Channal isolated AD data acqusition module

After the data acquisition input channel is isolated, there will be no ground circulation and mutual interference

Features

- ●All input signal channels are fully isolated, with an isolation voltage of 3000VDC
- ● Data acquisition isolation and conversion to RS485/232 support Modbus RTU communication protocol
- ●The measurement accuracy is better than 0.05%, and the module accuracy can be programmed to calibrate
- ●Signal input/output isolation withstand voltage 3000VDC
- ●Low cost, small volume, modular design, convenient for desktop or rail installation
- ●Wide power supply range: 8 — 50VDC
- ●High reliability, convenient programming, easy installation and wiring
- ● The user can program the target module address, baud rate, etc.
- ●It can be monitored directly based on on-site data collection and display results

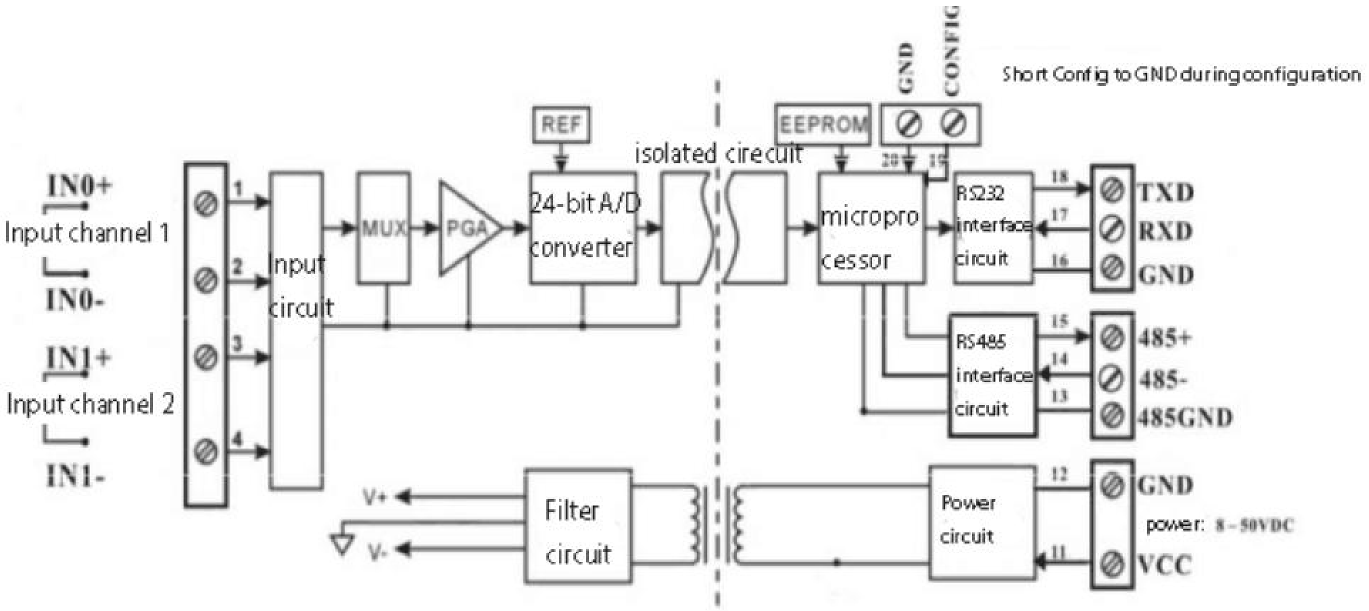
Application

- ● Industrial equipment operation measurement, monitoring and remote control
- ● Intelligent building control, security engineering and other automated system monitoring
- ● RS232/485 bus industrial automation system remote monitoring
- ● Sensor signal isolation conversion and long-term transmission
- ● Analog signal A/D conversion, adjustment and remote transmission
- ● Multi-channel operation data acquisition and recording in industrial field
- ● Development of medical and industrial control products
- ● Analog 4-20mA/0-10V acquisition isolation and transmission

Chapter 1 Overview

Sunyuan ISO AD series fully isolated analog to digital products (Adam module) can achieve signal safety isolation and high-precision data acquisition, isolation conversion, monitoring and transmission between multiple sensors and the host. Products are widely used in RS-232/485 bus industrial automation control systems, 4-20mA/0-10V signal measurement, monitoring and control, small signal measurement, industrial field signal isolation and long-distance transmission and other remote monitoring occasions. Through the configuration of the software,

A variety of sensor types can be connected, including current output type, voltage output type and so on.



1.ISOAD 02A two-channel isolated AD data acquisition module product principle block diagram

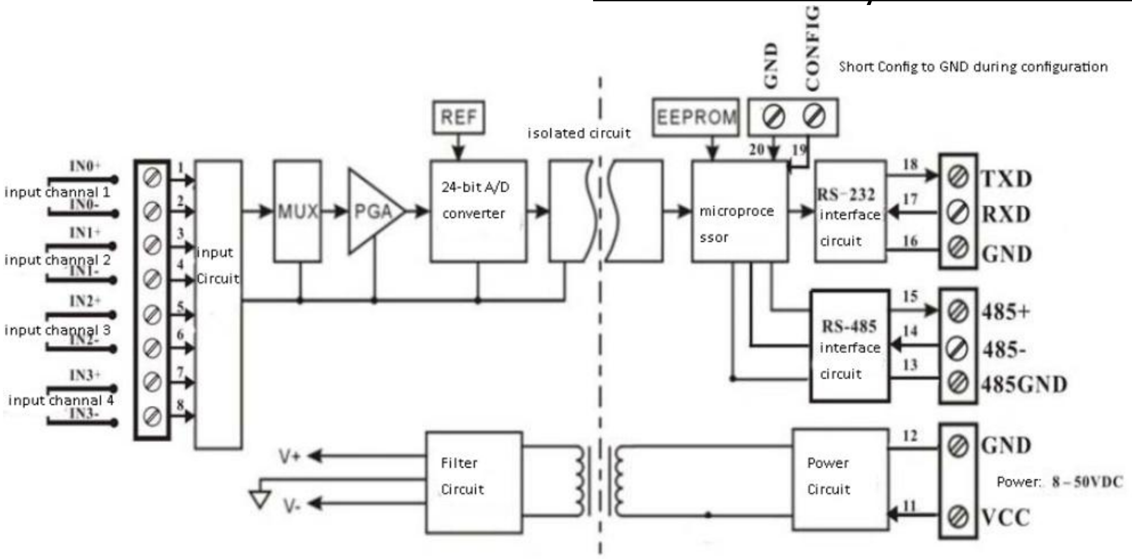


Figure 2 The functional block diagram of ISO AD 04A four-channel isolated AD data acquisition module

Introduction to ISO AD02/4A functions:

ISO AD02/4A channel isolated AD data acquisition module, which can be used to measure two (or four) current or voltage signals with completely independent input circuits. After each data acquisition input channel is isolated, it will not produce ground circulation and mutual interference. Meet the high-reliability performance needs of industrial field process control.

Analog signal input, 24-bit acquisition accuracy, all signal input ranges have been calibrated before the product leaves the factory. When in use, users can also easily program and calibrate by themselves. Please refer to the product selection for the specific current or voltage input range. When measuring two signals, the two input selections must be the same.

1. Communication protocol

Communication interface: 1 standard RS-485 communication interface and 1 standard RS-232 communication interface.

Communication protocol: Support two protocols, ASCII character protocol and MODBUS RTU communication protocol. Which communication protocol can be used by programming,

It can realize network communication with various brands of PLC, RTU or computer monitoring system.

Data format: 10 bits. 1 start bit, 8 data bits, 1 stop bit.

Communication address: (00H-FFH) and baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400bps) can be set; the longest distance of the communication network can reach 1200 meters, connected by twisted-pair shielded cable . The communication interface is designed with high anti-interference, ±15KV ESD protection, and the communication response time is less than 100mS.

2. Anti-interference

The checksum can be set as required. There are transient suppression diodes inside the module, which can effectively suppress various surge pulses, protect the module, and the internal digital filter can also suppress the power frequency interference from the power grid.

Model Selection

ISO AD 02(4)A -U(A)□

Isolation method
between channels
ISO:Isolation between channels
SY:non-isolated between CHN
（Common land）

Number of channels
02：2-channels
04：4-channels

Input voltage or current signal value

U1：0-5V	A1：0-1mA
U2：0-10V	A2：0-10mA
U3：0-75mV	A3：0-20mA
U4：0-2.5V	A4：4-20mA
U5：0-±5V	A5：0-±1mA
U6：0-±10V	A6：0-±10mA
U7：0-±100mV	A7：0-±20mA
U8：customize	A8：customize

Remarks: ISO means channel isolation, SY means channel non-isolation; AD means A/D acquisition and conversion module. The ISO AD module supports RS23 and RS485 communication interface output at the same time. The user can choose the corresponding communication interface according to the use environment, but only one of the two interfaces can work at the same time, otherwise it will cause interference.

Selection example 1: Model: ISO AD 02A-A4 Means two channels, 4-20mA signal input.

Selection example 2: Model: ISO AD 04A-A7　Means four channels, 0-±20mA signal input.
Selection example 3: Model: ISO AD 02A-U1　Means two channels, channel isolation, 0-5V signal input.

General parameters:

(typical @ +25℃，Vs is 24VDC)

Input type: current input / voltage input

Accuracy: 0.05%

Input offset: ±0.1 uA/℃

Temperature drift: ±15 ppm/℃ (±30 ppm/℃, maximum)

Input resistance：50Ω (4-20mA/0-20mA/0-±20mA Current input)
100Ω (0-10mA/0-±10mA Current input)
1KΩ (0-1mA/0-±1mA Current input)
Greater than 1MΩ (voltage input)

bandwidth：-3 dB 10 Hz

Conversion rate：10 Sps

Common Mode Rejection (CMR)：120 dB（1kΩ Source Imbalance @ 50/60 Hz）

Normal mode suppression (NMR)：60 dB（1kΩ Source Imbalance @ 50/60 Hz）

Input protection: overvoltage protection, overcurrent protection

communication　:Protocol RS-485 or RS-232 ASCII code character protocol and MODBUS RTU communication protocol
Baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400bps) can be configured by software
Address (00H~FFH) can be configured by software

Communication response time: 100 ms max

Power supply:　+8 — 50 VDC wide power supply range, internal anti-reverse connection and overvoltage protection circuit
Power consumption: Operating　Less than 1W
temperature:　- 45 — +80℃

Working humidity: 10 — 90% (no condensation)

Storage temperature:-55 — +85℃
Storage humidity: 10 — 95% (no condensation)

Isolation withstand voltage: between input / output or between channels: 3KVDC, 1 minute, leakage current 1mA
The output and power supply share the same ground.

Impact resistance voltage:　3KVDC, 1.2/50us (peak)

Dimensions:　123 mm x 70 mm x 30mm

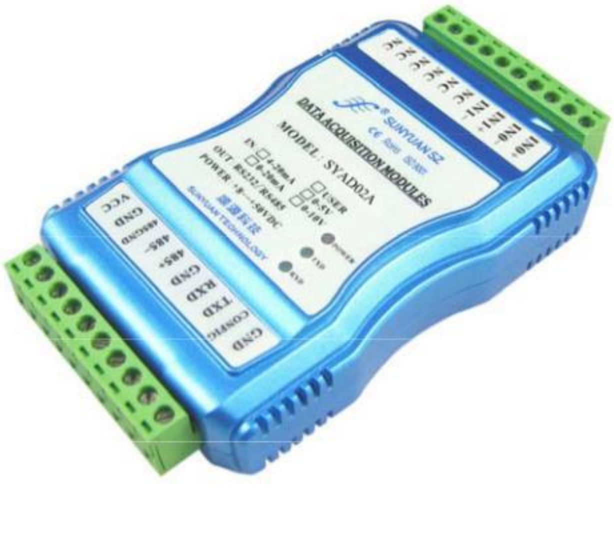


Figure 3 ISO AD 02A/04A channel analog signal acquisition display control isolation transmitter Product picture

Application wiring diagram:

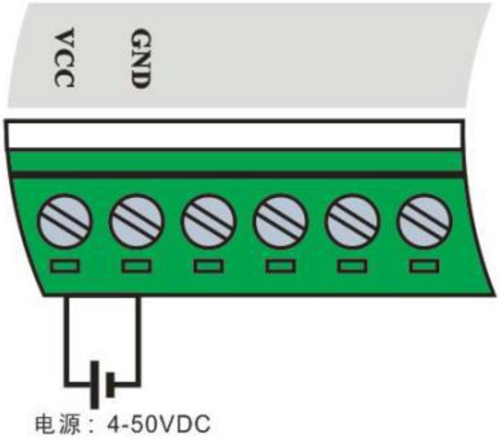


Figure 4 Module power supply wiring diagram

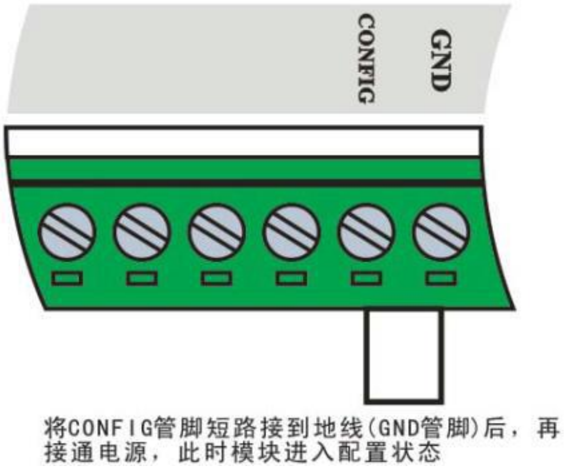

CONFIG
GND
将CONFIG管脚短路接到地线(GND管脚)后，再接通电源，此时模块进入配置状态

Figure 5 Wiring diagram of configuration mode

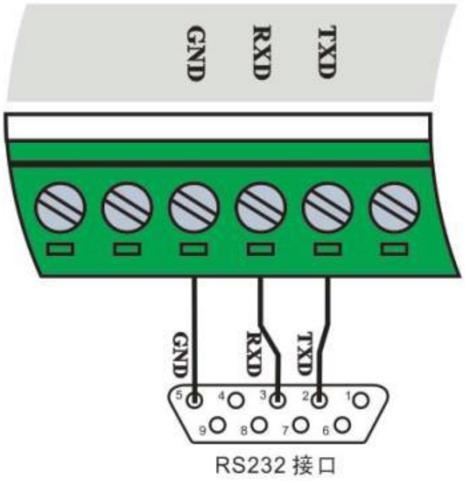


Figure 6 RS232 interface wiring diagram

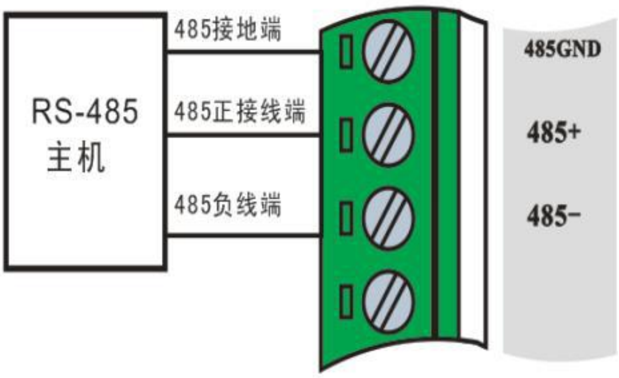


Figure 7 RS485 interface application wiring diagram

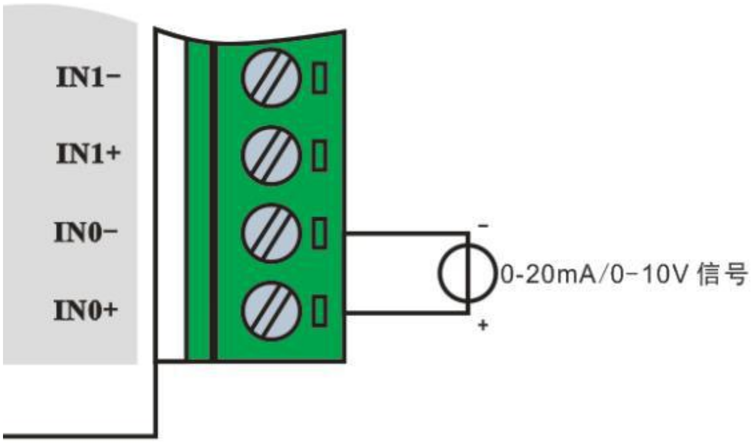
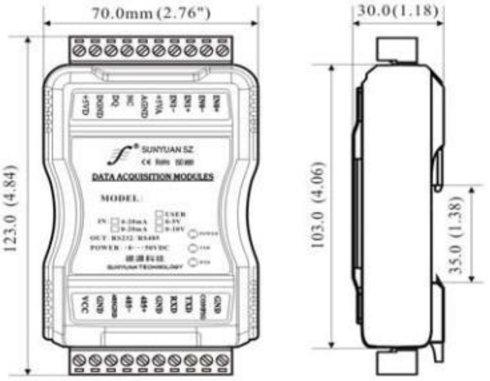


Figure 8 Module input signal wiring diagram

Product dimensions:



Pin definition:

Pin	Name	Description	Pin	Name	Description
1	**IN0+**	Input channel 0 positive terminal	11	**VCC**	Power positive terminal
2	**IN0-**	Input channel 0 negative terminal	12	**GND**	Power ground
3	**IN1+**	Input channel 1 positive terminal	13	**485GND**	RS485 ground terminal
4	**IN1-**	Input channel 1 negative terminal	14	**485-**	RS485 negative terminal
5	**IN2+**	Input channel 2 positive terminal	15	**485+**	RS485 positive terminal
6	**IN2-**	Input channel 2 negative terminal	16	**GND**	RS232 serial ground wire
7	**IN3+**	Input channel 3 positive terminal	17	**RXD**	RS232 receiver
8	**IN3-**	Input channel 3 negative terminal	18	**TXD**	RS232 sender
9	**NC**	Empty feet, keep	19	**CONFIG**	Configuration pin
10	**NC**	Empty feet, keep	20	**GND**	Configure the ground wire

Table 1 Pin Definition Note: Only four-channel products with pins 5, 6, 7, and 8 are signal input terminals, and two-channel products are empty pins.

Initialize the **ISO AD02/4A** module

When connecting to the RS-232/RS-485 network, a unique address code must be assigned to the ISOAD02/4A module. The address code is a hexadecimal number and the value is between 0x00 and 0xFF. All brand new ISO AD02/4A modules use the same factory initial settings, as shown below:

The address code is 01H
Baud rate 9600 bps
Prohibit checksum
ASCII character communication protocol

Since the address codes of the new modules are the same, their addresses will conflict with other modules, so when you build the system, you must reconfigure the address of each module. After connecting the ISOAD02/4A module power cord and RS485 communication line, you can modify the address of the ISOAD02/4A module through configuration commands. The baud rate, checksum status, and communication protocol also need to be adjusted according to user requirements. Before modifying the baud rate, checksum status, and communication protocol, the module must first enter the configuration status, otherwise it cannot be modified.

How to make the module enter the configuration state

The ISOAD02/4A module has a special pin labeled CONFIG. Short-circuit the CONFIG pin to the ground wire (GND pin), and then turn on the power supply. At this time, the module enters the configuration state. In this state, the configuration of the module is as follows:

The address code is 00H
Baud rate 9600 bps
Prohibit checksum
ASCII character communication protocol

At this time, you can modify the ISO AD02/4A module's baud rate, checksum status and other parameters through the configuration command, and you can also select the communication protocol by setting the module's communication protocol command. When you are not sure about the specific configuration of a certain module, you can also install the configuration jumper to make the module enter the configuration state, and then reconfigure the module. If the user needs to set the module to the MODBUS RTU communication protocol, please refer to the relevant instructions in the MODBUS communication protocol chapter.

Chapter 2 Module Calibration

The calibration must be carried out under the ASCII character communication protocol. Calibration is not supported under Modbus protocol.

The product has been calibrated before leaving the factory, and the user can use it directly without calibration. During use, the user can also recalibrate the module. During calibration, the module needs to input appropriate signals, and different input ranges require different input signals.

In order to improve the calibration accuracy, it is recommended to use the following equipment to calibrate:

1. A DC voltage/current signal source with stable output and low noise
2. A 5 and a half or more high-precision voltage/current measuring instrument monitors the accuracy of the input signal

Calibration process:

1. Select the input channel to be calibrated, and connect the corresponding input signal according to the input range of the module.
2. The ISO AD02/4A module zero point is calibrated when 0 is input, and the full scale is calibrated when 120% of the input full scale. For example, when inputting 4-20mA, when calibrating the zero point
Input 0mA, input 24mA when calibrating full scale. (For 0-5V input, input 0V when calibrating zero point, and input 6V when calibrating full scale).
3. Input the zero signal to the channel to be calibrated for the analog input module, usually 0mA or 0V.
4. After the signal is stable, send the offset calibration $AA1N command to the analog input module (N represents the channel code currently being calibrated, 0 or 1).
5. Input a current or voltage signal of 120% of full scale to the channel to be calibrated for the analog input module.
6. After the signal is stable, send the gain calibration $AA0N command to the analog input module (N represents the channel code currently being calibrated, 0 or 1).
7. Calibration is complete

Chapter 3 ASCII Character Communication Protocol

Introduction

When the controller communicates with the ASCII character communication protocol, each 8Bit in a message is transmitted as 2 ASCII characters (for example, when the number 34 is transmitted, the ASCII codes 0x33 and 0x34 corresponding to 3 and 4 will be transmitted respectively). This mode is mainly The advantage is that the time interval between command characters is not limited.

Character protocol command set

The command consists of a series of characters, such as the first code, address ID, variables, optional checksum byte and a terminator (cr) to display the command. The ISOAD02/4A module does not support broadcast addresses, so the host only controls one ISO AD02/4A module at a time.

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

Command start identifier. All commands need a command start identifier, such as %,$,#,@,... etc.		1- character
(Addr)	The address code of the module, if not specified below, the value range is 00～FF (hexadecimal).	2- characters
(Command)	Command code or variable value.	1- character
[data]	Command parameters.	Variable length
[checksum]	Checksum is an optional parameter. This option is only required when checksum is enabled.	2- characters
(cr)	The command end identifier, (cr) is used as the carriage return end character, and its value is 0x0D.	1- character

The checksum is used to check whether the communication between the host and the module is correct. When the checksum is enabled, both the command and response must be appended with the checksum [Checksum] parameter
number. It occupies 2 characters. The checksum character is placed after the command or response character and before the carriage return character.
Calculation method: Calculate the sum of the ASCII code values of all the characters sent before, and then AND the hexadecimal number 0xFF. The result is a two-digit hexadecimal number.

Application example: prohibit checksum (checksum)

User command **$022(cr)**
Module response **! 02000600 (cr)**
Enable checksum (checksum)
User command **$022B8 (cr)**
Module response **!02000640AD (cr)**
'$' = 0x24 '0' = 0x30 '2' = 0x32
B8=(0x24+0x30+0x32+0x32) AND 0xFF
'!' = 0x21 '0' = 0x30 '2' = 0x32 '4'=0x34 '6' = 0x36
AD=(0x21+0x30+0x32+0x30+0x30+0x30+0x36+0x34+0x30) AND 0xFF

Commonly used analog input module commands

1. Read the data of all channels of the module
2. Read the data of module channel N
3. Configure the module

4. Read configuration status
5. Offset calibration
6. Full scale calibration
7. Read module name
8. Enable or disable channel commands
9. Read channel status command
10. Set the communication protocol command

Command response

The response information depends on various commands. The response also consists of several characters, including the first code, variables, and end identifier. There are two types of the first code of the response signal, '!' or '>' means valid command and '?' means invalid. By checking the response information, you can monitor whether the command is valid

Note: 1. Make sure that the address is correct. If the address is wrong, the target module will not respond.
2. The command must be in capital letters.

1. Read all channels to collect data command

Command function: Read back the data collected by all channels in the currently configured data format.

Command syntax: #AA(cr)

Parameter Description：# Delimiter.

AA Target module address, the value range is 00H～FFH (hexadecimal).

(cr) End character, host computer enter key (0DH)

Response syntax: >(data)(cr) command is valid.

?AA(cr) Invalid command or illegal operation.

Parameter Description：> Delimiter.

(data) represents all channel data read back. The data format can be engineering units, percentage of FSR, hexadecimal complement, or ohms. For details, see Article 3 of the Command Set.

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond. If a channel has been closed, the data read out is displayed as a space character.

Application example: user command #23(cr)

Module response >+04.765+04.756 (cr)

Description: The input on the module whose address is 23H is (the data format is in engineering units):

Channel 0: +04.765mA Channel 1: +04.756mA

2. Read single channel acquisition data command

Command function: Read back the data collected by a single channel in the currently configured data format.

Command syntax: #AAN(cr)

Parameter Description:# Delimiter.

AA Target module address, the value range is 00H～FFH.

N Channel code (0-3)

(cr) Terminator, host computer enter key (0DH).

Response syntax：>(data)(cr) The command is valid.

?AA(cr) The command is invalid or illegal operation or the channel is closed.

Parameter description:> Delimiter.

(data) represents the data of channel N read back. The data format can be engineering units, percentage of FSR, hexadecimal complement, or ohms.

For details, see Article 3 of the Command Set.

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond.

Application example: user command #230(cr)

Module response >+04.632 (cr)

Note: On the module with address 23H, the input of channel 0 is +04.632mA (data format is engineering unit).

3.Configure module commands

Command function: Set the address, input range, baud rate, data format, checksum status of the target module. Configuration information is stored in non-volatile memory EEPROM

Command syntax：%AANNTTCCFF(cr)

Parameter Description Delimiter.

AA The current address of the target module, the value range is 00～FF (hexadecimal).

NN The new address of the target module, the value range is 00～FF (hexadecimal).

TT type code. ISO(SY)AD02/4A products must be set to 00.

CC uses hexadecimal to represent the baud rate code, see Table 2 for details.

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

Table 2 Baud rate codes

FF Use 8 hexadecimal digits to represent the data format and checksum. Note that bits2 to bits5 do not have to be set to zero.

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

Table 3 Data format, checksum code

Bit7: reserved bit, must be set to zero

Bit6: Checksum status, 0: prohibited; 1: allowed

Bit5-bit2: No, generally set to zero.

Bit1-bit0: Data format bits.

00: Engineering Units

01: percentage of full scale (% of FSR)

10: Twos complement of hexadecimal

(cr) terminator, host computer enter key (0DH).

Response syntax: !AA(cr) command is valid.

?AA(cr) command is invalid or illegal operation, or the configuration jumper is not installed before changing the baud rate or checksum.

Parameter Description:! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module

(cr) Terminator, host computer enter key (0DH).

Other instructions: Note 3: If the user wants to reconfigure the address, baud rate, checksum status and data format of the module, a configuration jumper must be installed to make the module enter the configuration state. At this time, the target module address is 00H, which is AA =00H, NN is equal to the new address. Otherwise, an error message will be returned number.

- Note 4: After executing the configuration command, the slave will return the new address as the response data to the master.

If the address is wrong or the communication is wrong, the target module will not respond.

Application example: user command %0011000600(cr)

Module response !11(cr)

Description：% Delimiter.

00 It means that the original address of the analog input module you want to configure is 00H.

11 Indicates that the hexadecimal address of the new module is 11H.

00 Type code, ISO(SY)AD02/4A product must be set to 00.

06 Indicates the baud rate is 9600 bps.

00 Indicates that the data format is engineering units, and checksums are prohibited.

4、Read configuration status command

Command function: Read the configuration information of the target module.

Command syntax: $AA2(cr)

Parameter description: $ Delimiter.

AA Target module address, the value range is 00H～FFH.

2 Read configuration status command keyword.

(cr) Terminator, host computer enter key (0DH).

Response syntax:!AATTCCFF(cr) The command is valid.

?AA(cr) Invalid command or illegal operation.

Parameter Description： Delimiter.

AA Represents the address of the target module.

TT Represents the type code.

CC Represents the baud rate encoding. See Table 3 for details

FF See Table 4 for details

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond.

Application examples: User commands $302(cr)

Module response !300F0600(cr)

Explanation:! Delimiter.

30 Indicates that the target module address is 30H.

00 Indicates the input type code.

06 Indicates the baud rate is 9600 bps.

00 Indicates that the data format is engineering units, and checksums are prohibited.

5. Offset calibration command

Command function: Calibrate the zero offset of channel N of the target module.

Command syntax: $AA1N(cr)

Parameter Description： Delimiter.

AA Target module address, the value range is 00H～FFH.

1 Offset calibration command keyword.

N Channel code 0～3

(cr) Terminator, host computer enter key (0DH).

Response syntax: !AA (cr) command is valid.

?AA(cr) Invalid command or illegal operation.

Parameter Description：! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module

(cr) Terminator, host computer enter key (0DH).

Other instructions: The product has been calibrated when it leaves the factory, and the user can use it directly without calibration.

When calibrating the target module, you should calibrate the offset first, and then calibrate the gain.

When calibrating, you need to add a suitable input signal to the channel to be calibrated on the target module. Different input ranges require different input voltages

Or current. For the specific calibration method, please refer to the calibration module chapter.

If the address is wrong or the communication is wrong, the target module will not respond.

Application examples: User commands $2310(cr)

Module response !23(cr)

Description: Perform offset calibration on channel 0 of the module whose address is 23H.

6. Gain calibration command

Command function: calibrate the gain of channel N of the target module.

Command syntax: $AA0N(cr)

Parameter Description：$ Delimiter.

AA Target module address, the value range is 00H～FFH.

0 Gain calibration command keyword.

N Channel code 0～3

(cr) Terminator, host computer enter key (0DH).

Response syntax：!AA(cr) The command is valid.

?AA(cr) Invalid command or illegal operation.

Parameter Description：! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module

(cr) Terminator, host computer enter key (0DH).

Other instructions: The product has been calibrated when it leaves the factory, and the user can use it directly without calibration.

When calibrating the target module, you should calibrate the offset first, and then calibrate the gain.

During calibration, the analog input module needs to add a suitable input signal to the channel to be calibrated. Different input ranges require different inputs

Voltage or current. For the specific calibration method, please refer to the calibration module chapter.

If the address is wrong or the communication is wrong, the target module will not respond.

Application examples: User commands $2303(cr)

Module response !23(cr)

Description: Perform gain calibration on channel 3 of the address 23H module.

7. Read module name command

Command function: read the name of the target module.

Command syntax: $AAM(cr)

Parameter description: $ delimiter.

AA Target module address, the value range is 00H～FFH.

M Read module name command keyword.

(cr) Terminator, host computer enter key (0DH).

Response syntax：!AA(ModuleName)(cr) The command is valid.

?AA(cr) Invalid command or illegal operation

Parameter Description:! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module.

(ModuleName) The module name can be ISOADA08, ISO AD02/4A or ISO 4014, etc., which represents the model of the module you are using.

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the syntax error or communication error or address does not exist, the module does not respond.

Application examples: User commands $08M(cr)

Module response !08ISO(SY)AD02A (cr)

Note: The name of the module whose address is 08H is ISO AD02A.

8. Enable or disable channel commands

Command function: This command is used to open or close a channel of the module.

Command syntax: $AA50V(cr)

Parameter description: $ delimiter.

AA Target module address, the value range is 00H～FFH.

5 Enable or disable the data acquisition channel command keyword of the module.

V A hexadecimal number, which corresponds to the 1st to 0th digits of the binary expression representing the 1st to 0th channel

Bit value is 0: Disable the channel

Bit value 1: Enable channel

(cr) Terminator, host computer enter key (0DH).

Response syntax: !AA(cr) command is valid.

?AA(cr) Invalid command or illegal operation

Parameter description: ! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module.

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond.

Application examples: User commands $08503(cr)

Module response !08 (cr)

escription: Set the channel value to 0x03. 3 is 0011, which means channel 0 and channel 1 are enabled.

9. Read channel status command

Command function: Read the channel status command of the target module.

Command syntax: $AA6(cr)

Parameter description: $ Delimiter.

AA Target module address, the value range is 00H～FFH.

6 Keyword of the command to read the channel status.

(cr) Terminator, host computer enter key (0DH).

Response syntax: !AA0V(cr) command is valid.

?AA(cr) Invalid command or illegal operation

Parameter Description:! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module.

V A hexadecimal number, 1~0 digits of the number represent 1~0 channels

Bit value is 0: Disable the channel

Bit value 1: Enable channel

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond

Application examples: User commands $186 (cr)

Module response !1803(cr)

Note: The current channel status value is 0x03.

0x03 is 0000 and 0011, indicating that all channels of the module with address 18H have been enabled.

10. Set the communication protocol command

Command function: Set the communication protocol of the target module to ASCII character communication protocol or Modbus RTU protocol.

Command syntax: $AAPV(cr)

Parameter description: $ delimiter.

AA Target module address, the value range is 00H～FFH.

P Set the communication protocol command keyword.

V Protocol code, can be 0 or 1

0: ASCII character protocol

1：Modbus RTU protocol

(cr) Terminator, host computer enter key (0DH).

Response syntax: !AA(cr) command is valid.

?AA(cr) Invalid command or illegal operation

Parameter Description:! The delimiter indicates that the command is valid.

? Delimiter, indicating that the command is invalid.

AA Represents the address of the target module.

(cr) Terminator, host computer enter key (0DH).

Other instructions: If the address is wrong or the communication is wrong, the target module will not respond.

The command to set the communication protocol is valid only in the configuration state.

Application example 1: User command $00P1(cr)

Module response !00 (cr)

Description: Set the communication protocol to Modbus RTU protocol.

Application example 2: User commands $00P0(cr)

Module response !00 (cr)

Description: Set the communication protocol to ASCII character protocol.

Input range and data format

The analog input module uses 4 data formats:

00: Engineering Units

01: percentage of full scale (% of FSR)

10: hexadecimal complement(Twos complement)

Input range	Data Format	Positive full scale	Zero	Negative full scale	Display resolution
A1：0-1mA A5：0-±1mA	Engineering unit	+1.0000	±0.0000	-1.0000	0.1uA
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
A2：0-10mA A6：0-±10mA	Engineering unit	+10.000	±00.000	-10.000	1uA
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
A3：0-20mA A4：4-20mA A7：0-±20mA	Engineering unit	+20.000	±00.000	-20.000	1uA
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
U1：0-5V U5：0-±5V	Engineering unit	+5.0000	±0.0000	-5.0000	0.1mV
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
U2：0-10V U6：0-±10V	Engineering unit	+10.000	±00.000	-10.000	1mV
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
U3：0-75mV	Engineering unit	+75.000	±00.000	-75.000	1uV
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
U4：0-2.5V	Engineering unit	+2.5000	±0.0000	-2.5000	0.1mV
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
U7：0-100mV	Engineering unit	+100.00	±000.00	-100.00	0.01mV
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB
A8：Custom U8：Custom	Engineering unit	+100.00	±000.00	-100.00	0.01%
	Percentage of full scale	+100.00	±000.00	-100.00	0.01%
	Hexadecimal complement	7FFFFF	000000	800000	1LSB

Table 4 Input range and data format

Application examples

1、The input range is ±20mA, and the output is 4 mA

	User command	#01(cr)
Engineering unit	Module response	>+04.000(cr)
Percentage of full scale	Module response	>+020.00(cr)
Hexadecimal complement	Module response	>199999(cr)

2. The input range is ±10V, and the output is 2.5V

	User command	#01(cr)
Engineering unit	Module response	>+02.500(cr)
Percentage of full scale	Module response	>+025.00(cr)
Hexadecimal complement	Module response	>1FFFFF(cr)

3. The relationship between hexadecimal complement and analog conversion

When the module is a current/voltage input type, the following relationship can be used to convert: X/7FFFFF=Xin/Xf

Note: X: represents the hexadecimal complement corresponding to the analog quantity

Xin: Indicates the amount of analog signal input by the channel.

Xf: The analog quantity that represents the full scale of the product. For example, 20mA.

4. In the voltage input type, Xin is the channel voltage input Vin, and Xf is the full-scale voltage input.

5. If the input is a negative voltage or current, the read value is reversed and added by one and then brought into the above formula to calculate the corresponding analog value.

Chapter 4 Modbus Communication Protocol :Introduction

The Modbus protocol defines the information structure that the controller can recognize and use. When communicating on the Modbus network, the protocol enables each controller to know its own device address, identify the data addressed to it, determine the type that should act, and retrieve the data and information contained in the information. , The controller can also organize the reply information, and use the Modbus protocol to transmit this information.

Controller communication uses master-slave technology, that is, only one device (master device) can initiate transmission (query). Other devices (slave devices) respond accordingly based on the data provided by the master device's query. Typical main equipment: host and programmable instrument. Typical slave device: programmable controller. The master device can communicate with the slave device alone, or it can communicate with all slave devices in a broadcast mode. If it communicates alone, the slave device returns a message as a response, if it is queried by broadcast, it does not respond. The Modbus protocol establishes the format of the master device query: device (or broadcast) address, function code, all data to be sent, and an error detection domain.

The response message from the device is also composed of the Modbus protocol, including the confirmation domain to be acted upon, any data to be returned, and an error detection domain. If an error occurs during message reception, or the slave device cannot execute its command, the slave device will create an error message and send it out as a response

Modbus has two transmission modes: ASCII and RTU:

When communicating in ASCII mode, each 8-bit byte in a message is sent as 2 ASCII characters, and LRC error detection is adopted. The advantage is that the time interval for sending characters can reach 1s without error;

When communicating in RTU mode, each 8-bit byte in the message contains two 4-bit hexadecimal characters. CRC error detection is adopted. The advantage is that under the same baud rate, it can transmit more than ASCII data.

ASCII mode and RTU mode data format, for more information, please refer to the related Modbus communication protocol.

Data format comparison between ASCII mode and RTU mode:

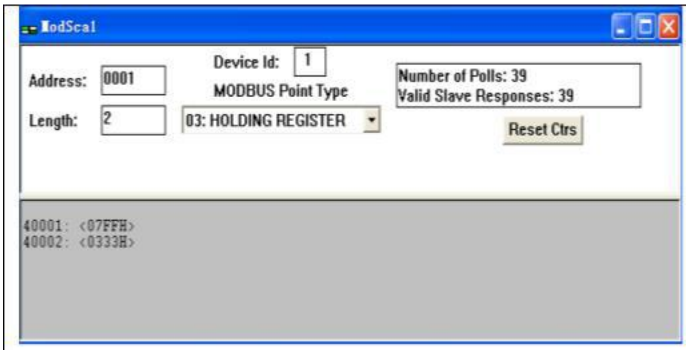
	ASCII mode	RTU mode
Code system	▪ Hexadecimal, ASCII characters 0～9, A～F ▪ Each ASCII character in the message is a hexadecimal word Symbol composition	▪ 8-bit binary, hexadecimal 0～9, A～F ▪ Each 8-bit field in the message is composed of one or two hexadecimal characters
Data bit	▪ 1 start bit ▪ 7 data bits, the least significant bit is sent first ▪ 1 parity bit, no parity bit ▪ 1 stop bit (when there is parity), 2 Bit (when there is no parity)	▪ 1 start bit ▪ 8 data bits, the least significant bit is sent first ▪ 1 parity bit, no parity bit ▪ 1 stop bit (when there is parity), 2 Bit (when there is no parity)
Error checking area	▪ LRC (Longitudinal Length Detection)	▪ CRC (cyclic redundancy detection)

Note: This module only supports Modbus RTU transmission mode, not Modbus ASCII transmission mode.

1、Configure Modbus RTU mode

The factory default protocol of the module is the ASCII character communication protocol. If you need to set the module to the Modbus RTU communication protocol, please follow the steps below:

1. Short the CONFIG pin (pin 3) and GND pin (pin 4).

 ModScal Address: 0001 Device Id: 1 MODBUS Point Type Length: 2 03: HOLDING REGISTER Number of Polls: 39 Valid Slave Responses: 39 Reset Ctrs 40001: <07FFH> 40002: <0333H>	Description: Adress is the starting address of the register Device ID is the address of the target module Length is the number of registers to be read MODBUS Point Type: Modbus function type selection 40001: Corresponding to the data in the register, the analog input value of the 0th channel 40002: Corresponding to the data in the register, the analog input value of the first channel ● ● ●

2. Correctly connect the power cord and communication interface line.

3. When the power is turned on, the module automatically enters the configuration state. At this time, the module communication address is 00 and the baud rate is 9600.

4. Wait 1 minute for the module to initialize.

5. Send the command $00P1(cr) (00 is the address of the corresponding target module, you can also refer to the set communication protocol command), check the response, if it is !00(cr), the setting is successful.

6. Turn off the power and disconnect the connection between the CONFIG pin and the GND pin.

7. The module has been successfully set to Modbus RTU communication protocol mode.

2、Data format under MODBUS RTU (Host query)

The host query information specifies the starting address of the register to be read and the number of registers. The starting address of the register addressing is 0000. The query format is as follows:

Slave Address	Function	Starting Address Hi	Starting Address Lo	No.ofPoints Hi	No.ofPoints Lo	Error Check(CRC)
01	03	00	00	00	08	44 0C

If the host sends query information Tx： 01 03 00 00 00 08 44 0C

01 Device address

03 Function code

00 00 Register addressing start address

00 08 Number of registers

44 0C CRC check code

Slave response

The register data in the response message of the slave is 2 bytes corresponding to each register, the first byte is the high-orde and the second is the low-order data. The response format is as follows:

Slave Address	Function	Byte Count	Data Hi(Register 40001)	Data Lo(Register 40001)	Data Hi(Register 40002)	Data Lo(Register 40002)	Error Check(CRC)
01	03	10	19	99	99	00	9E 68

orresponding information such as slave Rx： 01 03 10 19 99 00 00 00 00 00 00 00 00 00 04 00 00 00 00 87 69

01 Device address

03 Function code

10 bytes

19 99 First register data

00 00 Second register data

▪

▪

▪

87 69 CRC Check code

The following figure shows the description of the register information viewed through the MODSCAN software

Description of supported registers:

Address4X	Data content	Attributes	the data shows
40001	IN0	Read only	Analog input value of channel 0
40002	IN1	Read only	Analog input value of channel 1
40003	IN2	Read only	2nd channel analog input value (only four channel products)
40004	IN3	Read only	3rd channel analog input value (only four channel products)
40211	Module name	Read only	High bit: 0x40 Low bit: 0x21
40221	Channel status	Read/write	High bit: 0x00 Low bit: channel status (0x03/0x0F)

Table 5 Modbus RTU register description