

Multi-channel 4-20mA Data Acquisition Module, RS485/232 Output, ASCII Command Set or Modbus RTU Channel to Channel High Isolation

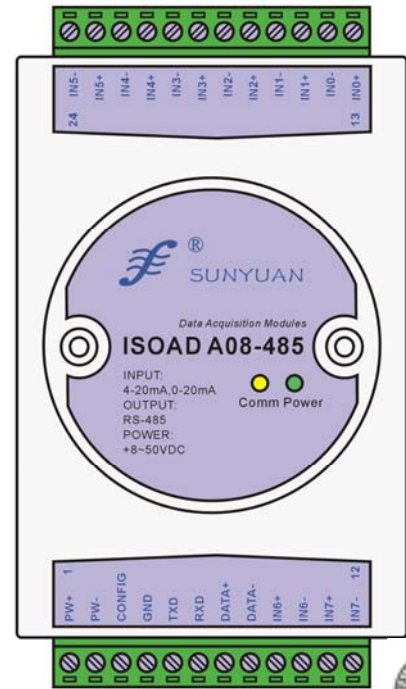
ISOAD is designed for sensor-to-host data acquisition, suit for collecting analog signal for detection or controlling of remote equipment. Using the latest passive isolation technology, signal channels are isolated to each other and the anti-interference capability is greatly enhanced.

The device includes power supply isolation, channels' isolation, A/D converter and RS-485 module. Each serial port can transfer a maximum of 255 ISOAD A08 Series modules support two types of communication protocol, command set and MODBUS RTU. The Command set is compatible with the ADAM modules. Baud rate can be set by codes, can work with modules made by other manufacturer.

All the configures and protocol info are stored in EEPROM.

ISOAD A08 Series follow industry-standard design, manufacture, each channel / output /power supply bear 3000VDC isolation voltage.

Operating temperature range - 45 °C ~ +80 °C.



- **Reliable Isolated Signals**

Up to 8 channel Isolation, ensure that no disturbance happen between them.

- **High Accuracy**

Distortion < 0.05%

- **Flexible Power Supply**

Universal Power Supply: 8-50VDC

- **Multi-port Isolation**

The design and high isolation level (3 kV) provides protection for service personnel and downstream devices against impermissibly high voltage

- **Flexible Config**

Program Calibration

Pre-defined ASCII protocol or Modbus-RTU. Choose by codes when use.

0-255 Address

Baud rate: 300、600、1200、2400、4800、9600、19200、38400bps, choose when use

- **Easy to use**

Compact DIN rail Mounting

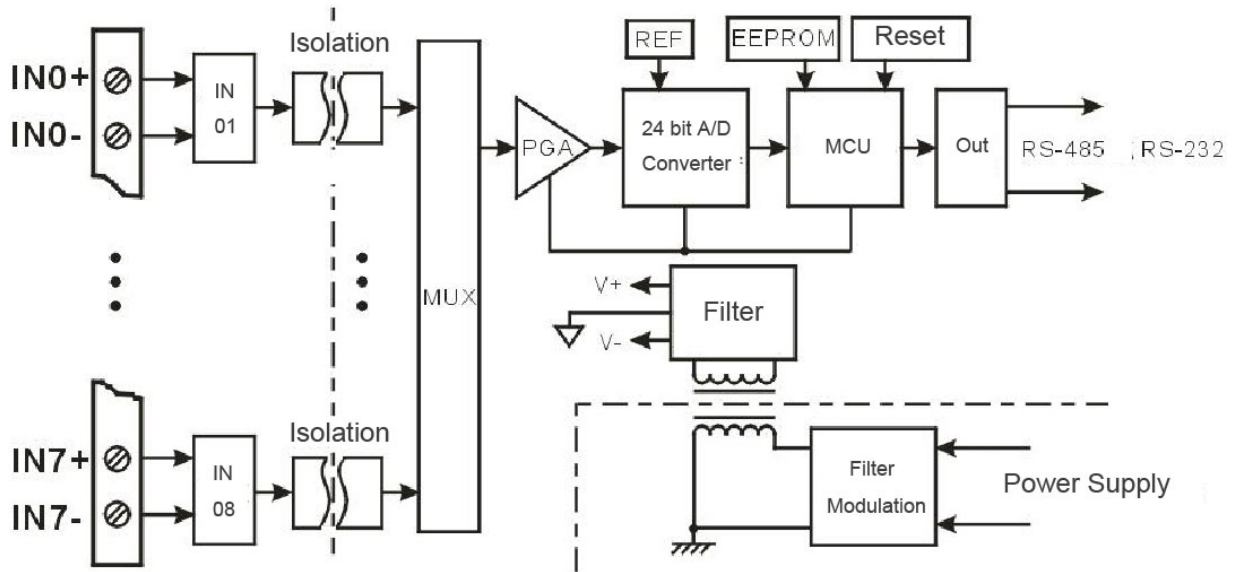
- **Safe**

±15KV ESD Protection to Ports.

ANSI/IEEE C37.90.1-1989 Momentary protection



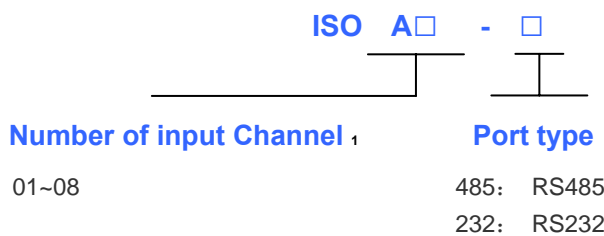
Block Diagram



General Function:

- Input: 8-channel 4-20mA input, calibrated before delivery. Channels isolate with each other. User can re-calibrate if needed.
- Communication:
 - Port: RS485 or RS232 serial port. Choose before order.
 - protocol: Pre-defined ASCII protocol or Modbus-RTU. Choose by codes when use.
 - Data format: 10bit. 1 start-bit, 8 data-bit, 1 end-bit
 - Address: 0-255
 - Baud rate: 300、600、1200、2400、4800、9600、19200、38400bps, choose when use
 - Transfer Distance: <1200 m, twists shiled cable
 - Port protection: ±15KV ESD
- Anti-distrubance: Set checksum according to need. Internal MOMENTARY bate diode protects the device from surge impulses. Internal digital filter also inhibit the grid frequency interference.

Ordering Information:



1: The number only determine how many input channels inside, all other terms (demension, functions, wiring diagram etc) remain the same.

Example

ISOAD A01-485	1 input channel	RS485 Output
ISOAD A06-232	6 input channel	RS232 Output

Params:

(typical @ +25°C, Vs is 24VDC)

Input:	4-20mA/0-20mA
Accuracy:	refer to diagram 2 below.
Input Maladjustment:	$\pm 0.1 \mu\text{A}/^\circ\text{C}$
Temperature Drift:	$\pm 15 \text{ ppm}/^\circ\text{C}$ ($\pm 30 \text{ ppm}/^\circ\text{C}$ at Max)
Input Resistance:	$<250\Omega$
Bandwith:	-3 dB 10 Hz
Conversion Speed:	10 Sps
Common-Mode Rejection(CMR):	120 dB ($1\text{k}\Omega$ Source Imbalance @ 50/60 Hz)
Normal Mode Rejection (NMR):	60 dB ($1\text{k}\Omega$ Source Imbalance @ 50/60 Hz)
Input port protection:	ANSI/IEEE C37.90.1-1989 Momentary protection
Communication:	RS485 or RS232, ASCII protocol or Modbus-RTU, use define Baud rate, 0~255 address.
Response Time:	$<100 \text{ ms}$
Operation Power:	8-50VDC
Power consume:	$<1\text{W}$
Operation Temperature:	- 45 ~ +85 $^\circ\text{C}$
Operation Humidity:	10 ~ 90% (non-condensing)
StorageTemperature:	- 45 ~ +85 $^\circ\text{C}$
Storage Humidity:	10 ~ 95% (non-condensing)
Isolation:	3KVDC, 1 minute, leak current: 1mA
Impact Voltage Tolerance:	3KVAC, 1.2/50us(peak value)
Dimensions:	101 mm x 23 mm x 116.5 mm

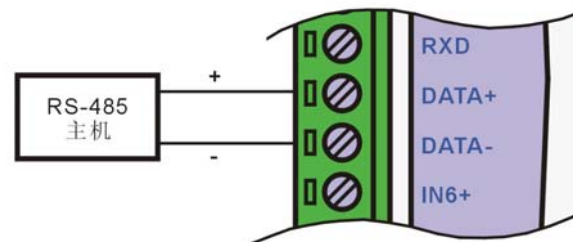
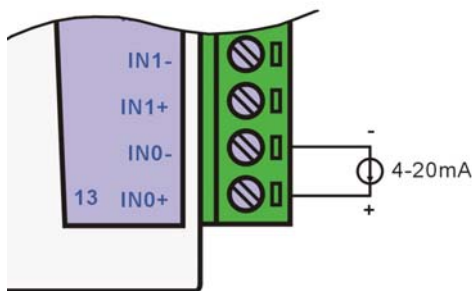
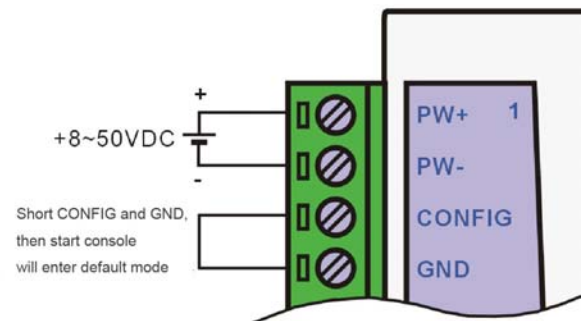
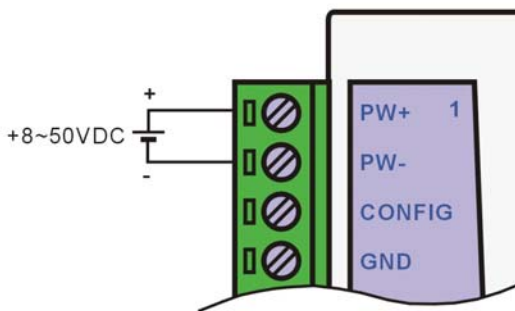
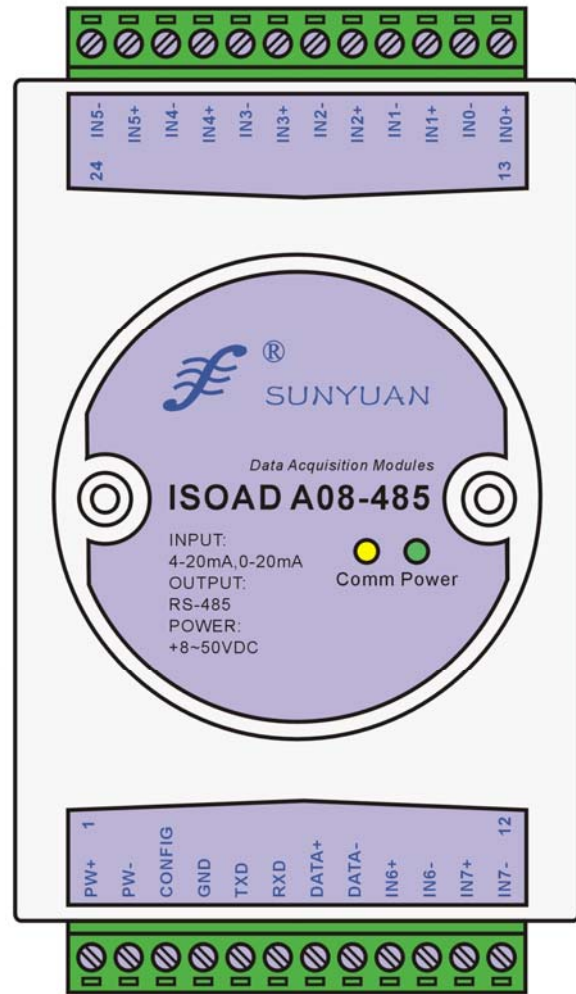
Diagram 2

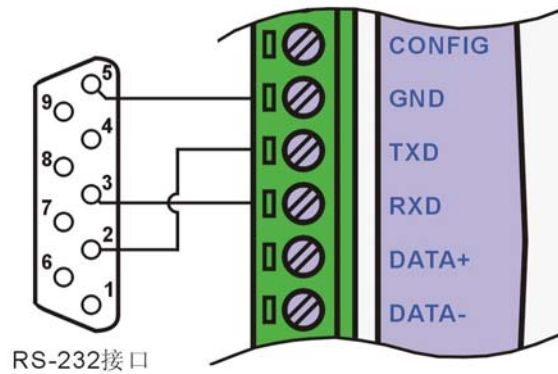
Input Range	Typical	Max	Peak to Peak
4-20 mA	$\pm 0.02 \% \text{ FS}$	$\pm 0.05 \% \text{ FS}$	$\pm 0.01 \% \text{ FS}$
0-20 mA	$\pm 0.02 \% \text{ FS}$	$\pm 0.05 \% \text{ FS}$	$\pm 0.01 \% \text{ FS}$

Since the input signal are used in isolation passive isolation technology, the input signal at near zero input conversion precision will be reduced, so 0-20mA input, the form of an accuracy of one input 0.2mA ~ 20mA (or 1% ~ 100%) accuracy at the time, and in the importation of 0mA ~ 0.2mA (that is, 0% ~ 1%), the accuracy of 0.5% FS.

Pin Discription and Link Guid:

Pin	Name	Discription
1	PW+	Power +
2	PW-	Power -
3	CONFIG	Config
4	GND	Output Ground
5	TXD	RS-232 send port
6	RXD	RS-232 receive port
7	DATA+	RS-485 +
8	DATA-	RS-485 -
9	IN6+	Channel 6 +
10	IN6-	Channel 6 -
11	IN7+	Channel 7 +
12	IN7-	Channel 7 -
13	IN0+	Channel 0 +
14	IN0-	Channel 0 -
15	IN1+	Channel 1 +
16	IN1-	Channel 1 -
17	IN2+	Channel 2 +
18	IN2-	Channel 2 -
19	IN3+	Channel 3 +
20	IN3-	Channel 3 -
21	IN4+	Channel 4 +
22	IN4-	Channel 4 -
23	IN5+	Channel 5 +
24	IN5-	Channel 5 -





Initialization:

Using with RS485, all ISOAD A08 modules should be assigned with unique address (00-FF). However all modules have same default setting in factory:

Address: 01

Baud rate: 9600bps

Checksum: disabled

So users have to set new and unique addresses for different modules when implement them into the RS485 network. After linking the module with power supply and RS485 cable, use commands to change the module's address. This job is done one module by one module. Users can change Baud rate, Check sum and protocol. Enter default mode to make these changes.

To enter default mode, first short link PIN Config and PIN GND, then connect power supply. In this mode, original config is:

Address: 00

Baud rate: 9600bps

Checksum: disabled

Now it is ready to change settings by commands. If users are going to use MODBUS RTU, please refer to detail descriptions later.

Command Set:

Every command is used of a series characters, such as leading code, address ID, command, checksum, end symbol (cr). Except "***" synchronous command, commands have effects on one module each time.

Command format: (Leading Code)(Addr)(Command)[data][checksum](cr)

(Leading Code) is the first letter of command. All commands need a leading code. such as: %, \$, #, @, ...

1 Character

(Addr) is module address code, default value range is 00~FF (hexadecimal), 2 Characters

(Command) represents command code or variable value Variable Length

[data] some output command need data Variable Length

[checksum] represents optional parameters, only need it when checksum is enabled. 2 Characters

(cr) terminating character, value is 0x0D 1-character

When checksum is enabled, [Checksum] is required. Command and response must append checksum characters. Checksum is used to check all input command, to help you find the errors between host computer and module. Calculating Method: two-character (hexadecimal), is the sum of all sending characters ASCII, then AND 0xFF.

Example: **Disable checksum**

command: \$002(cr)
response: !00020600 (cr)

Enable checksum

command: \$002B6 (cr)
response: !00020600 A9 (cr)
'\$' = 0x24 '0' = 0x30 '2' = 0x32
B6=(0x24+0x30+0x30+0x32) AND 0xFF
'!' = 0x21 '0' = 0x30 '2' = 0x32 '6' = 0x36
A9=(0x21+0x30+0x30+0x30+0x32+0x30+0x36+0x30+0x30) AND 0xFF

Analog Input Module Command Table:

- 1、 Read Analog Input Module Data
- 2、 Read Channels N Analog Input Module Data
- 3、 Set Module
- 4、 Read Set State
- 5、 Offset Calibration
- 6、 Span Calibration
- 7、 Read Module Name
- 8、 Enable/Disable Channle Commands
- 9、 Read Channle Status
- 10、 Choose Protocol

Response :

Response depends on all kinds of command. It is formed some characters, such as delimiter character, variable and carriage return sign. Its leading codes has '!' or '>', represents command is valid, '?' is invalid. So that can watch command whether is valid by testing response information.

Note: ALL COMMANDS SHOULD BE ISSUED IN UPPERCASE CHARACTERS! And make sure your command address is correct.

1、 Read Analog Input Data command

Describe: Returns the input value from a specified analog input module in the currently configured data format

Syntax: #AA(cr)

delimiter character

AA is (range 00-FF) represents the 2-character hexadecimal address of the module.

(cr) is the terminating character, carriage return (0Dh)

Response :

>(data)(cr) command is valid.

?AA(cr) invalid command or nonlicet operation

> delimiter character

(data) Returns data. The data format is in Engineering Units, Percent of FSR, Two's complement hexadecimal, or ohms. Refer to Chapter 4 Command Set.

(cr) terminating character, carriage return (0Dh)

There will be no response if the module detects a syntax error or communication error or if the specified address does not exist.

Example: command #23(cr)

Response >+04.765+04.756+04.632+04.000+05.001+06.000+08.800+16.000(cr)

The analog input module channel 0 is +04.765V , channel 1: +04.756V ,channel 2: +04.632V,channel 3: +04.836V channel 4 is +05.001V , channel 5: +06.000V ,channel 6: +08.800V,channel 7: +16.000V at adres 23H (Data formats is engineer units)

2、Read Channels N Analog Input Module Data

Describe: Returns the channels N input value from a specified analog input module in the currently configured data format

Syntax: #AAN(cr)

delimiter character

AA is (range 00-FF) represents the 2-character hexadecimal address of the module.

N channels code 0~3

(cr) is the terminating character, carriage return (0Dh)

Response :

>(data)(cr) command is valid.

?AA(cr) invalid command or nonlicet operation

> delimiter character

(data) Returns channel N data.The data format is in Engineering Units, Percent of FSR, Two's complement hexadecimal,or ohms. Refer to Chapter 3 Command Set.

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: command #232(cr)

Response >+04.632 (cr)

Channel 2 input signal is +04.632V at 23H (Data formats is engineer units)

3、Set Analog Input Module Command

Description:Set address,input ranges,baud rate,data formats,checksum and state for a analog input module, counter data are stored in a EEPROM.

Syntax: %AANNTCCFF(cr)

% delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

NN indicates new module hexadecimal adress,value NN range is 00-FF

TT hexadecimal indicates type code.ISO4014 must set 00

CC Baud Rate code (hexadecimal)

Baud rate code	Baud rate
01	300 baud
02	600 baud
03	1200 baud
04	2400 baud
05	4800 baud
06	9600 baud
07	19200 baud
08	38400 baud

Table 3 Baud rate code

FF (8-bit parameter) hexadecimalre presents data formats,checksum.

Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit2	Bit 1	Bit 0
------	-------	-------	-------	-------	------	-------	-------

Table 4 Data format,checksum

Bit7: Not used(set to 0)

Bit6: checksum states,if 0: Disabled,if 1: Enabled

Bit5-bit2: Not used(set to 0)

Bit1-bit0: Data Format Bit

00: Engineering Units

01: % of FSR

10: Twos complement hexadecimal

11: ohms

(cr) terminating character, carriage return (0Dh)

Response: !AA(cr) command is valid

?AA(cr) command is invalid or nonlicet operation, or do not set up line before changing baud rate or checksum

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(cr) terminating character, carriage return (0Dh)

If you configure module for the first time,AA=00、 NN equals to new address.If reconfigure module changing address,input range,data formats,AA equals to present or new address.If reconfigure module changing baud rate or checksum state, must install command string,make them in listening mode,module address is 00H,also AA=00H,NN=present or new address.

There will be no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: Command %0011050600(cr)

Response !11(cr)

Description: % delimiter character

00 indicates analog input module initial address that you want to set is 00H

11 indicates new module hexadecimal address is 11H

05 indicates input range:±2.5 V

06 indicates baud rate:9600 baud

00 indicates data format is Engineering Units, checksum is disabled

4、 Read Set State Command

Description: Read set for the specified a analog input module.

Syntax: \$AA2(cr)

\$ delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

2 indicates read set state command

(cr) terminating character, carriage return (0Dh)

Response: !AATTCCFF(cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character

AA represents input module address

TT Type Code,Table 5

CC Baud rate code,Table 3

FF Table 4

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: command \$302(cr)

Response !300F0600(cr)

- ! delimiter character
- 30 indicates analog input module address is 30H
- 0F indicates that input is K,testing range is 0°C~1000°C
- 06 represents that baud rate is 9600 baud
- 00 represents that data format is Engineering Units,disable checksum

5、 Offset Calibration Command

Description: Calibrates an analog input module to correct for offset errors

Syntax: \$AA1N(cr)

- \$ delimiter character
- AA module address, (range 00-FF) represents the 2-character hexadecimal
- 1 represents offset calibration command
- N channels code 0-3
- (cr) terminating character, carriage return (0Dh)

Response: ! AA (cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(cr) terminating character, carriage return (0Dh)

Products have been calibrated,user can use them directly.After calibrating offset command,then calibrate gain errors.

In order to successfully calibrate an analog input module's input range, a proper calibration input signal should be connected to the analog input module before and during the calibration. (See following Calibration information)

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

Example: command \$2310(cr)

Response !23 (cr)

Calibrate offset channel 0 at address 23H module.

6、 Span Calibration Command

Description: Calibrates an analog input module to correct for gain errors

Syntax: \$AA0N(cr)

- \$ delimiter character
- AA module address, (range 00-FF) represents the 2-character hexadecimal
- 0 represents gain calibration commandre
- N channels code 0-3
- (cr) terminating character, carriage return (0Dh)

Response: !AA(cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(cr) terminating character, carriage return (0Dh)

Products have been calibrated,user can use them directly.After calibrating offset command,then calibrate gain errors.

In order to successfully calibrate an analog input module's input range, a proper calibration input signal should be connected to the analog input module before and during the calibration. (See following Calibration information)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: command \$2303(cr)

Response !23 (cr)

Calibrate gain errors channel 3 at address 23H module.

7、Read Module Name Command

Description: Return the module name from the specified analog input module

Syntax: \$AAM(cr)

\$ delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

M represents Read module name command

(cr) terminating character, carriage return (0Dh)

Response: !AA(ModuleName)(cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(ModuleName) is ISO4011or ISO4012and so on, represents your module type

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: Command \$08M(cr)

Response !08ISOADA08 (cr)

Counter Module is ISOADA08 at adress 08H

8、Enable/Disable Channle Commands

Description: Enable/Disable specified analog input channel of a module

Syntax: \$AA5XY(cr)

\$ delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

5 command code

XY bit 3-0 of X represent Channel 7-4

bit 3-0 of Y represent Channel 3-0

1: enable 0: disable

(cr) terminating character, carriage return (0Dh)

Response: !AA (cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: Command \$08537(cr)

Response !08 (cr)

3 is 0011, Channel 4 and 5 will be enabled, 6 and 7 disabled. 7 is 0111, Channel 2, 1 and 0 is enabled, 3 is disabled.

9、Read Channle Status

Description: Return the enabled/disabled status of all channels of a module.

Syntax: \$AA6(cr)

\$ delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

6 command code

(cr) terminating character, carriage return (0Dh)

Response: ! !AAXY(cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

XY bit 3-0 of X represent Channel 7-4

bit 3-0 of Y represent Channel 3-0

1: enable 0: disable

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: Command \$186 (cr)

Response !18FF (cr)

0xFF is 1111 1111, means all channels are enabled.

10、Choose Protocol

Description: Choose ASCII command set or MODBUS RTU as operation protocol

Syntax: \$AAPV(cr)

\$ delimiter character

AA module address, (range 00-FF) represents the 2-character hexadecimal

P command code

V Protocol code. 0: ASCII command set; 1: MODBUS RTU

(cr) terminating character, carriage return (0Dh)

Response: ! !AA (cr) command is valid

?AA(cr) command is invalid or nonlicet operation

! delimiter character which indicates a valid command.

? delimiter character which indicates a invalid command.

AA represents input module address

(cr) terminating character, carriage return (0Dh)

There is no response if the module detects a syntax error or communication error or if the specified address does not exists.

Example: Command \$00P1(cr)

Response !00 (cr)

Choose MODBUS RTU

Input Range and Data Format:

Analog Input four data formats: 00: Engineering Units 01: % of FSR

10: Twos complement hexadecimal 11: ohms (only available for products made for thermal resistance)

Input Range	Data Formats	+F.S.	ZERO	Displayed Resolution
4~20mA	Engineering Units	+20.000	±04.000	1uA
	% of FSR	+100.00	±020.00	0.01%
	Twos complement hexadecimal	7FFFFFFF	199999	1LSB
0~20mA	Engineering Units	+20.000	±00.000	1uA
	% of FSR	+100.00	±000.00	0.01%
	Twos complement hexadecimal	7FFFFFFF	000000	1LSB

Example:

Input Range:±20mA,Output:4 -20mA

command #01(cr)

Engineering Units	Response	>+04.000(cr)
Percent of FSR	Response	>+020.00(cr)
Twos complement hexadecimal	Response	>199999(cr)

Calibration:

The device is already calibrated in factory and can be use directly.

Users can also re-calibrate the module.

In order to improve calibration precision,suggest to do as the following meters:

- 1、 Stable output,low noise DC voltage/current signal source
- 2、 High precision meter

Calibration Process:

1. Choose right input range,different input ranges need different calibration voltage
2. Input a right ZERO signal to analog input module channel of needing calibration
3. Send out offset calibration \$AA1N command to analog input module,after signal stable
4. Input a right SPAN signal to analog input module channel of needing calibration
5. Send out offset calibration \$AAON commandto analog input module,after signal stable
6. Finished

Use MODBUS RTU:

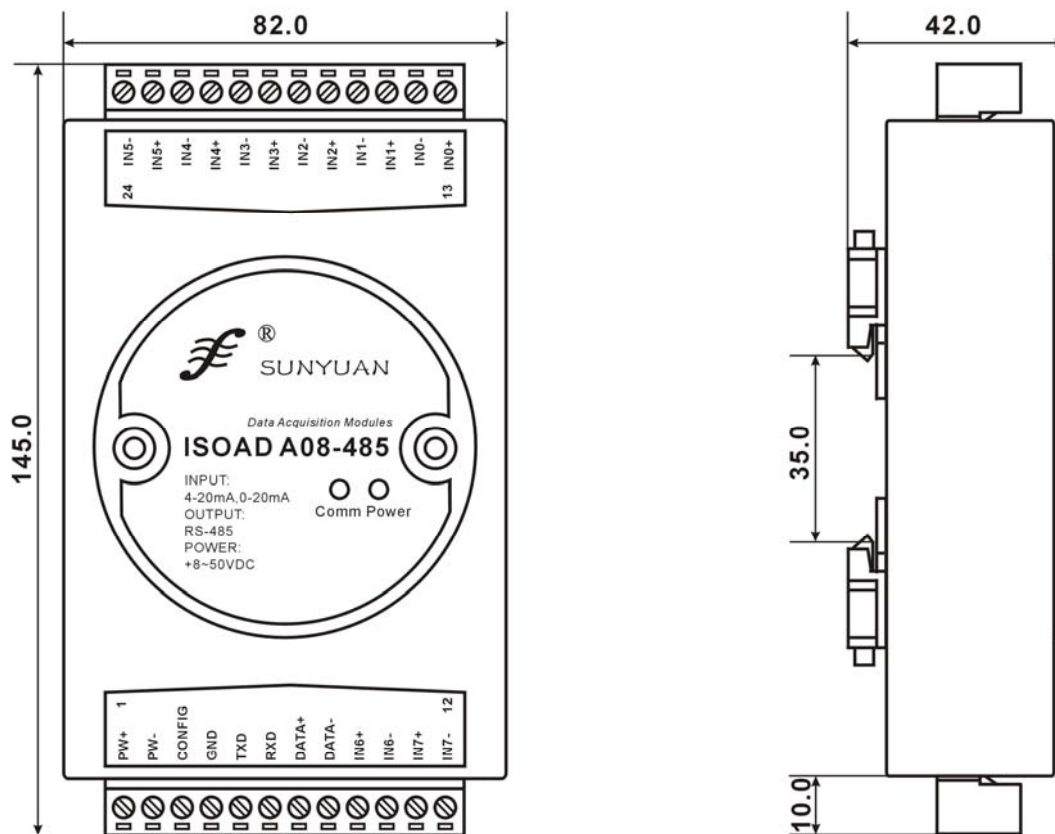
The device use ASCII command set as default protocol. To use MODBUS RTU, follow these step to change:

1. Short link CONFIG and GND
2. Correctly link Power and other cables
3. Switch on power supply.
4. Wait for the module to finish intialization, about 5 minutes
5. Send command \$00P1(cr), response should be !00(cr)
6. Switch off power supply
7. Device use MODBUS RTU protocol

Rigister Detail:

Addr 4X	Content	R/W	Description
40001	IN0	Read only	Received data of Channel 0
40002	IN1	Read only	Received data of Channel 1
40003	IN2	Read only	Received data of Channel 2
40004	IN3	Read only	Received data of Channel 3
40005	IN4	Read only	Received data of Channel 4
40006	IN5	Read only	Received data of Channel 5
40007	IN6	Read only	Received data of Channel 6
40008	IN7	Read only	Received data of Channel 7
40211	Device Name	Read only	Higher bits: 0x01 Lower bits: 0x08
40221	Channel Status	Read/Write	Higher bits: 0x00 Lower bits: Channel Status (0xFF)

Dimensions:



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