEPROM Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEPROM Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.2.6.2 AD-TC-08 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00524 (0x020B)	CJC Enable 0: Disable 1: Enable	R/W	0
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00656 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-

40577~40584 (0x0240~0x0247)	Temperature Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40609 ~ 40616 (0x0260~0x0267)	CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40641 (0x0280)	CJC Value, Unit : 0.01℃	R	-
40642 (0x0281	CH8~CH15 CJC Value, Unit : 0.01℃		
40657 (0x0290)	Module CJC Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃		
40705~40720 (0x02C0~0x02CF)	CH0~CH15 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	
40577 (0x02F4)	CH0~CH7 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0
40578 (0x02F5)	CH0~CH15 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0
40579 (0x02F6)	CH0~CH15 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0
40580 (0x02F7)	CH0~CH15 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

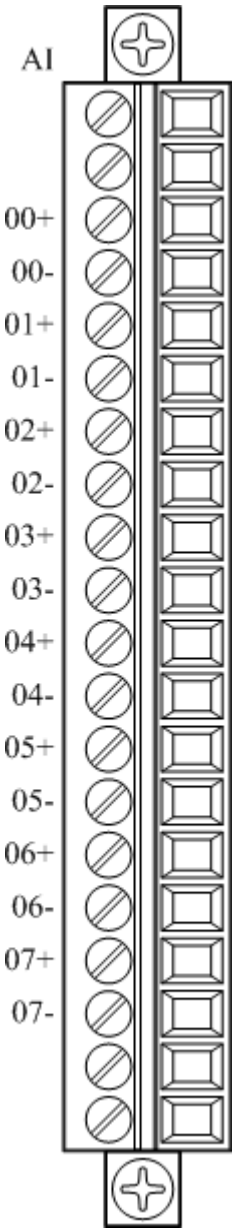
Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-

<table>
<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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting: 2bytes
<table>
<tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</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
Bit0: EEPROM Fault
Bit1: Inner Master/Slave Comm Fault.</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>EEPROM Fault Code
0: No Error
1: No Connect
2: Data Fault
3: Configure Fault</td><td>R</td><td></td></tr>
<tr><td>44130
(0x1021)</td><td>Inner Master/Slave Comm Fault
0: No Error
1: No Response
2: ID Not Match
3: Comm. TimeOut</td><td>R</td><td></td></tr>
</table>

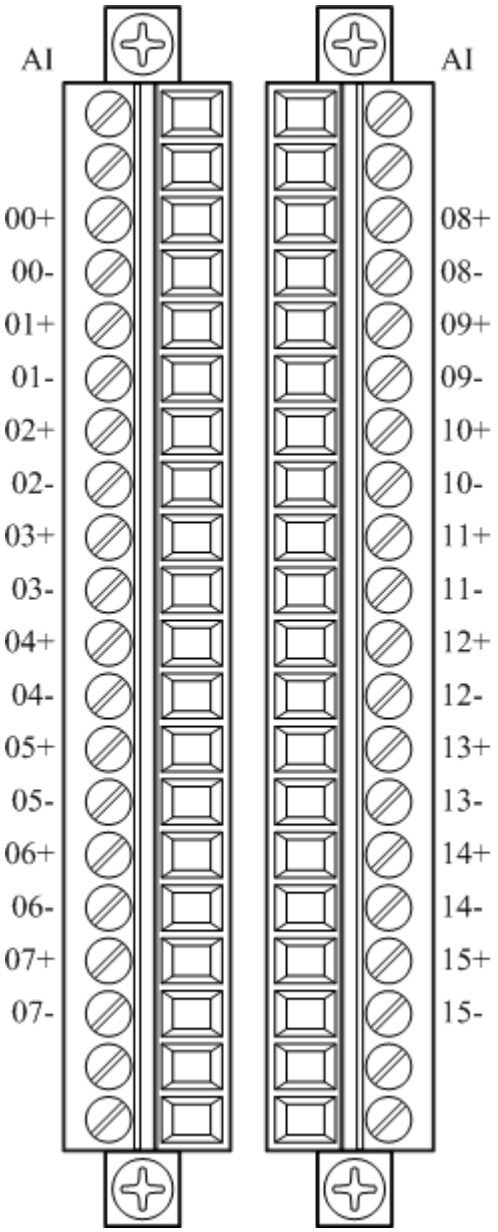
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.3 AD-PR-A-08/16 8/16-Channel Current Input Module

3.3.1 Terminal Assignment

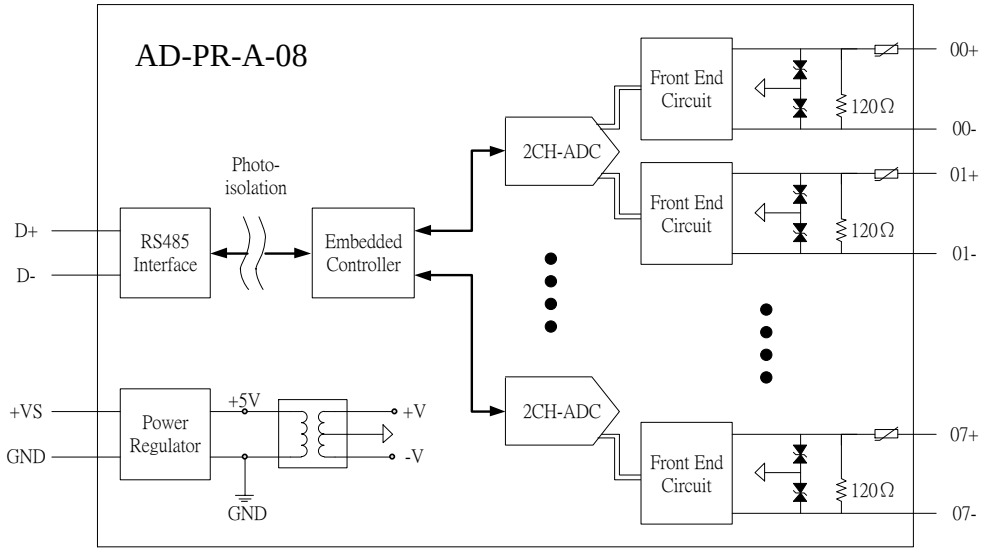


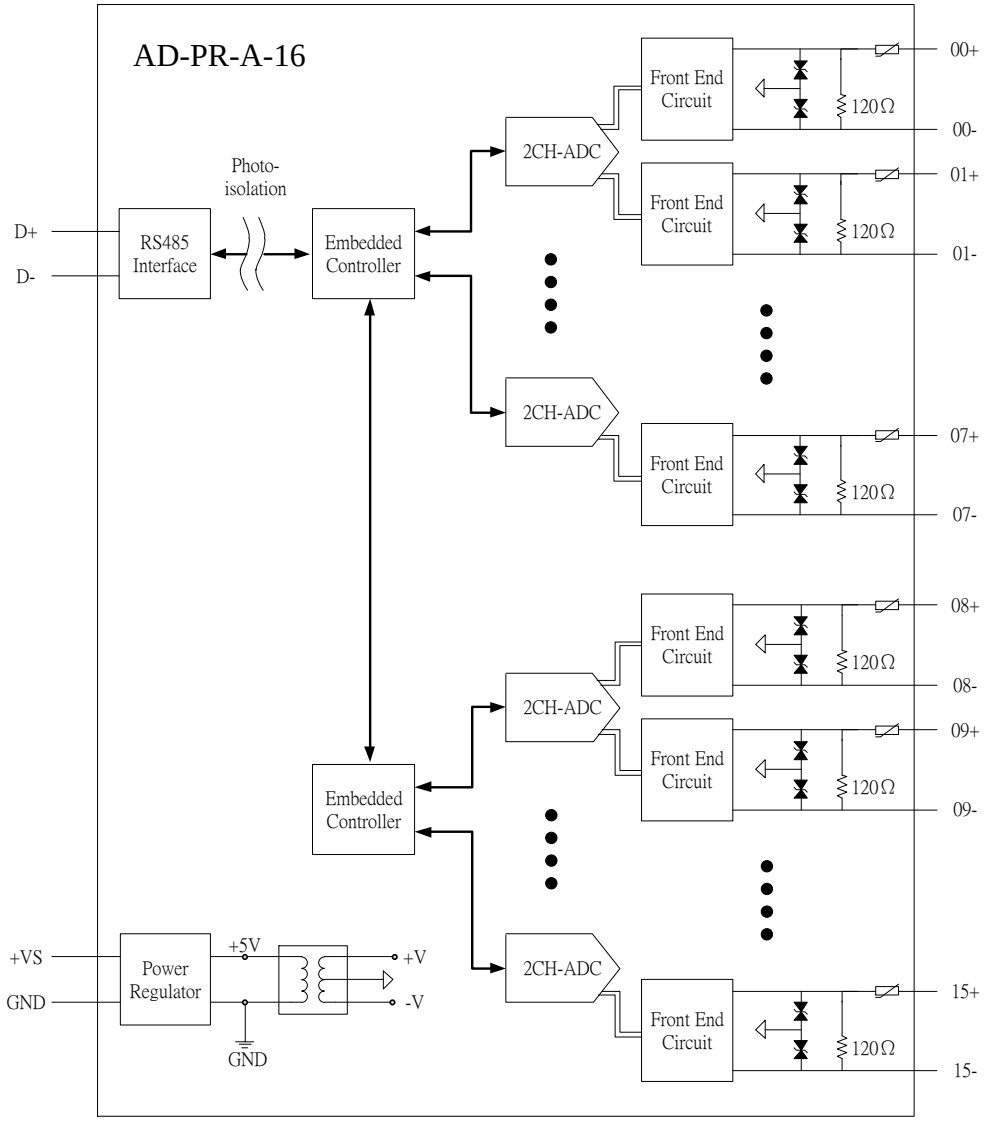
AD-PR-A-08



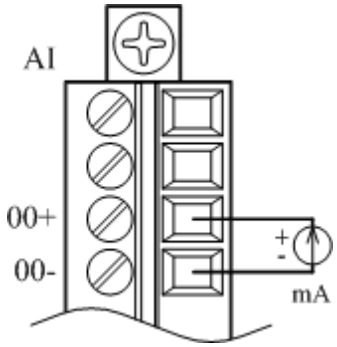
AD-PR-A-16

3.3.2 Block Diagram





3.3.3 Channel Connecting



3.3.4 IO Specifications

	AD-PR-A-08	AD-PR-A-16
Channels	8 channels	16 channels
Current Input	±20mA, 4~20mA, 0~20mA	
Burn-out Detection	4~20mA	
Channel Independent Configuration	Yes	
Sampling Rates	2.5 samples/second per channel	
Resolution	16-bit	
Accuracy	±0.1% FSR	
Input Impedance	120Ω	
Span Drift	±25 ppm/℃	
Zero Drift	±6 μV/℃	
Power Consumption	1.6W @ 24V	2.8W @ 24V

3.3.5 Related Reference

3.3.5.1 Input Signal Type Setup

Address	Function	R/W	Initial value
40705~40720 (0x02C0~0x02CF)	CH0~CH15 Input signal type setup 0x0201: 4~20mA 0x0202: 0~20mA 0x0203: ± 20 mA	R/W	0x0201

Input ranges & type for each analog signal is adjustable.

3.3.5.2 Hexadecimal / Engineering Unit

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

Setup the output value on 2's Comp Hexadecimal, or Engineering scaling. As Below

Current Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0201	4~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	4000 (0FA0H)	20000 (4E20H)
0x0202	0~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	20000 (4E20H)
0x0203	±20 mA	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-20000 (B1E0H)	20000 (4E20H)

3.3.5.3 Signal Value

Address	Function	R/W	Initial Value
00641~00646 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disalbe. Bit1 = 1, CH1 Disable	R/W	0

Once completing the setup, please enter the measured value. This is to enable/ disable the channel(s) and check if the value is out-of-range (4~20mA contact loss is deemed to be “out of range”)

3.3.5.4 Current Measurement Adjustment

Address	Function	R/W	初始設定
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Offset Range：-0.5000~0.5000 FSR	R/W	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Gain Range：-3.0000~3.0000	R/W	1.0000

The Module provides Offset/Gain Register for Current Input, which is used to fine-tune the readings.

Calculated as follows:

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

3.3.6 Modbus Address

3.3.6.1 AD-PR-A-08 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	CH0~CH7 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30520 40513~40520 (0x0200~0x0207)	AI CH0 ~ CH7 Value	R	-
40673~40680 (0x02A0~0x02A7)	AI CH0 ~ CH7 Current Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40696 (0x02B0~0x02B7)	AI CH0 ~ CH7 Current Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40712 (0x02C0~0x02C7)	CH0~CH7 Input signal type	R/W	0x0201
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH7 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0
40577 (0x02F4)	CH0~CH7 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0
40578 (0x02F5)	CH0~CH7 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0

40579 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0
40580 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	Watch dog timer (unit: 0.1s) Range: 0 ~ 0x00FF	R/W	0
44109 (0x100C)	System watch dog 0x0001: Enable 0x0000: Disable	R/W	0
44110 (0x100D)	Status of system watch dog 0x0001: Timeout 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0
44112 (0x100F)	Program CRC	R	

44128 (0x101F)	Module Error Status Bit0: EEPROM Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEPROM Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.3.6.2 AD-PR-A-16 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00656 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30528 40513~40528 (0x0200~0x0207)	AI CH0 ~ CH15 Value	R	-
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Current Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Current Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40712	CH0~CH15 Input signal type	R/W	0x0201

(0x02C0~0x02C7)			
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0
40577 (0x02F4)	CH0~CH15 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0
40578 (0x02F5)	CH0~CH15 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0
40579 (0x02F6)	CH0~CH15 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0
40580 (0x02F7)	CH0~CH15 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

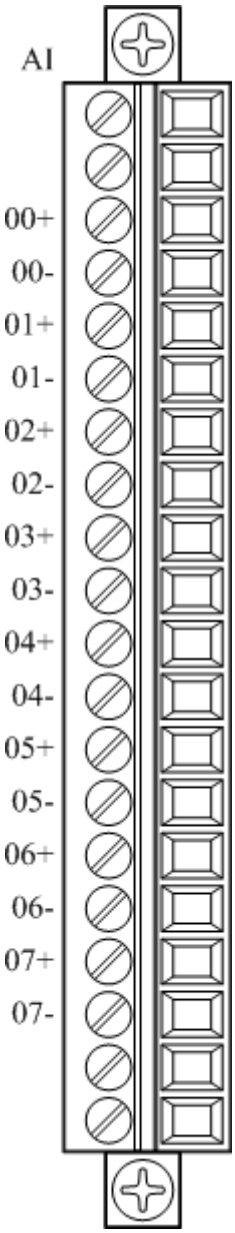
Address	**Function**	**R/W**	**Initial Value**
44097 0x1000	Firmware version 2 Bytes High Byte | Low Byte Main version | Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0

<table>
<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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</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
Bit0: EEPROM Fault
Bit1: Inner Master/Slave Comm Fault.</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>EEPROM Fault Code
0: No Error
1: No Connect
2: Data Fault
3: Configure Fault</td><td>R</td><td></td></tr>
<tr><td>44130
(0x1021)</td><td>Inner Master/Slave Comm Fault
0: No Error
1: No Response
2: ID Not Match
3: Comm. TimeOut</td><td>R</td><td></td></tr>
</table>

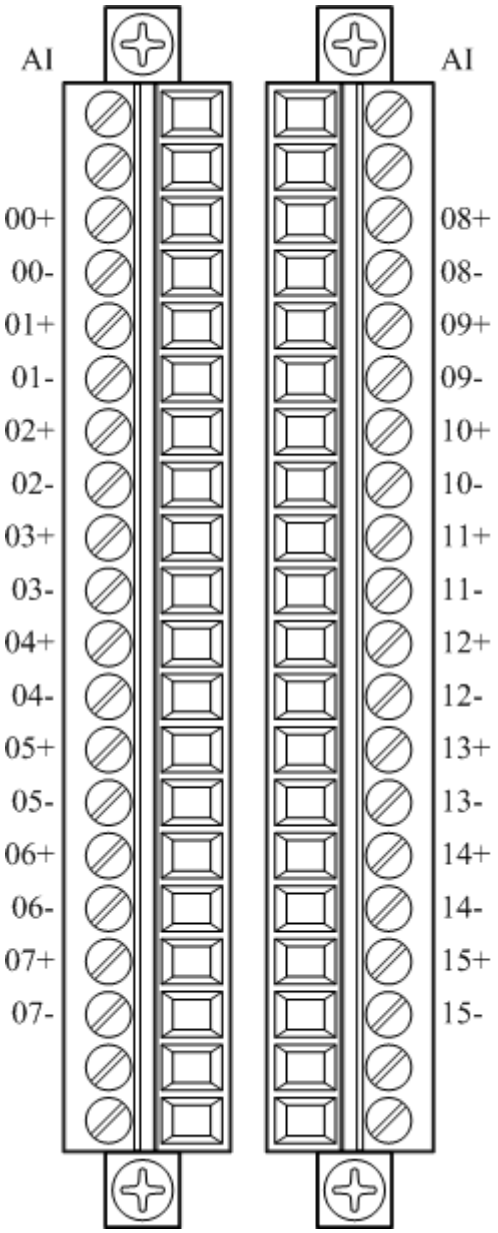
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.4 AD-PR-V-08/16 8/16-Channel Voltage Input Module

3.4.1 Terminal Assignment

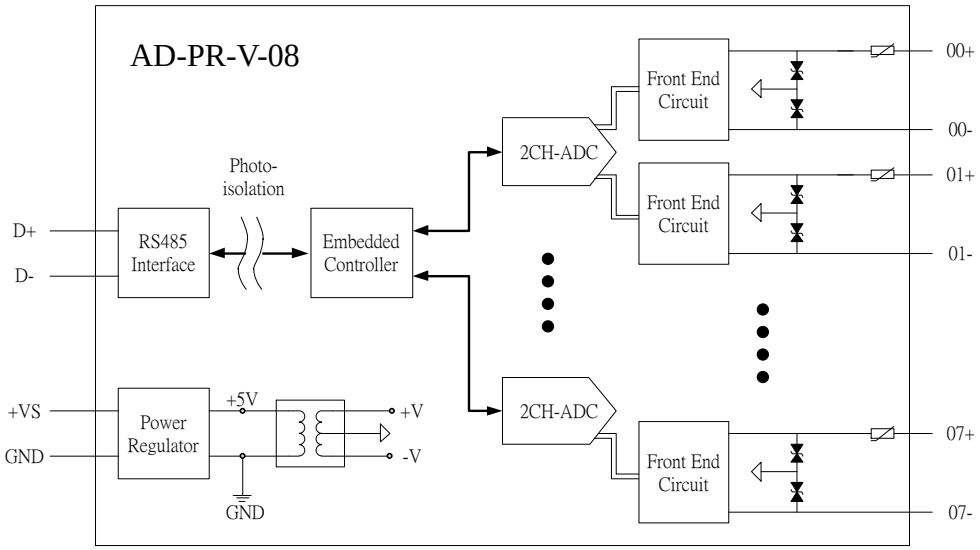


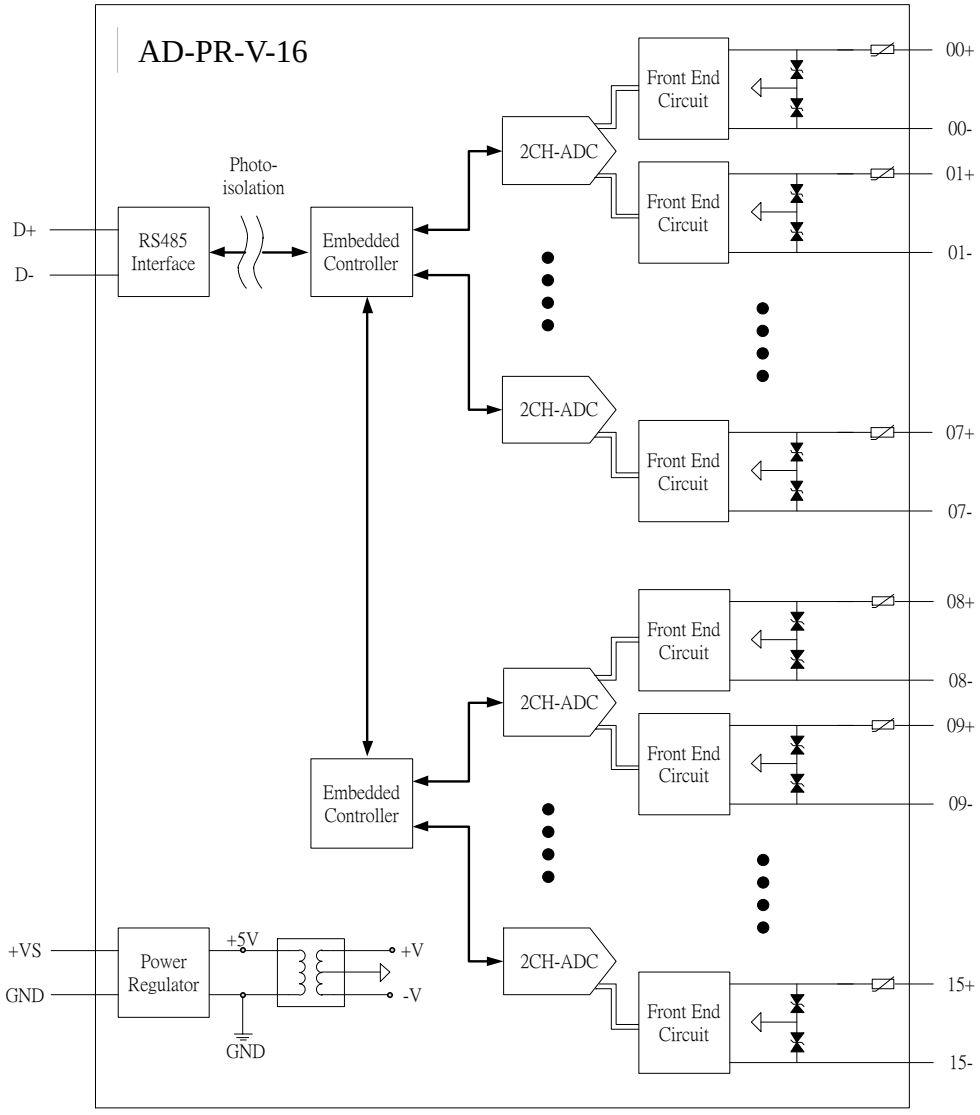
AD-PR-V-08



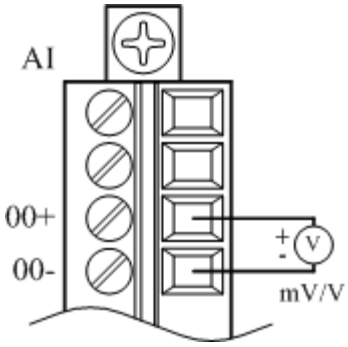
AD-PR-V-16

3.4.2 Block Diagram





3.4.3 Channel Connecting



3.4.4 IO Specifications

	AD-PR-V-08	AD-PR-V-16
Channels	8 channels	16 channels
Voltage Range	±1V, ±5V, ±10V, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V	
Burn-out Detection	No	
Channel Independent Configuration	Yes	
Sampling Rates	2.5 samples/second per channel	
Resolution	16-bit	
Accuracy	±0.1% FSR	
Input Impedance	1MΩ	
Span Drift	±25 ppm/℃	
Zero Drift	±6 μV/℃	
Power Consumption	1.6W @ 24V	2.8W @ 24V

3.4.5 Related Reference

3.4.5.1 Input Signal Type Setup

Address	Function	R/W	Initial value
40705~40720 (0x02C0~0x02CF)	CH0~CH15 Input signal type setup 0x0101: 0 ~ 10V 0x0102: 0 ~ 5V 0x0103: 0 ~ 1V 0x0106: ±10V 0x0107: ±5V 0x0108: ±1V	R/W	0x0106

Input ranges & type for each analog signal is adjustable.

3.4.5.2 Hexadecimal / Engineering Unit

Address	Function	R/W	Initial value
40737 (0x02E0)	AI Value format 0x0000: Hex 0x0001: Engineering	R/W	0
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-

Setup the output value on 2's Comp Hexadecimal, or Engineering scaling. As Below

Voltage Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0101	0~10 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	10000 (2710H)
0x0102	0~5 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	50000 (C350H)
0x0103	0~1 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	10000 (2710H)
0x0106	± 10 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)

		Engineering Unit	-10000 (D8F0H)	10000 (2710H)
0x0107	± 5 V	2’s Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-5000 (EC78H)	5000 (1388H)
0x0108	± 1 V	2’s Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-10000 (D8F0H)	10000 (2710H)

3.4.5.3 Signal Value

Address	Function	R/W	Initial Value
00641~00646 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disalbe. Bit1 = 1, CH1 Disable	R/W	0

Once completing the setup, please enter the measured value. This is to enable/ disable the channel(s) and check if the value is out-of-range.

3.4.5.4 Voltage Measurement Adjustment

Address	Function	R/W	初始設定
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Offset Range：-0.5000~0.5000 FSR	R/W	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Gain Range：-3.0000~3.0000	R/W	1.0000

The Module provides Offset/Gain Register for Voltage Input, which is used to fine-

tune the readings.
Calculated as follows:

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 V1.14

3.4.6 Modbus Address

3.4.6.1 AD-PR-V-08 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00648 (0x0280~0x0287)	CH0~CH7 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30520 40513~40520 (0x0200~0x0207)	AI CH0 ~ CH7 Value	R	-
40673~40680 (0x02A0~0x02A7)	AI CH0 ~ CH7 Voltage Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40696 (0x02B0~0x02B7)	AI CH0 ~ CH7 Voltage Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40712 (0x02C0~0x02C7)	CH0~CH7 Input signal type	R/W	0x0106
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0x0000
40746 (0x02E9)	CH0~CH7 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0x0000
40577 (0x02F4)	CH0~CH7 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0x0000
40578 (0x02F5)	CH0~CH7 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000

40579 (0x02F6)	CH0~CH7 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0x0000
40580 (0x02F7)	CH0~CH7 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	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)	Program CRC	R	

44128 (0x101F)	Module Error Status Bit0: EEPROM Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEPROM Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.4.6.2 AD-PR-V-16 Modbus address table

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00537 (0x0218)	Allow calibration 0: Disallow 1: Allow	R/W	0
00641~00656 (0x0280~0x028F)	CH0~CH15 Out of range 0: normal 1: out of range	R	0

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

Address	Function	R/W	Initial Value
30513~30528 40513~40528 (0x0200~0x020F)	AI CH0 ~ CH15 Value	R	-
40673~40688 (0x02A0~0x02AF)	AI CH0 ~ CH15 Current Offset Range：-0.5000~0.5000 FSR	R/W V1.14	0
40689~40704 (0x02B0~0x02BF)	AI CH0 ~ CH15 Current Gain Range：-3.0000~3.0000	R/W V1.14	1.0000
40705~40720 (0x02C0~0x02CF)	CH0~CH15 Input signal type	R/W	0x0106
40737	AI Result format of measurement	R/W	0x0000

(0x02E0)	0x0000: Hex 0x0001: Engineering		
40746 (0x02E9)	CH0~CH15 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0x0000
40577 (0x02F4)	CH0~CH15 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0x0000
40578 (0x02F5)	CH0~CH15 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0x0000
40579 (0x02F6)	CH0~CH15 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0x0000
40580 (0x02F7)	CH0~CH15 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

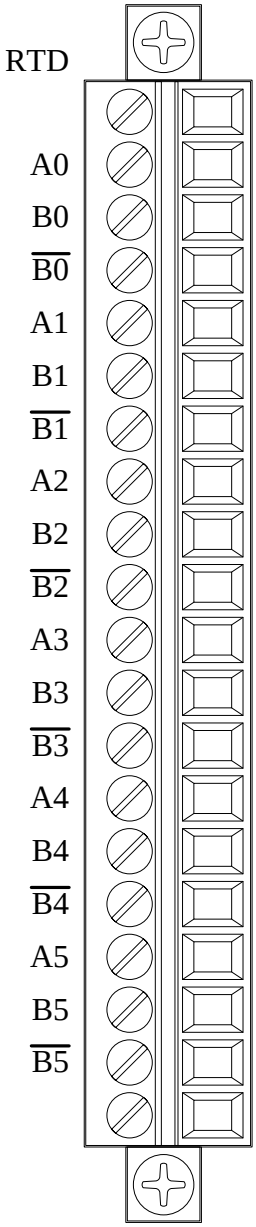
Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte | Low Byte Main version | Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0

<table>
<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
Bit0: EEPROM Fault
Bit1: Inner Master/Slave Comm Fault.</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>EEPROM Fault Code
0: No Error
1: No Connect
2: Data Fault
3: Configure Fault</td><td>R</td><td></td></tr>
<tr><td>44130
(0x1021)</td><td>Inner Master/Slave Comm Fault
0: No Error
1: No Response
2: ID Not Match
3: Comm. TimeOut</td><td>R</td><td></td></tr>
</table>

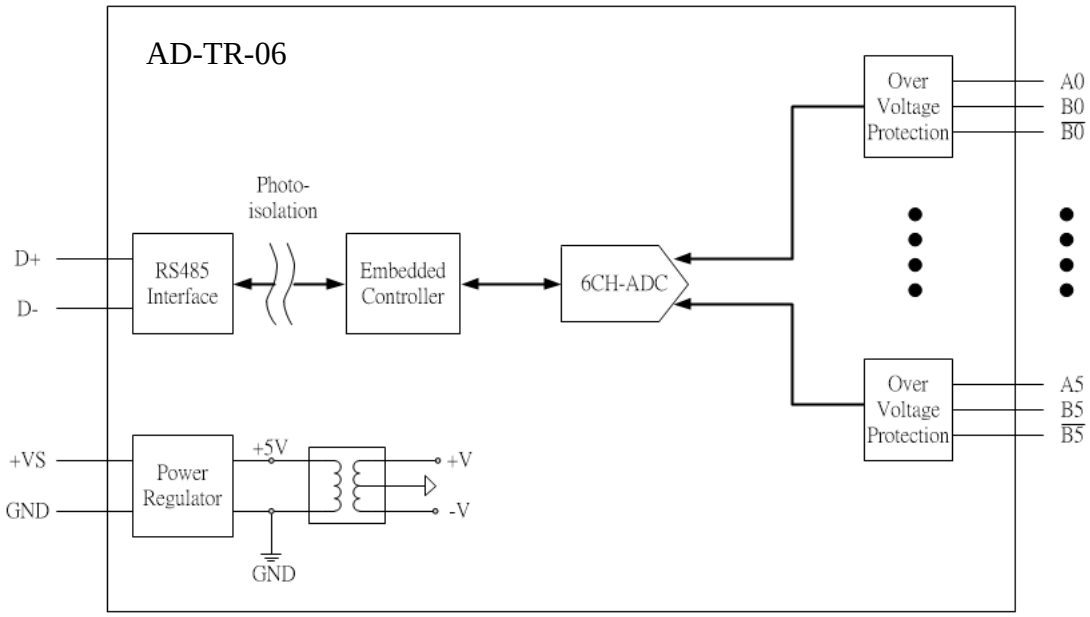
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.5 AD-TR-06 6-Channel RTD Input Module

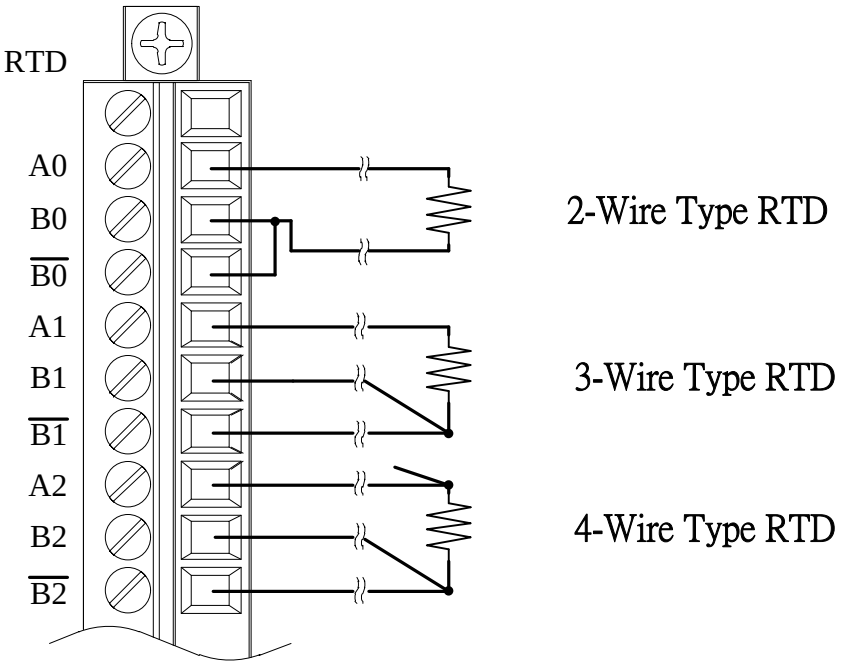
3.5.1 Terminal Assignment



3.5.2 Block Diagram



3.5.3 Channel Connecting



3.5.4 IO Specifications

Channels	6 channels
Sensor Types	Platinum 100 α= 0.00385 (IEC) -200 ~ 600℃ Platinum 100 α= 0.00392 (JIS) -200 ~ 600℃ Platinum 1000 α= 0.00385 (IEC) -200 ~ 600℃ Cu 100@0℃ α= 0.00421 -20 ~ 150℃ Cu 1000@0℃ α= 0.00421 -20 ~ 150℃ Cu 50@@0℃ -0 ~ 200℃ Nickel 100Ω α= 0.00618 -60 ~ 180℃ Nickel 120Ω α= 0.00672 -80 ~ 260℃ Nickel 507.5Ω α= 0.00520 -80 ~ 260℃ Nickel 604Ω α= 0.00518 -200 ~ 200℃ BALCO 500 -40 ~ 150℃
Disconnection Detection	Yes
Channel Independent Configuration	Yes
Sampling Rates	12 samples/second (Total)
Resolution	16-bit
Accuracy	±0.1% FSR
Span Drift	±25 ppm/℃
Zero Drift	±6 μV/℃
OverVoltage Protection	±35V
Power Consumption	1.6W @ 24V

3.5.5 Related Reference

3.5.5.1 Input Signal Type Setup

Address	Function	R/W	Initial value
40705~40710 (0x02C0~0x02C5)	CH0~CH5 Input signal type setup 0x0401: Platinum 100 α= 0.00385(IEC) 0x0402: Platinum 100 α= 0.00392(JIS) 0x0403: Platinum 1000 α=0.00385 0x0404: Cu 100@0°C α=0.00421 0x0405: Cu 1000@0°C α=0.00421 0x0406: Cu 100@25°C α=0.00427 0x0407: Cu 50@0℃ 0x0408: Nickel 100Ω α=0.00618 0x0409: Nickel 120Ω α=0.00672 0x040A: Nickel 507.5Ω α=0.00520 0x040B: Nickel604Ω α=0.00518 0x040C: BALCO 500	R/W	0x0401

Each channel of the module can be indpendently set various analog signal input range.

3.5.5.2 Hexadecimal / Engineering Unit

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

Setup the output value on 2’s Comp Hexadecimal, or Engineering scaling. As Below

RTD				
Mode	Range	Format	Min (-FS)	Max (FS)
0x0401	Platinum 100 α= 0.00385(IEC) - 200 ~ 600 ℃ (18.52~313.71Ω)	2's Comp Hex	-10922 (D556H)	32767 (7FFFH)
		Engineering Unit	-2000 (F830H)	6000 (2710H)
0x0402	Platinum 100 α= 0.00392(JIS) -200 ~ 600 ℃ (17.08~317.59Ω)	2's Comp Hex	-10922 (D556H)	32767 (7FFFH)
		Engineering Unit	-2000 (F830H)	6000 (2710H)
0x0403	Platinum 1000 α=0.00385 -200 ~ 600 ℃ (185.2~3137.1Ω)	2's Comp Hex	-10922 (D556H)	32767 (7FFFH)
		Engineering Unit	-2000 (F830H)	6000 (2710H)
0x0404	Cu 100@0℃ α=0.00421 -20 ~ 150 ℃ (91.564~163.168Ω)	2's Comp Hex	-3469(EEEFH)	32767(7FFFH)
		Engineering Unit	-2000(F830H)	15000(3A98H)
0x0405	Cu 1000@0℃ α=0.00421 -20 ~ 150 ℃ (915.64~1631.68Ω)	2's Comp Hex	-3469(EEEFH)	32767(7FFFH)
		Engineering Unit	-2000(F830H)	15000(3A98H)
0x0406	Cu 100@25℃ α=0.00427 0 ~ 200 ℃ (90.346~167.750Ω)	2's Comp Hex	0(0000H)	32767(7FFFH)
		Engineering Unit	0(0000H)	20000(4E20H)
0x0407	Cu 50@0℃ -50 ~ 150 ℃ (39.242~82.134Ω)	2's Comp Hex	-10922(D556H)	32767(7FFFH)
		Engineering Unit	-5000(EC78H)	15000(3A98H)
0x0408	Nickel 100Ω α=0.00618 -60 ~ 180 ℃ (69.520~223.221Ω)	2's Comp Hex	-10922(D556H)	32767(7FFFH)
		Engineering Unit	-6000(E890H)	18000(4650H)
0x0409	Nickel 120Ω α=0.00672 -80 ~ 260 ℃ (66.60~380.31Ω)	2's Comp Hex	- 10082(D89EH)	32767(7FFFH)
		Engineering Unit	-8000(E0C0H)	26000(6590H)
0x040A	Nickel 507.5Ω α=0.00520 -80 ~ 260 ℃ (344.10~1328.16Ω)	2's Comp Hex	- 10082(D89EH)	32767(7FFFH)
		Engineering Unit	-8000(E0C0H)	26000(6590H)
0x040B	Nickel 604Ω α=0.00518 -200 ~ 200 ℃ (245.34~1301.9Ω)	2's Comp Hex	-32768(8000H)	32768(7FFFH)
		Engineering Unit	-20000(B1E0H)	20000(4E20H)
0x040C	BALCO 500 -40 ~ 150 ℃ (379.35~ 802.36Ω)	2's Comp Hex	-8738(DDDEH)	32767(7FFFH)
		Engineering Unit	-4000(F060H)	15000(3A98H)

3.5.5.3 Signal Value

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 40513~40518 (0x0200~0x0205)	AI CH0 ~ CH5 Value	R	-
40746 (0x02E9)	CH0~CH5 Channel Disalbe。 (Each bit map to corresponding channel) Ex. Bit0 = 1, CH0 Disalbe. Bit1 = 1, CH1 Disable	R/W	0

Once completing the setup, please enter the measured value. This is to enable/ disable the channel(s) and check if the value is out-of-range.

3.5.5.4 Temperature Offset

Address	Function	R/W	Initial Value
40577~40582 (0x0240~0x0245)	CH0~CH5 temp offset, Unit 0.01℃ Range：-50.00℃ ~ 50.00℃	R/W	0

Setting the temperature offset register with in the module. When selecting thermocouple intput mdoe, register can fine-tuning of temperature.

3.5.6 Modbus Address

Coil (0xxxx) / (1xxxx)

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

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)	Temperature Compensation unit: 0.01℃, Range: -50.0℃ ~ 50.0℃	R/W	0
40705~40710 (0x02C0~0x02C5)	CH0~CH5 Input signal type	R/W	0x0401
40737 (0x02E0)	AI Result format of measurement 0x0000: Hex 0x0001: Engineering	R/W	0
40746 (0x02E9)	CH0~CH5 Channel Disalbe。 (Each bit map to corresponding channel)	R/W	0
40577 (0x02F4)	CH0~CH5 Calibrate maximum value to each channel. (Each bit map to corresponding channel) Ex. Bit 0 = 1, Calibrate CH0. Bit 1 = 1, Calibrate CH1.	W	0
40578 (0x02F5)	CH0~CH5 Calibrate 0 level to each channel. (Each bit map to corresponding channel)	W	0
40579 (0x02F6)	CH0~CH5 Perform internal calibration to each channel. (Each bit map to corresponding channel)	W	0
40580 (0x02F7)	CH0~CH5 Calibration in process (Each bit map to corresponding channel) 0: No operation 1: Calibration in process	R	-

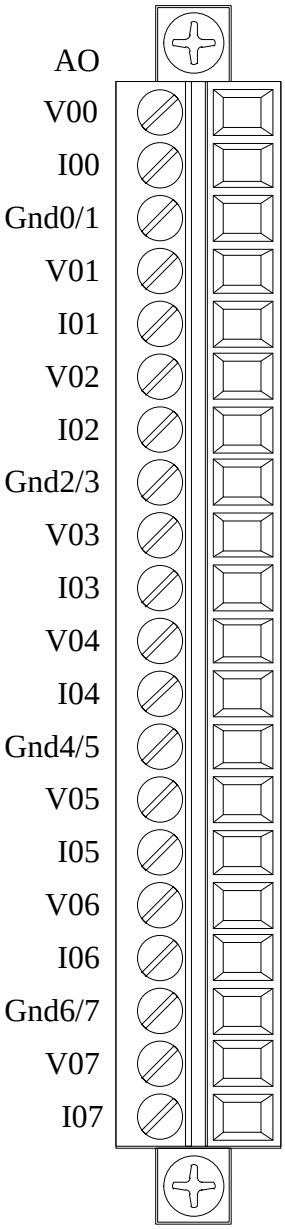
<table>
<tr><th>Address</th><th>Function</th><th>R/W</th><th>Initial Value</th></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><td>High Byte</td><td>Low Byte</td></tr><tr><td>Main version</td><td>Sub-version</td></tr></table></td><td>R</td><td>-</td></tr>
<tr><td>44098~44105
(0x1001~0x1008)</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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting: 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</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
Bit0: EEPROM Fault
Bit1: Inner Master/Slave Comm Fault.</td><td>R</td><td></td></tr>
<tr><td>44129
(0x1020)</td><td>EEPROM Fault Code
0: No Error
1: No Connect
2: Data Fault
3: Configure Fault</td><td>R</td><td></td></tr>
</table>

44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

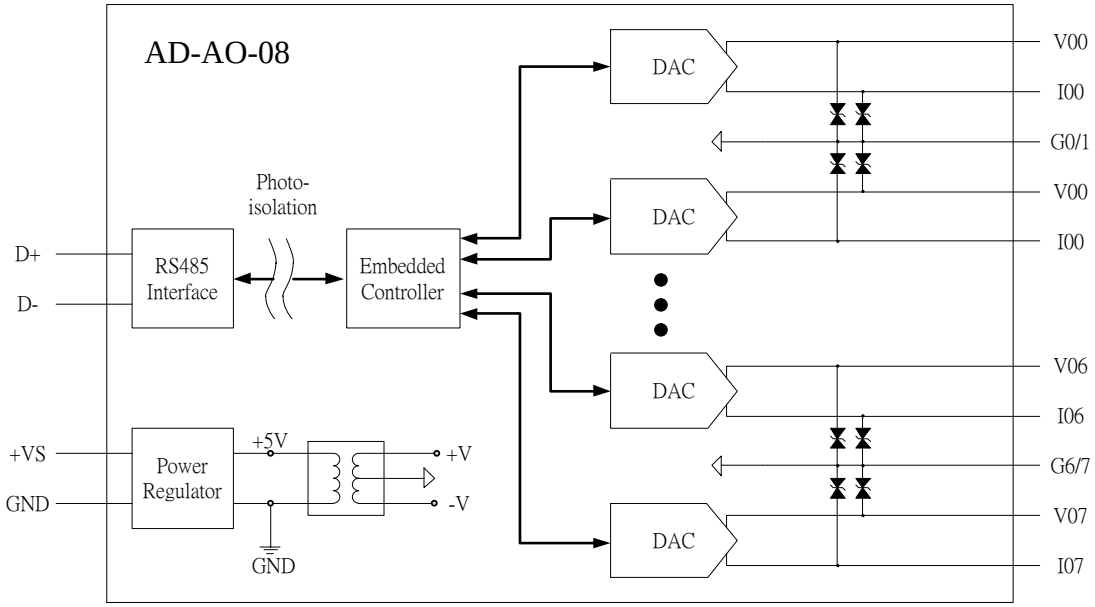
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

3.6 AD-AO-08 8-Channel Analog Output Module

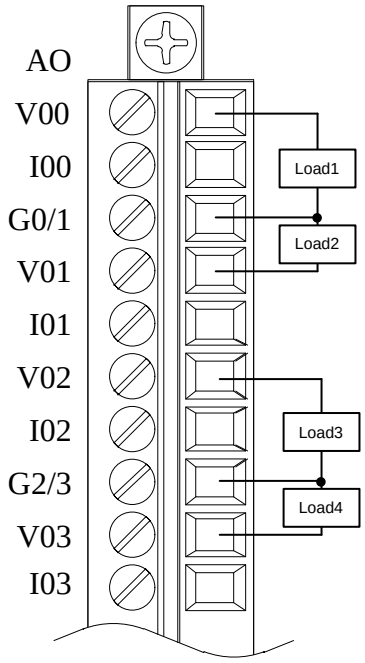
3.6.1 Terminal Assignment



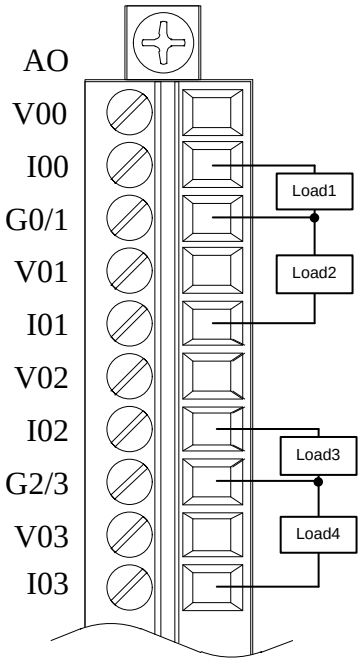
3.6.2 Block Diagram



3.6.3 Channel Connecting



Voltage Out



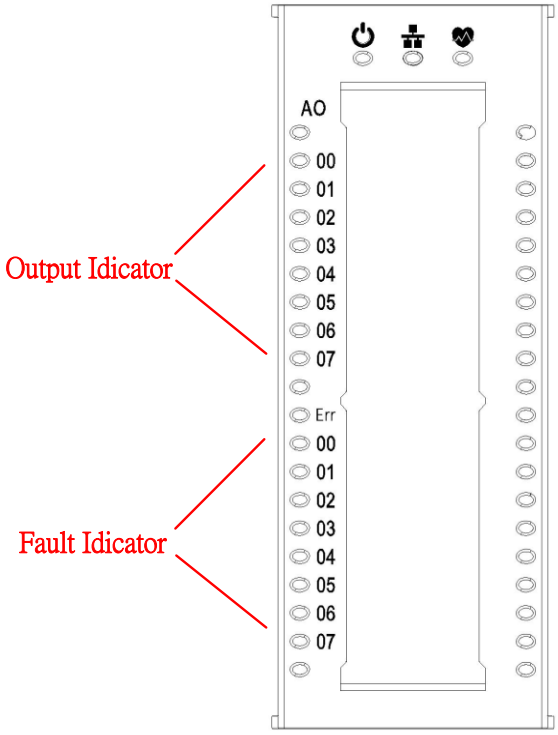
Current Out

3.6.4 IO Specifications

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 Capactity	10V @ 10mA
Current Output Capactity	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)

3.6.5 Related Reference

3.6.5.1 Front Pannel Information



When Analog Output, the corresponding LED will be light up

When the current is output, if the open wire detected, the error indicator LED will be light up

3.6.5.2 Output Signal Type Setup

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

Output ranges & type for each analog signal is adjustable.

3.6.5.3 Hexadecimal / Engineering Unit

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

Setup the output value on 2's Comp Hexadecimal, or Engineering scaling. As Below

Voltage Output				
Mode	Range	Format	Min (-FS)	Max (FS)
0x1101	0~10 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	10000 (2710H)
0x1102	0~5 V	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	50000 (C350H)
0x1106	± 10 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-10000 (D8F0H)	10000 (2710H)
0x1107	± 5 V	2's Comp Hex	-32768 (8000H)	32767 (7FFFH)
		Engineering Unit	-5000 (EC78H)	5000 (1388H)

Current Input				
Mode	Range	Format	Min (-FS)	Max (FS)
0x1201	4~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	4000 (0FA0H)	20000 (4E20H)
0x1202	0~20mA	2's Comp Hex	0 (0000H)	65535 (FFFFH)
		Engineering Unit	0 (0000H)	20000 (4E20H)

The affected addresses are as follows：

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

3.6.5.4 Output Signal Setting/Reading

Address	Function	R/W	Initial Value
40785~40792 (0x0310 ~ 0x0317)	CH0 ~ CH7: Analog Output Value	R/W	0

Set the target analog output value。

Address	Function	R/W	Initial Value
40769~40134 (0x0300 ~ 0x0307)	CH0 ~ CH7: Read Back of Analog Output Value	R	

Read the current analog output value。

3.6.5.5 Power-ON Value

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

Module has the function of power-on value.

3.6.5.6 Output Status when Host Watchdog Timeout

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

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

3.6.5.7 Analog Output 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

Set the output from 0 to full scale time. The module update time: 10ms。

Slew Rate = Full Scale value /setting time。

Ex1:

Type: 0 ~ 10V, Set: 5 sec, Slew Rate: 2 V/s

Ex2:

Type: 0 ~ 5V, Sett: 5sec, Slew Rate: 1 V/s

Ex3:

Type: 0 ~ 10V, Set: 500ms, Slew Rate: 20 V/s

Ex4:

Type: -10 ~ 10, Set: 500ms, Slew Rate: 20 V/s

3.6.5.8 Open Wire Detected

Address	Function	R/W	Initial Value
00897~00904 10897~10904 (0x0380~0x0387)	CH0~CH7 Open Wire Detected 0:Not Detected 1:Detected	R	-

Use current output Type, when the output is open, the corresponding channel will

output 1. the normal state, the corresponding channel is 0.

Address	Function	R/W	Initial Value
40921 (0x0398)	CH0 ~ CH7 Open Wire Detected Status	R	

Each bit map to corresponding channel

Ex. Bit 0 = 1, CH0 Open Wire Detected

Bit 1 = 1, CH1 Open Wire Detected

3.6.6 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00793 (0x0318)	AO Allow calibration 0: Disallow 1: Allow	R/W	0
00897~00904 10897~10904 (0x0380~0x0387)	CH0~CH7 Open Wire Detected 0:Not Detected 1:Detected	R	-
04113 (0x1011)	Allow Load Factory Calibration Value 0: Disallow 1: Allow	R/W	0

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
40897~40904 (0x0380~0x0387)	CH0 ~ CH7: Analog output Type Code 0x1101：0 ~ 10V 0x1102：0 ~ 5V 0x1106：-10V ~ 10V 0x1107：-5V ~ 5V 0x1201：4 ~ 20mA 0x1202：0 ~ 20mA	R/W	0x1106
40913 (0x0390)	AO Value format 0x00: Hex 0x01: Engineering	R/W	

40921 (0x0398)	CH0 ~ CH7 Open Wire Detected Status (Each bit map to corresponding channel)	R	
40993 (0x03E0)	CH0 ~ CH7 Full Scale Calibration Value Range：-100 ~ 100	R/W	
41009 (0x03F0)	CH0 ~ CH7 Zero Calibration Value Range：-100 ~ 100	R/W	

Address	Function	R/W	Initial Value
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	Watch dog timer (unit: 0.1s) Range: 0 ~ 0x00FF	R/W	0
44109 (0x100C)	System watch dog 0x0001: Enable 0x0000: Disable	R/W	0
44110 (0x100D)	Status of system watch dog 0x0001: Timeout 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0
44112 (0x100F)	Program CRC	R	

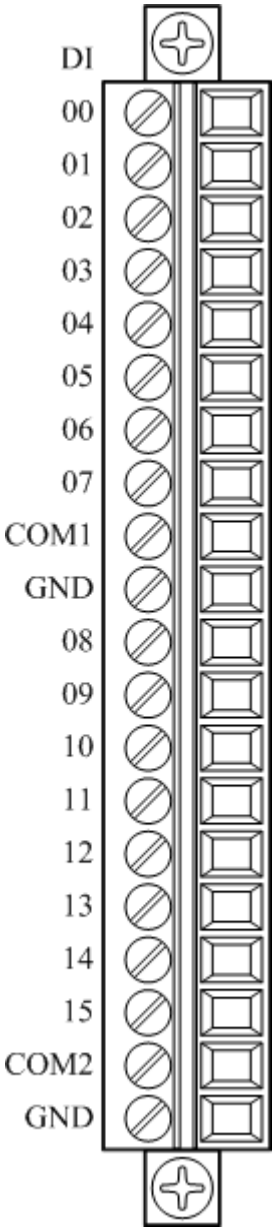
44128 (0x101F)	Module Error Status Bit0: EEProm Fault Bit1: Inner Master/Slave Comm Fault.	R	
44129 (0x1020)	EEProm Fault Code 0: No Error 1: No Connect 2: Data Fault 3: Configure Fault	R	
44130 (0x1021)	Inner Master/Slave Comm Fault 0: No Error 1: No Response 2: ID Not Match 3: Comm. TimeOut	R	

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

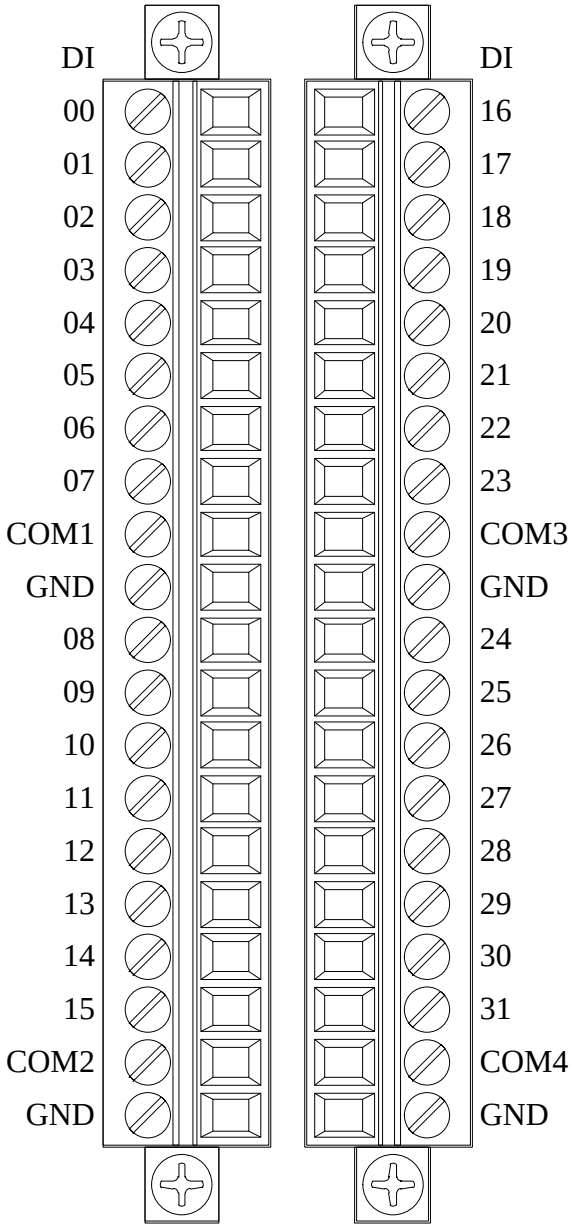
Chapter 4. Digital Module Information

4.1 AD-DI-16/32 16/32-Channel Digital Input Module

4.1.1 Terminal Assignment

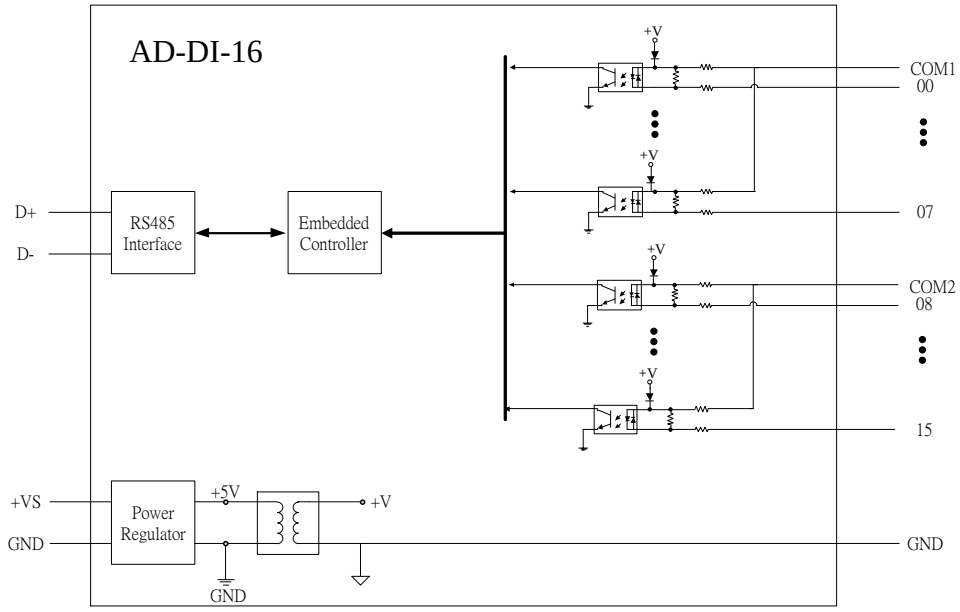


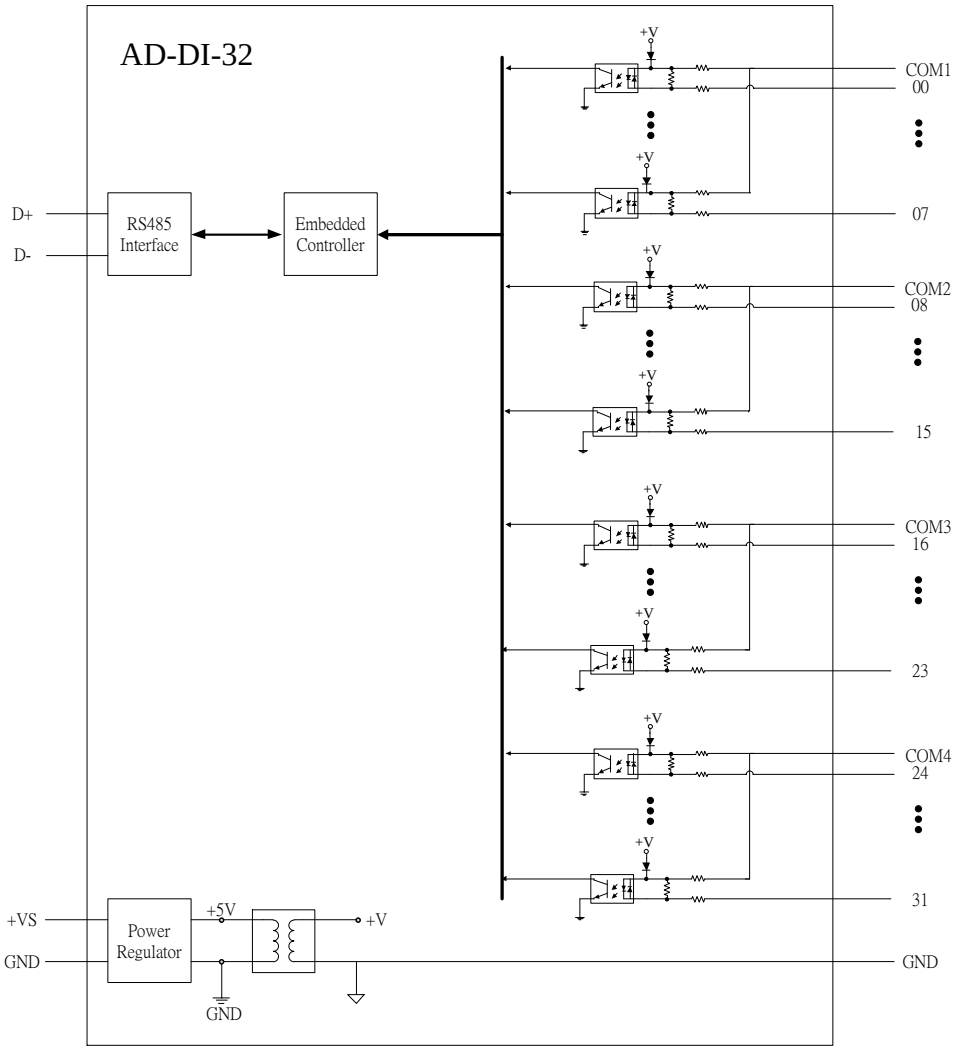
AD-DI-16



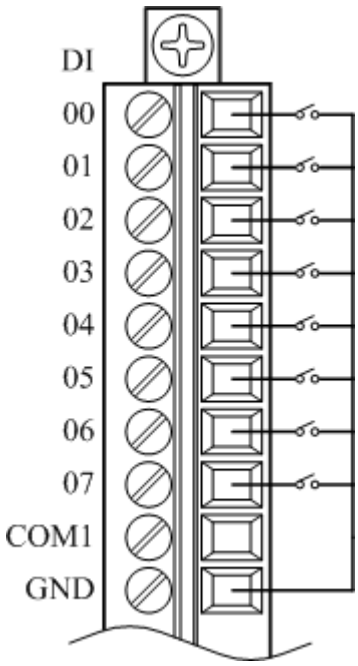
AD-DI-32

4.1.2 Block Diagram

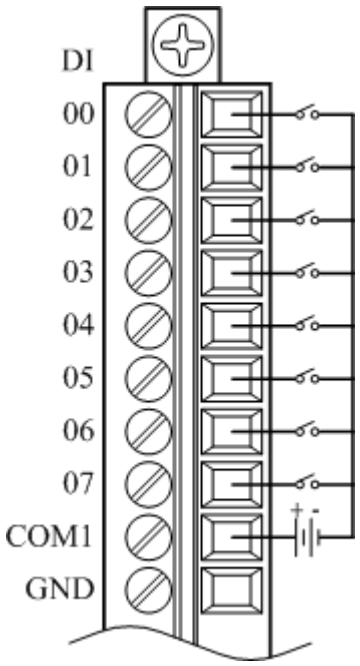




4.1.3 Channel Connecting



Dry Contact



Wet Contact

4.1.4 IO Specifications

		AD-DI-16	**AD-DI-32**
Digital Input Channels		16	32
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	
Power Consumption		1.6W @ 24V	2W @ 24V

4.1.5 Related Reference

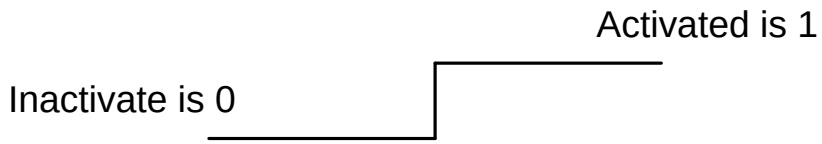
4.1.5.1 Digital Input Active State

Address	Function	R/W	Initial Value
40129 (0x0080)	DI CH0~CH31 Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0x0000

ADPower series digital module supports invert DI status, when setting is 0x0000, if the external signal is logic level high, the DI status is 1, if the external signal is logic level low, the reading value is 0; when setting is 0x0001, if the external signal s logic level high, the reading value is 0, if the external signal s logic level low, the DI status is 1.

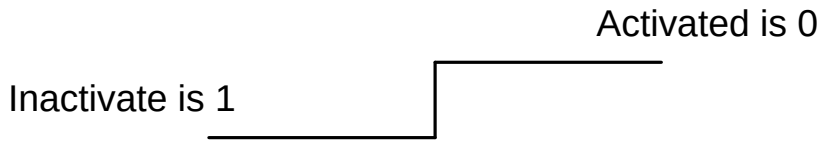
When Input Active Value Define as 0：

External signal:



When Input Active Value Define as 1:

External signal:



4.1.5.2 Digital Input Status

Address	Function	R/W	Initial Value
00001~00032 10001~10032 (0x0000~0x001F)	DI CH0~CH31 Input Status	R	
30065~30066 40065~40066 (0x0040~0x041)	DI CH0~CH31 Input Status (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	

The address can be used to read digital input channel status

4.1.5.3 Read/Clear the Digital Input Counter

Address	Function	R/W	Initial Value
000145~000176 (0x0090~0x00AF)	DI CH0~CH31 Counter Clear	W	0
30001~30032 40001~40032 (0x0000~0x001F)	DI CH0~CH31 DI Counter Value	R	0
40137~40138 (0x0088~0x0089)	DI CH0~CH31 Counter Edge Define (Each bit map to corresponding channel) 1=rising edge 0=falling edge	R/W	0
40077~40078 (0x004C~0x004D)	DI CH0~CH31 Counter Clear (Each bit map to corresponding channel) Note: This Address is available after V1.02	W	0

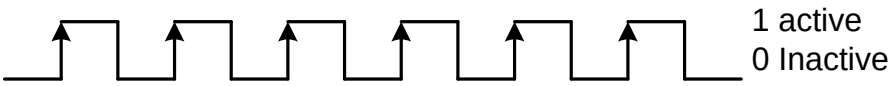
Module has the function of counting the external pulse number of the digital signal. The maximum frequency must be less than 100Hz.

Refer following description for how counter works:

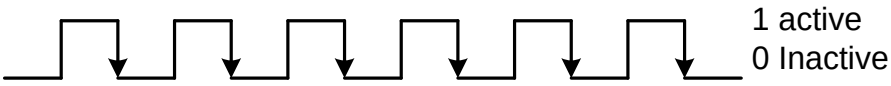
When Input Active Value Define is 0:

External signal：

Rising edge counter:



Falling edge counter:

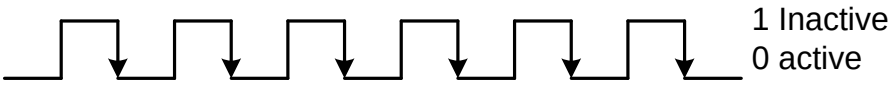


When Input Active Value Define is 1:

External signal：

Rising edge counter:

Falling edge counter:



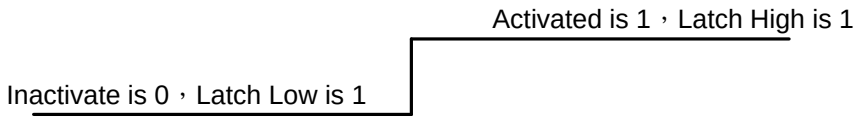
4.1.5.4 Read/Clear Latch Status

Address	Function	R/W	Initial Value
00033~00064 (0x0020~0x003F)	DI CH0~CH31 Latch High Value	R	0
00065~00096 (0x0040~0x005F)	DI CH0~CH31 Latch Low Value	R	0
000129 (0x0080)	DI CH0~CH31 Latch Clear	W	0
40069~40070 (0x0044~0x0045)	DI CH0~CH31 Latch High Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40073~40074 (0x0048~0x0049)	DI CH0~CH31 Latch Low Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear Note: This Address is available after V1.02	W	0

Module has the function of latch the external pulse of the digital signal.

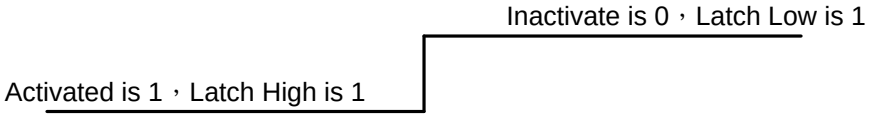
When Input Active Value Define is 0:

External signal:



When Input Active Value Define is 1:

External signal



4.1.6 Modbus Address

4.1.6.1 AD-DI-16 Modbus Address

Coil (0xxxx) / (1xxxx)

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

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

Address	Function	R/W	Initial Value
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 DI Counter Value	R	0
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to corresponding channel)	R V1.02	
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to corresponding channel)	R V1.02	0
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to corresponding channel)	R V1.02	0
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to corresponding channel)	W V1.02	0
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear	W V1.02	0

<table>
<tr><td>40129
(0x0080)</td><td>DI CH0~CH15 Input Active Value Define
0x0000: input value 0 for non-signal;
0x0001: input value 1 for non-signal;</td><td>R/W</td><td>0</td></tr>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH15 Counter Edge Define
(Each bit map to corresponding channel)
1=rising edge 0=falling edge</td><td>R/W</td><td>0</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><td>High Byte</td><td>Low Byte</td></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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting : 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</td></tr>
</table>

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

4.1.6.2 AD-DI-32 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00001~00032 10001~10032 (0x0000~0x001F)	DI CH0~CH31 Input Status	R	0
00033~00064 (0x0020~0x003F)	DI CH0~CH31 Latch High Value	R	0
00065~00096 (0x0040~0x005F)	DI CH0~CH31 Latch Low Value	R	0
000129 (0x0080)	DI CH0~CH31 Latch Clear	W	0
000145~000176 (0x0090~0x00AF)	DI CH0~CH31 Counter Clear	W	0

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

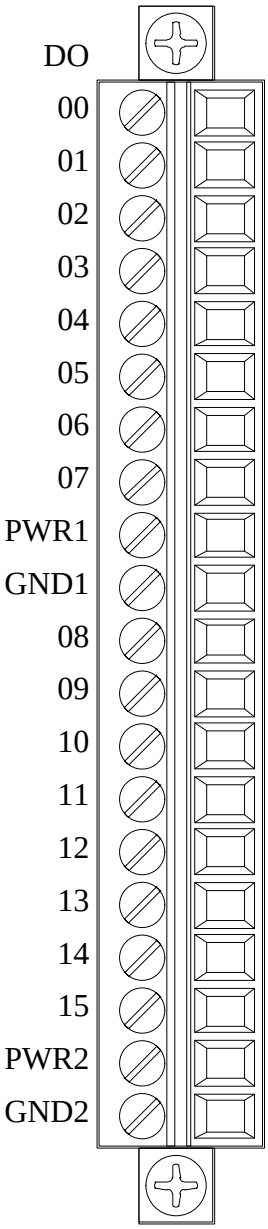
Address	Function	R/W	Initial Value
30001~30032 40001~40032 (0x0000~0x001F)	DI CH0~CH31 DI Counter Value	R	0
30065~30066 40065~40066 (0x0040~0x041)	DI CH0~CH31 Input Status (Each bit map to corresponding channel)	R V1.02	
40069~40070 (0x0044~0x0045)	DI CH0~CH31 Latch High Value (Each bit map to corresponding channel)	R V1.02	0
40073~40074 (0x0048~0x0049)	DI CH0~CH31 Latch Low Value (Each bit map to corresponding channel)	R V1.02	0
40077~40078 (0x004C~0x004D)	DI CH0~CH31 Counter Clear (Each bit map to corresponding channel)	W V1.02	0
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear	W V1.02	0
40129 (0x0080)	DI CH0~CH31 Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0

<table>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH31 Counter Edge Define
(Each bit map to corresponding channel)
1=rising edge 0=falling edge</td><td>R/W</td><td>0</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><td>High Byte</td><td>Low Byte</td></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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting : 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>
</table>

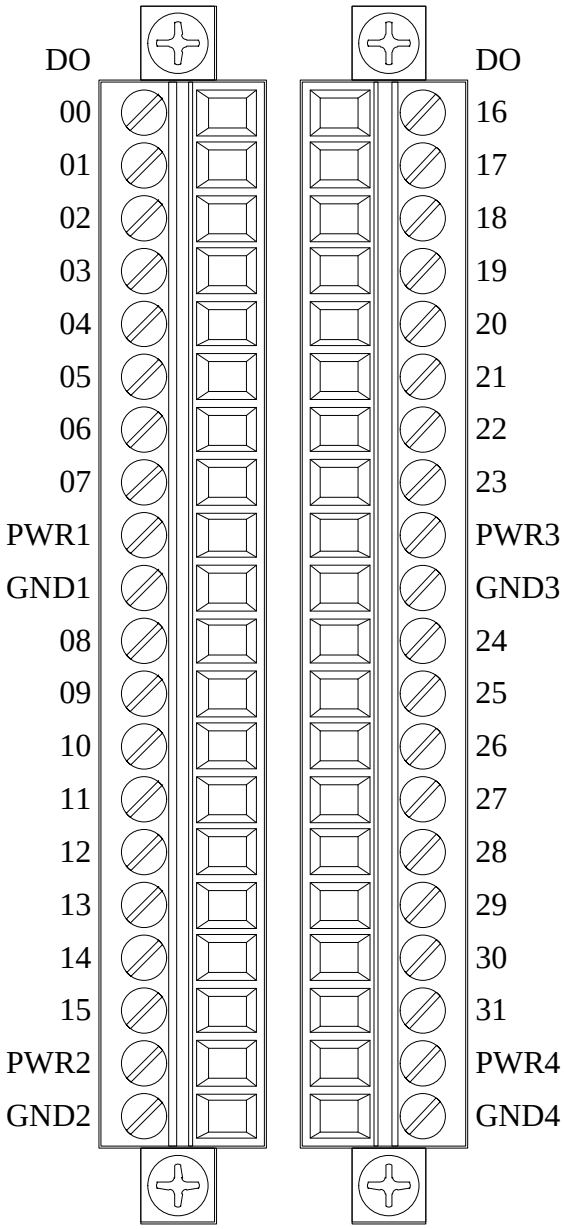
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

4.2 AD-DO-16/32 16/32-Channel Digital Output Module

4.2.1 Terminal Assignment

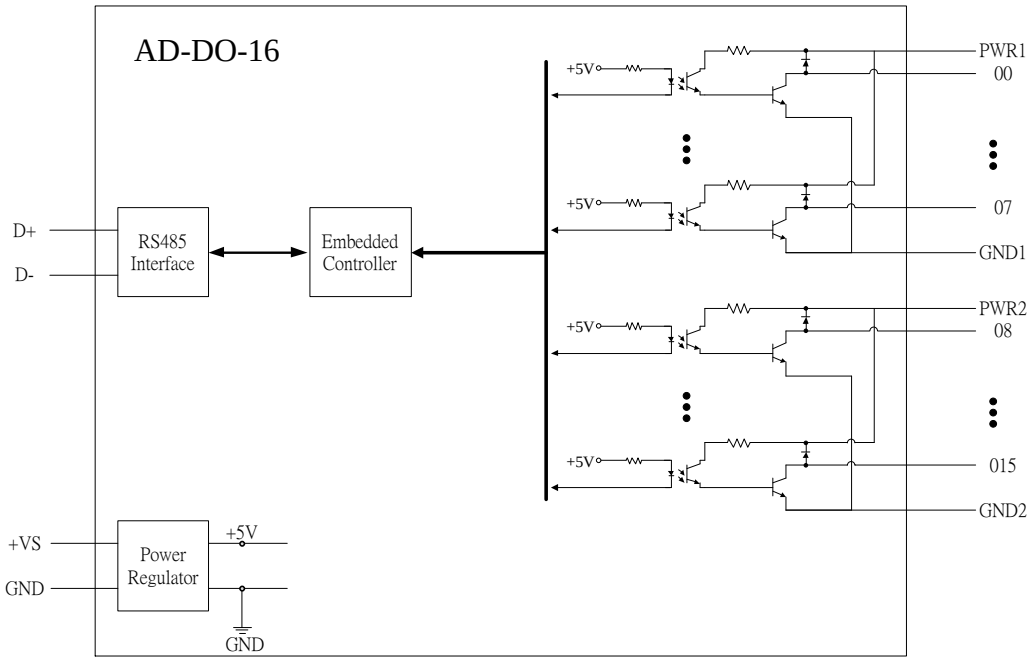


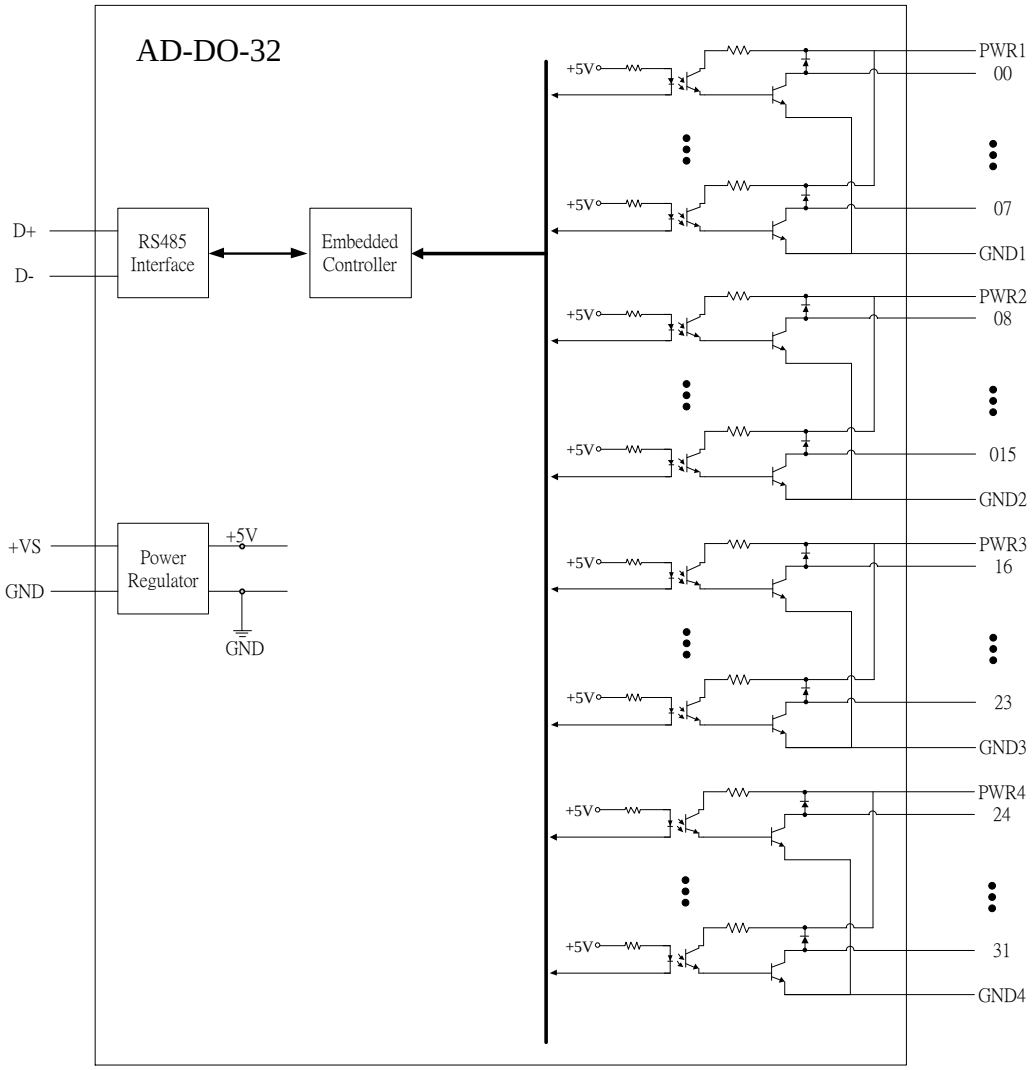
AD-DO-16



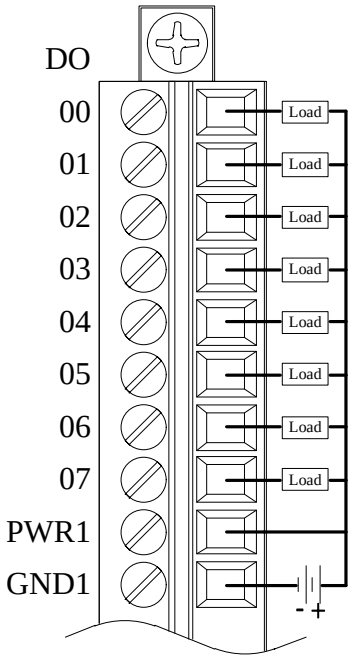
AD-DO-32

4.2.2 Block Diagram





4.2.3 Channel Connecting



4.2.4 IO Specifications

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

4.2.5 Related Reference

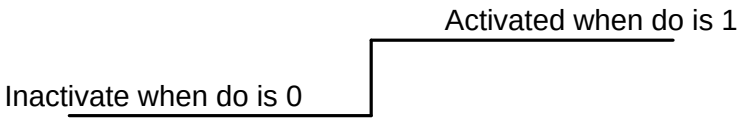
4.2.5.1 Digital Output Active State

Address	Function	R/W	Initial Value
40385 (0x0180)	Digital Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	All 0x0000

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 inactivate; when 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.

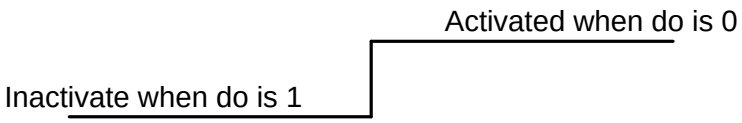
When Output Active Value Define is 0:

Digital output



When Output Active Value Define is 1

Digital output



4.2.5.2 Digital Output Status

Address	Function	R/W	Initial Value
00257~00288 (0x0100~0x011F)	DO CH0~CH31 Output Status	R/W	-
40321~40322 (0x0140~0x0141)	DO CH0~CH31 Output Status (Each bit map to corresponding channel) Note: This Address is available after V1.02	R/W	

The address can be used to read digital output status

4.2.5.3 Power-on Value

Address	Function	R/W	Initial Value
40257~40258 (0x0100~0x0101)	DO CH0~CH31 Power On Value (Each bit map to corresponding channel)	R/W	0

Module has the function of power-on value. The address can be used to configure the power-on value for all channel.

4.2.5.4 Host Watchdog Timer

Address	Function	R/W	Initial Value
40259~40260 (0x0102~0x0103)	DO CH0~CH31 Safety Output Value (Each bit map to corresponding channel)	R/W	0

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

4.2.6 Modbus Address

4.2.6.1 AD-DO-16 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00257~00272 (0x0100~0x010F)	DO CH0~CH15 Output Status	R/W	-

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

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH15 Power On Value (Each bit map to corresponding channel)	R/W	0
40259 (0x0102)	DO CH0~CH15 Safety Output Value (Each bit map to corresponding channel)	R/W	0
40321 (0x0140)	DO CH0~CH15 Output Status (Each bit map to corresponding channel)	R/W V1.02	0
40385 (0x0180)	DO CH0~CH15 Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	Watch dog timer (unit : 0.1s) Range: 0 ~ 0x00FF	R/W	0
44109 (0x100C)	System watch dog 0x0001: Enable 0x0000: Disable	R/W	0
44110 (0x100D)	Status of system watch dog 0x0001: Timeout 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

4.2.6.2 AD-DO-32 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00257~00288 (0x0100~0x011F)	DO CH0~CH31 Output Status	R/W	-

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

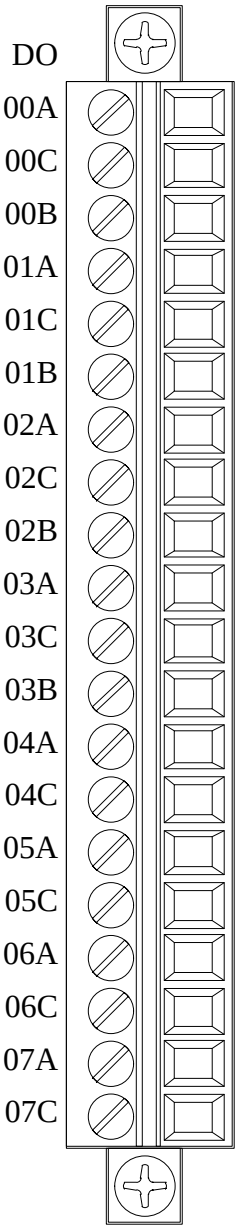
Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH31 Power On Value (Each bit map to corresponding channel)	R/W	0
40259 (0x0102)	DO CH0~CH31 Safety Output Value (Each bit map to corresponding channel)	R/W	0
40321~40322 (0x0140~0x0141)	DO CH0~CH31 Output Status (Each bit map to corresponding channel)	R/W V1.02	0
40385 (0x0180)	DO CH0~CH31 Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0
44097 0x1000	Firmware version 2 Bytes High Byte | Low Byte Main version | Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0

<table>
<tr><td>44107
(0x100A)</td><td>COM port setting : 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</td></tr>
</table>

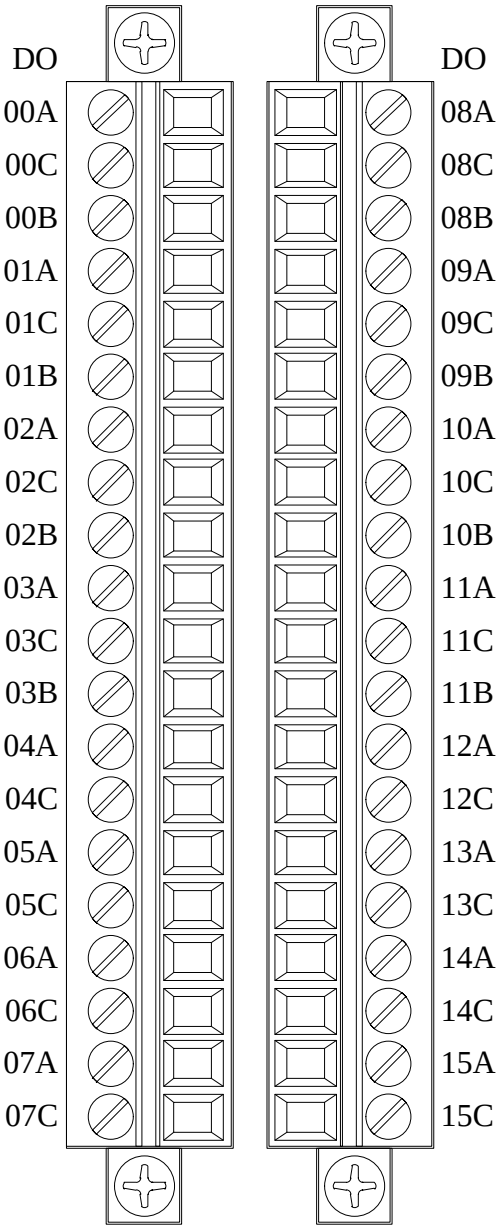
Note: If the “R/W” field has a marked version, which means that it is available after the marked version.

4.3 AD-RO-08/16 8/16-Channel Relay Output Module

4.3.1 Terminal Assignment

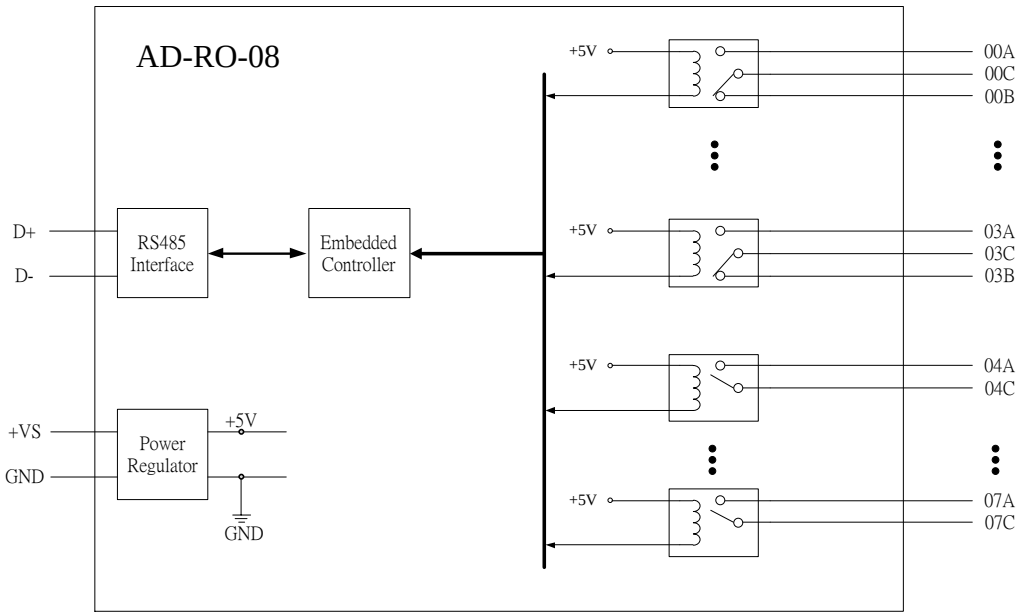


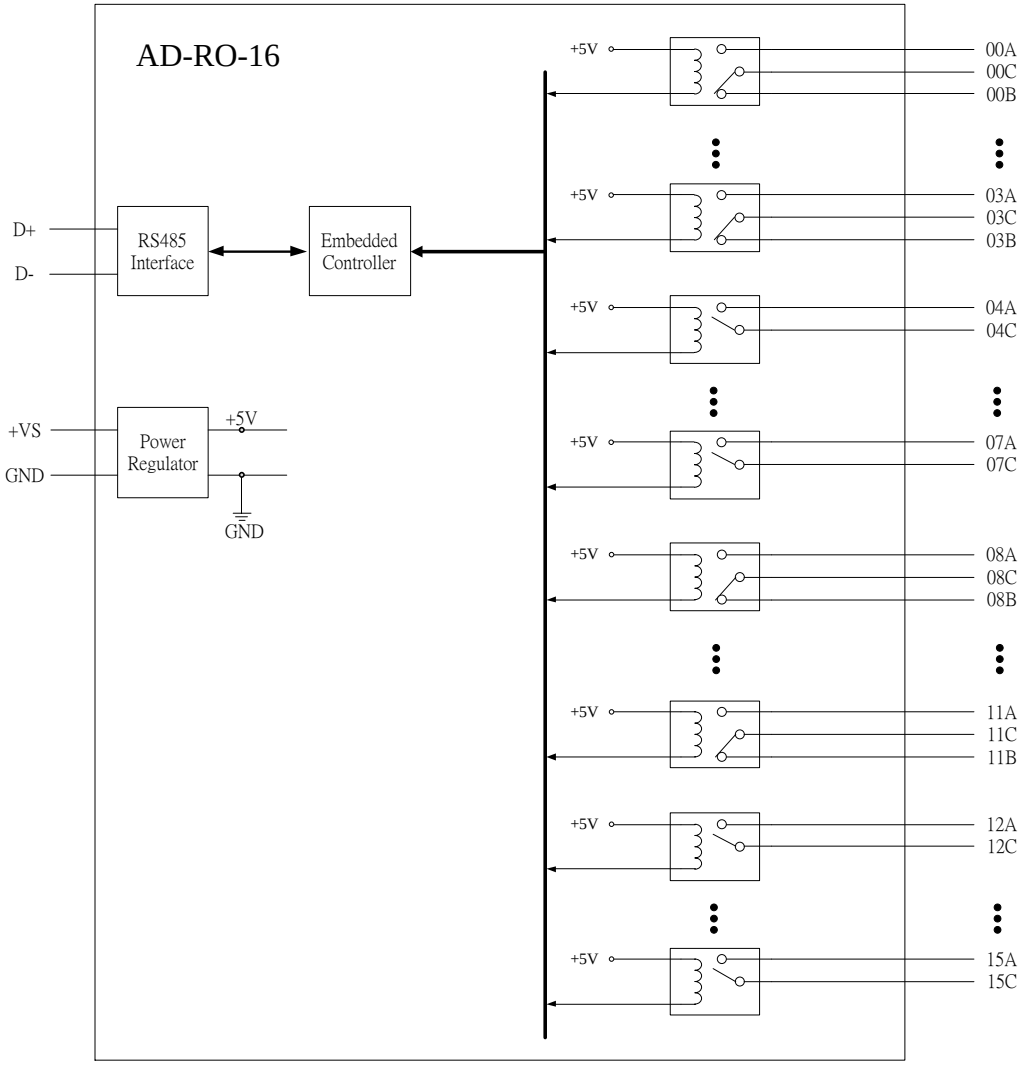
AD-RO-08



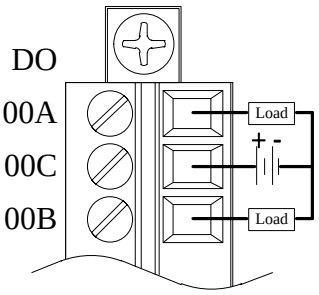
AD-RO-16

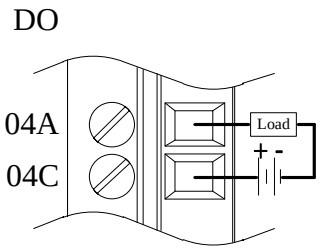
4.3.2 Block Diagram





4.3.3 Channel Connecting





4.3.4 IO Specifications

Digital Output	**AD-RO-08**	**AD-RO-16**
Relay Output Channels	4 Form A, 4 Form C	8 Form A, 8 Form C
Contact Rating	5A 250VAC/30VDC	
Dielectric Strength	3KV	
Operate Time	10ms Max.	
Relese Time	5ms Max.	
Electrical Endurance	$1x10^5$ops@3A 250VAC/30VDC	
Power Consumption	2.4W @ 24V	3.8W @ 24V

4.3.5 Related Reference

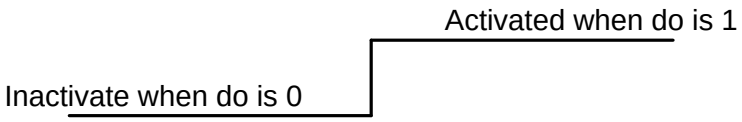
4.3.5.1 Digital Output Active State

Address	Function	R/W	Initial Value
40385 (0x0180)	Digital Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0

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 inactivate; when 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.

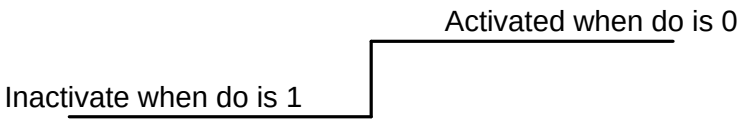
When Output Active Value Define is 0:

Digital output



When Output Active Value Define is 1

Digital output



4.3.5.2 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 corresponding channel) Note: This Address is available after V1.02	R/W	

The address can be used to read digital output status

4.3.5.3 Power-on Value

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH15 Power On Value (Each bit map to corresponding channel)	R/W	0

Module has the function of power-on value. The address can be used to configure the power-on value for all channel.

4.3.5.4 Host Watchdog Timer

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

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

4.3.6 Modbus Address

4.3.6.1 AD-RO-08 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00257~00264 (0x0100~0x0107)	DO CH0~CH7 Output Status	R/W	-

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

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH7 Power On Value (Each bit map to corresponding channel)	R/W	0
40259 (0x0102)	DO CH0~CH7 Safety Output Value (Each bit map to corresponding channel)	R/W	0
40321 (0x0140)	DO CH0~CH7 Output Status (Each bit map to corresponding channel)	R/W V1.02	0
40385 (0x0180)	DO CH0~CH7 Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0
44097 0x1000	Firmware version 2 Bytes High Byte: Main version; Low Byte: Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0
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)	Watch dog timer (unit : 0.1s) Range: 0 ~ 0x00FF	R/W	0
44109 (0x100C)	System watch dog 0x0001: Enable 0x0000: Disable	R/W	0
44110 (0x100D)	Status of system watch dog 0x0001: Timeout 0x0000: Normal	R/W	-
44111 (0x100E)	Counter of communication frame	R	0

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

4.3.6.2 AD-RO-16 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00257~00272 (0x0100~0x010F)	DO CH0~CH15 Output Status	R/W	-

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

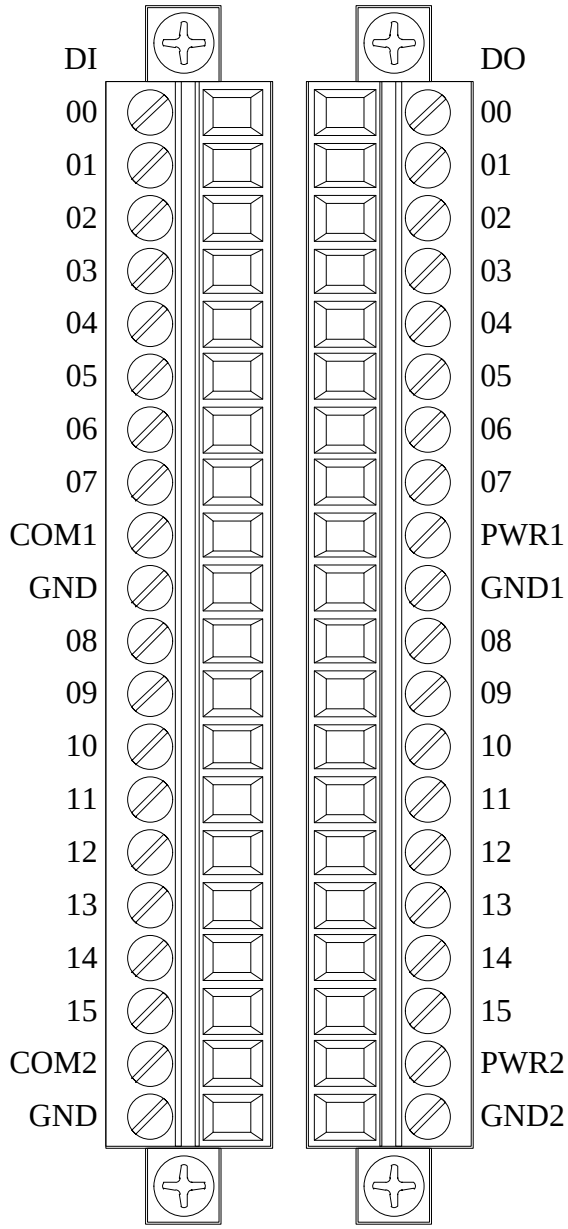
Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH15 Power On Value (Each bit map to corresponding channel)	R/W	0
40259 (0x0102)	DO CH0~CH15 Safety Output Value (Each bit map to corresponding channel)	R/W	0
40321 (0x0140)	DO CH0~CH15 Output Status (Each bit map to corresponding channel)	R/W V1.02	0
40385 (0x0180)	DO CH0~CH15 Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0
44097 0x1000	Firmware version 2 Bytes High Byte | Low Byte Main version | Sub-version	R	-
44098~44105 (0x1001~0x1008)	Module name 16 Bytes (16 ASCII char)	R	-
44106 (0x1009)	Modbus response delay time (unit: ms) Range: 0~30	R/W	0

<table>
<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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</td></tr>
</table>

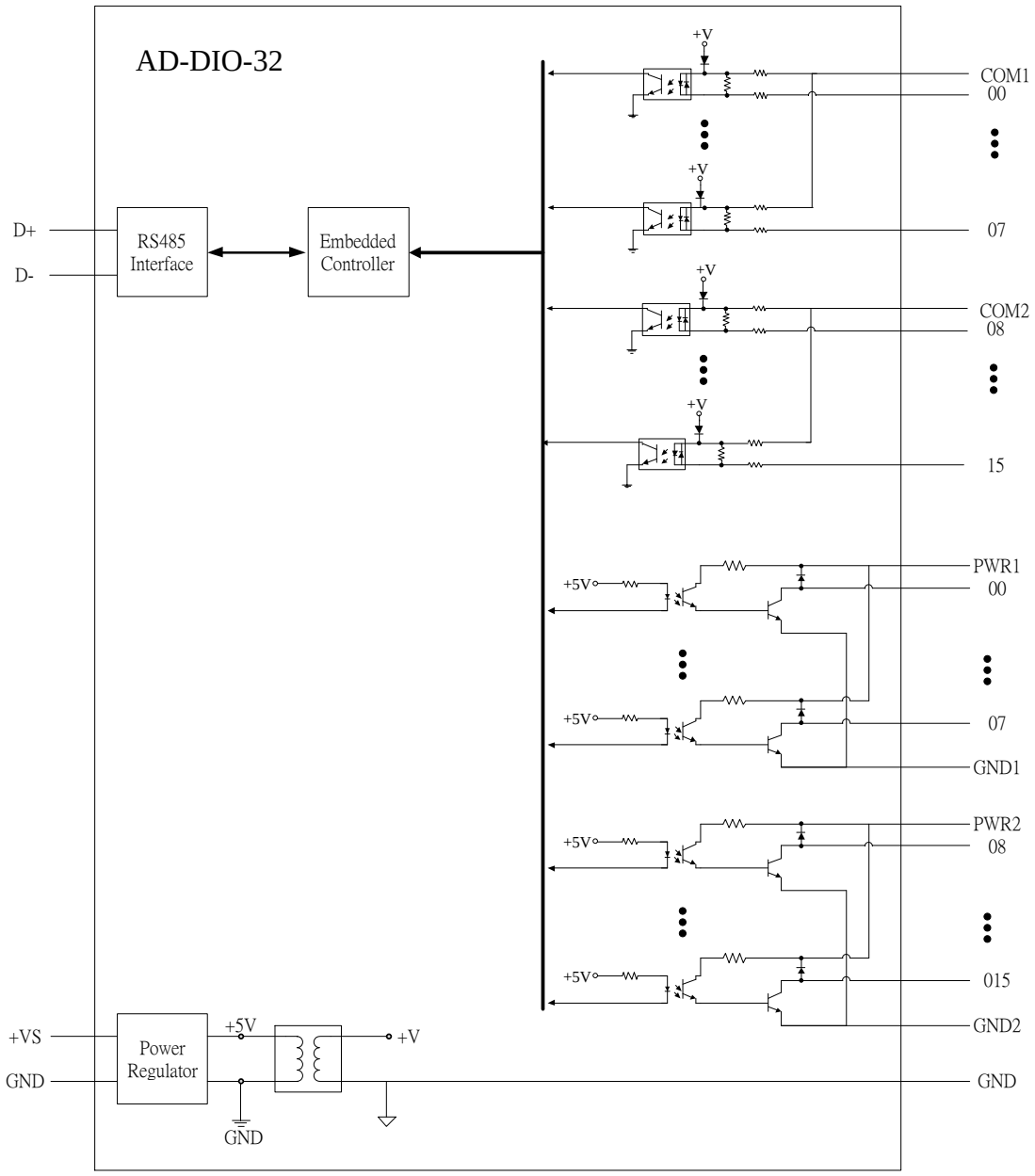
Note: If the “R/W” field has a marked version, which means that it is available after the marked version.

4.4 AD-DIO-32 16-Channel Digital Input/16-Channel Digital Output Module

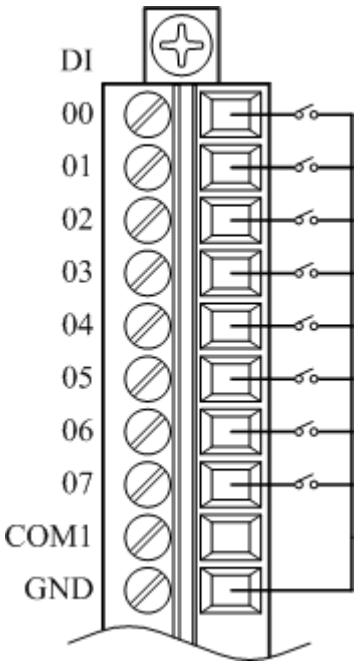
4.4.1 Terminal Assignment



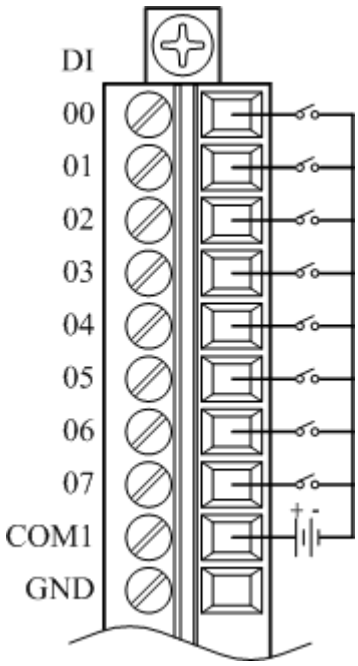
4.4.2 Block Diagram



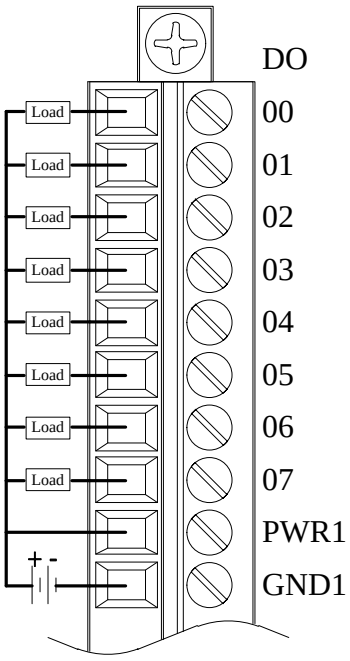
4.4.3 Channel Connecting



Dry Contact Connection



Wet Contact Connection



4.4.4 IO Specifications

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
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		1.6W @ 24V

4.4.5 Related Reference

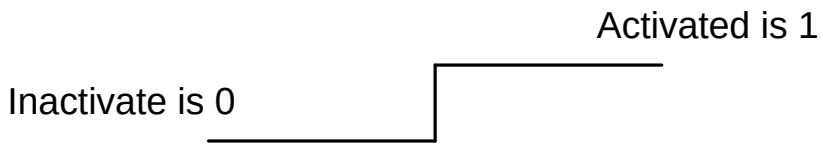
4.4.5.1 Digital Input Active State

Address	Function	R/W	Initial Value
40129 (0x0080)	Digital Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0

ADPower series digital module supports invert DI status, when setting is 0x0000, if the external signal is logic level high, the DI status is 1, if the external signal is logic level low, the reading value is 0; when setting is 0x0001, if the external signal s logic level high, the reading value is 0, if the external signal s logic level low, the DI status is 1.

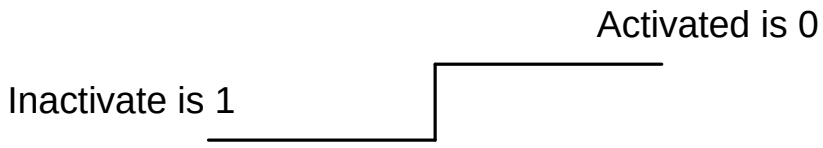
When Input Active Value Define as 0：

External signal:



When Input Active Value Define as 1:

External signal:



4.4.5.2 Digital Input Status

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	

The address can be used to read digital input channel status

4.4.5.3 Read/Clear the Digital Input Counter

Address	Function	R/W	Initial Value
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	0
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 DI Counter Value	R	0
40137 (0x0088)	DI CH0~CH15 Counter Edge Define (Each bit map to corresponding channel) 1=rising edge 0=falling edge	R/W	0
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to corresponding channel) Note: This Address is available after V1.02	W	0

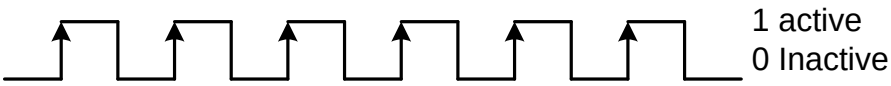
Module has the function of counting the external pulse number of the digital signal. The maximum frequency must be less than 100Hz.

Refer following description for how counter works:

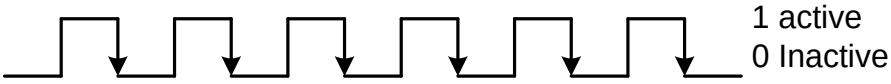
When Input Active Value Define is 0:

External signal：

Rising edge counter:



Falling edge counter:

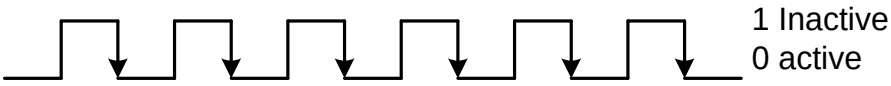


When Input Active Value Define is 1:

External signal：

Rising edge counter:

Falling edge counter:



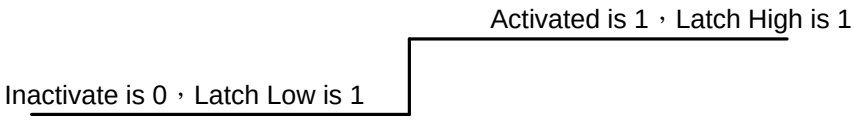
4.4.5.4 Read/Clear Latch Status

Address	Function	R/W	Initial Value
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	0
00065~00080 (0x0040~0x004F)	DI CH0~CH15 Latch Low Value	R	0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear Note: This Address is available after V1.02	W	0

Module has the function of latch the external pulse of the digital signal.

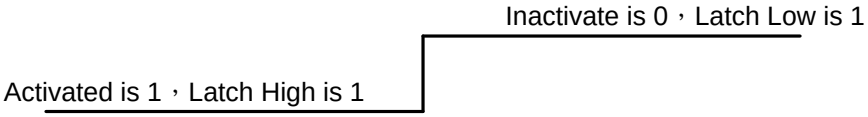
When Input Active Value Define is 0:

External signal:



When Input Active Value Define is 1:

External signal



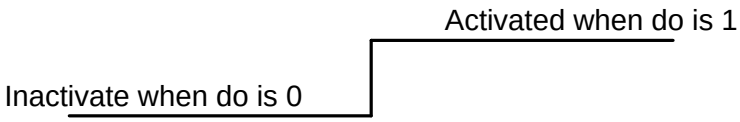
4.4.5.5 Digital Output Active State

Address	Function	R/W	Initial Value
40385 (0x0180)	Digital Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0

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 inactivate; when 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.

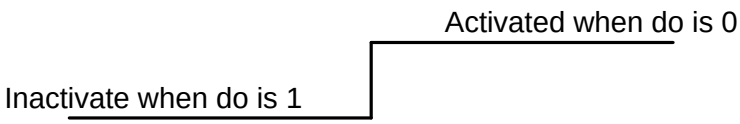
When Output Active Value Define is 0:

Digital output



When Output Active Value Define is 1

Digital output



4.4.5.6 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 corresponding channel) Note: This Address is available after V1.02	R/W	

The address can be used to read digital output status

4.4.5.7 Power-on Value

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH15 Power On Value (Each bit map to corresponding channel)	R/W	0

Module has the function of power-on value. The address can be used to configure the power-on value for all channel.

4.4.5.8 Host Watchdog Timer

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

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

4.4.6 Modbus Address

Coil (0xxxx) / (1xxxx)

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

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

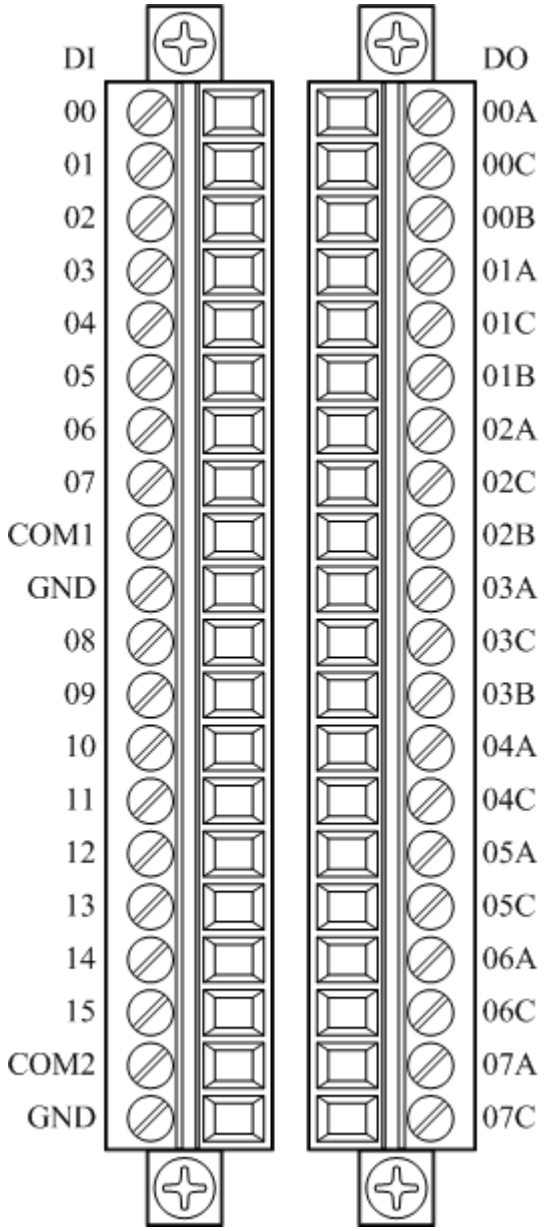
Address	Function	R/W	Initial Value
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 DI Counter Value	R	0
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to corresponding channel)	R V1.02	
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to corresponding channel)	R V1.02	0
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to corresponding channel)	R V1.02	0
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to corresponding channel)	W V1.02	0
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear	W V1.02	0
40129 (0x0080)	DI CH0~CH15 Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0

<table>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH15 Counter Edge Define
(Each bit map to corresponding channel)
1=rising edge 0=falling edge</td><td>R/W</td><td>0</td></tr>
<tr><td>40257
(0x0100)</td><td>DO CH0~CH15 Power On Value
(Each bit map to corresponding channel)</td><td>R/W</td><td>0</td></tr>
<tr><td>40259
(0x0102)</td><td>DO CH0~CH15 Safety Output Value
(Each bit map to corresponding channel)</td><td>R/W</td><td>0</td></tr>
<tr><td>40321
(0x0140)</td><td>DO CH0~CH15 Output Status
(Each bit map to corresponding channel)</td><td>R/W
V1.02</td><td>0</td></tr>
<tr><td>40385
(0x0180)</td><td>DO CH0~CH15 Output Active Value
0x0000: output value 1 for active;
0x0001: output value 0 for active;</td><td>R/W</td><td>0</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><td>High Byte</td><td>Low Byte</td></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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting : 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</td></tr>
</table>

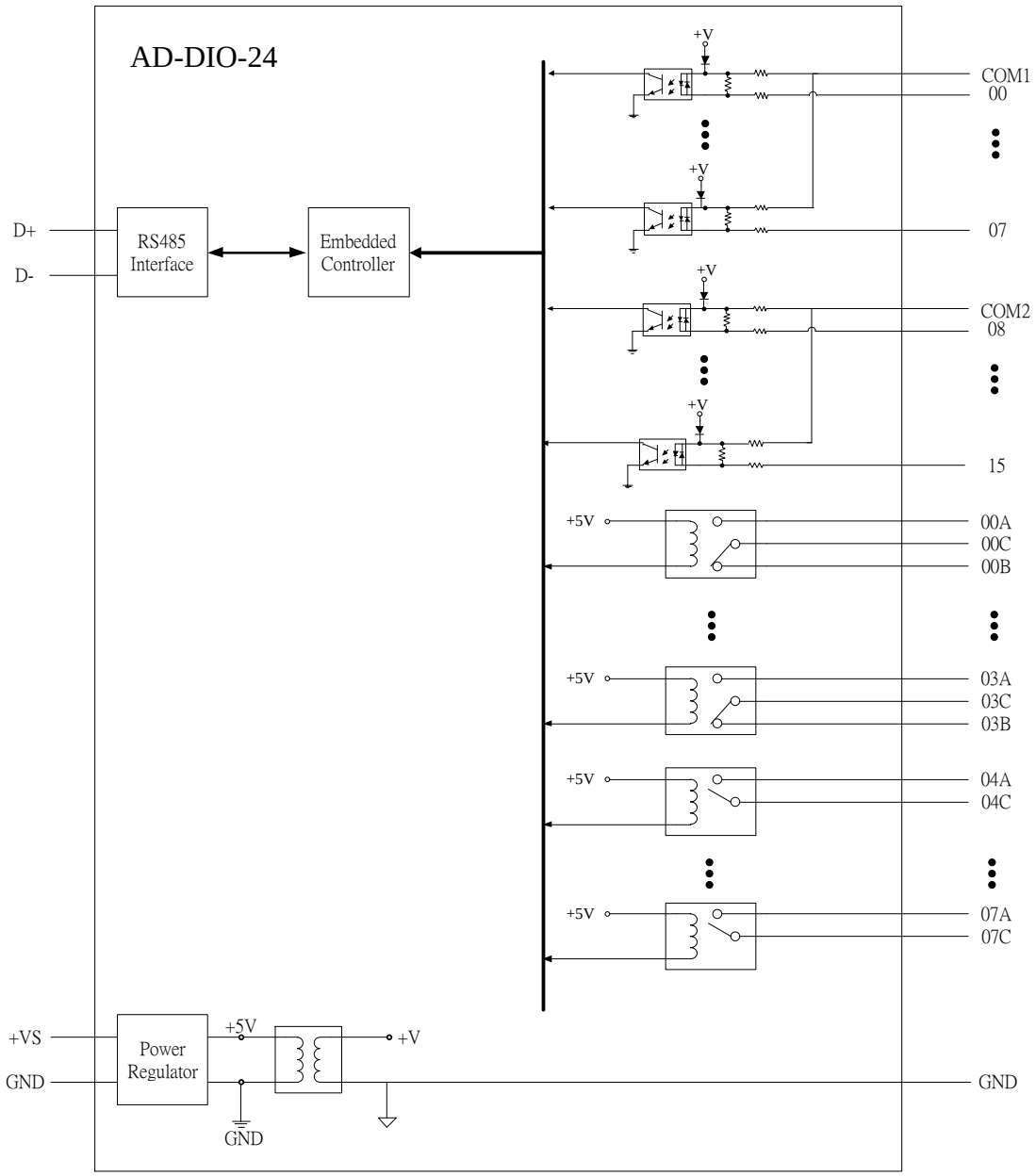
Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

4.5 AD-DIO-24 16-Channel Digital Input/8-Channel Relay Output Module

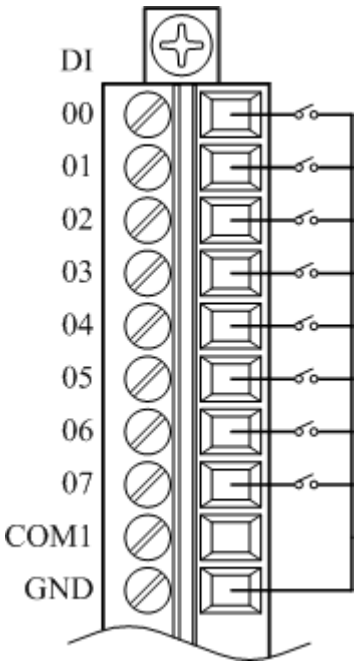
4.5.1 Terminal Assignment



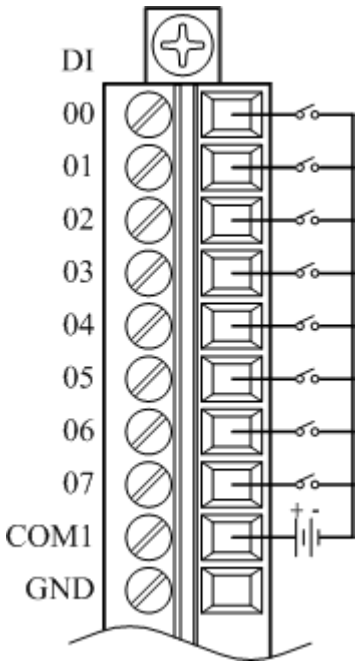
4.5.2 Block Diagram



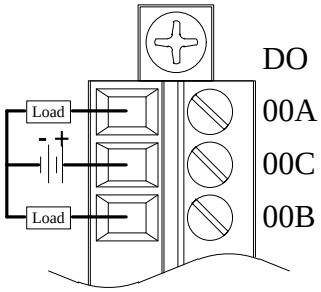
4.5.3 Channel Connecting

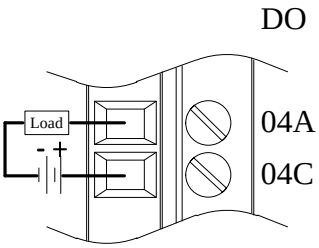


Dry Contact Connection



Wet Contact Connection





4.5.4 IO Specifications

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
Digital 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		2.8W @ 24V

4.5.5 Related Reference

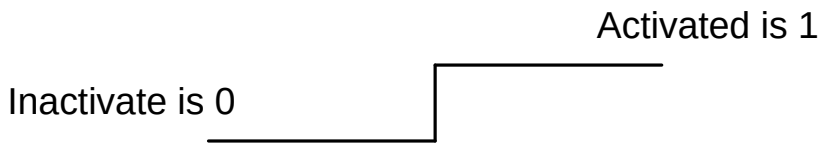
4.5.5.1 Digital Input Active State

Address	Function	R/W	Initial Value
40129 (0x0080)	Digital Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0

ADPower series digital module supports invert DI status, when setting is 0x0000, if the external signal is logic level high, the DI status is 1, if the external signal is logic level low, the reading value is 0; when setting is 0x0001, if the external signal s logic level high, the reading value is 0, if the external signal s logic level low, the DI status is 1.

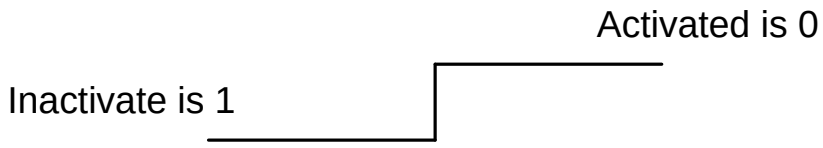
When Input Active Value Define as 0：

External signal:



When Input Active Value Define as 1:

External signal:



4.5.5.2 Digital Input Status

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	

The address can be used to read digital input channel status

4.5.5.3 Read/Clear the Digital Input Counter

Address	Function	R/W	Initial Value
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	0
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 DI Counter Value	R	0
40137 (0x0088)	DI CH0~CH15 Counter Edge Define (Each bit map to corresponding channel) 1=rising edge 0=falling edge	R/W	0
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to corresponding channel) Note: This Address is available after V1.02	W	0

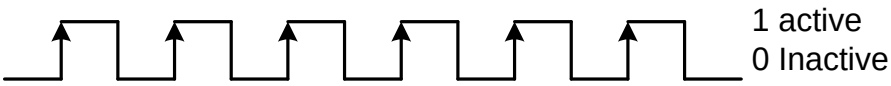
Module has the function of counting the external pulse number of the digital signal. The maximum frequency must be less than 100Hz.

Refer following description for how counter works:

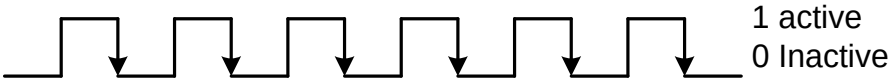
When Input Active Value Define is 0:

External signal：

Rising edge counter:



Falling edge counter:

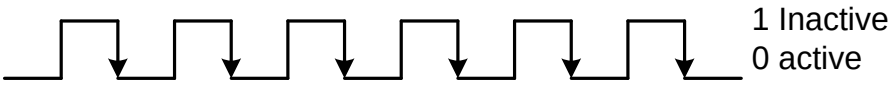


When Input Active Value Define is 1:

External signal：

Rising edge counter:

Falling edge counter:



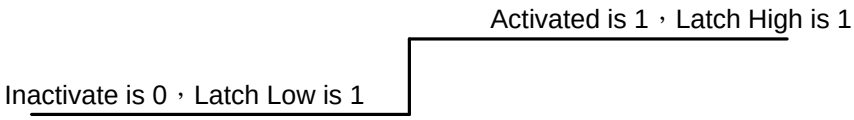
4.5.5.4 Read/Clear Latch Status

Address	Function	R/W	Initial Value
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	0
00065~00080 (0x0040~0x004F)	DI CH0~CH15 Latch Low Value	R	0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to corresponding channel) Note: This Address is available after V1.02	R	
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear Note: This Address is available after V1.02	W	0

Module has the function of latch the external pulse of the digital signal.

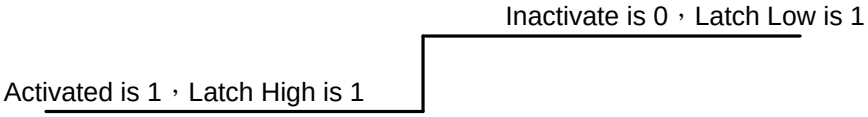
When Input Active Value Define is 0:

External signal:



When Input Active Value Define is 1:

External signal



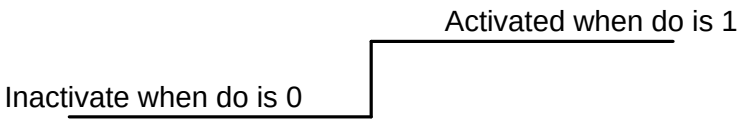
4.5.5.5 Digital Output Active State

Address	Function	R/W	Initial Value
40385 (0x0180)	Digital Output Active Value 0x0000: output value 1 for active; 0x0001: output value 0 for active;	R/W	0

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 inactivate; when 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.

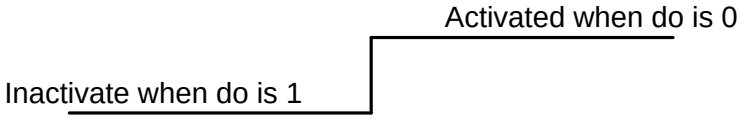
When Output Active Value Define is 0:

Digital output



When Output Active Value Define is 1

Digital output



4.5.5.6 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 corresponding channel) Note: This Address is available after V1.02	R/W	

The address can be used to read digital output status

4.5.5.7 Power-on Value

Address	Function	R/W	Initial Value
40257 (0x0100)	DO CH0~CH7 Power On Value (Each bit map to corresponding channel)	R/W	0

Module has the function of power-on value. The address can be used to configure the power-on value for all channel.

4.5.5.8 Host Watchdog Timer

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

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

4.5.6 Modbus Address

Coil (0xxxx) / (1xxxx)

Address	Function	R/W	Initial Value
00001~00016 10001~10016 (0x0000~0x000F)	DI CH0~CH15 Input Status	R	0
00033~00048 (0x0020~0x002F)	DI CH0~CH15 Latch High Value	R	0
00065~00080 (0x0040~0x004F)	DI CH0~C15 Latch Low Value	R	0
000129 (0x0080)	DI CH0~CH15 Latch Clear	W	0
000145~000160 (0x0090~0x009F)	DI CH0~CH15 Counter Clear	W	0
00257~00264 (0x0100~0x0107)	DO CH0~CH7 Output Status	R/W	-

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

Address	Function	R/W	Initial Value
30001~30016 40001~40016 (0x0000~0x000F)	DI CH0~CH15 DI Counter Value	R	0
30065 40065 (0x0040)	DI CH0~CH15 Input Status (Each bit map to corresponding channel)	R V1.02	
40069 (0x0044)	DI CH0~CH15 Latch High Value (Each bit map to corresponding channel)	R V1.02	0
40073 (0x0048)	DI CH0~CH15 Latch Low Value (Each bit map to corresponding channel)	R V1.02	0
40077 (0x004C)	DI CH0~CH15 Counter Clear (Each bit map to corresponding channel)	W V1.02	0
40113 (0x0070)	DI Latch Clear 0x01: DI Latch Clear	W V1.02	0
40129 (0x0080)	DI CH0~CH15 Input Active Value Define 0x0000: input value 0 for non-signal; 0x0001: input value 1 for non-signal;	R/W	0

<table>
<tr><td>40137
(0x0088)</td><td>DI CH0~CH15 Counter Edge Define
(Each bit map to corresponding channel)
1=rising edge 0=falling edge</td><td>R/W</td><td>0</td></tr>
<tr><td>40257
(0x0100)</td><td>DO CH0~CH7 Power On Value
(Each bit map to corresponding channel)</td><td>R/W</td><td>0</td></tr>
<tr><td>40259
(0x0102)</td><td>DO CH0~CH7 Safety Output Value
(Each bit map to corresponding channel)</td><td>R/W</td><td>0</td></tr>
<tr><td>40321
(0x0140)</td><td>DO CH0~CH7 Output Status
(Each bit map to corresponding channel)</td><td>R/W
V1.02</td><td>0</td></tr>
<tr><td>40385
(0x0180)</td><td>DO CH0~CH7 Output Active Value
0x0000: output value 1 for active;
0x0001: output value 0 for active;</td><td>R/W</td><td>0</td></tr>
<tr><td>44097
0x1000</td><td>Firmware version 2 Bytes<table><tr><td>High Byte</td><td>Low Byte</td></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: ms)
Range: 0~30</td><td>R/W</td><td>0</td></tr>
<tr><td>44107
(0x100A)</td><td>COM port setting : 2bytes<table><tr><td>High Byte</td><td>Low Byte</td></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>0</td></tr>
<tr><td>44109
(0x100C)</td><td>System watch dog
0x0001: Enable 0x0000: Disable</td><td>R/W</td><td>0</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>0</td></tr>
</table>

Note: If the "R/W" field has a marked version, which means that it is available after the marked version.

Chapter 5. FAQ

If you have difficulty in using ADPower Series module, please look up the related information in this manual. Shall you have any unsolved issues, comment or suggestion, please visit our website and contact us. With the greatest enthusiasm and endeavor, we will be always ready to serve you.
Website: http://www.adtek.com.tw

5.1 Communication

If you failed in communicating with the module, please proceed with the following 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 command from the host.
3. Under permissive conditions, other equipment may also be used to detect whether the host PC can be communicate with a normal communication protocol which 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. (please download the software via ADTEK official site. http://www.adtek.com.tw) .
5. Setup the module into INIT mode, and have it communicate with the following parameters: address number **01**, serial transmission rate is 9600bps, no parity bit and the communication protocol is Modbus.

5.2 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 storage in Memory, please use Utility software to check it or reset it to INIT mode.

Please refer to 2.1.11 (Factory Reset) to solve I/O module abnormality.